GOVERNMENT OF NEPAL
MINISTRY OF FORESTS AND ENVIRONMENT

Hydropower Environmental Impact Assessment Manual

JULY 2018

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Message from the Minister

As Nepal gears up to judiciously respond to meeting the needs of our growing population and promote a thriving economy, we must be mindful of how we utilize our natural resources. As the lead agency responsible for the forest sector and environment, the development of any new infrastructure that has significant environmental and social implications falls under the jurisdiction of the Ministry of Forests and Environment.

Nepal's fragile topography presents numerous challenges. Existing threats of earthquakes, Glacial Lake Outburst Floods, landslides, deforestation and climate change, among others, if not assessed, planned and managed carefully, has the potential to devastate communities, livelihoods and the ecology. Nepal's commitment to ensuring more focus on these issues is evident by its initiative to integrate the Ministry of Forests and Soil Conservation with the Ministry of Population and Environment to form the Ministry of Forests and Environment.

As hydropower is an important sector for the Government of Nepal for economic prosperity, it is important that this development is carried out sustainably. Our priority is to ensure that despite the vast environmental and social challenges we face, we are able to support the development of infrastructure that is environmentally, socially, culturally and economically viable. On behalf of the newly set up Ministry of Forests and Environment, I am therefore pleased to present the Hydro Environment Impact Assessment Manual at such a critical juncture.

This Manual, along with the National EIA Guideline, I am confident, will serve as a useful and practical guide to all stakeholders involved in the hydropower industry, irrespective of the individual project's installed capacity.

Through the usage of this Manual, we can expect to learn many lessons along the way, which will result in the need to amend and update certain sections from time to time. As such, the Ministry will work to periodically update and improve the Manual based on practical experiences.

Mr. Shakti Bahadur Basnet
Honorable Minister

GOVERNMENT OF NEPAL
MINISTRY OF FORESTS AND ENVIRONMENT

Foreword

Renewable energy continues to take precedence as a major economic development goal for Nepal. This is evident by the Government of Nepal's ambitious target to harness 10,000 MW by 2030. To realize the country's promising hydropower potential, it is the Government's desire to see the pace of development go hand in hand with environmental and social safeguards that are in line with Environmental Protection Act, 1997 and Environmental Rules,1997, international standards and good industry practices so that the people can be assured of infrastructure development that is responsible as well as sustainable.

The Environmental Impact Assessment (EIA) has always played an integral role in Nepal's hydropower development process. Over the years, Nepal has been gradually moving from small and medium scale construction of hydropower projects to large scale development to not only meet our growing domestic demand for electricity and to jumpstart industrial growth but to also generate a significant source of revenue by exporting our surplus electricity. As hydropower projects scale up and increase, Nepal recognizes the need to revamp and align our national environmental and social safeguards with good international industry practices.

To address this need, the Ministry of Forests & Environment has prepared this Hydropower Environmental Impact Assessment Manual, in line with the National Environmental Impact Assessment Guideline

Significant time and effort have been invested in the development of this Manual. It has undergone extensive gap analysis of existing Nepali EIA related documents and legislation followed by a series of multi-stakeholder participatory processes in order to assist hydropower companies conduct better EIAs that meet international standards and aid the Government with the review and approval process.

This Manual has been designed in a format that is user-friendly and aims to guide practitioners, regulators and developers in the industry understand in detail the importance of several existing gaps like meaningful engagement of stakeholders, adequate definition of areas of influence and study areas, sufficient identification of baseline studies, knowledge on identifying and quantifying impacts, need of precision on impact predictions, and suitable alternatives analysis.

The Ministry is confident that the adoption of this Manual will help both EIA practitioners and hydropower developers in Nepal in streamlining, identifying and managing environmental and social risks as well as impacts better. Finally, this Manual will also help the Government review project EIAs more efficiently and improve the EIA process overall.

Mr. Bishwa Nath Oli, PhD
Secretary

GOVERNMENT OF NEPAL
MINISTRY OF FORESTS AND ENVIRONMENT

Acknowledgement

The Ministry of Forests & Environment wishes to thank the International Finance Corporation (IFC) in collaboration with the International Centre for Integrated Mountain Development (ICIMOD), supported by the Australian Government through the Sustainable Development Investment Portfolio (SDIP) and the Government of Japan for their valuable technical support and unwavering commitment to the completion of this Manual.

We are confident it will be a useful guide for Environmental Impact Assessment practitioners, developers and regulators in achieving a holistic outcome to minimizing negative impacts on the ecosystem while maximizing development benefits and gaining greater acceptance of projects by local communities and Governments. It will also help our ministry improve the review process for EIAs for hydropower projects.

We would also like to thank the Ministry of Energy, Water Resources and Irrigation (MoEWRI) of the Government of Nepal, development partners, hydropower project proponents, civil society and relevant stakeholders for their time and participation in the series of consultations during the development of this Manual.

Mr. Maheshwar Dhakal, PhD
Joint Secretary

Acronyms

CBS	Central Bureau of Statistics
CDC	Compensation Determination Committee
CFUG	Community Forest Users Group
CEMP	Construction Environment Management Plan
CIA	Cumulative Impact Assessment
CITES	Convention on International Trade of Endangered Species, Fauna and Flora
CSO	Civil Society Organizations
DBH	Diameter Breast Height
DCC	District Coordination Committee
DoED	Department of Electricity Development
EHS	Environment, Health, and Safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPR	Environment Protection Rules
EPT	Ephemoroptera, Plecoptera and Trichoptera Index
ESIA	Environmental and Social Impact Assessment
FPIC	Free, Prior and Informed Consent
FSL	Full Supply Level
GLOF	Glacial Lake Outburst Floods
GoN	Government of Nepal
GPS	Global Positiong System
IES	Incentives for Ecosystem Services
IFC	International Finance Corporation
IPP	Independent Power Producers
IUCN	International Union for Conservation of Nature
KPI	Key Performance Indicators
MoEWRI	Ministry of Energy, Water Resources and Irrigation
MoFE	Ministry of Forests and Environment
MOL	Minimum Operating Level
MoPE	Ministry of Population and Environment
NEA	Nepal Electricity Authority
NGO	Non-Government Organizations
NTFP	Non-Timber Forest Products
OHS	Occupational Health and Safety
PPE	Personal Protective Equipment
PRA	Participatory Rural Appraisal
PROR	Peaking Run-of-River
RAP	Resettlement Action Plan
REDD	Reducing Emissions from Deforestation and Degradation
ROR	Run-of-River
RRA	Rapid Rural Appraisal
RSC	Report Suggestion Committee
SD	Scoping Document
SDIP	Sustainable Development Investment Portfolio
STD	Sexually Transmitted Diseases
TOR	Terms of Reference
TSP	Total Suspended Particulate
VDC	Village Development Committee
WECS	Water and Energy Commission Secretariat

Glossary of Terms

Terms	Definition
Ancillary elements	Activities, facilities and infrastructure directly related to the project (e.g. workers' camps, transmission line for supply of construction power).
Area of influence	Anticipated extent of direct or indirect potential impacts of the proposed hydropower project.
Associated facilities	Facilities needed for a successful hydropower which would not be constructed or expanded in the absence of the project and without which the project would not be viable (e.g. transmission lines).
Construction period	Time taken to construct the hydropower project from the initial site preparation to the start of commercial operation. The time normally includes the initial testing of the plant (commissioning).
Dam	Concrete or earthen barrier constructed across a river and designed to control water flow or to create a reservoir.
Design discharge	Volume of water required to run the turbines at full capacity that is diverted from the river through the channel to the powerhouse which is measured in cubic meters/second (m3/s).
Flushing gates (bottom and sediment)	Bottom gates used for draining the reservoir and rarely used, e.g. unless there was an emergency or significant maintenance issue. Sediment flushing can also be done through the bottom gates, although special sediment flushing gates can also be built into the dam structure.
Head	Pressure created by the difference in elevation between the intake axis and the water turbine axis.
Installed capacity	Designed electrical output of the hydropower project when operating at full load.
Intake structure	Structure that allows water to be moved from the reservoir and delivered to the penstock and turbines.
Full Supply Level (FSL)	Normal maximum level of the water in the reservoir.
Minimum Operating Level (MOL)	Lowest level to which the reservoir is used during low flow season.
Draw Down	Difference between Full Supply Level and Minimum Operating Level.
Operating head	Elevation difference between the forebay pond and the turbines in the powerhouse.
Peak Load	Generation of electricity to meet the peak demand.
Base Load	Continuous electricity production.

Penstock	Set of pipes that ensure uniform flows from the reservoir/diversion to the turbines.
Powerhouse	Building that houses the turbines and control equipments.
Reservoir (headpond)	Area of land inundated for the storage of water within the river channel or as a pondage outside of the main river channel.
Spillway	Structure to pass surplus and flood waters downstream to prevent over topping of the dam.
Storage capacity	Storage volume of water stored in the reservoir; used for power generation.
Switchyard area	Area where outdoor/indoor switching equipment are installed or electricity substation and control structures through which the power is transferred from the hydropower plant to the transmission lines.
Tailrace	Canal that carries water away from the powerhouse after electricity generation to discharge into a natural stream.
Tunnel or headrace channel	Channel designed to maintain the head between the intake and powerhouse to divert water to the penstock.
Turbines	Engine in a powerhouse that rotates with the force of falling water to generate electricity with the help of generator.
Vulnerable groups	Vulnerable people are those who by virtue of gender, ethnicity, age, physical or mental abilities, or social status, may be more adversely affected by adverse impacts as defined by the Government of Nepal.
Weir	Dam on a river to stop and raise the water level for the purpose of conveying it to a mill, forming a fish pond, or the like.

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1

Introduction

1.1 Purpose of the Manual

This Environmental Impact Assessment (EIA)[1] Manual has been developed by the Ministry of Forests and Environment to facilitate the sustainability of the hydropower sector development process in Nepal and provide guidance on "good practices".

Global experiences indicate that inadequate and lack of proactive management of environmental and social issues can have significant and adverse impacts on the cost, quality, security, and schedule of hydropower project planning, construction and operation.

An EIA's comprehensiveness and its quality offers the very foundation to facilitate the hydropower project development processes by:

1. Identifying and addressing environmental and social risks and impacts, opportunities and management strategies.
2. Focusing on resources and attention where it is required the most.
3. Identifying stakeholders and gaining support and building understanding with stakeholders.
4. Informing decision-makers with the necessary evidence to support further action.

This Manual enforces a comprehensive EIA adhering to the spirit of Environment Protection Act and associated Environment Protection Rules[2] and National EIA Guideline and international good practices for sustainable hydropower development. This Manual has been developed within the framework of existing Policies, Acts and Regulations of the Government of Nepal to be used as a reference document and will not supercede prevailing laws.

1.2 Use of the Manual

The Manual is prepared for government authorities, hydropower developers, consultants, civil society groups and others. Specifically, the Manual can be used at different phases and for different purposes for the preparation and review of EIAs for hydropower projects:

1. EIA study by the proponent;
2. Follow up and review of EIA report by the Government and stakeholders;
3. Planning environmental, social, health, safety and security monitoring by the proponent;
4. Undergoing monitoring of compliance and conducting the audit by the government.

The Manual can be used for all types of hydropower projects that require an EIA based on the Environment Protection Act and its regulations, particularly Schedule-2 of the regulations. It aims to facilitate the EIA process for all hydropower projects such as run-of-river (diversion and/or storage), storage reservoir and pumped storage facilities and associated facilities of the project such as power transmission lines, substations, construction materials management, and access roads.

[1] Reference to EIAs inherently includes social impacts and thus the term Environmental and Social Impact Assessment (ESIA) is not used throughout.

[2] Environment Protection Act (1997); Environment Protection Rules (1997).

The Manual can be used in conjunction with Nepal's standards, administrative systems and processes and guidelines to be followed for all EIAs in Nepal. The Manual does not include Initial Environmental Examination (IEE) process defined in Schedule 1 of the Rules. However, proponents pursuing an IEE can benefit by following the "good practice" recommendations.

As per Government of Nepal directive in 2009, hydropower projects with a capacity between 1MW and 50MW are subject to only an IEE. However, good practice recommends the use of this Manual for hydropower projects that demonstrate environmental & social impacts that are diverse, irreversible or unprecedented, irrespective of installed capacity (including projects 50MW or less). A potential impact is considered significant if it may be irreversible (such as loss of a major habitat), affect vulnerable groups or ethnic minorities, involve involuntary displacement and resettlement, or affect significant cultural heritage sites. Project proponents and developers are encouraged to seek guidance from the Ministry of Forests and Environment for clear direction on the above. The overall objective is to ensure an appropriate assessment of project risks and mitigation measures that will enable a well planned, well managed and well executed project delivery and help avoid cost overruns.

After providing an overview of the hydropower sector in Nepal, the Manual outlines the approach for preparing, submitting, reviewing and implementing EIAs related to hydropower in Nepal.

i) Section 4-Stakeholder engagement and public participation
ii) Section 5-Screening process for hydropower project proposal
iii) Section 6-Scoping and developing terms of reference for the EIA study
iv) Section 7, 8 & 9-Identifying, assessing and managing environmental and social impacts
v) Section 10-Reporting Section and
vi) Section 11- Reviewing EIAs

1.3 Consideration of Other Manuals

While following this Manual, hydropower proponents and developers are advised to seek further guidance from manuals prepared by MoEWRI.[3]

[3] Published by the Department of Electricity Development, these include: Manual for Preparing Scoping Document for EIA of Hydropower Projects; Manual for Preparing Terms of Reference for EIA of Hydropower Projects, with Notes on EIA Report Preparation; Manual for Preparing Environmental Management Plan (EMP) for Hydropower Projects; Manual for Public Involvement in the EIA Process of Hydropower Projects; Manual for Developing and Reviewing Water Quality Monitoring Plans and Results for Hydropower Projects; Manual for Addressing Gender Issues in the EIA/IEE for Hydropower Projects and; Manual for Conducting Public Hearings in the EIA Process for Hydropower Projects.

2

Hydropower in Nepal

2.1 Sector Summary

The Government of Nepal estimates a total national theoretical hydropower generation of 83,000MW[4] whilst only about 70% of the population had any form of electricity supply in 2017. The current installed capacity stands at just above 1000MW. The Ministry of Energy, Water Resources and Irrigation forecasts a 30% increase in electricity demand from 2015 to 2020, requiring an increase of 3,384 MW in installed capacity. To address the shortage in electricity generation in Nepal, the Ministry of Energy, Water Resources and Irrigation, the Office of the Investment Board and other government agencies continue to prioritize the implementation of hydropower projects.

The Nepal Electricity Authority (NEA) prepares an Annual Report summarizing the state of the hydropower sector in Nepal, including the total energy available, generation capacity and other metrics from both the NEA itself and Independent Power Producers (IPP).[5] The total available energy in 2015 includes NEA's 43 percent, IPP's 34 percent and import from India at 23 percent.

2.2 Types and Components of Hydropower Projects

Refer to the glossary for brief descriptions of individual elements of a hydropower project and commonly used terms and to Figure 1 for an example of a typical storage reservoir hydropower project.

2.2.1 Overview

Hydropower plants are power generation facilities that allow the use of water resources to generate electricity. Hydropower development involves the construction of a water diversion and intake structure to convey available water to the powerhouse containing hydraulic turbines. Water flows through the hydraulic turbines connected to the electricity generators. The electricity produced is then sent to a substation and distributed using high voltage power transmission lines.

2.2.2 Hydropower Schemes

Major hydropower schemes are categorized based on the water diversion and storage characteristics. The major hydropower types considered for the purpose of this Manual are presented below.

Storage reservoir hydropower plant

A storage reservoir hydropower plant involves the construction of a dam to store large volumes of water and sustain stable hydraulic head for power generation. Residence time of water upstream of the dam could be months or several years. Such type of plant retains water during high flows (i.e. rainy season) and releases water for hydropower generation during low flows (i.e. dry season) or throughout the entire year resulting in a high fluctuation in storage reservoir elevation. Storage reservoir hydropower plants can be used either as a base load or peaking plant, depending on the demand of the regulating authority.

4 Ministry of Energy, Electricity Demand Forecast Report 2014-2040, accessed http://moen.gov.np/pdf_files/Electricity-Demand-Forecast-Report-2014-2040.pdf (as of January 2017)

5 http://www.nea.org.np/annual_report

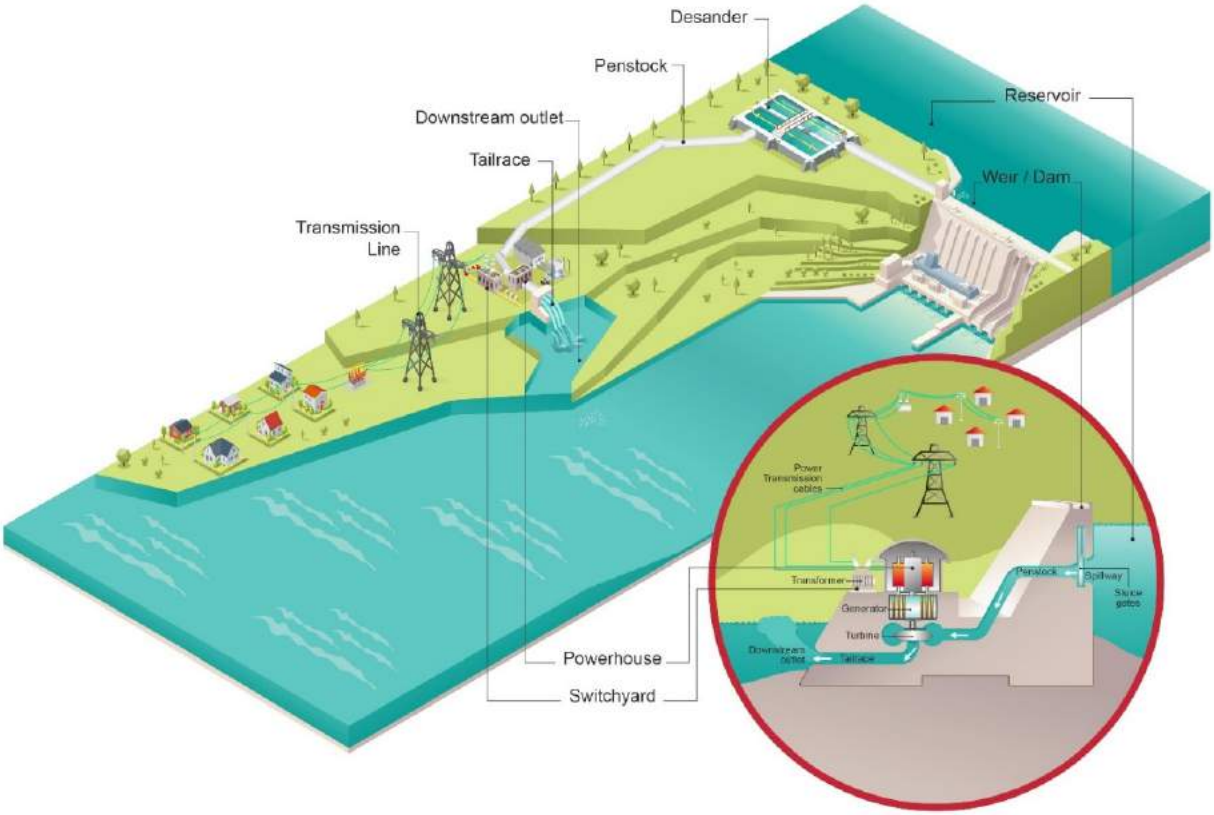

Figure 1: **Typical storage reservoir hydropower project (IFC & GHD, 2017)**

Depending on the design configuration and topographic condition of the area, storage reservoir dams create significant changes in existing flow conditions of the river network and inundation of a portion of the watershed. Storage dams alters natural sediment flow in the river and are usually designed to have flushing tunnels to periodically release sediments accumulated at the upstream reservoir.

Depending on the design configuration and topographic condition of the area, storage reservoir dams create significant changes in existing flow conditions of the river network and inundation of a portion of the watershed. Storage dams alters natural sediment flow in the river and are usually designed to have flushing tunnels to periodically release sediments accumulated at the upstream reservoir.

Pumped Storage Hydropower Plant

A pumped storage hydropower plant involves building two water containment structures to create an upper and a lower reservoir. Water is pumped from the lower reservoir to the upper reservoir during low electricity demand. Water from the upstream reservoir is then released during peak demand. This back and forth pumping and power generation cycle provides the advantage of maximizing water resource for power generation, particularly during daily peaking demand. The impacts associated with this type of power plant are similar to that of the storage and peaking dams.

Run-of-River/Diversion Hydropower Plant

This plant consists of a relatively small diversion structure or weir, a diversion tunnel or penstock, and a downstream powerhouse. The weir diversion structure is of relatively lower height with relatively minimal water retention upstream of the intake structure. These projects are typically used as base load, which allows the use of available water for power generation at any time.

Water diverted from the weir intake structure to the powerhouse is then returned to the river through the tailrace. The river section between the diversion structure and the powerhouse/tailrace is deprived of its natural flow when water is diverted to the powerhouse during power generation.

Assessing the impacts of this diversion and reduction in natural flow at a certain section of the river during operation would be necessary.

Run-of-River Reservoir Hydropower Plant
This scheme creates a storage reservoir upstream of the diversion structure or weir to create substantial hydraulic head and resulting power generation capacity. Water retention capacity of the upstream reservoir is usually several hours, or days, to maintain stable supply of water volume for hydropower generation. Similar to run-of-river diversion hydropower plants, the reservoir type will also result in depriving a certain section of the river of natural flow ('dewatered segment') during power generation. This section is also called the 'curtailed reach'.

Impacts associated with this type of scheme include inundation of reservoir areas and changes in in-stream flows.

2.2.3 Ancillary Elements

Ancillary elements are activities, facilities and infrastructure directly related to and usually funded by the project. These can include (not exhaustive):

- Access roads and bridges
- Quarries and waste disposal areas
- Stockpiling areas
- Crusher plant
- Bunker (if required)
- Construction worker's camps and associated cafeterias and food processing areas
- Site office
- Lay down areas
- Maintenance areas

An access road is the road used to reach the hydropower project, as well as any additional roads to the various components of the project. Access roads can include roads used to bring construction materials and mechanical and electrical equipment to the site. The length and width of the access road may have important environmental impacts by creating corridors through landscapes up to 30 meters wide (road, plus associated drainage, foundations, etc.).

To construct a larger hydropower project may require hundreds or thousands of construction staff. As such, there is a need to provide them accommodation when they are not working, along with all ancillary elements including but not limited to potable water, washing water, food mess halls, sewerage infrastructure, laundries, etc.

Additionally, there will be a need for lay down areas to store construction equipment. Further, if a reservoir wall is to be constructed, raw materials will need to be sourced to build the wall. As such, it is highly likely that a quarry will be needed to source the material from. This same site, or an alternate site may also be needed for the placement of waste spoil during construction.

All these issues should be considered as part of the greater project, particularly for the EIA when considering the entire construction of a hydropower project.

2.2.4 Associated Facilities

Besides the infrastructure storing, diverting and producing electricity, there are many other associated facilities are needed for a successful hydropower project. Associated Facilities are defined as "Facilities that are not funded as part of the project, and; that would not have been constructed or expanded if the project did not exist, and; without which the project would not be viable." Therefore, to be defined as an Associated Facility, there has to be mutual dependency, for example:

- **Roads:** In addition to ancillary access roads built as part of the project (Section 2.2.3), additional new or upgraded roads may be funded/planned outside of the project which are only viable due to the opportunity presented by the project taking place – e.g. additional power, population centers, forest clearance, resettlement, etc.
- **Transmission lines/hubs:** Transmission lines are used to evacuate the power generated by the hydropower project and make it available for use by transferring it to either domestic or cross-border urban centers. They vary in terms of measured kilometers (km) of length and kilovolts (KV) of power running through them. Large capacity transmission lines often require a 50 – 60 meter wide corridor which has to be cleared of trees over 3 meters height. Individual electric towers may have a footprint of 15 x 15 meters. Transmission lines may also have associated roads or tracks to provide maintenance access.

2.3 Project Phases

This section describes the key phases of a typical hydropower project over its lifecycle. See Section 8 for detailed discussion of impacts associated with operation activities during each phase and Section 9 for impact management measures. Appendix D comprises a matrix describing some of the impacts and management measures associated with various aspects of the environment during each project phase.

Pre-construction Phase

Pre-construction activities involve pre-engineering investigation to determine the feasibility of installing a hydropower facility within the pre-identified areas. Activities include hydrological studies, geological and geotechnical investigation, site surveys, seismic investigations, identification of potential quarry sites, construction of new access roads, initial environmental investigations, stakeholder mapping activities, securing approvals and permitting processes.

The initial phase is critical in determining whether or not a project can proceed to the construction phase. The geological and geotechnical testing and investigation requires bringing in of drilling rigs and construction of access roads. Road surfaces and bridges may need to be reinforced when planning project pre-construction and construction phase logistics due to the challenge of transporting heavy equipment along small, mountainous roads with low overpasses and hanging cables, etc.

At this stage, the project affected communities are consulted and engaged. The project proponent is responsible for providing sufficient information about project development activities, to facilitate better understanding and informed decisions by the community/regulatory authorities.

Misinformation about the project can result in community protests at early stages of project development. It is therefore, necessary to develop an effective stakeholder engagement plan and implement it throughout the project life cycle. Land acquisition and negotiation is also undertaken during this stage which may potentially cause involuntary resettlement, livelihood and economic displacement. A land acquisition, resettlement and livelihood restoration plan is prepared as needed depending on the social impacts identified.

Construction Phase

Construction activities include building the major components of the hydropower facility. Such components include a diversion structure, weir or dam, water intake structure, headwork such as penstock and tunnels, powerhouse, tailrace pipeline or tunnel, substation or switchyard, power transmission lines, and access roads.

During this phase, a construction workers' camp, spoils disposal area, laydown areas, access roads, water treatment plant, concrete batching plant, aggregate crushing plant are also established to support construction activities. The construction program could take years (e.g. on average three to five years) before the hydropower plant can start operating.

Site preparation activities include removal of top soil, earthmoving activities which may involve blasting, filling, and tunneling. Quarrying and transport of filling materials are also required. Hydropower facilities are usually built in remote areas requiring the opening up of new access roads. Weir and dam construction require careful foundation filling and concreting work to ensure building according to structural design plans. Site preparation and tunneling work generate spoils that should be properly disposed of in a designated spoils disposal area.

Headwork and tailrace work include laying of conveyance pipes from point of diversion to discharge. Powerhouse constructionn involves civil works and installation of hydropower turbines and other electro-mechanical equipment.

Commissioning Phase

Extensive testing and commissioning work is required prior to full hydropower project operation. Tasks such as reservoir preparation, coffer dam removal, waterway filling, fish ladder/fish passage operation and electrical/mechanical device testing require detailed planning, consultation and coordination during the commissioning process. Immediately upon completion of satisfactory commissioning, a trial operation and reliability run of between 3 and 30 days may commence.

