ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) STUDY
of
MONJO KHOLA MINIHYDRO SUBPROJECT (942 kW)

Submitted To

Alternative Energy Promotion Centre

Nepal: Private Sector-Led Mini Grid Energy Access Project (MGEAP)

Mid Baneshwor, Kathmandu

Nepal

Energy Service Company
Monjo Khola Mini Hydro Pvt. Ltd.
Tilganga 8, Kathmandu,
Bagmati Province
Nepal
Telephone No: 01-4464222, 01-4464333
Email: monjokholaminihydro@gmail.com
Website: www.yetiworld.com.np

Consultant
Eco Friend International Pvt. Ltd.
Lalitpur-2
Sanepa, Nepal
Tel: +977-9851127867
Email: ecofriend.nepal@gmail.com

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Abbreviations

AC	Alternate Current
ACSR	Aluminum Conductor Steel Reinforced
AEPC	Alternative Energy Promotion Centre
amsl	Above Mean Sea Level
B	Breath
BA	Basal Area
BOD	Biological Oxygen Demand
BS	Bikram Sambat
BZ	Buffer Zone
BZMC	Buffer Zone Management Committee
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
DHM	Department of Hydrology and Meteorology
DIA	Direct Impact Area
dia.	diameter
DNPWC	Department of National Parks 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
EMP	Environmental Management Plan
EMIMAP	Environmental Management Implementation Management Action 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
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
MKMH	Monjo Khola Mini Hydro
MKMHP	Monjo Khola Mini Hydro Subproject
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
OUV	Outstanding Universal Value
pH	Potential of Hydrogen
PID	Proportional Integrative Derivative
KPLRM	Khumbu Pasanglhamu Rural Municipality
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 Secretaria

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 subproject 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 - Monjo Khola Mini Hydro Pvt. Ltd is preparing the ESIA of this subproject.

Energy Service Company (ESCO)

The Monjo Khola Mini Hydro Pvt. Ltd. is an energy service company (ESCO) which aims to develop Monjo Khola Mini Hydro Subproject (MKMHP), located in Khumbu Pasanglhamu Rural Municipality (KPLRM)-Ward No. 3, Solukhumbu district, Province No.1. The address of the ESCO is as follows:

Address of Proponent:

Monjo Khola Mini Hydro Pvt. Ltd.
Kathmandu-8, Tilganga,
Bagmati Province, Nepal
Telephone No: 01-4464222, 01-4464333
Email: monjokholaminihydro@gmail.com

Relevancy of the ESIA Study

The primary objective of the proposed subproject is to generate 942 kW electrical energy from Monjo Khola and supply energy to meet electricity demand of 582 households for lighting, cooking and space heating in Chyuma, Byankar, Tok Tok, Thulo Gamela, Phakding, Sano Gamela, Chermading, Ghat, Thadakoshi, Chheplung, Chaurikharka and other settlements of Ward No. 3 along with Muse of Ward No. 2. At present, 4 existing 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 lie in Everest/Everest base camp trekking trail, one of the most popular trails worldwide, demand of energy is huge. To meet the demand, they are mostly dependent on high priced LPG, kerosene and fuelwood. The cost of petroleum fuel increases by 200% 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, Monjo Khola 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 without increasing the use of precious wood resources from the environment.

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 buffer zone

(BZ) of the Sagarmatha National Park (SNP), which is considered as ecologically sensitive area, an Environmental and Social Impact Assessment (ESIA) is required as a 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 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 MKMHP (942 kW).

Methodology

This ESIA for Monjo Khola Mini Hydro Subproject has been conducted in accordance with the methodology described in the Terms of Reference (ToR)[2] cleared by the World Bank.

Subproject Description

The proposed subproject is a run-off-river scheme and uses water from Monjo Khola, a perennial river and tributary of Dudhkoshi River. Water will be diverted at elevation of 2960 m amsl and intake will be made at elevation of 2960.50 m amsl. Diverted water will be streamed down to a power house located at 2744 m amsl through 1410 m long penstock pipe. The gross head will be of 215.50 m with design discharge of 0.56 m^3/s at $Q_{80\%}$. Two turbines with the rated output of 496 kW will be coupled with two 650 kVA synchronous generators which will be used to generate total electrical power of 942 kW. Generated electricity will be transmitted through underground 11 kVA transmission lines and distributed through 1.1 kVA distribution lines to 582 households in Chyuma, Byankar, Tok Tok, Thulo Gamela, Phakding, Sano Gamela, Chermading, Ghat, Thadakoshi, Chheplung, Chaurikharka and other villages of Ward No. 3, and Muse village of ward no. 2 of Khumbu Pasanglhamu Rural Municipality (KPLRM). National grid has not reached this rural municipality. All the settlements lie in buffer zone of Sagarmatha National Park. The total subproject cost is NPR 571,611,140.45

Existing Environmental Condition

Physical Environment

The proposed subproject area is located in north eastern 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 with 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 2960.50 m while the powerhouse will be at 2744 m. The elevation of transmission and distribution lines ranges from 2533 to 2810 m. The subproject area lies in temperate climatic zone. The average annual rainfall is 2100 mm. January is the coldest month and July is the warmest month of the subproject area. The minimum temperature of Monjo area goes below 0°C about 6 months in a year.

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

[2] *https://www.aepc.gov.np/uploads/docs/monjo-khola-mini-hydro-subproject-942-kw-terms-of-reference-tor-for-environmental-and-social-impact-assessment-esia-study-1643344225.pdf*

The current land use pattern of Ward No. 3 is dominated with glacier (38.66%), followed by barren land (16.90%), forest (16.28%), grassland (16.09%), shrub land (10.40%), water body (0.88%), built up (0.64%) and agriculture (0.15%). The weir will be in river while most of the penstock pipe lies in forest area and some part will be in private cultivated land, which will be underground. Powerhouse will be constructed in private barren land. All Transmission and distribution lines will be underground except river crossing and will pass along trekking routes.

The Monjo Khola starts from Kyasar Glacier and flows from east to west direction. It then merges with Dudhkoshi River at Monjo village. It is a snow fed perennial river with maximum catchment elevation of 6628 m while minimum elevation of catchment being 2960 m. The total catchment area is 43.26 km^2. Out of the total catchment 43.53% of the catchment 18.83% lies in permanent snowline above 5000 m. The observation of air, water and sound quality showed that the observed standards are within the limit of national guidelines. No sources of pollution have been observed.

Biological Environment

The subproject area lies in the Buffer Zone of Sagarmatha National Park (SNP) and SNP is recognized by UNESCO as the world heritage site. The subproject area is located in Temperate Life Zone. The intake area and some part of penstock lies in Fir Birch Rhododendron Forest while remaining subproject structures lie in Upper Temperate Blue Pine Forest Zone. Transmission and distribution line will follow existing foot trail, not disturbing Upper Temperate Blue Pine Forest Zone as well as Temperate Mountain Oak Forest Zone.

The subproject area falls within *Chaurikharka Buffer Zone User Committee*. Under this committee, the forest in and around the physical civil structures of power generation is being managed by Himalaya Buffer Zone Community Forest User Groups (BZCFUG), which is under the Buffer Zone User Committee. The Jurisdiction of BZCFUG is up to Banker area and from there, Kongde BZCFUG manages the forest areas up to Phakding. Similarly, Pemachholing BZCFUG manages from Phakding to Chhuthuwa. Dudhkunda Buffer Zone Community Forest (BZCF) lies in and around Ghat village area while Red Panda BZCF covers from Thadokoshi to Lukla. Thus there are 5 BZCFs in Ward No. 3 of KPLRM while Muse BZCF in Ward No. 2.

According to locals, there are no fish seen in the Monjo Khola till date. However, some reptiles and amphibians are recorded in the SNP and its buffer zone (SNP Management Plan 2016-2020). During the field visit, Himalayan Tahr, scats of carnivore (may be of grey wolf), and deer species are recorded. Altogether 17 mammals were reported in the subproject areas. More than 90 different bird species have been reported in the subproject area and none of the species are categorized as critically endangered.

Socio-Economic and Cultural Environment

The total population of 23 load centers with 582 HHs is 2171 with average family size of 3.73. The most dominant ethnic group is Sherpa (62.97%). Other Castes are Tamang (12.20%), Rai (13.30%), Magar (2.88%), outcaste (4.66%) and others (3.99%). Based on religion, majority of HHs are Buddhists (53.13%), followed by Hindu (40.50%), Christian (5.43%) and Kirant (0.94%) (KPLRM Profile, 2019). Major occupations are agriculture, tourism, services, foreign employment and business. Average land holding per household in load center is 4013 m^2 (7.89 ropani). Food sufficiency and crop diversity is very poor in the area. Potato and wheat are major food crops. Majority of HHs have access on electricity (only for lighting purposes) from four existing micro hydro project and some also use solar home

system. LPG, Kerosene and fuelwood are major sources of cooking fuel. The literacy rate in subproject area is 70.41%. In subproject area, there are four schools and two health centers. All the HHs have toilets and also have access 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 also available in subproject area. The majority of people follow Buddhish and there are 6 Gumbas in subproject area. Eight households from Sherpa community are in direct impact zone with 33 people, 18 Male and 15 female. The subproject needs to acquire 1280.24 m^2 private land from these HHs.

Identification/Prediction of Impacts

Beneficial Impacts

The beneficial impact from the subproject during construction is employment opportunities for the local people. Approximately 100 skilled and 250 unskilled human resources will be employed during construction. Other advantages are opportunity to improve technical skills, increase in economic activities and exposure of locals to 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 942 kW electrical energy and demand of energy of locals will be met.

Adverse Impacts

Physical Environment

Change in land use, topography, soil erosion, sedimentation, spoil generation and disposal, impact on hydrology and river morphology, and loss of top soil are major adverse impacts on physical environment during construction. During operation, change in microclimate, change in river water 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. 0.63 ha of forest area will be required for long term lease to construct various subproject components which is managed by Himalaya Buffer Zone Community Forest User Group. A total of 33 trees (30 poles and 3 trees) need to be fell down. 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 potential adverse impacts during construction. Impact on Monjo Khola due to reduced water flow (**Table 38**), impact on critical natural habitat species, and disturbance to wildlife due to resident workers, possible forest fire and pressure on forest for fuelwood are the impacts during operation. There is no possibility of electrocution to bird and wild animals due to underground T & D with armored cables[3].

Socio-economic and Cultural Impacts

Approx. 5.83 ha of land is planned to be acquired on short term and long term lease for subproject infrastructure construction. In case of private land to be acquired for powerhouse and tailrace, the owner is willing to sell the land in negotiation. The penstock pipe will be buried 1 m deep, and does not even affect cultivation during operation. For community forest land, compensation will be made according to GoN regulations.

[3] *It is mandatory requirement set by the GoN to keep the T&D cable underground for activities inside national parks and buffer zones.*

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 workforce, possible unsocial activities like gambling, alcoholism, girl trafficking and prostitution, gender based violence, COVID-19 and child labour 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, water use right (Monjo Khola Micro Hydro needs to be dismantled), issues of benefit sharing, issues of electricity tariff and management of existing 4 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 Buffer Zone of the SNP and SNP is recognized by UNESCO as the world heritage site. The subproject 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).

Benefit Augmentation/Adverse impact Mitigation Measures

Benefit Augmentation Measures
Priority for employment will be given to locals. Tariff 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 as 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. The extraction of riverbed materials will be planned properly in such a way that river morphology does not change after the removal of the materials. People will be made aware about early warning system and emergency preparedness plan.

Biological Environment
To compensate the tree cutting, plantation will be done in the ratio 1:10. People, school children and subproject workers will be sensitized on conservation of environment, biodiversity and wildlife. Unnecessary visit and smoking in forest will be prohibited to construction workers to reduce the possible risk of forest fire, hunting and poaching. A minimum flow of 10% of the mean monthly flow will be released during operation to sustain the aquatic life of Monjo Khola. Workers and subproject staffs will be provided with LPG for cooking to reduce the pressure in the forest.

Socio-economic and Cultural Environment
Compensation of land and crops will be provided as per negotiation with land owners. All the workers and staffs will be provided with insurance and the use of appropriate PPEs will be ensured. 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. To reduce the conflict between workers and locals, code of conduct including SEA/SH will be strictly implemented. Grievance Redress Committee at subproject level will be formed and made functional.

Monitoring and Reporting

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

Conclusion

Monjo Khola Mini Hydro Pvt. Ltd will implement the proposed subproject in the buffer zone of Sagarmantha National Park which will generate 7,243,292.16 kWh of annual average energy. The subproject intends to acquire about 0.1686 ha of private land and about 5.48 ha 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.

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, Monjo Khola Mini Hydro Subproject (942 kW) is being developed under MGEAP. Monjo Khola Mini Hydro Pvt. Ltd. is a private Energy Service Company (ESCO) registered in the Ministry of Industry, Commerce & Supplies, Office of the Company Registar, Kathmandu, and is located in Ward No. 8, Tilganga (**Annex I**). The ESCO has proposed to develop Monjo Khola Mini Hydro Subproject (MKMHP) at Khumbu Pasanglhamu Rural Municipality, Ward No. 3 of Solukhumbu district in Province No. 1. This subproject will be developed in off grid area. The Monjo Khola Mini Hydro Pvt. Ltd. has received technical clearance from the Department of Electricity Development (DoED) on 18/11/2076 (1 March 2020) (**Annex II**). The Khumbu Pasanglhamu Rural Municipality has provided generation license on 03/12/2076 (16 March 2020) (**Annex III**). Since this subproject is located in buffer zone of the Sagarmatha National Park (SNP), Department of National Park and Wildlife Conservation (DNPWC) has provided consent to carry out Brief Environmental Study (BES) of the subproject on 18 August 2021 (02 Bhadra 2078) (**Annex IV**). Furthermore, Environmental and Social Impact Assessment (ESIA) is mandatory as per World Bank's Operational Policies (OPs) to identify potential environmental and social (E&S) risks and impacts associated with the subproject.

There are already 4 existing micro hydro plants in the subproject area with the installed capacity of 255 kW in total (details in Section 4.3.14, **Table 36**). These existing micro hydro plants are not operating in their full capacity. All the existing MHPs are more than 10 years old. These plants were severely hit by the 2015 AD earthquake and have not received adequate funds to restore them to full capacity. Moreover, as the project locations are inaccessible by roadheads, operation and maintenance are very costly. All micro hydro plants being community managed projects, financial burden is huge to maintain the plant at its full capacity. These four plants cannot fulfill mere lighting requirements of the beneficiary households. As most of these households lies on Everest/Everest base camp trekking trail, one of the most popular trails worldwide, demand of 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% in these regions compared to general market rates. Therefore, to present a feasible alternative to these high-priced fuels with locally generated power, Monjo Khola Mini Hydro Subproject has been proposed. The subproject is a run-off-river and uses water from Monjo Khola, which is a perennial river and is a tributary of

Dudhkoshi River. The ESCO plans to develop mini hydro subproject with 942 kW capacity to provide electricity facility to 582 households in Monjo, Chyuma, Byankar, Tok, Thulo Gamela, Phakding, Sano Gamela, Chermading, Ghat, Thadakoshi, Chheplung and Chaurikharka villages of Ward No. 3, and Muse village from Ward No. 2. 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 buffer zone (BZ) of the 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)[4] to identify potential environmental and social (E&S) risks and impacts associated with the subproject.

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 MKMHP (942 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 2019 and EPR 2020, Nepal Rastra Bank ESRM 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, have significant impacts 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;

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

- 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) Biodiversity Management Plan, (vii) Stakeholder Engagement Plan, (viii) Benefit Sharing Plan; and (ix) Landslide and slope stability management plan, as needed;
- 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 Monjo Khola Mini Hydro Subproject has been conducted in accordance with the methodology described in the Terms of Reference (ToR)[5] cleared by World Bank on 12 September 2021 (27 Bhadra 2078). 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 the stage of draft ESIA report preparation. Initially, the approved ToR document for ESIA of MKMHP was thoroughly studied and reviewed. The Detailed Feasibility Study (DFS) including Detail Engineering Design (DED) Report 2021 prepared by Communication and Energy Developers Pvt. Ltd. (CED) was 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 also reviewed. Previously studied environmental assessment reports of hydropower projects and other related projects (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) and relevant website (mateoblue.com). Other information were 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 data of the study area was done by analyzing the data of the nearest meteorological station and monitoring station at. Other information such as Hydrology and Sedimentation, Geology and Seismicity, Watershed etc. will be collected referring from the secondary sources such as topographic,

[5] *https://www.aepc.gov.np/uploads/docs/monjo-khola-mini-hydro-subproject-942-kw-terms-of-reference-tor-for-environmental-and-social-impact-assessment-esia-study-1643344225.pdf*

geological and seismic hazard maps and subproject's 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. Information on population of Rural Municipality, household size, male-female ratio were collected from Central Bureau of Statistics (CBS). Socio-economic and cultural information, infrastructures, ethnicity, schools and development activities in the subproject area were collected from RM/district profile.

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 (BZCFUG) 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, VI, & VII).

1.3.3 FIELD ASSESSMENT: OBSERVATION AND PHOTOGRAPHS, 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 collected from two locations on 17 November 2021(1 Mangsir 2078) - headworks area of MKMHP and drinking water supply at Monjo settlement. The water quality analysis was carried out for sixteen different parameters (6 physical, 9 chemical and 1 microbial parameters) in 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) for noise quality. 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 thorough site observation by geologist during DFS and on-site delineation in maps, which was reviewed and verified by the 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 discussions with local communities.

1.3.3.2 BIOLOGICAL ENVIRONMENT

The information on fauna, 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. Local people of the subproject impact area were consulted to collect information on use and management of forest resources including availability and use of NTFPs as well as Medicinal and Aromatic Plants (MAPs), ethno-botanical importance of the plant species, problems encountered in use and management of forest resources and the possible impacts of the project 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 Monjo 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 relevant government organization such as MoEWRI, MoFE, DNPWC SNP, BZUC, RM and non-governmental organization such as UNESCO Nepal Office and ICIMOD 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.

Forest and Vegetation

Forest inventory was done with purposive sampling in the areas where subproject structures and facilities are proposed. Broadly the samplings were done in 2 sites - i) intake and headwork site and ii) Penstock alignment.

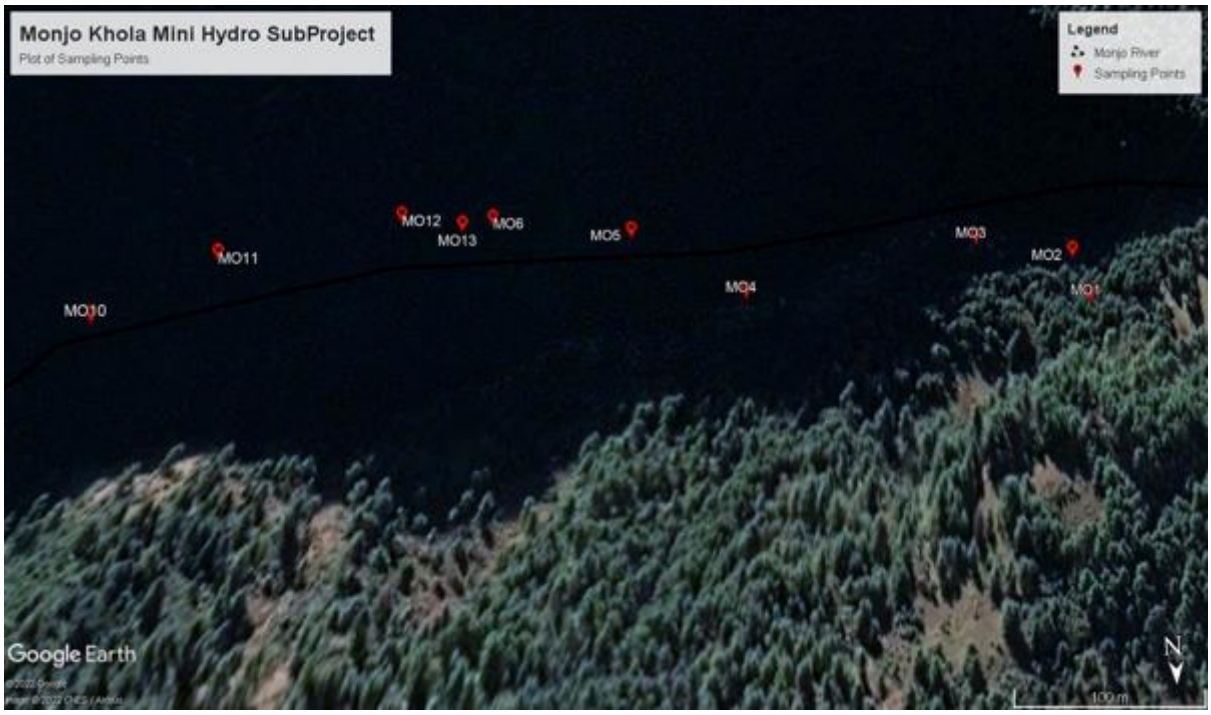

Figure 1: Sampling points along the headworks and penstock

Plot Design:

Nested quadrate was prepared in each sampling point. Initially 20x20 m^2 square shaped tree plot was prepared for tree. Then 5x5 m^2 square plots for shrubs and 1x1m^2 square plots for herbs were laid down at the centre of 20x20 m^2 of tree plots (**Figure 1**). Thus 3 plots were laid down in each sampling points. Altogether 27 sampling points were laid down. Thus, a total area of 10,800 m^2 for tree, 675 m^2 for shrub and 27m^2 for herb were surveyed. All tree species having DBH greater than 10 cm were considered within 20x20 m^2 pot. DBH and height of all trees were measured with the help of DBH tape and clinometer respectively. Crown cover percentage of trees within the sampling plots was estimated visually for the determination of stocking of forest. Number of all shrub species having height greater than 10 cm, and tree species with less than 10 cm dBH and greater than 10 cm height were studied within nested quadrate of 5x5 m^2. Similarly, the number of all herb species and seedlings of shrub and tree with height less than 10 cm were counted in 1x1 m^2 nested plot.

Stand Size:

The stand size classification is presented in **Table 1**. The classification has been modified based on Forest Inventory Division (FSRC, 1995).

Table 1: Stand size classifications

Symbol	Stand Size	DBH (cm)
1	Poles	10 - 25
2	Small saw timber	>25 - 50
3	Large saw timber	> 50

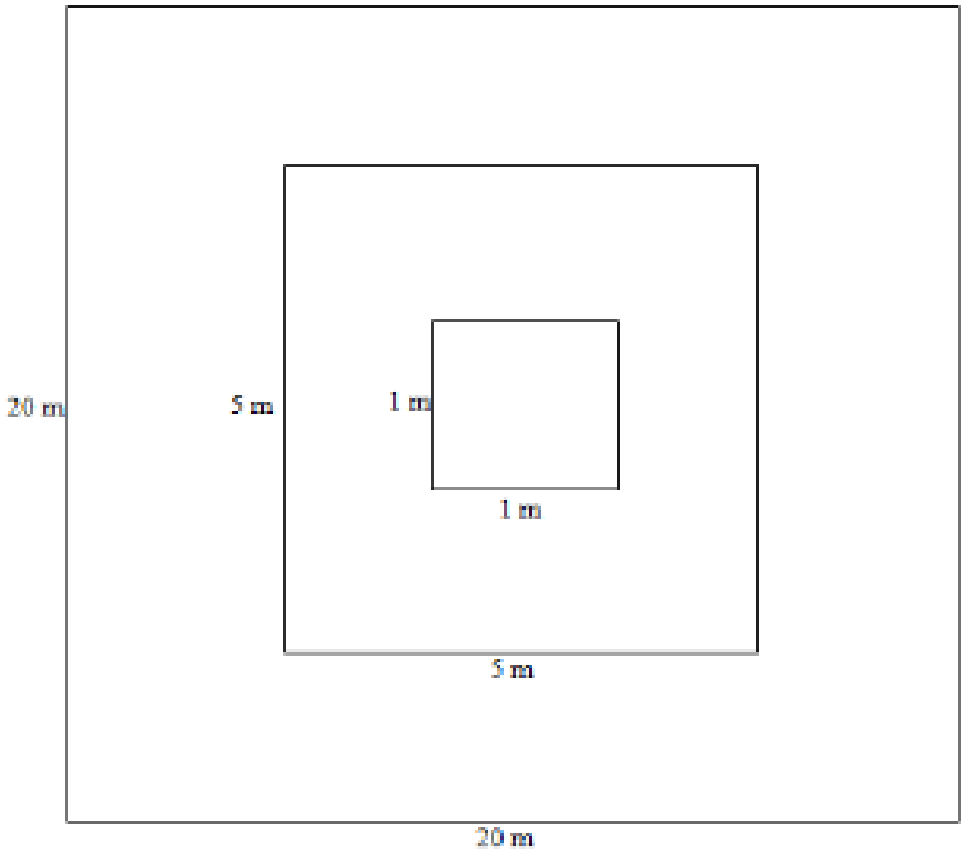

Figure 2: Plot Design (Nested quadrate plot)

Tree Volume:
Basal area and height of trees were measured for calculation of standing trees trunk volume. This was estimated as

$$TreeVolume = \frac{BA \times H}{2} \ldots\ldots\ldots\ldots\ldots \text{(i)}$$

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

Timber and Fuelwood Volume:
Timber volume is calculated as follows (DoF, 2061):

$$Timber\ Volume = Tree\ Volume \times Quality\ of\ Tree \ldots\ldots\ldots\ldots\ldots \text{(ii)}$$

Where, tree volume is from eq. (i) and quality of tree is based on DoF (2061). If the tree is of 1st class, tree volume is multiplied by 2/3, while 1/2 for 2nd class tree and 0 for 3rd class tree.

Fuelwood volume is calculated as follows (DoF, 2061):

$$Fuelwood\ Volume = Tree\ Volume \times Quality\ of\ Tree + Branch\ Volume \ldots\ldots\ldots \text{(iii)}$$

Where, tree volume is from eq. (i) and quality of tree is based on DoF (2061). If the tree is of 1st class, tree volume is multiplied by1/3, while 1/2 for 2nd class tree and 1 for 3rd class tree.

Tree Biomass:
Tree standing volume was multiplied with its dry wood density to get stem biomass of tree. Using stem biomass, branch biomass and foliage biomass were calculated using ratio of branch to stem biomass and foliage to stem biomass for various species (HMGN, 1988).

$$Stem\ Biomass = Tree\ Volume\ X\ Tree\ Wood\ Density \ldots\ldots\ldots\ldots\ldots \text{(iv)}$$

Where, tree volume is from eq. (i), and tree wood density was obtained from various sources such as DoF (2010), Sharma E.R. and Pukkala T. (1990) and Master plan for forestry Sector (HMGN, 1988).

$$Tree\ Biomass = Stem\ Biomass + Branch\ Biomass + Leaf\ Biomass \ldots\ldots\ldots\ldots\ldots \text{(v)}$$

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 basal area. The basal area is replaced by coverage in case of shrubs and herbs.

$$IVI = \text{RD} + \text{RF} + \text{RBA or RC} \ldots\ldots\ldots\ldots\ldots \text{(vi)}$$

Where,

RD = Relative Density
RF= Relative Frequency
RBA = Relative Basal Area (for tree)
RC= Relative Coverage (for shrubs and herbs)

Density:
Shrub/Herb density is calculated as follows;

$$Density\ (No./ha) = \frac{I}{A\ X\ N} \text{x}\ 100 \ldots\ldots\ldots\ldots\ldots \text{(vii)}$$

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

Basal Area:

$Basal\ Area\ (m^2) = \frac{pd^2}{4}$ … … … … … … … … … … … (xiii)

Where,

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

$Relative\ Basal\ Area\ (\%) = \frac{TIBA}{TBA} X100$…….. (xiii)

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

Wildlife and Avian Fauna

Information on wildlife (including mammalian, herpetofauna and avian fauna) of the subproject area was gathered using both direct and indirect methods. Direct method involved transect walk which was proposed on observing status of wildlife in forest and immediate surroundings within subproject's impact area. Animals, herpetofauna and birds spotted along the route and information on their habitat were recorded. Moreover, identification of pug marks/footprints, droppings/pellets, ground digging and uprooting, tree scratching 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, herpetofauna 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 project area, **Annex** VII. Additional information on animal presence, movements issues and human wildlife conflicts were obtained by using indirect

methods i.e. discussions with a range of stakeholders that included local people, SNP, RM, BZCFUGs etc.

Fish

The water bodies have cold temperature and low nutrient contents. 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 Monjo Khola and Dudhkoshi River. Not any 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 following:

Household survey: Household (HH) survey was 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, 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 BZCFUC, 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 OF COLLECTED SAMPLE OF WATER

Water sample were collection at two locations - headworks area of MKMHP and drinking water supply at Monjo settlement. Laboratory analysis of thus collected water was carried out for the analysis of different parameters, **Annex** X. Direct observation and measurements of sound pressure level were done at two locations (headworks and powerhouse) for noise quality on 17 November 2021 (1 Mansir 2078). Data collection on air quality was done by indirect assessment.

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 was used as the major source for verification and validation of primary data collected during the field survey. The generated information from the primary sources were analyzed and tabulated. The likely impacts were assessed covering both adverse and beneficial ones.

Based on identification of the potential impacts, their predictions have been 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 types of subprojects 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 will occur within the subproject 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 2: 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 3** below depicts the cumulative score of level of significance.

Table 3: Cumulative scores of level 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 DRAFT REPORT

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

1.3.7 PUBLIC CONSULTATION, DISCUSSION, INTERACTION AND PUBLIC HEARING, DISCLOSURE OF DRAFT REPORT

The consultation and interaction with locals were conducted from the planning phase of the subproject. Most of the discussions were informal. Interaction with, SNP, Women's Group, BZCFUG, monastery, health institution, school and other relevant stakeholders were made during affixation of public hearing notice.

Similarly, a public hearing for the proposed MKMHP was done on 11 November 2021 (25 Kartik 2078). Before the public hearing, a public notice was published in Arthik Abhiyan, a National Daily Newspaper published from Kathmandu mentioning Time, Place and Date of Public Hearing, **Annex** XI. Similarly, a public notice from local FM was aired for the same, **Annex** XII. Public hearing commenced with information dissemination on project and subproject introduction, subproject activities, potential environmental and social risks and impacts, augmentation and mitigation measures, responsible agencies, total project cost and

financial mix. Additionally, the participants were also made aware that any suggestion and concerns regarding the subproject to be shared with local field coordinator of the ESCO. A total of 44 people participated in the public hearing. Among the participants, 13 were female and 31 were male. With respect to ethnicity, 31 participants were Sherpa, 13 were from other ethnic community (Rai: 4, Tamang: 2, Magar: 1, Newar: 2, Bahun/Chettri: 5). Meeting minute of the public hearing has been prepared and presented in **Annex** XIII. Major issues raised during the public hearing are as follows:

Table 4: Issues Raised during Public Hearing and Response from the ESCO

SN	Issues Raised	Commitment from ESCO	Remarks
1	Priority to locals for employment	First priority will be given to locals as per their capacity and skills.	
2	Investment Opportunities for Locals	Opportunity for investment will be provided at appropriate time to residents in form of local shares.	
3	Provision of Minimum Tariff for Affected People or Households	Appropriate Tariff will be fixed after negotiation with locals.	
4	Provision of free electricity for social and cultural institutions such as school, Gumba etc.	This issue will be discussed with board members of the company and appropriate solution will be sort out.	
5	As it seems that previous survey has not included the households of Geringma and Skangding, households from these settlements should be involved in distribution of electricity	Provision will be made to distribute electricity to each and every household from Jor Salle to Muse.	
6	Energy demand of each households should be calculated.	Has already been collected.	
7	Information has to be given to locals how they get shares from proposed subproject.	Will be notified to locals in appropriate time.	
8	Issues of private land should be settled down.	This issue will be addressed at mutual understanding and negotiation. ESCO has proposed three modalities on compensation to private land. These are as follows: i) Purchase the land ii) Convert the value of land to local shares iii) Long term lease of the land The rates of the land will be fixed with mutual	

SN	Issues Raised	Commitment from ESCO	Remarks
		understanding between the ESCO and the land owners.	
9	There should be clear about the effects of subprojects on existing old micro hydro projects and peltric set and mechanism of settlement/management of these issues	Issues of existing old micro hydro projects and peltric set will be addressed with appropriate alternative.	Peltric set is already closed and ESCO has already made an agreement with all 4 existing micro hydro management committee

2 DESCRIPTION OF THE SUBPROJECT

2.1 GENERAL INFORMATION ON THE SUBPROJECT

The Monjo Khola Mini Hydro Subproject is a Greenfield subproject and is a run-off-river scheme which will use water from Monjo Khola. The subproject will provide electricity facility to 582 households in Jorsalle, Chyuma, Byankar, Tok Tok, Thulo Gamela, Phakding, Sano Gamela, Chermading, Ghat, Thadakoshi, Chheplung, and Chaurikharka Villages of Ward No. 3 as well as Muse village of Ward No 2. The subproject is planned to develop 942 kW capacity releasing 10% of minimum monthly flow as per "Directive on Physical Infrastructure Construction and Operation in Conservation Areas, 2065"[6].

2.2 LOCATION AND ACCESIBILITY

2.2.1 DESCRIPTION OF LOCATION

The components of the subproject have been proposed to implement in Monjo village, Ward No. 3, Khumbu Pasanglhamu Rural Municipality, Solukhumbu district, Province No.-1 and the power generated will be distributed to all HHs in Ward No. 3 and Muse village in Ward No 2. Geographically, the proposed subproject lies between 27°46'00"N to 27°46'30"N latitude and 86°43'20.00"E to 86°44'30.00"E longitude. The elevation within the subproject area varies between 2744 m to 2960 m amsl.

Major subproject components such as headworks (including intake, desanding basin) and some part of penstock pipe are proposed to be located on the left bank of Monjo Khola while remaining part of penstock, tailrace and powerhouse facility as well as the switchyard station are proposed to be located on the right bank of Monjo Khola, which is a tributary of Dhudhkhosi River.

The subproject site can be reached via aeroplane up to Lukla and then by foot or helicopter from Kathmandu. Flight from Kathmandu to Lukla takes around 30 minutes. From Lukla, the site is either accessible by helicopter or on foot. Travel on foot from Lukla to subproject site is 13 km. Construction materials and electromechanical equipment can be transported to the subproject site either by helicopter or mules. Alternatively, the subproject site can be accessed by road along with walk on foot. A motorable road of 216 km from Udaypur connects to Salleri bazar, district headquarter. From Salleri Bazaar there is seasonal road to Buksa which is 48 km. From Buksa, the subproject site is accessible either by helicopter or on foot. Travel distance on foot from roadhead (Buska) via Lukla to subproject site is around 45 km and requires 3 days for a loaded porter. From Lukla to Monjo, it is about 13 km foot trail.

[6]*At least 10% of the monthly discharge should be released to river/stream in order to generate electricity using river/stream in National Parkes and Conservation area.*

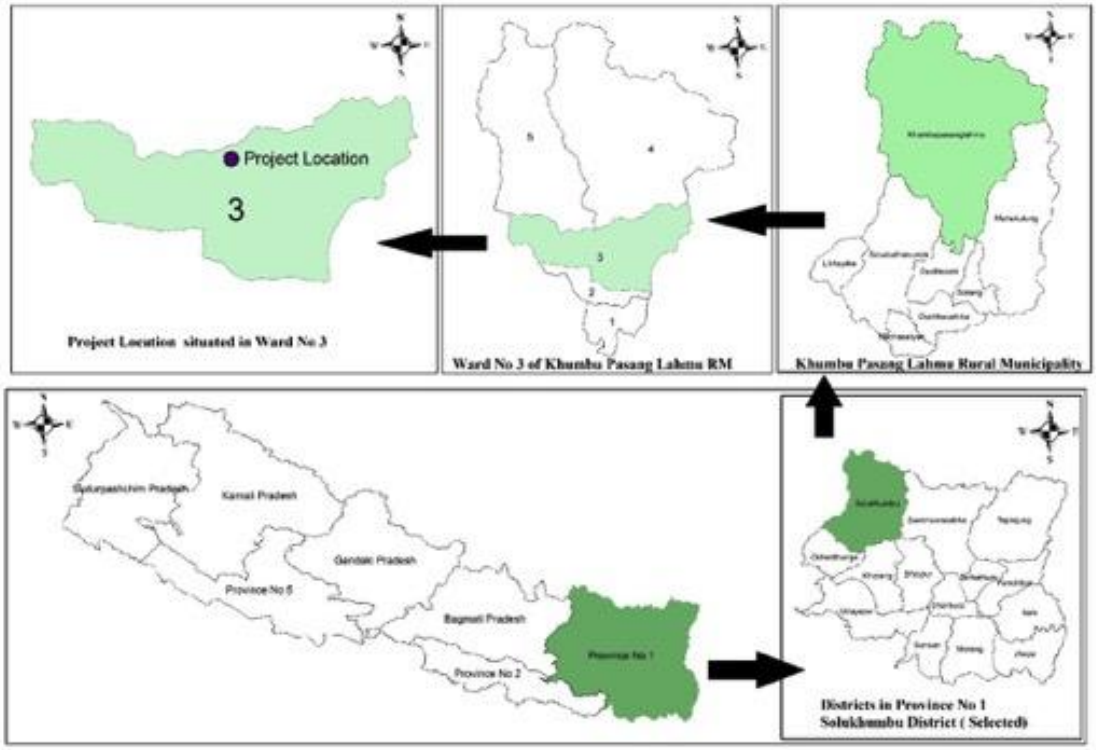

Figure 3: Subproject Location in District Map

(Shape file modified by CED)

Figure 4: Subproject Location on Google Earth Map

(Map Source: Over lay on Google map, Modified by CED)

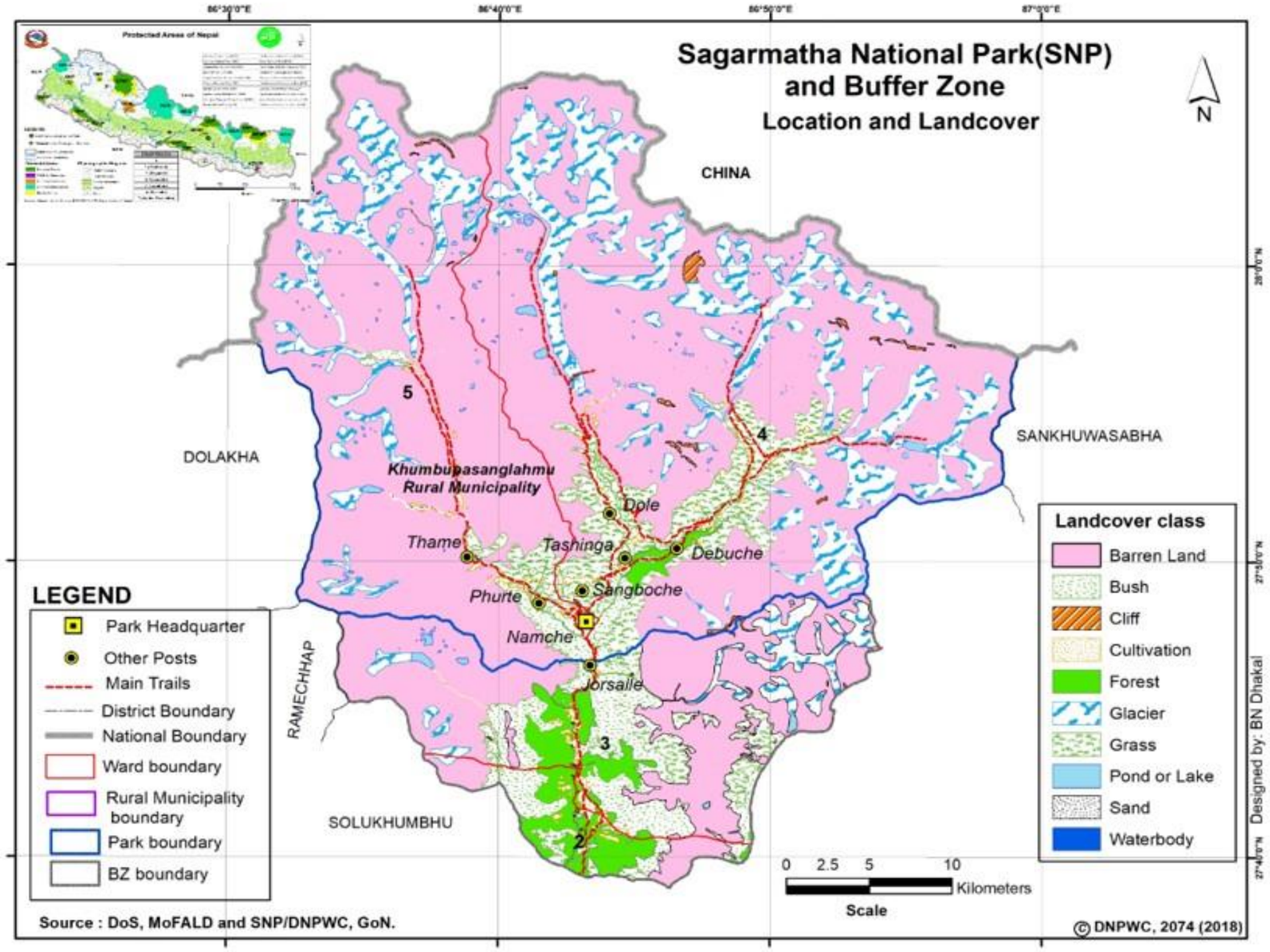

Figure 5: Subproject Location along with Sagarmatha National Park Boundary

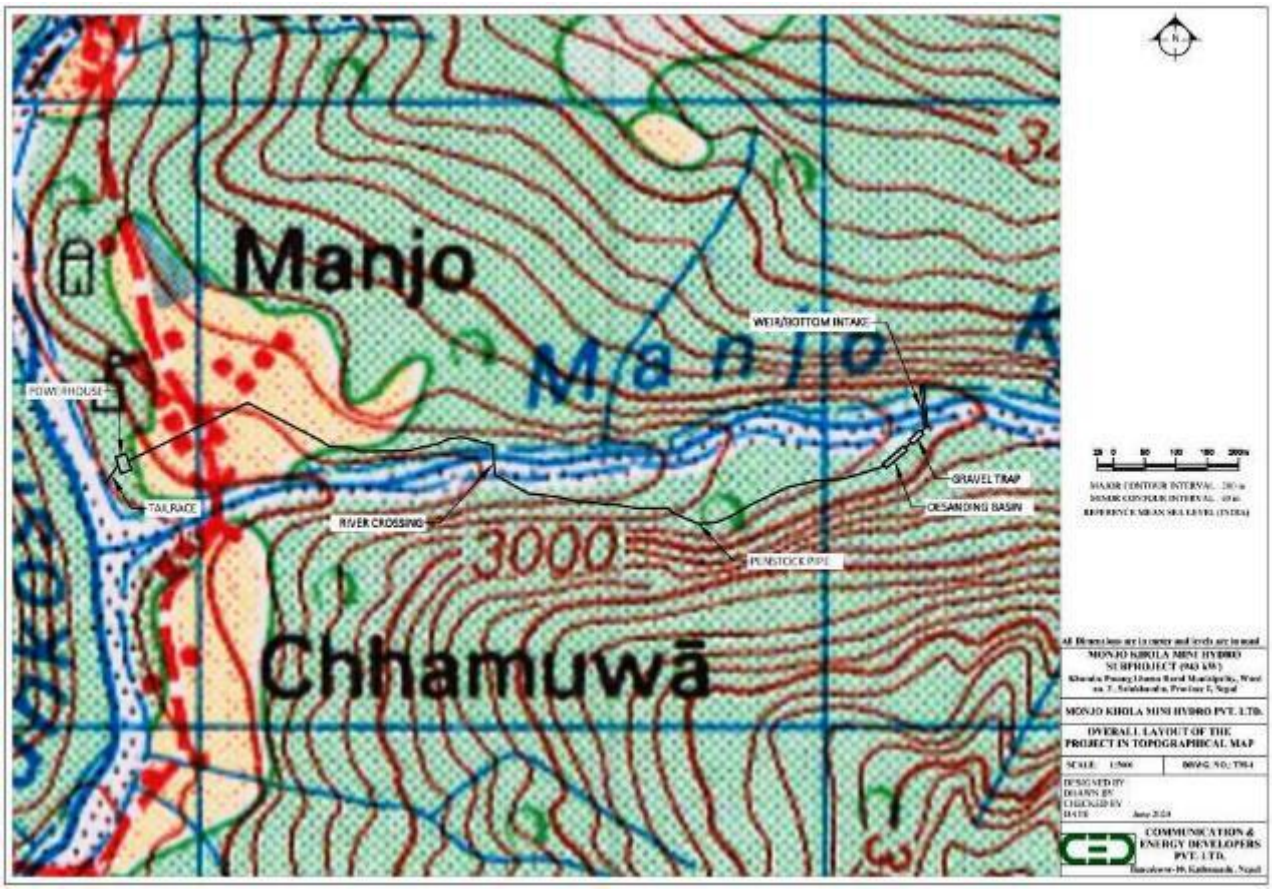

Figure 6: Subproject Location in Topographic Map

2.2.2 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)[7] and Indirect Impact Zone (IIZ)[8] - based on the nature and the extent of the impact of construction and operation of subproject components.