If the project includes establishing a reservoir, this will result in the inundation of areas of the same elevation as the operating level of the dam, including existing vegetation, potential farmlands or areas of economic value to local communities. If settlements are present, these structures will be submerged.

Operation Phase

The hydropower plant has a full operating life span of 50 to 100 years. Turbines are designed to continuously operate with regular routine maintenance checks. The powerhouse serves as the main control room/office for operating the power generators. Hydropower facilities are sometimes promoted as a tourist destination once they are in full operation.

The operation of the hydropower facility will result in fluctuation of flow releases downstream of the tailrace section of the dam whereas the section between the toe of the dam and the tailrace may experience reduced flows depending on the operational rules of the hydropower operator. Good international industry practice recommends maintaining environmental flow along the curtailed section of the river between the dam and the tailrace.

Decommissioning and Rehabilitation Phase

The decommissioning of a hydropower plant is not usually done until the plant has served its useful life and in accordance with a dedicated decommissioning plan, usually drafted as part of the detailed design package. Decommissioning of hydropower facilities during their useful life is not common, unless there is a need to replace the facility, catastrophic damage resulting from a natural disaster or if sedimentation build-up upstream of the weir/dam has resulted in significant reduction in storage

capacity. Hydropower facilities usually serve their purpose for a very long time, and are passed on from one generation to the next.

In the event that the hydropower plant has to be decommissioned, activities are dependent on the hydropower scheme in question but may include: Demolishing the powerhouse, weir, penstock and/or pipelines; Storing, reusing, reselling or disposing of materials in a responsible manner (e.g. identified waste disposal area). Turbine equipment can often be sold or refurbished for potential reuse.

Decommissioning of a high dam can be especially challenging so high dams or large hydropower storage facilities can often remain as originally established and be regularly maintained for recreational purposes. Large hydropower facilities that have been offline for several years can be rehabilitated, as necessary, and operated again.

Ancillary elements of a hydropower project may need to be decommissioned, either directly post-construction of the facility or at the end of its useful life along with the main hydropower project components. The impact assessment for the decommissioning phase of facilities is equally as important as during the construction phase.

3

EIA Process for Hydropower

This Manual should be used in conjunction with the Nepal's National EIA Guideline which dictate the minimum standards, administrative systems and processes and templates to be followed during an EIA for any qualifying project. Where appropriate, good international practices have been included with this Manual to augment the standard EIA approach, and assist hydropower project proponents in better defining environmental and social risks, responsibilities and opportunities.

The formal process of EIA in Nepal should be coordinated with the process of technical feasibility studies, project design and stakeholder engagement to maximize opportunities for an efficient, safe and effective development. Table 1 and Table 2 define the steps required to prepare the Scoping Document (SD), Terms of Reference (ToR) and the Review and Approval process in accordance with the National EIA Guideline.

Table 1: Scoping Document and Terms of Reference Review & Approval Process

Preparation of SD and ToR by the Proponent
Publication of a 15 day notice in a national daily by the proponent to a) inform concerned local organizations and individuals about the proposal in brief; b) define the local levels that maybe be affected by the proposal implementation; and c) solicit their concerns and suggestions on the proposal.
Preparation of the scoping document (SD) after field study and consultations/interactions with stakeholders and preparation of the terms of reference (TOR) based on the scoping document by the proponent/consultants
Submission of the SD and TOR by the proponent to the concerned Ministry.
SD and TOR forwarded to MOFE by the concerned Ministry along with its comments/ suggestions or recommendations for approval.
Formation of the EIA Report Suggestion Committee (RSC), chaired by Joint Secretary of MOFE.
Review SD and TOR by the committee members; send a letter to the proponent for revision of SD and TOR as per suggestions of RSC; and submission of revised SD and TOR to MOFE by proponent.
Internal decision process in MOFE regarding conditional/unconditional approval/disapproval or requirement for resubmission with modifications.
Notification to the concerned Ministry about the conditional/unconditional approval/disapproval.

Table 2: EIA Report Review & Approval Process

Preparation of EIA report by the Proponent
Desk Study/Field study, preparation of draft EIA report based on the approved TOR.
Conduct public hearing by the proponent in the area of rural municipality/municipality (new local bodies) where the project has been proposed to be implemented; collect public opinion /comments/suggestions on the proposal.
Collection of recommendation letters from all concerned rural municipalities/municipalities (new local bodies)/stakeholders such as CFUGs.
Submission of EIA report by the proponent to the concerned Ministry.
EIA report forwarded to MOFE by the concerned Ministry along with comments/suggestions or recommendations for approval.
Disclosing the EIA report for review/comments by publishing a 30 day notice in a national daily newspaper by MOFE.
Review EIA report by committee members of RSC; send letter to the proponent for revision of EIA as per suggestions of RSC; submission of revised EIA to MOFE by proponent.
Internal decision process in MOFE regarding conditional/unconditional approval /disapproval or requirement for resubmission with modifications.
Notification to the concerned Ministry about the conditional/unconditional approval/disapproval.

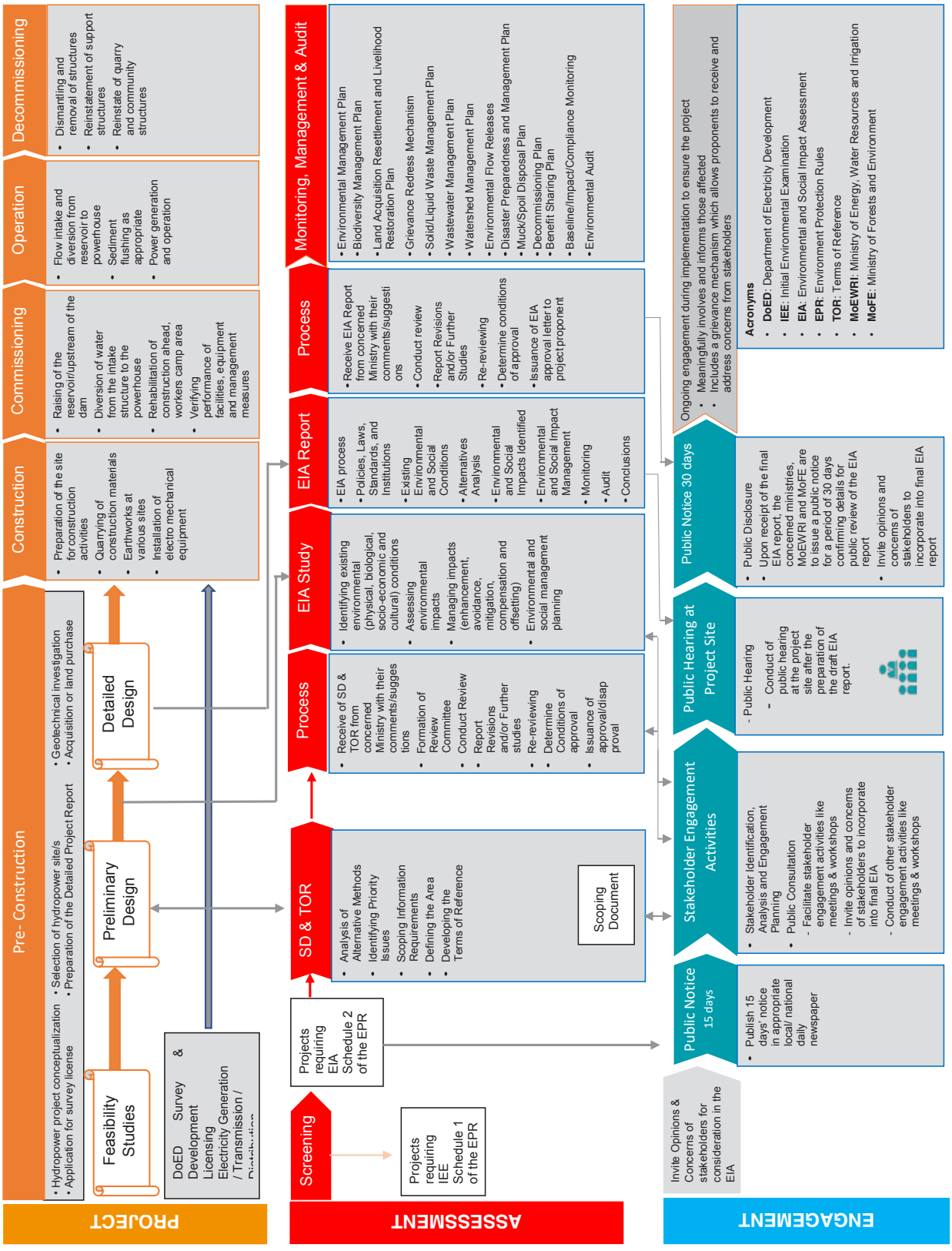

Figure 2: Integrated overview of the EIA Process in Nepal

4

Stakeholder Engagement

The overall schedule, cost and effectiveness of an EIA and even the project itself, is often determined by the quality and success of stakeholder engagement activities. Early, effective, earnest and continuous engagement can help ensure an informed debate, offset potential opposition and improve outcomes for all stakeholders. Figure 2 indicates how the stakeholder engagement process is linked to corresponding EIA and project development processes in Nepal.

The Rules establish the importance of stakeholder engagement for infrastructure development in Nepal. A high level overview of the purpose, benefits and methods of ensuring stakeholder inputs into the EIA process is provided in the National EIA Guideline - specifying that community participation is to be actively sought at the onset (Scoping), execution (Engaging) and completion (Disclosure) of the EIA process.

However, established international good practice is to seek effective engagement with stakeholders through disclosure of project information and ongoing (continuous) consultation with local communities on matters that directly affect them -throughout the hydropower project lifecycle: Project identification / Screening (pre-feasibility); Scoping (feasibility); EIA study; EIA report submission / review; Implementation of environmental protection measures; Monitoring, evaluation and auditing. This process should be guided by a comprehensive Stakeholder Engagement Plan, prepared and made available at the commencement of the project.

To ensure compliance with national regulations and good practice, the proponent should ensure that stakeholder consultation and engagement is extensive and is used to garner genuine stakeholder input on perceived environmental and social risks and opportunities. The user committee or concerned committees engaged in stakeholder consultations should have mandatory participation from women and vulnerable groups so that their voices and opinions are taken into account. Local people may be the source of information and should be engaged in such a way to ensure they have a chance to understand and inform project activities and their implications.

Consultation processes can sometimes underachieve their goals simply because the stakeholder engagement team do not fully understand their project. To counter this risk, the stakeholder engagement team should have a high level of professional social science expertise, complemented by in-depth knowledge of the specific hydropower project components and activities to be undertaken during the various phases. The team should be prepared to communicate this knowledge with the various stakeholders in a manner that is easy to understand and avoids misunderstanding of information.

Complementary to Nepal's National EIA Guideline and to meet international good practice standards, the following sub-section provide details on stakeholder identification/analysis, stakeholder engagement processes/methods and public disclosure to be undertaken at various stages in the project development and EIA process. Further good practice guidance to inform the stakeholder engagement process is widely available online.

4.1 Stakeholder Identification and Analysis

Stakeholders are persons, groups or institutions who are directly or indirectly affected by a project, as well as those who may have interests in a project or the ability to influence its outcome, either

positively or negatively. Appropriate and robust stakeholder identification and analysis during the early stages of project (ideally during the scoping phase of the EIA) is important to ensure the success of the stakeholder engagement process.

The stakeholder identification and analysis should be an iterative process and consider the following:

- The whole range of stakeholders should be identified and engaged to reduce risks to the project, such as protests and conflict.
- Within communities, there may be different needs, dependencies, vulnerabilities and opinions about a project, based on gender, caste, ethnicity, age, education levels, language skills, social status and other cultural nuances. The stakeholder identification should be employed as a tool to understand and acknowledge these differences and ensure representation from various groups.
- Acknowledge that different stakeholders would be critical at different stages/phases of the project. For example, construction workers and workers' associations would be an important group of stakeholders during the construction phase of the project.

Key stakeholder groups to consider include:

- Project proponent, partners and financiers
- Government agencies and administrative bodies such as urban and rural municipalities involved in hydropower development at provincial/district and local level
- Key informants such as local/regional leaders, community headpersons/elderly, academics, expert advisory groups and customary institutions, such as Guthi
- Civil society organizations (CSO) and non-government organizations (NGOs)
- Local community groups, interest groups, beneficiaries and user groups within the project area of influence
- Vulnerable groups within the project area of influence, such as those who - by virtue of gender, ethnicity, age, physical or mental abilities, or social status - may be more adversely affected by negative impacts, including the following:
  - Elderly (all citizens above the age of 60)
  - Janajatis/ethnic groups and people/Indigenous People
  - Dalits (especially, elderly, women and children)
  - Single women (especially unmarried, divorcees and widows)
  - People with disability
- Users of land/resources within a specific area that may not be members of the local community
- Local businesses, service providers (schools, hospitals, and others)
- Industry and business representatives of various industries/businesses in the project area of influence such as tourism, agriculture, and others
- Contractors for pre-construction, construction and operation activities
- Project workers

Tools to identify stakeholders include stakeholder mapping, web searches, site investigation, local knowledge of key informants, existing studies/reports on the project or the area and government documents, among others.

Often due to the scale of hydropower projects, a large number of stakeholders are involved. It is important to analyze stakeholders based on their level of interest/impact and influence. The matrix in Figure 3 can assist in stakeholder analysis and prioritization.

To register stakeholders and manage their feedback through the life of the project, it is critical to maintain a record of stakeholders. Stakeholder contact details and meeting and interaction notes, should be maintained in an appropriate database.

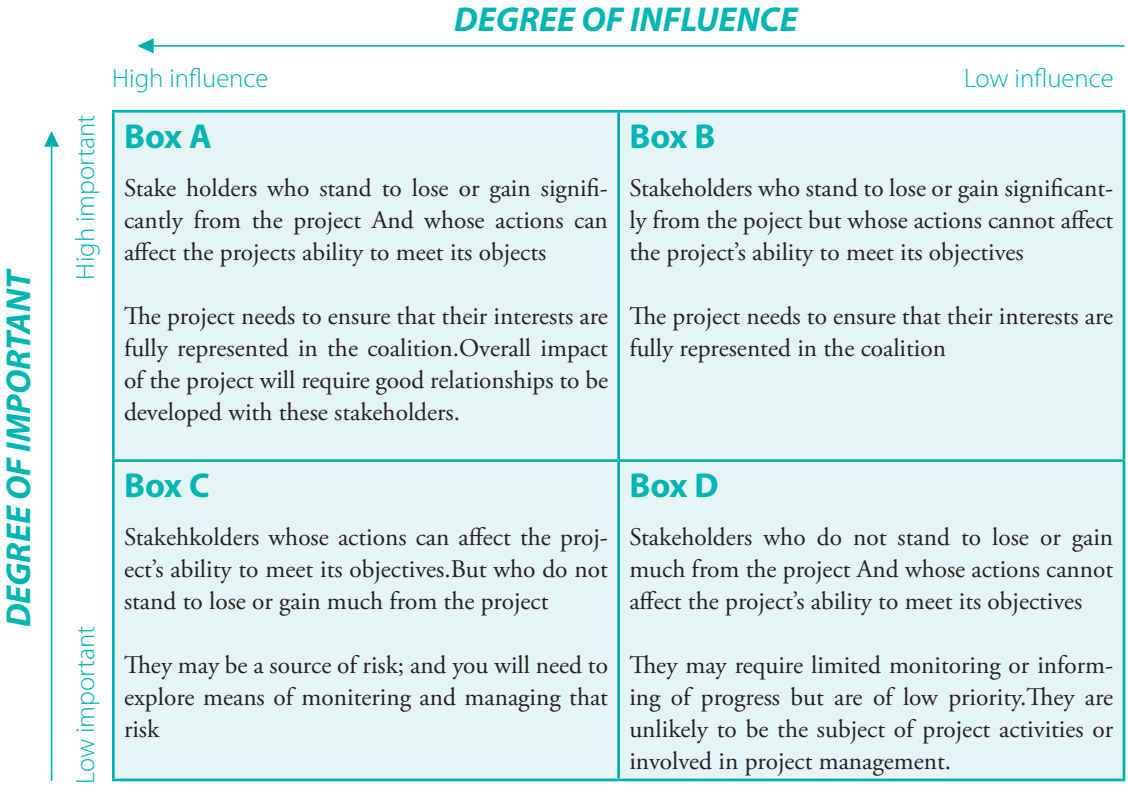

Figure 3: Stakeholder Analysis Matrix

4.2 Stakeholder Engagement

Nepal's legal regime on EIA provides ample opportunities for people potentially-affected by a project to participate, as summarized in Table 3.

Key considerations in stakeholder engagement include:

- Recognition of the differences between various stakeholders and the need to engage with them in a manner that suits them to ensure meaningful and inclusive participation, which includes ensuring adequate representation of women and vulnerable groups in consultations (e.g. ensuring active participation of women in the executive committee and should any consultative bodies be established for the purpose of engagement, conducting different meetings for men and women, etc).
- Level of education/literacy of the various stakeholders, language and the use of technical terms, consultations should be in the local language to ensure stakeholders understand.
- Recognize and respect cultural sensitivities and nuances.
- Local conflicts, power dynamics and respective vulnerabilities within and between communities.
- Degree of access to information sources/technologies. This is especially important in the age digital/social media when there is ample opportunity for the circulation of untruths and unsubstantiated information.
- Application of the process of informed consultation and participation and where the specific circumstances require it for affected Indigenous Peoples, follow appropriate guidelines for ensuring Free, Prior and Informed Consent (FPIC).[6]

[6] International Labour Organization (ILO) Convention 169 'The Indigenous and Tribal Peoples Convention' to which Nepal is a signatory.

Table 3 : Summary of stakeholder engagement activities in EIA

EIA / Project Phase	Stakeholder engagement activities to be undertaken
Screening	Initial identification of key stakeholders and stakeholder groups that may be impacted, benefited and/or interested in the project.
	Inception meetings with high level government authorities and line agencies about the purpose and scope of project.
Scoping	Detailed identification and listing of all stakeholders that may be impacted, benefited and/or interested in the project.
	Inform all project stakeholders, of the determination of area of influence, understanding of existing conditions and preliminary identification of impacts arising from the project.
	Preparation of a project wide stakeholder engagement strategy/plan.
	15-days public notification by the proponent in a national daily newspaper - inviting public to participate in the scoping and preparation of the EIA.
	Analyze and reflect stakeholder opinions and concerns in the EIA Scoping Document and TOR.
	Develop project policies, protocols, procedures for stakeholder engagement.
	Develop a complaints/grievance mechanism.
	Set up communication tools to allow stakeholder feedback – email, phone, social media, office front, postal address, media, etc.
EIA study	Ongoing stakeholder engagement activities to inform the preparation of the EIA, including validating the socio-economic baseline information, understanding impacts, developing mitigation management strategies and preparation of various plans as part of the EIA.
	Public hearing program at the project site after the preparation of the draft EIA report, as per the Rules. This offers local people and interested public an opportunity to voice additional issues and concerns to be considered in the final EIA report.
	Submit recommendation letters of the concerned urban and rural municipality with the final EIA report. This legal provision in the Rules further provides peoples' representatives an opportunity to raise issues.
	One-month public notification by the Ministry, as per the Rules, for inviting public feedback to final EIA report. This allows interested people an opportunity to check the EIA report against its approved TOR, and to provide inputs to the decision-making process.
	Commencement of consultation / negotiation activities for land acquisition for the project.
Detailed design, Construction, Commissioning, Operation and Decommissioning	Ongoing consultation with stakeholders as per the Stakeholder Engagement Plan, to inform them of project progress and gather updated information of their issues/concerns.
	Grievance management mechanism.

Various methods of stakeholder engagement should be considered and applied, depending on the specific project context, including the following.

- Community meetings and exchanges of information at project sites, district offices, etc.
- Public hearing and dialogue with local leaders and users/target groups (existing and those identified during the stakeholder mapping exercise)
- Public notifications by national and local newspaper, radio
- Posting of notices at public locations in the project area that people may visit frequently, particularly in the offices of municipalities, health posts, schools, etc.
- Panels comprising representatives from concerned organizations and local people
- Online forums and social media (as they grow in popularity, for example, spreading information via facebook pages, project website, etc.)
- Opportunities for stakeholder review of draft reports and monitoring/evaluation results
- Opportunities for one-on-one consultations and focus groups should be provided for specific groups and particularly for those that are most directly affected by the project, vulnerable groups, women and the elderly.

4.2.1 Stakeholder Engagement Plan

A Stakeholder Engagement Plan should be developed to specify who, how, why, when, what and where and in which language stakeholders should be consulted, and to ensure that:

- All necessary information is obtained during stakeholder engagement to facilitate identification of stakeholder issues and concerns
- A mechanism is put in place to ensure that the findings from stakeholder engagement are considered in the EIA and in the evolving project design
- Local knowledge is gathered to be used in impact and mitigation measure identification
- A pro-active communications strategy is put in place to ensure accurate, timely and two-way exchange. This should include anticipating questions that stakeholders may have about the project and developing clear and easy to understand standard responses to these questions. All project personnel should have access to the same set of information and key messages.
- The project is implemented in a way that meaningfully includes and informs those affected.
- A grievance mechanism is in place, specifying how stakeholder concerns will be received/addressed.

4.2.2 Grievance Management Mechanism

A grievance management mechanism should be developed at an early phase of the project for receiving, evaluating and addressing project related grievances from affected communities at the level of the company or the project as a measure to preempt rather than react to escalation of tensions with local communities, and regularly monitored.

A properly designed grievance management that is well supported and understood by the local communities increases the likelihood of resolving disputes quickly. Factors to consider to ensure an effective grievance mechanism include:

- Clear processes that are culturally appropriate, easily accessible, transparent, free of cost to all stakeholders and prevents retribution without impeding access to other remedies.
- Appointing a female member in its core team.
- Contractors and sub-contractors to have their own internal mechanisms in place to manage grievances.
- Ensuring that the project has in place appropriate and adequate resources - people, systems, processes and budget to support the effective operation, management and monitoring of the mechanism.

5

Screening

Screening is the initial process through which a prospective hydropower project proponent clarifies the purpose and rationale for the proposal, identifies opportunities for alternatives to the project, considers the environmental issues associated with it, and determines what form of environmental assessment is required according to the EPR, 1997.

5.1 Purpose and Rationale of the Project

Issues to be considered by a prospective hydropower project proponent should be a part of the project planning and feasibility study process.

The key questions to address are: What is the rationale of the project? What is the problem or opportunity being addressed by the project? Whether the project is complementary to the long-term policy, plans and strategies of the Government of Nepal? What is the best method/ technology/location to address the problem or generate opportunity? What type of hydropower and development projects are operating or being planned in the same watershed and whether there are any existing integrated river basin plans relevant to the proposed project?

5.2 Analysis of Alternatives to the Project

When considering the purpose and rationale for the project, the proponent should explore Alternatives to the project: The various technically and economically feasible ways to address the problem or opportunity (e.g. to provide a certain amount of electricity for domestic consumption or export).

The alternative analysis to the problem of a lack of electricity and/or opportunity to export electricity may include: Energy efficiency measures to reduce waste, demand-side measures, etc.; Alternative means of generating electricity (e.g. thermal, solar or wind generation, etc.).

The analysis of project alternatives should also consider the 'non-implementation scenario' which requires the proponent to consider and describe the implications of doing nothing (i.e. not addressing the problem or opportunity).

5.3 Screening of Proposals

All hydropower proponents must screen their proposed projects according to the Rules once the alternatives are considered to determine if they should:

a. Conduct an IEE – to be supervised and approved directly by the MoEWRI with no oversight from the MoFE, or;

Box 1: Project Characteristics

- Purpose and rationale of the project
- Review of alternatives
- Project areas and proposed locations (catchment area)
- Relevant policies, laws, standards and guidelines
- Licensing protocols (survey, construction) – see DoED website
- Other hydropower / development projects operating / planned in the same watershed
- Existing, integrated strategies, plans, impact assessments and/or collaborative platforms relevant to the river basin
- Key characteristics and components (technology, capacity, mode of operation)
- Sources of raw materials
- Transportation and site accessibility
- Grid connection requirements, power transmission line capacity, possible routes
- Substation capacity, proposed location and footprint
- Equipment, power, water supply and manpower requirements
- Project phasing plans: Pre-construction, construction, commissioning, operation, and decommissioning
- Summarize identified risks and assumptions

b. Conduct an EIA – to be led by the MoEWRI with oversight and conditional or unconditional approval by the MoFE.

The Rules provide specific minimum screening criteria for determining whether various project types are to be subject to either IEE (Schedule 1) or EIA (Schedule 2). Proponents should review the criteria for all project types to check if criteria seemingly unrelated to hydropower projects may be triggered by their specific project activities.

Screening is usually performed by the hydropower project proponent themselves, with or without the assistance of third-party consultants, and under the Rules.

Box 1 outlines key project characteristics to allow the Ministries to review and verify that the proponent has demonstrated sufficient understanding of their proposed project, identified all applicable legislation and reached a reasonable conclusion regarding the requirement for EIA (or IEE). A project proposal may be re-designated by either the MoEWRI or MoFE if they are of the opinion that the proponent has not correctly identified the applicable IEE or EIA protocol. Good practice recommends that proponents consult with both the MoEWRI and MoFE during this process and are encouraged to submit a Project Screening Report to the MoEWRI (copied to the MoFE).

6

Scoping

With the screening process having determined the need for an EIA, this section describes the next stage of Scoping; the process of defining the approach, extent and key characteristics of the EIA. Scoping helps to increase the efficiency of the EIA process by ensuring that the time and resources allocated are proportional to the project's size, complexity and potential impacts.

Scoping is typically initiated during the feasibility stage of hydropower project development by publishing a 15 day public notice in a national daily newspaper.

6.1 Analysis of Alternatives

Having explored alternatives to the project at the Screening stage, the proponent should explore Alternative options of implementing the project as part of Scoping the EIA - and in tandem with the technical feasibility studies.

Analysis of alternatives may include:

- Alternative hydropower schemes, technologies and modes of operation, such as storage, peaking, run-of-river generation (Section 2.2.2).
- Technical criteria, such as capacity, difference in head, accessibility, constructability, operation and maintenance.
- Alternative options for associated facilities / ancillary elements (dam sites, transmission line routes, roads, raw materials to be used, sources of energy to be used for the project, etc.).
- Financial considerations, such as capital requirements, operating costs, environmental and social costs and relative returns on investment.
- Project management options: project phasing or schedule.
- Alternatives of the project and forest land.

6.2 Identifying and Prioritizing Potential Issues

The early identification and prioritization of potential issues helps inform the overall approach to the proposed project and EIA.

6.2.1 Identifying Priority Issues

Each project will have its own specific issues relevant to the local context so developing a thorough understanding of those issues, through expert judgment by qualified specialists, is essential.

The scoping process should identify both actual and perceived issues of concern to stakeholders and community members associated with the project. Issues raised by both stakeholders and experts are grouped together to prepare a final long list of issues. These issues should be documented and carefully considered to determine their importance. Only reasonable, legitimate, relevant and priority issues should be shortlisted for investigation during the subsequent EIA. However, proponents should ensure careful communication, with reasoning, regarding any excluded issues determined to be unreasonable, irrelevant or low priority.

6.2.2 Baseline Environmental Conditions

This section should provide a description of the baseline information on the existing environmental conditions of the project implementation area. Table 4 presents a checklist of generic environmental components to be considered for the identification of priority issues to be addressed during subsequent EIA study.

Table 4: Parameters to identify priority issues for hydropower projects

Theme	Parameters to be Considered When Identifying Potential Priority Issues Associated with a Hydropower Project (not exhaustive)
Physical and Chemical Environment	
Weather and climate	Local scale climate change projections / resilience
Hydrology and stream flows	Seasonal flows (i.e. velocity, volumes, duration of high and low flows, timing, frequencies, predictability, etc.) Sediment loads and sedimentation rates along the river channel River morphology and drainage pattern Flood risks
Watershed and erosion potential	Vulnerability of the project area to soil erosion and landslides Potential loss of top soil
Surface water, springs and groundwater quality	Surface and/or groundwater quality / pollution Number, location, seasonal flows and water quality of any aquifers, wells or springs relied on by local communities that could potentially be affected by project-related activities
Geology and geological hazards	Proximity of project components to active faults Vulnerability of the project area to geo-hazards including subsidence, liquefaction, landslides, earthquakes, ground movement, extreme flooding events, GLOFs, and other geological hazards
Sedimentation	Areas prone to erosion and deposition Sedimentation risk and sediment load assessment
Land use and cover	Total land requirement and types. Land uses within the area of influence. Lands within the area of influence declared by the national law as special or critical for various reasons (e.g. ecological, economic or socio-cultural) Areas that are vulnerable to natural hazards as well as those occupied by indigenous cultural communities Sensitive areas such as downstream communities, community forest, relevant social infrastructure (e.g. road and bridges), sacred sites, and areas to be inundated.
Air quality and noise levels	Air quality conditions and point sources Noise point sources and ambient noise levels at sensitive receptors
Landscape values and visual amenity	Landscape values and visual character of the area of influence Visually prominent landscape components or values, structures and other existing infrastructures Interesting features may include places of worship, tourist destinations, populated areas, or other places of interest
Construction materials	
Ancillary facilities	
Biological Environment	
Terrestrial, aquatic and riparian flora and fauna	Terrestrial flora and fauna in the area of influence Riparian flora and fauna in the area of influence (Fisheries and aquatic life) Species of interest (e.g. important to locals) Species considered rare, endangered, threatened and vulnerable Non-timber forest products (NTFP) and ethnobotany Agro-biodiversity Migratory species Invasive species Rare, endangered species based on CITES and IUCN Areas of high biodiversity values Existing anthropogenic influences within the area of influence Susceptibility to anthropogenic and seasonality influences hunting, poaching and illegal trading Forest type and management practices

Theme	Parameters to be Considered When Identifying Potential Priority Issues Associated with a Hydropower Project (not exhaustive)
Natural and critical habitats	National and international designated protected areas Loss, degradation, fragmentation of forest Biodiversity hotspots, biological corridors and connectivity. Direct habitat loss Critical habitats
Ecosystem services	Provisioning, regulating, supporting and cultural ecosystem services
Socio-Economic Environment	
Economic and employment opportunities	Opportunities for individuals' employment on the project Creation of new jobs and need for skills development Opportunities for local/national business to supply goods and services to the project / workers camps / associate industries Impacts on industries like tourism that rely on access to natural assets Livelihoods Local government revenue and service enhancement opportunities
Population and demographic changes	Increase in population of communities that host project workforce / resettled people Decrease in population in areas from where communities are displaced
Community values	Changes to: Community identity, traditions, customary practices, networks and cohesion Community stress, conflict and Impact on law / order arising from project related changes/activities Amenity of areas due to presence of construction activities and construction traffic
Involuntary displacement Disruption to livelihoods and assets	Community severance and demographic shifts Resettlement and rehabilitation of the affected households Changes to: Access to sources of livelihoods Homes, farmland, gardens Community buildings Common property resources (e.g. traditional grazing, common agricultural farms, community resting place) Land and productive resources (may lead to loss of livelihood) Availability of infrastructure, facilities, services and utilities (roads, water supply, rural electrification, education, health facilities, etc.) Potential benefit sharing plans
Health and safety	Emotional and mental stress caused due to resettlement Loss or gain in access to medical and healthcare facilities Spread of diseases Sanitation, hygiene, water and waste management Safety risks from construction activities
Gender	Different experiences of men and women of different social groups of various impacts Increased female labor force participation Ownership and use of compensation amount Land titles for women or joint titles for husband and wife Changes to gender roles/responsibilities and norms Poor and marginalized people
Vulnerable people	Specific issues of relevance to vulnerable people
Dewatered zone (water use right)	Use of water for drinking water supply, irrigation, energy generation, water transport, recreational activities, fishing
Social security	Law and order

Theme	Parameters to be Considered When Identifying Potential Priority Issues Associated with a Hydropower Project (not exhaustive)
Cultural Environment	
Cultural assets	Loss of cultural lands, sites and connection to place (cremation sites) Traditional festivals Traditional lifestyles and practices
Indigenous knowledge and practices	Types and nature of indigenous knowledge
Religious/cultural practices, rituals, and tribes	Types of religion and ritual practice
Language	
Other	
Environmental flows	Changes to environmental flows affecting the physical/chemical, biological, socio-economic and/or cultural environments Impacts due to peaking operations if any

6.3 Scoping Information Requirements

The Scoping information requirements are built upon a deeper understanding of the core project information supplemented as follows as outlined in Appendix C.

Information on Project Proposal

Information relating to the project proposal is presented in Table 5 below:

Table 5: : Information requirements for the project proposal

Information requirements	Minimum requirements	Examples
Project information	Rationale or objectives	Company name and address
	Configuration or scheme	Run-of-river/PROR/Storage scheme
	Details of project components with salient features	Camp sites, storage yard, quarry site, crusher plant, batching plant, vehicle parking area, spoil disposal area, health care facilities, solid waste/waste water management facility, hazardous waste management facility, access road, construction power supply lines, evacuation of generated energy
	Ancillary and associated facilities	Construction materials, work force, construction power, explosives, equipment and machineries
		Administrative unit (location/layout map should be shown in topo map and google image,
		Key project phases
		Blasting/tunnelling
		Flow releases
		Tabular format (e.g. MS Office, Gantt chart)
	Construction requirements	
	Location/layout	
	Anticipated project activities	
	Construction methods	
	Operation methods	
	Project implementation schedule	

Public Notice

To inform the public about the project proposal and key details. Opinions, comments and suggestions will be solicited through the publication of the public notice in national daily newspapers. The sample advertisement shall be presented in this section. Public comments, opinions, and suggestions will be gathered in writing within given period as per provision of EPR, 2054. Sample Public Notice is presented in Appendix E.

Public Participation in Scoping

Public participation is essential in scoping for the EIA. Participation of the stakeholder groups can be achieved through several methods as discussed in Section 4.

Involvement of Multi-disciplinary Specialists

Scoping can be achieved by engaging an EIA study team with specific experience of hydropower projects and common associated environmental and social issues.

Collection of environmental Issues

Environmental issues related to physical, chemical, biological, socio-economic, cultural aspects raised by the general public and identified by key specialists will be prioritized and documented in the scoping document. These issues shall cover the entire project lifecycle. These environmental issues will be categorized as beneficial and adverse for preconstruction, construction and operation stages of the project implementation.

Scoping Document

The results of the scoping exercise will be described in a Scoping Document following the prescribed template presented and the information requirements specified in Appendix F.

6.4 Defining the Area of Influence

This section describes methods for defining the area of influence for the hydropower project EIA. This process includes establishing the geographical boundaries of EIA-related studies based on consideration of natural, social/administrative and spatial boundaries of relevance to the proposed project. Considerations in determining the area of influence are summarized in Table 6.

Table 6: Considerations in Determining the Area of Influence

Areas	Definitions and Descriptions
Spatial extent	The area over which the project components are to be established and wherein physical, chemical, biological, and socio-economic impacts are likely to occur. Areas to be occupied by the hydropower and associated facilities / ancillary elements: Weir/dam, powerhouse, headrace and tailrace (penstock or tunnel), construction and permanent access and haul roads, site and control office, workers' camp, water source and wastewater treatment facility, aggregate quarry site, concrete batching plant, spoils disposal area, switchyard or substation, transmission towers and lines, reservoir or retention area behind the dam or the weir, curtailed reach downstream of the dam until well below the tailrace. Applicable to the project, regional and wider socio-economic levels.
Temporal extent	Considering the evolution of activities over the hydropower project lifecycle (pre-construction, construction, operation and decommissioning) and relating to seasonal variations of physical, chemical, biological and social attributes of the existing environment. Examples include: Natural migration patterns of aquatic species; precipitation patterns; community / cultural activities along the river
Direct impact area	The areas to be disturbed as a result of construction and installation activities of the hydropower project components.
Indirect impact area	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.

The area of influence should encompass both the anticipated extents of direct or indirect potential impacts of the proposed hydropower project, as well as buffer zones to ensure that initial estimates of extent were accurate. For example, the operation of a hydropower facility is likely to result in changes to the upstream and downstream flow regime of the river.

Good practice is to include Ancillary Elements (e.g. reservoir areas and adjacent lands, spoil disposal sites, laydown areas, worker camps, access roads, off-site areas required for resettlement, etc.) and, potentially, Associated Facilities (e.g. power transmission lines) even if they do not belong to the same project or proponent. This is especially the case if it can be demonstrated that the elements / facilities would not otherwise have been constructed without the project, and that, without them, the project would not be viable.

The proposed location of project components, including the area to be occupied by upstream retention or impounding reservoirs as a result of weir or dam operation, and the length of the dewatered stretch of the river downstream of the weir or dam, usually define the 'direct impact area'. However, proponents should also investigate the potential for direct impacts extending below the tailrace (e.g. in the case of peaking operations for instance).

Socio-economic activities of relevance to a proposed project are often not contained within the physical boundaries of the project or a particular area. To be able to capture all stakeholders and project activities and impacts, the socio-economic area of influence can be considered on three levels, including:

- ***Project Level:*** Including the footprint for hydropower project construction and operation, associated project infrastructure, areas under inundation and construction laydown areas.

- ***Regional Level:*** Including administrative boundaries of villages, towns, districts with which the project is likely to have direct interaction. It should include upstream and downstream communities that would be impacted as a result of the project and also communities that would host the resettlement population.

Although good practice recommends that natural and social boundaries should drive the process, the definition of the area of influence should also consider administrative boundaries since relevant development plans, demographic data, institutions and decision-making authorities are often aligned. Identifying and considering impacted communities in their entirety is important to capture impacts on community cohesion and community values.

The temporal extent of the project influence involves considering hydropower development project activities over time – pre-construction, construction, commissioning, operation and decommissioning - and the season of the year when the above phases are planned to occur. This can be done by undertaking modeling studies to determine potential impacts on physical and ecological attributes of the river system, e.g. changes in flow regime, precipitation, socio-economic and cultural practices throughout the hydropower project lifecycle / seasons.

6.5 Developing the Terms of Reference (TOR)

The project proponent should prepare the TOR ideally during the project feasibility stage when sufficient information about project components and configuration is known. It should be prepared as per the prescribed template in this Manual and submitted for approval separately or along with the scoping document. After approval, the TOR becomes an official document, on the basis of which EIA study is supposed to be carried out and can also used as a reference material during the review of EIA report, whose format is given in Appendix G.

In preparing the ToR, a proponent should be looking to answer the following questions:

- What will be done?
- Why will it be done?
- How will it be done?
- When will it be done?
- Who will do it?
- How much will it cost?

Table 7: Terms of Reference Information Requirements

Information Requirements	Comments and Examples
General introduction of the proposal	State the objectives and rationale of developing the hydropower project. The information already presented in the screening and scoping documents will be presented again in this section of the TOR. Additional information/updates/changes to the proposal from the time the scoping document was completed until the development of the TOR should be provided in this section. Provide a map with labels showing the delineated catchment area, and proposed location of the weir/dam, powerhouse, headrace, and tailrace, substation and transmission lines; including project support facilities, etc. Describe the operational characteristics and phasing of the proposed project (pre-construction, construction, commissioning, operation and decommissioning, if relevant).
Relevant policies, legislation and standards	Establish the relevant national and local legislation of Nepal in relation to hydropower development and its associated impacts. A summary of the guidelines, standard procedural aspects, acts, rules, regulations, and policies pertaining to watershed management, forestry protection, water quality and effluent discharge, ecological flows, waste management, etc. should be provided under this section. Dates should be mentioned in Bikram Sambat with English date in parenthesis. Legal provisions that hinders the project implementation should be identified and discussed with possible way out for easement. Relevant international treaties and conventions, in which Nepal is signatory to, and applicable to the hydropower development, should be reviewed.
Study approach and methodology	Proposed approach and methodologies for investigation of physical, chemical, biological, socio-economic and cultural attributes within the project's area of influence. Appendix C: Matrix of common project activities, issues, impacts and management measures. The following matrix provides a summary of common activities (in order of project phase) and associated issues, examples of impacts and typical impact management measures which should be considered during hydropower project development / EIA studies. The EIA Consultant is responsible for identifying and confirming the potential impacts on existing physical-chemical, biological and social environmental baseline conditions based on the understanding of proposed hydropower project development activities and modelling studies to be undertaken by key specialists engaged to perform environmental impact assessment.
Anticipated project impacts	Impacts on the physical, chemical, biological, socio-economic and cultural environment identified and prioritized in the Scoping Document should be discussed and elaborated in this section of the TOR. Potential for cumulative impacts from multiple cascading hydropower project should be noted if relevant.
Analysis of Alternatives	This section shall present the Analysis of Alternatives as per Section 5.2 of this Manual, including the 'Non-implementation scenario' and alternative options for implementation of the project proposal
Environmental Mitigation and Management	A provisional environmental management plan (EMP) shall be developed and incorporated in the ToR document. Because the necessary investigations have not yet been completed at the TOR stage, the EMP section will merely be a framework of anticipated environmental management requirements for the project. The basic hierarchy for managing impacts should be referenced, involving maximization of beneficial impacts, and then avoidance, minimization, mitigation and/or compensation for adverse impacts. The EMP will be validated and elaborated during the formal conduct / conclusion of the EIA study.
Project Management	EIA implementation schedule, estimated budget for the study, and specialist requirements.

7

Identifying Existing Conditions

This section provides information on the establishment of existing baseline conditions within the project's area of influence. As per the definition of the 'Environment' in the EPR, 1997, the information is grouped according to four main sections: Physical/chemical, Biological, Socio-economic and Cultural environments. Appendix A provides a checklist of baseline study parameters, sources of data, methods of collection, requirements of Nepal standard and recommendations for good international practice standards and guidelines. Discussions on key requirements are provided in the following paragraphs.

However, it is essential that the baseline survey program be tailored to reflect the information required to usefully inform the EIA for the project and the watershed in question. The survey effort/design should respond to the nature and scale of the hydropower project(s), stakeholders, the nature of the area of influence and the magnitude of anticipated / potential impacts (including due consideration of cumulative impacts where appropriate). For example:

- Baseline information from the project area which is considered adequate for characterizing the existing conditions with certainty should be included in the EIA study but not the survey program.
- Baseline information from the project area which is not considered adequate for characterizing the existing conditions with certainty should be included in the survey program to inform the EIA study. Surveys are often used to address information gaps or to validate environmental and socio-economic baseline data collected from secondary sources.

Issues which are not relevant or of low importance to the project in the given physical, chemical, biological, and socio-economic and cultural settings (see Section 6.2) should not be included in the EIA study / survey program.

7.1 Physical and Chemical Environment Conditions

The following paragraphs provide a description of the minimum requirements in establishing the baseline physical and chemical conditions within the area of influence. The minimum requirements are consistent with the National EIA Guideline, with the addition of some areas to satisfy good international practices.

The following physical/chemical attributes should be established in the baseline assessment:

7.1.1 Topography/Geomorphology

Nepal's position on the globe is between 26°22' to 30°27' north latitude and 80°4' to 88°12' east longitude. The average east west length 800 km and average north south width being 140 km. Within the 147,181 km2 area of the country, Nepal has a very diverse environment resulting from its impressive topography. A cross-section of the country reveals that the topography generally progresses from altitudes of less than 100 m in the southern Terai plain, up to more than 8,000 m peaks in the north. Nepal can be divided into five ecological regions:

Terai: This is the northern part of Indo-Gangetic plain. The Terai extends nearly 800 km from east to west and about 30-40 km from north to south. The average elevation is below 750 m, including Terai region, Bhavar Terai and Inner Terai.

Siwalik: Commonly referred to as the Churia Hills, the elevation in the Siwalik ranges from 700 to 1,500 m

Middle mountain: Also known as the Mahabharat range, the elevation of this range is from 1,500 to 2,700 m. The Middle Mountain is cut in many places by antecedent rivers such as Kosi, Gandaki (Narayani), Karnali and Mahakali.

High Mountains: High Mountains range from 2,200 to 4,000 m. This region consists of phyllite, schists and quartzite, and the soil is generally shallow and resistant to weathering.

High Himalaya: Ranges from 4,000 to above 8,000 m dominate the High Himalaya.

The EIA report should mention following topographic features of the project area as baseline information:

- Altitude range of the project area
- Latitude and longitude of the project area
- Land aspect of the project area
- Terrain feature of the project area
- Topographic map showing contour
- Topographic map showing natural and manmade features on ground.

7.1.2 Weather and Climate

Nepal has an extremely wide range of climate within a short latitudinal distance extending from 26°22' to 30°27'N and longitudinal distance from 80°04' to 88°12'E. Its location and variation in altitude create a wide range of climatic condition ranging from subtropical to alpine or arctic. The country has a monsoon climate with four distinct seasons. The seasons can be defined as: monsoon (June to September), post-monsoon (October to November), winter (December to February), and pre-monsoon (March to May). Eighty percent of the precipitation in Nepal comes in the form of summer monsoon rain, with winter precipitation more common in the western hills.[7]

The EIA should describe climate patterns within the proposed project area of influence. The climatological parameters to be reported include temperature, humidity, atmospheric pressure, wind and precipitation. Data can be obtained from the Department of Hydrology and Meteorology[8] or through the project developer's Detailed Project Report or Project Feasibility Report. Information should be secured from the nearest weather station or using the regional climate data over a 30-year period minimum average, whichever is available. Secondary sources and actual onsite measurements can also be used. Such information should be presented in statistical analysis covering the maximum, minimum and extreme values, as may be applicable. In determining the existing climate condition over the project site and within the area of influence, the Köppen climate classification system will be adopted.

It is recommended to include climate change projections, from the Intergovernmental Panel on Climate Change, regional and national agencies or organizations, into the assessment of existing climate conditions on site to determine any potential effects throughout the duration of hydropower operations. Use of appropriate tools to carry out climate risk screening, including information on evaporation and evapotranspiration, is recommended.

Baseline information on weather and climate will be used in hydrological flow modelling that will be used to assess impacts on changes in instream flows.

7.1.3 Hydrology and Stream Flows

The hydrological characteristics are first established by delineating the catchment area from where precipitation drains from upstream tributaries areas until the downstream point of confluence. Within this catchment area, the configuration and location of the hydropower facilities are established based upon topographical conditions dictating difference in head, accessibility, and constructability of project facilities, among others.

[7] Study of Climate and Climatic Variation over Nepal, Government of Nepal. MoPE Department of Hydrology and Meteorology, 2015. www.dhm.gov.np/uploads/climatic/612449471Climate%20and%20Climatic%20variability.pdf

[8] Department of Hydrology and Meteorology, MoPE (www.dhm.gov.np/climate)

Baseline information should include: description of the catchment area, its shape, slope, and size; delineation of river systems (i.e. major river and tributaries) and its geomorphology (i.e. river cross-section, depth, and substrate type); seasonal flows (i.e. velocity, volumes, duration of high and low flows, timing, frequencies, predictability, etc.) based on historical measurements or modelling; and sediment loads and sedimentation rates along the river channel (refer to further discussion on sedimentation in the next paragraph).

Flow measurements and morphological conditions should be described in representative reaches of the river to be affected by the hydropower project as well as in important tributaries if any, such as upstream of the tail of the reservoir, at the reservoir site, at the proposed weir location, in the dewatered reaches, and a few sites downstream of the proposed powerhouse and tailrace locations. Information on hydrology and flow measurements can be obtained from the Department of Hydrology and Meteorology. Flood risks without the project should also be described particularly downstream of the proposed hydropower facilities (dam or weir and powerhouse). Flooding risks can be established using historic evidence of high flood and lean flow as per experience of local people, flood marks, etc. and using secondary sources (Department of Hydrology and Meteorology), or through flood modelling.

7.1.4 Watershed and Erosion Potential

The watershed influencing the hydropower project should be delineated and drawn in a map. Sub-watersheds should also be shown in maps. Information on the watershed would include its legal status (e.g. national legislation/proclamation). In addition, presence of other projects as well as anthropogenic activities within the watershed will be described. Historical changes in the condition of the watershed will be included in the EIA. This will include changes in general cover (e.g. forest to agricultural) and increase/decrease of built-up areas and other human activities within the watershed.

Records showing vulnerability of the project area to soil erosion and landslides should be included in the EIA. This will be supported by government generated documents and maps, if available. Alternatively, this could be presented using topographic maps indicating steep slopes prone to erosion or landslides.

Baseline information should also describe general status of forest cover, measurement of degraded forest lands, and status of protected areas (if any) (refer to Biological Environment, Terrestrial Flora and Fauna in Section 7.2.1 for detailed discussion of requirements).

7.1.5 Surface Water, Springs and Groundwater Quality

Baseline information should include analysis of the quality of waterbodies within the area of influence. Parameters to be reported include: water temperature, pH, dissolved oxygen, total dissolved gasses, total dissolved solids, total suspended solids, salinity, contaminants (e.g. sulphides, selenium, ferrous and manganese ions, and organic mercury) and nutrients (e.g. phosphorus and nitrogen). Some other monitoring parameters to be identified as necessary during EIA study include: biological oxygen demand, chemical oxygen demand, total and fecal coliform, alkalinity, hardness, chloride, oil and grease, pesticide.[9]

In conducting water quality monitoring, implication of seasonality to changes should also be discussed.

Surface water sampling stations should consider the location of the project components that will be installed. For instance sampling should be done at the upstream and downstream sections of the point of discharge expected from construction camps and any other ancillary facility that may generate wastewater; upstream and downstream sections of the tunnel expected to potentially discharge water coming from tunnel boring, blasting or excavations; and other relevant sections of the reservoir, dam, and tailrace and on the upstream and downstream sections of major tributaries and the confluences with the river within the project's area of influence. Sampling frequency should consider monsoon and winter seasons.

[9] The Manual for Developing and Reviewing Water Quality for Hydropower Projects (2002), Table 2 developed by the Department of Electricity Development, HMG Nepal provides complete list of recommended parameters for monitoring.

Baseline information on groundwater quality within the area of influence should also be included in the EIA. At a minimum, groundwater quality parameters should include: pH, biological oxygen demand, dissolved oxygen, oil and grease, total suspended solids, heavy metals (e.g. mercury, arsenic, cadmium, chromium and lead). If groundwater is being utilized by the local communities for drinking, baseline conditions should also be analyzed and compared against Nepal's Drinking Water Quality Standards.[10]

For springs and/or aquifers, estimates of the discharge volumes located in areas that could be affected by project activities should be included. For instance it is important to assess the presence of any aquifer within the alignment of the proposed tunneling works, as well as any springs that could potentially be affected by access roads, quarries, heavy vehicle movement, construction camps or any associated infrastructure, ancillary facilities, or any project-related activities.

The number, location, seasonal flows and water quality of springs and groundwater wells being relied on by local communities for consumption or livelihood support should be assessed thoroughly in the baseline studies. Refer to Section 7.3 for further discussion on socio-economic considerations related to water supply/sources).

7.1.6 Geology and Geological Hazards

General geological features within the area of influence should be described in the baseline section, including subsurface stratigraphy and surface topography. Government generated maps showing general geological attributes may be referred to. Special geological features protected by the national government or by customary laws should also be identified in this section.

The vulnerability of the project area to geo-hazards including subsidence, liquefaction, landslides (see Section 7.1.4), flooding (Box 2), and mud or debris flow should be included in the EIA.

Proximity of project components to active faults should be described and shown in maps. The location of these faults, in relation to the proposed location of the dam and hydropower facilities, should be illustrated in a local and regional map. As an integral component of the engineering design, a separate structural integrity and dam break analysis has to be carried out independently by the project design and engineering team to assess risks of failure due to earthquakes, ground movement, as well as other potential risks such as extreme flooding events, GLOFs, and other geological hazards. This investigation has to be presented in detail and identify any GLOF threats including mitigation and emergency preparedness measures.

Box 2: Glacial Lake Outburst Floods

- Within a glacier, water travels in conduits as large as several meters across. Sometimes those conduits can become blocked by ice, debris such as sand and boulders or rock embankments. When sufficient water pressure builds up behind the natural 'dam' to cause it to burst, the torrent that's released can be substantial. These Glacial Lake Outburst Floods (GLOF) are particularly difficult to prepare for because there is often little or no evidence of imminent threat.
- It has been estimated that more than one in five dams in the Himalayas are likely to experience overwhelming floods caused by GLOF. In the event of such a breach, many dams could experience a deluge greater than they are designed to withstand.
- Whilst it remains challenging to determine the likelihood of individual lakes causing a damaging flood, prospective hydropower projects in Nepal should seek to include good practice hazard assessments as part of the EIA study in order to better understand the specific risk of GLOFs in the watershed. Mitigation strategies, such as attempts to reduce water levels and/or install early-warning systems should be investigated.

[10] Drinking Water Quality Standards, Nepal (2006), Website: moste.gov.np/legal_documents/Regulation#.WNzNwme7paQ

7.1.7 Sedimentation

Reduced instream flows in rivers resulting from weir or dam construction may potentially lead to sediment build up and hindrance to natural sediment movement along river channel. Baseline studies should establish sediment load at specific sections of the river where key hydropower facilities will be established (in sampling stations similarly described in Section 7.1.5 above). Natural occurrence of sedimentation may be attributed to exposed areas prone to erosion or any human activities or explorations within the catchment. The baseline study should document areas prone to erosion (see discussion in Section 7.1.4), which may then lead to sedimentation of river tributaries.