2.2.2.1 DIRECT IMPACT ZONE (DIZ)

The DIZ of the MKMHP 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, powerhouse, penstock, material quarry sites, labor camp, material storage house 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. 3. The term "Core Project 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.

[7] *The areas to be disturbed as a result of construction and installation activities of the minihydro project components.*
GoN, 2018. Hydropower Environmental Impact Assessment Manual, Ministry of Forest and Environment
[8] *Factors not directly affected by project activities and associated facilities / ancillary elements, but which could potentially experience beneficial / adverse impacts from the project or may raise community expectations / concerns of such impacts.*
GoN, 2018. Hydropower Environmental Impact Assessment Manual, Ministry of Forest and Environment

2.2.2.2 INDIRECT IMPACT ZONE (IIZ)

The Indirect Impact Zone (IIZ) of Monjo Khola Mini hydro is the surrounding area around 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. The entire area of Ward No. 3 and Muse village of Ward No. 2 of Khumbu Pasanglhamu RM has been taken as IIZ.

2.2.3 NEARBY COMMUNITIES AND FORESTS, ENVIRONMENTALLY SENSITIVE AREAS, AND HERITAGE SITES

The nearest settlement from power generation infrastructure is Monjo village, mostly dominated by Sherpa ethnic community. Other settlements where generated power will be distributed are Jor Salle, Chhamuwa, Benker, Tok Tok, Ghattekhola, Jamphutte, Rangding, Gumela, Thulo Gumela, Sano Gumela, Phakding, Chhermading, Chhusherma, Ghat, Lowa, Thado Koshi, Teka, Nachipang, Chheplung, Bosum, Chaurikharka, Chaurikharka (Dhunge), Muse and Muse (Bakudingma). All the settlements except Muse lies in Ward No. 3 of Khumbu Pasanglhamu RM and Muse lies in Ward No. 2 of same Rural Municipality. The distance to each settlement from the subproject site is presented in **Table 23**. In all settlements, Sherpa is the dominant ethnic community. Other caste/ethnic groups are very less. Rai, Tamang, Magar, Chhetri and others are few and most of them have migrated for trade. Within subproject area there are five buffer zone community forests (BZCFs)—Himalaya BZCF, Pemachholing BZCF, Kongde BZCF, Red Panda BZCF and Muse BZCF. Himalaya BZCF lies in power generation as well transmission distribution line areas while others along the transmission distribution line areas. The direct impact area on the forest is in the power generation area location as the transmission lines are underground along the foot trails except river crossing areas. Therefore, the subproject will directly impact the Himalaya BZCF. The subproject area lies in buffer zone of SNP, which is itself the World Heritage Site under criteria (vii).

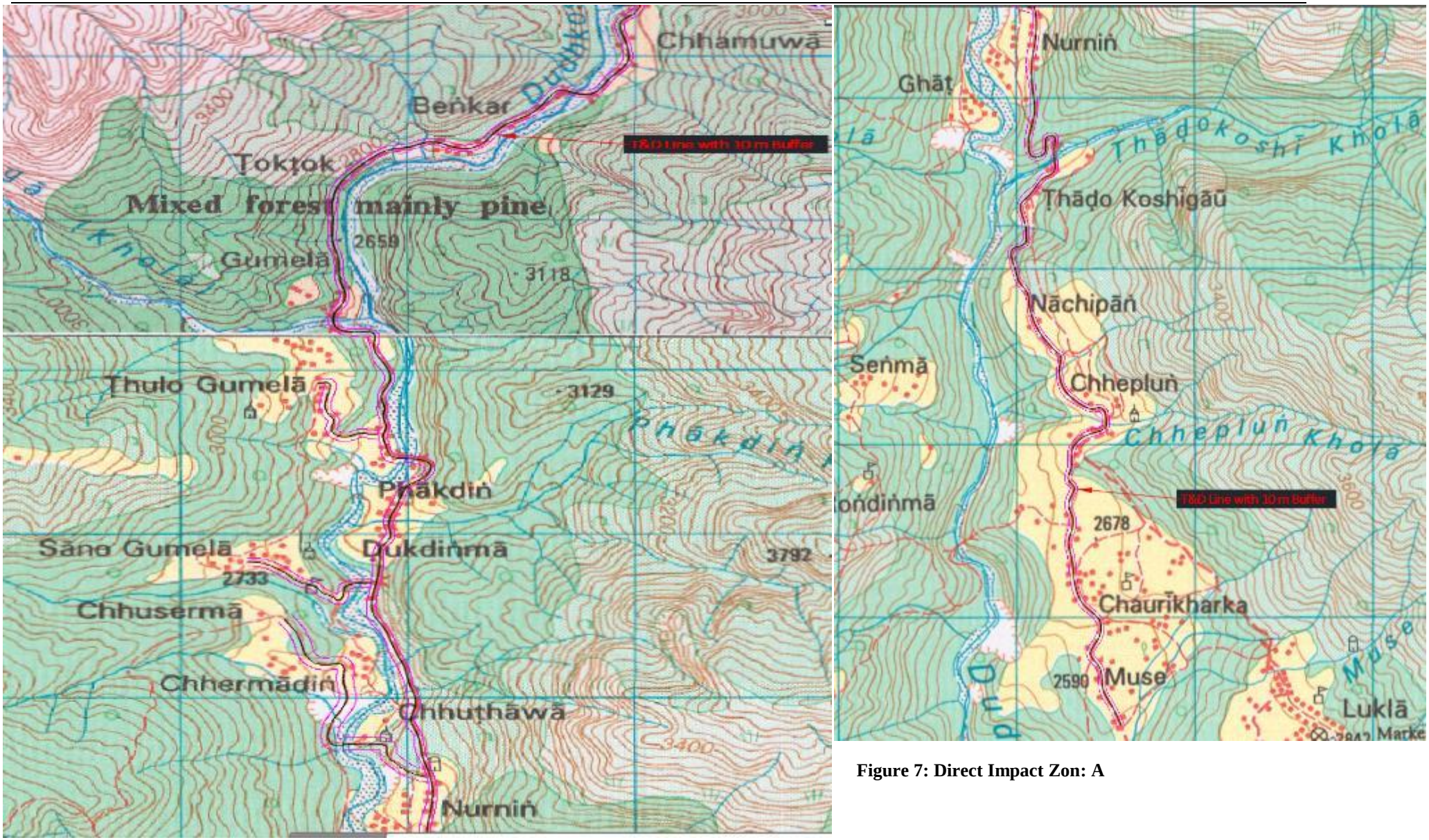

Figure 7: Direct Impact Zon: A

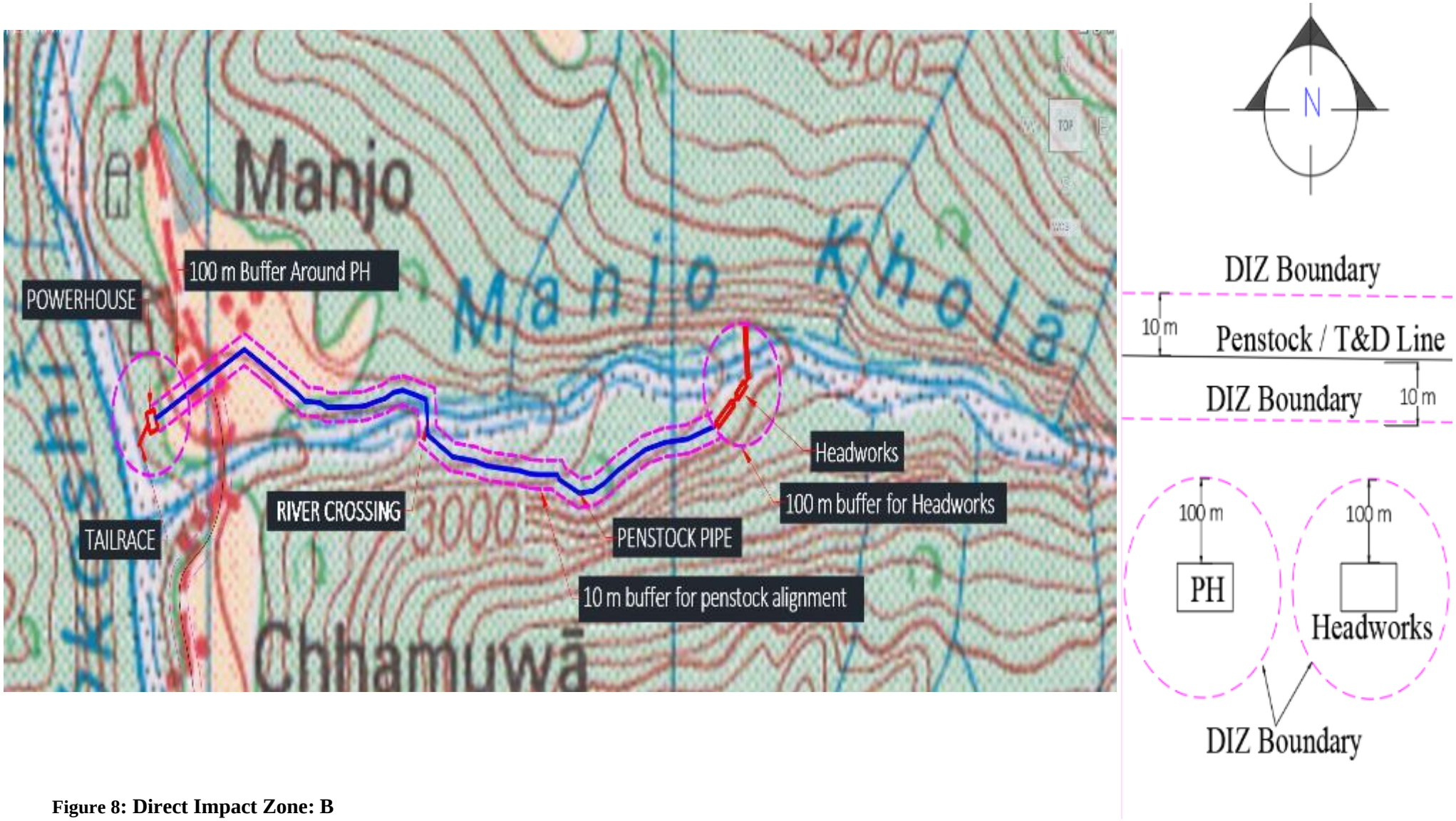

Figure 8: Direct Impact Zone: B

2.3 SALIENT FEATURES

The salient feature of the proposed subproject is as follows;

Table 5: Salient feature of the Subproject

1	**Location**	
	Province	1
	District	Solukhumbu
	Gaunpalika	Khumbu Pasanglhamu Rural Municipality Ward No. 3
	Subproject Boundary	27°46'00"N to 27°46'30"N and 86°43'20.00"E to 86°44'30.00"E
	Intake	27°46'15.20"N and 86°44'15.80"E, elevation 2960 amsl
	Powerhouse	27°46'15.00"N and 86°43'20.18"E, elevation 2744 amsl
2	**General**	
	Name of River	Monjo Khola
	Nearest Town	Lukla (9.5 km)
	Type of Scheme	Run of River
	Gross Head	215.50 m
	Installed Capacity	942 kW
	Annual Energy	7,243,292.16 kWh
3	**Hydrology**	
	Catchment Area at Headworks Site	43.26 km^2 (Total), 18.83 km^2 (>5000 m) 24.43 km^2(A> 2960, A < 5000 m)
	Measured Discharge	447 lps (5 March 2020)
	Design Discharge ($Q_{80\%}$)	0.560 m^3/s
	Design Flood (1 in 100 year)	15 m^3/s (Intake) , 31 m^3/s (Powerhouse)
	Compensation flow	10% of discharge of driest month (Min)
4	**Diversion Weir**	
	Type	Concrete gravity type weir
	Length	8.5 m
	Height	1.45 m
	Crest level	El. 2960.50 m
5	**Intake**	
	Type	Bottom/Drop intake
	No of Orifice	1 No.
	Size of trashrack	6.0 m (L) x 0.71 m (B)
	Inclination of trashrack	15^o
6	**Gravel Trap**	
	Size (L x B x H)	6 m x 1.5 m x 2.15 m

	Bed load size to trap	2 mm
7	**Approach Canal**	
	Type	Rectangular RCC canal
	Length	2.4 m
	Size (B x H)	0.7 m x 1.3 m
	Bed Slope	1:100
8	**Desanding Basin cum Forebay**	
	Type	Conventional with head pond
	Size (L x B x H)	28.5 m x 3.2 m x 2.34 m
	Number of Bay	1 No.
	Nominal size of trapped particle	0.2 mm
9	**Penstock Pipe**	
	Type	Mild Steel Pipe (Exposed & Buried)
	Internal Diameter	600 mm
	Pipe Thickness	6 mm thick 532 m long
		8 mm thick 182 m long
		10 mm thick 650 m long
		12 mm thick 46 m long
	Branch pipe	MS 300 mm dia, 12 mm thick 10.00 m long (Each)
	Total Length of the pipe	1410 m
	No of Anchor Block	44 Nos
10	**Powerhouse**	
	Type of powerhouse	Surface Type
	Size (L x B x H)	21 m x 8.73 m x 6.7 m
	Turbine Axis Level	El. 2745.00 m
11	**Tailrace Conduit**	
	Type	Pipe and Canal
	Canal Size (L x B x H)	24.71 m x 0.66 m x 0.82 m
	Pipe	MS 600 mm dia, 6 mm thick, 47.22 m long
12	**Turbines**	
	Type	Horizontal Shaft Pelton Turbine Double Jet
	Number of Units	2 No.
	Discharge per unit	0.280 m^3/sec
	Rated Output (Mechanical)	496 kW X 2
	Synchronous Speed	1000 rpm
	Rated Net Head	204.99 m

	Rated Efficiency at 100% Discharge	88%
13	**Generators**	
	Type	3-Phase, Synchronous, Brushless
	Rated Output Capacity per Unit	650 kVA
	Rated Efficiency	97%
	Frequency	50 Hz
	Rated Voltage	0.4 kV
	Number of Poles	6
	Speed	1000 rpm
	No of units	2 Nos.
14	**Governor**	
	Type	Electronic, PID Oil-hydraulic, self-closing without electric power
	No of units	2 Nos.
15	**Transformer**	
	A. Power Transformer	
	Type	ONAN Cooling, YNyn0, 3 phase
	Rated capacity	650 kVA
	Voltage ratio	0.4/11 kV
	Efficiency	98%
	No of units	2 Nos.
	B. Distribution Transformer	
	Type	11/0.4 kV, 3-phase, oil immersed, copper owned AVR with parallel operation
	Rated Capacity	150 kVA- 2 Nos
		125 kVA- 5 Nos
		100 kVA- 1 No
		75 kVA-3 Nos
		50 KVA-3 Nos + 1 No as Station Transformer
		50 kVA-1 No
16	**Transmission & Distribution line**	
	Total Length of 11 kV underground line (underground PVC sheathed armored 3 core 70 sq. mm aluminum)	16.00 km

	Total length of 11 kV overhead line during river crossings (Dog ACSR)	0.80 km
	1.1 kV 120 sq.mm. 4 Core XLPE Insulated Unarmored Aluminum Cable	8.00 km
	1.1 kV 95 sq.mm. 4 Core XLPE Insulated Unarmored Aluminum Cable	6.00 km
	1.1 kV 35 sq.mm. 4 Core XLPE Insulated Unarmored Aluminum Cable	10.00 km
17	**Switchyard**	
	Type	Indoor, Single Bus Configuration, 11 kV
	Dimension	3.55 m X 6.32 m
	Location	Inside Powerhouse
18	**Load Center**	
	Ward No 3:	
i	Bosum	9
ii	Byankar	43
ii	Chauri Kharka	34
iv	Chaurikharka (Dungde)	54
v	Chesurma	12
vi	Chheplung	59
vii	Chhermading	6
viii	Chyuma	25
ix	Ghat	40
x	Ghattekhola	4
xi	Jamphutte	8
xii	Lowa	5
xiii	Monjo	59
xiv	Ngamateng	6
xv	Phakding	56
xvi	Rangding	13
xvii	Teka	5
xviii	Thadokoshi	17
xix	Tok-Tok	26
xx	Thulo Gumela	32
xxi	Sano Gumela	25
	Sub-Total (Ward No 3)	538
	Ward No 2:	
i	Muse	40

ii	Muse (Bakudingma)	4
	Sub-Total (Ward NO 2)	44
	Total	**582**
19	**Power and Energy**	
	Type of Power Plant	Run-of-river
	Design Discharge	0.56 m³/s
	Total Gross Head	215.50 m
	Rated Net Head	204.99 m
	Installed Capacity	942 kW
	Total Annual Energy	7,243,292.16 kWh
20	**Subproject Cost Estimate**	
	Total subproject Cost with VAT and Provisional Sums and IDC	NRs. 571,611,140.45
	Cost Per kW	NRs. 606,805.88
	Tariff Rates	NRs. 11 for HH and NRs. 18 for Enduse
	Net Present Value (@ 6% discount factor)	NRs. 196,916,550.75
	Subproject rate of return	10.72%
	Equity rate of return	13.18%
	B/C Ratio	1.32
	Payback	8 years
21	**Financial Mix**	18 Months
	AEPC Subsidy (23.86 %)	136,374,000.00
	ESCO Investment (20.00%)	114,322,228.09
	Bank Loan (56.14 %)	320,914,912.36
22	**Construction Period**	18 Months

2.4 TECHNICAL ASPECTS

2.4.1 SUBPROJECT COMPONENTS

Water of Monjo Khola will be diverted by constructing 8.5 m long and 1.45 m high diversion weir during construction of headworks to generate annual average sellable energy of about 7,243,292.16 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 1.3 km upstream from the confluence of Monjo settlement.

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 8.5m and its crest level is fixed at 2960.50 m amsl. The bed level of river at upstream side of weir is 2959.57 m amsl and at downstream of weir is 2959.35 m amsl. The high flood level at weir is 2961.38 m amsl for flood discharge of 15 m^3/s at 100 years return period. The platform level for gates operation is fixed at 2962.38

m amsl. Upstream apron of 1.5 m length is provided whereas downstream apron is of length 7.3 m.

ii) Bottom Intake

As the gradient of river is steep, the bottom intake is proposed for the diversion of water from river. The length of trashrack provided along the axis of weir is 6m and the inclined width of trashrack is 0.71m. The trashrack is capable of diverting 0.67 m^3/s of discharge which is 20% more than the design turbine discharge (0.56 m^3/s). The normal water level at intake is fixed at 2960.50 m amsl.

iii) Approach Canal

The diverted water from intake is carried through approach canal to the gravel trap. The width of canal is 0.7m and overall depth is 1.3m. The length of canal is 2.4 m.

iv) Gravel Trap

The length of gravel trap is 6m, width is 1.5 m and average depth is 2.15m.The normal water level at gravel trap is 2959.80 m amsl. Side spillway of length 4m is provided at gravel trap to spill the excess flood discharge. The crest level of spillway is fixed at 2959.85 m amsl. The size of flushing gallery provided at gravel trap is 0.4m x 0.4m. The inlet transition of length 1.5m is provided whereas outlet transition of length 0.9m is provided.

v) Desanding Basin

The length of basin is 28.5m, width is 3.2 m and average depth is 2.34 m.The design size of particle to settle at desanding basin is 0.2 mm. The inlet transition of length 4.70 m is provided to maintain the steady flow at basin. The size of flushing gallery provided at basin is 0.4m x 0.4m. The bed slope of 1:50 is provided at basin. At the end of desanding basin, headpond of length 2m, width 3.2m and depth 3.02m is provided to maintain the adequate submergence depth for penstock pipe. The normal water level at headpond is maintained at 2959.71 mamsl.

2.4.1.2 PENSTOCK PIPE AND SUPPORTS

Mild steel penstock pipe with internal diameter 600mm and length 1410 m is proposed for conveying water from headpond to the turbine. The thickness of pipe varies from 6 mm to 12mm. After bifurcation, two manifolds of 10 m length and 300 mm internal diameter is provided. Anchor blocks are provided at each horizontal and vertical bends to restrain the forces generated at bends. Total 44 numbers of blocks are provided (including bifurcation and branches) in the subproject.

2.4.1.3 POWERHOUSE AND TAILRACE

i) Power House

The powerhouse is located near Monjo Village on left bank of Dudhkoshi 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 about 2744 m. It contains two units of horizontal shaft Pelton turbine which drives a generator and generates a power of 471 kW each, with total installed capacity of 942 kW. The dimension of the powerhouse is 21m x 8.73 m x 6.7 m. The floor level of powerhouse is fixed at 2744.40 m amsl elevation and the turbine axis level is at 2745.00 m elevation.

ii) Tailrace

The water form two units of powerhouse are conveyed to Dudh Koshi River through combination of tailrace canal and pipe. The length of tailrace canal is 24.71m and that of pipe is 47.22 m. The bed slope of 1:200 is provided for tailrace canal. Tailrace canal have width of 0.66 m and overall depth of 0.82 m. The diameter of pipe used in tailrace is 600 mm. At outlet portion, gabion and boulder riprap protection are provided to prevent erosion of soil.

2.4.1.4 SWITCHYARD AREA

An indoor switchyard of 3.55 m X 6.32 m has been proposed for the transmission of 942 kW of power. The generated powers from two 650 kVA alternators are transferred to a 400 V busbar. From this busbar two transformers of 630 kVA each are connected in parallel operation and the power is fed to a single bus system of 11 kV. This bus system will be used to transmit electricity in high voltage majorly through a high voltage underground cable. The transformers, transformer protection system, CTs, PTs, isolators, VCBs and bus bars are major equipment of the outdoor switchyard. The details of switchyard equipment can be viewed in the electrical single line diagram of Monjo Khola Mini Hydro Subproject.

2.4.1.5 TRANSMISSION AND DISTRIBUTION LINE

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

Table 6: T&D along Load Center

S. N.	Entities	Power Allotted, kW						Total
		1.0	1.5	2.0	2.5	3.0	4.0	
1	Household	54	278					332
2	Small Hotel		75					75
3	Miduum Hotel			38				38
4	Big Hotel					24		24
5	Resturant		74					74
6	Social Institution					20		20
7	Hospital					1		1
8	Snooker House	3						3
9	Shops	9						9
10	Ward Office				1			1
11	Bakeries			2				2
12	End Uses						3	3
Total Entities		**66**	**427**	**40**	**1**	**45**	**3**	**582**
Total Allotted Power		**66**	**640.5**	**80**	**2.5**	**135**	**12**	**936**

Further as a part of subproject, the power/energy to be generated at MKMHP will be evacuated and distributed to the proposed Khumbu Pasanglhamu RM-3 through a 40.80km long transmission and distribution with 11kV transmission line and 400/230 V as distribution voltage. The transmission line uses only public land along with foot trails through underground distribution system.

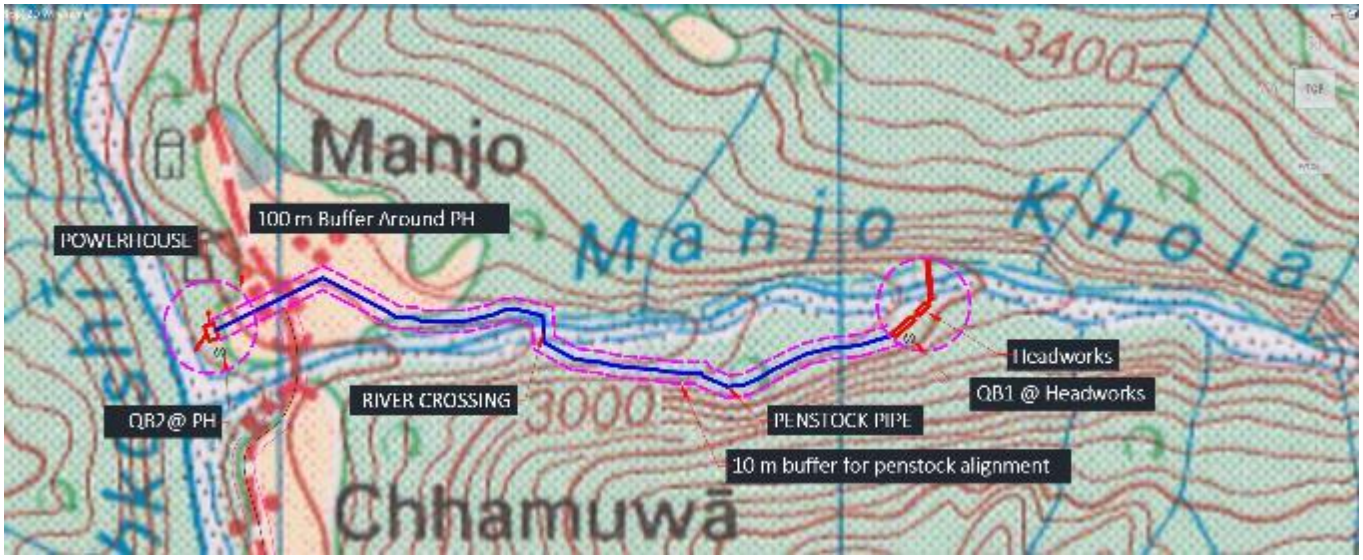

Figure 9: Subproject Components on Topo map: QB1 and QB2 represent Quarry and Borrow Sites

2.4.2 ANCILLARY FACILITIES

a) Site Access

Site access shall be provisioned by using existing trails from Monjo to reach to various subproject component sites. The details of the access trails are provided in **Table 7** hereunder.

Table 7: Site Access

SN	Description	Length	Width of trail	Remarks
1	Monjo to Powerhouse	150 m	4 ft	
2	Powerhouse to Headwork	1.5 km	4 ft	

b) Subproject Camps and Storage

One subproject camp (near the forebay location of existing old Monjo Khola Micro hydro Project) is proposed to accommodate Contractor's construction workforce as personnel of supervising Engineers and the Employer's staff. The camp will be located at the right bank of Monjo Khola on private land. A careful assessment is needed in the ESIA to understand potential E&S impacts of the labor camp, its location, proximity to settlements and the way workers will be managed.

c) Material Storage and Workshop

Material storage and mechanical workshops are located on the right bank of Monjo Khola at the camp site.

d) Local Construction Material

Local construction material requirement will be minimal as depicted in **Table 8** 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. The identified sites are temporary and approval for the sites will be taken from the RM before starting the construction work.

Table 8: Proposed construction material and burrow sites for MKMHP

SN	Site Code	Location	Capacity	Coordinate	
				N	E
1	Site-1	Headworks	3915 cu.m	27°46'15.14"	86°44'15.06"
2	Site-2	Powerhouse	659 cu.m	27°46'14.80"	86°43'19.61"

(Source: DFS)

e) Batching Plants and Aggregate Crushing Plants

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

f) Materials and Equipment Transportation

The construction materials and electromechanical equipment will be transported to 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 airlifted to project site.

2.4.3 SUBPROJECT EQUIPMENT AND CIVIL WORKS

Subproject equipment includes mechanical and electrical. Mechanical includes penstock pipe, turbine and governor. On the same way the electrical works or equipment are generators, transformers, transmission and distribution lines and switchyard. The civil works includes diversion weir, intake, gravel trap, approach canal, desanding basin cum forebay, anchor blocks and powerhouse.

2.4.4 SUBPROJECT OWNERSHIP

The subproject ownership will be with Monjo Khola Mini Hydro Pvt. Ltd., Kathmandu-8, Tilganga, Bagmati Province, Nepal.

2.4.5 DESCRIPTION OF LAND REQUIRED FOR THE SUBPROJECT

An estimated land area of about 5.83 ha is required for construction of the subproject components and provisioning for subproject facilities among which 5.7 Hectors is public land and 0.13 hectors is categorized as private land. **Table 9** presents further details about the lands required for the different subproject's components.

Table 9: Estimated Land Requirement and Ownership for MKMHP

SN	Component	Land Area (Ha)	Acquisition (Temporary or Permanent)	Land Ownership	Land Use
1	Headworks	0.054	Long-term Lease	Public	Forest
2	Penstock Alignment	0.411	Permanent for Private land and Long-Term Lease for Public	Public (0.3380 ha) + Private (0.0730 ha)	Forest (Public) Private (Seasonal Agriculture Land)
3	Powerhouse, Switchyard and Tailrace	0.055	Permanent	Private	Agriculture Land
4	Spoil Disposal	0.05	Temporary (Short term	Public	Forest

SN	Component	Land Area (Ha)	Acquisition (Temporary or Permanent)	Land Ownership	Land Use
	Sites		Lease)		
5	Quarry and Burrow Sites	0.39	Temporary (Short term Lease)	Public	Forest
6	Workshop and Material Storage	0.08	Temporary (Short term Lease)	Public	Forest
7	Subproject camps and offices	0.05	(Long term Lease)	Public	Forest
8	Transmission Lines	4.55	Temporary	Public	Trekking Trail
9	Electric pole Installation	0.008	Long Term Lease for Public	Public	Forest
10	Weir	0.18	Long term Lease from BZCF	Public	Forest
	Total	**5.83**			

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 at Monjo while distribution structures spreads from Muse to Jor Salle.

Table 10: Subproject Operating Regime

1	**Subproject Location**		
	Province	1	
	District	Solukhumbu	
	Gaunpalika	Khumbu Pasanglhamu Rural Municipality Ward-3	
	Subproject Boundary	27°46'00"N to 27°46'30"N 86°43'20.00"E to 86°44'30.00"E	
2	**Structure**		
	Intake	27°46'15.20"N 86°44'15.80"E, elevation 2960 amsl	Monjo
	Power House	27°46'15.00"N 86°43'20.18"E, elevation 2744amsl	Monjo
	Transmission and Distribution Lines	27°41'11.25"N to 27°46'45.74"N 86°43'10.66"E to 86°43'21.05"E (Elevation range 2533 m amsl to 2810 m amsl)	From Muse to Jorsalle

(Source: DFS)

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
- Hydromechanical works: Fabrication, transportation, erection and testing of gates, trash racks, penstock pipes etc., Civil works for steel structures and then the installation works.
- Electromechanical works: Equipment installation

- Transmission Line work
- Commissioning of Power Plant
- 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;
- O&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 about a total of 250 unskilled and 100 skilled human resources will be involved daily during the peak construction period in two shifts. The details of workers and their type (in terms of skilled, semiskilled and unskilled) are as follows:

Table 11: Details of Human Resources

SN	Category	Number	Remarks (Migrant/Local)
A	**Skilled Human Resource**	**100**	**Migrant**
1	Site Engineer	2	
2	Overseer	3	
3	Mason	35	
4	Gabion Mistri	12	
5	Welder	4	
6	Iron Worker	10	
7	Mechanics	2	
8	Electrician	2	
9	Supervisor	5	
10	Foreman	15	
11	Painter	5	
12	Carpenter	5	
B	**Unskilled Human Resource**	**250**	**Local**
1	Camp Worker	10	
2	Survey Helper	5	
3	Mechanics helper	15	
4	Watchman	2	
5	Welder helper	10	
6	Staff man	4	
7	Tape man	4	
8	Labor	200	

(Source: DFS)

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

Subproject Period	Type of Human Resource	Number	Total
Q1	Skilled	70	250
	Unskilled & Semiskilled	180	
Q2	Skilled	100	350
	Unskilled & Semiskilled	250	
Q3	Skilled	100	350
	Unskilled & Semiskilled	250	
Q4	Skilled	100	350
	Unskilled & Semiskilled	250	
Q5	Skilled	100	350
	Unskilled & Semiskilled	250	
Q6	Skilled	100	300
	Unskilled & Semiskilled	200	

** 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)

Detail of equipment required for execution of the proposed subproject is given in **Table 13**.

Table 13: Construction Equipment

SN	Equipment	Quantity
1	Jackhammer	5 Sets
2	Shovel	100 Sets
3	Pick Axe	50 Sets
4	Rammer	30 Sets
5	Sledge Hammer	20 Sets
6	Wheel Barrow	20 Sets
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)

Approx. 783.73 m^3 of concrete and stone masonry work of volume 287.53 m^3 are estimated to be required for the subproject construction. Sand and stones are locally available materials and will be collected from the quarry sites as shown in **Figure 9**. The main construction materials and their estimated quantity are presented as below;

Table 14: Estimate of Construction Materials

SN	Construction materials	Quantity	Source
1	Cement (bags)	9,500	Factory
2	Aggregate (m^3)	900	Quarry Sites
3	Sand (m^3)	850	Quarry Sites

4	Boulder Stone (m^3)	2,200	Quarry Sites
5	Reinforcement Bars (ton)	63	Factory

(Source: DFS)

2.4.10 POWER SUPPLY ARRANGEMENTS

As there is no National Grid, two diesel generator sets each with 10 kVA capacities will be required at the headworks site and powerhouse respectively to meet the electricity demand of the construction purpose and for lighting of construction camps. Alternatively, a nearby micro hydro of 50 kW (Monjo MHP) can be used for required energy.

2.4.11 SPOIL GENERATION AND DISPOSAL (INCLUDING ESTIMATED QUANTITIES)

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.

2.4.12 SUBPROJECT IMPLEMENTATION SCHEDULE AND CONSTRUCTION WORK PLAN

The proposed MKMHP will require an estimated time frame of about 18 months for completion from the date of commencement to the date of commercial operation, **Annex XIV**.

3 LAW AND POLICY

The Government of Nepal has developed various acts, regulations and guidelines for environmentally friendly development activities. Similarly, WB has some guidelines and requirements for environmental study. The most relevant policies, laws, rules and regulations, and other guidelines and directives, which will govern the undertaking of ESIA of the proposed subproject, include the following.

3.1 NATIONAL REGULATORY FRAMEWORK

The GoN has a well-established legal framework for environmental assessment of development projects. The most relevant national policies, acts and guidelines of the GoN concerning environmental management, which are relevant to the proposed subproject, are listed as follows.

1. Constitution of Nepal
2. *Muluki Devani Sanhita Ain, 2017*
3. Fourteenth Plan 2016-2019
4. Hydropower Development Policy 2001
5. Rural Energy Policy 2006
6. Land Acquisition, Resettlement and Rehabilitation Policy 2015
7. National Environmental Impact Assessment Guideline 1993
8. Environment Protection Act 2019
9. Environment Protection Rule 2020
10. Electricity Act 1992
11. Water Resources Act 1992
12. Land Acquisition Act 1977
13. Land Revenue Act 1977
14. Labour Act 2074
15. Local Governance Operation Act 2017
16. National Parks and Wildlife Conservation Act 1973
17. National Foundation for Upliftment of Aadibasi/Janjati Act 2002
18. Forest Act 2019
19. Forest Rules 2022
20. Child Labor (Prohibition and Regulation) Act 2000
21. Ancient Monuments Preservation Act 1956
22. Buffer Zone Management Regulation 1996
23. Royalty and Benefit Sharing Mechanism

3.3 INTERNATIONAL CONVENTIONS

3.3.1 International Convention on Biodiversity 1992

The Parliament of Nepal ratified the International Convention on Biodiversity in 1993 to become its party. The convention was enforced in Nepal on 21 February 1994. Article 14 of the Convention urges Parties to introduce appropriate procedures requiring IEE of the proposed project that are likely to have significant adverse effects on biological diversity with a view to avoiding or minimizing such effects and, where appropriate, allow for public participation in such procedures. The convention also focuses on reducing transboundary impacts on biodiversity.

3.3.2 Convention on International Trade in Endangered Species of Wild Fauna and Flora 1975

Nepal became party to Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 1975 to control the trade of endangered wild flora and fauna to further endangering of their survival. The Convention urges Parties not to allow trade in specimen of species included in the CITES Appendices I, II, and III except in accordance with the provisions of the Convention.

Pursuant to Section 10 of the *National Park and Wildlife Conservation Act* 1973, the hunting of animal protected under Schedule 1 is prohibited throughout Nepal. Most of these species are also listed in CITES appendices. Under this Act, it is illegal to collect, obtain or keep any part of a dead animal protected under Schedule1 without a certificate, and such goods are prohibited for sale, purchase or disposal. Pursuant to Section 26, any person illegally killing, wounding, purchasing, selling or transferring a protected animal, or keeping as a trophy, selling or purchasing any part thereof, will incur a fine or imprisonment or both.

3.3.2 International convention related to IPs

Nepal is signatory of ILO Convention on Indigenous and Tribal Peoples, 1989 (No.169) which deals with the safeguard of indigenous people and their social interest. Similarly, United Nations Declaration on the Rights of Indigenous Peoples was adopted by the United Nations General Assembly during its 61st session on 13 September 2007. The non-binding declaration outlines the individual and collective rights of indigenous peoples, as well as their rights to identity, culture, language, employment, health, education and other issues. The UN describes it as setting an important standard for the treatment of indigenous peoples that will undoubtedly be a significant tool towards eliminating human right violation against the indigenous people and assisting them in combating discrimination and marginalization.

3.4 WORLD BANK SAFEGUARD POLICIES

The following World Bank safeguard policies are likely to be triggered by the proposed project.

3.4.1 OP/BP 4.01 - Environmental Assessment

Objective: The objective of this policy is to ensure that Bank financed projects are environmentally sound and sustainable.

Applicability: The environmental issues will be addressed adequately in advance. An integrated Environmental Screening and Environmental Assessment (EA) with Environmental and Social Management Plan (ESMP) will be developed to manage environmental risks and maximize environmental and social benefits wherever applicable.

3.4.2 OP/BP 4.04 - Natural Habitats

Objective: The policy recognizes that the conservation of natural habitats is essential for long-term sustainable development. The Bank, therefore, supports the protection, maintenance and rehabilitation of natural habitats in its project financing, as well as policy dialogue and analytical work. The Bank supports and expects the Borrowers to apply a precautionary approach to natural resources management to ensure environmentally sustainable development.

Applicability: This policy may be triggered by the Project due to activity requiring forest/ wildlife lands, locating close to the natural habitats with the potential to cause significant

adverse impact or degradation of natural habitats whether directly (through construction) or indirectly (through human activities induced by the project).

3.4.3 OP/BP 4.36 - Forests

Objective: This policy focuses on the management, conservation, and sustainable development of forest ecosystems and resources. It applies to project that may have impacts on (a) health and quality of forests; (b) affect the rights and welfare of people and their level of dependence upon forests and projects that aim to bring about changes in the management, protection or utilization of natural forests or plantations, whether they are publicly, privately or community owned. The Bank does not support the significant conversion or degradation of critical forest areas or related critical natural habitats.

Applicability: Impact of construction activities on Forest areas required to be taken care of. The forest related issues, avoidance/ minimization of forest loss and its management should be integrated with EA study and ESMP.

3.4.4 OP/BP 4.11 - Physical Cultural Resources

Objective: This policy aims at assisting 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.

Applicability: This policy may be triggered by subprojects where cultural property, historical, religious and unique natural value and unique environment features may be affected due to project.

Safeguard Requirement: Application has to be prepared and submitted to Archaeological Department in case any impact is envisaged due to the project. The impact on such features should be integrated with ESIA study and included in ESMP.

3.4.5 OP/BP 4.10 - Indigenous Peoples

Objective: This policy aims to protect the dignity, right and cultural uniqueness of indigenous people to ensure that they have a voice in project design and implementation, do not suffer from development activities; that they receive social and economic benefits. *Applicability*: This policy may be triggered if there are indigenous people in the project area; when potential adverse impacts on indigenous people are anticipated; and if indigenous people are among the intended beneficiaries.

Safeguard Requirement: Social assessment is carried out and integrated into Vulnerable Community Development Plan if required.

3.4.6 OP/BP 4.12 - Involuntary Resettlement

Objective: The 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.

Applicability: There will be need for limited land acquisition resulting inrelocation or loss of shelter, loss of assets or access to assets; loss of income sources or means of livelihood. This policy applies to all components of the project that result in involuntary resettlement,

regardless of the source of financing including projects that are carried out, or planned to be carried out, contemporaneously with the project.

Safeguard Requirement: SIA standalone or as a part of larger study ESIA and Resettlement Action Plan in consultation with the community and project authorities.

3.4.7 OP/BP 7.50 - International Waterways

Objective: The 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.

Applicability: This policy applies to the following types of international waterways: (a) any river, canal, lake, or similar body of water that forms a boundary between, or any river or body of surface water that flows through, two or more states, whether Bank members or not;

(b) any tributary or other body of surface water that is a component of any waterway described in (a) above.

Safeguard Requirement: While the policy applies, an exception from notification requirement under this policy has been obtained from the World Bank.

3.5 WORLD BANK GROUP ENVIRONMENTAL HEALTH AND SAFETY GUIDELINES

The following principles derived from the Environmental Health and Safety Guidelines of the World Bank will be applied to the project.

3.5.1 General Environmental Health and Safety Guidelines

The General Environmental Health and Safety Guidelines[9] contain information on cross-cutting environmental, health, and safety issues potentially applicable to all industry sectors. 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.

3.5.2 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 recommendations for their management.

[9] *http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policiesstandards/ehs-guidelines*

4 ENVIRONMENTAL AND SOCIAL BASELINE ASSESSMENT

4.1 PHYSICAL ENVIRONMENT

4.1.1 TOPOGRAPHY

Topographically the subproject area is rugged and undulated. The topography of the subproject area is of gentle to steep slope. The headworks lie in narrow river valley of Monjo Khola. The hill slope is steep. The MKMHP runs through steep to mild slope rock before some cultivated land at Monjo village. Powerhouse area is somewhat flat area, river terrace made by Dudhkoshi River.

4.1.2 GEOLOGY

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

The subproject area geologically lies on the Trans and Higher Himalayan Crystalline Zone in the eastern part of Nepal and area possesses the high-grade metamorphic rocks. The area falls within the Khumbu Migmatite Schuppe Zone. This zone is distributed widely in the upper reaches of the Bhotekoshi Khola and Dudhkoshi River, occupying the main part of the crystalline Schuppen in this region.

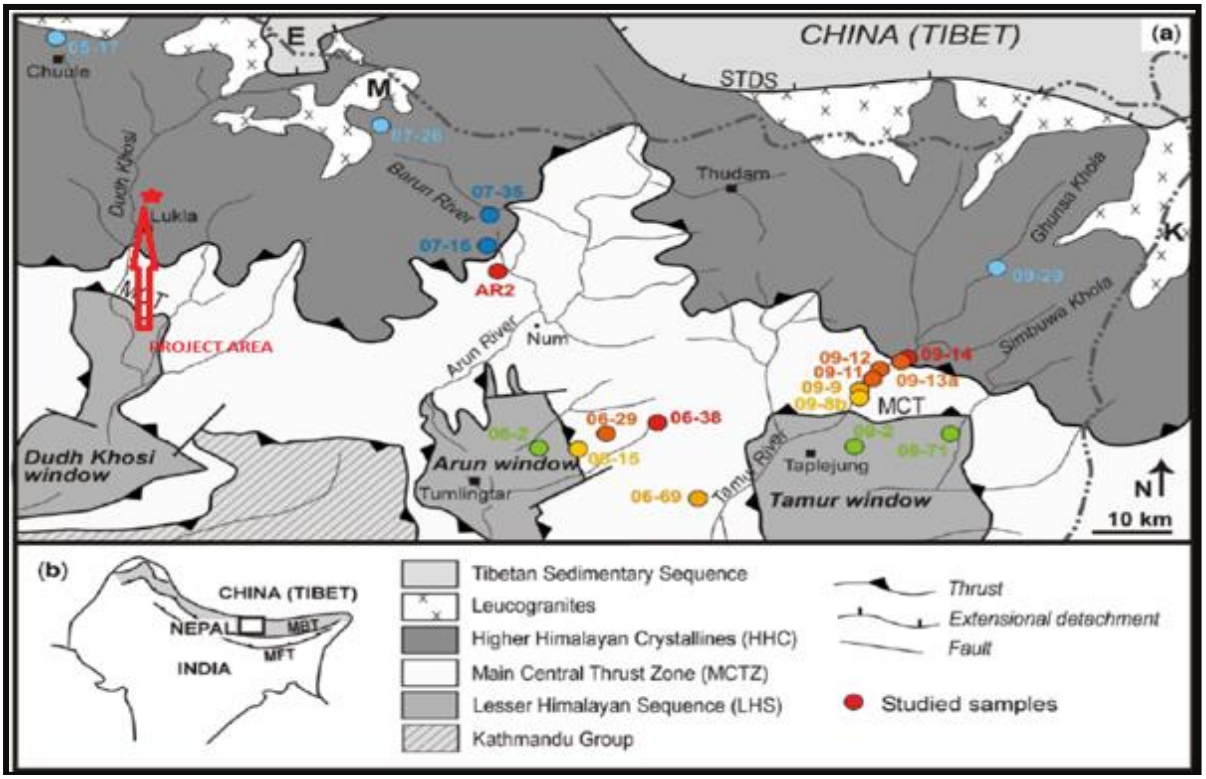

Figure 10: Simplified geological map of Eastern Nepal (modified from Goscombe et al. (2006), Groppo et al. (2009), and Mosca et al. (2011) Red Star indicates study area.