Sediment retention upstream from the dam or weir may generate sediment deficient river flow downstream, otherwise commonly referred to as 'hungry river', which has the potential for significant riparian erosion downstream of the dam or weir. Sedimentation risk and sediment load assessment are key components of engineering studies requiring the EIA team to collaborate and communicate closely with the design and construction team to better understand the potential for sedimentation significant of this issues. Additional data could be gathered as part of the EIA process through observations and photo-documentation, and through conduct of actual sediment sampling at strategic locations along the river stretch where the key components of the hydropower plant will be established.

7.1.8 Land Use and Cover

The EIA should describe and locate in a map existing land uses within the area of influence. Lands within the area of influence declared by the national law as special or critical for various reasons (e.g. ecological, economic or socio-cultural) will be referred to in the baseline section. Areas that are vulnerable to natural hazards as well as those occupied by indigenous cultural communities will be described in the EIA.

The general project area should be drawn over geo-referenced contour maps. Sensitive areas such as downstream communities, community forest, relevant social infrastructure (e.g. road and bridges), sacred sites, and areas to be inundated by the storage reservoir should also be shown in a topographic map.

7.1.9 Air Quality and Noise Levels

Existing air quality conditions prior to the proposal's development are determined by establishing air sampling stations within the direct impact areas, particularly near sensitive receptors. Air quality parameters to be analyzed according to the standard parameters under the National Ambient Air Quality Standard of the Government of Nepal (e.g. nitrogen oxides, carbon oxides, sulphur oxides and particulate matters less than 10 and 2.5 microns). The number of sampling stations will depend on the location of sensitive receptors (e.g. residences, schools) and/or ecological areas (airsheds, national parks, etc.) near and/or downwind of the project site. The air sampling averaging time and test methods will be based on the 2012 National Ambient Air Quality Standards of Nepal. The baseline sampling will be done once in a year.

Noise monitoring should also be conducted to establish the existing ambient noise levels at nearby sensitive receptors. This will aid in determining any changes in background noise levels that may potentially impact nearby sensitive receptors during the project's construction and operational phases. The noise level guideline values of the MoPE (draft standards)[11] will be used. Noise levels should not exceed 55 decibels (dBA) during from 07:00–22:00 in residential / institutional / educational areas; and 45 dBA at night time (22:00–07:00); or should not result to an increase in background levels of 3 dBA at the nearest receptor location off-site. The monitoring period duration will be at least 48 hours using a noise meter capable of logging data continuously over this time period, preferably covering weekday and weekend. A-weighted, continuous equivalent sound levels (dBA), will be the type of acoustic index to be measured.

[11] Sound quality standards (2012.) http://moste.gov.np/legal_documents/Regulation#.WUm6NmcUlaQ

7.1.10 Landscape Values and Visual Amenity

Good international practice suggests understanding the landscape values and visual character of existing physical conditions within the area of influence. The EIA should describe visually prominent landscape components or values, structures and other existing infrastructures, which are likely to be affected by the hydropower project. Interesting features may include places of worship, tourist destinations, populated areas, or other places of interest.

The landscape and visual amenity study could be equally relevant for associated facilities like the transmission lines and also particularly for major components of the projects such as the dam and the powerhouse.

7.2 Biological Environment Conditions

The following paragraphs describe the minimum requirements for establishing the baseline conditions of the biological environment. The information requirements are consistent with the National EIA Guideline. Where local guidelines do not exist, good international industry practices are referenced to define acceptable methodology.

Appendix A provides a summary list of minimum requirements for establishing baseline conditions on the biological environment which shall inform the impact assessment for hydropower projects, including recommendations on international standards and guidelines for each biological aspect.

At the minimum, baseline conditions on terrestrial flora and fauna; aquatic biodiversity values or ecosystem services such as fisheries or fishing resources, endemic or endangered mammal, amphibians, fish, plants or invertebrate aquatic or riparian species; and status of these species and their populations need to be described. International standards suggest investigating surrounding environment on catchment/watershed scale, including tributaries not expected to be affected (see earlier discussion on watershed under physical environment in Section 7.1.4) and identifying presence of critical habitats and key ecosystem services, if any.

7.2.1 Terrestrial and Riparian Flora and Fauna

The EIA should describe the scope, spatial extent (area) and temporal (timing) and methodologies used for studies and/or surveys used to provide information on the ecosystems/habitat and flora and fauna in the area of influence. The EIA should also show species or habitats of interest (e.g. important to locals) and species or habitats that are considered sensitive or vulnerable from the perspective of project stakeholders including those with conservation concern at the national (i.e. National Parks and Wildlife Conservation Act of 1973) and international context (i.e. IUCN Redlist).

Particularly for hydropower projects, riparian flora and fauna within the area of influence should also be described; placing special emphasis semi-submerged plants, as well as mammals and birds that are frequently found in riparian zones. The description of the level of diversity through the measurement of various biodiversity indices should be included. Anthropogenic influences present within the area of influence should be documented and described in the EIA. Areas of high biodiversity values regardless of habitat type and level of disturbance will be identified and described. Maps should be prepared to show the context of the project site in relation to surrounding vegetation, and ecological communities as well as show survey sites and location of species and habitats of interest.

Sampling frequency should consider the wet and dry season.

7.2.2 Aquatic Flora and Fauna

The EIA should describe all types of aquatic habitats present in the area of influence and the flora and fauna present in these habitats that could potentially be affected by the proposal project. Control

sites beyond the area of influence should also be established for comparison with existing conditions and for future monitoring of the project's impacts. Details of the scope, timing (survey season/s) and methodology used to obtain information on the aquatic community and/or habitat within the area of influence should be included.

The identification of sampling stations should consider and include different types of habitat along river reaches (i.e. ponds ripples, waterfalls, meanders, slow flowing sections, etc.). Information on the importance of species and habitats of interest should include the following: utilization (e.g. spawning, foraging, resting, hiding), level of diversity, abundance patterns, conservation significance and population status, location and extent, susceptibility to anthropogenic and seasonality influences.

Information about macroinvertebrates, including crustaceans, mollusks, and aquatic insects, should be included in the EIA, as well as information on plankton and periphyton (see Box 3) for suggested sampling methodologies). Amphibians and reptiles present within the area of influence primarily important to the locals and/or ecologically vulnerable should also be identified, the level of their dependence on unique habitats within the area of influence will be described as well.

There are several benthic macroinvertebrate diversity indexes that can be used to analyze river productivity, water and habitat quality, and overall river health. Common indices include Beck's Biotic Index (Terrell and Pertetti, 1996), Benthic Index of Biotic Integrity (Fore et al., 1998), Hilsenhoff's Biotic Index (Hilsenhoff, 1981), and the EPT Index (Lenat, 1998). The EPT Index (Box 4), which uses three orders of aquatic insects (i.e. Ephemoroptera or mayflies, Plecoptera or stoneflies, and Trichoptera or caddisflies), can be easily sorted and is commonly used as an indicator of water quality. The higher the species richness or EPT index mean high quality rivers.[12]

It is important that the information collected as part of the aquatic flora and fauna baseline, be linked to the baseline information collected - preferably at the same sites – as part of the hydro-morphological, surface water quality, sedimentation, and sediment flow baseline data as described in Sections 7.1.3, 7.1.5, and 7.1.7. This will greatly increase efficiencies, avoid rework, and help better understand the correlation between physical and biological parameters (e.g. species presence and their relationship with temperature, dissolved oxygen, water quality, depth, velocity or substrate type), as well as any e-flows and sediment flow impact assessment, modelling and potential risks and impacts assessment and mitigation / management plans.

7.2.3 Fisheries

Baseline information should include important fishing areas across the area of influence, whether these are for subsistence, commercial or recreational purposes. The EIA should discuss the species present in the area of influence and describe the diversity, life histories, reproductive cycles, behaviors, and habitat preferences as well as conservation status. Specific for any migratory fish species, information on their migratory patterns in time (e.g. timing and potential triggers of upstream and/or downstream migration along the river reach) and space (e.g. waterways used for migration including main stream or river and tributaries in project area) should be included.

The report may also include the types of gears used for fishing, the seasons and locations of where such gear is used, as well as the metrics used to calculate population densities, such as Catch per Unit Effort (CPUE), fish health and life stages, etc.

Baseline sampling should consider the wet and dry season.

A proposed methodology for capturing baseline fisheries data is described in Box 3.[13]

[12] The Watershed Science Institute, Technical Note 3 provides guidelines in collecting samples to construct an EPT Index Score. Website: https://www.wcc.nrcs.usda.gov/ftpref/wntsc/strmRest/wshedCondition/EPTIndex.pdf

[13] Boxes 3 and 4 are provided for reference purposes only.

Box 3: Methodologies for Aquatic Flora and Fauna Baseline Sampling

- The ***study reach can be identified and target species determined*** by: Defining the location of reservoir or impounded area; Delineating the curtailed reach and the area between the powerhouse and the tailrace; Mapping out important tributaries within the area of influence, particularly fish spawning sites; Delineating the area upstream of the reservoir, particularly if presence of long-range migratory fish have been established through secondary sources or interviews, and; Identifying a control reach or area not likely to be affected by the project.
- Apart from considering the location of the hydropower dam, powerhouse, and tailrace, the ***location of the sampling stations*** should consider the characteristic of flows at different sections of the river reach. Ecological characteristics and species richness may vary as a function of habitat types such as ponds, ripples, water falls, meanders, and slow flowing sections. It is important to establish sampling stations that characterizes these varying habitats.
- For hydropower projects expected to cause long-term impact on aquatic habitats and ecological values, a full ***season sampling cycle*** is recommended during: (i) monsoon season, (ii) post-monsoon season, (iii) winter season, and (iv) pre-monsoon season.
- Aquatic biodiversity (flora, fauna, and fisheries in particular) require a robust assessment to establish existing conditions of multiple aquatic taxonomic groups, including fish, macroinvertebrates, plankton, vegetation, and periphyton. The ***methodology of sampling*** is determined depending on the taxonomic groups present in the river ecosystem. Combination of several techniques could be possible for particularly diverse or difficult-to-sample taxa groups:
- ***Macrobenthos:*** Macroinvertebrates, including mainly crustaceans, mollusks, and aquatic insects, may be sampled with a variety of gear types including Surber samplers, Hess samplers, and D-frame kick-nets. Surber samplers and Hess samplers are operated almost similarly, but Hess sampler are more effective at eliminating sampling contamination from upstream and may therefore be the preferred technique in highly turbid or turbulent conditions. Both types are effective for quantitative sampling because the frame of the sampler fits over a known area of stream bottom. D-frame nets are the most portable and easiest to use sampling gear and can be used in the widest variety of habitats, but are the most difficult gear type to use quantitatively.
- ***Plankton*** are sampled using anchored drift net plankton samplers or other equivalent gear type. The sampler is anchored or swept in an upstream direction. All habitats should be sampled in approximate proportion to their abundance in the sample reach. The number of samples will depend on field conditions, but diverse habitats may require deploying multiple samplers.
- ***Vegetation*** are sampled either visually or using hook, rake, grapple, or other device capable of retrieving aquatic vegetation for examination. Snorkelling can also be performed to establish baseline aquatic vegetation through photographic transects. Consultants are encouraged to use 100 m linear transects for aquatic vegetation surveys depending on practicality in implementing field methods.
- ***Periphyton*** sampling involves removing representative sample of periphyton from a known area of suitable habitat to be analysed. The USEPA Rapid Bioassessment Protocol (RBP) is one of the most commonly applied and cost-efficient protocol available for sampling periphyton. The protocol includes: (i) sampling a single habitat type at each site, used when periphyton biomass is to be used as a measure of primary productivity, and; (b) Multi-habitat sampling of a range of habitat types at each site, used when periphyton diversity has to be calculated.
- ***Fish.*** A variety of sampling methods are available, including: gill/trammel, seine fyke (or bongo), and cast nets. Gill and trammel nets are appropriate for slow and moderate currents without significant amounts of floating debris, which can foul and damage the net. Cast nets are useful for almost all types of flows except for fastest currents. They are particularly useful for sampling isolated pools and eddies in otherwise swiftly flowing habitats that would be difficult to sample with other methods. Also, cast nets are useful for sampling the upper to mid-water column or smooth bottom areas and cannot be used over rough bottoms or areas with large amounts of debris. Seines can be used effectively in almost any habitats that are shallow enough to wade safely, except habitats with large amounts of debris or large rough rocks on the bottom. Consultants are encouraged to use the most appropriate method of sampling technique based on initial assessment of baseline instream flow conditions, review of secondary data, and key informant interviews with local fishermen.

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Box 4: Illustration on use of EPT index

The Ephemoroptera, Plecoptera, and Trichoptera (EPT) Index is commonly used as indicator of water quality of state of pollution in rivers. The photographs below shows the characteristics of these benthic macroinvertebrates, also commonly known as mayflies, stoneflies, and caddisflies respectively.

Ephemoroptera or mayflies

Plecoptera or stoneflies

Trichoptera or caddisflies

The EPT Index is determined by counting the total number of distinct taxa within the EPT groups. The EPT is the summation of identified number of species for each EPT group. The EPT index or taxa is then compared to corresponding water quality ratings.

An example EPT index ranges and their corresponding water quality ratings is illustrated below.

Water Quality Rating	Excellent	Good	Good to Fair	Fair	Poor
Index EPT	>27	21 to 27	14 to 20	7 to 13	0 to 6

7.2.4 Natural and Critical Habitats

Hydropower projects may potentially have an effect on natural and/or critical aquatic or terrestrial habitats, including biodiversity hotspots, biological corridors and connectivity. For terrestrial habitats this may be particularly relevant in areas to be inundated as a result of water retention or impounding reservoir and as a result of construction of access roads, either due to direct habitat loss or to blockage of circulation or connectivity of important terrestrial biological corridors. Similarly, in the case of aquatic and riparian habitats, impacts can be related to direct habitat loss as a result of: impoundments; loss of longitudinal and lateral instream habitat connectivity from weirs or reduced flows, and/or; as a consequence of the modification of water and sediment flows.

Critical habitats are areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species;[14] (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes.

As part of the EIA, baseline study should include in-field surveys that considers seasonal data and the sampling has to be conducted by competent professionals and external experts as necessary, especially if the project site involves natural and critical habitats. In-field surveys and assessments should make use of recent data acquired within the proposed location of the project facilities, including related and associated facilities, and the project's area of influence. The baseline studies should also be informed by literature reviews and initial desktop analysis.

[14] As listed on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species.

Literature reviews could comprise peer-reviewed journals; regional assessment, national or regional planning documents (e.g. National Biodiversity Strategy and Action Plan and Local Biodiversity Action Plans); and cross-referencing the International Union for Conservation of Nature Red List of Threatened Species.

7.2.5 Ecosystem Services

The term ecosystem services describes the multiple benefits derived by the society from the ecosystem. The EIA will document ecosystem services provided in the area of influence, and define those priority ecosystem services that will need to be protected, along with their quality, quantity, use/importance to local people, and the availability of alternatives for those priority ecosystem services.

7.3 Socio-economic Conditions

Describing the existing socio-economic conditions provides a baseline information against which the potential changes resulting from the project can be assessed. This includes changes from the existing social baseline conditions during construction of the project, commissioning and operation.

7.3.1 Socio-economic Indicators

To gain a good understanding of the communities likely to be affected, the EIA should develop a detailed socio-economic profile for the social area of influence. The social baseline should profile any groups that may be differentially impacted or have greater vulnerability to the effects of the project due to various factors (e.g. gender, caste, ethnicity, age, physical or mental abilities, or socio-economic status (i.e. level of poverty). Groups should also be identified who may be considered vulnerable to feelings of isolation, insecurity and defenselessness.

Information to be included in the socio-economic profile is outlined in below section and Table 8 and should be identified and prioritized in the Scoping Phase and defined in the TOR.

Population Profile

A population profile of all communities located within the social area of influence should be developed. Data should be collected and analyzed for the following population indicators:

- Total population
- Population growth
- Age distribution
- Gender distribution
- Education levels, access to the educational institutions
- Migration / demographic movement
- Family and household structure and size
- Occupation and income
- Sources of livelihoods
- Land/Home ownership, tenure and construction type and material used
- Household assets
- Religious practices
- Ethnicity
- Health conditions including sanitation, drug/alcohol use and physical activity levels

Several of these indicators are discussed in more detail in the sections below. Some of this information may be available from secondary data sources, however a significant amount of information will need to be collected through community surveys.

Gender

Participation of women in the surveys should be a key consideration. Women participating in the survey can often feel more comfortable when being surveyed by females, or hold knowledge that men are not permitted to know. It is therefore important that the survey team include women and men who

can also speak the local language. The survey questionnaire should be designed to capture information related to household structure, roles, relations and responsibilities and sex-disaggregated data.

Vulnerable Groups

The existing conditions should document and map the location, demographic profile (including population, gender, economic/livelihoods, education, health, cultural aspects) of vulnerable groups, including any distinct cultural sites or practices of Indigenous People associated with the area.

The proponent should apply principles and activities from its stakeholder engagement strategy/plan including ICP and FPIC (if triggered) for the collection of baseline data. Refer to Section 4.2 for details on stakeholder (including Indigenous People) engagement.

Economic Context and Livelihoods

The local and regional economic context should be profiled, including local industries particularly those dependent on the water e.g. fishing, agriculture, tourism, navigation; and/or those related to land loss or access when significant land acquisition and/or physical and economic resettlement is expected. This includes proposed activities, and those funded by government, private sector and international development agencies.

In addition, the income status of households, and other measures of poverty e.g. seasonal food deficit, nutritional status, available income for clothing, health or education, mean of livelihoods, assets should be assessed.

Employment and Labor Implications

Data on the existing labor force participation in the social area of influence should be profiled, including level of employment, unemployment levels, skills base, current work practices, pay rates for different roles, and variations across age and gender for each of these indicators. Information about existing employment opportunities in the region should be described, including an estimate of the proportion available for local communities, along with access to skills development, training, and small business development in local communities. Similarly, possible impacts – positive and negative of the labor influx should to be captured.

Education Levels

In addition to education levels across age groups and gender, access to education facilities should also be profiled. This includes auditing the number of government and private education facilities, including their distance from communities and the services provided.

Health

As well as health levels across age groups and gender, the social baseline should include information about relevant health conditions for the communities, prevalent diseases, status of any water/air borne diseases, prevalent drug and alcohol use, level of health care available, service provision by government and private providers, and access to health facilities including distance from communities.

Cultural Heritage

Refer to Section 7.4 for details on cultural heritage existing conditions.

Cultural Practices

A survey of the different religions practiced in the social area of influence should be discussed. This includes the level of participation/attendance, location of religious facilities (e.g. places of worship), and important religious events and activities, existence of religious trust and guthis. Particular attention should be given to any religious use of rivers and associated sites.

Services and Facilities

Information on access to and capacity of community assets should be audited and mapped including:

- Built assets or physical capital including houses, community buildings, schools, clinics, religious buildings, emergency response facilities, access roads and bridges
- Social and institutional capital in terms of governance and legal structures within the villages, health and educational capacity (teachers, nurses, doctors etc.), patterns of land ownership, tenure and use, and other assets
- Water supply and sanitation including but not limited to domestic water supply including spring, ground water wells, river and other natural sources of water and access to sanitation by household, and irrigation projects. See Section 7.1.
- Land assets or natural capital including agricultural fields (irrigated and rainfed), seasonal cropping patterns and yields, forests (community managed and production forests), timber and fruit trees
- Livestock and animal husbandry including but not limited to the numbers and different types of animals (cattle, buffalos, sheep and goats, pigs and poultry)
- Fisheries and aquaculture resources including but not limited to the types of fishing, boats and equipment used and seasonal patterns of production and yields. See Section 7.2.
- Other patterns of natural resource use, e.g. mining, eco-tourism.

Land Tenure/Titles

The baseline should identify and document the status of land use – residential, agri, commercial and land ownership/tenure and titles for individual households as well as for community assets, especially where land acquisition would be required for location of project's associated facilities / ancillary elements and for the reservoir and at locations where the resettlement would occur. It should also include the status of non-title holders, encroachers, squatters etc.

Socio-Political Situation/Contextual Risks

An overview of relevant social, conflict and security issues within the social area of influence should be included issues related to land rights / tenure issues, political tensions, tensions between villages and local groups, pressure on existing resources, and loss of traditional practices (e.g. changes to fishing, gardening, hunting, common property resources – community forestry). Historical information should also be included for relevant issues, including parties involved, and any past, current or proposed activities (e.g. Government interventions) that may reduce social, conflict and security issues.

Summary of socio-economic and cultural indicators to be investigated for the baseline

Table 8 provides a summary of the various socio-economic indicators that should be investigated for the affected communities including vulnerable groups. Refer to Appendix A for a full list of baseline study parameters and study methodology for hydropower projects.

Table 8: Socio-economic and cultural indicators to be investigated for the baseline

Category	Indicators
Population	Total population
	Population growth
	Age and gender distribution/ratio
	Family and household size and structure
	Average household size
	Ethnic composition
	Occupation
	Migration patterns and numbers
	Spoken Language
	Religion
	Demographic composition of vulnerable/marginalized groups
Education	Enrolment details
	Literacy rate
	Educational status (according to level of degree, and age)
	Access to the educational institution
Houses and settlements	Types of houses and settlement pattern (nucleated/ dispersed family, ownership status, materials used for construction and house type)
	Distance of settlements
	Total number of households
	Land titles and ownership
	Ownership of land and house
Income and economy	Level of income and expenditure
	Sources of income – agriculture, salaries, remittance, small/informal sales and business,
	Means of livelihood,
	Employment type
	Land ownership/home ownership land tenure system
	Household assets - agriculture, livestock
	Local/regional industries and economic activities – agriculture, animal husbandry, tourism, fisheries, rafting, mining, quarrying and other industries
Health, sanitation, hygiene, water and waste management	General health condition of the community – mortality, morbidity rates, mother and child health
	Types of common prevalent and new diseases (e.g. HIV/AIDS, STD), with special emphasis on water born or water-vector related disease (e.g. dengue fever, malaria)
	Status of communicable and non-communicable diseases
	Prevalence of drugs and alcohol use
	Toilet and sewer facilities
	Source / access / quality of drinking water
	Water usage – irrigation and fishing
	River dependency on ecosystem systems
	Existing waste management practices (waste generation rates, solid waste management, and disposal practices/facilities)
Religion/community	Religious practices
	Religious significance of the water sources especially those that would be impacted by the hydro power project
	Level of participation/attendance
	Location of religious facilities (e.g. places of worship)
	Important religious events and activities,
	Festivals
	Local and traditional religious practices/rituals

Category	Indicators
Cultural heritage	Ceremony locations
	Sacred sites
	Cultural buildings or relics; historical sites
	Meeting places
	Archaeological sites.
Infrastructure facilities and services available to and accessed by communities in the study area	Education facilities – schools, training institutions
	Health facilities – clinics, hospitals, traditional medicine practices, emergency response
	Transport facilities – roads connections, bus/taxi services, other modes of travel and transport
	Communication facilities – telephone, mobile facilities, post office, others.
	Water and sanitation facilities - domestic water supply and access to sanitation, irrigation projects, water mills, water availability for agricultural / recreational (e.g. rafting, swimming) / households use, water (use) rights, water user groups, status of upstream and downstream water use, toilets and their condition
	Financial institutions – banks, saving groups, personal lending
	Common areas - Local markets, recreational sites, common areas in communities, common property resources (e.g. traditional grazing, common agriculture farms, community resting place)
	Information related to availability, access to and capacity of these institutions to cater to the affected communities should be understood.

7.3.2 Socio-economic Baseline Data Collection

Both primary and secondary data sources are required to inform the social baseline and profile the various indicators discussed in Section 7.3.1.

Table 9 provides a list of primary and secondary data sources that could be collected for hydropower EIAs in Nepal. The collected data should be presented in tables, graphs, maps and written form within the social baseline as an integral component of the EIA.

The section below discusses field surveys in more detail, which are a key technique for gathering primary data from communities affected by hydropower projects.

Table 9: Examples Data Collection Methods for Socio-economic Aspects of EIAs

Data Type	Examples of Data Source
Primary data	Observations from site walkthroughs and site visits
	Consultation with stakeholders through meetings, surveys, focus group discussions (refer to and Section 3 and the National EIA Guideline for details on methods for community/public participation)
	Consultations with impacted communities (refer to the National EIA Guideline for details on methods for community/ public participation)
Secondary data	Most recent census reports
	Previous project documentation and other technical studies prepared for the EIA
	Socio-economic surveys by development organizations
	Government socio-economic policies and legislation
	Reports and survey data available with relevant government departments and their offices
	Websites, articles and reports from the local authority, government organizations, civil society organizations, unions, development banks and lenders, local media, business groups, and international industry organizations
	Travel publications
	Press releases and media coverage for the specific project or type of project (hydropower)
	Civil society and business organization annual or corporate social responsibility reports

7.3.3 Household Surveys

Household surveys are a key data source to collect baseline information about affected households and communities, as well as assist to identify potential impacts and management/mitigation measures. Some of the key considerations for hydropower socio-economic field surveys are discussed below.

Survey Design

Surveys are useful methods for directly consulting with vulnerable or under-represented groups to ensure their needs are understood and addressed. Field surveys should be designed to respond to the type of information required to inform the EIA, the nature and scale of hydropower project, the target population, and the nature and magnitude of socio-economic impacts. Appendix B provides an example of a household survey that could be used to gather socio-economic baseline data.

Sample Size

Sample size for the household survey should include a full census (100%) of every household that is impacted by involuntary resettlement as part of the Land Acquisition, Livelihood Restoration and Involuntary Resettlement Action Plan (RAP). In cases where resettlement is not involved, the sample size for the household survey should be rationally legitimate.

Types of sampling likely to be appropriate for hydropower EIAs include:

- Random sampling – identifies a subset of a statistical population in which each member has an equal probability of being chosen.
- Spatial sampling – based on estimating the scope of project impacts, severity of socio-economic impacts, capturing a representative sample.
- Selective Sampling – targeted at affected people of special interest (e.g. fishers) or particular vulnerable groups such as women, Indigenous People, Dalits and others.

Gender

The survey questionnaire should be designed to capture information according to gender, so sex-disaggregated data can be captured.

Target Communities

Household surveys may be required with different groups of stakeholders and target communities depending on the project and types of impact. Examples of target communities and types of surveys for hydropower projects in Nepal are provided in Table 10.

Table 10: Examples of target communities and types of surveys

Target Community	Focus of Survey
Communities that would be relocated due to inundation at the reservoir or due to location of project's associated facilities / ancillary elements	• Full census for every resettled household • Demographic and economic data • Inventory of all assets that would be lost due to resettlement • Dependence on river/water and surrounding land resources • Living conditions • Access and availability of social infrastructure • Social networks and cultural/religious practices/believes, political conditions
Host communities for relocated population	• Demographic and economic data • Capacity of social services and other infrastructure to meet demand from incoming population • Existing social / political tensions
Upstream and downstream communities including below tailraces	• Demographic and economic data • Dependence on river/water and surrounding land resources

Target Community	Focus of Survey
Workforce that will be employed on the project and others that may relocate into the social area of influence in search of employment opportunities	• Demographic profile • Living conditions • Inventory of assets • Availability and access to social infrastructure

7.4 Cultural heritage Conditions

Cultural attributes that should be studied include: traditional ceremony locations, mythological sites, sacrifice locations, cultural buildings or relics, houses, graves, sacred sites, important meeting places, archaeological sites, paleontological, historical, cultural, artistic and religious values; unique natural features such as sacred groves, rocks, lakes, and waterfalls; and practices of communities embodying traditional knowledge, lifestyle, rituals, living arrangements, religious practices. The profile should discuss and map these various cultural attributes of the communities within the social area of influence, including any distinct cultural sites or practices of Indigenous Peoples associated with the area.

The EIA should identify and distinguish between cultural heritage and critical cultural heritage and describe their significance in the area of influence.

Information on the location of cultural and critical sites can be sourced from:

- Desktop review of the project area of influence for tangible (physically present) cultural heritage, including records from the Government of Nepal's Department of Archaeology.
- Identify local areas of cultural significance, such as graveyards or sacred sites, through the use of questionnaires and stakeholder engagement during social assessment field visits.
- If sites of cultural significance have been identified, undertake a detailed walkover of these sites and locate them using Global Positioning System (GPS).

If potential sites of cultural significance or critical cultural sites have been identified (e.g. sites of archaeological interest), detailed investigation would be required. Such investigation should be referred to or guidance for this investigation should be sought from the Department of Archaeology. The data should be presented in an easy to understand manner, along with mapping for all of the above within the area of influence.

8

Assessing Impacts

This section includes the qualitative and quantitative analysis and evaluation of impacts associated with hydropower project proposals as listed in Section 6 of the TOR. This section also characterizes residual impacts in terms of magnitude, extent, duration, reversibility and frequency. All impacts should be characterized qualitatively and quantitatively to the extent possible.

Appendix C provides an example listing of key project impacts of typical hydropower project development activities on physical, biological and socio-cultural attributes. The impacts are described in more detail in the next subsections. The EIA study team shall be qualified to identify these impacts and potential risks, and would then be able to rank high environmental and social risks requiring development of impact management plans.

8.1 Physical and Chemical Environment Impacts

8.1.1 Hydrological Impacts

Assessment of hydrological impacts includes identification and analysis of project impacts on the change in river morphology and drainage patterns as well as the potential effects of flooding in the project area and in the broader area of influence. Refer to Table 9 in Appendix D to assess the project site's environmental release and water balance in ROR/Storage projects.

If the proposed hydropower project is sited on an unregulated river, then additional investigation may be required to describe the degree of regulation that will result from the project and the changes in the flow regimes expected.

Potential changes in stream water flow, velocity and depth, as well as timing, duration, abruptness of transition and predictability of flow regimes due to project activities will be identified and assessed. Installation of project structures that may result in alterations in sediment characteristics and transport downstream will be identified and assessed. The impact section of the EIA will consider the discussion of the potential project impacts on water resources and competition in water use of downstream users.

8.1.2 Watershed Impacts

Project activities and components may potentially impact the condition of the watershed. Building of access roads, conveyance (water pipes) and transmission lines may cause habitat fragmentation and hindrance to wildlife natural movements. Project access roads that may potentially be utilized to carry out illegal activities such as poaching or used to transport illegally harvested forest products, will be assessed. Aggravation of existing soil erosion rates due to project activities will be identified and assessed. A useful tool developed by ICIMOD under the Department of Soil Conservation and Watershed Management, among others, can be used to aid in assessing watershed impacts and developing mitigation measures.

8.1.3 Surface, Springs and Groundwater Impacts

The quality of water in streams may be modified depending on the type and operational mode of the hydropower project, the morphology of the river, quantity and dynamics of downstream releases. Thus, project activities (e.g. building of cofferdams during construction stage) that may cause potential degradation of water quality should be identified and its impacts assessed.

The potential impact of tunneling and other construction activities on water quality - including surface water, groundwater or springs - should also be assessed. In many cases, tunneling can result in changes in pH level and elevated levels of turbidity, total suspended and dissolved solids, which could potentially result in fish kills and depletion of species richness in the river.

Waste water discharges (including effluents from nearby workers' camps and construction sites) and storm water runoff should be identified and assessed. Discussion should include identification of unintended impacts of the project during operation stage, such as rapid sediment accumulation and its impacts on surface water quality should be assessed. Project impacts to water quality across project stages and the timing of project activities to various seasons should be identified and assessed

Box 5: Cumulative Impact Assessment

- Environmental impacts are often assessed at the project level, but when a number of projects are considered together, global experience shows that cumulative impacts can cause significant adverse environmental and social issues.
- Cumulative impacts result from the successive, incremental or combined effects of a project or activity when considered with existing, planned or reasonably anticipated future ones. For practical reasons, the identification and management of cumulative impacts are limited effects generally recognized as important on the basis of scientific concerns or concerns of affected communities. These impacts are incremental effects of past, present, or future activities combined with the proposed project.
- Examples of cumulative impacts that could be attributed to a hydropower project in Nepal include:
- Reduction of water flow in a river basin due to multiple projects / reservoirs combining to affect both upstream and downstream river reaches / users.
- Increases in sediment loads on a watershed or increased erosion which can result in the loss for example, of important sediment and nutrients for agriculture in the Terai.
- Secondary, consequential or induced social impacts, such as collective in-migration of construction workers for multiple projects.
- Cumulative Impact Assessments (CIA) are not required by the Rules (1997) or National EIA Guideline. However, hydropower project proponents are encouraged to try and understand, assess and effectively engage with river basin stakeholders to manage cumulative impacts within a given river basin.

8.1.4 Geology and Geological Hazards

Project impacts in terms of potential modification of surface landforms, topography, and slope should be identified. The potential inducement of project activities (e.g. tunneling) to subsidence, liquefaction, landslides and mud/debris flow should be identified and assessed. The possibility of the project aggravating geologic hazards present within the area of influence has to be identified and its impacts assessed.

8.1.5 Sedimentation

Assessment of sediment load is achieved through hydrologic/hydraulic modelling, and is usually an integral component of the engineering design. It is very important for the EIA Study team to work closely together with the engineering team, to assure they coordinate data sampling, modelling assumption and coherent design to meet both, the engineering / design requirements and the ecological and social needs to maintain river biological, geo-morphological and ecosystem services / social integrity.

8.1.6 Land Use and Cover Changes

The compatibility of the proposed hydropower project will be assessed vis-à-vis the existing land use and the regulated/proclaimed land use within the area of influence. Land tenure issues should be identified and its impacts assessed. Installation of project components that may result in restriction of existing access utilized by local communities should be identified and assessed. A table for land requirement is given in Appendix D.

8.1.7 Air Quality and Noise Impacts

In order to assess the potential impacts on air quality and noise during the development and implementation of a hydropower project, the construction and operation practice and work processes involved should be determined in order to provide the appropriate mitigating measures to address possible changes to air quality and noise. During construction, the primary contributors to air and noise emissions would arise from mobile and/or stationary sources, such as on- and off-road vehicles, diesel generation sets, use of heavy equipment, etc. Fugitive dust arising from land/vegetation clearing and working on crushers/concrete making plants may impact air quality as well. Exposure to air and noise pollution from work areas during the construction of plant office, campsites, and other facilities must be considered as well. The construction of the major components of the hydropower plant such as the intake tunnels, sedimentation chambers, surge shafts penstock and powerhouse, may result in an increase in air pollution due to cutting, blasting, dust, and vehicular exhausts. Noise levels may also increase during the construction of any of these underground/surface components, which may impact also the working conditions of workers in the area. The overall investigation of impacts should take into consideration how the project activities may affect the existing communities as well as its disturbance to the flora and fauna in the area.

8.1.8 Greenhouse Gas Emissions (where applicable)

An emerging body of knowledge and research addresses the relevant climate change impacts that are generated through different types of hydropower project lifecycles in terms of greenhouse gas emissions. Depending on the type of hydropower project, this may include: loss/decomposition of affected/submerged vegetation; fuel types, average consumption and emission loads from the equipment and machinery used; emissions and CO2 e.g. from the concrete batching plant; and impacts from all other project-related activities. As an example, large storage hydropower dams may create low stream flow conditions, potentially leading to significant thermal stratification and therefore anoxic conditions in the colder, bottom layers of water of the reservoir. In this case, greenhouse gases are released in the form of methane which is converted to carbon dioxide (CO2) as it travels up to the surface through the water column.

Where relevant, the EIA may discuss what impacts greenhouse gas emissions and loss of carbon storage through vegetation clearing and/or soil degradation will have on the environment.

8.1.9 Vibration Assessment

Depending on the type of hydropower scheme and/or extent of blasting activities required during the project's construction stage, a vibration modelling assessment will be undertaken to identify the communities and other activities in the area of influence that may be impacted by any noise and vibration. Using recognized quality assured methods, impacts of the noise and vibration emissions (including fugitive sources) throughout the project construction phases on the environmental and social values with reference to current and proposed sensitive receptors will be predicted. The impact prediction must address the cumulative impact of the noise with other known emissions of noise associated with the project and possible future development within the area and the potential impacts of any low-frequency (<200 Hz) noise emissions.

8.1.10 Landscape and Visual Impact Assessment

Visual impacts should be determined by rating and describing potential impacts on visual amenity. Visual interpretations may include view sheds, key features, including populated areas, and protected areas.

8.2 Biological environment impacts

Depending on the type and location of the proposed hydropower project, habitat degradation, fragmentation and conversion may be one of the most significant potential threats to terrestrial, riparian and aquatic biodiversity and disruption of key ecosystem services. Aquatic and riparian habitat degradation and conversion may result from the creation of reservoir (e.g. changes from a free flowing lentic to a lake-like lotic environment), longitudinal upstream- downstream barrier effect caused by the weir, changes in instream flow regimes, dewatering river reaches, and potential abrupt daily flow variation downstream from the tailrace if the project is operating in peaking mode. Terrestrial habitats may be adversely impacted if important areas are flooded by the reservoir, the reservoir creates barrier for important ecological corridors, as well as land-use changes as a result of the development of access roads, development of transmission lines, etc. Once in operation, downstream waters depleted of sediment load, may have greater erosion power (e.g. hungry rivers) and adversely impact riparian habitat. Hence, the EIA should describe the area to be disturbed by all pre-construction, construction and operation activities.

8.2.1 Terrestrial and Riparian Flora and Fauna

The EIA should describe the likely impacts on the biodiversity and natural and critical terrestrial and riparian habitats to be affected by the project activities, including any potential barrier effect on identified ecological corridors. It should include information on the extent of vegetation removal and habitat loss, threat to existence and/or loss of important species of conservation concern, threat to abundance, frequency and distribution of important species in terms of species considered important by the locals and species of conservation value, impacts on breeding and foraging habitat of riparian mammals (e.g. river otters), amphibians, reptiles, birds, and riparian vegetation, and degradation of the structural (e.g. forest coverage) and functional (e.g. permeability) connectivity of any biological corridor impacted.

The vegetation cover and types (e.g. forest, shrub land, grassland etc.) should be described, together with any significant species found or likely to be found within the area of influence. Vegetation removal and loss of habitat should be assessed in terms of its proportion to the terrestrial ecosystems and types found across the area. Important species associated with these types of habitat should be identified and shown in the map, or be modelled, as appropriate.

The assessment should document the impact on all species and habitats within the area of influence, with reference to any species considered as threatened (IUCN Red list: Endangered (EN) or Critically Endangered (CE). The EIA will include an assessment of their population within the area of influence and describe how they will be impacted by the various components of the project across project timeline (i.e. preconstruction, construction, operation, etc.). The impact assessment will consider the threat of the project and whether the species will be likely to get extirpated (local extinction) in the area of influence and whether this may cause a likely change in the overall conservation status of the species. In addition, the assessment of forest loss will be guided by the Ministry prescribed procedures.

8.2.2 Aquatic Flora and Fauna

The EIA should assess the impacts of the project activities to specific aquatic flora and fauna within the area of influence, primarily those that will be affected by modification of river ecosystem instream flow regimes due to a dam or diversion scheme, and changing water flows (e.g. quantity, variability, duration and predictability of high and low and water quality.

Changes brought about by modification in the morphology of the river channel and flood plains as well as changes in hydrologic connections will be assessed. The EIA should also assess the impacts of the changes of water temperature on aquatic flora and fauna due to riparian vegetation clearing.

Box 6: Environmental Flows - eFlows

- Environmental and social issues are intrinsically interlinked. A specific environmental impact can often directly and/or indirectly result in an additional environmental or social impact. For example, changes in flow regimes have impacts for the geomorphology, habitats and ecosystem services of the river, its fisheries and downstream water users. The lack of environmental flow can result in a reduction in fish biomass, which can in turn, result in reduced access to food and/or livelihood for a family that relies on the fishery (loss of ecosystem service).
- The Government of Nepal Hydropower Development Policy (2001) states that:
- ***"Downstream release shall be maintained, at either 10% of minimum mean monthly discharge, or the quantum identified in the EIA study whichever is higher. Implementation of EIA recommendations shall be emphasized"*** (Rijal and Alfredson, 2015)
- Good practice EIA for hydropower in Nepal would include an analysis of the impacts of changes to environmental flows based on scenario assessments to provide a greater understanding of the instream flow requirements, and thresholds under different flow regimes. The assessment of environmental flows should consider a range of scenarios based on good practice guidance – i.e. not just the 10% rule but, for example, seasonal flow releases to maintain river channels or to trigger fish migration.
- When considering all individual environmental and social impacts, an EIA should identify the interlinkages of relevant impacts on other environmental and social issues. Only then will an EIA properly identify all impacts and enable fully-informed decision-making and management planning.
- The impact on changes in instream flows to aquatic ecology can be assessed using environmental flow modelling or methodologies that may be appropriate depending on availability of information and practicality. A variety of methodologies have been used to determine environmental flow requirements, which may be broadly described as follows:
- Hydrological models based on naturalized, historical monthly or daily flow records can be used to determine percentage of existing annual flow that can be released to support ecological and social values in rivers
- Hydraulic rating methods, also known as habitat retention, that use changes in hydraulic variables such as wetted perimeter, maximum depth, measured across single, limiting river cross sections (e.g. riffles), as a surrogate for habitat factors known or assumed to be limiting to target biota
- Habitat simulation or rating, also referred to as microhabitat or habitat modelling, which involves detailed analyses of the quantity and suitability of instream physical habitat available to target species or assemblages under different discharges (or flow regimes), on the basis of integrated hydrological, hydraulic and biological response data
- Holistic methodologies involves an ecosystems approach to river management wherein important and/or critical flow events are identified in terms of select criteria defining flow variability, for some or all major components or attributes of the riverine ecosystem
- The selection of appropriate method would be based on available hydrological data, freshwater and riparian ecological values, ecosystem services provided, and social needs identified, river uses based on social surveys and site observations, historical flow data and predicted flows based on nature of operation of the hydropower facility. The environmental flow specialist would have the ability to select the more appropriate method for a specific hydropower project.

8.2.3 Fisheries

Potential impacts on fish species diversity and abundance will be assessed across the project life. Hindrance to fish natural longitudinal or lateral movements due to obstruction caused by project structures (temporary and permanent) or modification of instream flow regimes will be assessed specially for migratory fish. Loss of access to suitable spawning sites and overall impact on the population of affected fish species in the downstream and upstream reaches will be included. Similarly, modification of instream flow regimes, may affect the natural cues (e.g. flow, velocity, temperature) for upstream and downstream migration, and reduced flows may cause increased temperatures or low dissolved oxygen in the dewatered reaches potentially significantly degrading foraging and/or spawning habitat conditions. Also, loss of suitable fish habitats such as gravel beds and in-channel wetland areas due to project activities will be discussed in the EIA.

Potential entrainment of fish when migrating downstream into hydropower facilities will also be assessed. Potential impacts that may cause the displacement of fishing areas will be identified and assessed. Assessment should include discussion on a range of designs to facilitate passage of migratory fish. Measures may include the provision of fish ladder/fish passage in intake location and fish screen in power house, among others.

8.2.4 Natural and Critical Habitats

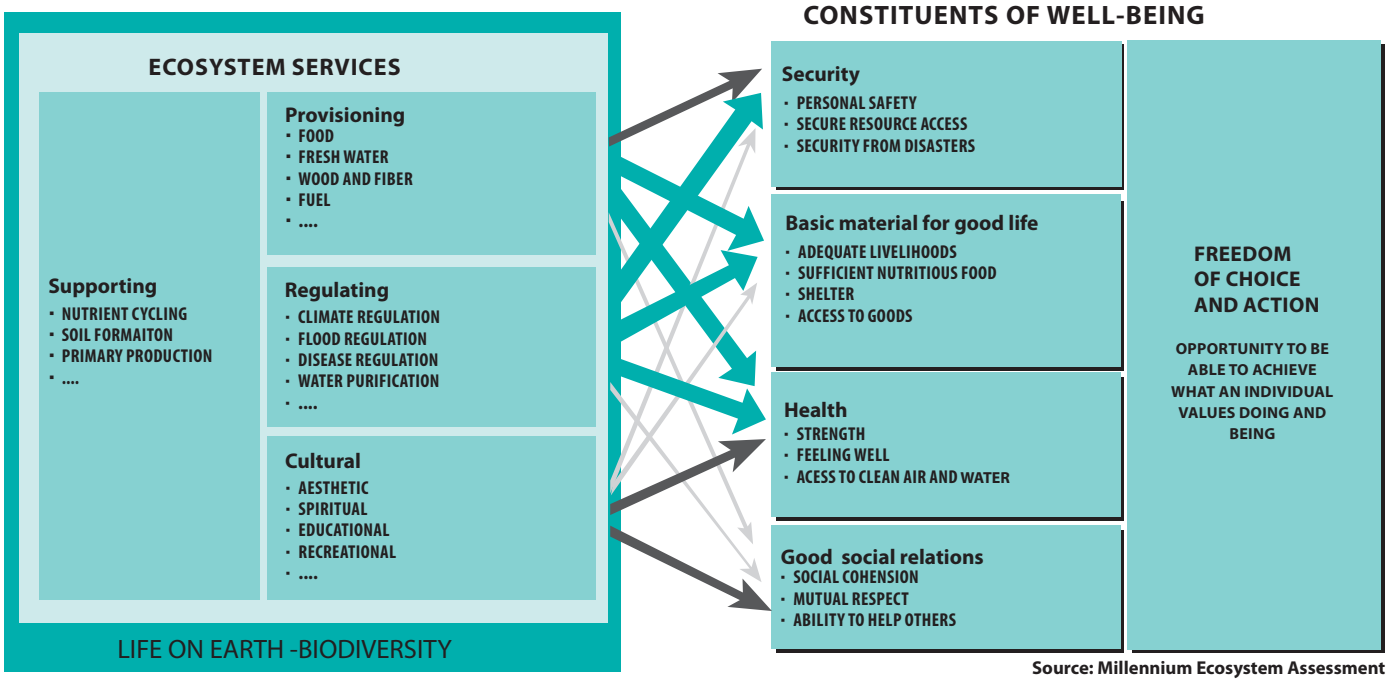
The impact on natural and/or critical terrestrial and aquatic habitats, including biodiversity hotspots corridors and connectivity should be assessed in the impact assessment section of the EIA report. As mentioned earlier, hydropower project development involving the construction of key project components and associated facilities may result in habitat loss, fragmentation, blockage of circulation and connectivity of important biological corridors. The assessment should focus on impacts related to habitat loss, degradation and fragmentation, introduction or presence of invasive species, overexploitation, hydrological changes, and habitat pollution.

8.2.5 Ecosystem Services

Good international practice recommends avoiding impacts on ecosystem services. The impact assessment should spell out project-related direct, indirect and residual impacts on ecosystem services identified in the baseline studies. Direct impacts may include loss of provisioning ecosystem services or access to such services, degradation of regulating, cultural and supporting ecosystem services.

Figure 4 illustrates the four categories of ecosystem services and their linkages to socio-economic indicators and general human well-being. For example, the hydropower project may result in a significant effect in the watershed, which may subsequently result in impacts on provisioning services to local communities and, eventually, to their sources of basic resources for daily sustenance.

Figure 4: Ecosystem Services and Linkages to Socio-economic Factors[15]



Source: Millennium Ecosystem Assessment

ARROW'S COLOR: Potential for mediation by socioeconomic factor

ARROW'S WIDTH: Intensity of linkages between ecosytem services and human well being

8.3 Socio-economic Impacts of Hydropower Projects

This section provides an overview of the typical socio-economic impacts that should be considered and addressed through the pre-construction, construction, commissioning, and operation phases of hydropower projects. Impacts applicable to each individual project should be identified during the scoping exercise and should be further investigated and described during impact assessment process.

Refer to Appendix C for details on the phases during which specific impacts should be anticipated.

Employment and business development opportunities and impacts on other industries

The EIA should identify and describe the employment and business development opportunities that the project would generate through the different phases of development. This should include the number of workers required, types of skills required, areas from where the workforce would be sourced, potential to maximize proportion of local/regional workers through appropriate recruitment strategy and training. Demographic analysis of availability of local and regional workforce should be provided, to understand the potential for sourcing local/regional workforce.

Labor influx management plan needs to be developed – labor camps, their management etc.

An analysis of local, regional and national business development opportunities should be provided. This should include the types of businesses and industries that would be required to service the project and its workforce demand for goods and services. Local people and businesses could be involved in servicing the workers' camps. The EIA should describe how the project will support local/regional employment and business development.

Large projects can attract and draw an existing workforce from other industries and services, creating shortfalls in those businesses and services. Construction activities, changes to the visual landscape, changes to water flows, and ecology can impact other industries/businesses that rely on these resources. The EIA should identify, describe and such impacts on the local and regional economy.

[15] UNEP/GRID-Arendal, Millennium Ecosystem Assessment, 2007 (https://www.grida.no/resources/6075)

Involuntary Displacement and Resettlement Impacts

When project sites are fixed and the proponent has been given Government authority to develop the land for the project, the local communities living and operating on the land will have to be resettled, such physical removal and/or economic activities impact is involuntary displacement of people and/or livelihoods. The EIA must provide information on:

- Location and extent of land requirement for all components of the project with appropriate mapping
- Details of land tenure, title and ownership throughout the area with appropriate mapping
- Specific land use and activities undertaken in the area, including agriculture, fishing, gravel and sand mining, and other industries with appropriate mapping
- Exact number of affected households and people living on the required area, or using the area for livelihoods and other community activities
- Detailed description of the livelihood patterns and socio-economic status of the communities and the ethnic mix of the population
- Analysis of dependency of various stakeholders on the land required for the project
- Outline the process of obtaining the land and how consultation was undertaken in acquiring the land
- Outline the resettlement process for any affected people and demonstrate that consultations have been undertaken with all affected peoples
- Description of potential impacts at the place where people will be relocated
- Provide details that demonstrate that any affected peoples are no worse off
- Consider social impacts on host communities (the communities which will host the people being resettled).

Box 7: Challenges in livelihoods assessment

- Some key challenges to be aware of during livelihoods assessment and management are:
- Distinguish the impacts caused by physical and economic displacement due to land acquisition or restriction of land use; where physically and economically displaced persons who face loss of assets, or access to assets, are entitled to compensation at full replacement cost. Those livelihood impacts caused due to other project impacts, such as reduced or sediment entrapment which would in turn reduce fishing resources or sand / gravel, are subject to mitigation and fair compensation, but are not an entitlement.
- It is sometimes challenging to distinguish between these impacts hence appropriate eligibility criteria should be developed to categories impacted persons.
- Ensure all persons impacted by involuntary resettlement and economic displacement are identified for compensation and assistance and that ineligible persons are discouraged from claiming benefits (such as opportunistic settlers).
- Ensure impact management strategies and compensation criteria are fair, uniform to all impacted persons and transparent to the extent possible. This will assist in managing any community conflict that could arise due to a perception of unfair or ununiformed compensation and opportunities to respite livelihoods.

Livelihoods Impacts

Land acquisition may also result in the loss of access to land or resources, and to sources of subsistence traditional livelihood and other sources of economic activities (e.g. agriculture, timber and non-timber forestry products, mining, etc.), which is referred to as economic displacement. At times, physical displacement of houses may not be necessary but people who have connections to the land may experience loss of other assets or access to assets (e.g. agricultural land) that will result in a disruption of livelihoods and associated loss of income, this is referred to as economic displacement. Either way, if there is disruption to livelihoods, the EIA will be required to assess the extent of this disruption for all affected people and provide a formal and fair process of compensation and livelihood replacement and enhancement. Assessment of impacts on livelihoods should consider the contribution of women to livelihoods of the household and impacts on other vulnerable groups.

Guidance on assessing livelihoods impacts due to land acquisition and economic displacement should be based on Good Practice. Care should be taken in identifying and distinguishing between livelihoods impacts caused due to land acquisition and that caused due to economic displacement.

Demographic/Population Impacts

Demographic/population changes related hydropower projects can arise from:

- Displacement of people from one area
- Resettlement of the displaced population in another area
- Influx of construction workforce and potential unplanned influx of outsiders (extended family and friends) and others looking for work.

The EIA should describe demographic changes in areas from where people are displaced, host communities for the displaced people and areas which will house the project workforce. The EIA should analyze and describe:

- Numbers and profile of households and population that will be displaced from the area and how that would change the demographic profile of the displaced, and host local area and district.
- Numbers and profile of workers that will be brought in to undertake pre-construction and construction activities. Identify the location of where the construction workforce will reside and the numbers of international, national and local staff.
- Analyze and describe the changes in gender, age and household/family composition.

Gender Related Impacts

Impacts on women could include - marginalization in employment opportunities on hydropower projects, a breakdown in social values, norms and security for women (increased Gender Based Violence and exploitation introduction/increase in prostitution and other crime towards women) due to influx of male dominated construction workforce, increased sexually transmitted diseases, and due to increased local unemployment and loss of livelihoods for local population and loss of livelihoods leading to poor nutrition for women. Women often do not have land titles as a proof of ownership due to restrictions on inheritance and land ownership that result in women not getting formal land titles making compensation difficult as it is based on land titles. This may result in a widening of the gender gap and worsen the position and status of women in their community.

Impacts on vulnerable groups

The EIA must address the issue of vulnerable groups (defined in Section 4) as a result of the pre-construction and construction of the project. Impacts on the Indigenous People should be assessed in accordance with Good Practice. The EIA should understand and assess impacts on vulnerable groups related to:

- Loss of access to land and natural resources under customary use
- Loss of critical cultural heritage of Indigenous People
- Loss of identity and cultural values and feel of further isolation and marginalization
- Livelihoods impacts (refer to section on Livelihoods impacts)
- Involuntary displacement and resettlement impacts (refer to section on involuntary displacement and resettlement impacts).