4.1.3 GEOLOGY OF THE HEADWORKS AREA

The dam site is located in narrow valley of Monjo Khola with bedrock at right bank and colluvium on the left bank. The bedrock at right bank consist of planar, parallel, continuous, slightly weathered, medium to thickly foliated, coarse grained, dark grey to white colored gneiss with wavy lamination of quartz veins with three prominent discontinuity sets . Most of the area is exposed with bedrock with thin colluvial soil cover. Hill slope at the right bank is about 65° facing NW direction. The left bank facing towards SE direction and slope is gentler (~ 30-35°) than the right bank.

The quaternery deposits that includes colluvium in the hill slopes in left bank around desander. The colluvial soil comprises boulders, gravels, cobble and pebbles of gneiss with sand. Most dominant proportion (about 60%) 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 1500 m upstream from the confluence of Dudhkoshi River and Monjo Khola. The bedrock is well exposed on the left bank of Monjo River. Bedrock on the right bank is fresh to slightly weathered, coarse grained, strong, massive gneiss and schist. Bedrock is expected in medium depth (5-10m) along the weir axis. The left bank consists of colluvial deposit. From diversion weir to desander area at the left bank consist of old landslide area at uphill side, which does not pose any threat to the subproject.

4.1.4 GEOLOGY OF WATER CONVEYANCE

The main geology around the water conveyance route is gneiss as bedrock exposure, colluvium, alluvium, residual soil, gneiss with thin soil cover and scattered forest, gneiss with residual soil and forest cover and gneiss with colluvial soil and some forest**.** The Headworks area near dam site mostly consists of bedrock gneiss on the right bank. The water conveyance route passes through the lest bank of Monjo Khola following initially through colluvium, strong bedrock gneiss, then the soil and of residual soil in lay then bedrock and then reaches the South West sloping hillslope until it reaches the river crossing about 100 m upstream from the existing intake of Monjo Micro Hydro. Then following right bank through the existing canal upto Monjo village**.** Slight to moderately weathered, medium to thickly foliated, coarse grained, light to dark grey colored, gneiss is exposed near to the left bank and right bank due to cross cutting of river channel up the pipe crossing. From crossing to downstream, the alignment mostly passes through the colluvial soil formed by the weathering and erosion of the bedrock gneiss consisting of boulder, gravel sandy silt along the cultivated land. The soil is sandy silt.

4.1.5 GEOLOGY OF THE POWERHOUSE AREA AND TAILRACE

The powerhouse site is located in downhill slope of Monjo village and 20 m upslope from Dudhkosi River. The powerhouse lies above alluvial soil composed of loose, subrounded to rounded, gravel of gneiss with sand and silt. The thickness of soil is expected to be 20 m to 25 m according to field observation.

4.1.6 METEOROLOGICAL CONDITION

4.1.6.1 PRECIPITATION

The precipitation in the Khumbu Region may be considerably greater in upper slopes than in the valleys. The average annual precipitation is about 2,100 mm at elevations between 2,500 to 3,000 m amsl. Between the altitudes 3,500 and 4,500 m amsl, precipitation is around 1,000

mm, and around 500 mm above 4,500 m amsl. The non-monsoon precipitation is around 150 mm at altitudes above 3,500 m amsl. At 3,000 m amsl, precipitation is around 250 mm. Data available from Chaurikharka Meteorological Station (2613m amsl), is taken into consideration as our subproject also lies in its vicinity. The monsoon precipitation observed at this station is 81 per cent of the annual total. Likewise, monsoon wetness index of the catchment area is taken as 1000 from Isolines in Monsoon Index Map. More than 80% of annual rainfall occurs during four months - June to September, **Table 15 and Figure 11**.

Table 15: Monthly Precipitation at Chaurikharka Station (mm)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Chaurikharka	16	28	51	80	106	310	566	531	303	92	14	9

(Source: DHM, 2020)

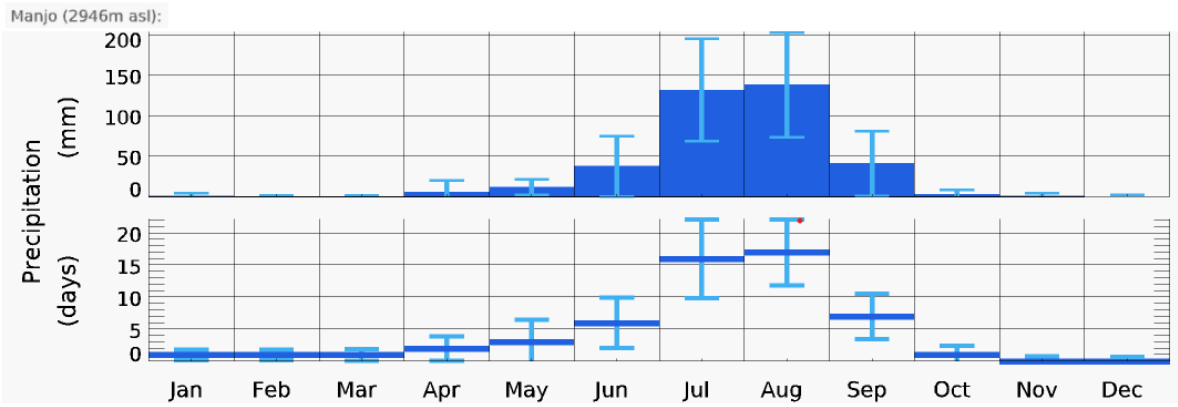

Figure 11: Average Monthly Rainfall and Rainy Days

(Source: meteoblue.com)

4.1.6.2 TEMPERATURE

The Meteorological Station in Namche located at the elevation of 3450 m which shows the mean monthly temperature. This has been taken as reference station for temperature data. According to the data observed, January is the coldest month and July is the warmest month, **Table 16**. Taking reference from meteoblue.com, about 6 months of a year the minimum temperature of Monjo goes down below 0°C, **Figure 12**.

Table 16: Mean monthly temperature at Namche (degrees Celsius)

Meteorological Station	Elevation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Namche	3450	-0.7	0.6	3.5	7.2	9.2	11.4	12.4	12.1	11.0	7.6	4.0	0.8

(Source: DHM, 2020)

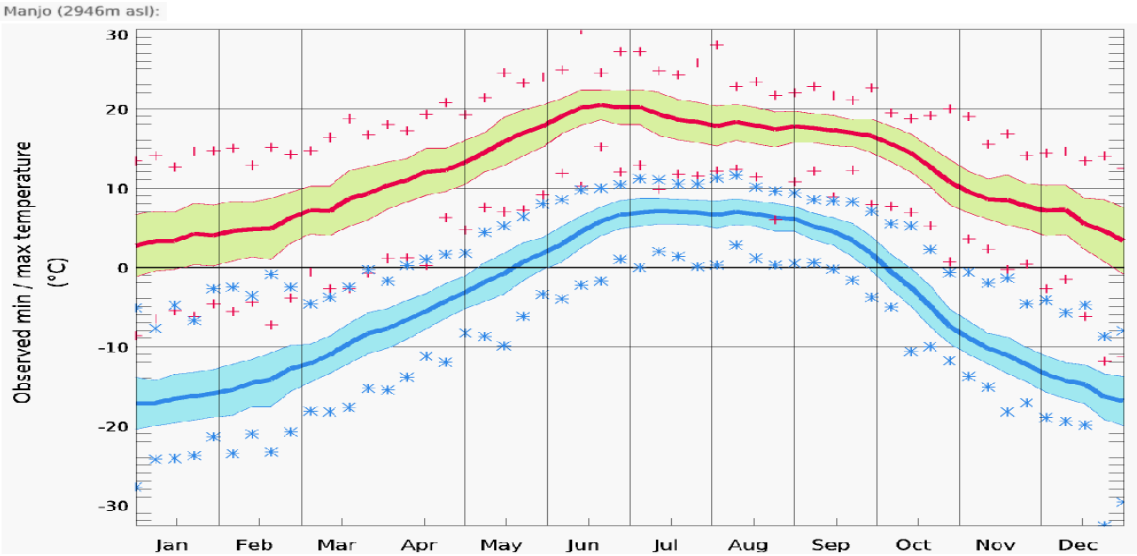

Figure 12: Average Minimum and Maximum Temperature

(Source: meteoblue.com)

4.1.6.3 HUMIDITY

As there is no any meteorological station in Monjo, the humidity of the Namche has been taken as reference. **Figure 13** shows that the month of December has the lowest humidity while July is with the highest humidity in the area. The same humidity profile is expected in Monjo although the figure may vary due to slight change in geographical location and altitude.

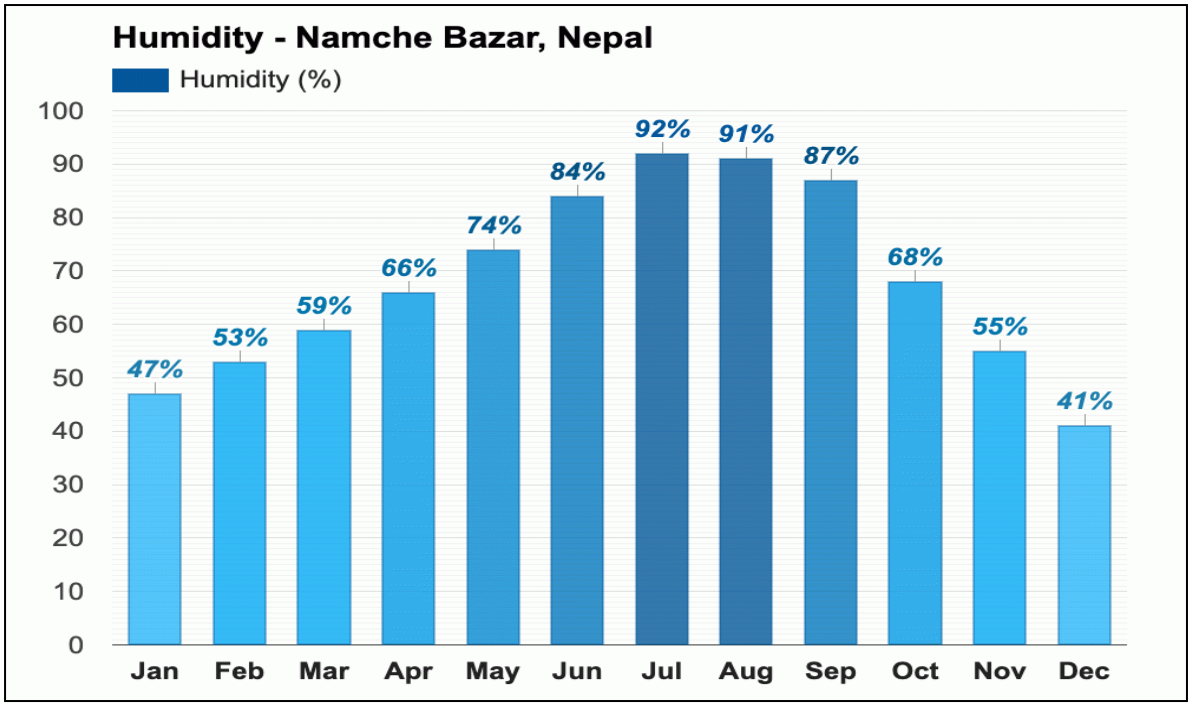

Figure 13: Humidity

4.1.6.4 WIND SPEED

The subproject area is located in narrow river valley surrounded by towering Snowy Mountain. Therefore high wind speed is expected to be rare at subproject site. The highest wind speed seems to be not above 20 km/hr which occurs during March.

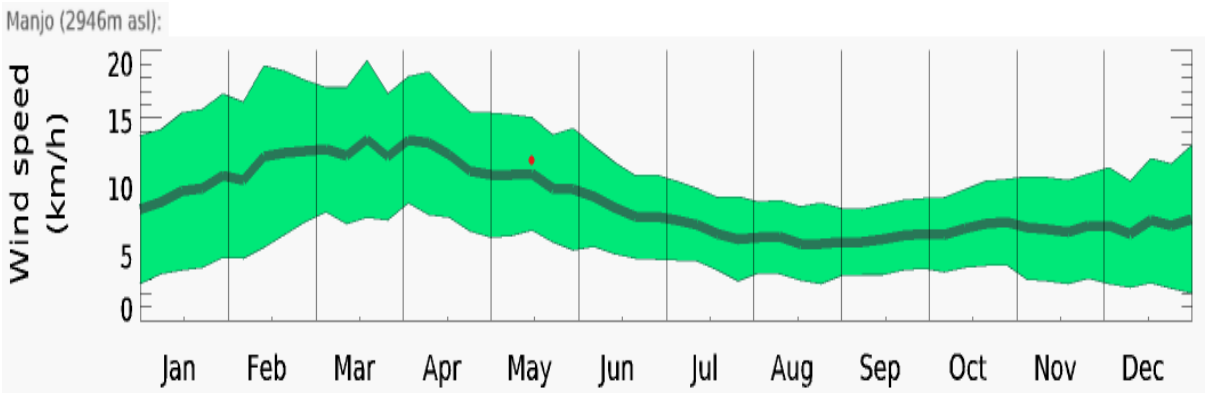

Figure 14: Wind Speed at Monjo

(Source: meteoblue.com)

4.1.7 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 from cooking and heating purposes. Thus, air quality of the area seems good. The air quality shown in meteoblue is under national ambient air quality standard (Value of PM_{10} is 120 µg/m^3 in 24 hrs), **Figure 15**.

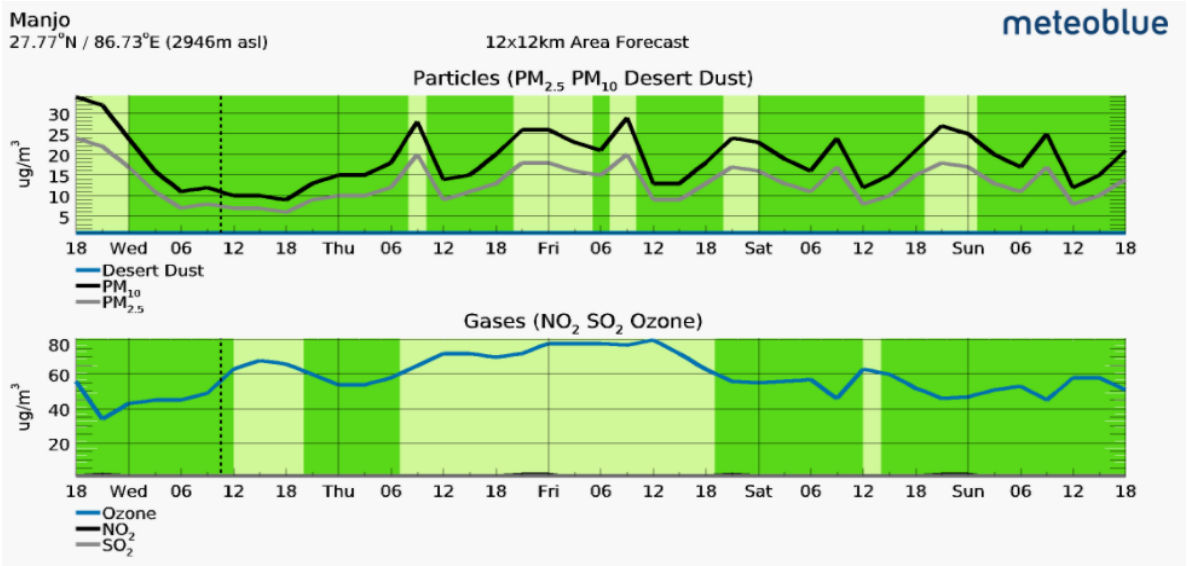

Figure 15: Air Quality Forecast of Monjo (Dec. 29, 2021 to Jan. 2, 2022)

(Source: meteoblue.com)

4.1.8 NOISE QUALITY

The noise quality was found to be within tolerable limits and there are no any means of noise pollution sources except naturally flowing streams and helicopter movement in air. The sound level measured at headwork area was 72 dB while 74dB 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 dBA and 40 dBA during day and night respectively. The higher level of sound in the headworks and powerhouse area is due to the sound of flowing water.

4.1.9 WATER QUALITY

The water quality in the subproject area is found to be good as there is no sources of contaminants such as sewerage systems and factories. Two water samples were taken from field - one from headwork area of the proposed subproject while one from drinking water supply at Monjo to assess the water quality. Various parameters were tested in laboratory of NAST, Kathmandu. 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 17: Water Quality of Monjo Khola

SN	Parameters	Sampling Sites	Remarks#
		River Water	
Physical			
1	Temperature (°C)	18.5*	
2	pH	8.07	6.5-8.5
3	Conductivity (µS/CM)	14	1500
4	Turbidity (NTU)	0.36	5 (10)
5	Total Dissolved Solids (mg/L)	6.84	
6	Total Suspended Solids (mg/L)	4	
Chemical			
7	Total Hardness (as $CaCO_3$)	8	500 mg/L
8	Chloride Content (mg/L)	2.84	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 Content (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)	2.8	
15	Chemical Oxygen Demand (mg/L)	41	
Microbial Test			
16	Total Coliform Count	50	0/100 mL

#Nepal Drinking Water Quality Standard 2062; ND-Non-Detected; number in brackets () refers the acceptable values when alternatives not available.

* Water quality was tested in NAST lab at Kathmandu. The temperature mentioned in the report do not indicated the temperature of water at the time of sampling.

4.1.10 SUBPROJECT LOCATION FROM FLOOD LEVEL

Flood analysis is carried out in hydrological study of the subproject. The protection walls provided at intake area is designed to withstand flood level of 100 years return flood. The desilting basin is places safely above flood levels. Other structures are away from flood plain areas. The powerhouse site is also located higher than the flood level of the Dudhkoshi River. All the structures have been designed above the flood level based on 100 years of return period (Source: DFS)

4.1.11 SOIL QUALITY

Soil mostly contains quaternery alluvial deposits alongwith colluvial deposits. The soil comprises boulders, gravels, cobble and pebbles of gneiss with sand. Most dominant proportion (about 60%) is of boulder and cobble in headwok areas. The soil around the water conveyance route is colluvium and alluvium, residual soil with thin soil cover in scattered forest area. The alignment mostly passes through the colluvial soil formed by the weathering and erosion of the bedrock gneiss consisting of boulder, gravel sandy silt along the cultivated land with sandy silt soil. The power house lies at upper old river terrace alluvial soil

composed of ill sorted, loose, subrounded to rounded, gravel of gneiss with sand and silt. The thickness of soil is expected to be 20m to 25 m according to field observation in and around powerhouse area.

4.1.12 WATER RESOURCES

Dudhkoshi and Monjo Khola are the major water resources in the subproject area. Both are snow fed rivers. The Dudhkoshi water is not used for any household and irrigation purposes while water form Monjo Khola is being used by micro hydro and for drinking by some households (HHs) and livestock. Other major streams in the subproject influence area are Nagbuwa Khola and Thado Koshi, from where electricity has been generated.

4.1.13 AGRO-ECOLOGICAL ZONES WITHIN SUBPROJECT AREA OF INFLUENCE

The area of influence falls in Hilly (up to 4000 m) agro-ecological region of Nepal. Here 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 in the area. Some people have started vegetable farming in plastic tunnel.

4.1.14 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 ($mb \geq 6$) in Himalayan thrusts occur at deeper levels as compared to the similar magnitude earthquakes at shallowest level in the adjoining Tibet region.

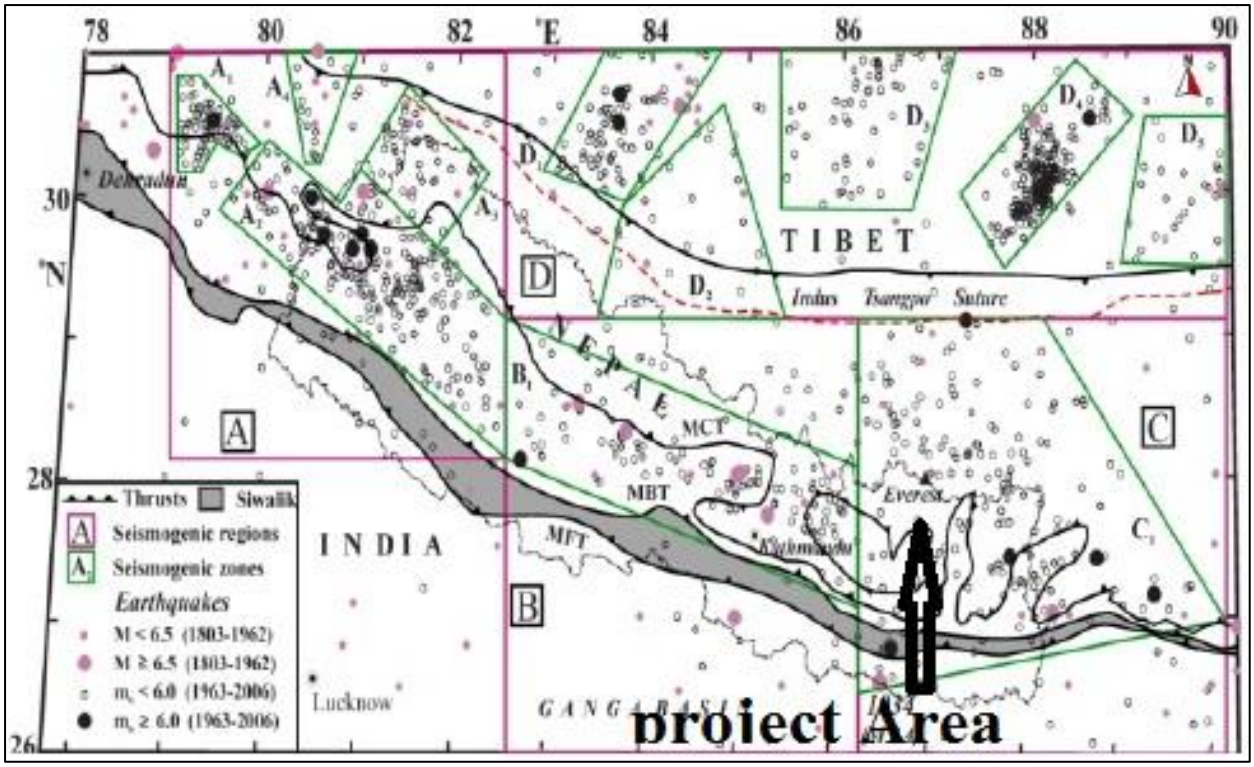

Figure 16: Seismic Map (1803-2006) of Nepal and Seismic Zoning its adjoining Region in Nepal Himalaya.

The subproject area falls in the Class (C) having high seismic risk, Figure 16. Considering the historical and recent earthquake and design parameter of Upper Karnali project and Arun 3 Hydropower Project, the Seismic coefficient for MKMHP 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 0.30 g for the subproject and a value of 0.18 g may be appropriate as Design Base Earthquake (DBE). Thus, the recommended value for MCE of 0.30g has been considered to be sufficient for this subproject (DFS).

4.1.15 CLIMATE CHANGE AND NATURAL DISASTERS

4.1.15.1 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 in 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 17, top graph). Similarly, anomaly strips shows warmer years are increasing (Figure 8, lower graph). In Figure 17, solid line of the top graph shows mean annual temperature while dash blue line represents linear temperature change trend; the stripes of lower part of graph shows the warmers strips representing average temperature for a year- blue for colder and red for warmer years. On the same way, the trend of mean annual precipitation from 1980 to 2020 shows gradual increase of precipitation (Figure 17 top graph). Similarly, anomaly strips shows wet years are increasing (Figure 18, lower graph). In the Figure 8, solid line of the top graph shows mean annual precipitation while dash blue 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.

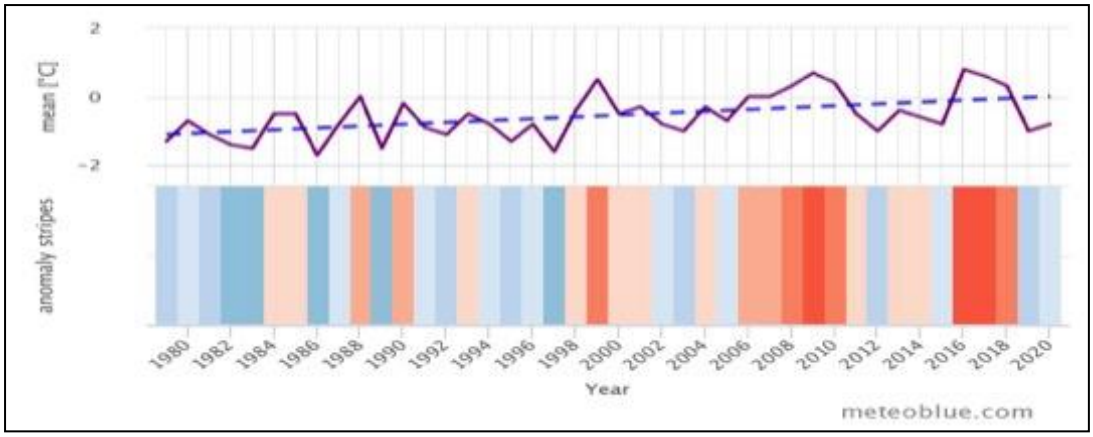

Figure 17: Mean yearly temperature, trend and anomaly, 1979-2022 at Monjo

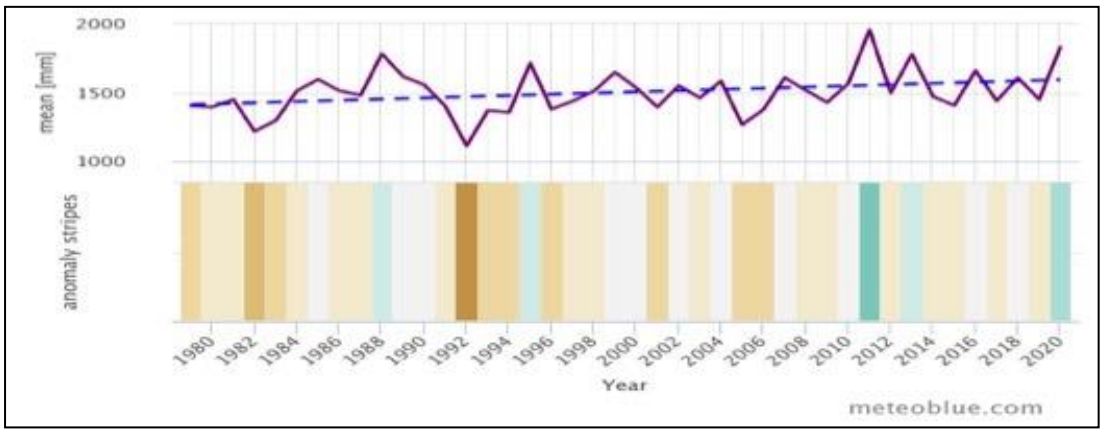

Figure 18: Mean yearly precipitation, trend and anomaly, 1979-2022, at Monjo

The top graph in Figure 17 shows the temperature anomaly for every month since 1979 up to 2020. Here red months are warmer while blue months are colder than the normal. The graph clearly shows that warmer months are in increasing trend, which reflects the global warming associated with climate change. The lower graph in the Figure 19 shows the precipitation anomaly for every month since 1979 up to now. Here, green months are wetter and brown months are drier than normal. The anomaly tells wetter months are in increasing trend.

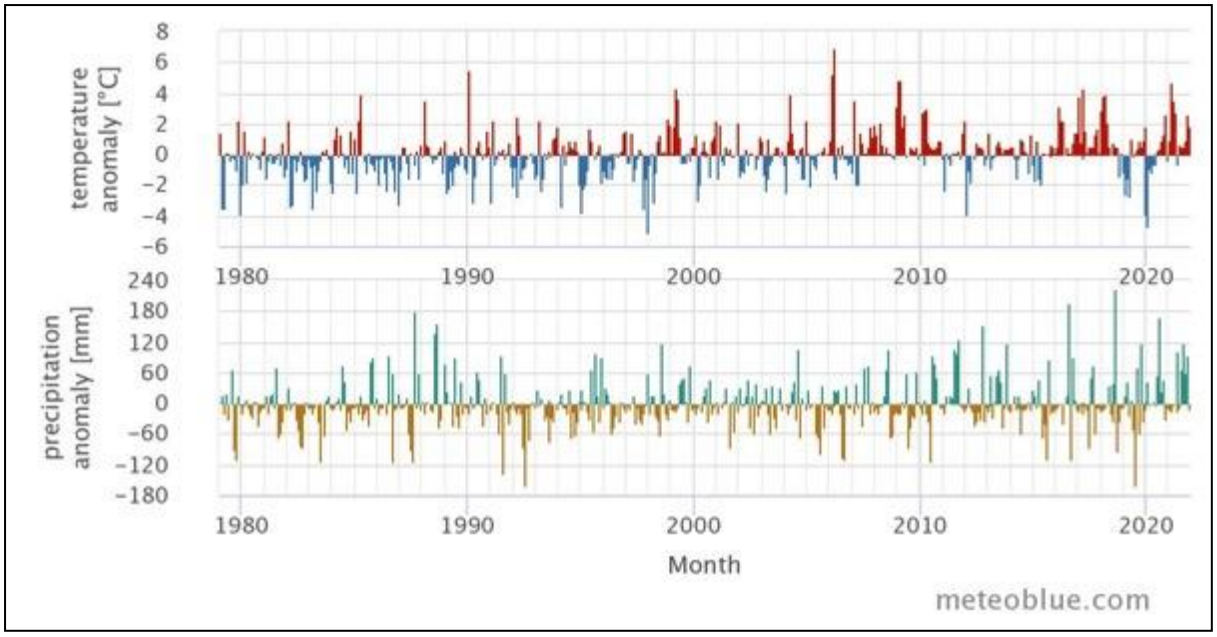

Figure 19: Monthly Anomalies for Temperature and Precipitation in 1979-2022 at Monjo

4.1.15.2 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. Effects 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 310 houses in Ward No. 3 of the RM.

The issue of climate change and GLOFs is prominent in the subproject area. GLOFs are now much more frequent, creating serious risks for human populations and having implications for the water supply in South Asia and the flow of major rivers such as the Ganges, Indus and Brahmaputra (Khanal et al., 2012). The Dudhkoshi 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). The Monjo Khola starts from Kyasar Glacier. But lake formation and GLOF events have not been recorded till date from this glacier. Risk of GLOFs from Imja and Dig Tsho, two glacial lakes in the Dudhkoshi basin with high probability of burst is always there. Dig Tsho (Langmoche) Glacial Lake is in contact with the Langmoche hanging glacier in the Dudhkoshi Basin. Dig Tsho is located at 27º52′25″N and 86º35′37″E, at an elevation of 4365 m, in a sub-basin of the Nangpo–Tsangpo area in Bhote Koshi Valley. The lake is fed by the Langmoche Glacier, which originates at 5400 m at the foot of the northeast face of Tangri Ragi Tau (6940 m). The case of GLOF from Dig Tsho was reported on 4 August 1985 destroying the nearly completed Namche Hydropower Plant, 14 bridges, trails, cultivated land, etc and caused the loss of many lives (ICIMOD, 2001). Imja Lake is another source of GLOF in the region. It is located at the toe of Imja Glacier, at 27°59′17″ N and 86°55′31″ E in the easternmost part of the Sagarmatha region. It is the largest and potentially most dangerous glacial lake in the region. It has been estimated that the pick outflow discharge of Dig Tsho GLOF is 5610 m^3/sec with 6.2 m depth at outlet, and it will reach at Larja Dovan after 30 minutes with discharge of 2577 m^3/sec attaining 5.5 m depth of flood. Similarly, the peak outflow discharge of Imja GLOF is estimated at 5461 m^3/s. The peak discharge attenuates to about 2166 m^3/s at the boundary of the buffer zone at

about 45 km from the outburst site. It has been estimated that the GLOF will reach Larja Dovan after 34.80 minutes with discharge of 3223 m^3/s and depth 6.9 m while it reach Benkar after 38.80 minutes with discharge of 2447 m^3/s and depth 6.6 m (Bajracharya et al., 2007).

The powerhouse of MKMHP is located at 2745.0 m amsl. It is situated on left bank of the Dudhkoshi River. The elevation of Dudhkohi riverside located just below the powerhouse is 2726 m amsl. Elevation difference (2745-2726 m amsl) between the Dudhkoshi riverside and powerhouse location is 19 m. Thus it can be seen that powerhouse located between Larja Dovan and Benkar is safe from flood depth of 6.9 m at Larja Dovan and 6.6 m at Benkar from potential Imja GLOF and also from Dig Tsho GLOF.

4.2 BIO-ECOLOGICAL ENVIRONMENT

The subproject area lies in Temperate Life Zone (elevation range: 2000-3000 m). As per the Conservation Science Programme WWF-US (1998), the subproject area falls under East Himalayan Broadleaved Forest Ecoregion (1500-3000 m) with Upper Temperate Blue Pine Forest and Fir Birch Rhododendron Forest. The intake area along with about 150 m of penstock pipelining area lies in Fir Birch Rhododendron Forest while remaining subproject structures of power generation lie in Upper Temperate Blue Pine Forest Zone. Transmission line up to to Nurin lies in Upper Temperate Blue Pine Forest Zone while remaining lies in Temperate Mountain Oak Forest Zone.

4.2.1 VEGETATION IN SUBPROJECT AREA

The subproject area lies in the Sagarmatha National Park (SNP) Buffer Zone. The area of influence falls within *Chaurikharka Buffer Zone User Committee*. Under this committee, the forest in and around the physical structures of power generation has been managed by Himalaya Buffer Zone Community Forest User Groups. The forest user group manages all the protection, conservation and utilization activities of the forest taking permission from SNP authority. Thus, Locals directly participate in forest management in the area. SNP authority provides opportunity to collect fuelwood, timer and other forest products as per operation plan of community forest. The Jurisdiction of Himalaya Buffer Zone Community Forest User Group (BZCFUG) is up to Banker area. From there, Kongde BZCFUG manages the foret areas up to Phakding. Similarly, Pemachholing BZCFUG manages from Phaking to Chhuthuwa. Dudhkunda BZCF lies in and around Ghat while Red Panda BZCF from Thadokoshi to Lukla. Thus there are 5 BZCFs in ward number 3 of KPLRM while Muse BZCF in Ward No. 2. Overall T&D line has been designed to be underground passing along existing foot trails and along the existing bridges in river crossings so there is no need for tree cutting. Hence among six BZCFs there will be direct impact only on Himalaya BZCF in Monjo as mini hydro components such as intake, desilting basin and some sections of penstock alignment lies in this BZCF. Altogether 3 trees and 30 poles will be felled down along penstock alignment, which will be compensated in nearby land as per GoN requirement (1:10 ratio).

4.2.1.1 HEADWORKS/INTAKE

Headworks/Intake area lies in Himalaya BZCF. The forest type is Fir-Birch-Rhododendron Forest. As the area is ecotone of lower subalpine and temperate zone, it has mixed species of vegetation. Basically the area is dominancy of birch (*Betula utilis*) and fir (*Abies spectabilis*) along with a number of *Rhododendron* species. As the subproject area is confined to the river valley, the trees are sparse. Similarly, shrubs are also very few. Common shrubs found in the

area are *Rosa sericea, Spiraea canescens,* Cotoneaster sp., *Ephedra gerardiana, Hydrangea heteromalla,* Lonicera sp.etc. Herbaceous and grass species in the area are *Aconitum heterophyllum, Anaphalis margaritacea, Arabis pterosperma, Astilbe rivularis, Cicerbita cyanea, Corydalis longipes,* Impatiens sp., Primula sp., Rhodiola sp., *Swertia macrosperma, Agrostis pilosula, Helictotrichon virescens etc*., which are not threatened or protected (https://www.iucnredlist.org/).

4.2.1.2 PENSTOCKS

The penstock pipe lies in elevation zone of 2960 to 2744 m. The area falls on Fir-Birch-Rhododendron Forest and Upper Temperate Blue Pine Forest Zone. Upper portion about 150 m of penstock pipe lies in Fir-Birch-Rhododendron Forest and remaining in Upper Temperate Blue Pine Forest Zone. About 950 m of the penstock pipe falls in forest area (Himalaya BZCF) while remaining passes through cultivated private land with settlements. The trees are *B.utilis, A. spectabilis* and a number of *Rhododendron* species in upper parts while *Abies pindrow, Acer caesium, Pinus wallichiana* and a number of Rhododendron species are found in middle of the penstock areas. In cultivated area, mostly *P. wallichiana* trees are seen. *Colquhounia coccinea, Cotoneaster* sp., *Hydrangea* sp., *Juniperus communis, Leptodermis lanceolata,* Lonicera sp., Potentilla sp., *Rhododendron* sps. *Rosa* sp., *Viburnum* sp. etc. are found as shrubs in the area. *Aconitum heterophyllum, Anaphalis margaritacea, Arabis pterosperma, Astilbe rivularis, Cicerbita cyanea, Corydalis longipes, Impatiens* sp., Primula sp., Rhodiola sp., *Swertia macrosperma, Agrostis pilosula, Helictotrichon virescens, Andropogon* sp. etc are common herbs and grasses found in the area.

4.2.1.3 POWERHOUSE AND TAILRACE AREA

The powerhouse site lies in private land with mostly Blue Pine (*P. wallichiana*). Similarly, the tailrace area is also dominated by Blue Pine with some *A. spectabilis*. *Colquhounia coccinea*, Cotoneaster sp., *Hydrangea sp*., *Leptodermis lanceolata,* Lonicera sp., Potentilla sp., *Rhododendron* sps. *Rosa* sp., *Viburnum* sp. etc. are found as shrubs in the area. *Aconitum heterophyllum, Anaphalis margaritacea, Astilbe rivularis, Cicerbita cyanea, Impatiens* sp., *Primula* sp., Rhodiola sp., *Agrostis pilosula, Helictotrichon virescens, Andropogon* sp. etc. are common herbs found in the area.

4.2.1.4 TRANSMISSION AND DISTRIBUTION LINES

Along the transmission and distribution, there are 5 BZCFs— Himalaya BZCF upto Banker, Kongde BZCF up to Phakding, Pemachholing BZCF upto Chhuthuwa, Dudhkunda BZCF in and around Ghat, and Red Pand BZCF at Thadokoshi. Transmission lines upto to Nurin lies in Upper Temperate Blue Pine Forest Zone while remaining lies in Temperate Mountain Oak Forest Zone. The major plant species in north to the Nurin is same as of power generation area as both are in same vegetation zone— Upper Temperate Blue Pine Forest Zone. The oak, locally known as khasru (*Q. semecarpifolia*), forms a distinct type of forest in association with *Rhododendron arboreum* towards the sourthen parts of the area of influence. Beside these two species, *B .utilis, A. spectabilis, P. wallichiana, Acercaesium, A. campbellii, Ilex dipyrena,* Ligustrum sp., *Lyonia ovaliifolia, Prunus cornata, Sorbus cuspidata,* Symplocus sp., and *Tsuga dumosa* are common.*Aconogonum campanulatum, Berberis chitria, Cotoneaster acuminatus, Daphne bholua, Eurya acuminate, Gaultheria fragrantissima, Inula nervosa, Laportea terminalis, Leptodermis lanceolata, Mahonia napaulensis, Rhododendron lepidotum,* Rosa sp., *Spiraea bella, Viburnum mullaha,* Zanthoxylum sp., etc. are some common shrubs in the area. *Clematis montana, Hedera nepalensis* and *Holboellia latifolia* are common climbers. *Aconitum spicatum, Anaphalis*

triplinervis, Bistorta amplexicaulis, Bupleurum hamiltonii, Corydalis chaerophylla, Cuscuta reflexa, Parochetus communis, Pedicularis gracilis, Rubia manjith, Thalictrum chelidonii, Valeriana jatamansii, Agrostis pilosula and *Eulalia mollis* are common herbs and grasses in the area, of which fauna listed in **Table 18** are protected species. The transmission lines will be distributed to Jor Salle in north and Muse on south. The transmission lines will be made underground along the foot trails except river crossings. Therefore, there will be no direct impact on the existing forest.

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

There are many plants used by local communities as medicines, foods, incenses, timber, fuelwood, fodder and also decorative purposes. More than 50 plants species are used by locals for various purposes. Some commonly used NTFPs by locals are Aconitum sp., Anaphilis sp., *Arisaema flavum, Barberis sp.,* Clematis sp., *Cotoneaster microphyllus,* Drepanostachyum sp., *Ephedra gerardiana, Euphorbia sikkimensis, Gaultheria fragrantissima,* Juniperus sp., *Meconopsis horidula, Michelia champaca, Nardostachys grandiflora, Plantago erosa, Rheum austtrale, Rhododendron anthopogon, Rhododendron campylocarpum, Rumex nepalensis, Urtica dioica* etc. Similarly, wild edible mushrooms are extensively used by local people. Such common mushrooms are *Armillariel lamellea,* Boletus sp., *Hydnum repandum,* Ramaria sp., *Paxillus involutus, Tylopilus eximus* etc. **Table 18** presents the protected floral species found in ZOI of the subproject, which will not be impacted by the subproject activities.

Table 18: Conservation Status of some Flora species of Subproject Area (not comprehensive)

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

4.2.2 FAUNA

In this section, wildlife found in and around the subproject areas is discussed. According to locals, there are no any fish seen till date. So, lists of mammals, birds and herpetofauna of SNP are given here. During the field visit, Himalayan Tahr, scats of carnivore (may be of grey wolf), and deer sp. are recorded.

4.2.2.1 MAMMALS

Altogether 17 mammals were reported from the subproject areas as shown in **Table 19.**

Table 19: Conservation Status of Mammals potentially occurring in Subproject Area with updates from Sagarmatha National Park and its Buffer Zone Management Plan 2016-2020

SN	Nepali Name	Common Name	Scientific Name	Conservation Status			Remarks
				NRDB, NPWC	IUCN Red List	CITES Appendix	
1	Ghanse Muso	Alpine Vole	*Pitymys*	-	LC	-	VC

			sikimensis				
2	Chhuchundro	Brown Toothed Shrew	*Soriculus caudatus*	-	LC	-	VC
3	Chituwa	Common Leopard	*Panthera pardus*	S	LC	I	C
4	Pani Chuchundro	Elegant Water Shrew	*Nectogale elegans*		LC		C
5	Syal	Golden Jackal	*Canis aureus*	S	LC	III	VC
6	Bwasho	Grey Wolf	*Canis lupus*	VU, P	LC	I	C
7	Kalo Bhalu	Himalayan Black Bear	*Ursus thibetanus*	VU	VU	I	C
8	Muse Thutekharayo	Himalayan Mouse-hare	*Ochotona roylei*		LC		C
9	Jharal	Himalayan Tahr	*Hemitragus jemlahicus*	S	VU		VC
10	DuhureGhar Muso	House Mouse	*Mus musculus*		LC		VC
11	Ghar Muso	House Rat	*Rattus rattus*		LC		VC
12	Dhendu	Grey Langur	*Presbytis entellus*	S	LR / NT	I	C
13	Kasturi	Musk Deer	*Moschuschrysogaster*	EN, P	LR/NT	I	C
14	Habre	Red Panda	*Ailurus fulgens*	EN, P	EN	I	R
15	Rato Bandar	Rhesus Monkey	*Macaca mulatta*	S	LR/NT	II	C
16	Saiberiyalimal asapro	Siberian Weasel	*Mustelasibirica*	S	LC	III	C
17	Malsapro	Yellow-throated Marten	*Mustela flavigula*	S	LC	III	C

Status

a. National Parks and Wildlife Conservation (NPWC) Act, 1973: P= Protected, S = Susceptible
b. Nepal Red Data Book (NRBD): EXN= Extinction from Nepal, C= Critically Endangered, E= – Endangered, V=Vulnerable, S= Susceptible, I= Introduced, ?= Not confirmed, End= Endemic species of Nepal
c. IUCN Red List Category: EX = Extinct, EW = Extinct in the Wild, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened, LC = Least Concern, DD = Data Deficient, NE = Not Evaluated, LR/LC = Lower Risk/ Least Concern, LR/NT = Lower Risk/ Near Threatened
d. Convention on International Trade of Endangered Species of Flora and Fauna (CITES): Appendix (I, II and III)
e.