Impacts on Community Values, Health, Safety, and Well-Being

The EIA should understand and assess impacts associated with, but not limited to:

- Loss of identity and sense of belonging to a place/community due to resettlement
- Breakdown in community cohesion due to resettlement
- Conflict over payment/compensation or other project related issues such as locals verses non-local construction workforce
- Safety and security issues such as influence/impact of the generally male dominated construction workforce on local women and youth.
- Emotional and psychological stress during resettlement to new locations
- Impacts related to changes in amenity, increased noise, dust, other disturbances and how that affects people's day to day life
- Impacts related to changes in environmental conditions, contamination of water sources, land and food sources, increased solid waste in the area and how that impacts people's day to day life
- Safety issues from increased traffic, construction machinery, transportation and storage of hazardous material/chemicals and construction activities
- Nutritional disorders due to loss of or disruption to livelihoods

- Spread of transmitted diseases from contact with a large external workforce, including STDs and HIV/AIDS
- Spread of water borne or air borne diseases from contamination of water sources, spread of viruses or bacteria
- Increase in crime, alcohol and drug abuse including violence, exploitation including sexual as a result of an increase in income and the use of that money to pay for alcohol or as a result of stress from resettlement.

Other safety issues that should be considered and managed are:

- Potential flooding due to structural failure of the dam
- Potential drowning of people swimming and recreating in the reservoir
- Potential drowning or loss of possession issues downstream of tailrace, especially in peaking plants, as there could be daily abrupt highs and lows to the flow putting people who use those areas at risk.

Workforce and Working Conditions

Hydropower projects often require large skilled and un-skilled construction workforce, sourced by local, regional, national and international labor. Labor rights are governed by Labour Act 2074 (2017), which includes the right to employment and social security for workers.

EIA should provide details on:

- Equitable recruitment and wages
- Analysis of locally, regionally and nationally available workforce for the project, and requirement of international workforce
- Training
- Working conditions and safety gear
- Living conditions at construction workforce accommodation facilities
- Transportation of workforce – from home to the project area and from workers accommodation to the project site
- Behavior management and code of conduct
- Medical support and emergency response

Human resources policies and procedures of the proponents and contractors should address these requirements.

Impacts on Social/Community Infrastructure, Housing and Accommodation, Increase in Informal Settlements

The demographic/population impacts arising from the project can lead to impacts on community/social infrastructure such as medical and health facilities, schools, child care, housing and accommodation. Demand for such facilities and services can increase in the host communities while need for similar services could decrease in communities or areas from where people would be displaced.

With the influx of workers, outsiders looking for work and displacement of vulnerable groups, there could be the risk of informal settlements developing. The EIA should discuss and assess the potential of such impacts and where they might occur and how they might affect the existing communities/nearest villages in the area.

The EIA should include information on how the proponent will manage such impacts through provision of additional services and facilities, remove, clean up and rehabilitate the areas of both, worker camps and informal settlements after the completion of the construction work, according to the requirements of the local communities and planning authorities.

8.4 Cultural Heritage Impacts

It is important to acknowledge and identify impacts of the project on cultural heritage in the local and regional area of influence. Impacts on cultural heritage can have wider effects on the identity and beliefs of the community or religion. The EIA should include an archaeological and cultural heritage impact assessment. Cultural property, including archaeological, historical, paleontological, and religious sites and objects, can be inundated by reservoirs or destroyed by associated quarries, borrow pits, roads, or other works. The impact assessment should consider tangible and intangible cultural assets including archaeological sites, items, story places, buildings/temples, special ceremonies, graves of ancestors and holy saints and other sacred places and describe how the pre-construction and construction activities, including the influx of workers, has the potential to change the traditional culture of the communities.

8.5 Impact Assessment Methods

Once impacts are identified, the prediction and assessment of impacts should be further supported by understanding of the magnitude, extent and duration of the impacts, collectively considered impact significance.

The National EIA Guideline prescribes a methodology (Method 1) wherein the physical, chemical, biological, socio-economic and cultural impacts identified during the various phases of the project are ranked according to their impact magnitude, extent and duration – to determine an overall impact significance rating. Refer to Appendix A for a full list of baseline study parameters and study methodology for hydropower projects. In addition to complying with Method 1, proponents are required to use either Method 2 or Method 3 to help determine the significance of project impacts.

8.5.1 Method 1

The valuation of impacts is guided by the numerical ratings for magnitude, extent, and duration of project-specific impacts. The sample tabulated risk assessment is shown in Table 11.

Table 11: Environmental and social Impact Ranking Method Magnitude of Impacts

Magnitude of Impacts

Magnitude	Numerical value / rating
High or Major	60
Moderate	20
Minor	10

Extent of impacts

Extent	Numerical value / rating
Regional	60
Local	20
Site-specific	10

Duration of impacts

Duration	Numerical value / rating
Long-term	20
Medium-term	10
Short-term	5

Impact ranking and management matrix (example)

Project Phase Aspect of the Environment	Environmental impact	Impact ranking or rating								Impact management measures
		Direct	Indirect	Beneficial	Adverse	Magnitude	Extent	Duration	Total	
Construction										
Physical & Chemical	e.g. Vegetation clearing	Y	N	N	Y	60	10	20	90	e.g. offsetting through establishment of tree replacement nursery and plantation
Biological										
Socio-economic										
Cultural										
Commissioning										
Physical & Chemical	e.g. Raising of reservoir level and inundation of physical resource									
Biological										
Socio-economic										
Cultural										
Operation										
Physical & Chemical										
Biological										
Socio economic										
Cultural										

Source: Adopted from the National EIA Guideline

8.5.2 Method 2

Table 12: Example criteria for determining significance of impacts

Criteria	Definition
Nature of impacts on environment / community	Beneficial - w that result in net benefits Adverse - Impacts that result in net detriments
Type of impact	Direct - Impacts resulting directly from changes caused by the project Indirect – Secondary impacts caused by the project
Duration and project phase	Temporary - Less than one year Short-term - one year or more and less than five years Medium-term - five years or more and less than 10 years Long-term - 10 years or more Pre-construction – before construction of project starts Construction – when project is being constructed Operation – when project is in use
Level of impact	Negligible – Marginal change from the baseline conditions so no discernible effect is expected and functional recovery occurs within several months Minor – A small but measurable change from the baseline conditions. Changes are expected to be temporary and/or only affect only a small area / number of people. Functional recovery is expected within five years. Medium – Noticeable and relatively substantial change from the baseline conditions. Changes may be longer term or temporary and affect a large area / number of people. Functional recovery is expected within five years. Major – A change fundamentally altering the baseline conditions and affecting a large area / number of people, and/or a moderate area / number of people over the long-term. Functional recovery is expected to take more than 10 years, if at all.

8.5.3 Method 3

Identified impacts can be categorized based on the type or nature of each impact, as follows:

- Beneficial impact – where the impacted environment / stakeholders would be 'better off' due to the proposed development
- Adverse impacts – where the impacted environment / stakeholders would be 'worse off' due to the proposed development.

The adverse impacts can further be assessed to determine their impact significance. The significance of adverse environmental and social impacts on receptors, systems and resources should be assessed using a consistent approach aligned with the whole of the EIA, wherein the impact significance was evaluated on a likelihood and consequence matrix. Likelihood and consequence criteria are detailed in the tables below respectively, with the impact significance matrix shown below.

Likelihood and Consequence criteria

Likelihood level	Description
Almost certain; Common	Will occur, or is of a continuous nature, or the likelihood is unknown. There is likely to be an event at least once a year or greater (up to ten times per year). It often occurs in similar environments. The event is expected to occur in most circumstances.
Likely; Has occurred in recent history	There is likely to be an event on average every one to five years. Likely to have been a similar incident occurring in similar environments. The event will probably occur in most circumstances.
Possible; Has occurred in the past, but not common	The event could occur. There is likely to be an event on average every five to twenty years.
Unlikely; Not likely or uncommon	The event could occur but is not expected. A rare occurrence (once per one hundred years).
Remote; Rare or practically impossible	The event may occur only in exceptional circumstances. Very rare occurrence (once per one thousand years). Unlikely that it has occurred elsewhere; if it has occurred, it is regarded as extremely unique.

Consequence criteria

Consequence category	Environmental description	Social description
Critical Severe, widespread long-term effect	Destruction of sensitive environmental features. Severe impact on ecosystem. Impacts are irreversible and /or widespread. Regulatory and high-level government intervention/action. Community outrage expected.	Irreversible changes to social characteristics and values of the communities of interest or community has no capacity to adapt and cope with change.
Major Wider spread, moderate to long-term effect	Long-term impact of regional significance on sensitive environmental features (e.g. wetlands). Likely to result in regulatory intervention/action. Environmental harm either temporary or permanent, requiring immediate attention. Community outrage possible.	A long-term recoverable change to social characteristics and values of the communities of interest or community has limited capacity to adapt and cope with change. Long-term opportunities emanating from the project.
Moderate Localized, short-term to moderate effect	Short-term impact on sensitive environmental features. Triggers regulatory investigation. Significant changes that may be rehabilitated with difficulty. Repeated public concern.	Medium-term recoverable changes to social characteristics and values of the communities of interest or community has some capacity to adapt and cope with change. Medium term opportunities emanating from the project.
Minor Localized short-term effect	Impact of fauna, flora and /or habitat but no adverse effects on ecosystem. Easily rehabilitated. Requires immediate regulator notification.	A short-term recoverable change to social characteristics and values of the communities of interest or community has substantial capacity to adapt and cope with change. Short-term opportunities emanating from the project.
Negligible Minimal impact or no lasting effect	Negligible impact on fauna/flora, habitat, aquatic ecosystem or water resources. Impacts are local, temporary and reversible. Incident reporting according to routine protocols.	Local, small-scale, easily reversible change on social characteristics or values of the communities of interest, or communities can easily adapt or cope with change. Local small-scale opportunities emanating from the project that the community can readily pursue and capitalize on.

Impact significance matrix

Consequence	Likelihood				
	Almost certain	**Likely**	**Possible**	**Unlikely**	**Remote**
Critical	Very High	Very High	High	High	Medium
Major	Very High	High	High	Medium	Medium
Moderate	High	Medium	Medium	Medium	Low
Minor	Medium	Medium	Low	Low	Very Low
Negligible	Medium	Low	Low	Very Low	Very Low

9

Managing Impacts

Managing impacts consists of benefit enhancement/augmentation and adverse impact mitigation measures in response to the assessed impacts (Section 8). Appendix C comprises a matrix describing some of the generic impacts and associated management measures relevant for various aspects of the environment during each project phase. The basic hierarchy for managing impacts should always be applied, involving enhancement of beneficial impacts, and then avoidance, minimization and/or compensation for adverse impacts.

9.1 Beneficial Impact Enhancement

Project development also includes benefits which can be sustained through enhancement or maximization measures of beneficial impact. Enhancement measures involve being able to provide programs to support biodiversity and conservation, and community development programs. Some examples include restoration of biodiversity resources through watershed management programs or establishment of nursery and tree plantation. Impacted communities and resettled communities can benefit from improved social infrastructure or vocational skills training.

9.2 Avoidance

In the hierarchy of impact mitigation, avoidance is in the first order of priority. This means that the proposed project should consider means of avoiding the impacts from occurring. Examples include: Lowering the dam height to reduce the area of inundation and avoid excessive resettlement of households. Another example is avoiding community clamor or anxiety about a project proposal by providing sufficient information about the project development activities through strategic communication campaigns: Initiation of public awareness programs; Implementation of health education programs; Social support enhancement programs, and; corporate social responsibilities. If the aspect of the project cannot be avoided or the activity resulting in potential impact cannot be stopped, minimization and compensatory measures should be implemented.

9.3 Minimization and Mitigation

Mitigation measures involve bringing down the impact to minimum possible level and taking actions to reduce impact over the time of project operation. For hydropower facilities, corrective measures may include, among others: Providing fish ladders to allow migratory fish to move along the river upstream and downstream of the storage dam; locating the ladder far away from the intake to avoid upstream migrating fish entrapment down the turbines; providing an environmental flow regime to maintain the ecological and social integrity of the river; managing the upstream catchment to reduce sediment loads; flushing sediments during high flows to avoid silting of spawning areas. It is essential that mitigation measures are thought about at early stages of project development to enable their inclusion in the design.

9.4 Compensation

As stated above, hydropower development may involve land acquisition in areas to be developed for establishing permanent structures such as weir, powerhouse, headrace tunnel/penstock and tailrace, including access roads. The acquisition of these lands can potentially result in the physical resettlement

or economic displacement of people. These impacts are mitigated through compensatory measures. The project proponent should be able to undertake proper valuation of properties, crops, and detailed measurement surveys of houses to be affected by the development of the project along with identifying resettlement and rehabilitation options for households that will be involuntarily displaced.

Corporate social responsibility and social development programs aimed at enhancing lives of communities throughout the life of the project operation should also be identified and developed. Additionally, project proponents are encouraged to explore, identify and develop a benefit sharing plan that go beyond mitigation and compensation measures, in consultation with local communities. Benefit sharing schemes could include rural electrification programs, education and employment programs, local equity participation, incentives for ecosystem services, royalties, etc. Refer to Appendix A for more details on common project activities, issues, impacts, and management measures.

9.5 Environmental Management Plan

This section provides information on the process of developing the Environmental Management Plan (EMP) for hydropower projects based on the analysis conducted during the EIA study. The National EIA Guideline references some of the requirements for the EMP.

The EMP provides a set of management measures (Section 8.5) for addressing the range of anticipated impacts identified during the EIA (Section 8) during the different project phases.

Appendix C provides a project-phase focused matrix of potential hydropower project impacts and possible management measures. Typically, projects will provide for an EMP covering pre-construction, construction and operation.

The implementation of a practical and results-based EMP that is capable of identifying and evaluating the actual effects of a project relative to those predicted during the EIA phase is of critical importance. The project proponent should work with design consultant and contractors to devise and implement practical adaptive management approaches to ensure appropriate and timely corrective action can be taken as soon as issues are identified.

Good practice would include occupational, health and safety (OHS) considerations, directly in the EMP.

In developing the EMP, the project proponent should indicate the estimated budget to implement the enhancement and mitigation measures along with the implementation schedule. Roughly, the budget for implementing the environmental management plan depends on the sensitivity of the social and natural environment and the significance of the potential impacts.

The EMP should also include a Disaster Preparedness and Management Plan that identifies potential geo-hazards along with their risk assessment and puts in place a robust responsive preparedness and management plan in coordination with project affected people and local bodies. This should involve building the capacity of local communities and local bodies to prepare for, manage and mitigate potential disasters, setting up of early warning systems, gauging stations to monitor water levels, scheduled drills, etc.

9.6 Environmental Monitoring

The objectives of the Environmental Monitoring Framework are:

- To ensure project components are constructed and operated in compliance with the Government of Nepal's laws and regulations and approval requirements of the EIA;

- To measure the success of proposed mitigation measures in minimizing and/or reducing potential environmental and socio-economic impacts;
- To continuously monitor changes to the baseline environmental and social conditions during construction and operation activities;
- To facilitate a continual review of post-construction and operation activities based on performance data and consultation feedback; and
- To implement corrective actions or new adaptive management programs, as required, if proposed mitigation measures are unable to reduce and/or eliminate potential project-related impacts, or meet the predetermined level of performance.

The monitoring framework is intended to provide guidance on the content of the environmental monitoring procedures and shall not replace any Government of Nepal standards, regulations or laws that are mandatory during construction and operation activities. The following environmental monitoring frameworks are advisable. The baseline, compliance and impact monitoring is required. The baseline information should be recent and updated. The compliance and impact monitoring are performed during construction and operation phases of the project.

Table 13: Environmental Monitoring Framework

Monitoring Parameters	Monitoring Indicator	Monitoring Location	Monitoring Method	Monitoring Frequency	Monitoring Responsibility	Monitoring cost
Pre-construction and Construction Phase						
A. Baseline Monitoring						
Landslides and erosion	Number of landslides/ debris flows/gully formation sites marked and indicated in suitable maps	Dam site, Spoil disposal sites, internal access roads, burrow pit sites, camps, storage facilities etc.	Direct observation and mapping in the appropriate scale map			
Air Quality	TSP , PM10 and PM2.5	Main Dam and reregulating site, Powerhouse site	As per National Ambient Air quality Standards, Nepal			
Water Quality	As there is no water quality standard set for fresh water bodies and rivers, parameters as per Generic Standard Part I: Tolerance Limits for Industrial Effluents to be Discharged into Inland Surface Waters, Nepal, will be used for monitoring indicators	Upstream Dam and downstream of the main and reregulating dams	As per Generic Standard Part I: Tolerance Limits for Industrial Effluents to be Discharged into Inland Surface Waters, Nepal,			
Noise level	dBA	Main dam, reregulating dam and power house site	Type 1 and type 2 sound level meter meeting standard			
Land pollution	Open defecation and garbage disposal places	Along dam site area.	Direct observation			

Monitoring Parameters	Monitoring Indicator	Monitoring Location	Monitoring Method	Monitoring Frequency	Monitoring Responsi-bility	Monitoring cost
Forest Ecology	Forest Status in terms coverage, species present		Three sample plots in each area			
	Photographic documentation showing the forest area from a fixed distant spot (locate the sample plot and photograph tak-en spot in map)		Photography			
Wildlife / Wild-life status	Wildlife status in terms of species present and reported, Raider wildlife		Consultation with locals, note season of raiding, frequency of raiding, and the place raided			
Markets	No of Hotels/Tea stall and Restau-rants	Dam site, Camp site, Internal access road and ancillary facility sites	Direct enumer-ation			
Consumer price	Price of local and imported con-sumer items such as rice, wheat, maize, millet, milk, meat (chick-en, mutton, buff), sugar, kerosene, LPG, vegetables, food/person with meat and without meat, rental for night stay etc. Labor cost/day (male and female)	Dam site, Camp site, Internal access road and ancillary facility sites	Market survey and documentation			
Sanitation	No of Hhs having toilets, Practice of sanitation (Child defecation, solid waste disposal), Source of water (Piped, springs, river etc.) and their quality	Dam site, Camp site, Internal access road and ancillary facility sites	Field survey and documentation, Photographs and testing water quality samples as per drinking quality standards			
Total cost baseline monitoring						
B. Compliance monitoring						
EMP Mitigation Measures	All mitigation actions listed in Mitigation Man-agement Plan for construction phase, all the various man-agement plans implementation	All structural sites and facility sites and their surroundings	Direct supervision and documenta-tion, Consultation with the people			

Monitoring Parameters	Monitoring Indicator	Monitoring Location	Monitoring Method	Monitoring Frequency	Monitoring Responsibility	Monitoring cost
Project Vehicles	As per the limits stipulated in Nepal Vehicle Mass Emission Standards	Vehicles used in Project	Certifications of the vehicles			
Diesel Generators sets	As per the exhaust Emission standards for diesel generating sets	Project area	Certification of the suppliers			
Water quality	Parameters listed in " Tolerance Limits for Industrial Effluents to be Discharged into Inland Surface Waters for compliance	U/S dam site and downstream and burrow pit areas , construction camps	As per Tolerance Limits for Industrial Effluents to be Discharged into Inland Surface Waters			
Climate	Air temperature, rainfall and Humidity	Dam site, Reservoir area and Powerhouse	Establish weather station and arrange manpower to for daily observation			
Water quality in the camps	As per Nepal Drinking Water Quality Standard for compliance	Water supply reservoir and one end tap of the camps	As per Nepal Drinking Water Quality Standard			
Public and Occupational Health (Ambulance, medical doctor, first aid, PPE)	Outbreak of epidemic disease in the village, in the construction camps, Number of workers reporting sickness, no of workers injured, No of construction accident, Number of fatal incidents etc.	All surrounding villages, construction camps	Direct observation, consultation with local people/communities and health workers, managers of camps and construction workforce, health care facilities of the construction camps and sites			
Law and order	Theft, burglary, quarrels, social unrest, Number of police case etc.	Construction areas, labor camps	Direct observation and consultation with the local communities and affected Municipal/Rural Municipal authority and reports of the construction camp management			
C. Impact Monitoring						
Landslides and erosion	Number of landslides/ debris flows/gully formation sites	Dam site, power house, Spoil disposal sites, internal access roads, pit sites, camps, storage facilities etc..	Direct observation and mapping in the appropriate scale map			
Land pollution	Open defecation and garbage disposal places	Along Dam Sites and power house	Direct observation			

Monitoring Parameters	Monitoring Indicator	Monitoring Location	Monitoring Method	Monitoring Frequency	Monitoring Responsi-bility	Monitoring cost
Air Quality	TSP , PM10 and PM2.5	Dam site and powerhouse site	As per National Ambient Air quality Standards, Nepal			
Water Quality	As there is no water quality standard set for fresh water bodies and rivers, parameters as per Generic Standard Part I: Tolerance Limits for Industrial Effluents to be Discharged into Inland Surface Waters, Nepal, will be used for monitoring indicators	U/S of dam site and downstream tailrace and all burrow pit areas , construction camps	As per Generic Standard Part I: Tolerance Limits for Industrial Effluents to be Discharged into Inland Surface Waters, Nepal,			
Noise level	dBA	Dam site, Powerhouse site	Type 1 and type 2 sound level meter meeting standard			
Forest Ecology	Forest Status in terms coverage, species present		Three sample plots in each area			
	Photographic documentation showing the forest area from a fixed distant spot (locate the sample plot and photograph taken spot in map)		Photography			
Wildlife	Wildlife status in terms of species present and reported, Raider wildlife (monkey, porcupine, jackal, leopard)		Consultation with locals, note season of raiding, frequency of raiding, and the place raided			
Faunal and floral diversity	Status of faunal and floral diversity	All remaining forest after forest clearance	Field survey			
Aquatic ecology	Fish types available	Monitoring locations as per Baseline survey EIA report	Cast net, 200 times in one stretch			
Affected people by land and property acquisition	Satisfaction on the resettlement and rehabilitation packages	All project sites	Grievances records, consultation with the affected households			
Affected people by land and property acquisition	Economic and social status of the displaced households	Displaced households of the project	Sampling survey of the displaced households			

Monitoring Parameters	Monitoring Indicator	Monitoring Location	Monitoring Method	Monitoring Frequency	Monitoring Responsibility	Monitoring cost
Markets	No of Hotels/Tea stall and Restaurants	Dam site, Powerhouse site	Direct enumeration			
Consumer price	Price of local and imported consumer items such as rice, wheat, maize, millet, milk, meat (chicken, mutton, buff), sugar, kerosene, LPG, vegetables, food/person with meat and without meat, rental for night stay etc. Labor cost/day (male and female)	Dam site, Powerhouse site	Market survey and documentation			
Sanitation	No of Hhs having toilets, Practice of sanitation (Child defecation, solid waste disposal), Source of water (Piped, springs, river etc.)	Dam site, Camp site, Internal access road and ancillary facility sits	Field survey and documentation, Photographs			
Total impact and compliance Monitoring costs – construction						
Operation Phase						
Compliance monitoring						
Mitigation Measures	All mitigation actions listed in EMP and Environmental Mitigation Management for Operation phase	All structural sites and facility sites and their surroundings	Direct supervision and documentation			
Water quality in the operation camp	As per Nepal Drinking Water Quality Standard for compliance	Water supply reservoir and one end tap of the camps	As per Nepal Drinking Water Quality Standard			
Landslides and erosion	Number of landslides/ debris flows/gully formation sites	Dam site, internal access roads	Direct observation and mapping in the appropriate scale map			
Air Quality	TSP , PM10 and PM2.5	Dam site, internal access roads	As per National Ambient Air quality Standards, Nepal,			
Water Quality	Parameters listed in " Tolerance Limits for Industrial Effluents to be Discharged into Inland Surface Waters" 2003 – to examine impact on the receiving water body	Upstream Dam and downstream tailrace	As per Tolerance Limits for Industrial Effluents to be Discharged into Inland Surface Waters" 2003,			

Monitoring Parameters	Monitoring Indicator	Monitoring Location	Monitoring Method	Monitoring Frequency	Monitoring Responsibility	Monitoring cost
Climate	Air temperature, rainfall and Humidity	Damsite / Powerhouse site	As per parameter listed			
Noise level	dBA	Dam site/ Powerhouse site	Type 1 and type 2 sound level meter			
Forest Ecology	Forest Status in terms coverage, species present		Three sample plots in each area			
Wildlife	Wildlife status in terms of species present and reported,		Consultation with locals, note season of raiding, frequency of raiding, and the place raided			
Aquatic ecology	Fish types available	Upstream Dam site, and downstream tailrace	Cast net, 200 times in one stretch			
Land acquisition and resettlement	Performance	All Project sites and surrounding areas	Sample survey,			
Markets	No of Hotels/Tea stall and Restaurants	Dam site and powerhouse site	Direct enumeration			
Consumer price	Price of local and imported consumer items such as rice, wheat, maize, millet, milk, meat (chicken, mutton, buff), sugar, kerosene, LPG, vegetables, food/person with meat and without meat, rental for night stay etc. Labor cost/day (male and female)	Dam site / powerhouse site)	Market survey and documentation			
Sanitation	No of Hhs having toilets, Practice of sanitation (Child defecation, solid waste disposal), Source of water (Piped, springs, river etc.)	Dam site/ powerhouse site, camp sites and internal access roads	Field survey and documentation, Photographs			
Total Monitoring Operation						

9.6.1 Baseline impact and compliance monitoring

Baseline monitoring should be conducted during the pre-construction phase to fill in baseline data gaps and to update baseline information provided in the EIA report. Impact monitoring should be conducted during the construction and operation phase to detect environmental changes which may have occurred as a result of project implementation. Compliance monitoring should be conducted periodically or continue over the duration of construction and operation to ensure project compliance with recommended environmental protection standards.

Compliance monitoring should be given first priority with focus on ensuring compliance with mitigation actions, which are intended to contribute to the control and management of environmental degradation. The impact monitoring at ambient levels should be conducted as appropriate and required.

9.6.2 Internal monitoring

Regular frontline internal environmental monitoring of construction work, associated activities and the implementation of environmental management measures should be undertaken by the project, irrespective of the indicated monitoring responsibility in Table 13.

For the land acquisition, resettlement and rehabilitation of the affected households, project should undertake frontline monitoring and shall keep all records pertaining to the Compensation Determination Committee (CDC) decisions. The project is responsible to be aware of the EMP provisions on compensation on lost assets and productivity, and livelihood assistance to the project displaced people prior to the decision of the CDC. The project shall also keep all records of compensation payments and livelihood assistance.

Frontline monitoring of the project information disclosure, regular stakeholder consultation, community relationship liaison, public grievances, and response to grievances, etc. shall be undertaken by the project.