Remarks (It refers to abundance in the subproject area which is based on the consultation during field visit) : VC= Very Common, C= Common, R= Rare

4.2.2.2 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.

4.2.2.3 FISHES

During the consultation with the people living from generations in the subproject area, it was revealed that neither they have seen fishes in Monjo Khola in their lifetime nor they have heard from their ancestor about it. According to the local people and representatives from RM, SNP and BZMC, the nearest point from the subproject site where the fishes can be found is Khari Khola, located in Ward No. 1 of Pasanglhamu RM, the downstream from approx. 4-5 m height steep waterfall of Dudhkoshi River and which is approx. 20 km away from MKMHP site. 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. People also mentioned that the steep waterfall could be potential barrier to migrate the fishes that are found in Khari Khola to upper part of Dudhkoshi River.

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 XV**) also verified the information. During consultation, a discussion on presence of fishes in Monjo Khola was conducted. As per the discussion, there is no availability of fishes in the river due to high drops and slope gradient, high altitude and cold and freezing water. There are so many drops along the Monjo Khola with minimum 0.41 % to maximum 72.51%, which is clearly visible in Longitudinal Section of Penstock Pipe alignment, Figure 25. Information on major drops throughout different chainage is presented in **Table 20**. 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[10] 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 not 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 Monjo Khola and other streams in Monjo village. Even during that period, people did not find any fish, though they were able to catch few toads.

[10] *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)

Table 20: Major drops at different Chainage

S. No.	Chainage from intake		Existing Ground Level		Level Difference, m
	From	To	From	To	
1	0+080	0+100	2953.02	2947.22	5.80
2	0+100	0+120	2947.22	2942.06	5.16
3	0+160	0+180	2932.85	2927.69	5.16
4	0+240	0+260	2930.44	2921.34	9.10
5	0+340	0+360	2906.8	2902.43	4.37
6	0+460	0+500	2900.36	2893.94	6.42
7	0+600	0+620	2854.92	2839.66	15.26
8	0+620	0+640	2839.66	2833.29	6.37
9	0+720	0+740	2817.74	2814.42	3.32
10	0+860	0+900	2813.88	2807.44	6.44

4.2.2.4 BIRDS

More than 90 different bird species have been reported in the subproject area. Some birds which are common in the subproject area are Imperial Eagle (*Aquilla heliacal*), Common Buzzard *(Buteo buteo)* , Himalayan Griffon *(Gyps himalayensis)* , Horned Lark *(Eremophila alpestris)* , Himalayan Swiftlet *(Collocalia brevirostris)* , Snow Piegon *(Columba leuconota),* Common Raven *(Corvus corax),* Large-billed Crow *(Corvus macrorhynchos),* Pied Cuckoo *(Clamator jacobinus),* Common Kestrel *(Falco tinnunculus)* , Carpodacus sp., Asian House Martin *(Delichon dasypus),* Nepal House Matrin *(Delichon nepalensis)* ,Grey-backed Shrike *(Lanius tephronotus),* Luscinia sp., Long-tailled Thrush (*Zoothera dixoni),* Motacilla sp., Montifringilla sp., House Sparrow (*Passer domesticus),* Prunella sp., Snow Partridge *(Lerwa lerwa),* Himalayan Monal *(Lophophorus impejanus),* Satyr Tragopan *(Tragopan satyra),* Spotted laughing thrush *(Garrulax ocellatus),* Yuhina sp, Common Hoop (*Upupa epops)* etc. **Table 21** presents the conservation status of the birds, which may be seen in the SNP and buffer zone, but they are not likely to occur in the subproject area (ZoI).

Table 21: Conservation Status of Birds in the Subproject Area (not comprehensive)

SN	Nepali Name	English Name	Scientific Name	CITES Appendix	IUCN Red List	Nepal Red Data Book	Remarks
1	Giddha	CinereousVulture	*Aegypiusmonachus*	-	NT	EN	R
2	Chilime	Blood Pheasant	*Ithaginis cruentus*	II	LC	LC	C
3	Cheel	Osprey	*Pandion haliaetus*		LC	LC	C
4	Danphe	Impeyan Pheasant	*Lophophorusimpejanus*	I	LC	NT	C
5	Tibbati Him-Kukhura	Tibetan Snowcock	*Tetraogallustibetanus*	-	LC	-	C
6	Dadi Bhayeko Giddha	Bearded Vulture	*Gypaetusbarbatus*	-	NT	VU	R
7	Munal	Crimson-horned Pheasant	*Tragopansatyra*	III	NT	VU	C

8	Shahi Baaj	Peregrine Falcon	*Falco peregrines*	I	LC	LC	C
Key to threatened status: CR – Critically Endangered; EN – Endangered; VU – Vulnerable; NT – Neat Threatened; LC – Least Concern; DD – Data Deficient. Comments: VC= Very Common, C= Common, R= Rare							

4.2.3 PROTECTED AREAS

The subproject area lies within Buffer Zone of Sagarmatha National Park (SNP). The SNP and its Buffer Zone qualify as legally protected areas of Nepal, while the SNP is additionally recognized by UNESCO as a World Heritage Site (WHS). The subproject is located outside the boundary of the WHS. The Buffer Zone listed as an IUCN Management Category VI protected area, recognizes the continued sustainable use of resources by local communities that can be mutually beneficial with conservation. Though Birdlife International has described the SNP and its Buffer Zone as an Important Bird Area (IBA), which is recognized for five globally threatened and 75 biome-restricted bird species, no major impacts on birds are expected as the entire transmission line will be underground and the ZoI is not route of any migratory bird, as stated above.

4.2.4 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 threatened species are however known or expected to occur and there is justification for recognizing critical habitats for those species that are likely to be impacted by the subproject. **Table 22** presents a brief analysis of threatened species for which critical 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 subproject area.

Table 22: Assessment of species for which critical natural habitat are justified and species which may require mitigation for their protection

Species	Justification	Altitude Range (m)	Potential Impact from the Project
Mammals			
Snow leopard (*Uncia uncia*)	Included as a WHS OUV NRBD, NPWC= EN,P IUCN= VU CITIES Appendix= I	3500-5600	Not impacted as not present at the project altitude

Red Panda (*Ailurus fulgens*)	Included as a WHS OUV, reported to be common, used for naming a local BZUG. NRBD, NPWC= EN,P IUCN= EN CITIES Appendix= I	2800- 3900	Potentially impacted by influx of workers, through illegal hunting or disturbance by their dogs.
Himalayan Musk Deer (*Moschus chrysogaster*)	Reported to be common NRBD, NPWC= EN,P IUCN= LR/NT CITIES Appendix= I	Up to 3000	
Himalayan Black Bear (*Ursus thibetanus*)	Known to be present in and around the SNP NRBD, NPWC= VU IUCN= VU CITIES Appendix= I	1000-3000	Likely attracted to inappropriately discarded waste, potentially escalating human-wildlife conflict.
Birds			
Eastern Imperial Eagle (*Aquila heliaca*)	Reported to be present IUCN= VU CITIES Appendix= I	Up to 3900	Both species unlikely to be impacted by the project
Himalayan Griffin (*Gyps himalayensis*)	Reported to be present IUCN= NT	1200-5500	

(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 23 settlements with 582 households has been identified as load centers.

Table 23: Load Centers with Distance

SN	Settlements (Load Centers)	No. of HHs (582 Beneficiary Households)	Distance from Monjo (Km)
i.	Bosum	9	11.45
ii.	Byankar	43	1.63
iii.	Chauri Kharka	34	11.15
iv.	Chaurikharka (Dungde)	54	11.64

SN	Settlements (Load Centers)	No. of HHs (582 Beneficiary Households)	Distance from Monjo (Km)
v.	Chesurma	12	7.93
vi.	Chheplung	59	9.83
vii.	Chhermading	6	7.17
viii.	Chyuma	25	0.81
ix.	Ghat	40	7.43
x.	Ghattekhola	4	3.77
xi.	Jamphutte	8	4.20
xii.	Lowa	5	8.18
xiii.	Monjo& Jorsalle	59	0.16/1.01
xiv.	Muse	40	11.68
xv.	Muse (Bakudingma)	4	12..49
xvi.	Ngamateng	6	3.74
xvii.	Phakding	56	5.19
viii.	Rangding	13	4.55
xix.	Teka	5	8.67
xx.	Thadokoshi	17	8.17
xxi.	Tok-Tok	26	3.50
xii.	Thulo Gumela	32	4.90
xiii.	Sano Gumela	25	6.57

(Source: Field Survey)

Various entities have different demands, **Table 24**. Demand varies from 1 kW to 4 kW. The highest demand is with end uses.

Table 24: Demand as Per Entity Category

Category	No.	Demand Per category (kW)
Households	278	1.5
Households	54	1
Big Hotels (More than 20 Rooms)	24	3
Medium Hotels (11-20 Rooms)	38	2
Small Hotels (Up to 10 Rooms)	75	1.5
Restaurants	74	1.5
Social Institutions	20	3
Snooker House and Shops	12	1
Ward Office	1	2.5
Bakeries	2	2
End Uses	3	4
Hospital	1	3

(Source: DFS)

4.3.2 IDENTIFICATION AND DESCRIPTION OF SUBPROJECT AFFECTED PEOPLES (APS) IN THE AREA IN TERMS OF FAMILY SIZE, RELIGION, AGE, SEX, ETHNICITY, INCOME, HOUSEHOLD SIZE, OCCUPATIONAL PATTERNS AND THEIR RELEVANCE WITH THE SUBPROJECT

The total population of Khumbu Pasanglhamu RM is 8989 in 2433 houses with average family size of 3.69 (KPLRM Profiles, 2019). The female population (50.02%) is slightly more than male population. The population in Ward No. 3, where the subproject site lies, is

1752 in 480 HHs with average family size of 6. Nearly two third of the population of Ward No. 3 is economically active. Nearly 8% people are of old age group. The most dominant ethnic group is Sherpa (62.97%) (Figure 20). Other Castes are Tamang (12.20%), Rai (13.30%), Magar (2.88%), outcaste (4.66%), and others (3.99%). Based on religion, majority of HHs are Buddhists (53.13%), followed by Hindu (40.50%), Christian (5.43%), and Kirant (0.94%).

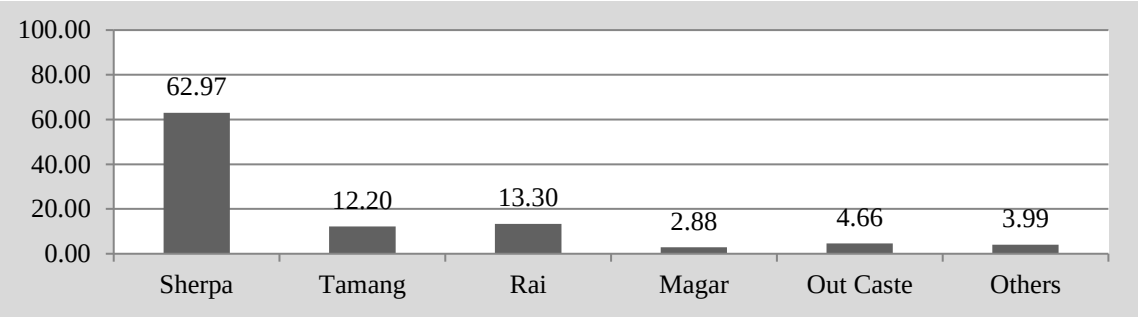

Figure 20: HHS Percentage Based on Caste/Ethnicity in Ward No. 3

(Source: KPLRM, 2019)

Besides Ward No. 3, Muse settlement from Ward No. 2 is also a load center. It has 44 houses with 173 population. Nearly 48% population is male and all are Sherpa ethnic people. They follow Buddhist religion. In all 23 settlements, identified as load center, have 2,171 population with average family size of 3.73, **Table 25**[11]. Population, number of households and average family size in each settlement is presented as below;

Table 25: Population in Affected Settlements

SN	Settlements	HHs	Population			Average Family Size
			Male	Female	Total	
1	Bosum	9	19	20	39	4.33
2	Byankar	43	82	85	167	3.88
3	Chaurikharka	34	65	59	124	3.65
4	Chaurikharka (Dhunge)	54	103	104	207	3.83
5	Chesurma	12	18	24	42	3.50
6	Chheplung	59	104	88	192	3.25
7	Chhermading	6	11	12	23	3.83
8	Chyuma	25	47	49	96	3.69
9	Ghat	40	64	77	141	3.53
10	Ghattekhola	4	10	8	18	4.50
11	Jamphutte	8	16	15	31	3.88
12	Lowa	5	6	5	11	2.20
13	Monjo and Jorsalle	59	132	91	223	3.84
14	Muse	40	77	82	159	3.98
15	Muse (Bakudingma)	4	8	6	14	3.50
16	Ngamateng	6	8	9	17	2.83
17	Phakding	56	126	109	235	4.20
18	Rangding	13	31	18	49	3.77

[11] *The difference in the total number of households in ward 3 and number of households as load center is mainly due to fact that each individual entity such as residential, hotel, restaurant, lodges, shops, bakery, social institution, ward office and snooker house has been considered as separate household while the survey or census data does not take separate them as separate entity i.e., there may be many houses or load centers under single ownership.*

SN	Settlements	HHs	Population			Average Family Size
			Male	Female	Total	
19	Sano Gumela	25	55	60	115	4.60
20	Teka	5	13	13	26	5.20
21	Thadokoshi	17	35	36	71	4.18
22	Thulo Gumela	32	54	54	108	3.38
23	Tok-Tok	26	42	21	63	2.42
	Total	**582**	**1126**	**1045**	**2171**	**3.73**

(Field Survey 2021)

Among the beneficiary households 8 households have been identified under DZI since some project components (penstock, powerhouse and tailrace) are constructed on their private land.

Table 26: Ethnicity and Population of HHs in DZI

SN	Name	Project Components to be constructed	Cast	Population		
				M	F	T
1	Pasang Sherpa	Tailrace	Sherpa	2	2	4
		Power House				
		Penstock				
2	Fura Futi Sherpa	Penstock	Sherpa	1	2	3
3	Ngawang Gele	Penstock	Sherpa	3	3	6
4	Doma Sherpa	Penstock	Sherpa	3	3	6
5	Dali Sherpa	Penstock	Sherpa	1	1	2
6	Kaji Sherpa	Penstock	Sherpa	4	1	5
7	Pasang Temba Sherpa	Penstock	Sherpa	2	2	4
8	Kami Dorji Sherpa	Penstock	Sherpa	2	1	3
			Total	18	15	33

(Source: CED)

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

The Khumbu Pasanglhamu Rural Municipality is extended in 1539.11 km^2 area. Out of the total land area, approx. 44% is covered with snow/glacier, 19.85% is barren land, 15.61% is grass land, 9.98% is covered with forest and 9.30% is shrub land. Other land category areas are very less (Agriculture-0.67%, Built up Area- 0.01% and water Body-0.58%). Out of total area 280.42 Km^2 in Ward No.3, snow/glacier is 38.66%, barren land 16.90%, forest 16.28%, grassland 16.09%, shrub land10.40%, water body 0.88%, built up 0.64% and agriculture 0.15% (KPLRM, 2019).

Traditionally, Sherpa 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. For the conservation of the forest area outside the national park, the SNP has handed over it to local community as buffer zone community forest. Land to be used for headworks (540 m^2) and some parts of the penstock are public land (3305 m^2) which lies in the buffer zone community forest. Remaining part of penstock and powerhouse site lies in private land (Details in **Table 9**). The tailrace area is also in private land. Similarly, all the lands required for transmission line is public. Average land holding per household in load center is 7.89 Ropani. Average land holding in different load center is presented in **Table 27.**

Table 27: Average Landholding in Load Centers

SN	Settlements	Average Land Holding (Ropani/HH)
1	Bosum	14.11
2	Byankar	4.12
3	Chaurikharka	12.71
4	Chaurikharka (Dhunge)	12.89
5	Chesurma	11.41
6	Chheplung	10.25
7	Chhermading	2.33
8	Chyuma	2.6
9	Ghat	5.98
10	Ghattekhola	2
11	Jamphutte	8.29
12	Lowa	2.25
13	Monjo and Jorsalle	5.62
14	Muse	10.47
15	Muse (Bakudingma)	14.25
16	Ngamateng	4.83
17	Phakding	4.17
18	Rangding	6.33
19	Sano Gumela	11.45
20	Teka	14.6
21	Thadokoshi	8.88
22	Thulo Gumela	5.27
23	Tok-Tok	2.53
	Average	**7.89**

(Field Survey 2021)

The components of subproject lie in public as well as private land. Thus, it affects the people directly or indirectly. During construction period, the private land will be excavated for penstock pipe lining, powerhouse construction activities and other purposes such as storage, camps etc. Thus, these activities affect the local people and their livelihood. Ten land plots of 8 households in the DIZ will be affected by the subproject structures. A total of about 1280.24 m^2 of private land is required. **Table 28** shows the total landownership of the HHs included in DIZ. As mentioned in table, the subproject components require very less percentage of land compared to the total landholding of the households, Moreover the land to be acquired for penstock alignment can be used for agriculture as the penstock will be buried.

Table 28: Total landholding and % of affected land by subproject components

SN	Name	Plot No.	Affected Land (m^2)	Total Land (m^2)	% Of Affected Land in total	Remarks
1	Pasang Sherpa	3	51.77	6104.88	10.11	Tailrace
		13	498.23			Power House
		16	67.48			Penstock

2	Fura Futi Sherpa	15	136.53	508.74	26.84	Penstock
3	Ngawang Gele	17	14.46	4500	0.31	Penstock
4	Doma Sherpa	20	311.41	2543.7	12.24	Penstock
5	Daali Sherpa	23	13.33	1526.22	0.87	Penstock
6	Kaji Sherpa	31	33.21	30524.4	0.11	Penstock
7	Pasang Temba Sherpa	32	87.5	780	11.22	Penstock
8	Kami Dorji Sherpa	33	66.32	2290	2.9	Penstock
	Total		1280.24			

4.3.4 OTHER HOUSEHOLD PROPERTY SUCH AS PHYSICAL STRUCTURE AND TREE (FRUITS TREE, TIMBER TREE AND OTHERS)

Most of the houses in the area are constructed with stone cement masonary 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**). All eight houses in the DIZ are made from stone walls with CGI roofing.

Table 29: House type in Ward No. 3

Type	Number
Stone mud wall	60
Stone Cement wall	179
RCC	3
Tin and Wood	152
Others	1

(Source: KPLRM, 2019)

Diversity of fruits is low due to climatic condition of the subproject area. Commercial horticulture is rare. Planting of apple trees has become common in the area. Others include peach, plum and pear **(Table 30)** in Ward No. 3.

Table 30: Fruits Type in Ward No. 3

Name of Fruits	**Number of HHs**
Syaau (Apple)	104
Aaru (Peach)	21
Aluchaa (Plum)	34
Naaspati (Pear)	5

(Source: KPLRM, 2019)

Pasang Sherpa (HH in DZI) has planted some Apple plants (30 saplings) in plot no 13. Other houses on DIZ did not plant any fruits on the subproject affected lands.

4.3.5 CROPPING AND GRAZING PATTERNS

The RM has diverse climate due to altitudinal variation 1,543 m amsl to 8,848 m amsl. Ward numbers 1, 2 and 3 have relatively warm climate and so more people dependent on agriculture activities (KPLRM, 2019). Agriculture land is very premium in Ward No. 3. People in general cultivate potato, buckwheat, barley, naked barley and maize, of which potato is the most common crop. Generally, ripening of crops takes more than 6 months due

to cold climate. People are also cultivating vegetables such as cauliflower, cabbage, tomato, carrot, radish, capsicum, bean, chilly, cucumber etc. in plastic tunnel.

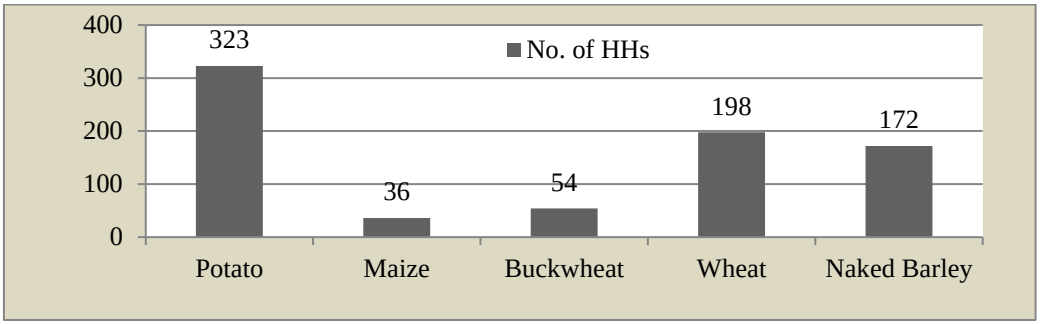

Figure 21: Number of HHs Growing Different Crops

(Source: KPLRM, 2019)

Yak, cow, horse, mule, goat, jyokpo[12] and bull are the livestock reared in the Ward No. 3. Cow is the livestock that is reared by most HHs in more numbers. There is no specific grazing system. Open grazing is common.

Table 31: Crops and livestock of the households in DIZ

SN	Name	Crops (kg/year)	Livestock	Vegetables (kg/year)
1	Pasang Sherpa	None	None	600
2	Fura Futi Sherpa	None	Cow: 2 Nos	200
3	Ngawang Gele	None	None	None
4	Doma Sherpa	Potato: 400	Cow: 2	500
5	Daali Sherpa	Potato: 250	Cow: 2	400
6	Kaji Sherpa	Potato: 200	Yak :1	500
7	Pasang Temba Sherpa	Potato: 100	None	200
8	Kami Dorji Sherpa	Potato: 400	Yak :1	500

(Source: CED)

4.3.6 VULNERABILITY OF THE AFFECTED PEOPLES (APS)

The households that have disabled, elderly people (elder headed without any other bread winner), single women, female headed, Dalit 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. However, due to the loss of private land, 8 families are identified as vulnerable. During construction period, the private land will be excavated for penstock pipe lining, powerhouse construction activities and other purposes such as storage, camps etc. Thus, these activities affect the local people and their livelihood. Ten land plots of 8 households will be affected by the subproject structures. A total of about 1686.27 m^2 land from locals is required for the proposed subproject structures. **Table 32** shows that people who are losing land parcel due to subproject development activities and furthermore people of these HHs also have tourism or hotel business as alternative source of income generation. In Addition to it, the land required except from powerhouse, (penstock alignment) can be

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

used for agriculture as the penstock will be buried. The landowner of 8 HHs were not found vulnerable due to disable, elderly people, single women, female headed households, and dalit.

Table 32: List of People Losing Land

SN	Name	Plot No.	Affected Land (m^2)	Total Land (m^2)	% of Affected Land in total	Remarks
1	Pasang Sherpa	3	51.77	6104.88	10.11	Tailrace
		13	498.23			Power House
		16	67.48			Penstock
2	Fura Futi Sherpa	15	136.53	508.74	26.84	Penstock
3	Ngawang Gele	17	14.46	4500-5000	0.31	Penstock
4	Doma Sherpa	20	311.41	2543.7	12.24	Penstock
5	Daali Sherpa	23	13.33	1526.22	0.87	Penstock
6	Kaji Sherpa	31	33.21	30524.4	0.11	Penstock
7	Pasang Temba Sherpa	32	87.5	780	11.22	Penstock
8	Kami Dorji Sherpa	33	66.32	2290	2.9	Penstock
	Total		1280.24			

4.3.7 EDUCATION

Overall literacy rate in the RM is 67.72%. The literacy rate in subproject influence area, Ward No.-3, is 70.41%. Literacy rate of eight households under DZI is 100%.

Table 33: Literacy Rate

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 owned school and one private school in the RM. In subproject influence area i.e., Ward No. 3, there are four schools—one secondary and three basic, **Table 34**.

Table 34: 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	

Ward No.	SN	Name of School	Level	Remarks
	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 2021)

4.3.8 OCCUPATION/ EMPLOYMENT AND INCOME

Tourism activities like trekking, mountain climbing, hotel and restaurant are the major economic activities of the area. Agriculture land is very premium and productivity is also very less. Major occupations are agriculture, tourism, services, foreign employment and business (Figure 22). Unemployment figure is also significant in Ward No.3 of the RM.

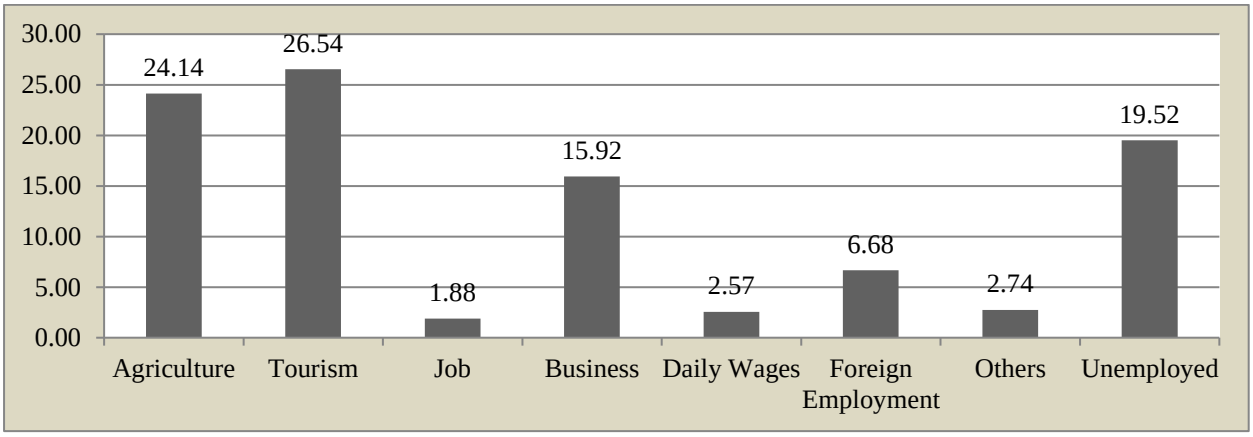

Figure 22: Population Percentage by Occupation in Ward Number 3

(Source: KPLRM, 2019)

Occupation/Employment and income status of the households in the DZI is shown in **Table 35**. Six households have major occupation as hotel business where as for two households its tourism (Trekking).

Table 35: Demography, Occupation and Economic Characteristics of Eight Affected Households

S.N.	Name of Land Owner	Population			Major Occupation	Source of Income/Amount (NPR)			Expense (NPR)	Major Crops	Livestock
		M	F	T		Agriculture and Livestock	Tourism	Business (Hotel/ Lodge)			
1	Pasang Sherpa	2	2	4	Hotel Business/ Agriculture	HH purpose only		1000000	600000	vegetables	None
2	Fura Futi Sherpa	1	2	3	Hotel Business	HH purpose only/milk		300000	200000	vegetables	Cow-2
3	Ngawang Gele	3	3	6	Hotel Business			300000	200000	None	None
4	Doma Sherpa	3	3	6	Hotel Business/ Agriculture	HH/Hotel purpose only/Milk		300000	250000	vegetables/Potato	Cow-2
5	Daali Sherpa	1	1	2	Hotel Business/ Agriculture	HH purpose only/Milk		250000	100000	vegetables/Potato	Cow-2
6	Kaji Sherpa	4	1	5	Hotel Business/ Agriculture	200000		500000	270000	vegetables/Potato	Yak-1
7	Pasang Temba Sherpa	2	2	4	Tourism	HH purpose only	300000		200000	vegetables/Potato	None
8	Kami Dorji Sherpa	2	1	3	Tourism/ Agriculture	HH purpose only	400000		300000	vegetables/Potato	Yak -1

(Source: CED field Survey)

4.3.9 ACCESSIBILITY OF ELECTRICITY IN THE SUBPROJECT AREA

The subproject area is not accessible by national grid. Four local community managed micro hydro power plants (**Table 36** in Section 4.3.14) are operational which provide electricity for mere lighting purpose. Demand of electricity for space heating and cooking cannot be met by these micro hydro plants.

4.3.10 PHYSICAL AND CULTURAL RESOURCES IN THE SUBPROJECT AREA

There are four schools in Ward No. 3; three basic and one secondary school. Similarly, there are two health institutions in Ward No 3: Monjo clinic and Chaurikharka Health Post. There is no temple in Ward No. 3 but 5 Gumbas (KPLRM, 2019). The nearest Gumba is Uchche Chholing Gumba in Monjo which is about 200 m up eastwards from the Monjo settlement (Field Visit 2021). Gumba is the main meeting or gathering place for locals. In Monjo, there is a meeting hall in the premises of Yuwa Basic School, managed by Khumbila Woman Group.

4.3.11 CULTURAL 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. Mani Rimdu is celebrated for 3 days in November. The first day of festival involves prayers, second day for colorful lama dancing where 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. All these festivals are carried out in public places and do not lie in the DIZ, hence are not affected by the subproject components.

4.3.12 DESCRIPTION OF SETTLEMENTS OF INDIGENOUS PEOPLE, DALITS AND OTHER RELIGIOUS AND MINORITIES WITHIN THE SUBPROJECT AFFECTED AREA

The major settlement in Ward No 3 is of Sherpa. Other caste and ethnic groups migrate here for business purposes. In all settlements, Sherpa are dominant indigenous group. Tamang, Magar, Rai, Newar and Sunuwar are other indigenous group in the area. Most of the other groups are migrants. Beside them Chhetri and Dalits are remaining groups in project influence area, **Figure 23**.

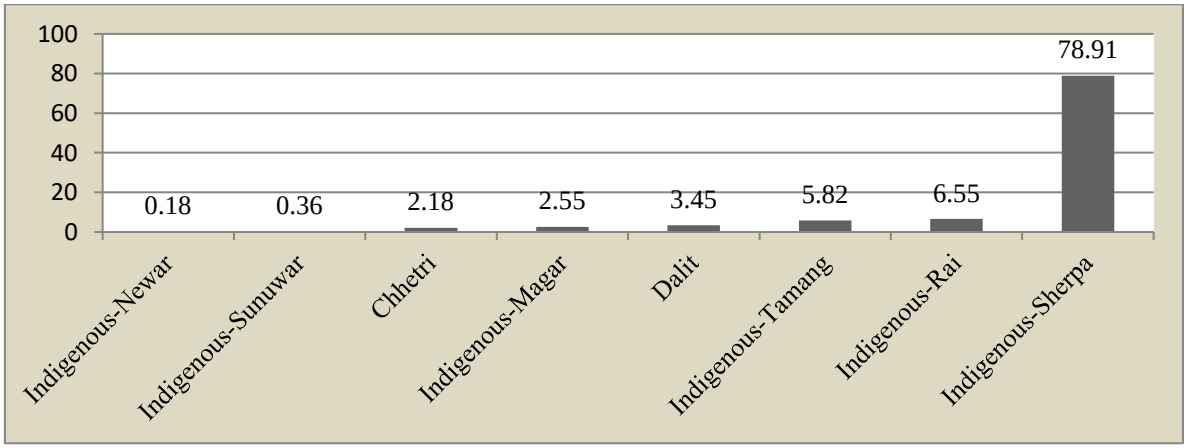

Figure 23: Indigenous Group in PIA

More than 95% HHs follow Buddhism in PIA. 3.6% of total HHs follow Hinduism while rest (less than 1% HHs_ are Christian (Figure 24). All eight households in the DZI are Sherpa and follow Buddhist religion.

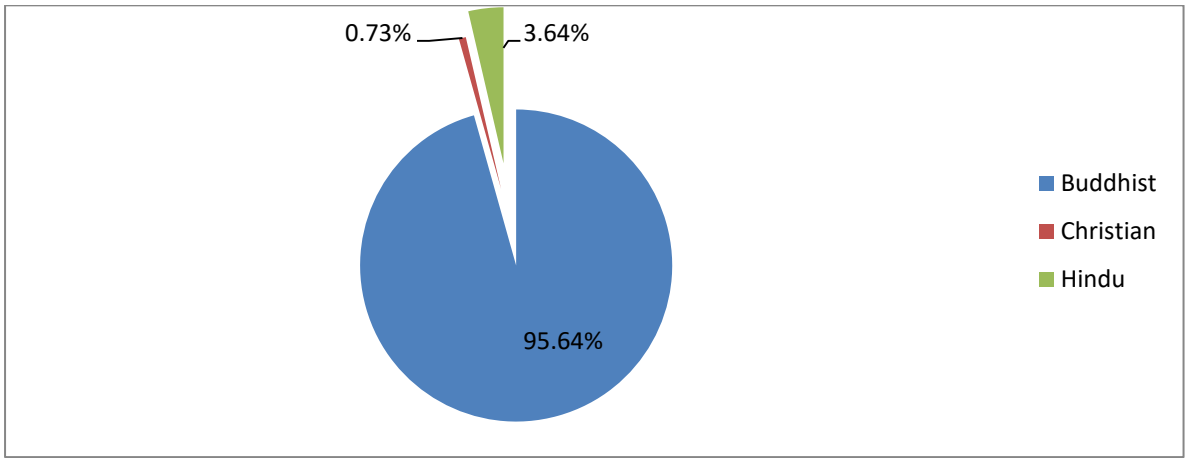

Figure 24: Religion in PIA

4.3.13 COMMUNICATION FACILITY

Basically, subproject area has 3G services. 4G mobile network facilities are also available in the subproject area although network or quality is poor. Similarly, internet facilities and 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 to radio. The major source of information in the subproject area is internet 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 Monjo (about 1.5 km to headwork and 150 m to power house). There are four micro hydro powerplants in subproject area, **Table 36**. The existing micro hydro in the subproject area are not operational in their full capacity as these plants are more than 10 years old and need regular repair & maintenance. Thus, existing MHPs 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. Similarly, all the settlements have access on drinking water facilities. Monjo Water Supply User Committee manages the water supply system in Monjo. There are five community building in the subproject area (1 at Monjo, 1 at Toktok, 2 at Ghat and 1 at Chheplung).

Table 36: Existing Micro Hydro Projects

S.N.	Hydropower	Ward	Installed Capacity (kw)
1	Thadokoshi Micro Hydropower	3	100
2	Chhusema Micro Hydropower	3	35
3	Ghatte khola Micro Hydropower	3	70
4	Monjo khola Micro Hydropower	3	50

Table 37: Bridges in PIA

SN	Name of Bridge	Type of Bridges	Address	Remarks
1	Larcha Dovan Bridge	Suspension	Boarder of Ward No. 3 and Ward No. 5	
2	Jor salle Bridge	Suspension	Jor Salle	Crossing
3	Tawa Bridge	Suspension	Tawa	
4	Monjo Khola Bridge	Iron Bridge	Inbetween Monjo and Chhumowa	Crossing
5	Benkar Bridge	Suspension	Benkar	Crossing
6	Benkar Jharana Bridge	Iron Bridge	Benkar	Crossing
7	Ghatte Khola Bridge	Concrete Bridge	Jamphutte	Crossing
8	Phakding Bridge	Suspension	Rangding	Crossing
9	Phakding Bridge	Iron Bridge	Phakding	Crossing
10	Rokamba Bridge	Suspension	Rokamb	
11	Chhuserma Bridge	Iron Bridge	Inbetween Chhuserma and Sano Gumela	
12	Chhuthawa Bridge	RCC Bridge	Chhuthawa	Crossing
13	Thadokoshi Bridge	Truss Bridge	Thado Koshi	Crossing
14	Thadokoshi Bridge	Suspension	Thado Koshi	Crossing
15	Syangma Bridge	Wooden Bridge	Syangma, Inbeween Ward No. 2 and 3	
16	Rongding Bridge	Wooden Bridge	Tot, Rongding, Inbeween Ward No. 2 and 3	
17	Chheplung Bridge	RCC Bridge	Chheplung	
18	Thulokhas Bridge	RCC Bridge	Kyangma	
19	Kyangma Bridge	Suspension	Inbeween Ward No. 2 and 3	
20	Ghat Teka Bridge	Suspension	Ghat	
21	Kamsewa Bridge	Wooden Bridge	Lwaha-Neka Khola	

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 or confusions among community members. 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. Collective decision making is in practice in the subproject area where each community member can express their views without any kind of coercion. If the disputes are not settled through this process it is taken to Ward or Rural Municipality office.

4.3.16 STATUS AND ISSUES OF WOMEN AND CHILDREN 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 actively involved in decision making process that takes place at their families and society. 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, Chaurukharka BZUC exists in subproject area. There are 10 BZUGs under Chaurikharka BZUC and 9 Buffer Zone Community Forests User Groups (BZCFUGs). Out of 10 BZUGs and 9 BZCFUGs, 5 BZUGs (Khumbila, Gautam Buddha, Phari, Tsomalongma and Kusung Khangaru) and 6 BZCFUGs (Himalayan, Kongde, Dudh Kunda, Pema Tsoling, Redpanda and Muse) lie in subproject area.

4.4 OUTSTANDING UNIVERSAL VALUES (OUV) OF SAGARMATHA NATIONAL PARK HERITAGE SITE

Chapter 4.2.3 explains the SNP is recognized by UNESCO as the World Heritage Site (WHS). The subproject is located in the Buffer Zone of the SNP but close to the boundary of the SNP and WHS. 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 (then under Department of Forest). The wholeness of the 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, 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).

The following points present a summary of the above OUV:

- Mount Everest and 7 other mountain peaks with altitude more than 7000 m

- Sherpa cultural heritage such as the Tengboche monastery and the unique conservation-oriented Sherpa culture that has maintained the landscape integrity.
- Sherpa community and over 20 Sherpa villages.
- Ecological habitat diversity associated with six altitudinal vegetation classes
- Rare and endangered animals such as Snow Leopard and Red Panda.
- Gokyo and associated lake group that forms a Ramsar site
- Tourism is a main income source for the local people and the park, but is demanding of natural resources.
- Demand for firewood is a major cause for deterioration.

5 ALTERNATIVE ANALYSIS

Alternative analysis is an integral part of the subproject feasibility study. Alternative analysis is primarily governed by the factors like technical feasibility, economic viability and environmental acceptability. 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 Forest and government land be used for MKMHSP.

The aim of the proposed subproject MKMHSP is to construct and install a system having 942 kW installed capacity and to distribute electricity at local level through 11 and 1.1 kVA transmission lines. The various alternatives to achieve the subproject objectives of MKMHP with no or minimum environmental damages are discussed in the following sections.

5.1 DESIGN ALTERNATIVE

Proposed MKMHSP is a run of river and initially it was proposed as an installed capacity of 500 kW. During Detailed Feasibility Study it was found that electricity demand in the subproject area is very high. Accordingly, the subproject was studied considering different alternatives. Optimization of the installed capacity of MKMHP was carried out to establish the optimal plant size for power production from the hydropower subproject. For this purpose, various installed capacities of the subproject and the corresponding flow conveyance systems were considered for economic analysis, keeping the full supply level at the headworks and the tail water level at the powerhouse fixed. To identify the optimum installed capacity of the subproject, local demand, water flow and head were considered. For a fixed design head, the increase in installed capacity was achieved by varying the flow in the conveyance system through variations in the dimensions of the desanding basin, penstock, power station and tailrace canal. For each alternative scheme, preliminary cost estimates of the requisite works were prepared based on quantity takeoffs from preliminary designs and rates from subprojects of similar nature. Finally optimum installed capacity of MKMHP was fixed at 942 kW.

5.2 SUBPROJECT SITES

During the desk study and survey, the survey team tried to identify potential alternative sites for intake and powerhouse. Upstream locations of Monjo Khola from proposed intake consisted a waterfall which could give a significant head gain. But very steep slopes consisting unstable boulders on the right bank and a landslide on left bank of the river sections was unfavorable for construction of headworks structures. The right bank downstream of the proposed intake location also consisted of steep and rocky slopes. Major portions of the headrace alignment would have to go through a very steep topography if was constructed on right bank of the river. Compared to this left bank of the Monjo Khola at proposed Intake location consisted appropriate space for headworks. Also due to gentle terrain it also provided opportunity for easier waterway layout. A river crossing is also provided to avoid steep terrain for headrace.

Alternative route in the left bank of the river was also considered to avoid the river crossing and follow the left bank for powerhouse location. This stretch of the river was unfeasible due to its very steep topography considering the right bank. Furthermore, appropriate and safe location for powerhouse constructing was not available at left bank of the river.

Due to landslide of at right bank of Monjo Khola just below main trekking trail, penstock pipe route doesnot follow the right bank of Monjo khola, and it affected on location of powerhouse. Thus penstock pipe route passes through Monjo village towards the proposed location of power house. Location for penstock layout also considered the willingness to sell the land by the locals to the subproject. Layout route was chosen through the land whose owners were willing to sell the land to the subproject.

Powerhouse location lies in the left bank of Dudhkoshi River. It is placed well above the high flood levels of the river. Flood hydrology is also carried out for powerhouse safety. Lower elevations form proposed powerhouse location was also not suitable as the land formation mainly has alluvium and colluvium depoists. These areas were not suitable for powerhouse construction due to possibilities of flood and landslide hazards.

Alternative study was also carried considering possibilities of not replacing existing Monjo Khola micro hydro project. But this would result in loss of power. This was not recommended by the locals as they were willing to replace the existing micro hydro power project for a mini hydro subproject. The power demand at load centers were ever increasing and power generated by micro hydro was limited to lighting at household level. The local demand for electricity was much higher. Hence decreasing power was not considered.

5.3 TOPOGRAPHY

Penstock pipe route through right bank was not feasible due to steep slope. Similarly, Penstock pipe route was also impossible without river crossing due to steep slope at left bank just below the intake of existing Monjo Khola Micro Hydro.

5.4 TECHNOLOGY

Technology alternative seeks other modes of electricity facility to fulfill similar requirements for the regional development as would be achieved by installation of hydropower. The people within the zone of influence require safe, efficient, cheap and healthy energy for daily lighting and cooking activities. At the same time, there is an urgent need to conserve the environment in terms of physical, biological, social and cultural aspects. Possible alternative options to achieve above-said prospect would include solar power, wind power, thermal power, fossil fuel and firewood. Power import from national grid is another option. Solar and wind power are also sources of clean energy which create or produce very less environmental degradation. However, the potentiality of both solar and wind power largely depends on the sunshine hour and wind velocity which may not be available all the time at Monjo. Besides, there are problems associated with these sources. Imported solar panels are complex in technology and expensive in maintenance. Power generated from solar power is very small to be used for heating and cooking purpose. Some household in the subproject affected area have small solar panels for lightening purpose that is not sufficient as they need more power for cooking, lightening, heating, running electronic and electrical equipment and others. Furthermore, battery life significantly reduces in subproject region due to low temperatures. Safe disposal of battery is also a challenging issue in subproject area. Thus, the solar and wind power could not be an appropriate alternate for this subproject. Thermal power plant is associated with serious environmental problems like air pollution due to CO_2 emission, sludge handling, high noise, high temperature and fire hazard. Besides, petroleum products are imported from abroad, price is continuously increasing, and there is a problem of spare parts and their high cost. The subproject site is remote and far from national grid and rest part of country is already in shortage of power. Various problems are stumbled during its import

such as lack of high voltage transmission line, and time required for installation of such facility is quite long. Thus, it is an optimum necessity to seek out the permanent source of electricity at local level itself for the continuous supply of electricity. Considering the above alternatives, mini hydro can be the best option to serve the purpose of electricity requirement of the subproject area.

5.5 WORK PLAN

Work Plan will be based on intensive technologies of construction equipment and maximum utilization of local resources to the extent possible. This is to ensure lowest possible cost for subproject development and ensure quality in the works undertaken. Due priority will be given for the recruitment of local people which will minimize the requirement of temporary camp, reduce fuel wood and timber requirement, enhance local skill and economy and develop better relationship between the subproject and local people. The construction work will be scheduled in daylight and construction at night will be prohibited. The implementation of the subproject will require sand and aggregate which will be used from the proposed quarry sites and crushing the excavated materials.

5.6 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 need 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.

5.7 USE OF FOREST AND GOVERNMENT LAND

The subproject's layout option is such that minimal forest area is required. The size of the subproject is small, forest requirement for long term lease is limited (0.63 ha only) which will be compensated as per Procedural Guideline for the use of Forest Land, 2063. The location and potential site for the compensatory plantation will be provided by the concerned GoN authority and will be located before construction.

5.8 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.

5.9 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 the risk associated with cost overrun during construction. Similarly, the powerhouse area is located on the terrace made by the Dudhkoshi River. It has been designed considering GLOFs from Imja and Dig Tsho. The risk of GLOF has also been accounted by referring to the potential GLOF discharge estimates.

6 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 ISSUES

6.1.1.1 CONSTRUCTION PHASE

i) Employment generation and skill enhancement and increase in trade and business

Approximately 250 unskilled and 100 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 jobs will provide opportunity to increase cash 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 community and social support programs

The subproject through community support program will suggest improvement of local services like health posts, schools, drinking water and social services. These programs are envisaged to help develop local infrastructures and social services in the subproject impacted area helping local people to improve their quality of life. *The impact will be direct in nature, high in magnitude, local in extent and long term in duration.*

iii) 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. *The impact will be indirect 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 forces from outside the subproject area will reside in the sub project 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 projects. 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 utilize the local resources such as local agriculture produces, construction materials and water resources. 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 942 kW of power to local people

The implementation of the proposed MKMHP will generate 7,243,292.16 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 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, operation of electronic appliances and machine such as fridge, washing machine, television and, room heating 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 Intergovernmental 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 projects as per Electricity Act 2049, Clause No. 4 & 11, local government can fix the royalty from the mini hydro subproject. *The impact will be direct in nature, moderate in magnitude, local in extent and long term in duration.*

6.1.2 ADVERSE ISSUES

6.1.2.1 PHYSICAL ENVIRONMENT

6.1.2.1.1 Construction Phase

i) Change in Land Use

Areas under different land use patterns will be required for the subproject construction. In the case of MKMHP, forest area, private land and river banks will be utilized for the subproject construction. About 5.83 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 0.758 ha permanently for the construction of different subproject component thus changing the land use category (**Table 9**; Section 2.4.5). *The impact will be direct in nature, moderate in magnitude, site specific in extent and long term in duration.*

ii) Possible Glacier Lake Outburst Flood (GLOF) and Associated Impacts

The impacts of potential outbursts of glacial lakes upstream of the Dudhkoshi 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 of the lake, depth of the lake, 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 in magnitude as GLOFs may affect tailrace only. *The impact will be indirect in nature, low in magnitude, site specific in extent and short term in duration.*

iii) Landslide and Soil Erosion

Construction activities will include 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. The clearing activities of forest and agricultural land 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 impact is indirect, low in significant, site specific in extent and short term in duration.*

iv) 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 wastes would be challenging. Improper disposal of the spoil may result in destruction of productive land and vegetation, 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, low in magnitude, short term in terms of temporal coverage and site-specific in terms of spatial coverage.*

v) 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 affects 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.*

vi) 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 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.*

vii) Water Pollution and Increase in Sediment Loads

Changes in the water quality of surface water bodies are likely to occur due to construction activities. In major stretches of the Monjo Khola, there is limited space available on both river banks, and as most of the construction activities will be located close to the river, there is an increased possibility of water quality deterioration.

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. The impacts will be felt most during the dry season. 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 Monjo Khola can be expected to a certain level. The potential for adverse impacts is nevertheless short-term in nature. *The impact will be indirect in nature, moderate in magnitude, short term in duration and local in terms of spatial coverage.*

viii) 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 on settlements in close proximity to noise sources at penstock alignment along Monjo and 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.*

ix) 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. *The impact will be of direct in nature, low in magnitude, site specific in extent and short term in duration.*

x) 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. During the construction phase, there will be significant quantity of construction materials such as gravels, aggregates, bricks, cement, etc. around the construction area. Seepage and leakages from the stockpiled construction materials can directly impact soil and water quality of the river. Additionally, if not properly managed, the beauty of local topography might be affected. *The impact will be direct in nature, low in magnitude, site specific in extent and short term in duration.*

xi) 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 settlements from the project site is Monjo which is approx. 150 m 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.*

xii) Air Pollution Related Issues

During construction period, the activities such as transportation of man and material, excavation and operation of crushing plant will generate dust. This impact on air quality will however be short in duration and for the most part be 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 smoke pollution due to cooking activities. Because, during construction period, there will be large number of construction workers in the subproject area. 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. *However, the impact will be direct in nature, low in magnitude, local in extent and short term in duration.*

xiii) 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 0.560 m^3/s of flow through the pipe to the powerhouse located downstream. Therefore, the river stretch of about 1.3 km between the proposed intake and confluence between Dudhkoshi River and Monjo Khola site can be classified as a reduced flow reach .

The basin hydrology and flow regime of Monjo 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 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 short term in duration.*

xiv) Loss of Top Soil

Subproject requires forest and agriculture land. The top soil, estimated to be about 100 m^3will be destroyed if not removed before construction. *The impact will be direct in nature, low in magnitude, site specific in extent and short term in duration.*

xvi) Impacts on Reduced flow Zone

The river stretch of about 1.3 km between the proposed intake and confluence between Dudhkoshi River and Monjo Khola site can be classified as a reduced flow zone. The water in this segment of river is not used for irrigation, drinking and not any livelihood purposes by local communities. However, there is a Monjo Khola micro hydro capacity of 50 kW (currently operating not in full capacity) which needs to be dismantled as the proposed subproject utilizes water from the upstream of the intake of Monjo Khola micro hydro. So, the proposed subproject will have impacts in Monjo Khola micro hydro. 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 Monjo Khola is not reported. SNP management plan was also referred for information on fisheries. Thus, impacts on fishes and other aquatic life due to the reduction of river flow in reduced flow reduced flow zone is not observed.

6.1.2.1.2 Operation Phase

i) GLOF and Associated Impacts

Although Monjo river originates fom Kyaser Galcier, lake formations and outbursts have not been reported till date.The powerhouse of Monjo Khola Mini Hydro Subproject is located at an elevation of 2745.0 masl on the left bank of the Dudh Koshi river. The elevation of Dudhkohi river bank is located just below the Powerhouse site at an elevation of 2726 masl. Elevation difference (2745-2726 masl) between the Dudhkoshi river bank and powerhouse location is 19 m. Powerhouse is safe against the flood depth of 6.9 m from potential Imja GLOF. Also flood depth of 5.5 meters from Dig Tsho GLOF suggests powerhouse is also safe from potential Dig Tsho GLOF. *The impact will be indirect in nature, moderate 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 Monjo Khola in intake site will eventually result in some impacts on the downstream reduced flow zone. Low volume of water is likely to increase the temperature in the reduced flow zone. The change in flow during wet season is not considered significant but in dry period (2.5 months) the flow will be significantly reduced which causes adverse impact on river morphology. This will be a residual impact until the subproject will be in operation. **Table 38** presents the predicted range of monthly water discharge in the River and reduction from original water flow. **Figure 25** presents the current and future seasonal water flow. Monthly design discharge was determined using Medium Irrigation Project (MIP) method.

Table 38: River Discharge after Flow Diversion

Month	Monthly River Discharge (m^3/sec)	Design Discharge for power generation (m^3/sec)	Discharge at the river after flow diversion to intake (m^3/sec)	Discharge % After flow diversion
January	0.731	0.560	0.171	23
February	0.549	0.490	0.059	11
March	0.396	0.338	0.058	15
April	0.305	0.246	0.059	19
May	0.792	0.560	0.232	29
June	1.829	0.560	1.269	69
July	4.419	0.560	3.859	87
August	7.619	0.560	7.059	93
September	5.029	0.560	4.469	89
October	2.438	0.560	1.878	77
November	1.250	0.560	0.690	55
December	0.945	0.560	0.385	41

There will be some change in the water quality in the dry season in the reduced flow stretch of the river between weir and confluence of Monjo Khola and Dudhkoshi River. Because of the reduction of the flow discharge and contribution of nutrients, there will be growth of blue filamentous algae in the reduced flow stretch of the river.

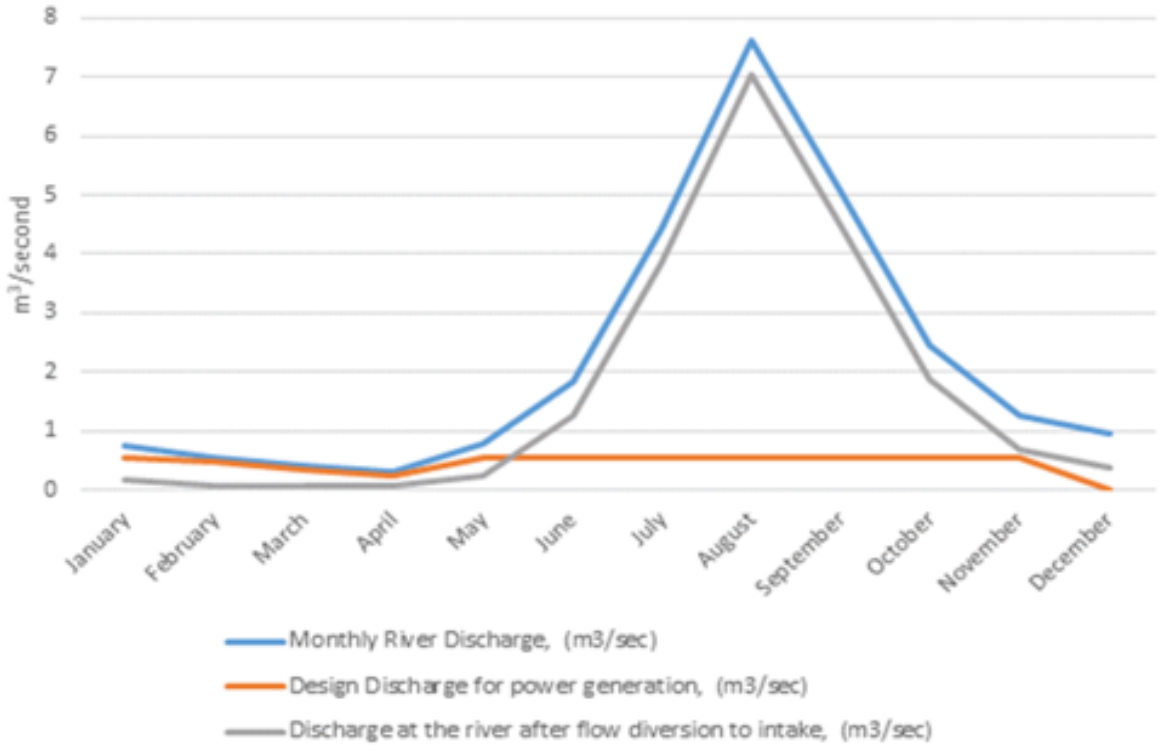

Figure 25: Discharge at the River after Flow Diversion

Figure 25 shows monthly River discharge, design discharge for power generation and discharge after flow diversion for power generation. Throughout the year discharge at the river after diversion to intake is more than 11%[13]. **Table 38** shows monthly river discharge which is 11% in February, 15% in March, 19% in April and remaining nine months discharge at the river after diversion to intake is more than 23%. *The impact will be direct in nature, moderate in magnitude, local in extent and long term in duration.*

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 under:

(i) Undisturbed section upstream the upper limit of the reservoir
(ii) Reservoir section of about 5 m length
(iii) Reduced flow section of about 1.3 km length

As the existing aquatic life are co-existing with the undisturbed river morphology will find difficulties to sustain their life cycle in the changed morphological and water conditions of the changed river stretches. Major changes in aquatic life will occur in the reservoir section and in the reduced flow section through November to May every year. *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

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

[13] *Hydropower Development Policy (2001) requires a hydropower project to release the quantum of water which is higher of either at least 10% of the minimum monthly average discharge of the river/stream.*

will be limited after subproject construction. Wastewater 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

Due to the downstream release after flow diversion at intake, **Table 38**, and no possible source of contaminants around the river environment, change in water quality is not envisioned.

vii) Noise and Vibration at Power House

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 any the impact to the community. Noise and vibration will be is 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 plan. *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 desilting basins erodes the river bank. *The impact is indirect in nature, low in magnitude, site specific in extent and long term in duration.*

6.1.2.2 BIOLOGICAL ENVIRONMENT

6.1.2.2.1 Construction Phase

i) Loss of Forest Area

Total forest land required by the subproject is 0.63 ha. The subproject will acquire these lands from BZCF on long term lease. *Impact is of direct in nature, moderate magnitude, site specific in extent and long-term duration.*

Table 39: Forest Area Required for Subproject Components

SN	Subproject Component	Forest Area (Ha)	Community Forest	Remarks
1	**Headworks (weir)**			
1.1	Pondage area	0.18	Himalaya BZCF	Long-term Lease
1.2	Headworks	0.054	Himalaya BZCF	Long-term Lease
2	**Penstock**	0.338	Himalaya BZCF	Long-term Lease
3	**Camps and Office**	0.05	Himalaya BZCF	Long-term Lease
4	**Electric Poles**	0.008	Himalaya BZCF	Long-term Lease
	Total	**0.63**		

ii) Loss of Forest Vegetation and Overall Vegetation Diversity

Estimated total number of 30 poles and 3 trees need to be cut down for penstock laydown purpose. Due to tree cutting, 9.92 m^2 tree basal area, 11.56 m^3 tree standing volume, 2.21 m^3

timber volume, 5.23 m^3 fuel wood and 4,305.63 kg tree biomass will be lost. Total value of lost timber is estimated to be NRs. 775,000.00 and for fuelwood NRs.150,000.00. *The impact will be direct in nature, moderate in magnitude, site specific in extent and long term in duration.*

Table 40: Tree Basal Area, Volume and Biomass Loss

Local Name	**Scientific Name**	BA (m^2)	Volume (m^3)	Biomass (Kg)	Timber (m^3)	Fuelwood (m^3)
Thingure Sallo	*Abies pindrow*	3.48	4.02	2952.21	2.03	3.52
Gobre Sallo	*A. spectabilis*	0.55	0.46	302.59	0.00	0.53
Bhoj patra	*Betula utilis*	0.03	0.02	21.35	0.00	0.03
Balu	*Pieris formosa*	0.01	0.00	2.29	0.00	0.00
Rani Sallo	*Pinus wallichiana*	5.70	6.98	925.23	0.17	1.01
Gurans	Rhododendron sp.	0.16	0.08	101.96	0.00	0.14
Total		**9.92**	**11.56**	**4305.63**	**2.21**	**5.23**

Source: Field Survey, 2021

iii) Pressure on Forest for Fuelwood

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

iv) Impact on Red Panda and Himalayan Musk Deer:

The preferable altitude for the habitat of Red Panda and Himalyan Musk Deer is (3000-3200 m)[14] and (3800-4000 m)[15] respectively, and the subproject development activities will be carried out in the altitude range of (2700- 2900 m). Furthermore, during consultation with local people and other relevant stakeholders (SNP, Buffer Zone Committee, and RM) they revealed that these animals are seen around the subproject area however, the subproject construction activities will take place below 3000 m altitude so the subprojects activities will not have direct impact on their habitats. Local people and stakeholders also confirmed that these animals rarely moves around the subproject area nonetheless these animals are not territorial of subproject area. 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. Red Pandas are unable to escape quickly and are vulnerable to predation by dogs. *This impact is of direct in nature, moderate in magnitude, site specific in extent and long term in duration.*

v) Impact on Himalayan Black Bear:

The preferable altitude for the habitat of Himalayan Black Beer is (1000-3000 m)[16]. They are dangerous animals that forage opportunistically as both hunters and scavengers. Food waste

[14] *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*

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

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

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 in the Monjo 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.*

vi) Impact on Natural and Critical Natural Habitat (wildlife and their movement route and migratory bird movement route) Avian Fauna

Natural habitats are impacted by the footprint areas of the subproject components, such as the headworks/intake, penstocks and camp/office. The area of natural habitat that will be lost is estimated to cover approximately 0.442 ha. An analysis of alternatives has revealed this option to be the least destructive, and this loss of natural habitat requires compensation mitigation. *This impact is of direct in nature, moderate in magnitude, site specific in extent and long term in duration.*

vii) Impact on Aquatic Flora and Fauna

Construction activities and wastes from labour camps may degrade the water quality affecting the aquatic flora and fauna. Spoils and other construction wastes, chemicals and organic wastes increase the sediment loads, BoD and CoD of the river waters. DO may be reduced. This ultimately affects the aquatic flora and fauna of Monjo Khola. *The impact is direct, moderate in magnitude, site specific in extent and short term in duration.*

viii) Impact on Non-timber Forest Products

Anaphilis sp., *Barberis* sp., *Drepanostachyum* sp., *Nardostachys grandiflora*, *Plantago erosa*, *Rhododendron anthopogon*, *Rhododendron campylocarpum*, *Rumex nepalensis*, *Urtica dioica* and wild edible mushrooms are the major NTFPs that would be affected due to excavation and construction activities during subproject construction. The affected NTFPs are abundant in the other parts of the subproject area as well as outside the subproject area also. *The impact will be direct in nature, low in magnitude, site-specific in extent and short term in duration.*

ix) 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 in magnitude, local in extent and short term in duration.*

x) Wildlife Hunting and Poaching

Workers from outside the subproject area may involve in wildlife hunting and poaching. *The impact will be indirect in nature, moderate in magnitude, local in extent and short term in duration.*

xi) Increased Incidence of Human Wildlife Conflict

Some construction works may affect the wildlife movement. In addition, they might enter to nearby agriculture land and settlements, resulting in increased crop raiding and livestock loss. 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.*

6.1.2.2.2 Operation Phase

i) Reduced River Flow

The diversion of Monjo Khola in intake site will eventually result in some impacts on the downstream reduced flow zone which is the river stretch of about 1.3 km between the proposed intake and confluence of Monjo Khola and Dudhkoshi River. Low volume of water is likely to increase the temperature in the reduced flow zone. The change in flow during wet season is not considered significant but in dry period (2.5 months) the flow will be reduced which may cause some adverse impact on river morphology. There will be some change in the water quality in the dry season in the reduced flow 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 reduced flow stretch of the river. The potential impacts on fish are not envisaged as the presence of fish was not reported. *The impact will be direct in nature, moderate 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 minimal 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.

iv) Bird Casualties due to Electrocution and Collision with Transmission Line

Transmission and distribution lines are underground in all areas except river crossing. The overhead line across the rivers will be aligned to existing bridges and insulated cables are used. Hence there is no possibility of bird causalities due to electrocution and collision with transmission lines. *The impact will be of direct in nature, low in magnitude, local in extent and long term in duration.*

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 cigarettes, buds and match stick used by the resident workers 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.*

vi) Pressure on Forest for Fuel Wood

The resident workers may use fuelwood during winter for campfire, space heating and even for cooking. This may create pressure on local resources although resident workers are very few. *The impact will be indirect in nature, low in magnitude, site specific in extent and long term in duration.*

6.1.2.3 SOCIO-ECONOMIC AND CULTURAL ENVIRONMENT

6.1.2.3.1 Construction Phase

i) Land Acquisition and Compensation Related Issues

An estimated land area of about 5.83 ha is required for construction of the subproject components and provisioning for subproject facilities of which 0.758 ha will be required permanently for subproject component construction and the remaining 5.07 ha will be required temporarily. Out of the 0.758 ha land to be permanently acquired, 0.13 ha is private cultivated land and 0.628 ha is community forest land. Temporarily leased land is mostly barren land. The permanent structure of the subproject will be constructed in the permanently acquired land and temporary subproject ancillaries will be constructed in leased land. In case of private land to be acquired for powerhouse and tailrace, the percentage of land lost is very low compared to land holding of the owner. The compensation for private land needed for the subproject will be fixed in negotiation with landowners. In the initial conversation with land owners, they have provided written consent to ESCO mentioning that they are ready to negotiate with ESCO for the compensation of their private land. Some of the land owner also mentioned that they are willing to sell the land to the ESCO. Since the penstock is buried 1m deep, it will not hampared agriculture activities in the private. Penstock layout does not even affect the crops that can be cultivated. Hence the owners will be compensated as well as they can use to land as before. For community forest land, compensation will be made according to government regulations. *The impact is direct, moderate in magnitude, local in extent and long-term in duration.*

ii) Loss of Agriculture Land and Crops

Penstock will be buried (1 m) in 0.075 hector of private cultivated land. This will not hamper the agricultural production. Whereas, production is not possible in 0.055 hector private land where powerhouse and tailrace will be constructed. As per the landowner, this land is used for vegetable farming with yearly yield of 600 kg, which will be lost after land acquisition. Estimated loss of vegetable in terms of monetary value is about NPR 120,000/Year. Further, the loss of crops in private agriculture land due to construction activities will be recoreded for the purpose of compensation and the compensation for the loss of crops in private land will be fixed in mutual understanding of landowners and ESCO. *The impact will be direct in nature, low in magnitude, site specific in extent and long term in duration.*

iii) Loss of Physical Structure

There will be no loss of physical structures (like private house, sheds, community structures, religious monuments etc.) due to the construction of subproject components.
The impact will be direct in nature, low in magnitude, site specific in extent and short term in duration.

iv) Effect on Existing Social Infrastructures

There are four existing micro hydro projects in PIA (**Table 36** in Section 4.3.14). Out of four micro hydro, Monjo Khola Micro Hydro Project (MKMHP) will be impacted during construction period, as the proposed subproject activities will be conducted in the periphery of MKMHP. Sedimentation on water and disturbance on water supply canal will affect in power generation from MKMHP. Similarly, 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, high in magnitude, site specific in extent and short term in duration.*

v) Pressure on Existing Facilities, Services and Resources of the Subproject Area

There will be increased pressure in social service and facilities due to the migrant work force and outsider's population. The population of a relatively smaller subproject area can become crowded with addition of the outsiders. The addition of the outsider population creates pressure in social service providing institutions in the area. Experience of hydropower subprojects construction in Nepal, reveals pressure on the social service institutions particularly health services, water supply systems, administrative services, local law and order maintaining institutions and above all the sanitation management of the area. The implication is shortages of medicine, and medical personnel in nearby health posts; shortages in water supply; increase in thefts, quarrels over resources with a burden to local administration and law and order institutions; and above all increase in solid waste, human waste and degradation of the overall sanitation status of the area. *The impact will be indirect in nature, high in magnitude, site specific in extent and short term in duration.*

vi) Health and 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 sharp construction materials pose threat to public safety unless adequate awareness is provided and strict regulations are formulated. *The impact will be indirect in nature, high in magnitude, site specific in extent and short term in duration.*

vii) 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.*

viii) 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, moderate in magnitude, local in extent and of short term.*

ix) 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 projects 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 will be conflicts generated. Moreover, with increased migrant workforce in the area, there will 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.*

x) 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 may create dispute at workplace and hindrance on progress of works. *The impact will be indirect in nature, moderate in magnitude, site specific in extent and short term in duration.*

xi) 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 PIA, it 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.*

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

Locals of subproject area, 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, sexual exploitation & abuse, sexual harassment in/among workers, subproject staffs and also with local people. As the subproject development activities takes place close vicinity of human settlement and influx of labour during the construction phase there is a risk of SEA/SH. If there is no mechanism to address these issues at subproject level initially, it will create a huge problem later. 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.*

xiii) 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 behaviour, increment of wastes, unnecessary noise and shouting might disturb the nearby community. *The impact will be indirect in nature, moderate in magnitude, local in extent and short term in duration.*

xiv) 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.*

xv) Child Labor

Since 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 probability of child labor is almost nil in the subproject area. *The impact will be direct in nature, low in magnitude, local in extent and short term in duration.*

xvi) 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.

xvii) Impact on Historical, Religious, Cultural and Touristic Important Sites

Components of the mini hydro are either isolated from the human settlement (Like Intake and powerhouse) or hidden (underground penstock) in the settlement areas. Hence, the proposed subproject does not have any negative impacts on historical, religious, cultural and touristic sites. Also, there is no effect on local intangible cultural heritage.

xviii) The Pattern of Uses of Natural Resources in Festivals and Religious Rituals

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

6.1.2.3.2 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, high 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 transformer mounting. 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, high in magnitude, site specific in extent and long term in duration.*

iii) 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. Local people may cross the river. 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, site specific in extent and long term in duration.*

iv) 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. The labor requirement will decrease drastically, and so will be the income opportunities. Similarly, the employment opportunity will be drastically reduced during this phase. *The impact will be indirect in nature, low in magnitude, local in extent and short term in duration.*

v) Water Right Issues

Currently water is being used for running of Monjo Khola Micro Hydro from the downstream of Intake of MKMHP. When MKMHP will be operated, Monjo Khola Micro Hydro needs to be shut down. *Thus, this impact is direct in nature, high in magnitude, site specific in extent and long term in duration.*

vi) Issues related to Benefit Sharing of Subproject

Locals want some benefits as they have to provide local resources to private sector. There arises the issue of benefit sharing in terms of share on company and benefit accrued from power generation. This issue may effect on sustainability of the subproject. *Thus, this impact is indirect in nature, moderate in magnitude, local in extent and long term in duration.*

vii) Issues Related to Tariff of Electricity

Households have been using the electricity provided to them from local micro hydro plants. The electricity provided was able to meet only the lighting demand, hence the tariff rates were bare minimum. The proposed subproject aims to provide energy not only for lightening but also for space heating, electric cooking, electric house appliances and small industry as per need of the local people. Therefore, local peoples' willingness to pay the electricity tariff is very important in one hand while making profit from investment for developer is in another hand. *This impact is direct in nature, high in magnitude, local in extent and short term in duration.*

viii) Stress on Local Resources & Infrastructure

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

ix) Issues Related to Management of Existing Micro Hydro Subproject

There are four existing micro hydro projects in subproject area (**Table 36** in Section 4.3.14). Out of four micro hydro, MKMHP needs to shut down as the proposed subproject utilizes water from the upstream of the intake of Monjo Khola micro hydro. It is not feasible to run Monjo Khola micro hydro during operation period. Therefore, it will be dismantled when MKMHP comes in operation. Other three remaining micro hydro will also be impacted. People may use the electricity from new subproject that provides energy as per their demand. Therefore, other three micro hydro may be affected and their revenues may be impacted if not used by locals. *This impact is direct in nature, high in magnitude, local in extent and long term in duration.*

6.1.2.4 IMPACTS TO INTEGRITY OF PROTECTED AREAS AND OUTSTANDING UNIVERSAL VALUE

As the subproject area falls within BZ, outside of SNP and UNESCO WHS. The following points summarize the OUV of the WHS:

- Mount Everest and 7 other mountain peaks with altitude more than 7000 m
- Sherpa cultural heritage such as the Tengboche monastery and the unique conservation-oriented Sherpa culture that has maintained the landscape integrity.
- Sherpa community and over 20 Sherpa villages.
- Ecological habitat diversity associated with six altitudinal vegetation classes
- Rare and endangered animals such as Snow Leopard and Red Panda.
- Gokyo and associated lake group that forms a Ramsar site
- Tourism is a main income source for the local people and the park, but is demanding of natural resources.
- Demand for firewood is a major cause for deterioration.

The proposed activity is confined in a small site along the river banks and trails outside of the SNP and WHS and will not directly impact the area. During construction, there will be minor topographical changing works for penstock and transmission and distribution laying as both will be underground except river/stream crossing. It will impact the local visual perception, but not within the park area. Regarding potential impact to the OUV, the subproject will not impact the mountain peaks, the diversity of habitats over different altitudes or the Gokyo Rasmar site. This ESIA provides extensive baseline data and analysis of social impacts associated with Sherpa culture. Provision of electricity will positively impact tourism through reducing the demand for natural resources and wood fuel, which over the long-term will benefit landscapes and capacity of the ecosystem to support threatened species such as Snow Leopard and Red Panda. Snow leopard survive in high altitude habitats which are not impacted by the subproject. Red panda are potentially impacted indirectly during the construction phase when there is an influx of workers, as discussed in Section 6.1.2.2. Thus the impact of proposed subproject on integrity of the protected area and WHS OUV is *indirect in nature, low in magnitude, local in extent and long term in duration.*

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 41 and 42). For example, impacts likely to occur outside the subproject's 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 41: Evaluation of Impacts

SN	Likely Impacts	Nature	Magnitude	Extent	Duration	Total Score	Significance (pre-mitigation)
1. Construction Stage (Beneficial)							
i)	Employment opportunities for local people and impact on local economy and skill development	D	H(60)	L(20)	ST(05)	85	Significant
ii)	Benefits to community and social support programs	D	H(60)	L(20)	LT(20)	100	Highly Significant
iii)	Benefits from implementation of environmental mitigation programs and benefit augmentation measures	ID	M(20)	L(20)	LT(20)	60	Moderately Significant
iv)	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 Significant
v)	Benefits for Exposure of local population to new technologies and technology transfer	D	L(10)	L(20)	LT(20)	50	Moderately Significant
vi)	Utilization of local resources	ID	L(10)	L (20)	ST (05)	35	Insignificant
2. Operational Stage (Beneficial)							
i)	Employment generation and skill enhancement	D	M (20)	L(20)	LT(20)	60	Moderately Significant
ii)	Benefits to be incurred from addition of 942 kW of power	D	H(60)	L(20)	LT(20)	100	Highly Significant
iii)	Changes in local economic activities	ID	M(20)	L(20)	LT(20)	60	Moderately Significant
iv)	Changes in micro and macro economy	ID	L(10)	L(20)	LT(20)	50	Moderately significant
v)	Sharing of electricity royalty to concerned authorities	D	M (20)	L(20)	LT(20)	60	Moderately Significant

Note: D = Direct, ID = Indirect, S= Site specific, L= Local, R= Regional, ST=Short Term, LT= Long Term, H = High=Moderate, LO= Low
Value in the parentheses 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 (sume of numeric value* below *45) =in significant.*

Table 42: Evaluation of Impacts

SN	Likely Impacts	Nature	Magnitude	Extent	Duration	Total Score	Significance (pre-mitigation)
1. Physical Environment							
1.1 Construction Stage (Adverse)							
i)	Change in land use	D	M (20)	SS (10)	LT (20)	50	Moderately Significant
ii)	Possible Glacier Lake Outburst Flood (GLOF) and associated impacts	IN	L (10)	SS (10)	ST (05)	25	Insignificant
iii)	Landslide and soil erosion	IN	L (10)	SS (10)	ST (05)	25	Insignificant
iv)	Generation of spoils and spoil disposal related issues	D	L (10)	SS (10)	ST (05)	25	Insignificant
v)	Impact due to quarrying activity	D	M (20)	SS (10)	ST (05)	35	
vi)	Impact on material quarrying sites	D	M (20)	L	ST		
vii)	Water Pollution and Increase in sediment loads	ID	M (20)	L	ST		
viii)	Noise pollution	D	L (10)	SS (10)	ST (05)	25	Insignificant
ix)	Soil pollution	D	L (10)	SS (10)	ST (05)	25	Insignificant
x)	Issues of haphazard stockpiling of construction material	D	L (10)	SS (10)	ST (05)	25	Insignificant
xi)	Solid waste generation	IN	M (20)	SS (10)	ST (05)	35	Insignificant
xii)	Air pollution related issues	D	L (10)	L (20)	ST (05)	35	Insignificant
xiii)	Hydrology and river morphology	D	M (20)	SS (10)	ST (05)	35	Insignificant
xiv)	Loss of top soil	D	L (10)	SS (10)	ST (05)	25	Insignificant
1.2. Operational Phase (Adverse)							
i)	GLOF and associated impacts	ID	L (10)	SS (10)	ST (05)	25	Insignificant
ii)	Impacts on river morphology and possible microclimatic changes	D	L (10)	SS (10)	LT (20)	40	Insignificant
iii)	Land submergence due to diversion weir and associated impacts	D	L (10)	SS (10)	LT (20)	40	Insignificant
iv)	Management of solid waste and wastewater	ID	L (10)	SS (10)	LT (20)	40	Insignificant
v)	Change in river water quality	D	L (10)	SS (10)	LT (20)	40	Insignificant
vi)	Noise and vibration	D	L (10)	SS (10)	LT (20)	40	Insignificant
vii)	Soil erosion due to tailrace discharge	D	L (10)	SS (10)	LT (20)	40	Insignificant
viii)	Impact on downstream due to sediment flushing	ID	L (10)	SS (10)	LT (20)	40	Insignificant
2. Biological Environment							

SN	Likely Impacts	Nature	Magnitude	Extent	Duration	Total Score	Significance (pre-mitigation)
2.1. Construction Stage (Adverse)							
i)	Loss of forest area	D	L (10)	SS (10)	ST (05)	25	Insignificant
ii)	Loss of forest vegetation and overall vegetation diversity	D	M (20)	SS (10)	MT (10)	40	Insignificant
iii)	Pressure on forest for fuelwood	ID	L (10)	SS (10)	ST (05)	25	Insignificant
iv)	Impact on natural and critical natural habitat • Impact on Red Panda and Himalayan Musk Deer • Impact on Himalayan Black Bear	D	M (20)	SS (10)	ST (05)	35	Not significant
v)	Impact on aquatic flora and fauna	D	M (20)	SS (10)	ST (05)	35	Insignificant
vi)	Impact on non-timber forest products	D	L (10)	SS (10)	ST (05)	25	Insignificant
vii)	Possible Risk of forest fire	ID	L (10)	L (20)	ST (05)	35	Insignificant
viii)	Wildlife hunting and poaching	ID	M (20)	SS (10)	ST (05)	35	Insignificant
ix)	Human wildlife conflict	D	M (20)	SS (10)	ST (05)	35	Insignificant
2.2. Operational Stage (Adverse)							
i)	Reduced river flow	D	L (10)	L (20)	MT (10)	40	Insignificant
ii)	Disturbance to the wildlife due to resident workforce	ID	L (10)	SS (10)	ST (05)	25	Insignificant
iii)	Bird casualties due to electrocution and collision with transmission line	D	L (10)	SS (10)	ST (05)	50	Insignificant
iv)	Forest fire	ID	L (10)	SS (10)	ST (05)	25	Insignificant
v)	Pressure on forest for fuelwood	ID	L (10)	SS (10)	ST (05)	25	Insignificant
3. Socio economic and Cultural Environment							
3.1. **Construction Stage** (Adverse)							
i)	Land acquisition and Land compensation related issues	D	M (20)	L (20)	LT (20)	60	Moderately significant
ii)	Loss of agricultural land and crop production	D	L (10)	SS (10)	LT (20)	40	Insignificant
iii)	Effect on existing social infrastructures	D	L (20)	SS (10)	ST (05)	75	Insignificant
iv)	Loss of physical structures	D	L (20)	SS (10)	ST (05)	75	Insignificant
v)	Pressure on existing facilities, services and resources of the subproject area	ID	M (20)	SS (10)	ST (05)	35	Insignificant

SN	Likely Impacts	Nature	Magnitude	Extent	Duration	Total Score	Significance (pre-mitigation)
vi)	Health and sanitation and public safety	ID	M(20)	SS (10)	ST (05)	35	Insignificant
vii)	Occupational health and safety related issues	D	M (20)	SS (10)	ST (05)	35	Insignificant
viii)	Social-cultural conflict between local community and outside work force	D	M (20)	SS (10)	ST (05)	35	Insignificant
ix)	Issues relating to unsocial activities like gambling, alcoholism , girl trafficking and prostitution	ID	M (20)	SS (10)	ST (05)	35	Insignificant
x)	Gender Discrimination	ID	M (20)	SS (10)	ST (05)	35	Insignificant
xi)	Stakeholder Engagement and information disclosure	ID	L (10)	L (20)	ST (10)	40	Insignificant
xii)	Issues of grievances management and gender based violence (GBV)	ID	M (20)	SS (10)	ST (05)	35	Insignificant
xiii)	Issues related to disturbance to community during construction	ID	L (10)	SS (10)	ST (05)	25	Insignificant
xiv)	Child labour	D	L (10)	SS (10)	ST (05)	25	Insignificant
3.2. Operation Phase (Adverse)							
i)	Occupational health and safety related issues of the power station workers	D	L (10)	SS (10)	LT (20)	40	Insignificant
ii)	Public Safety Related Issues/movement of people in dangerous places	D	L (10)	SS (10)	LT (20)	40	Insignificant
iii)	Issues relating to sudden release of water to downstream	D	L (10)	SS (10)	LT (20)	40	Insignificant
iv)	Withdrawal of economic opportunity	ID	L (10)	L (20)	ST (05)	35	Insignificant
v)	Water right issues	D	L (10)	SS (10)	ST (05)	35	Insignificant
vi)	Issues related to benefit sharing of subproject	ID	L (10)	SS (10)	LT (20)	40	Insignificant
vii)	Issues related to tariff of electricity	D	L (10)	L (20)	ST (05)	35	Insignificant
viii)	Issues related to management of micro hydro subproject	D	L (10)	SS (10)	ST (05)	25	Insignificant
4	**Impacts to integrity of protected areas and OUV**	**ID**	**L (10)**	**L (20)**	**ST (05)**	**35**	Insignificant

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 cost 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

The subproject will give first priority to the PAFs and local people who want to work in the subproject. The subproject will maintain the roster of the PAFs and at least a member of PAF will be employed during the subproject construction period. The subproject will include a binding clause in the contractor's agreement to give first priority to PAFs while hiring both skilled and unskilled labor forces and to give daily wages or monthly wages not less than the RM approved rates. The next priority will be given to local people for employment. Local people will be recruited for administrative and technical works as per their qualifications and skills. As per the household survey conducted, total number of

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.

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 942 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 households of ward no 3 and muse village of ward no 2.

iii. Implementation of ESMP

Implementation of ESMP will continue in operation phase also. 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.

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 good forest, fertile land, settlement areas for the establishment of labour camp, quarry sites, construction material stockpiling area including other permanent subproject features;
- Appropriate compensation will be provided for families who will loose their land.
- 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.
- Losses of forest area will be compensated as per the prevailing law. As per the Work Procedure Regarding Use of National Forest Area for Projects of National Priority, 2074, the subproject will develop a plantation site.
- 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.

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 Dudh Koshi River and its significance while working at power house and tailrace site.
- Prepare emergency plans in respect of GLOF warnings and establishment of evacuation paths for escape to higher ground (up to 15 m above river level at the intake site) at critical sites.

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 and powerhouse 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 civil and 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

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, private agricultural land, natural waterways etc will be strictly prohibited.
- The excavated areas including the slopes will be revegetated with the local species of grass, herbs, shrubs or trees so that the erosion prone area could be protected.

vi. *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 be prohibited
- Spoils will be kept separately and used for land reclamation
- Quarry sites will be reclaimed

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.

viii. *Water quality management and waste water disposal issues*

- 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.
- All kinds of 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. *Clogging of natural drainages*

Following are the mitigating measures to reduce the impact:

- During excavation natural drainage channels will be protected as far as possible
- Runoff drainages will be constructed in subproject construction sites and subproject facility sites (camps, storage facilities, muck disposal sites etc.) will be facilitated during the construction period and later remodified to suit to the local conditions in the operation period as permanent network. After the completion of the muck disposal, the muck disposal sites will be facilitated by permanent drainage networks to collect and discharge the runoff water safely to the water bodies
- In the agricultural fields, provisions will be made to drain the slope water to the down slope agricultural land.

x. *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.

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.
- 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.

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 where wild animals are not able to access
- Solid waste from the camp and work areas will be collected regularly and disposed in a manner that does not attract wildlife, particularly bears.
- Separate waste collection bins will be provided in the camps to segregate wastes of different nature.

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 revegetated to minimize the bare surface.
- The air quality monitoring will be done in major construction sites such as headworks, powerhouse, and settlements along access roads. 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 (0-25 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 Dudh Koshi River.

ii. *Impacts on river flow regime downstream of diversion weir (reduced flow stretch of Monjo 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 10% of the mean monthly flow (Mini Hydro Design Guidelines, AEPC, 2014). In addition, 5% of design discharge has been considered as seepage and evaporation loss. 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 2.75 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.

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 and wastewater from subproject permanent camp and subproject office will be managed properly.
- Haphazard disposal of wastes will be strictly prohibited.

v. *Noise and vibration*

Since, the operation phase impacts on noise quality 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.

vi. *Air Quality*

During operation, impacts on air quality is too minimal, so no need of mitigation measure.

vii. *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.

6.3.2.2 MITIGATION MEASURES FOR IMPACTS ON BIOLOGICAL ENVIRONMENT

6.3.2.2.1 Construction Phase

i. *Impacts on forests, natural habitat and overall forest biodiversity*

Following are the mitigating measures to reduce the impact

- Forest and vegetation will be cleared only to the required by pegging the area and numbering the trees prior to the start of clearing.
- Compensatory afforestation for the felled local tree species as per department of Forest guideline will be carried out in consultation with the Sagarmatha National Park and Buffer Zone Community Forest authorities. The plantation will be carried out with the species those are required to cut down for the subproject construction in order to compensate for the lost species. Moreover, emphasis will be given to the species with high value for timber and fuelwood.
- Loss of trees will be compensated by planting saplings at a ratio of 10 saplings: 1 mature tree. The cost of plantation has been estimated to be NRs. 408,852. The total cost including caretakers for five years has been estimated to be NRs.708,852. The saplings will be planted in 0.64 ha of land at the rate of 1600 plants per ha. The required land will be arranged during implementation phase in consultation with BZCFUG and SNP office. The BZCF has already identified the potential area for tree plantation, and it will be done by ESCO during implementation phase
- A separate plantation plan will be compiled by ESCO before plantation of the saplings to guide (1) the selection of species, (2) tree nursery requirements (location footprint size, water requirements, expected budget responsibilities for management and human resource capacity requirements, etc), (3) sapling planting procedures (location for various species, age at planting, etc) and (4) subsequent care and maintenance (watering, replacement of dead plants, keeping out livestock etc).

ii. *Impact on wildlife and avian population*

Following are the mitigating measures to reduce the impact

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

iii. *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.
- Buffer Zone Community Forest User Groups leadership shall be authorized and encouraged to conduct checks to ensure that fuelwood regulations are being enforced and complied with.

iv. *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.
- Members of each construction team will be appointed as fire prevention officers and will take responsibility for ensuring their teams take all necessary measures to avoid the unintended occurrence of fire.

v. *Loss of aquatic habitat and consequent impacts on aquatic lives*

Following are the mitigating measures to reduce the impact

- Unless required by the subproject structural placement, the riverbed will not be disturbed
- Spoil disposal in the river flood plain will be prohibited
- Construction camps will not be constructed near streams.
- Fuels and lubricants will be stored in safe and clean conditions, with appropriate measures taken to avoid accidental spills.

vi. *Disturbance to Critical Habitat features and other Wildlife due to Construction Activities*

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 Red Panda and 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
- Project team will collaborate with the Red Panda Network (RPN) in Nepal for advice on avoiding impacts and what mitigation can be applied for Red Pandas

- 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.

viii. *Impact on 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.

6.3.2.2.2 Operation Phase

i. *Impacts on aquatic fauna and their habitat*

Following are the mitigating measures to reduce the impact

- Residual environmental flow (10% of monthly flow) will be released round the year from the weir as per Hydropower Development Policy (2001) to sustain the aquatic life of the reduced flow section between weir and tailrace. (Refer **Table 38** for monthly discharge)
- The ESCO will prepare and implement an Environmental Flow Implementation Plan (EFIP), which will be monitored by the RM and BZMC. 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 SNP and other authorities as required; and (5) Review cycle for revision of the EFIP.

ii. *Impact on aesthetic value of the buffer zone*

Though the subproject site is in the buffer zone, the structures are away from the trekking route. The structures of subproject might not have pleasant impression on tourist.

iii. *Possible disturbance to the wildlife activities*

Following are the mitigating measures to reduce the impact

- No poaching and hunting activities will be allowed.
- 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.

iv. *Bird casualties due to electrocution and collision with transmission line*

This impact is negligible as transmission and distribution lines will be made underground except river crossing areas where the wires will be insulated.

v. *Pressure on forest for fuelwood*

- Prohibition on use of fuelwood
- Provision of LPG for cooking to resident workers
- Provision of electricity for heating purposes
- Buffer Zone Community Forest User Groups leadership shall be authorized and encouraged to conduct checks to ensure that fuelwood regulations are being enforced and complied with.

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 private lands which will be acquired by the subproject will be compensated in negotiation with land owners. The compensation is fixed based on current market value and in consultation with the subproject affected families. The compensation will be paid in cash.
- The standing crop at the time of acquisition will be allowed to harvest by the respective landowners. If construction works need to be done before the harvesting of standing crop, the standing crop will be compensated as per the production potential at market price. Private tress are not effected by subproject components.
- Employment priorities will be given to the population in the household whose land and property are lost due to subproject.
- Public land will be acquired as per GoN's law.

ii. *Loss of agricultural land and crop production*

The subproject will provide adequate compensation for the loss of agricultural land and crop production. As the penstock pipe will be buried 1 m deep, the private land can be used for agriculture activities after the construction.

iii.*Effect on existing social infrastructures*

Out of four micro hydro plants, only MKMH will be affected during the construction. Construction activities will be done in such a way that it will function during construction period. Construction sites will be immediately rehabilitated to check the disruption on electricity production. The same will be applied in trails. The trenches dug for laying of transmission and distribution lines will be rehabilitated immediately. Precaution will be made while digging trenches to protect water pipes, if there. And if water distribution pipe gets damage, it will be maintained immediately.

iv.*Pressure on existing facilities, services and 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

v.*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 local area people.
- 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.

vi. *Issues relating to public health and sanitation and as well as 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

vii. *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 culture of subproject affected 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 before commissioning of construction work and will be implemented.
- Gambling and alcohol drinking will be prohibited within the camp.