9.6.3 External Monitoring

To ensure high quality implementation of the EMP, the concerned ministry will perform the necessary monitoring. EMP evaluations will be based on:

- Design/Pre-construction:
  - reviewing detailed project designs, EMPs;
  - reviewing of the records and monthly monitoring reports of land acquisition and resettlement;
  - reviewing of projects bi-monthly monitoring report;
  - an inspection of the main Project sites.
- Construction:
  - reviewing project's monthly frontline monitoring reports;
  - reviewing of the written instructions and corrective actions by the project;
  - reviewing of the daily weekly, and monthly monitoring records of the project;
  - reviewing of the records and monthly monitoring reports of land acquisition and resettlement, and grievances;
  - inspecting all operational construction sites and associated facilities; and,
  - liaising with other GON authorities.

The timeline of such external monitoring activities at this stage cannot be stated due to a lack of external monitoring guidelines of development projects from the concerned ministries. What could be foreseen is that they have the legal right for external monitoring visits with the objective to ensure project compliance with the EMP, project approval conditions and statutory requirements. Section 8 of EPA and as per clause 13 and 23 of EPR 1997, the environmental inspectors are entitled to environmental inspections of the project to ensure compliance with national standards.

9.7 Environmental Audit

The environmental audit shall be conducted after 2 years of the operation of the proposal or delivery of service from the proposal/project. The official record and environmental monitoring reports concerning the implementation of environment protection measures required for environmental audit shall be provided by the proponent to the prescribed environmental auditor.

Environmental audit shall be undertaken as specified in Rule 14 of the EPR. The social audit is incorporated within the environmental audit.

In the context of EIA, the environmental audit shall assess the actual environmental impact, effectiveness of environmental impact mitigation and enhancement measures and functioning of monitoring mechanisms. The audit pays special attention to the changes occurred in the proposal implementation area before and after construction of the project.

Generally, the environmental (including social) audit is performed only once for each proposal. In general, the term "Audit" refers to the field of finance and accounting. However, for the purpose of this section, "Audit" means examination and assessment of a certain type of performance.

9.7.1 Types of Audit

The following types of environmental audit, as per international good practice, can be conducted to update the impacts likely to be caused on the environment while implementing the proposal:

- Decision Point Audit: It examines the effectiveness of the EIA as a decision-making tool.
- Implementation Audit: It ensures that approved terms and conditions have been fulfilled.
- Performance Audit: It studies the work of agencies associated with proposal management.
- Project Impact Audit: It examines environmental changes arising from the proposal implementation.
- Predictive Technique Audit: It examines the accuracy and utility of predictive techniques by comparing actual against predicted environmental impacts.

The EIA Procedure Audit examines critically the methods and approaches adopted during the EIA study.

- Since the EIA is a project level study, it is appropriate to conduct the Project Impact. It shall be ascertained in the EIA report as to what type of audit is to be carried out.
- Environmental audit makes a significant contribution to the gradual development of the concepts of EIA and helps to obtain information about the appropriateness of the environmental protection measures.
- In the course of environmental audit, monitoring results should be compared with data generated during the pre-proposal period. Such comparison may be made on the basis of other proposals or standard norms of similar nature. Comparisons made between the predicted impacts and actual impacts help to examine the accuracy and adequacy of EIA.
- The EIA report shall include the type of environmental and social audit to be conducted and information about the indicator/s, method and timing of the audit. Generally, it will be appropriate to maintain uniformity between the methods employed in collecting baseline data and information, and carrying out monitoring during the EIA. The EIA audit is carried out after 2 years of commencement of the proposal. The Ministry is responsible for carrying out this audit.

9.7.2 Format of Audit Report

The format of the audit report may vary depending on the objective and area of the audit. Nonetheless, it should be presented in a logical manner.

Chapter 1: Executive Summary

Chapter 2: Description of audit administrative activities, interviews conducted in project site, party conducting audit and the audit area and methods shall be included in this study. Similarly, data and details concerned with environmental monitoring and audit shall also be included.

Chapter 3: Full audit details

Chapter 4: Suggestions and corrective actions to be complied with regarding the project

Appendices

9.7.3 Human resources to be comprised in audit team

- Technical expert (relevant to the subject of proposal)
- Environment expert
- Social, economic and cultural expert
- (4-5 more experts on the basis of the sector and type of the proposal, and the severity of the impacts caused by it)

Table 14: Checklist for Environmental Audit (Use in conjunction with the Project EMP)

Physical Aspect/Component

	Parameters	Project Activities	Predicted Impacts	Key Impacts	Mitigation Measures	Effectiveness	Information	Source of Data
1	Air Quality							
2	Water Quality							
3	Noise Level							
4	Land Use							
5	Water Resources							

Biological Aspect/Component

	Parameters	Project Activities	Predicted Impacts	Key Impacts	Mitigation Measures	Effectiveness	Information	Source of Data
1	Forest							
2	Flora/ Vegetation							
3	Fauna/ Animals							
4	Non-Timber Forest Products							
5	Aquatic species							
6	Rare, Endangered and Threatened Species							
7	Protected Area							

Socio-economic and Cultural Aspect/Component

	Parameters	Project Activities	Predicted Impacts	Key Impacts	Mitigation Measures	Effectiveness	Information	Source of Data
1	Education							
2	Agriculture							
3	Employment							
4	Migration							
5	Health and Sanitation							
6	Environmental Beauty							
7	Gender Issues							
8	Religious and Cultural Aspects							
9	Social Status							

10 Reporting

10.1 Content and information requirements for the EIA report

The results of the baseline environmental studies, impact assessment, alternative analysis and recommendations of appropriate enhancement/mitigation measures, environmental management plans will be documented in an EIA report. Ideally the description of impacts and management measures in the EIA report should follow the order of the project cycle: preconstruction, construction, commissioning/operation and decommissioning.

The Environment Protection Rules (Schedule 6) provides an annotated template which should form the structure of the EIA Report. Table 15 summarizes relevant information requirements for the EIA report, including references to source information in this Manual. Good practice would ensure that all the aspects discussed in Sections 7, 8 and 9 and Appendix C of this Manual are duly considered and, if relevant to the project, addressed in the EIA report.

Table 15: EIA report content and information requirements

Content	Minimum Information requirements
Introduction	Project proponent details
	EIA objectives
	Project rationale
	Project background
	Project description
	Project locations/accessibility
	Project components
	Project activities
	Construction planning
Procedures Adopted for Preparing the Report	Review of information
	Delineation of catchment/watershed
	Public notice
	Baseline data checklist or questionnaire
	Field study methodology
	Stakeholder engagement and consultation
	Laboratory analysis
	Methodology for impact assessment
	Draft report preparation
	Final report preparation
Existing Environmental Conditions	Physical & chemical environment
	Biological environment
	Socio-economic environment
	Cultural environment
Impacts to be caused on the Environment and Protection Measures while Implementing the Proposal	Physical & chemical impacts
	Biological impacts
	Socio-economic impacts
	Cultural impacts

Content	Minimum Information requirements
Alternative Analysis of the Proposal	Non-implementation scenario (beneficial and adverse environmental impact) Alternative 1 (design, project site/location, topography, ecosystem diversity, operational procedure, timeline, raw materials, adverse impacts) Alternative 2 (design, project site/location, topography, ecosystem diversity, operational procedure, timeline, raw materials, adverse impacts) Alternative 3 (design, project site/location, topography, ecosystem diversity, operational procedure, timeline, raw materials, adverse impacts)
Measures to enhance Beneficial Impacts and Mitigate Adverse Impacts	Measures to enhance beneficial impacts Avoidance or preventive measures Minimization and mitigation or corrective measures Compensatory measures Resettlement and rehabilitation measures Benefit sharing measures
Policies, Acts, Rules, Guidelines, Standards	Policies and strategies/working policies on EIA and hydropower development Laws, acts, rules on hydropower development, forestry protection, land acquisition, watershed management, waste management Guidelines and manuals, Standards, on environmental flow, air quality, noise monitoring, water quality, effluent discharge
Environmental Audit	Environmental audit through any of the following methods: decision point audit, implementation audit, performance audit, project impact audit, predictive technique audit, EIA procedures audit
Conclusions	Overall commitments/obligations of the project proponent for environmental protection and compliance monitoring
Additional Information / Appendices	Copy of approved ToR of the EIA study Maps and photographs of the project site (showing land, geographical location, land use, geology, soils, geomorphology) Aerial photographs (project location and surrounding areas) Questionnaires and survey forms for each environmental and social attribute Charts and trends to describe environmental and social baseline information Climatic and hydrological data (historical data) Terrestrial and aquatic flora and fauna data and documentation Geological and risk evaluation data (dam safety and operational protocol) Baseline water quality, air quality, and noise level Documentation of public consultation and stakeholder engagement activities (attendance sheets, audio-visual presentation and recordings, presentation slides, photographs, contact information of key informants and stakeholder representatives consulted throughout the course of the EIA study) Socio-economic activities (responses to survey questionnaire) Qualification of EIA study teams and contact details Self-declaration forms of the EIA study team and project proponent (signed) Copy of public notices, deed of public inquiry, letter of recommendation, written opinions, and suggestions, public consultative meeting/public hearing related documents concerned with the study. Commitments/Obligations tracking, including environmental, social, stakeholders, etc.

The information requirements above are project specific and therefore not exhaustive.

11 Reviewing

The EIA Review process will be conducted in accordance with the Environment Protection Act, 1997.

The goal of the EIA review process is to determine whether the EIA report:

- Reflects the Policies, Rules and Regulations of the Government of Nepal
- Complies with the approved TOR
- Suggests reasonable alternatives to the proposed project
- Is based on scientifically- and technically-sound methodologies
- Identifies all beneficial and significant adverse environmental impacts likely to arise through project implementation, with impact management measures where applicable
- Provides clear, complete information in a way as to be understood by decision-makers
- Clearly describes risks, assumptions and limitations
- References the sources of information cited in the report

11.1 Approval

Where the EIA has satisfied the majority of the requirements necessary for approval, the Committee may determine that they wish to formalize a series of specific Conditions of Approval to reflect: (a) Commitments / Obligations made by the project proponent as part of the EIA; (b) Additional obligations determined by the Committee during the process of EIA review and discussion.

The Committee should issue a formal letter of conditional/unconditional EIA approval to the project proponent and publish a Notice to Proceed to signify the end of the EIA process and outlining the various post-approval and project implementation processes.

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Appendix A: Baseline study parameters and study methodology for hydropower projects

Environmental Aspect	Minimum Baseline Study Parameters	Source/Method of Data Collection	Use in EIA Study
Physical			
Weather and climate	Temperature Precipitation Humidity Evapotranspiration Wind direction Atmospheric pressures	Department of Hydrology and Meteorology (DHM) provides data on climate and weather Project Feasibility Study Report would contain information on historical weather and climate data as basis for assessing hydropower potential Secure 30-year average climate data from the DHM Secure Rainfall Intensity-Duration-Frequency (IDF) curves from DHM	Data will be used for characterizing existing weather and climate patterns within the study areas. Information will be used for hydrologic modelling.
Hydrology	Major rivers Average flow Maximum flow Other water resources	Stream flow data from DHM at certain sections of river (e.g. upstream of the weir or dam, downstream of powerhouse, and midstream of weir/dam of powerhouse) Project Feasibility Study Report would contain information on streamflow data used for investigating hydropower potential Secure/measure daily streamflow data at certain sections of the river; if not available, use suitable methods to calculate streamflow (e.g. rainfall-runoff method) Records of historical floods during extreme weather conditions and occurrence of glacial lake outburst floods (GLOF), ICIMOD	Information will be used in characterizing streamflow at certain sections of the river for hydropower development. Historical streamflow data will be used for hydrologic and hydraulic modelling of instream flow changes. Streamflow information will be used in analyzing aquatic habitat characteristics and water quality data.
Sedimentation	Sediment load concentration	Determine sediment load concentration at certain sections of the river in relation to proposed location of the hydropower facilities (i.e. weir, intake structure, powerhouse, etc.)	Sediment load will be used in hydrologic and hydraulic modelling to characterize river flows and aquatic habitat and future scenarios when hydropower plant becomes operational.
Air quality	Nitrogen oxides (NOx) Carbon monoxide (CO) Sulfur oxides (SOx) Particulate matters (total suspended particulates, PM10, PM2.5)	Ambient air monitoring compared to Nepal Ambient Air Quality Standards 2012 (2069 B.S.) and standard limits of ambient air quality parameters around construction sites Measurement, analysis with calibrated equipment (air quality parameters, including volatile organic compounds (VOCs) and benzene)	Establish baseline ambient air quality to assess whether construction activities are likely to impact ambient air quality.
Noise	Ambient noise level Equivalent noise level	Ambient and equivalent noise levels compared to Nepal Noise Standards 2012 (2069 B.S.) Noise levels for different land use categories and noise generating equipment Measurement, analysis with calibrated equipment (sound level)	Establish baseline ambient and equivalent noise levels to assess whether construction and operational activities of hydropower development are likely to impact nearby sensitive receptors.

Environmental Aspect	Minimum Baseline Study Parameters	Source/Method of Data Collection	Use in EIA Study
Water quality	Surface water quality parameters (including testing of dissolved oxygen, turbidity, total suspended solids, dissolved oxygen, conductivity, total nitrate, etc.) Groundwater quality compared to drinking water standards (including testing of dissolved oxygen, total suspended solids, conductivity, total nitrate, etc.)	Comparison of water quality parameters against Nepal Drinking Water Quality Standards, 2005 (2062B.S.) Establish water quality of identified source/s of drinking water supply in project camps and construction sites Compare drinking water quality standards against National Drinking Water Quality Standards, 2005 (2062B.S.)	Establish water quality of surface water and sources of drinking water supply for construction camps and water to be used for construction and operation of the site office.
Geology, geomorphology, soils, and natural hazards	Rock and soil type Geological formation and structure, lithology, attitudes of beds and discontinuities Occurrence of landslides Potential for debris flow Potential occurrence of GLOF Location of active faults Soil erosion potential Seismicity	Geological maps, engineering geological maps Aerial photographs Site walkthrough and observation Geotechnical investigation based on Detailed Project Report	Establish baseline information on geology, geomorphology, soils, and natural hazards as basis for safety engineering design criteria. Site specific risks, including but not limited to seismic activities, GLOF, slope stability, soil erosion, and other dynamic loading, in relation to construction and operation of hydropower project facilities should be established.
Land	Land use Use of natural resources Topography Land cover (i.e. types of agricultural lands)	Land use map Topographic map Field walkthrough Aerial photographs Satellite images GIS maps Google ® images	Establish land use and classification and identify potential conflict or encroachment on land use.
Watershed	Soil erosion potential Identify water sources such as springs, wetlands, catchment area etc. Delineate area of the watershed or catchment area Characterize existing condition of the watershed (i.e. determine protection status, regulatory mandate, etc.) Watershed hotspots	Soil loss estimation Measurement of degraded land area as shown on a map Soil erosion potential map Watershed	Establish existing baseline condition of the watershed or area of influence of the hydropower project to be able to assess potential impacts of the project on existing resources Also refer to "Biological Environment"

Environmental Aspect	Minimum Baseline Study Parameters	Source of Data, Method of Collection, and Nepal Standards Requirements	Use of in EIA Study
Biological			
Flora (terrestrial and aquatic) *Also refer to fishery and aquatic ecology	Forest type Forest management type: community, private, religious, lease-hold, government List of major plant species (protected species, endemic species, non-timber forest products) Ethno-botanically important plant species Aquatic plants Invasive species Agro-biodiversity Wildlife corridor Biodiversity hotspots Vegetation cover Medicinal plants	Field investigation, sampling, inventory and identification Herbarium collection and identification Nepal national inventory Interview with local community Site visit and observation CITES and IUCN lists Reports and periodicals from GoN. Forest Sector Rules and Regulation of GoN	Establish baseline data throughout seasonal variation and using secondary references and identify potential impacts of the hydropower project on critical habitats, flora and fauna.
Fauna (terrestrial)	Types of wildlife (including mammals, herpetofauna, entomofauna, reptiles, and their migration corridor) Avifauna (including migration patterns, particularly along/across project sites) Wildlife habitat and existing conditions	Field investigation using traps/nets, use of pellets, and appropriate techniques Interview with local communities Site walkthrough and observation (e.g. pug marks) Secondary data and CITES and IUCN lists Reports and periodicals from GoN. Forest Sector Rules and Regulation of GoN	Establish baseline information on terrestrial fauna.
Fisheries and aquatic ecology	Fish catch and species identified Fish movement or known migration along river and its tributaries Aquatic habitat status or existing conditions Status of resident and migratory fish Macro invertebrates including crustaceans, molluscs, aquatic insects Plankton and periplankton	Fish sampling Interview with fishermen Secondary data Field observation Meso-habitat survey Surber sampler Plankton net Appropriate fishing or netting technique	Delineate study area or area of influence (watershed, map of project key components, project type, and purpose). Identify areas likely to be affected (curtailed reach or section likely to experience reduced instream flows) Assess potential impacts of reduced instream flows on fisheries and aquatic ecology in general.

Environmental Aspect	Minimum Baseline Study Parameters	Source of Data, Method of Collection, and Nepal Standards Requirements	Use of in EIA Study
Socio-economic and cultural			
Demography	Population distribution (age, sex, religion, population, population growth, migration patterns) Family and types Ethnic composition, vulnerable and marginalized groups Average household size	Rural Municipality/Municipality profile District profile CBS data Household survey Focus group discussion Key informant interviews Participatory rural appraisal or PRA Rapid rural appraisal or RRA	Establish baseline conditions of project affected families within area of influence and assess potential impacts on these stakeholder groups.
Houses and Settlement	Types of houses and settlement pattern (nucleated, dispersed family), distance of settlements, ownership status, materials used for construction Total household Average household size	Rural Municipality/Municipality and municipality profile District profile Site visit and observations Focus group discussion Satellite images CBS data	Determine location of sensitive receptors, map project affected households within the project area of influence and assess potential impacts of hydropower development on these sensitive receptors.
Education	Number and type of educational institutions Enrolment details Literacy rate Educational status (according to level of degree and age)	Rural Municipality/Municipality and district profiles Household survey Interview with stakeholder groups School records	Determine level of education of project affected families and identify potential and capacity to be employed during project development. Assess potential benefits project may bring to these project affected families.
Health, sanitation, and hygiene	General health condition Types of prevalent, and new diseases (e.g. HIV/AIDS, STD) Status of communicable and non-communicable diseases Toilet and sewer facilities Sources and access to safe drinking water	Rural Municipality/Municipality and district profiles Household survey Interview, site visit, and observations Health posts, primary health care center, hospitals	Establish existing baseline conditions and identify avenues to prevent spread of communicable diseases during project implementation.
Waste management	Existing waste management practices (e.g. landfill sites, hazardous waste management practices, wastewater treatment and disposal, solid waste management disposal practices)	Rural Municipality/Municipality and district profiles Household surveys Interviews, site visit and observations Focus group discussion	Establish existing waste management practices and identify options for properly managing and disposing of wastes during construction and operation phase.

Environmental Aspect	Minimum Baseline Study Parameters	Source of Data, Method of Collection, and Nepal Standards Requirements	Use of in EIA Study
Physical / Community infrastructure	Status of road and bridges Existing power sources and facilities Communication (telephone, post office) Drinking water supply Market establishments Industry or factory Financial institutions (e.g. cooperatives, saving groups, banks) Police or security agencies Number of educational institutions Communication centers Water mills Micro-hydro facilities Irrigation supplies/ sources Recreational and religious sites (community common areas)	Rural Municipality/Municipality and district profiles Household survey Interview and conduct of focus group discussion Secondary sources	Establish baseline information to be able to identify potential social development programs to enhance existing conditions of project affected families within the area of influence.
Economy	Sources of income and expenditure level Livelihood sources Employment and remittances Land ownership and tenure system Livestock practices Poverty status	Rural Municipality/Municipality and district profiles Household surveys Interviews, site visit, and observations	Establish existing baseline conditions of project affected families within the area of influence and identify potential opportunities to improve livelihood to support families, especially those to be resettled.
Water use	Water use for agricultural purpose (e.g. rafting, swimming, household uses) Water use rights Water user groups Observations on upstream and downstream water uses	Rural Municipality/Municipality and district profiles Household surveys Interview, site visit and observations	Establish river water users/uses to be able to assess potential impacts on these user groups and opportunities for them to benefit from ecosystem services.

Environmental Aspect	Minimum Baseline Study Parameters	Source of Data, Method of Collection, and Nepal Standards Requirements	Use of in EIA Study
Gender status	Sex ratio Single-headed households Socially dependent groups (children, women) Differently-able Vulnerable groups Different experiences of men and women Changes to gender divide/roles Differences in education, literacy, and income generation in men & women. Sex based discrimination decision making process	Household surveys Rural Municipality/Municipality and District Profile, Walk through survey, Focus group discussion	Establish existing conditions and identify opportunities to promote opportunities to engage women in project development and enhance benefits to vulnerable groups.
Culture	Languages used Religious practices, rituals, and tribes Indigenous knowledge and practices Cultural and archaeological sites Traditional places and festivals (i.e. traditional lifestyles and practices) Sites and rituals for funeral sites Common property resources (e.g. traditional grazing, common agricultural farms, community resting place) Ethnic groups vs vulnerable groups (e.g. cast groups)	Nepal prescribed methodology and standards for archaeological finds and cultural heritage International Labour Organization 169 (Free, Prior and Informed Consent)	Establish baseline data and assess potential impacts on cultural heritage, vulnerable groups, their lifestyle and determine opportunities to preserve or enhance conditions, as appropriate.
Indigenous peoples	Traditional knowledge, skills, technology and special knowledge of the Aadibasi / Janjati Use of land Use of natural resource	Rural Municipality/Municipality and District Profile Walkthrough Survey Focus Group Discussions	Identify impacts on indigenous peoples.

Appendix B: Example socio-economic household survey

The following socioeconomic survey questionnaire can be used to collect baseline information on households within the hydropower project social area of influence.

The content / questions are subject to change depending on project site location and specific local conditions.

Contents:

A. Survey Details and Consent
B. Household Characteristics
C. Tenure, Settlement and Housing
D. Land, Agriculture and Natural Resource Use
E. Livelihoods, Income, Expenditure & Well-being
F. Access to Social Services and Amenities
G. Public Health
H. Socio-Cultural and Community Characteristics
I. Flood History

A. Survey Details and Consent

Date (day/month/year):	
GPS Coordinates:	
Name of the Province/District/Ward (RM/Mun.):	
Name of the Village:	
Code of the community:	
Upstream / Downstream of dam?	
Name of the interviewer:	
Code of the interviewer:	
Interview start time:	
Interview end time:	
Name of head of household (at that time) who is interviewed:	

Consent Form – it introduces the surveyor, explains the purpose of the survey, describes how long it will take and requests permission to proceed.

INTERVIEWER TO READ THE FOLLOWING TO INTERVIEWEE AND REQUEST THEIR SIGNATURE:

My name is _____. I am from _____working on behalf of the _____. I am collecting data for an Environmental and Social Impact Assessment study for the proposed _____ hydropower project which has the objectives of _____ (e.g. power generation, flood management, irrigation development, water abstraction, etc.). We would like to understand the current living conditions within the project area. The results from this survey will help _____(company) manage the projects potential environmental and social impacts and share the benefits with local people.

If you choose to participate in the survey you are free to refuse to answer any of the questions that may make you uncomfortable. You can also end the interview at any time. You can stop me at any time to clarify the questions or ask me to repeat something you don't understand. The question sessions will last about 30 to 60 minutes. We realise that your time is valuable and your participation is greatly appreciated. It is extremely valuable to the success of this Project of (national or regional or local) importance.

Your participation in this study is solely for research purposes. The answers you provide are confidential and will be stored securely in the offices of _____. Your confidentiality will be protected at all times.

Your name and any other identifying information will be accessible only to the researchers, and will never appear in any report that might be published.

Your participation in this study is completely voluntary. Please sign (or make a thumb print) below if you consent to participate in the study, or you refuse to consent.

Agree to participate	Yes		No	

B. Household Characteristics – categories should be modified to be useful to project socio-economic context

B.1 What is the gender / age profile of the household?

Age group	Females	Males
0-14		
15-24		
25-39		
40-54		
55+		

B. 2 What is the highest educational qualification attained in the household?

	F	M
None		
Post graduate studies		
University		
College		
High school		
Elementary		
Other		

B.3. What is the employment status of the main income earner?

Employed		Unemployed	
Self-employed			
Pensioner		Not able to work	
Student, pupil		Overseas worker	
Housewife		Other (specify)	

B.4 What is the caste/ethnic group of the majority of the household?

C. Tenure, settlement and housing

C.1. What is the land tenure type of your household?

Freehold	
Leasehold	
Customary	
Community Land	
Other (specify)	
Don't know	

C. 2 Has the household always stayed in this village:

Yes	
No	
If answer 'no' then add from where they moved from:	
Another province	
Another district in the same province	
Another village in the same district	

C.3 Does your household include the following structures?

Cement buildings	
Animal housing	
Grain storage	
Toilet structure	
Business structure	
Other (please specify)	

Other_____

C. 4 What type of functioning household goods do you have in your home?

Does the household have access to basic household items? e.g., stove, refrigerator, radio, cell phone	
Does the household have access to luxury items? e.g., TV, DVD player, fan, sewing machine, computer	
Does the household own basic means of transport? e.g., Cart, bicycle maybe even motorcycle?	
Does the household have access to luxury transport? e.g., car, truck, bus.	
Does the household have access to cultural items? Books, magazines, books for school	
Does the household have basic manual tools for farming? e.g., plough, hoe, axe	
Does the household have access to mechanised tools for farming? e.g., tractor	

Notes_____

D. Land and Agriculture

D.1 On the whole, how do you use your land plot? What is its main role?

It is an important source of our income because we sell the produce.	
It is an important source of our food.	
It serves for the family's rest	
We don't use it in any way	
Other (please specify)	

Other_____

D.2 Have you had a land dispute with anyone in the last 10 years and if so, what was the cause of it?

Boundaries	
Taking crops that weren't theirs	
Transaction amount	
Ownership	
Other (specify	
No dispute	

Other_____

D.3. Who in the community has the final say on land disputes? (INTERVIEWER TO COLLECT CONTACT DETAILS)

Household head	
Local leader	
Government land department	
Police	
Other (please specify)	

Other_____

D.4. What type of agricultural land does your household have? (MULTIPLE ANSWERS ALLOWED)

Grain crop land	
Orchard (fruit trees)	
Vegetable garden	
Pasture for animal grazing	
Fallow (unused) fields	
Other (specify)	
No agricultural land	

Other_____

D.5. If you didn't cultivate either all or the main part of your agricultural land plots this year, what are the reasons? (MULTIPLE ANSWERS ALLOWED)

The land plot is far away	
There is a shortage of irrigation water	
The soil quality is a poor	
Lack of finance	
Cultivation is not profitable	
Too old and unhealthy to work the land	
Because of a lack of mechanization (tractors, etc.)	
Lack of human resource	
Other (specify)	
Question not applicable	

Other_____

D.6 What type of crops does your family produce? (MULTIPLE ANSWERS ALLOWED)

Maize		Soy beans	
Beans		Watermelons and fruits	
Sorghum		Gourds	
Groundnuts / peanuts		Vegetables	
Ginger		Rice	
Cotton		Peanut	
Yams		Millet	
		Tomato	
Other (specify)			

Other_____

D.7 Which productive tree species does your family have to support household income?