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 mechanism to have access to information related to subproject will be developed. Information related to subproject will be publicly disclosed via 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)

GRM at subproject level will be established to address the issues related to compensation, labor and SEA/SH etc. Orientation on sexual exploitation and harassment and gender-based violence will be provided to the subproject staff & GRC. Furthermore, GRM should be made open to receive and investigate all the concerns and complaints about the subproject activities and the should be made functional throughout the subproject lifecycle

x. 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.

xi. Issues related to disturbance to community

Followings are the mitigating measures to reduce the impact

- Separate camps 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, traditional, cultural and religious activities.
- Unnecessary and untimely movement of construction of crew will be checked.

xii. 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

xiii. Issues of Child Labour

- Uses of child labour will be strictly prohibited
- Records of all workers will be kept including their identity with evidence of age.

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 in Nepali language.
- 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

Intake and power house area 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 risky zones.

iii. *Issues relating to sudden release of water to downstream and reduced flow zone*

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.

iv. *Issues of Withdrawal of economic opportunity*

Upon 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.

v. *Issues of water right at downstream and reduced flow zone*

Monjo Khola Micro Hydro (MKMH) which is situated in the reduced flow zone of proposed mini hydro intake will be shut down as there will not be sufficient water to operate the plant. At present, MKMH is not operating at full capacity due to poor maintenance and

management. Beneficiary households of MKMH are not getting enough energy as demanded and are happy if the new plant can provide required energy by replacing the old MKMH. Agreement between MKMH and MKMHP has been made to demolish the old MKMH. Similarly, separate agreement has been done with other three micro hydro and there is no effect on the operation of them (**Annex** XVI).

vi. *Issues related to benefit sharing of subproject*

Locals will be provided at least 10% of the share. Shares will be distributed after subproject construction. Beside the share, locals will be benefited from CSR and implementation of ESMP. Local government get the revenue and can be used for local development activities.

vii. *Issues related to tariff of electricity*

This issue will be managed in coordination with local people in presence of Electricity Regulatory Commission (ERC)

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

Agreement with four existing micro hydro plants has been made separately. MKMH has agreed to shut down the existing system and allow MKMHP to use headrace canal, as its running/operating cost has been more than its income. While the electricity generated from other three micro hydro will be purchased at agreed rate (**Annex** XVI).

6.3.2.4 Impacts to integrity of protected areas and Outstanding Universal Value

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
- All workers brought to the site from outside of the SNP will be registered with SNP authorities prior to start working.
- SNP authorities will be hosted by the project 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.

6.3.2.5 CUMULATIVE IMPACTS

There are no other hydro power projects on Monjo Khola, and the discharge from the tailrace of the subproject will be done on Dudhkoshi River at the point of confluence. The existing micro hydro will be closed. Therefore, it was concluded during screening that cumulative impact analysis is not required for the subproject.

Table 43: Proposed Mitigation Measures

SN	Environment & Social Impact	Mitigation Measures	Mitigation Cost(NPR)	Responsibility	Timeline	Remarks
A. Physical Environment						
Construction						
1	Change in land use	• Avoid of good forest, fertile land and settlement areas for labor camp, quarry sites, construction material stock piling	No Cost	ESCO/Contractor	Construction Period	
		• Rehabilitation of temporarily acquired land	Included in project cost	ESCO/Contractor	Construction Period	
		• Appropriate compensation to land owner		ESCO/Contractor	Preconstruction Period	
		• Development of Plantation Area/Compensatory Plantation	708,852.00	ESCO	Preconstruction Period	
2	Change in Topography	• Rehabilitation of quarry sites and excavated sites for laying of penstock pipe, transmission and distribution lines	Included in project 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	100,000.00	ESCO	Preconstruction/Construction Period	
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 • Deposition of spoils in designated area	Included in project cost	ESCO/Contractor	Construction Period	

SN	Environment & Social Impact	Mitigation Measures	Mitigation Cost(NPR)	Responsibility	Timeline	Remarks
		• Reuse of excavated materials • Prohibition of disposal of spoils in waterways				
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 • Backfill excavated areas	Included in project 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 be prohibited • Spoils will be kept separately and used for land reclamation • Quarry sites will be reclaimed	Included in project cost	ESCO/Contractor	Construction/operation Period	
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 project 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	Included in project cost	ESCO/Contractor	Construction Period	

SN	Environment & Social Impact	Mitigation Measures	Mitigation Cost(NPR)	Responsibility	Timeline	Remarks
		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 • No direct discharge of camp effluents in water sources.				
9	Clogging of natural drainage	• No disturbance to natural drainage • Construction of runoff drainage in construction sites • Prohibition of disposal of spoils in natural drainage	Included in project cost	ESCO/Contractor	Construction Period	
10	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 project cost	ESCO/Contractor	Construction Period	
11	Issues of haphazard stockpiling	• Storage at designated sites • Proper disposal of remaining construction materials	Included in project 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 project cost	ESCO/Contractor	Construction Period	
13	Air Pollution	• Establishment of crushing plants	Included in	ESCO/Contractor	Construction Period	

SN	Environment & Social Impact	Mitigation Measures	Mitigation Cost(NPR)	Responsibility	Timeline	Remarks
		away from settlements • Stabilization of spoils at tipping area • Revegetation of bare area	project cost			
14	Impact on River Morphology	• Extraction of river bed materials without affecting the river morphology	No extra cost	ESCO/Contractor	Construction Period	
15	Loss of fertile top soil	• Preservation of top soil and reuse for plantation and restoration purposes		ESCO/Contractor	Construction Period	
Operation						
1	GLOF and associated impacts	• Educate locals and workers about early warning system • Preparation of Emergency Preparedness Plan	100.000.00	ESCO	Operation Period	
2	Impacts on flow regime downstream of diversion weir	• Maintain minimum flow of 10% of the mean monthly flow and additional 5% of design discharge for seepage and evaporation loss	No extra cost	ESCO	Operation Period	
3	Land submergence created by 2.75 m high diversion weir	• Bank protection measures	Included in project cost	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	50,000	ESCO	Operation Period	
5	Noise and Vibration	• Ear muffs will be provided	10,000	ESCO	Operation Period	
6	Water contamination	• No discharge of effluent and chemicals in water body • Monitoring of water quality	50,000	ESCO	Operation Period	

SN	Environment & Social Impact	Mitigation Measures	Mitigation Cost(NPR)	Responsibility	Timeline	Remarks
		periodically				
B. Biological Environment						
Construction						
1	Impacts on forest area and forest vegetation	• Vegetation will be cleared only to required amount by pegging and numbering the trees • Compensatory plantation will be done as per GoN and will be cared for next five years	Already Included	ESCO/Contractor	Construction Period	
2	Possible impacts on protected flora and fauna	• Cutting of rare, endangered and endemic species will be avoided • Priority will be given for protected and endemic plants in compensatory plantation	No extra cost	ESCO/Contractor	Construction Period	
3	Impact on wildlife and avian fauna	• Prohibition on hunting and poaching • Awareness on wildlife and habitat conservation • No work on night time	100,000.00 (Awareness)	ESCO/Contractor	Construction Period	
4	Impacts on NTFPs/MAPs	• Support on NTFPs/MAPs promotion • Priority for NTFPs/MAPs in afforestation	No extra cost	ESCO	Construction/Operation Period	
5	Forest fire	• Restriction of visit on forest area • Awareness on biodiversity and consequences of forest fires	No extra cost	ESCO/Contractor	Construction Period	
6	Loss of aquatic habitat and consequent impacts on aquatic lives	• Unnecessary river bed will not be disturbed • Prohibition of spoil disposal in river flood plain	No extra cost	ESCO/Contractor	Construction Period	
7	Disturbance to Critical Habitat	• No poaching and hunting • Awareness on biodiversity	No extra cost; Cost	ESCO/Contractor	Construction Period	

SN	Environment & Social Impact	Mitigation Measures	Mitigation Cost(NPR)	Responsibility	Timeline	Remarks
	features and other wildlife	conservation • No construction work at night time. • Construction camps must use bear-proof dustbins. • There must be no food waste disposal in or around construction sites. • Domestic dogs are prohibited in construction camps. • Construction contractor will sign letters agreeing to SNP rules. • SNP rules will be printed and displayed on a notice board, accessible to all workers • Workers are registered with SNP authority.	for awareness has already included			
8	Impact on Red Panda and 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	No extra cost	ESCO/Contractor	Construction Period	

SN	Environment & Social Impact	Mitigation Measures	Mitigation Cost(NPR)	Responsibility	Timeline	Remarks
		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 workers.				
9	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	No extra cost	ESCO/Contractor	Construction Period	

SN	Environment & Social Impact	Mitigation Measures	Mitigation Cost(NPR)	Responsibility	Timeline	Remarks
		• 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.				
Operation						
1	Impacts on aquatic fauna and habitat	• Minimum water flow will be maintained. • Monitoring downstream flow levels • The ESCO will prepare and implement an Environmental Flow Implementation Plan (EFIP), which will be monitored by the RM and BZMC.	No extra Cost	ESCO	Operation Period	
2	Disturbance to wildlife activities	• Restriction to access the forest area • No poaching and hunting • Awareness on biodiversity conservation	100,000 (Awareness)	ESCO	Operation Period	
3	Bird Causalities	• Insulation of transmission and distribution lines in open areas (River crossing)	Included in the project	ESCO	Operation Period	
4	Pressure on forest for fuelwood	• Prohibition on use of fuelwood • Provision of LPG for cooking to resident workers • Provision of electricity for heating purposes • Monitoring to ensure fuelwood regulations are being enforced.	Included in the project	ESCO	Operation Period	

SN	Environment & Social Impact	Mitigation Measures	Mitigation Cost(NPR)	Responsibility	Timeline	Remarks
C. Socioeconomic and Cultural Environment						
Construction Phase						
1	Land acquisition and compensation	• Acquisition and compensation of private land will be done as per negotiation with individual households and public land as per GoN Rule. • Employment priority for affected households and locals	Cost required for compensation of land will be borne separately by ESCO	ESCO/Contractor	Preconstruction Period	
2	Loss of standing crops	• Compensation of standing crops as per market price	Cost required for compensation of land will be borne separately by proponent.	ESCO/Contractor	Preconstruction Period	
3	Effect on existing social infrastructures	• Rehabilitation of construction sites especially trenches for laying penstock pipe, transmission and distribution lines	Included in project cost	ESCO/Contractor	Construction Period	
4	Pressure on existing facilities, services and resources of the subproject area	• Support on educational and health institution • The subproject will support to upgrade the existing trekking trails of subproject affected area	500,000.00 (for educational institution); 200,000.00 (Upgrading and maintenance of Trekking Trails if needed, Otherwise, project will rehabilitate trekking)	ESCO/Contractor	Construction Period	
5	Issues of Occupational	• Provision of PPEs and First Aid • Preparation of Emergency	100,000.00 (PPEs);	ESCO/Contractor	Preconstruction Period	

SN	Environment & Social Impact	Mitigation Measures	Mitigation Cost(NPR)	Responsibility	Timeline	Remarks
	Health and Safety	Preparedness Plan • Provision of Fire Fighting Systems • Regular instruction on safety to workers • Provision of accidental insurance	25,000.00 (First Aid); 25,000.00 (Fire Fighting); Cost of Insurance in project cost			
6	Issues relating to public health and sanitation and as well as public safety	• Regular health checkup of Workers • Awareness program on health and sanitation • Provision of sign boards • Provision of fencing and restriction of unauthorized persons in construction sites	100,000.00 (Health checkup); 25,000.00 (Sign Board); No cost for awareness; Cost for fencing in project cost	ESCO/Contractor	Construction Period	
7	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	
8	Stakeholder engagement and information disclosure	• Maintenance of transparency of subproject activities • Preparation of Stakeholder Engagement Plan	50,000.00 for meeting; No extra cost for others.	ESCO/Contractor	Pre-construction/ Construction/ Operation Period	
9	Issues of GRM and GBV	• GRM committees at subproject level will be established • Project will make sure the functioning of the GRM • GBV will be taken seriously and	No extra cost	ESCO/Contractor	Construction Period	

SN	Environment & Social Impact	Mitigation Measures	Mitigation Cost(NPR)	Responsibility	Timeline	Remarks
		appropriate steps will be taken to manage it				
10	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	No extra cost; cost for toilets included in project cost	ESCO/Contractor	Construction Period	
11	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	Already Included	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	
Operation Phase						
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	25,000.00 (For safety sign); 25,000.00 (Safety equipment); 25,000.00	ESCO	Operation Period	

SN	Environment & Social Impact	Mitigation Measures	Mitigation Cost(NPR)	Responsibility	Timeline	Remarks
		• 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.	(Firefighting system)			
2	Public Safety Related Issues/Movement of people in dangerous places	• Restriction people in dangerous area • Safety signs and posts will be erected at crucial areas	No extra cost for restriction while cost of safety sign already included	ESCO	Operation Period	
3	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	
4	Issues of Withdrawal of economic opportunity	• Priority for employment during operation will be given to local people	No extra cost	ESCO	Operation Period	
5	Issues of water right at down stream	• Agreement has been for closure of MKMH	No extra cost	ESCO	Operation Period	
6	Issues related to benefit sharing	• Provision of shares • Implementation of ESMP • Local development from generated revenue	No extra cost	ESCO/Local Government	Operation Period	
7	Issues related to tariff of electricity	• Tariff will be fixed in coordination with local people in presence of ERC	No extra cost	ESCO	Operation Period	

7 STAKEHOLDER ENGAGEMENT AND GRIEVANCE REDRESS MECHANISM

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 MKMHP 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

Subproject Affected Families (PAFs), indigenous Peoples (IPs) and their organizations and Networks, Other different Social Groups—Women Groups; Mother Groups; Youth clubs, Buffer Zone User Groups (BZUGs), Buffer Zone Community Forest User's Group (BZCFUGs), Local affected communities; Ward No. 3 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, BZCFUGs, NGOs/CBOs and Associations working at local levels; Trade centers; 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.

The discussions during feasibility study were organized to share the information to the local people of subproject affected wards of RM. Initial walkover survey was carried out followed by individual interviews with local government officials. The preliminary consultation during feasibility stage was carried out at 2 different locations of Phakding and Monjo on 4th (2076 Falgun 21 BS) and 11th March 2020 (2076 Falgun 28 BS) respectively (**Annex** XV).Similarly, a public hearing on the proposed Monjo Mini Hydro Subproject was done on 11th November 2021. Before the public hearing program, a public notice was published in Arthik Abhiyan, a National Daily News Paper published from Kathmandu mentioning Time, Place and Date of Public Hearing (**Annex** XI). Similarly, a public notice from local FM was aired for the same program (**Annex** XII). A total of 44 people has been participated in the public hearing. A public notice was published on Arthik National Daily Newspaper on 16 February 2022 seeking any suggestion and comments from concerned stakeholders on

ongoing EA study of MKMHP. The key issues raised in different meetings, consultations and informal conversations were about the impacts on existing micro hydro, land acquisition and compensation issues, tariff, benefit sharing, employment opportunity and so on.

Table 44: Issues Raised During Public Hearing and Response from ESCO

SN	Issues Raised	Commitment from ESCO	Remarks
1	Priority to locals for employment	First priority will be given to locals as per their capacity and skills.	
2	Investment Opportunities for Locals	Opportunity for investment will be provided at appropriate time to locals.	
3	Provision of Minimum Tariff for Affected People or Households	Appropriate tariff will be fixed after negotiation with locals.	
4	Provision of free electricity for social and cultural institutions such as school, Gumba etc.	This issue will be discussed with board members of the ESCO and appropriate solution will be sort out.	
5	As it seems that previous survey has not included the households of Geringma and Skangding, households from these settlements should be involved in distribution of electricity	Provision will be made to distribute electricity to each and every household from Jorsale to Muse.	
6	Demand of each household should be calculated.	Has already been collected.	
7	Information has to be given to locals how they get shares from proposed subproject.	Will be notified to locals in appropriate time.	
8	Issues of private land should be settled down.	This issue will be addressed at mutual understanding and negotiation.	
9	There should be clear about the effects of subprojects on existing micro hydro and peltric set and mechanism of settlement/management of these issues	Issues of existing micro hydro and peltric set will be addressed with appropriate alternative.	Peltric set already closed.

7.1.5 INVOLVEMENT IN SUBPROJECT MONITORING

The social and environmental safeguard implementation will be monitored regularly during implementation phase. The team comprises of the representatives of stakeholders and ESCO will monitor the subproject site during pre-construction, construction, post construction and operation phase to ensure that all environmental and social issues are well addressed and comply with the requirements mentioned in the ESIA. Quarterly progress reports will be prepared and submitted 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. The Local Consultative Forum (LCF), which also acts at the level 1 GRM, has been envisioned as the entry point to put the grievances by at the local level. 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 MKMHP. The subproject GRM will be responsible for dealing with the grievances, concerns or complaints related to land acquisition and rehabilitation, Project Information Center (PIC), implementation of the mitigation measures incorporated in the ESMP and the workers' grievance).

Local households and stakeholders will be informed about the setting up of the Grievance mechanism 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.

The project's GRM is at no cost to complainants and guarantees that there will no retribution for people who lodge complaints on project activities. Furthermore, the grievance mechanism will not impede access to judicial and administrative remedies.

7.3 GRIEVANCE REDRESSAL MECHANISM (GRM) SYSTEM

The main purpose of this system is to ensure there is a robust and transparent process, consisting of a sequential process of resolution available to swiftly address the complaints. A subsequent level of resolution is triggered if the complainant remains unsatisfied with the resolution made by the lower level or if it remains unable to provide a resolution within a given time. The ESIA proposes the following three-tier GRM systems as explained below.

First Level of GRM:

This is based at the project locations in the participating municipalities and will serve as entry points for all complaints related to the project. Once the grievance is registered, it would come into the Level 1 of the GRM system. The Level 1 GRM committee will be led by project manager from ESCO and supported by the E&S staff and a technical engineer at the sub-project level. The Level 1 GRM formed in subproject 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 Level 1 GRM committee 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 Level 2 GRM committee.

Second Level of GRM: If the grievance remains unresolved, the Level 1 GRM committee will forward the complaint to the level 2 of the GRM system represented by the Project Safeguard Unit (E&S team of AEPC) and headed by project manager from MGEAP. The person (filing the grievance) will be notified by the Level 1 GRM committee 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. If complainants remain unsatisfied or reject the resolution provided by the Level 2 GRM, they will be advised to seek recourse through the courts or any formal system available

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 or level 1 of the GRM system. 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. If complainants remain unsatisfied or reject the resolution provided by the Level 3 GRM, they will be advised to seek recourse through the courts or any formal system available.

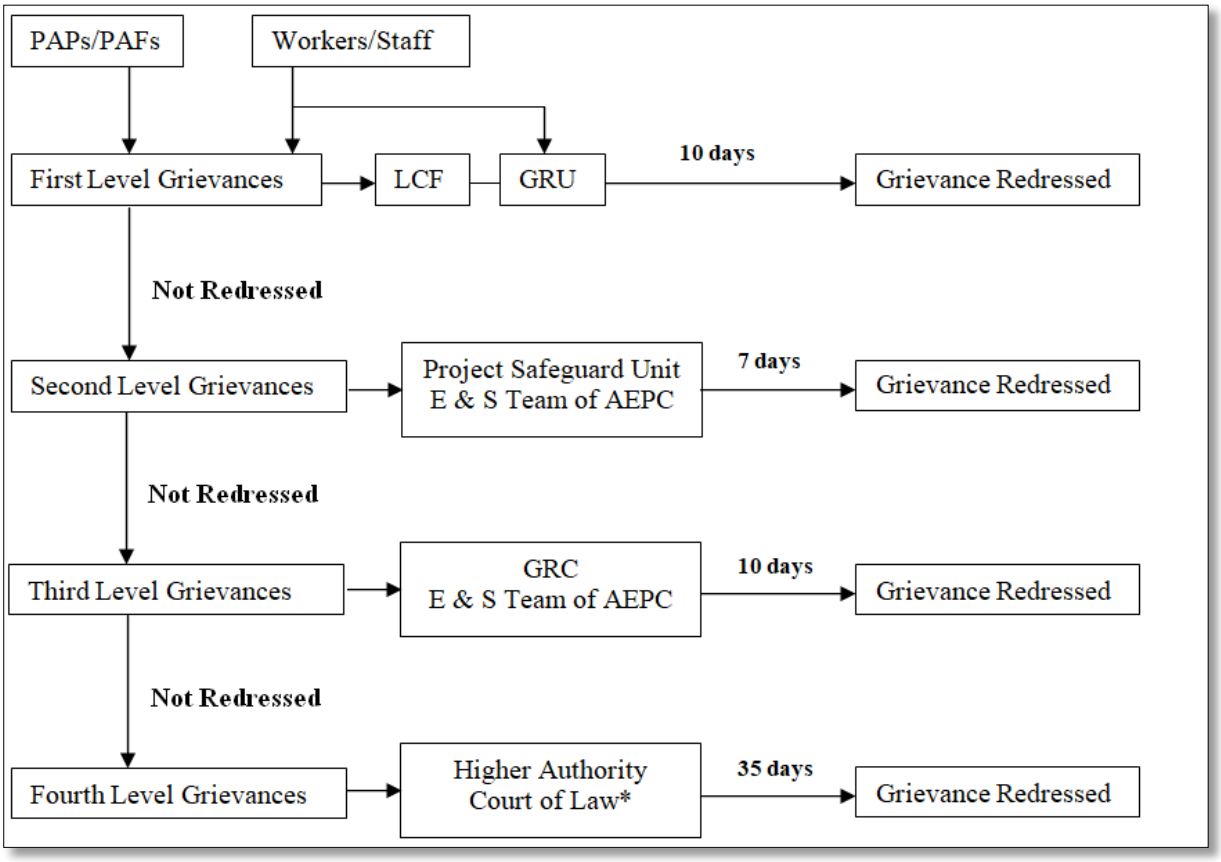

Figure 26: GRM Structure at Subproject Cycle

Note: 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.

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

Grievance Redress Mechanism (GRM) will be put in place where the concerns and complaints of all stakeholders, PAFs, community people and laborer regarding the land acquisition, damage to

crops and vegetation, SEA/SH and other subproject related activities that received from verbal and written form will be registered and resolved through proper investigation.

GRC established in project level and field level will have a member who will be designated as SEA/SH focal person to response with issues related to GBV and SEA/SH. The SEA/SH prevention and response COC prepared by PMT of MGEAP will be implemented for the subproject by which SEA/SH risks will be addressed. Furthermore, orientation on GBV including the risk and mitigation measures of SEA/SH will be provided to subproject staffs, laborers, members of GRC and community people living in the vicinity of subproject area.

8 INSTITUTIONAL ARRANGEMENT

Institutional arrangements are intended to make sure the smooth functioning if the subproject 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 spell 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 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.

8.1.2 PROJECT MANAGEMENT TEAM AT AEPC

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

8.1.3 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.

8.1.4 SAGARMATHA NATIONAL PARK

As the proposed site lies within the Buffer Zone (BZ) of SNP, authority to manage the BZ is with SNP. The ESCO will work in close coordination with 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 subproject activities on a regular basis.

8.1.5 KHUMBU PASANGLHAMU RURAL MUNICIPALITY

The RM is the concerned authority to provide generation license. Similarly it is the approval agency for Brief Environmental Study Report as per prevailing law of Nepal. It has right for monitoring activities of subproject.

8.1.6 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.

8.1.7 ESCO

The ESCO will be responsible for the preparation of DFS/DED, and ESIA as required by the WB and Brief Environmental Study (BES) 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 them to the AEPC/MGEAP. The AEPC/MGEAP will prepare quadrimester monitoring reports and submit to 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.

8.1.8 GRIEVANCES REDRESS COMMITTEE

The GRC, headed by the Subproject Manager will be responsible to resolve the grievances at third level which came through field level to Project Safeguard Unit, E &S Team of AEPC.

8.1.9 BUFFER ZONE MANAGEMENT COUNCIL

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

8.1.10 BUFFER ZONE USER COMMITTEE

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

8.1.11 BUFFER ZONE USE GROUPS

Under Chaurikharka BZUC, there are 10 Buffer Zone User Groups (BZUGs). Out of 10, 5 BZUGs lies in PA and they can coordinate for effective implementation and monitoring of proposed subproject.

8.1.12 BUFFER ZONE COMMUNITY FOREST USER GROUPS

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

8.1.13 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.

8.1.14 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 ESIA and the contract documents and compliance with the tender clauses. The contractor will be also required to recruit qualified environmental and social specialists, preparation of contractor's environmental and social management plans, environmental and social monitoring, supervision and reporting, establishing Grievance Redress Mechanism, application of code of conduct, incident reporting.

8.1.15 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 45 defines the roles and responsibilities of different administrative structure during the subproject cycle i.e., pre-construction, construction and operation phases.

Table 45: Roles and Responsibilities of Various Institutions for ESMP implementation

SN	*Institutions*	*Roles and Responsibilities*
1	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.
2	Project Management Office at AEPC	Overall responsibility from selection to implementation of the subproject.
3	The World Bank	Partner of the Project 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.
4	Sagarmatha National Park	Authorized agency for BZ management activities. 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 subproject activities on a regular basis.
5	Khumbu Pasanglhamu 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.
6	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.
7	ESCO (Monjo Khola Mini Hydro Pvt. Ltd.)	responsible for the preparation of DFS including DED and ESIA according to WB requirements preparation of BES and get approval from the GoN monitoring of the subproject Preparation of monitoring and progress report and submit it to the AEPC. Overall implementation of ESIA/ESMP
8	GRC	responsible to resolve the grievances at third level came through field level to Subproject Safeguard Unit, E &S Team of AEPC
9	BZMC	can play an important role in effective implementation and monitoring of proposed subproject
10	BZUC	an important role in effective implementation and monitoring of proposed subproject
11	BZUGs	can coordinate for effective implementation and monitoring of proposed subproject
12	BZCFUGs	coordinate for effective implementation and monitoring of proposed subproject
13	GRU	the responsibilities to resolve the local grievances and also of workers at field level

SN	*Institutions*	*Roles and Responsibilities*
14	Construction Contractors	responsible for implementation of mitigation measures specified in the part of contractor and compliance with the tender clauses
15	Construction Management/Supervision Consultant	coordination of the compliance monitoring and mitigation program
16	LCF	a platform for locals to keep their concerns, suggestions and grievances, and coordinates to addresses these issues

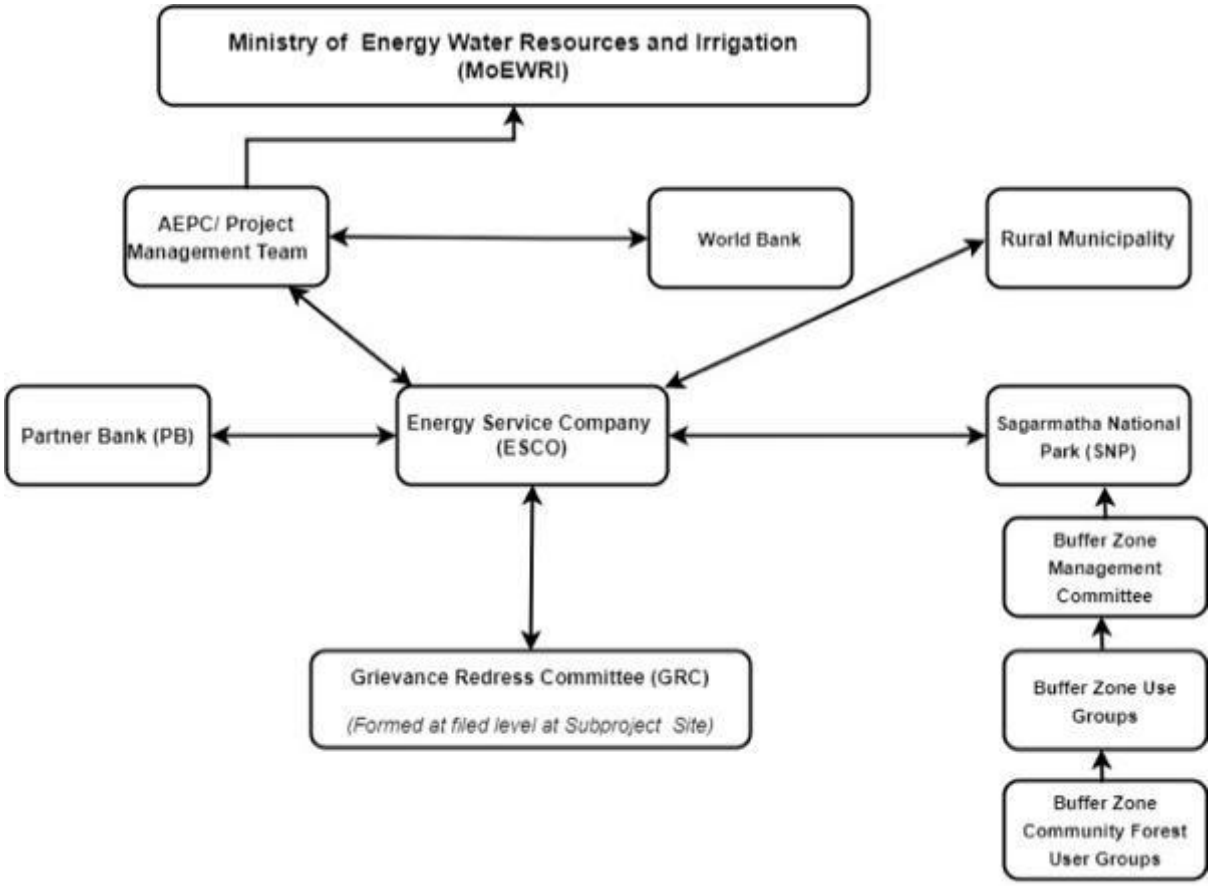

Figure 27: Organogram of the Subproject

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.

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 MKMHP, 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 MKMHSP 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 MKMHP is presented in **Table 46**.

Table 46: 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	100,000.00	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	Monjo 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	Monjo 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	Forest area, type, species composition, frequency, density, BA, crown cover, standing stock, biomass, Timber, fodder and fuelwood NTFPs, forest management, forest use, Energy use	Observation, GIS mapping, Forest measurements (Quadrate sampling), household surveys, FGD	Subproject Area	Before Construction	150,000.00	ESCO
9	Wildlife	Wildlife habitat, wildlife	Observation,	Subproject Area	Before Construction	250,000.00	ESCO

SN	Parameter	Indicators	Method	Location	Time	Cost (NPR)	Responsibility
	(including mammals, avian fauna and herpetofauna)	species, hunting and poaching activities, crop and animal depredation, human wildlife conflicts	Transect survey, Questionnaire surveys, FGD, KII				
10	Critical natural habitat species	Critically endangered species, their habitat, human wildlife conflict, crop and animal degradation	Observation, 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	Before starting construction work		
C. Socioeconomic and Cultural Environment							
11	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	150,000.00	ESCO
12	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		
13	Economy	Occupation and skills, markets, annual income and expenditures, food	Household survey, FGD	Subproject area	Before Construction		

SN	Parameter	Indicators	Method	Location	Time	Cost (NPR)	Responsibility
		sufficiency					
14	Sanitation and health	Drinking water source, treatment practices, toilet availability and types, cooking practices, waste management practices Diseases, treatment practices, disability, natality and mortality	Secondary sources, Household survey, FGD	Subproject Area	Before Construction		
15	Culture	Religious shrines, festivals	Discussions with the local people, Rural Municipality wards and observation, Questionnaire surveys	Subproject area	Before Construction		
16	History and archaeology	Sites of archaeological and historic significance	Secondary Sources, FGD	Subproject area	Before Construction		
17	Gender	Property ownership in women, participation of women in community groups, decision making by women	Household survey, FGD	Subproject area	Before Construction		
18	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. 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 47** 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 47: 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	25,000.00	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	25,000.00	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	200,000.00	Consulting engineers/ ESCO/AEPC/RM
4	Contractor's compliance to	Water quality, air quality, noise, forest clearance, employment,	Review of the regulatory documents, enlisting of	Subproject Area	Continuous during the	50,000.00	Consulting engineers/

S.N.	Parameter	Indicators	Method/ Guiding Document	Location	Time	Cost (NPR)	Responsibility
	GON's and WB's regulatory requirements (Acts, Regulations, Guidelines, Standards)	occupational health and safety	the relevant clauses, site inspection and observation/All the documents mentioned in Chapter 3.		construction period		ESCO/AEPC/RM
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	200,000.00	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 48: 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 and E-Flow	Temperature, pH, Turbidity, TDS, TSS, Conductivity, alkalinity, hardness, iron, BOD, COD, SO_4, DO, Total Coliform, Minimum downstream environmental flow requirement of the plant	Water sampling and laboratory test, Flow measurement and logging.	Monjo 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	Observation	Subproject area	Continuous		ESCO/AEPC/RM

S. N.	Parameter	Indicators	Methods	Location	Schedule (Time)	Cost (NPR)	Responsibility
		of waste			throughout subproject construction and one year of subproject operation		
B. Biological Environment							
6	Forest	Change in forest area (area)	Observation, GIS mapping	Headworks, Penstock Pipe alignment, forests in the subproject area	One time monitoring after completion of subproject construction	42,000.00	ESCO/AEPC/BZMC/BZUG/BZCFUG/SNP
7	Vegetation	No. of trees cleared	Records of clearance of species	Headworks, Penstock Pipe alignment	During clearance in each area	100,000.00	ESCO/AEPC/BZMC/BZUG/BZCFUG/SNP
8	Protected species	No of protected species cleared	Records of clearance of species	Headworks, Penstock Pipe alignment	During clearance in each area		
9	Compensatory Plantation	Status of plantation and survival rate	Records of plantation and counting of survived saplings	Plantation area	Every three months after plantation	250,000.00	ESCO/AEPC/BZMC/BZUG/BZCFUG/SNP
10	Wildlife	Poaching events, crop depredation frequency	Interviews with local people	Subproject area	Continuous throughout subproject construction		ESCO/AEPC/BZMC/BZUG/BZCFUG/SNP
11	Critical natural habitat species	Critically endangered species, their habitat, human wildlife conflict, crop and animal degradation	Observation, 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	Continuous throughout subproject construction and initial year of operation		
C. Socioeconomic and Cultural Environment							
11	Affected	Livelihood	Household survey	Affected households	End of every year	100,000.00	ESCO/AEPC/BZM

S. N.	Parameter	Indicators	Methods	Location	Schedule (Time)	Cost (NPR)	Responsibility
	households	conditions of the affected households by land and property acquisition	using structured questionnaires		during construction period; at the end of the first year of operation		C/BZUG/BZCFUG/ 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/BZM C/BZUG/BZCFUG/ 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 services	Pressures in existing service institutions and facilities such as schools, health posts, drinking water etc.	Records of particular service institution such as health posts and school, interviews with schools, teachers, health personnel, water user groups	Service institutions in the subproject area	Every four months during construction, one-time monitoring at the end of first year of operation		ESCO/AEPC/RM
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	150,000.00	ESCO/AEPC/Contractor
16	Occupational health and safety	Injuries, deaths, accidents of construction workforce	Subproject reports, interviews with construction	Construction areas	Every month during construction, one time monitoring at the end of first year		ESCO/AEPC/Contractor

S. N.	Parameter	Indicators	Methods	Location	Schedule (Time)	Cost (NPR)	Responsibility
			workers		of operation		
17	Conflicts	Conflicts between locals and outside workforce	Interviews, record keeping	Subproject area	Every month 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

Table 49: ESS Monitoring Plan for Operational Phase of Subproject

S.N.	Parameter	Indicators	Method/ Guiding Document	Location	Time	Cost (NPR)	Responsibility
1	ESCO's compliance in carrying out mitigation measures for impacts on Physical Environment	• Impacts on aquatic fauna and their habitat • Impacts on aesthetic value of the buffer zone • Possible disturbance to Critical Habitat features and other wildlife • Pressure on forest fuelwood • GLOF and associated Impacts • Impacts on river flow regime downstream (reduced flow stretch) of Monjo Khola and possible microclimatic changes	Site observation and discussion with subproject management, subproject staffs, Rural Municipality, SNP, Buffer Zone Management Committee, Buffer Zone Forest User Groups and local people using a checklist/ Approved ESIA, Subproject Contract and	Subproject Office/Subproject Site/	Monthly during the Operation Phase (continuous monitoring for critical habitat features and wildlife, aquatic fauna, impacts of reduced water flow downstream)	100,000.00	AEPC/Consulting engineers, ESCO & RM

S.N.	Parameter	Indicators	Method/ Guiding Document	Location	Time	Cost (NPR)	Responsibility
		• Management/final disposal of solid waste and wastewater • Noise & vibration, air and water quality	Specification document, Regulatory documents of GON				
2	ESCO/Contractor's compliance in carrying out mitigation measures for impacts on Socioeconomic and Cultural Environment	• Occupational health and safety related issues of the power station workers • Public safety related issues/movement or trespass of people in powerhouse area • Issues related to benefit sharing of subproject • Issues related to tariff of electricity • Functionality of GRM	Site observation and discussion with subproject management, subproject staffs Rural Municipality, SNP, Buffer Zone Management Committee, Buffer Zone Forest User Groups and local people using a checklist/ Approved ESIA, Subproject Contract and Specification document, Regulatory documents of GON	Subproject Office/Subproject Site/	Monthlyduring the Operation Phase (continuous on OHS public safety, and GRM)	100,000.00	AEPC/Consulting engineers, ESCO & RM
4	ESCO's compliance to GON's and WB's regulatory requirements	Water quality, air quality, noise, forest clearance, employment, occupational health and safety	Review of the regulatory documents, enlisting of the relevant clauses,	Subproject Area	Quarterly	50,000.00	Consulting engineers/ ESCO/AEPC/RM

S.N.	Parameter	Indicators	Method/ Guiding Document	Location	Time	Cost (NPR)	Responsibility
	(Acts, Regulations, Guidelines, Standards)		site inspection and observation				

9.2 REPORTING

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

10 ENVIRONMENTAL AUDIT

10.1 INTRODUCTION

An environmental auditing will compare monitoring results with information generated during the pre-subproject 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 EIA 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. This will be done only once and will be according to the EPR. 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 PHYSCICAL 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 including critical habitat species 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

Environmental audit of the subproject will be conducted according to EPR 2020 by Ministry of Forest and Environment. It will be conducted after 2 years of operation of the subproject.

11 ENVIRONMENTAL AND SOCIAL SAFEGUARD PLAN

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 has been taken into account while developing these plans.

This chapter includes following given management plans. The required cost will be managed from ESMP cost provided in design cost, which is inline with DFS (1% of the subproject 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 50: 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 on the top of the spoil sites to develop the land in a usable land for afforestation or other purpose	Post construction	Spoil disposal site	ESCO/ Contractor
Rehabilitation of the quarry area in such that puddles and depressions are not left out	Post construction	Quarry area	ESCO/ Contractor
Rehabilitate the temporarily	Post	Temporary camp and	ESCO/

Activities	Schedule	Location	Responsibilities
acquired cultivable land by tilling and spreading the top soil saved.	construction	storage area	Contractor
Handover the temporarily acquired land to the respective owners and get a certificate of handover	Postconstruction	Labour camps	ESCO/ Contractor

11.2 OCCUPATIONAL HEALTH AND SAFETY PLAN

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

Table 51: 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 by the construction workers and health and safety issues of the construction work	Before and during construction	All construction workers	ESCO/ Contractor
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 52: 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	Preconstruction/ 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	Preconstruction/ 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	Preconstruction/ 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 53: 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	Construction	Construction sites/Camp	ESCO/

Activities	Schedule	Location	Responsibilities
stretcher to evacuate the injured at the earliest to the nearest health post/hospital			Contractor
Provision of medical stock particularly forewater 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 fire fighting 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, earthquakes.) 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 54: 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
Preferential Electricity rates (Negotiation with local community and agreement on tariff)	Pre-construction	Subproject Area	ESCO
Equity Investment	Pre-construction/ Construction	Subproject Area	ESCO
Community Development Fund	Construction	Subproject Area	ESCO

11.6 LABOR MANAGEMENT PLAN

Table 55: Labor Management Plan

Activities	Schedule	Location	Responsibilities
Provision to rent house for migrant labour	Construction	Subproject Area	ESCO/Contractor
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 law	Construction/Post-construction	Subproject Area	ESCO/ Contractor

11.7 TRANSPORT MANAGEMENT PLAN

Table 56: 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 57: 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, religion and gender on this provision	Construction/Post-construction	Subproject Area	ESCO/ Contractor
Access to grievance redress mechanism to all workers, and 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 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 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 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 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 58: 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 sanitizers at work place and camp	Construction	Subproject Area	Contractor
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 59: 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 &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 Parties	Project information - scope and rationale and E&S principles, Project status, Health and safety	Joint public/community meetings, trainings/workshops Disclosure of written	As needed (monthly during Construction)	ESCO/ Supervision Consultant/

Stage	Target stakeholders	Topic of Engagement	Methods	Location/ Frequency	Responsibilities
		impacts, Employment opportunities, Environmental and social concerns, Grievance mechanism process, Training on ESMP and other management plan, Worker Grievance mechanism	information: brochures, posters, website, Information boards, Notice board at construction sites Grievance mechanism		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

12 CONCLUSION AND RECOMENDATION

Monjo Khola Mini Hydro Pvt. Ltd will implement the proposed subproject in the buffer zone of Sagarmantha National Park which will generate 7,243,292.16 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.

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 0.1686 ha of private land and about 5.48 ha of the government land will be leased for long-term. This subproject will also require 0.674 ha forest land. During the operation, environmental flow (10% of mean monthly flow as a minimum) will be released round the year from the weir as per Hydropower Development Policy (2001) to sustain the aquatic life of the reduced flow section between weir and tailrace. The water in the reduced flow 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 Monjo 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 reduced flow zone is not observed. 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 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. The ESCO will also compensate/mitigate any other impact encountered during construction and operation of the subproject which area not envisioned in the ESMP. According to GoN requirements, Brief Environmental Study (BES) was prepared and RM has provided approval. No further environmental study will be required for the subproject.

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14 ANNEXES

Annex I: Company Registration Certificate

नेपाल सरकार

उद्योग, वाणिज्य तथा आपुर्ति मन्त्रालय

कम्पनी रजिष्ट्रारको कार्यालय

कम्पनी दर्ताको प्रमाण-पत्र

दर्ता नं: २१४५७७/७५/०७६

श्री मोन्जो खोला मिनि हाईड्रो

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

स. रजिष्ट्रार

मितिः २०७६-०१-२५

Government of Nepal

Ministry of Industry, Commerce & Supplies

सहायक रजिष्ट्रार

Office of the Company Registrar

Registration No: 214577/75/076

CERTIFICATE OF INCORPORATION OF COMPANY

This Certificate of Incorporation has been issued to M/s Monjo Khola 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 सम्बन्धित 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

	दिन	महिना	साल
आयकर:	०१	०२	२०६६

स्थायी लेखा नम्बर : ६ ० ९ ५ २ ९ ९ १ ३

आन्तरिक राजस्व कार्यालय : आन्तरिक राजस्व कार्यालय बतीसपुतली

कारोबारको नाम : मोन्जो खोला मिनि हाईड्रो प्रा.लि.

करदाताको प्रकार : प्राइभेट लिमिटेड

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

व्यवसायका कारोबारहरु : विद्युत उत्पादन तथा वितरण,

करदाताको दस्तखत

२०६६/०२/०९
कर अधिकृत

करदाताले पालना गर्नुपर्ने कर्तव्यहरु:

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

Annex II: Technical Clearance from DoED

नेपाल सरकार
ऊर्जा, जलस्रोत तथा सिंचाइ मन्त्रालय
विद्युत विकास विभाग
(.....अनुमतिपत्र महाशाखा.....)

फोन नं. ४४१९०७४, ४४१९३७
४४१९७६८, ४४१९५०१
४४४५७७५, ४४३६११९
४४३९३६२
फ्याक्स ४४४३९०३
पोष्ट बक्स नं. २५०७
सानोगौचरण
काठमाडौं, नेपाल

पत्र संख्या :- २०७६/०७७
चलानी : ११६०

मिति: २०७६/११/१८

विषयः- Technical Clearance उपलब्ध गराइएको सम्बन्धमा ।

श्री खुम्बु पासाङल्हामु गाउँपालिका
गाउ कार्यपालिकाको कार्यालय,
चौरीखर्क,सोलुखुम्बु ।

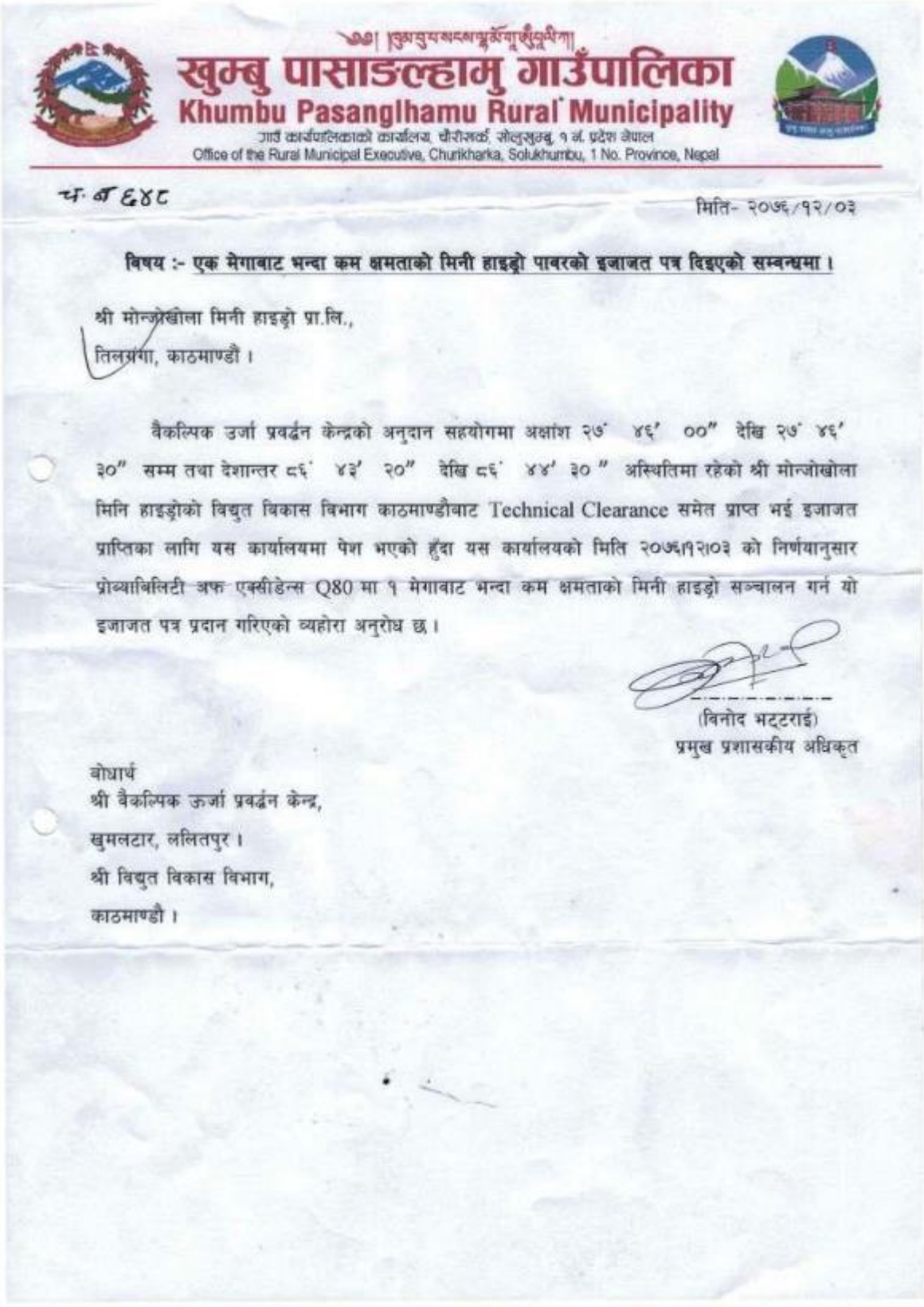
प्रस्तुत विषयमा तहाँको पत्र संख्या २०७६/०७७ , च.नं.३०७ को Technical Clearance (प्राविधिक सफाई/परामर्श) सम्बन्धी पत्र प्राप्त भइ व्योहोरा अवगत भयो ।
प्रस्तावित मोन्जो खोला मिनी जलविद्युत आयोजना(off-grid) को लागि तहाँबाट माग भएको Technical Clearance सम्बन्धमा कारवाही हुँदा सो आयोजनाको क्षमता प्रोब्याब्लिटी अफ एक्सीडेन्स Q80 मा १(एक)मे.वा. भन्दा कम देखिएकोले क्षेत्र दोहोरो पर्ने दुधकोशी-१० जलविद्युत आयोजनालाई कुनै पनि प्रतिकूल असर नपर्ने शर्तसहित तपसिल बमोजिमको सर्वेक्षण क्षेत्रमा Technical Clearance उपलब्ध गराइएको व्योहोरा विभागको मिति २०७६/११/१२को 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° ४६' ००" देखि २७° ४६' ३०" सम्म
देशान्तर: ८६° ४३' २०" देखि ८६° ४४' ३०" सम्म

(प्रदिप कुमार राउत)
इञ्जीनियर

बोधार्थ:
१.श्रीमान महानिर्देशकज्यू,विद्युत विकास विभाग
२.श्री मोन्जो खोला 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, Chaurikharka, Solukhumbu, 1 No. Province, Nepal

च.नं ६४८

मिति- २०७६/१२/०३

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

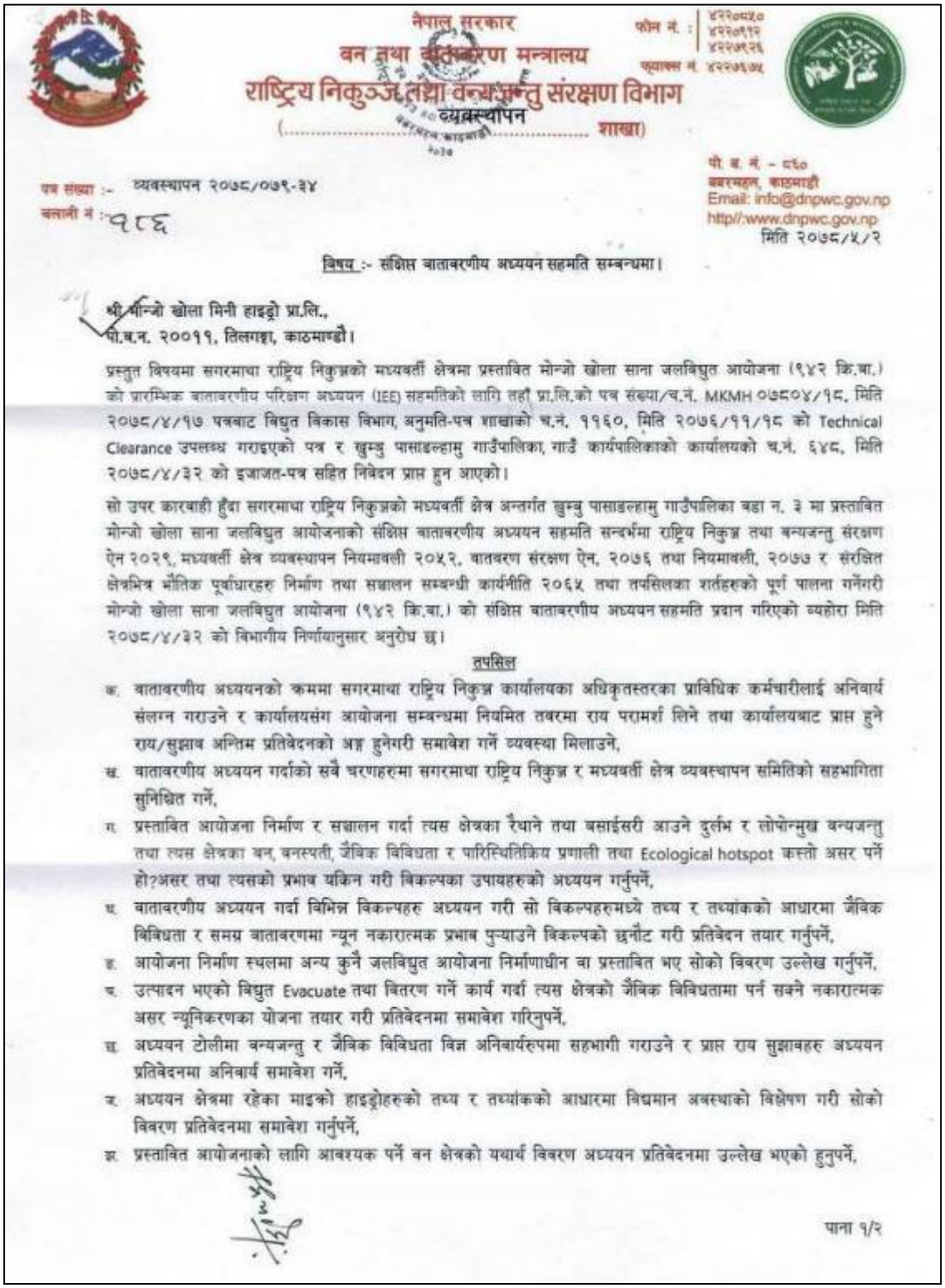
श्री मोन्जोखोला मिनी हाइड्रो प्रा.लि.,
तिलपंगा, काठमाण्डौ ।

वैकल्पिक उर्जा प्रवर्द्धन केन्द्रको अनुदान सहयोगमा अक्षांश २७° ४६' ००" देखि २७° ४६' ३०" सम्म तथा देशान्तर ८६° ४३' २०" देखि ८६° ४४' ३० " अस्थितिमा रहेको श्री मोन्जोखोला मिनि हाइड्रोको विद्युत विकास विभाग काठमाण्डौबाट Technical Clearance समेत प्राप्त भई इजाजत प्राप्तिका लागि यस कार्यालयमा पेश भएको हुँदा यस कार्यालयको मिति २०७६।१२।०३ 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,
काठमाण्डौ ।

Annex IV: Permission Letter for DFS from DNPWC



नेपाल सरकार
वन तथा वातावरण मन्त्रालय
राष्ट्रिय निकुञ्ज तथा वन्यजन्तु संरक्षण विभाग
व्यवस्थापन
(..... शाखा)

फोन नं. : ४२२०४५०, ४२२०९१२, ४२२७९२६
फ्याक्स नं. ४२२७६७५

पो. ब. नं. - ८६०
बबरमहल, काठमाडौं
Email: info@dnpwc.gov.np
http//:www.dnpwc.gov.np

पत्र संख्या :- व्यवस्थापन २०७८/०७९-३४
चलानी नं :- ९८६

मिति २०७८/४/२

विषय :- संक्षिप्त वातावरणीय अध्ययन सहमति सम्बन्धमा।

श्री मोन्जो खोला मिनी हाइड्रो प्रा.लि.,
पो.ब.न. २००११, तिलगङ्गा, काठमाण्डौं।

प्रस्तुत विषयमा सगरमाथा राष्ट्रिय निकुञ्जको मध्यवर्ती क्षेत्रमा प्रस्तावित मोन्जो खोला साना जलविद्युत आयोजना (९४२ कि.वा.) को प्रारम्भिक वातावरणीय परिक्षण अध्ययन (IEE) सहमतिको लागि तहाँ प्रा.लि.को पत्र संख्या/च.नं. MKMH ०७८०४/१८, मिति २०७८/४/१७ पत्रबाट विद्युत विकास विभाग, अनुमति-पत्र शाखाको च.नं. ११६०, मिति २०७६/११/१८ को Technical Clearance उपलब्ध गराइएको पत्र र खुम्बु पासाङल्हामु गाउँपालिका, गाउँ कार्यपालिकाको कार्यालयको च.नं. ६४८, मिति २०७८/४/३२ को इजाजत-पत्र सहित निवेदन प्राप्त हुन आएको।

सो उपर कारवाही हुँदा सगरमाथा राष्ट्रिय निकुञ्जको मध्यवर्ती क्षेत्र अन्तर्गत खुम्बु पासाङल्हामु गाउँपालिका वडा नं. ३ मा प्रस्तावित मोन्जो खोला साना जलविद्युत आयोजनाको संक्षिप्त वातावरणीय अध्ययन सहमति सन्दर्भमा राष्ट्रिय निकुञ्ज तथा वन्यजन्तु संरक्षण ऐन २०२९, मध्यवर्ती क्षेत्र व्यवस्थापन नियमावली २०५२, वातवरण संरक्षण ऐन, २०७६ तथा नियमावली, २०७७ र संरक्षित क्षेत्रभित्र भौतिक पूर्वाधारहरु निर्माण तथा सञ्चालन सम्बन्धी कार्यनीति २०६५ तथा तपसिलका शर्तहरुको पूर्ण पालना गर्नेगरी मोन्जो खोला साना जलविद्युत आयोजना (९४२ कि.वा.) को संक्षिप्त वातावरणीय अध्ययन सहमति प्रदान गरिएको व्यहोरा मिति २०७८/४/३२ को विभागीय निर्णयानुसार अनुरोध छ।

तपसिल

क. वातावरणीय अध्ययनको क्रममा सगरमाथा राष्ट्रिय निकुञ्ज कार्यालयका अधिकृतस्तरका प्राविधिक कर्मचारीलाई अनिवार्य संलग्न गराउने र कार्यालयसंग आयोजना सम्बन्धमा नियमित तवरमा राय परामर्श लिने तथा कार्यालयबाट प्राप्त हुने राय/सुझाव अन्तिम प्रतिवेदनको अङ्ग हुनेगरी समावेश गर्ने व्यवस्था मिलाउने,

ख. वातावरणीय अध्ययन गर्दाको सबै चरणहरुमा सगरमाथा राष्ट्रिय निकुञ्ज र मध्यवर्ती क्षेत्र व्यवस्थापन समितिको सहभागिता सुनिश्चित गर्ने,

ग. प्रस्तावित आयोजना निर्माण र सञ्चालन गर्दा त्यस क्षेत्रका रैथाने तथा बसाईसरी आउने दुर्लभ र लोपोन्मुख वन्यजन्तु तथा त्यस क्षेत्रका वन, वनस्पती, जैविक विविधता र पारिस्थितिकिय प्रणाली तथा Ecological hotspot कस्तो असर पर्ने हो?असर तथा त्यसको प्रभाव यकिन गरी विकल्पका उपायहरुको अध्ययन गर्नुपर्ने,

घ. वातावरणीय अध्ययन गर्दा विभिन्न विकल्पहरु अध्ययन गरी सो विकल्पहरुमध्ये तथ्य र तथ्यांकको आधारमा जैविक विविधता र समग्र वातावरणमा न्यून नकारात्मक प्रभाव पुऱ्याउने विकल्पको छनौट गरी प्रतिवेदन तयार गर्नुपर्ने,

ङ. आयोजना निर्माण स्थलमा अन्य कुनै जलविद्युत आयोजना निर्माणाधीन वा प्रस्तावित भए सोको विवरण उल्लेख गर्नुपर्ने,

च. उत्पादन भएको विद्युत Evacuate तथा वितरण गर्ने कार्य गर्दा त्यस क्षेत्रको जैविक विविधतामा पर्न सक्ने नकारात्मक असर न्यूनिकरणका योजना तयार गरी प्रतिवेदनमा समावेश गरिनुपर्ने,

छ. अध्ययन टोलीमा वन्यजन्तु र जैविक विविधता विज्ञ अनिवार्यरुपमा सहभागी गराउने र प्राप्त राय सुझावहरु अध्ययन प्रतिवेदनमा अनिवार्य समावेश गर्ने,

ज. अध्ययन क्षेत्रमा रहेका माइक्रो हाइड्रोहरुको तथ्य र तथ्यांकको आधारमा विद्यमान अवस्थाको विश्लेषण गरी सोको विवरण प्रतिवेदनमा समावेश गर्नुपर्ने,

झ. प्रस्तावित आयोजनाको लागि आवश्यक पर्ने वन क्षेत्रको यथार्थ विवरण अध्ययन प्रतिवेदनमा उल्लेख भएको हुनुपर्ने,

पाना १/२

नेपाल सरकार
वन तथा वातावरण मन्त्रालय
राष्ट्रिय निकुञ्ज तथा वन्यजन्तु संरक्षण विभाग
(..... व्यवस्थापन ..... शाखा)

फोन नं. : ४२२०८५०
४२२०९१२
४२२७९२६
फ्याक्स नं. ४२२७६७५

पो. ब. नं. - ८६०
बबरमहल, काठमाडौं
Email: info@dnpwc.gov.np
http//:www.dnpwc.gov.np

पत्र संख्या :- व्यवस्थापन २०७८/०७९-३४
चलानी नं :-

ञ. निर्माण गर्न प्रस्ताव गरिएका संरचनाहरुको GPS कोअर्डिनेट सहित निकुञ्जको सिमाना देखिने GIS प्रविधि समेत प्रयोग गरी तयार गरिएको टोपोनक्सा प्रतिवेदनमा संलग्न गराउने,

ट. अध्ययनको क्रममा स्थानीय जनता र सरोकारवाला निकायहरुबाट उठान भएका आर्थिक, सामाजिक, जैविक प्रभाव सम्बन्धी सवालहरु सम्बोधन गर्ने सम्बन्धमा अवलम्बन गर्नुपर्ने न्यूनीकरणका उपायहरु प्रतिवेदनको अभिन्न अङ्गको रुपमा समेटिनु पर्ने,

ठ. वातावरण संरक्षण नियमावली, २०७७ को नियम ९ बमोजिम वातावरणीय अध्ययन प्रतिवेदन स्वीकृत गर्ने सम्बन्धित निकायले प्राप्त वातावरणीय अध्ययन प्रतिवेदन सम्बन्धमा जाँचबुझ गर्दा सो विषयमा थप वातावरणीय अध्ययन गर्नुपर्ने देखिएमा संक्षिप्त वातावरणीय अध्ययनको हकमा प्रारम्भिक वातावरणीय परिक्षण र प्रारम्भिक वातावरणीय परिक्षणको हकमा वातावरणीय प्रभाव मुल्यांकन गर्न प्रस्तावकलाई आदेश दिनुपर्नेछ भन्ने व्यवस्था भए बमोजिम थप वातावरणीय अध्ययन गर्नुपर्ने भएमा सोही बमोजिम गर्नुपर्ने,

ड. अन्तिम प्रतिवेदन स्विकृती गर्नु पुर्व स्वीकृत गर्ने निकायले सगरमाथा राष्ट्रिय निकुञ्ज कार्यालय र राष्ट्रिय निकुञ्ज तथा वन्यजन्तु संरक्षण विभागको लिखित सहमति लिनुपर्ने,

ढ. प्रस्तावित आयोजना निर्माण तथा संचालन गर्दा सगरमाथा राष्ट्रिय निकुञ्जको Outstanding Universal Value (OUV) मा पर्नसक्ने प्रभाव समेतको अध्ययन गरी यकिन विवरण प्रतिवेदनमा उल्लेख गर्नुपर्ने र नकारात्मक असर पर्ने पाईएमा यूनेस्को (UNESCO) मा राय सुझावको लागि पठाउनु पर्ने, र

ण. यस वातावरणीय अध्ययन सहमति उपलब्ध गराइएको आधारमै यसपछिका अन्य कार्यका लागि सहमति प्रदान गर्न विभाग बाध्य हुने छैन।

2076/12/12

(नुरेन्द्र अर्याल)
सहायक व्यवस्थापन अधिकृत

बोधार्थ :
श्री वन तथा वातावरण मन्त्रालय,
सिंहदरबार, काठमाडौं।

श्री सगरमाथा राष्ट्रिय निकुञ्जको कार्यालय,
नाम्चेबजार सोलुखुम्बु

श्री खुम्बु पासाङल्हामु गाउँपालिका,
गाउँ कार्यपालिकाको कार्यालय, चौरीखर्क सोलुखुम्बु।

पाना २/२

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			
		Fuel-wood	Fodder	Medicine	Others

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 सर्वेक्षणः

१. घरमुलीको नामः २. ठेगानाः

३. शिक्षाः ४. मुख्य पेशाः

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 विवरणः

क्र.सं.	नाता	लिंग	उमेर	शिक्षा	पेशा	कैफियत

९. आम्दानीको श्रोतहरुः

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 छेत्रफलः

१०.२ मुख्य बाली तथा उत्पादनः

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 श्रोतः

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

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

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

१०. इन्धन

१०.१ उज्यालोको लागिः १०.२ खाना पकाउनः

१०.३ दाउरा प्रयोग भए त्यसको श्रोत .....

११. धर्म तथा संस्कृतिः

११.१ धर्म .....

११.२ चाडपर्वहरु

.....

समाप्त

Annex IX: Settlement Information Form

बस्तीको जानकारी:

१ ठेगानाः **२ बस्तीको नामः**

३. घरधुरी संख्याः **४. जनसंख्याः**

५. मुख्यजातजातिहरुः

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 वर्षाभन्दा 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 बजारः

१२. स्थानीय सरकारी, गैर-सरकारी, व्यक्तिगत तथा सेवा प्रदायक संघसस्था तथा पुर्बाधारहरु, धार्मिक, सांस्कृतिक तथा पुरातात्विक सम्पदाहरु र अन्य संस्थाहरुः

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

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 पुर्वाधार**			
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 चाडपर्वहरुः

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: Monjo Khola
Location: Solukhumbu
Lab Code: 078/08/16

S.N.	Parameters	Test Results	Standards #
	Physical Tests		
1.	Temperature (°C)	18.5	
2.	pH	8.07	6.5-8.5*
3.	Conductivity (µS/cm)	14	1500
4.	Turbidity (NTU)	0.36	5(10)
5.	Total Dissolved Solids (mg/L)	6.84	
6.	Total Suspended Solids (mg/L)	4	
	Chemical Tests		
7.	Total Hardness (as $CaCO_3$)	8	500 mg/L
8.	Chloride Content (mg/L)	2.84	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)	7.6	
14.	Biological Oxygen Demand (mg/L)	2.8	
15.	Chemical Oxygen Demand (mg/L)	41	
	Microbiological Test		
16.	Total Coliform Count	50↑	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: Monjo drinking water supply
Source:
Location: Monjo
Lab Code: 078/08/18

S.N.	Parameters	Test Results	Standards #
	Physical Tests		
1.	Temperature (°C)	18.5	
2.	pH	7.92	6.5-8.5*
3.	Conductivity (µS/cm)	18	1500
4.	Turbidity (NTU)	0.24	5(10)
5.	Total Dissolved Solids (mg/L)	8.95	
6.	Total Suspended Solids (mg/L)	2	
	Chemical Tests		
7.	Total Hardness (as $CaCO_3$)	12	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)	6.86	
14.	Biological Oxygen Demand (mg/L)	0.4	
15.	Chemical Oxygen Demand (mg/L)	ND	
	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

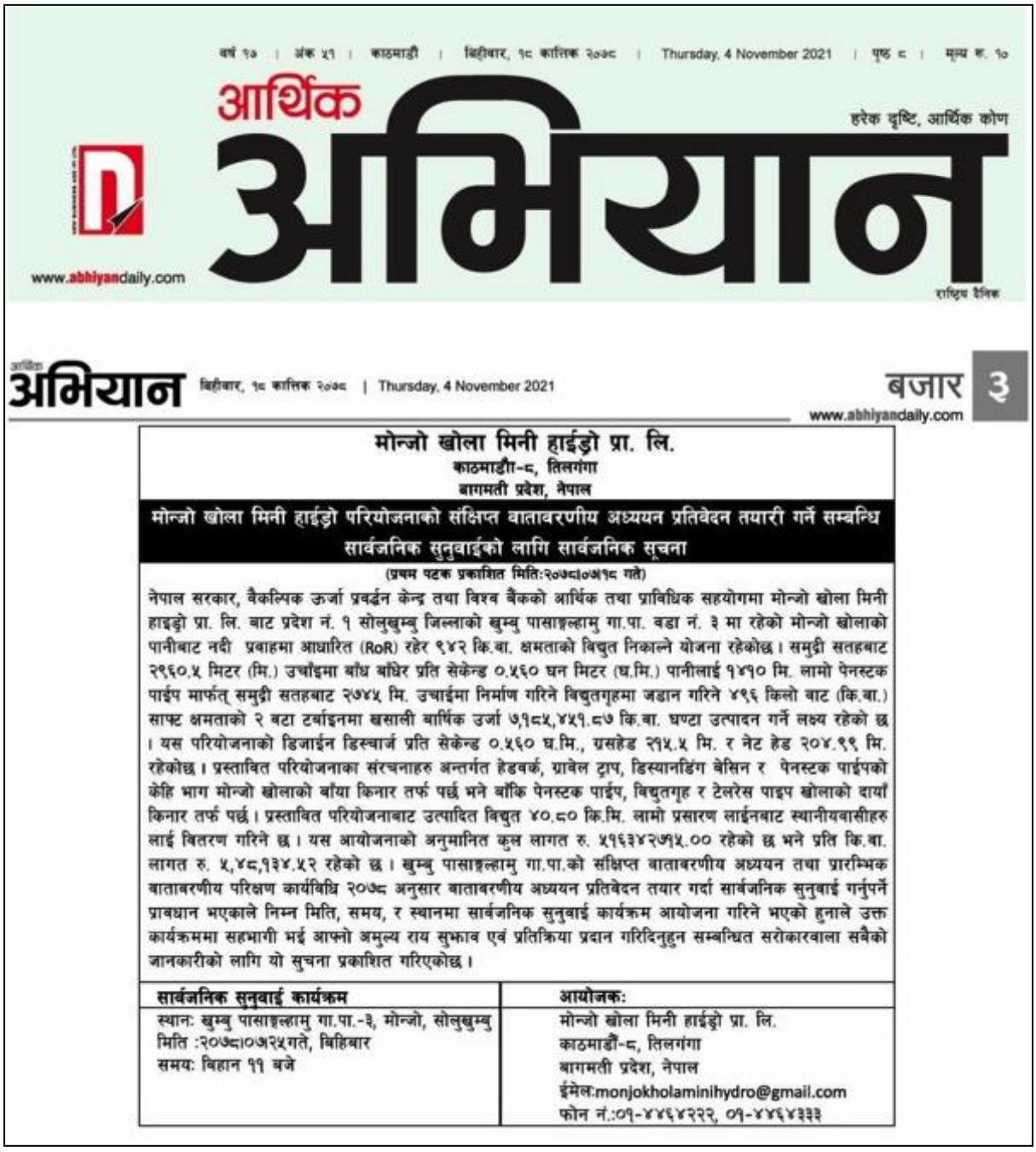
Dr. Tista Prasai Joshi
Scientific Officer

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

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आर्थिक अभियान बिहीवार, १८ कार्तिक २०७८ | Thursday, 4 November 2021

बजार ३

www.abhiyandaily.com

मोन्जो खोला मिनी हाईड्रो प्रा. लि.
काठमाडौं-८, तिलगंगा
बागमती प्रदेश, नेपाल

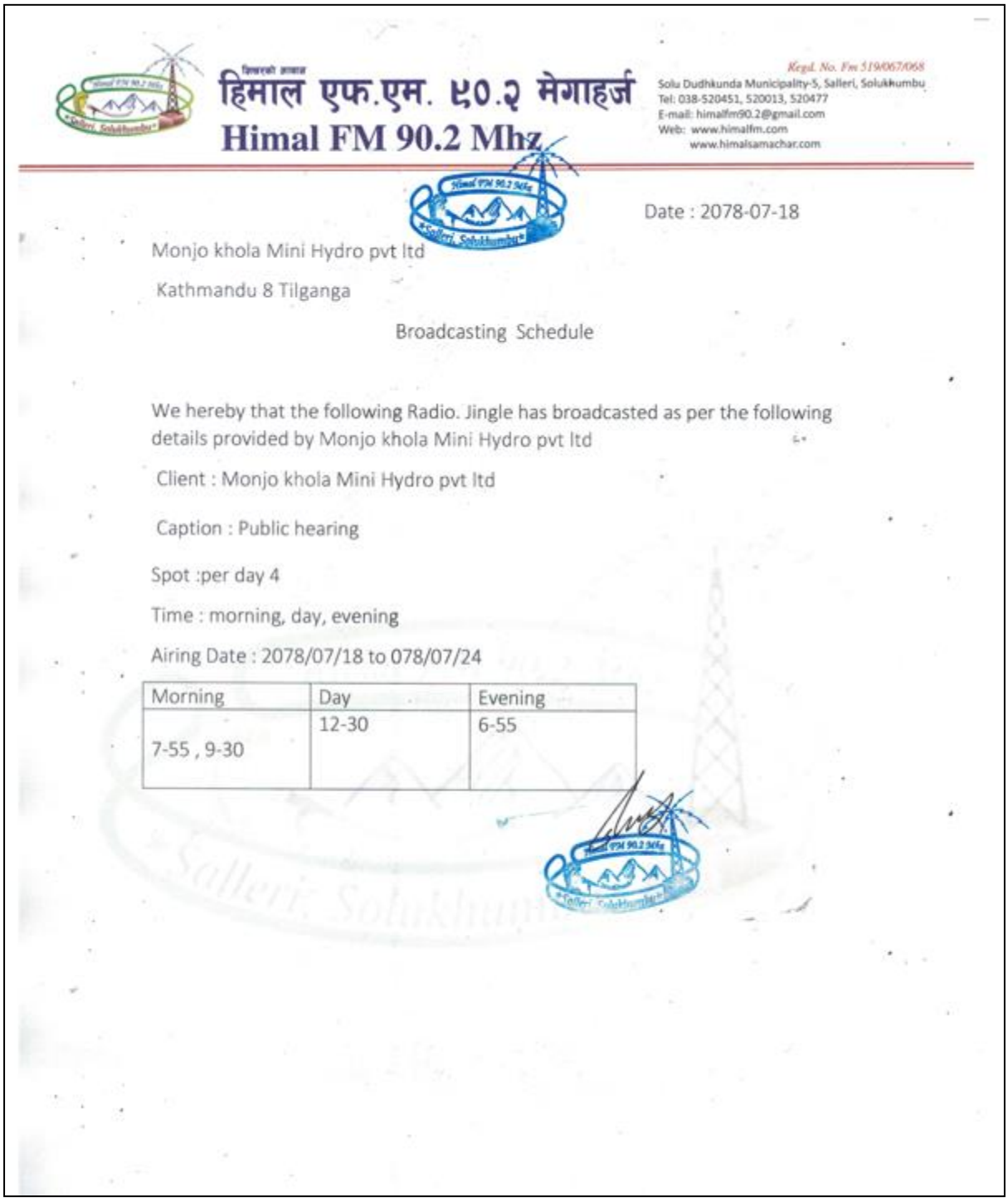
मोन्जो खोला मिनी हाईड्रो परियोजनाको संक्षिप्त वातावरणीय अध्ययन प्रतिवेदन तयारी गर्ने सम्बन्धि सार्वजनिक सुनुवाईको लागि सार्वजनिक सूचना

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

नेपाल सरकार, वैकल्पिक ऊर्जा प्रवर्द्धन केन्द्र तथा विश्व बैंकको आर्थिक तथा प्राविधिक सहयोगमा मोन्जो खोला मिनी हाइड्रो प्रा. लि. बाट प्रदेश नं. १ सोलुखुम्बु जिल्लाको खुम्बु पासाङ्ल्हामु गा.पा. वडा नं. ३ मा रहेको मोन्जो खोलाको पानीबाट नदी प्रवाहमा आधारित (RoR) रहेर ९४२ कि.वा. क्षमताको विद्युत निकाल्ने योजना रहेकोछ। समुद्री सतहबाट २९६०.५ मिटर (मि.) उचाँइमा बाँध बाँधेर प्रति सेकेन्ड ०.५६० घन मिटर (घ.मि.) पानीलाई १४१० मि. लामो पेनस्टक पाईप मार्फत् समुद्री सतहबाट २७४५ मि. उचाईमा निर्माण गरिने विद्युतगृहमा जडान गरिने ४९६ किलो वाट (कि.वा.) साफ्ट क्षमताको २ वटा टर्बाइनमा खसाली वार्षिक उर्जा ७,१८५,४५१.८७ कि.वा. घण्टा उत्पादन गर्ने लक्ष्य रहेको छ । यस परियोजनाको डिजाईन डिस्चार्ज प्रति सेकेन्ड ०.५६० घ.मि., ग्रसहेड २१५.५ मि. र नेट हेड २०४.९९ मि. रहेकोछ। प्रस्तावित परियोजनाका संरचनाहरु अन्तर्गत हेडवर्क, ग्रावेल ट्राप, डिस्यानडिंग बेसिन र पेनस्टक पाईपको केहि भाग मोन्जो खोलाको बाँया किनार तर्फ पर्छ भने बाँकि पेनस्टक पाईप, विद्युतगृह र टेलरेस पाइप खोलाको दायाँ किनार तर्फ पर्छ। प्रस्तावित परियोजनाबाट उत्पादित विद्युत ४०.८० कि.मि. लामो प्रसारण लाईनबाट स्थानीयबासीहरु लाई वितरण गरिने छ। यस आयोजनाको अनुमानित कुल लागत रु. ५१६३४२७१५.०० रहेको छ भने प्रति कि.वा. लागत रु. ५,४८,१३४.५२ रहेको छ। खुम्बु पासाङ्ल्हामु गा.पा.को संक्षिप्त वातावरणीय अध्ययन तथा प्रारम्भिक वातावरणीय परिक्षण कार्यविधि २०७८ अनुसार वातावरणीय अध्ययन प्रतिवेदन तयार गर्दा सार्वजनिक सुनुवाई गर्नुपर्ने प्रावधान भएकाले निम्न मिति, समय, र स्थानमा सार्वजनिक सुनुवाई कार्यक्रम आयोजना गरिने भएको हुनाले उक्त कार्यक्रममा सहभागी भई आफ्नो अमुल्य राय सुझाव एवं प्रतिक्रिया प्रदान गरिदिनुहुन सम्बन्धित सरोकारवाला सबैको जानकारीको लागि यो सुचना प्रकाशित गरिएकोछ।

सार्वजनिक सुनुवाई कार्यक्रम	आयोजक:
स्थान: खुम्बु पासाङ्ल्हामु गा.पा.-३, मोन्जो, सोलुखुम्बु मिति :२०७८।०७।२५गते, बिहिबार समय: बिहान ११ बजे	मोन्जो खोला मिनी हाईड्रो प्रा. लि. काठमाडौं-८, तिलगंगा बागमती प्रदेश, नेपाल ईमेल:monjokholaminihydro@gmail.com फोन नं.:०१-४४६४२२२, ०१-४४६४३३३

Annex XII: Notice Publication for Public Hearing



हिमाल एफ.एम. ९०.२ मेगाहर्ज
Himal FM 90.2 Mhz

Regd. No. Fm 519/067/068
Solu Dudhkunda Municipality-5, Salleri, Solukhumbu
Tel: 038-520451, 520013, 520477
E-mail: himalfm90.2@gmail.com
Web: www.himalfm.com
www.himalsamachar.com

Date : 2078-07-18

Monjo khola Mini Hydro pvt ltd

Kathmandu 8 Tilganga

Broadcasting Schedule

We hereby that the following Radio. Jingle has broadcasted as per the following details provided by Monjo khola Mini Hydro pvt ltd

Client : Monjo khola Mini Hydro pvt ltd

Caption : Public hearing

Spot :per day 4

Time : morning, day, evening

Airing Date : 2078/07/18 to 078/07/24

Morning	Day	Evening
7-55 , 9-30	12-30	6-55

Annex XIII: Meeting Minutes of Public Hearing

Date________
Page________

नेपाल सरकार, वैकल्पिक उर्जा प्रवर्द्धन केन्द्र तथा विश्व बैंकको आर्थिक तथा प्राविधिक सहयोगमा मोन्जो खोला मिनि हाइड्रो प्रा.लि. बाट प्रदेश नं.१ सोलुखुम्बु जिल्लाको खुम्बु पासाङल्हामु गा.पा. वडा नं. ३ मा रहेको मोन्जो खोलाको पानीबाट ९४२ कि.वा. क्षमताको विद्युत निकाल्ने योजना रहेको र उक्त परियोजनाको खुम्बु पासाङल्हामु गा.पा.को संक्षिप्त वातावरणीय अध्ययन तथा प्रारम्भिक वातावरणीय परिक्षण कार्यविधि २०७८ अनुसार संक्षिप्त वातावरणीय अध्ययन प्रतिवेदन तयार गर्दा सार्वजनिक सुनवाई गर्नुपर्ने भएकोले मिति २०७८ साल कार्तिक २५ गते बिहिबारको दिन सोलुखुम्बु जिल्लाको खुम्बु पासाङल्हामु गा.पा वडा नं. ३, मोन्जोमा खुम्बु पासाङल्हामु गा.पा वडा नं.३ का अध्यक्ष श्री मिङ्मा शेर्पा ज्युको अध्यक्षतामा तथा नुरु जाङबु शेर्पा ज्युको प्रमुख आतिथ्यको उपस्थिति साथै प्रस्तावक तथा परामर्शदाताको प्रतिनिधिहरु र स्थानीय सरोकारवालाहरुको उपस्थितिमा सार्वजनिक सुनवाई सम्पन्न भयो।

उपस्थिति :-

क्र.सं.	नाम / लिङ्ग	ठेगाना/संस्था/पद	हस्ताक्षर
१.	मिङ्मा छिरी शेर्पा पु.	खुम्बु पा.ल्हा. गा.पा. वडा ३ अध्यक्ष	
२.	नुरु जाङबु शेर्पा पु.	चौरीखर्क म.श. उ. समिति सचिव	
३.	छिमा तेन्जीङ शेर्पा पु.	मन्जो खोला मा.हा. अध्यक्ष	
४.	पासाङ सोनाम शेर्पा पु.	कोसिङ सामुदायिक वन सचिव	
५.	कामी तेम्बा शेर्पा	प्रमुख लामा, मन्जु गोम्बा	
६.	पासाङ दावा शेर्पा पु.		
७.	रिन्जी बहादुर शेर्पा पु.		
८.	सोनाम तेन्जीङ शेर्पा पु.	खुम्नला मध्यवर्ती सचिव	
९.	गोविन्द राई पु.	प्र.अ. मन्जु अ. वि.	
१०.	दावा नुरु शेर्पा पु.		
११.	ज्ञान बहादुर तमाङ पु.		
१२.	राम काजी मगर पु.	सामुदायिक वन अध्यक्ष	
१३.	कामी छिरी शेर्पा पु.	संस्कृति वातावरण अध्यक्ष	

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१४. पेम्बा तेन्जी शेर्पा पु.
१५. फुरा ग्याल्जेन शेर्पा पु.
१६. तेन्जीङ तामाङ पु.
१७. पासाङ छिकी शेर्पा महिला
१८. डोल्मा छिकी शेर्पा म. महजो खोला मिनी हाइड्रो उपाध्यक्ष
१९. फुटी छिकी शेर्पा म. फुरा छिकी शेर्पा
२०. दोमे शेर्पा म. दोमे शेर्पा
२१. च्याङडी शेर्पा म.
२२. फुर्तेम्बा शेर्पा पु. १ वडा नं ३ वडा सदस्य
२३. ङ्वाङ छिरीङ शेर्पा म.
२४. फुर्वा ग्याल्जेन शेर्पा पु. ~~सचिव~~ महजो ~~खोला~~
२५. आङ फुटी शेर्पा पु.
२६. ङ्वाङ कर्साङ शेर्पा पु. सचिव महजो खोला
२७. ल्हाक्पा तेम्बा शेर्पा पु. सचिव कर्सन लघुजलविद्युत
२८. ङ्वाङ छेरा शेर्पा पुसगामाथि कोषाध्यक्ष
२९. फुटी फुटी शेर्पा म.
३०. जाङमु शेर्पा म. जाङमु
३१. पेम्बा नुरु शेर्पा पु.
३२. ङ्वाङ डोमा शेर्पा म. अध्यक्ष स्कुल्वला समूह
३३. फुर्वा याङजी शेर्पा म. फुर्वा याङजी
३४. दावा याङजी शेर्पा म.
३५. डोमा शेर्पा म. डोमा शेर्पा
३६. शिव प्र. तिमल्सिना, पु., CED,
३७. रामजी बोगटी, पु.
३५. कमानसिंह राई पु. स. टोलि. का.
३६. कृपा रमर राई पु. कृपा राई
३७. टासी राई पु.
३८. केशव प्रधानाङ्ग - वै. ऊ. प्र. केन्द्र
३९. सुनिता खतिवडा - वै. ऊ. प्र. केन्द्र
४०. शिव हरि कुमाल्थोक - वै. ऊ. प्र. के
४१. धन ब. श्रेष्ठ पु. वातावरणीय अध्ययन टोली प्रमुख
४२. उमेश प्र. अधिकारी वातावरणीय अध्ययन टोली व्यवस्थापक
४३. ल्हाक्पा नुरु शेर्पा
४४. आङ तेन्जी शेर्पा

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छलफलका विषयहरु :-

क) भौतिक वातावरणमा पर्न सक्ने प्रभाव तथा क्षेत्रहरु :-

ख) जैविक वातावरणमा पर्न सक्ने प्रभाव तथा क्षेत्रहरु :-

ग) सामाजिक वातावरणमा पर्न सक्ने प्रभाव तथा क्षेत्रहरु :-

घ) सांस्कृतिक वातावरणमा पर्न सक्ने प्रभाव तथा क्षेत्रहरु :-

ङ) आर्थिक वातावरणमा पर्न सक्ने प्रभाव तथा क्षेत्रहरु :-

च) अन्य (विविध)

छलफलमा उठेका सवालहरु :-

१. प्रभावित क्षेत्रका वासिन्दाहरुलाई रोजगारीको लागि प्राथमिकतामा राख्नुपर्ने ।

२. बेंकर लगायत अन्य क्षेत्रका वासिन्दाहरुलाई समेत लगानीको लागि अवसर दिनुपर्ने ।

३. प्रभावित क्षेत्रका वासिन्दाहरुको लागि न्यूनतम शुल्क विद्युत महशुल उपलब्ध गराउने व्यवस्था हुनुपर्ने ।

४. गुम्बा, विद्यालय जस्ता सार्वजनिक संस्थाहरुलाई हालसम्म नि:शुल्क विद्युत उपलब्ध गर्दै आईरहेकोमा त्यही व्यवस्था गर्दै हुनुपर्ने ।

५. जोरसल्ले तथा बकाङ्दिङ्कु लगायत अन्य बस्तीहरुमा सेवा क्षेत्र हुँदैछ जस्तो देखिएकोले उक्त बस्तीहरु लगायत बस्तीहरु समेत विद्युत प्रसारणको लागि समेट्नु पर्ने ।

६. सम्पूर्ण घरधुरीको तथ्याङ्क आउनुपर्ने तथा उनीहरुको माग कति हो उल्लेख हुनुपर्ने ।

७. स्थानीयले विद्युत कम्पनीको सेयर के कसरी पाउने हो त्यसको जानकारी हुनुपर्ने ।

८. व्यक्तिगत जग्गाको बारेमा कस कसको जग्गा पर्दछ र ती जग्गाहरुको व्यवस्थापन कसरी गर्ने भन्ने कुरामा छलफल ~~[illegible]~~ सम्झौता हुनुपर्ने ।

९. हाल संचालनमा रहेका लघु जलविद्युत तथा पेल्ट्रिक सेट आयोजनाहरुको संचालनमा के कस्तो असर पर्ने तथा तिनीहरुको व्यवस्थापन कसरी गर्ने भन्ने कुरा टुंगो लगाउनुपर्ने ।

१०.

[signatures]

प्रस्तावकको तर्फबाट दिइएका जवाफहरु:-

१. प्रभावित तथा स्थानीय व्यक्तिहरुलाई रोजगारको लागि उच्च प्राथमिकता दिने प्रतिबद्धता व्यक्त गरियो।

२. स्थानीय सबैको लागि उचित समयमा लगानीको अवसर प्रदान गर्ने जानकारी गराइयो।

३. प्रभावित क्षेत्रको बासिन्दाहरुको लागि न्युनतम शुल्कमा उपलब्ध गराउने सम्बन्धमा लगानीकर्ता बिचमा छलफल गरी शुल्क निर्धारण गर्ने तथा स्थानीयसंग छलफलसमेत गरी निर्धारण गर्ने जानकारी गराइयो।

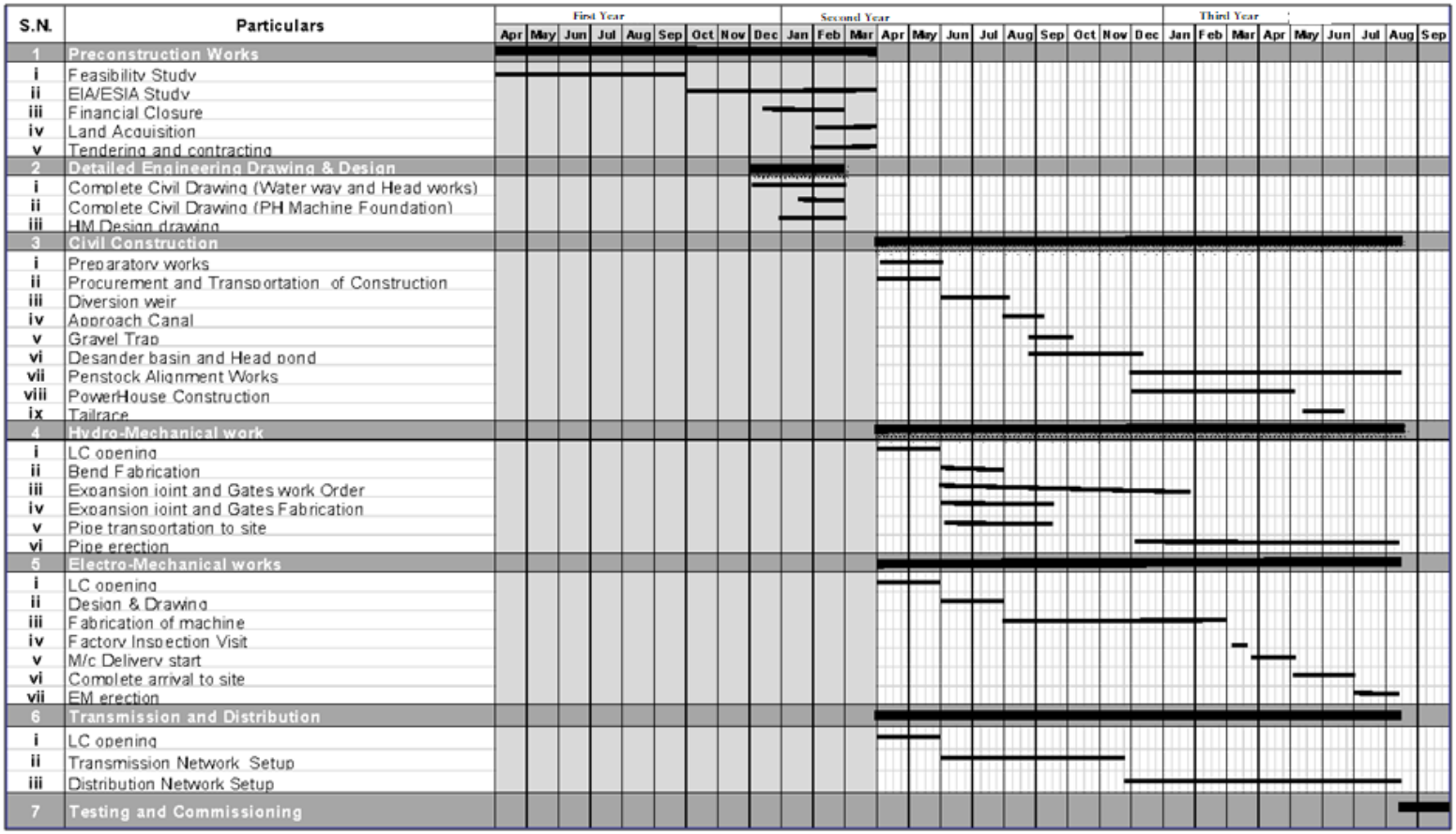
४. गुम्बा तथा विद्यालय जस्ता सार्वजनिक संस्थाहरुलाई सहुलियत विद्युत प्रदान गर्ने सन्दर्भमा कम्पनीको बोर्ड संग छलफल गरी निर्णय गर्ने जानकारी गराइयो।

५. जोरसल्ले देखि मुसे सम्मका सम्पूर्ण बस्तीहरुमा विद्युत प्रसारणको व्यवस्था गरिने प्रतिबद्धता जनाइयो।

६. व्यक्तिगत जग्गा कसकसको पर्छ तिनको पहिचान गरी वहाँहरुसँग सम्झदारी गरेर मात्र अगाडि बढाउने प्रतिबद्धता जनाइयो।

७. हाल संचालनमा रहेको लघुजलविद्युत तथा पेन्टिङ सेट सम्बन्धमा आपसी छलफल गरी उपयुक्त निकास निकाल्ने जानकारी गराइयो।

Annex XIV: Implementation Schedule



Annex XV: Stakeholder Meeting Minutes

२१-११-२०७६

आज मिति २०७६ फाल्गुन २१ गते सोलुखुम्बु जिल्लाको खुम्बु पासाङ ल्हामु गाउँपालिका वडा नं ३, फाक्दिङमा मोन्जो खोला सानो जलविद्युत आयोजनाले प्रभावित पार्ने गाउँ टोलसम्बन्धी वडा नं ३ को वडा अध्यक्ष श्री मिङ्मा छिरिङ शेर्पाको अध्यक्षतामा निम्न छलफल गरियो।

उपस्थिति :

१. श्री मिङ्मा छिरिङ शेर्पा, वडा अध्यक्ष, वडा नं ३
२. श्री केशव प्रधानाङ्ग, वैकल्पिक ऊर्जा प्रवर्धन केन्द्र,
३. श्री निरव भट्टराई, सि.इ.डि.
४. श्री सम्राट राज खनाल, सि.इ.डि.
५. श्री प्रसाद पण्डाल, सि.इ.डि.
६. श्री रोलिता थापा, सि.इ.डि.
७. श्री धन बहादुर [illegible], सि.इ.डि.
८. श्री आङदोर्जे शेर्पा, घाटे खोला लघु जलविद्युत
९. श्री आङ दावा शेर्पा, थुलोखोला लघुजलविद्युत
१०) श्री नुर्बु छिरिङ शेर्पा, थान्डा कोसी लघु जलविद्युत
११) श्री आङ नुरु शेर्पा (डाडोकोशी लघु जलविद्युत) अध्यक्ष
१२) श्री नुरु आङफुर शेर्पा (घट्टेखोला लघु जलविद्युत) प्रबन्धक
१३) श्री राम कुमार राई (" " ") सदस्य
१४) पेम्बा तेन्जिङ शेर्पा " " "
१५) लाक्पा नुरु शेर्पा ([illegible] सदस्य)
१६) निमछिरिङ राई
१७ दुर्गा बहादुर राई

प्रस्तावहरू :

१) मोन्जो खोला सानो जलविद्युत आयोजना प्रणाली को बारेमा श्री मिङ्मा छिरी शेर्पा द्वारा जानकारी गराउनु भयो।

२) वैकल्पिक ऊर्जा प्रवर्धन केन्द्र बाट यस आयोजनालाई पुर्‍याउने सहयोग बारे श्री केशव प्रधानाङ्ग द्वारा जानकारी गराउनु भ

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३. प्राविधिक तथा वातावरणीय अध्ययन सम्बन्धी हिमी कम्युनिकेशन एण्ड इन्जी डेभलपर्स प्रा. लि. का प्राविधिकहरुले जानकारी गराउनु भयो।

४. यस क्षेत्रमा हाल सञ्चालित आयोजनाहरुको व्यवस्थापन सम्बन्धी छलफल गर्न मोन्जो खोला लघुजलविद्युत आयोजना प्रा. लि. र हाल सञ्चालित आयोजनाको उपभोक्ता बिच समन्वय गर्ने।

आज मिति २०७६ फागुन २८ गतेका दिन यहाँ सोलुखुम्बु जिल्ला खुम्बु पासाङल्हामु गाउँपालिका वडा-३ मन्जु खोला साना जलविद्युत आयोजनाले प्रभावित पर्ने गाउँ रहेका सम्बन्धित वडा-३ का वडा अध्यक्ष श्री मिङमा छिरी शेर्पाको अध्यक्षतामा बैठक बसि छलफल गरियो।

उपस्थितिहरु :

(१) श्री मिङमा छिरी शेर्पा (वडा-३ अध्यक्ष)
(२) श्री केशव प्रधानाङ्ग (वैकल्पिक ऊर्जा प्रवर्द्धन केन्द्र)
(३) श्री धन बहादुर श्रेष्ठ (सि. इ. डि.)
(४) श्री डिमा तेन्जी शेर्पा (मान्जुखोला लघु जलविद्युत-अध्यक्ष)
(५) श्री आङ दोर्जी शेर्पा (हिमालय सामुदायिक वन-अध्यक्ष)
(६) श्री फुर्तेम्बा शेर्पा (खु.पा.गा.पा.-सदस्य)
(७) श्री फुरु आङबु शेर्पा (घट्टेखोला लघु जलविद्युत-प्रबन्धक)
(८) श्री पासाङ शेर्पा
(९) श्री ल्हाक्पा ग्यल्जेन शेर्पा
(१०) श्री डवाङ गेल्जे शेर्पा
(११) श्री ल्हाक्पा रिन्जी शेर्पा
(१२) श्री फुर्वे ग्यल्जेन शेर्पा
(१३) श्री ल्हाक्पा नुरु शेर्पा
(१४) श्री पासाङ छेजी शेर्पा
(१५) श्री छाङवा तमाङ
(१६) श्रीमति फुरा फुटी शेर्पा
(१७) श्रीमति डिमाले शेर्पा
(१८) श्रीमति दाली शेर्पा
(१९) श्रीमति डोल्मा टिकी शेर्पा

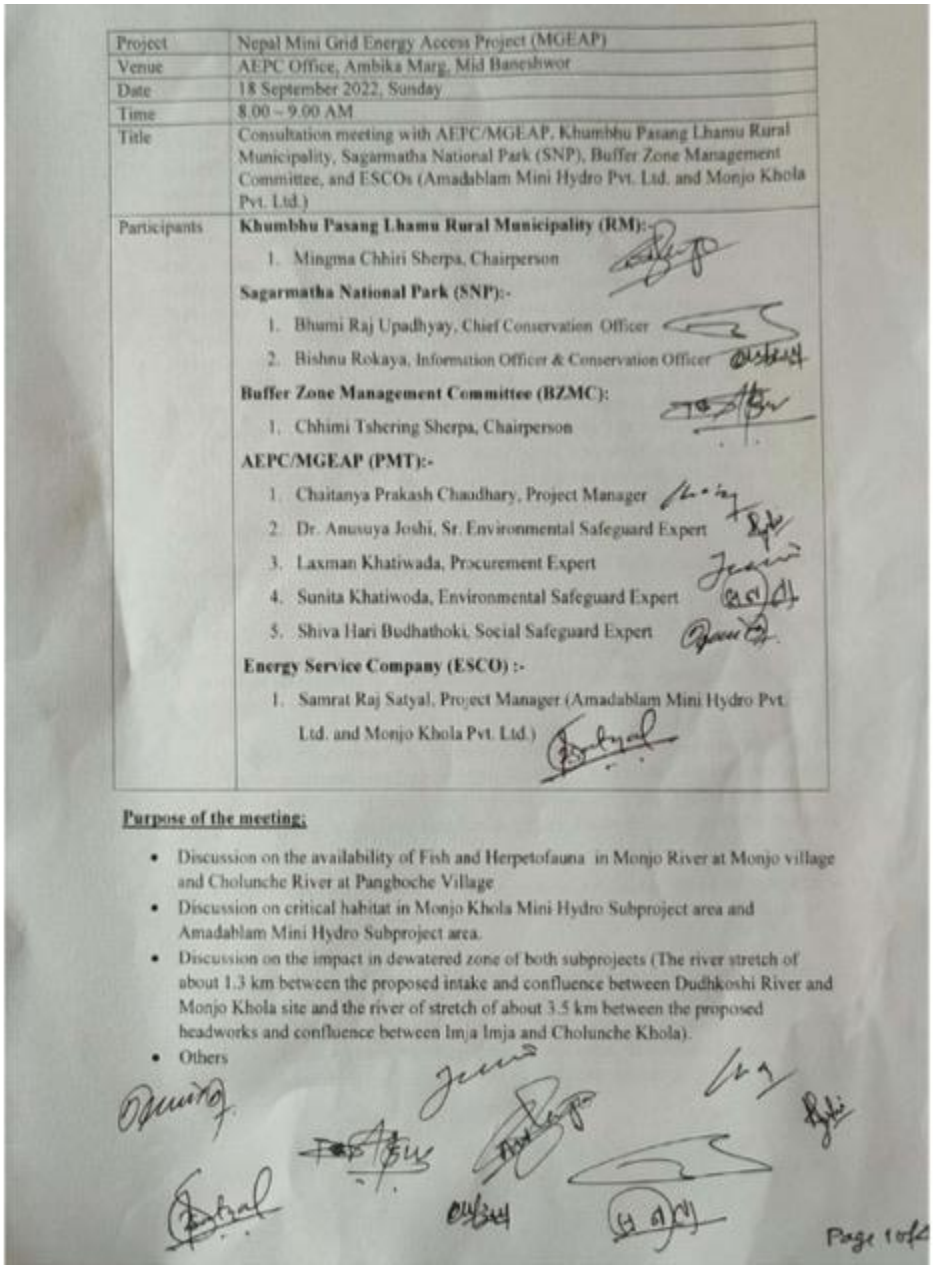
प्रस्तावहरु

(१) मन्जु खोला साना जलविद्युत आयोजना बारे
(२) मन्जु खोला लघु जलविद्युत बारे
(३) मन्जु खोला साना जलविद्युत आयोजनामा पर्ने व्यक्तिगत जग्गा बारे,

प्रस्ताव नं. १ माथि छलफल गर्दै मन्जु खोला साना जलविद्युत आयोजनाको प्रा. लि. को तर्फबाट श्री मिङ्मा छिरी शेर्पा द्वारा जानकारी गराइयो। उक्त आयोजनालाई पुर्याउने सहयोग बारे वैकल्पिक [illegible] तर्फबाट श्री केदार [illegible] द्वारा जानकारी गराइयो।

प्रस्ताव नं. २ माथि छलफल गरी यस ठाउँमा हाल संचालनमा आइरहेको मन्जुखोला लघु जलविद्युत व्यवस्थापन गर्ने छलफल गरी आयोजनाको उपभोक्ता [illegible] समन्वय गर्ने निर्णय गरियो।

प्रस्ताव नं. ३ माथि छलफल गर्दा यस मन्जुखोला साना जलविद्युत आयोजना निर्माण गर्दा निर्माणको क्रममा पर्ने व्यक्तिगत जग्गाहरुको बारेमा आयोजनाको प्राविधिकको रिपोर्ट आए पछि यस मन्जु खोला साना जलविद्युत प्रा. लि. ले (समुदायमा छलफल गरी) सम्पूर्ण समस्याको समाधान गर्ने भनि छलफल गरियो। साथै आयोजना सफल पार्न आवश्यक सहयोग समन्वय गर्नको लागि गाउँपालिका वडा बाट आवश्यक सहयोग गर्ने प्रतिबद्धता समेत जाहेर गरियो।



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.

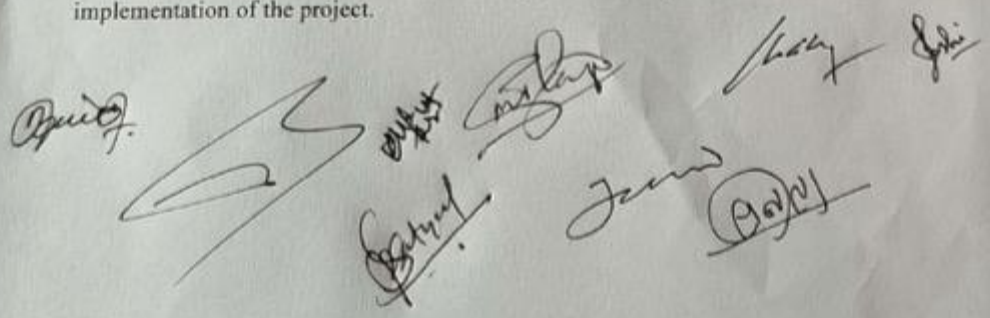

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Photo of Participants in meeting

Annex XVI Agreement Paper with Existing Micro Dydro

सम्झौता पत्र

आज मिति २०७८/०८/२६ का दिन यस काठमाडौं जिल्ला बागमती प्रदेश काठमाडौं महानगरपालिका वडा नम्बर ८, तिलगंगा स्थित मोन्जो खोला मिनि हाईड्रो प्रा.लि (प्रस्तावित आयोजना) का प्रतिनिधी र हाल संचालनमा रहेको सोलुखुम्बु जिल्ला, बागमती प्रदेश, पासाङ ल्हमु गाँउपालिका वडा नम्बर ..... स्थित मोन्जो खोला माइको जलविद्युत (५० कि.वा) आयोजनाको उपभोक्ता समिती तथा उपभोक्ताहरुका प्रतिनिधीबीच मोन्जो खोला मिनि हाईड्रो प्रा.लि.ले प्रबर्द्धन गर्ने लागेको मोन्जो खोला मिनि हाईड्रो (९.४२ कि.वा) को प्रबर्दन तथा व्यवस्थापन सम्बन्धमा दुवै पक्ष बीच निम्न लिखित बुंदाहरुमा छलफल भई सहमति भयो ।

छलफल तथा निर्णयका बुंदाहरु :

१) यस प्रस्तावित मोन्जो खोला मिनि हाईड्रो आयोजना (९.४२ कि.वा) विकासको निमित्त हाल कायम रहेको मोन्जो खोला माइको हाइड्रो (५० कि.वा) को विद्यमान संरचना हटाउनु पर्ने भएको हुनाले उक्त संरचना हटाउनका लागि मोन्जो खोला माइको हाइड्रो जलविद्युत आयोजना (५० कि.वा) ले मन्जुर गर्दछ । उक्त संरचनाहरु प्रस्तावित आयोजनाले आफ्नो श्रोत साधन प्रयोग गरी हटाउन मोन्जो खोला मिनि जलविद्युत प्रा.लि. लाई सम्पुर्ण अख्तीयारी प्रदान गरिएको छ । यस व्यवस्थामा मोन्जो खोला माइको जलविद्युत (५० कि.वा) आयोजनाको उपभोक्ता समिती तथा उपभोक्ताहरुको पूर्ण सहमती रहेको छ ।

२) बुंदा नं. १ बमोजिम साविकका संरचनाहरु हटाई आयोजना बन्द भएको कारणले मोन्जो खोला मिनि हाईड्रो प्रा.लि. संग कुनैपनि पक्षको कुनै प्रकारको प्रतिफल वा क्षतिपुर्ती दावि रहने छैन । साथै उक्त साविकको आयोजनाले बेहोर्नु पर्ने कुनै पनि दायित्व नरहेको र भविष्यमा कुनै दायित्व बापत दावि आएमा त्यसको जिम्मा प्रस्तावित आयोजनाले लिने छैन । उक्त दायित्व को फरफारकको जिम्मा स्वयम् मोन्जो माइको हाइड्रो (५० कि.वा) ले लिनु पर्ने छ ।

३) साविक आयोजना बन्द गरे बापत प्रस्तावित मोन्जो खोला आयोजनाले विस्तारित क्षमताको भरपर्दो बिद्युत साविकका उपभक्तोहरु समेतलाई उपलब्ध गराउनु पर्नेछ ।

४) साविक आयोजनाको बिस्थापनको लागि उक्त आयोजनाहरुले सहयोगकर्ता (donor) को सहमति आवश्यक भए साविक आयोजना स्वयम्ले लिनुपर्ने र प्रस्तावित आयोजनाले भविष्यमा सहयोगकर्ता (donor) बाट आउने सम्भावित कुनै पनि किसिमका माग दावि तथा क्षतिपूर्ति बेहोर्ने छैन ।

५) प्रस्तावित आयोजनाको निमार्ण, प्रवर्दन तथा दिगो व्यवस्थापन गर्ने सम्पूर्ण जिम्मेवारी प्रस्तावित आयोजना प्रवर्द्धकको हुनेछ । यस बापत वितरीत विद्युतको शुल्क बाहेक अन्य कुनै रकमशुल्क साविक उपभोक्ता तथा उपभोक्ता समुहसंग लिन पाइने छैन ।

६) प्रस्तावित आयोजनाको निर्माणको कममा आवश्यक पर्ने विद्युत साविक आयोजनले निर्धारण गरेका दरमा उपलब्ध गर्ने तथा निर्माण, प्रवर्द्धन र संचालनको लागी यस सम्झौताका सम्पूर्ण पक्षहरुबाट आवश्यक सहयोग गर्ने प्रतिबद्धता व्यक्त गर्दछन् ।

७) प्रस्तावित आयोजनाको निर्माण शुरु भए पश्चयात हाल संचालनमा रहेको मोन्जो खोला माइक्रो हाइड्रोबाट उत्पादन भइरहेको विद्युत आपूर्ति सेवा बन्द हुने र प्रस्तावित आयोजनाबाट लगभग १ वर्ष पश्चात विद्युत उत्पादन प्रारम्भ हुने कुरामा सबै पक्षको मन्जुरी छ । कुनै विशेष परिस्थितीले प्रस्तावित आयोजनाको निमार्ण तथा संचालनमा ढिलाई हुन गए बप १ वर्षमा आयोजना सम्पन्न गर्ने जिम्मा प्रस्तावित आयोजनाको हुनेछ । नियन्त्रण भन्दा बाहिरको परिस्थिति बाहेक सो भन्दा बढि ढिलाई गरि साविक उपभोक्तालाई विद्युत उपभोग गर्ने हकबाट वन्चित गरिने छैन ।

८) प्रस्तावित आयोजनाले विद्युत उत्पादन तथा वितरण प्रारम्भ गरे पश्चयात प्रस्तावित आयोजनाको विद्यमान नियम तथा प्रचलित नियम अनुसार निर्धारण गरेको दरमा साविक आयोजना / उपभोक्ताले विद्युत खरीद गरी उपभोग गर्ने सहमति भयो ।

९) साविक आयोजनाको साविक घरधुरी/संरचना/निवासले छोएको सडकसम्म विद्युत आपूर्ति गर्ने जिम्मा प्रस्तावित आयोजनाको हुनेछ भने उक्त स्थानबाट आफनो घर/संरचना/निवास सम्म विद्युत आपूर्ति गर्ने जिम्मेवारी साविक उपभोक्ताको हुनेछ । यस बापत आवश्यक सम्पूर्ण सामग्री/उपकरणको व्यवस्थापन साविक उपभोक्ताले गर्नुपर्नेछ ।

१०) यो सम्झौता कार्यन्वयनमा भविष्यमा कुनैपनि विवाद उत्पन्न भएमा दुई पक्ष मिलेर आपसी सहमतिमा विवाद सामाधान गरिनेछ, दुवै पक्ष बीच आपसी सहमति हुन नसके नेपालको प्रचलित कानून अनुसार विवादको समाधान गरिनेछ ।

११) यो सम्झौता, सम्झौता भएको मितीबाट लागू हुनेछ र प्रस्तावित आयोजना संचालनमा रहुन्जेल सम्म प्रभावकारी वहाल रहनेछ ।

मोन्जो खोला मिनि हाईड्रो प्रा.लि. को तर्फ बाट:

नाम: ल्हाक्पा सोनाम शेर्पा
पद: अध्यक्ष
हस्ताक्षर:
कम्पनीको छाप :

साक्षी :

नाम: उमेश पनेरु
पद: कोपरिट निर्देशक
हस्ताक्षर:

मोन्जो खोला माइको जलविद्युत (५० कि.वा) आयोजनाको तर्फ बाट:

नाम: डिम्मा तेन्जिङ शेर्पा.
पद: अध्यक्ष
हस्ताक्षर:
छाप:

साक्षी :

नाम: फुर्बा गेल्जेन शेर्पा.
पद: सदस्य.
हस्ताक्षर:

सम्झौता पत्र

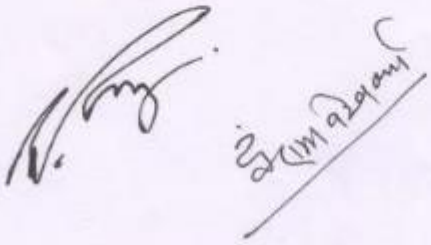
आज मिति 2066/07/26 का दिन यस काठमाडौं जिल्ला, बाग्मती प्रदेश, काठमाडौं महानगरपालिका वडा नम्बर ८, तिलगंगा स्थित मोन्जो खोला मिनि हाईड्रो प्रा.लि. (प्रस्तावित आयोजना) का प्रतिनिधी र हाल संचालनमा रहेको सोलुखुम्बु जिल्ला, बाग्मती प्रदेश पासाङ ल्हमु गाँउपालिका वडा नम्बर ..... स्थित घट्टे खोला माइक्रो जलविद्युत (७० कि.वा) आयोजनाको उपभोक्ता समिती तथा उपभोक्ताहरु का प्रतिनिधी बीच मोन्जो खोला मिनि हाईड्रो प्रा.लि.ले प्रवर्द्धन गर्न लागेको मोन्जो खोला मिनि हाईड्रो (९४२ कि.वा) को प्रवर्दन तथा व्यवस्थापन सम्बन्धमा दुवै पक्ष बीच निम्न लिखित बुंदाहरुमा छलफल सहमति भयो ।

बुँदाहरु :

१) यस प्रस्तावित मोन्जो खोला मिनि हाईड्रो (क्षमता ९.४२ कि.वा.) आयोजनाले निर्माण पछि हाल संचालनमा रहेको घट्टे खोला माइक्रो जलविद्युत (क्षमता ७० कि.वा.) को वितरण क्षेत्र लाई प्रभावित गर्ने हुनाले उक्त प्रस्तावित मोन्जो खोला मिनि हाईड्रो (९.४२ कि.वा) संचालनमा आए पछि हाल संचालनमा रहेको घट्टे खोला माइक्रो जलविद्युत (क्षमता ७० कि.वा.) द्वारा उत्पादित विद्युत मोन्जो खोला मिनि हाईड्रो (क्षमता ९.४२ कि.वा.) लाई बिकि गर्ने घट्टे खोला माइक्रो जलविद्युत (क्षमता ७० कि.वा.) आयोजना मन्जुर गर्दछ । उक्त विद्युतको बद्युत बिकि दर नेपाल विद्युत् प्राधिकरणद्वारा 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 मोन्जो खोला मिनि हाईड्राको हुनेछ । सो कुरामा घट्टे खोला माइक्रो जलविद्युत (क्षमता ७० कि.वा.) आयोजनाको उपभोक्ता समिती तथा उपभोक्ताहरुको पुर्ण सहमती छ ।



२) शर्त नं. १ बमोजिम घट्टे खोला माइको जलविद्युतको सम्पूर्ण संरचना सहित आयोजनाको व्यवस्थापकिय जिम्मा घट्टे खोला माइको जलविद्युत स्वयंको हुनेछ ।

३) प्रस्तावित आयोजनाको निर्माणको क्रममा आवश्यक पर्ने विद्युत सावित आयोजनले माथि बुंदा नं. १ मा उल्लेखित दरमा उपलब्ध गर्ने तथा निर्माण, प्रवर्द्धन र संचालनको लागी यस सम्झौताका सम्पूर्ण पक्षहरुबाट आवश्यक सहयोग गर्ने प्रतिवद्धता व्यक्त गर्दछन् ।

४) यस आयोजनाले विद्युत वितरण गर्न थालेपछि आयोजनाले निर्धारण गरेको दरमा विद्युत खरीद विकि गर्ने सहमति भयो ।

५) घट्टे खोला माइको जलविद्युत (क्षमता ७० कि.वा.) आयोजनाले बेहोर्नु पर्ने कुनै पनि दायित्व नरहेको र भविष्यमा कुनै दायित्व बापत दावि आएमा त्यसको जिम्मा प्रस्तावित मोन्जो खोला मिनि हाईड्रो आयोजनाले लिने छैन । उक्त दायित्वको फरफारकको जिम्मा स्वयम् घट्टे खोला माइको जलविद्युत (७० 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 ।

मोन्जो खोला मिनि हाईड्रो प्रा.लि (पहिलो पक्ष) तर्फ बाट :

नाम: ल्हाक्पा सोनाम शेर्पा
पद: अध्यक्ष
हस्ताक्षर:
कम्पनीको क्षाप :

Monjo Khola Mini Hydro Pvt. Ltd. Kathmandu

साक्षी :

नाम: उमेश पनेरु
पद: कोर्पोरेट निर्देशक
हस्ताक्षर:

घट्टे खोर्ला माइको जलविद्युत (७० कि.वा) आयोजनाको उपभोक्ता समिती (दोस्रो पक्ष) तर्फ

बाट :

नाम: तेकराम विश्वकर्मा

पद: अध्यक्ष

हस्ताक्षर:

कम्पनीको क्षाप :

साक्षी :

नाम: गुरु प्रसाद शर्मा

पद: प्रवन्धक

हस्ताक्षर:

मिति :

सम्झौता पत्र

आज मिति २०६८/१२/२६ का दिन यस काठमाडौं जिल्ला, बाग्मती प्रदेश, काठमाडौं महानगरपालिका वडा नम्बर ८, तिलगंगा स्थित मोन्जो खोला मिनि हाईड्रो प्रा.लि (प्रस्तावित आयोजना) का प्रतिनिधी र हाल संचालनमा रहेको सोलुखुम्बु जिल्ला बाग्मती, प्रदेश पासाङ लह्मु गाँउपालिका वडा नम्बर ३ स्थित ठाडोकोशी माइको जलविद्युत (१०० कि.वा) आयोजना को उपभोक्ता समिती तथा उपभोक्ताहरुका प्रतिनिधी बीच मोन्जो खोला मिनि हाईड्रो प्रा.लि.ले प्रवर्द्धन गर्ने लागेको मोन्जो खोला मिनि हाईड्रो (९.४२ कि.वा) को प्रवर्दन तथा व्यवस्थापन सम्बन्धमा दुवै पक्ष बीच निम्न लिखित बुदाहरुमा छलफल भई सहमति भयो ।

बुँदाहरु :

१) यस प्रस्तावित मोन्जो खोला मिनि हाईड्रो (क्षमता ९.४२ कि.वा.) आयोजनाले निर्माण पछि हाल संचालनमा रहेको ठाडोकोशी माइको जलविद्युत (१०० कि.वा) को वितरण क्षेत्र लाइ प्रभावित गर्ने हुनाले उक्त प्रस्तावित मोन्जो खोला मिनि हाईड्रो (९.४२ कि.वा) संचालनमा आए पछि हाल संचालनमा रहेको ठाडोकोशी माइको जलविद्युत (क्षमता १०० कि.वा.) द्वारा उत्पादित विद्युत मोन्जो खोला मिनि हाईड्रो (क्षमता ९.४२ कि.वा.) लाई बिकि गर्ने ठाडोकोशी माइको जलविद्युत (क्षमता १०० कि.वा.) आयोजना मन्जुर गर्दछ । उक्त विद्युतको विद्युत बिकि दर नेपाल विद्युत प्राधिकरणद्वारा ROR आयोजनाहरुलाई उपभोगको 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 विद्युतको वितरणको जिम्मा मोन्जो खोला मिनि हाईड्राको हुनेछ । सो कुरामा ठाडोकोशी माइके जलविद्युत (क्षमता १०० कि.वा.) आयोजनाको उपभोक्ता समिती तथा उपभोक्ताहरुको पूर्ण सहमती छ ।

२) शर्त नं. १ बमोजिम ठाडोकोशी माइको जलविद्युतको सम्पूर्ण संरचना सहित आयोजनाको व्यवस्थापकिय जिम्मा ठाडोकोशी माइको जलविद्युत स्वयको हुनेछ ।

३) प्रस्तावित आयोजनाको निर्माणको क्रममा आवश्यक पर्ने विद्युत सावित आयोजनले उपयुक्त दरमा उपलब्ध गर्ने तथा निर्माण, प्रवर्द्धन र संचालनको लागी यस सम्झौताका सम्पूर्ण पक्षहरुबाट आवश्यक सहयोग गर्ने प्रतिवद्धता व्यक्त गर्दछन् ।

४) यस आयोजनाले विद्युत वितरण गर्न थालेपछि आयोजनाले निर्धारण गरेको दरमा विद्युत खरीद विकि गर्ने सहमति भयो ।

५) ठाडोकोशी माइको जलविद्युत (क्षमता १०० कि.वा.) आयोजनाले बेहोर्नु पर्ने कुनै पनि दायित्व नरहेको र भविष्यमा कुनै दायित्व बापत दावि आएमा त्यसको जिम्मा प्रस्तावित मोन्जो खोला मिनि हाईड्रो आयोजनाले लिने छैन । उक्त दायित्वको फरफारकको जिम्मा स्वयम् ठाडोकोशी माइको जलविद्युत (१०० कि.वा) आयोजनाको उपभोक्ता समितीले लिनुपर्ने 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 ।

मोन्जो खोला मिनि हाईड्रो प्रा.लि (पहिलो पक्ष) तर्फ बाट :

नाम: ल्हाक्पा सोनाम शेर्पा
पद: अध्यक्ष
हस्ताक्षर:
कम्पनीको क्षाप :

Monjo Khola Mini Hydro Pvt. Ltd. Kathmandu

साक्षी :

नाम: उमेश पनेरु
पद: कोर्पोरेट निर्देशक
हस्ताक्षर:
कम्पनीको क्षाप :

ठाडोकोर्शी माइको जलविद्युत (१०० कि.वा) आयोजनाको उपभोक्ता समिती (दोस्रो पक्ष)

तर्फ बाट :

नाम:

पद:

हस्ताक्षर:

कम्पनीको छाप:

साक्षी :

नाम:

पद:

हस्ताक्षर:

कम्पनीको छाप:

मिति :

सम्झौता पत्र

आज मिति २०८८/१८/२८ का दिन यस काठमाडौं जिल्ला, बाग्मती प्रदेश, काठमाडौं महानगरपालिका वडा नम्बर ८, तिलगंगा स्थित मोन्जो खोला मिनि हाईड्रो प्रा.लि (प्रस्तावित आयोजना) का प्रतिनिधी र हाल संचालनमा रहेको सोलुखुम्बु जिल्ला, बाग्मती प्रदेश पासाङ ल्हमु गाँउपालिका वडा नम्बर ..... स्थित छुसेमा माइको जलविद्युत (३५ कि.वा) आयोजना को उपभोक्ता समिती तथा उपभोक्ताहरुका प्रतिनिधी बीच मोन्जो खोला मिनि हाईड्रो प्रा.लि.ले प्रबर्द्धन गर्ने लागेको मोन्जो खोला मिनि हाईड्रो (९.४२ कि.वा) को प्रबर्दन तथा व्यवस्थापन सम्बन्धमा दुवै पक्ष बीच निम्न लिखित बुदाहरुमा छलफल भई सहमति भयो ।

बुँदाहरु :

१) यस प्रस्तावित मोन्जो खोला मिनि हाईड्रो (क्षमता ९.४२ कि.वा.) आयोजनको निर्माण पछि हाल संचालनमा रहेको छुसेमा माइको जलविद्युत (क्षमता ३५ कि.वा.) को वितरण क्षेत्र लाई प्रभावित गर्ने हुनाले उक्त प्रस्तावित मोन्जो खोला मिनि हाईड्रो (९.४२ कि.वा) संचालनमा आए पछि हाल संचालनमा रहेको छुसेमा माइको जलविद्युत (क्षमता ३५ कि.वा.) द्वारा उत्पादित विद्युत मोन्जो खोला मिनि हाईड्रो (क्षमता ९.४२ कि.वा.) लाई बिक्रि गर्ने छुसेमा माइको जलविद्युत (क्षमता ३५ कि.वा.) आयोजना मन्जुर गर्दछ । उक्त विद्युतको विद्युत बिक्रि दर नेपाल विद्युत प्राधिकरणद्वारा 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 मोन्जो खोला मिनि हाईड्राको हुनेछ । सो कुरामा छुसेमा माइके जलविद्युत (क्षमता ३५ कि.वा.) आयोजनाको उपभोक्ता समिती तथा उपभोक्ताहरुको पुर्ण सहमती छ ।

२) शर्त नं. १ बमोजिम छुसेमा माइको जलविद्युतको सम्पुर्ण संरचना सहित आयोजनाको व्यवस्थापकिय जिम्मा छुसेमा माइको जलविद्युत स्वयंको हुनेछ ।

३) प्रस्तावित आयोजनाको निर्माणको क्रममा आवश्यक पर्ने विद्युत सांबिक आयोजनाले माथि बुँदा 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 गर्न थालेपछि आयोजनाले निर्धारण गरेको दरमा विद्युत खरीद बिकि गर्ने सहमति भयो ।

५) छुसेमा माइको जलविद्युत (क्षमता ३५ कि.वा.) आयोजनाले बेहोर्नु पर्ने कुनै पनि दायित्व नरहेको र भविष्यमा कुनै दायित्व बापत दावि आएमा त्यसको जिम्मा प्रस्तावित मोन्जो खोला मिनि हाईड्रो आयोजनाले लिने छैन । उक्त दायित्वको फरफारकको जिम्मा स्वयम् छुसेमा माइको जलविद्युत (३५ कि.वा) आयोजनाको उपभोक्ता समितीले लिनु पर्ने छ ।

६) यो सम्झौता अनुसार भविष्यमा कुनैपनि बिवाद 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 ।

मोन्जो खोला मिनि हाईड्रो प्रा.लि (पहिलो पक्ष) तर्फ बाट :

नाम: ल्हाक्पा सोनाम शेर्पा
पद: अध्यक्ष
हस्ताक्षर:
कम्पनीको छाप :

Monjo Khola Mini Hydro Pvt. Ltd. Kathmandu

साक्षी :

नाम: उमेश पनेरु
पद: कोर्पोरेट निर्देशक
हस्ताक्षर:

छुसेमा माइको जलविद्युत (३५ कि.वा) आयोजनाको उपभोक्ता समिती (दोस्रो पक्ष) तर्फबाट

:

नाम: दावा जाङ्बु शेर्पा

पद: अध्यक्ष

हस्ताक्षर:

कम्पनीको छाप :

साक्षी :

नाम: लहामा दे [illegible] शेर्पा

पद: सचिव

हस्ताक्षर:

मिति

Annex XVII: Photographs

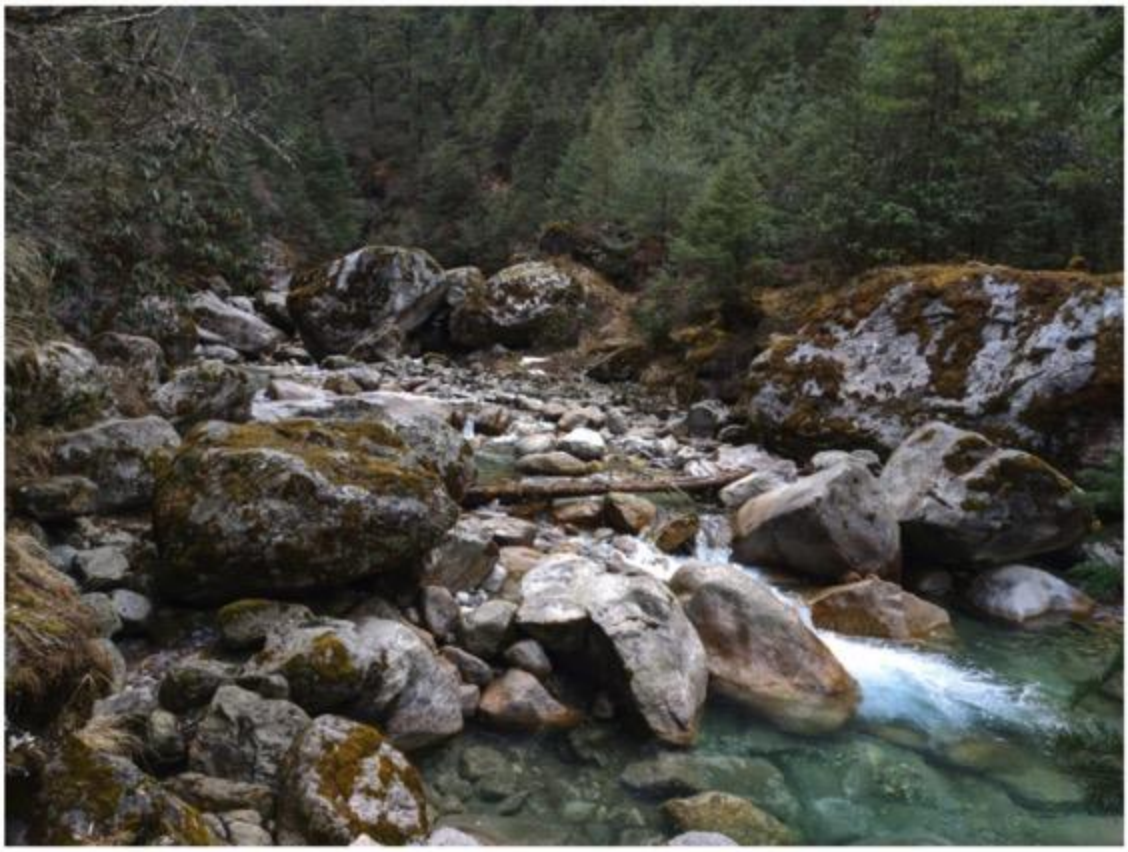


Figure 1: Monjo River

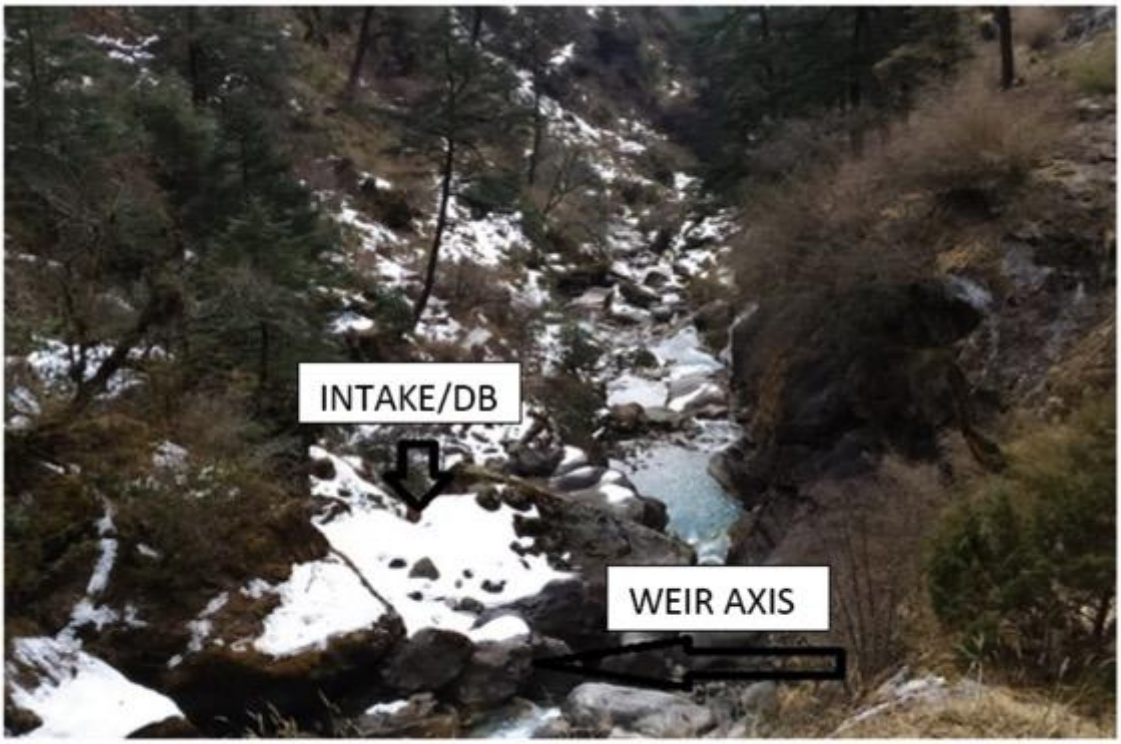


Figure 2: Weir, Intake and Desilting Basin(DB) Location

Figure 3: Penstock Route

Figure 4 : River Crossing

Figure 5 : Penstock Route

Figure 6: Penstock Route and Powerhouse (PH)

(Photo Source: DFS Report)

Chair Person of Monjo Khola Micro Hydro, at Public Hearing

Public Hearing Program at Monjo