Sal
Sissoo
Uttis
Chilaune
Bans
Nigalo
Khavar
Asna
Katus
Other (specify)

Other_____

D.8 Which of the following types of animal does your household own?

Buffalo
Cow
Yak
Goats
Sheep
Donkeys
Chicken
Duck
Ox
Horse
Dog
Other
None

Other_____

D.9 Does the household have access to communal grazing land

J. Yes	K.
L. No	M.

D.10 Where is the communal grazing land?

Less than half an hour walk
Half an hour to an hour walk
More than an hour walk

E. Livelihoods, Income, Expenditure & Well-being

E.1 Which are the main sources of income for your family? Select the answer(s) from the list provided. (*INTERVIEWER: maximum of three answers, ranked 1-3, where '1' is the highest expenditure***)**

Income source:	Rank
Permanent waged employment	
Short term employment	
Income from own business	
Income from rent	
Income from interest on deposits	
Self-employment income	
Income from agriculture	
Remittances from family members, relatives living/ working abroad	
Support from relatives living elsewhere (specify location)	
Pensions/allowances	
Income from sale of items of private property	
Money borrowing	
Other (Please specify)	

Other_____

E.2 What is the approximate monthly income of your family?

Monthly income
0-1000
1001-3000
3001-6000
6001-10000
More than 10001

E.3 . What type of products does your family sell in the project area and what contribution do they make to your household income?

	How much do you sell to support your income?		
Type of product	Less than half?	More than half?	All?
Grains and cereal crops			
Vegetables			
Fruits			
Firewood			
Medicinal plants			
Basket			
Fish			
Broken rocks or sand			
Chicken eggs			
Honey			
Other			

Other_____

E.4 How do you think the well-being of your family changed in the last three years (scale below):

N. 1 significantly worsened	O.
P. 2 worsened	Q.
R.3 remained the same	S.
T. 4 improved	U.
V. 5 significantly improved	W.

E.5 How would you evaluate your family's social condition?

Money suffices for everything. We can afford whatever we want	
Money suffices both for food and clothing and we can even save some	
Money suffices both for food and clothing requirements but we aren't able to save anything	
Money suffices only for minimum food and clothing requirements.	
We are struggling to eat three basic meals per day	
Don't know	
Other (specify)	

Other_____

E. 6. Of the expenditure items listed below, please identify those that your household spends the most money on:
(INTERVIEWER: maximum of three answers, ranked 1-3, whereby '1' is the highest expenditure item)

Types of expenditures	Rank
Food/drink	
Clothes/shoes	
Education	
Healthcare	
Visiting or sending money to family members	
Utilities/gas, electricity, water, phone	
Transportation	
Property tax/rent	
Religious ceremonies	

E.7 Please rank the three main economic activities of the women in your household that provide a source of family income? (1 is main)

Working someone else's land	
Working in someone's house	
Selling household agriculture produce	
Selling animal product	
Selling cooked food	
Sewing	
Employment	
Handicraft	
None	
Other	

Other_____

F. Access to Social Services and Amenities

F.1 How many children of school age in the household attend school or educational institutions?

	How many children of that age in household?	How many children attend?
Kindergarten/Primary school age		
Secondary school age		
College/university age		

F.2 Does your household have access to the following education services and facilities? If so, how close are they located to your home?

Source	Yes/No?	Walking time		
		Less than half an hour walk	half hour walk to 1 hour walk	More than 1 hour walk
Primary School				
Secondary day school				
Secondary boarding school				
Other (Specify)				

Other_____

F.3 By what means do children in your household get to school?

Walk
Public transport
Private means
Bicycle
Other (specify)

Other_____

F.4 What is your household's main mode of transport?

Walking
Bicycle
Motorcycle
Cart / Yak / Horse
Car
Bus
Boat
Other

Other_____

F.5 What is your household's nearest water source?

Piped household water supply
Compound / household borehole or well
Community borehole or well
River
Spring
Water vendor
Other (please specify)

Other_____

F.6 How often does the household obtain water?

Once a week
Twice a week
Every second day
Daily

F. 7 How many hours does the water collection take?

Less than 1 hr	
Between 1 & 2 hrs	
Between 2 & 3 hrs	
More than 3 hrs	

F. 8 What do you use the river for? MULTIPLE ANSWERS ALLOWED

Fishing	
Bathing	
Water for the crops	
Water for animals	
Drinking	
Watermill	
Religious ceremonies/Ritual event	
Business (river rafting)	
Don't use it	
Other (specify)	

Other_____

F. 9 What is the family's main toilet source?

Improved toilet in compound	
Pit latrine compound	
Water closet	
Bucket/pan	
Improved toilet, water closet or pit latrine in neighbour's compound	
Public toilet, water closet or pit latrine)	
No facility (field/bush)	

F. 10 Are you connected to electricity via (one answer):

Grid connection	
Generator	
None at all	
Other (specify)	

Other_____

F.11 What is your household's main source of light:

Electricity	
Kerosene lamp	
Gas lamp	
Candles	
Batteries	
Solar lamp	
None	
Other (specify)	

Other_____

F.12 What is your household's main source of cooking fuel:

Wood	
Liquid Petroleum Gas	
Kerosene	
Other (specify)	

Other_____

G. Public Health

G. 1 How many of your household members have suffered from the following illnesses in the past 3 months:

	child < 5,	child 5-15	adult	Male	Female
Fever					
Diarrhea					
Respiratory infec-tion,					
Heart diseases or blood high pressure					
others (specify)					

Other_____

G. 2 Did anyone in your household attend a:

	Number of attendances	Cost per visit
Modern health facility		
Traditional healer		

G. 3 How many pregnancies were there in your household in the last five years?

_____

Where were the delivery locations, how many of them were live-births, and how much did they cost?

	Home	Hospital	Traditional birth attendant	Total
How many deliveries				
How many live births				
Cost				

G. 4 Why has your household decided to deliver the child at home or using a traditional birth attendant? Because it is: (*MULTIPLE ANSWERS ALLOWED*)

Habit/tradition	
Cheapest option/no money for other facility	
Best option (e.g. help through relatives; providers are worse in quality)	
Do not know	
Other (specify)	

Other_____

G. 5 Is the closest modern health facility a private, public or charitable health care provider?

Private	
Public	
Charitable	
Don't know	

G. 6 Why has your household decided to use this facility? You may give more than 1 answer. Do you use it because it is:

Closest	
Cheapest	
Best	
Do not know	
Other (specify)	

Other_____

G. 7 When the facility was used by your household, how much was the average waiting time before seeing a doctor/midwife?

_____ (hours)

Immediately	
Within 4 hours	
Same day	
Next day	
Longer than next day	

G. 8 Do household members have any of the following disabilities? (Moderate to severe limitations in one or more activities of daily living)

Hearing	
Intellectual	
Seeing	
Emotional	
Mobility	
Learning	
No household members suffer from any serious disability	
Other	

Other_____

H. Socio-Cultural and Community Characteristics

H.1. Does your family visit any sites of historical or spiritual significance?

X. Yes	Y.
Z.No	AA.

H.2 Are there any regular ceremonies at these sites?

More than once a year	
Annually	
Less than annually	
Never	

H. 3 Are there any graves in or near this village belonging to the household?

BB.Yes	CC.
DD.No	EE.

H. 4 How many graves belong to this household?

_____

H. 5 Where do members of the community go to socialise and relax together?

Neighbours' compounds	
Religious places/cultural program/festivals	
Teashop	
Public resting places	
Village hall	
By the river	
Other	

I. Natural Disaster

I. 1. Can you remember a time your community or home was affected significantly by natural causes?

Type of natural disaster	Date (month and year)
Earthquake	
Flooding (including GLOFs)	
Severe drought	
Other	

Other_____ Thank you for your time

Appendix C: Hydropower project activities, impacts, mitigation measures

The following matrix provides a brief summary of common activities (in order of project phase) and associated issues, examples of impacts and typical impact management measures which should be considered during hydropower project development / EIA studies.

The Project Proponent is responsible for identifying and confirming the potential impacts on existing physico-chemical, biological and socio-economic, cultural and environmental baseline conditions based on the understanding of proposed hydropower project development activities and modelling studies to be undertaken by key specialists engaged to perform environmental impact assessment.

Project Phases and Activities	Potential Impacts on Key Environmental Aspects			
	Physical & Chemical	Biological	Social, Economic & Cultural	Enhancement/Mitigation Measures
Pre-Construction				
• Acquisition or land purchase of areas where dam or weir, intake structure, tunnel, penstock, powerhouse will be located. • Lease agreement with landowners where temporary facilities will be established (e.g. laydown areas, camp sites, water/wastewater treatment plants, temporary storage areas for used oils, scrap metals, other waste materials). • Compensation of project affected facilities Relocation of project affected families (along road and transmission line right-of-way) and areas within the reservoir that would be inundated (note: relocation of project affected families will be necessary before project commissioning). • Site clearance.	• There are no likely impacts on physico-chemical attributes when conducting preliminary desk-based assessments. • Avoidance or reduction can be achieved by selecting the location of the weir/dam in deep ravine to limit area to be inundated by reservior upstream of the weir/dam.	• There are no likely impacts on biological attributes when conducting preliminary impacts on biological asepcts. • Likely impact on vegetation and habitat.	• Stress, anxiety and fear among private/community/ indigenous land owners/communities regarding loss of land and inexperience in undertaking negotiations. • Physical and economic displacement of project-affected communities, relocation and resettlement. • Loss of livelihoods and loss of access to natural resources and cultural heritage. • Impacts on host communities/ area - demographic changes, availability and access to livelihoods and social infrastructure. • Impacts on community values, social fabric, health and well-being of both displaced and host communities. • Community conflicts. • Gender impacts. • Impacts on housing and accommodation, potential for increase in informal settlements due to influx of workers and their families and those seeking work.	• Preparing a land acquisition process and protocol, including: • Apply Free, Prior Informed Consent principles in working with local and indigenous communities. • Providing adequate time and information to private/ community landholders about land requirement for the project. • Providing legal and financial support to private/ community landholders to independently undertake land acquisition negotiations. • Develop Land Acquisition and Resettlement Action Plan to guide the compensation process and relocation procedures of project affected families. • Liaise with relevant government and private sector agencies for provision of social infrastructure services and facilities in resettled communities. • Community development programs for rehabilitation of relocated communities. The programs will have to be developed based on community needs. • Establish community benefit funds and develop a framework around the commitment of funds to be invested by the proponent and distribution of funds over the life of project and beyond.

Project Phases and Activities	Potential Impacts on Key Environmental Aspects			
	Physical & Chemical	Biological	Social, Economic & Cultural	Enhancement/Mitigation Measures
Construction				
• Preparation of the site for construction activities, including removal of topsoil, drill and blast in foundation work areas. • Establishment and operation of ancillary and associated facilities (access road, construction power supply line, camp site, storage yard, quarry site, crusher plant, batching plant etc.). • Depending on the type of dam and hydropower scheme, employ appropriate methods for construction of the dam or weir, intake structure, tunneling, trenching for pipeline, powerhouse foundation construction. • Quarrying of construction materials, processing, storage, and transport of these materials to the construction areas. • Earthworks at various sites for ongoing con struction. • Generation of spoils or excess excavated materials. • Regular heavy equipment movement. • Preparation of foundation and installation of concrete formworks, depending on appropriate construction methods. • Using appropriate construction methods and according to the engineering design, construction of weir/dam, intake structures, tunnel or penstock, powerhouse, tailrace. • Construction of all associated facilities (e.g. substation, switchyard, EIA to specify project components included in the study). • Installation of electro-mechanical equipment.	• Changes in site geomorphology as a result of dam or weir construction, including access road. • Land use change resulting from conversion of, for instance, agricultural lands. • Changes in soil quality from potential waste oil spills from heavy equipment usage. • Inducement of soil erosion and sedimentation due to construction of hydropower project components, such as removal of top soil, excavation of trenches, opening of access roads, quarrying activities, foundation preparation. • Dust generation and vehicle emissions and increased vehicular movement, resulting in alteration of air quality (e.g. dust particulate matter, NOx, SOx). • Pollution to surface water due to siltation, inadvertent disposal of waste oils, wastewater, and solid wastes into the river. • Indirect contamination of groundwater from waste oil or chemical spills on the ground seeping into groundwater table. • Contamination and potential contamination of groundwater and springs resulting from tunneling works. • Increased noise level from heavy equipment movement. • Inducement of vibration due to blasting and movement of heavy equipment. • Impacts on aquifer, springs, or general hydrogeological conditions due to tunnel and road construction. • Slope destabilization due to site preparation activities, during access road construction, weir or dam construction, and establishment of powerhouse. • Generation of significant amount of excess excavated materials or spoils due to tunneling works requiring proper disposal impacts. • Impact on soil quality and water quality resulting from improper disposal of waste construction materials and excessive spoils.	• Habitat fragmentation as a result of construction of access roads, weir or dam, powerhouse, above-ground pipeline and associated hydropower facilities. • Disturbance to aquatic habitat during construction of dam or weir. • Disturbance and/or removal of riparian vegetation during dam or weir construction, intake structure construction, penstock installation. • Loss of or encroachment on critical habitats, protected areas, wetlands, and forest lands. • Reduction in biodiversity indices for terrestrial and aquatic ecology. • Impact on endangered, threatened species and their habitats. • Impact on ecosystem services. • Clearing of vegetation. • Increased access to forest lands and products. • Illegal collection of forest products by workers and community having access to the project's area of influence. • Illegal fishing and poaching of wildlife by workers and community given the access to the project's area of influence. • Effect on aquatic ecology resulting from changes in water quality during construction activities, such as effect of increased siltation in water to aquatic fauna. • Effect on terrestrial flora fauna due to elevated noise levels from day-to-day project construction activities. • Inducement of forest fires due to anthropogenic activities.	• Influx of workers into the project area • Demographic changes to the area and communities hosting the workers camps • Impacts on housing and accommodation facilities in nearby towns • Potential for increase in informal settlements due to influx of workers and their families and those seeking employment on the project. • Impacts related to workers health and safety on site and at workers accommodation facilities. • Impacts on community values and safety of women in nearby local communities due to influx of workers. • Impacts on use of community facilities. • Conflict between local communities and migrated workers. • Potential for spread of diseases – STD, air borne and water borne diseases. • Impacts on demand for social infrastructure such as schools, hospitals, transport in the areas hosting workers. • Impacts on demand for emergency response services. • Beneficial impacts: • Employment and business opportunities for technical services, contractors and labor. • Impacts on other economic activities in the region such as creation of market for local products, tourism, etc.	• Confinement of construction and concreting works within designated areas of key project components to avoid downstream river contamination. • Implementation of construction environmental management plan (CEMP) containing details on proper disposal of construction wastes; dust and noise generation control; spoils management and disposal; erosion management plans; workers and community safety protocols, installation of appropriate signages; implementation of vehicle speed limits at construction sites; limitation on public access to construction work areas; adherence to occupational health and safety; slope stabilization and rehabilitation practices; transport and traffic management plan, and other relevant construction environmental management plans. • Installation of appropriate fish migration species for the locally identified migratory fish species. • Preparing a workforce management plan including, but not limited to: • Workforce accommodation strategy • Workforce health and safety • Financial institution for workers • Workers code of conduct at work and while interacting with local communities • Community development programs needed for provision of services for families of workers who migrate with them and their impact on host communities. • Preparing an emergency response plan for the project.

Project Phases and Activities	Potential Impacts on Key Environmental Aspects			
	Physical & Chemical	Biological	Social, Economic & Cultural	Enhancement/Mitigation Measures
Commissioning/Operation				
• Raising of the reservoir or upstream of the dam or weir (e.g. for storage reservoir of run-of-river hydropower scheme). • Diversion of water from the intake structure to the powerhouse (i.e. if involving penstock or pipeline) and flushing of tunnel. • Testing of electro-mechanical equipment. • Dismantling and rehabilitation of construction areas, workers camp area, areas under information settlements that have occurred as a result of the project.	• Generation of greenhouse gas from decomposition of biomass from inundated vegetation at dam or weir reservoir. • Alteration of water quality parameters due to flushing of tunnel, increased water level in the reservoir, reduction in in-stream flow between dam/weir and powerhouse. • Soil erosion along areas to be inundated, such as upstream of the dam or weir. • Elevated noise levels from powerhouse testing and commissioning. • Modification of aquifers/water bodies in certain sections of the river due to increased water level (in reservoir) and decreased water level (between dam and powerhouse). • Depending on intended operational scheme, downstream area of the powerhouse may experience sudden release of water resulting in increased volume of water or super saturation in dissolved oxygen.	• Flooding of terrestrial, riparian vegetation, and aquatic habitats. • Loss of rare and threatened species of terrestrial flora and fauna in areas to be inundated within the reservoir. • Loss of aquatic habitat and fish species resulting from reduced in-stream flow in section of the river between the weir or dam and the powerhouse. • Impact on biodiversity for both terrestrial and aquatic flora and fauna in areas to be inundated by the reservoir and areas with reduced in-stream flows between dam or weir and the powerhouse. • Introduction of invasive species during reservoir flooding and drying up of river section between the weir/dam and the powerhouse. • Effect on wildlife of substation or switchyard testing and commissioning. • Reservoir upstream of the weir/dam will create a new habitat for aquatic species (beneficial impact).	• Demographic changes due to workforce leaving the workers camps and the area. • Impacts on livelihoods of downstream communities that rely on the water resources tapped by the project. • Changes in the volume of water released may impact on the safety of downstream communities that may use the water course. • Changes in the volume of water released may impact on recreational use of the water resource and tourism if it relies on the water resource in the downstream communities. • Amenity impacts on nearby settlements.	• Powerhouse structure should be designed to avoid excessive noise to migrate to nearby sensitive receptors such as terrestrial fauna and households. • Construction sites, workers camp site and exposed sites will be rehabilitated immediately. • Slopes shall be stabilized with appropriate technique or methodology. • Ex-post audit of the resettlement action plan to ensure affected communities are not aggrieved but have benefited from the project development. • Restoration of community livelihoods of downstream communities affected due to the changes in the water resources. • Re-assessing community development programs to suit the commissioning and operations phase. • Safety alert and warning systems in the downstream areas.

Project Phases and Activities	Potential Impacts on Key Environmental Aspects			
	Physical & Chemical	Biological	Social, Economic & Cultural	Enhancement/Mitigation Measures
• Flow intake and diversion from reservoir/pondage to powerhouse. • Sediment flushing as appropriate.	• Changes in hydrological flow regime such as fluctuation in flow rate and water level upstream and downstream of the dam/weir, downstream of powerhouse depending on purpose of dam/operational rule. • Changes in water quality such as turbidly level, dissolved oxygen, total suspended solids, temperature, oil and grease. • Sediment build up at the reservoir upstream of the weir or dam. • Impact on sediment flushing on dewatered section or reduced in-stream flow section of the river between the weir or dam and powerhouse. • Alteration of river geomorphology upstream and downstream of the dam and the powerhouse. • Generation of greenhouse gas such as production of methane as a result of anaerobic degradation of biomass at upstream reservoir.	• Changes in water quality during hydropower generation resulting on impact on biodiversity of terrestrial and aquatic ecology. • Ecological consequences of flushing of sediments, emergency water releases, and operational releases to aquatic ecology downstream of the powerhouse and the dam spillway. • Limitation on fish migration and other aquatic migratory species past dam and flood plains. • Restrictions on terrestrial wildlife movement due to habitat fragmentation.	• Impact within dewatered zone (e.g. irrigation of crops from river water resource, water mill, microhydro, religious and cultural values and practices, fishing, recreational mill). • A small number of long term employment opportunities for locals. • Long term business opportunities for local/national businesses for maintenance of the project infrastructure. • Safety impacts around project infrastructure and downstream.	• Implementation of environmental management plan including appropriate waste management and disposal. • Operation of fish migration system. • Implementation of emergency preparedness and response protocols, disaster risk reduction and climate change adaptation as appropriate. • Safety alert and warning systems for dam safety. • Review the community development programs and the community benefit program and confirm future benefit sharing, management arrangements and roles and responsibilities.
• Power generation and operation according to intended operational scheme as per design (base load or peaking power plant). • Regular routine maintenance.	• Elevated noise levels from turbine operation. • Generation of waste oil and used chemicals.	• Elevated noise levels impacting on terrestrial fauna. • Generation of waste oils and chemicals may impact on identified ecological values.	• Amenity impacts on nearby settlements.	• Implementation of environmental management and monitoring plan to ensure proper management of waste oils and chemicals used for regular routine maintenance and mitigation of noise generation. • Implementation of occupational health and safety plan.

Project Phases and Activities	Potential Impacts on Key Environmental Aspects			
	Physical & Chemical	**Biological**	**Social, Economic & Cultural**	**Enhancement/Mitigation Measures**
• Hydropower generation (long term)	• Beneficial impacts resulting from hydropower generation may include: • Creation of micro-climate within the reservoir area and downstream of the powerhouse • Dam can also be used for flood control • Depending on the purpose of the dam, reservoir can also be tapped as water supply and irrigation source • Depending on the purpose of the dam, reservoir can be used for recreational purposes such as boating and fishing, or tourism purposes	• Beneficial impacts on biological component during hydropower operation may include: • Creation of aquatic habitat upstream of dam or within the reservoir (e.g. fish spawning grounds) • Watershed management and forestry protection to preserve hydropower water resource • Opportunities for fish farming at the dam reservoir	• Beneficial impacts on socio-cultural aspects of hydropower operation may include: • Promotion of tourism • Enhancement of community development through social development and corporate social responsibility programs • Creation of new industries and market development • Revenue generation and benefit sharing • Payment of royalties as appropriate • Increased access to renewable energy source and reduction in reliance to fossil fuels or use of firewood in rural communities • Connection to electricity by rural communities • Adverse impacts would include safety issues from damage to infrastructure such as breaking of dam/ tunnels, fallen power lines due to natural disasters or other reasons	• Establishment of forest nursery and watershed protection and conservation. • Corporate social responsibility and social development programs throughout the life of project operation. • Benefit sharing and payment of royalties to affected communities. • Implementation of the environmental management and monitoring plan. • Implementation of environmental flow releases, as may be appropriate, respective of ecological values identified in in-stream river ecosystem. • Emergency response, safety and alert systems.

Appendix D: Appendix D: Additional Information Requirements

Table 1(A): Types of Permanent Land to be required for the Project

S.N.	Project Components*	LAND TYPE (in hectare)													Total area (in ha)	Remarks
		Forest						Cultivated		Barren		River & Flood Plain	Built up/ Residen-tial			
		Govt. managed					Pvt.									
		protected area	national	CF	LHF	Rel.		Gvt.	Pvt.	Gvt.	Pvt.		Public	Pvt.		
1.	Head works:															
	Intake															
	De-sander															
2.	Water Convey-ance:															
	Canal															
	Forebay															
	Pen-stock pipe															
	Tailrace canal															
3.	Power house															
4.	Access road															

Table 1 (B): Types of Temporary Land to be required for the Project

S.N.	Project Compo-nents*	LAND TYPE(in hectare)													Total area (in ha)	Remarks
		Forest						Cultivated		Barren		River & Flood Plain	Built up/Resi-dential			
		Government. managed					Pvt.									
		Protected area	National	CF	LHF	Rel.		Gvt.	Pvt.	Gvt.	Pvt.		Public	Pvt.		
1.																

Table 2: Land Requirements for the Temporary and Permanent Infrastructure

Land Type	Land Requirement (Ha.)			Project Component
	Temporary	Permanent	Total	
Total				

Table 3: Type of affected land use by the project components

Project component	Land Use	Affected Party

Table 4: Loss of Agricultural Production due to project area

S.N.	Loss of Agriculture Land (ha)			
	Type of loss	Area (ha)	Unit productivity (Kg/ha)	Total loss kg/ha (Agriculture productivity)
1				
2				
	Total			

Table 5: Forest loss at Different Project Components

S.N.	Project Components	Types of Forest	Forest Area (ha)	Loss of Vegetation				Crown Cover (%)	Basal Area (m2/ ha)	Forest Types (Sal, Pine, Shrubs, Barren etc.)
				Seedling per ha.	Saplings per ha.	Pole size tree per ha.	No. of Tree per ha.			
1	Headworks									
2	Water Conveyance (Canal, Penstock)									
3	Powerhouse									
4	Fore bay									
5	Access Road									
6	Campsite, spoil disposal site									
	Total									

Note: * Average DBH and Range of DBH to be for pole and Tree class

** Seedling 0-4 cm DBH 4-10 cm DBH; Pole Class 10-30 cm DBH; Tree Class> 30 cm DBH

*** Possible usages are-fire wood, fodder etc.

Table 6: Total Loss in terms of plant species

	Botanical Name	Local Name	Avg. DBH/ Range (for >= 10 cm DBH)	Loss of Vegetation				Standing Wood		Biomass for Standing Tree (Kg.)		Biomass Usage
				Loss of Regeneration		Loss of Tree (number)				Wet	Dry	
				Seedlings per ha.	Saplings per ha.	Pole Class	Tree class	Timber (kg	Fuel wood (kg)			
1												
2												
3												
4												
5												
6												
7												
8												

9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
	Total										

Table 7: Total Forest Loss

Type of Forest	Area (ha.)	Loss of Vegetation				Crown Cover (%)	Standing Wood		Biomass for standing tree and ground vegetation (kg)		Biomass Usage
		Loss of Regeneration		Loss of tree (Number)			Timber (kg	Fuel wood (kg)	Wet	Dry	
		Seedlings per ha.	Saplings per ha.	Pole class	Tree class						

Table 8: Power and Energy Production

S.N.	Months	Avg. Monthly Discharge in the river at intake (m3/s)	Total d/s release including Env. Flow and Others (m3/s)#	Diversion Discharge for Power	Production	
					Power (MW)	Energy (GWH)
1	January					
2	February					
3	March					
4	April					
5	May					
6	June					
7	July					
8	August					
9	September					
10	October					
11	November					
12	December					
13	Annual Average					

Note:

Table 9: Environmental Release and Water Balance

S.N.	Months	Avg. Monthly discharge in the river At intake (m3/s)	Downstream Environmental release (m3/s)	Additional d/s release (m3/s)			Diversion for power	Total Discharge m3/s)	Production Power (MW)
				Irrigation	Water Mills	Others			
1	January								
2	February								
3	March								
4	April								
5	May								
6	June								
7	July								
8	August								
9	September								
10	October								
11	November								
12	December								
	Annual Average								

Appendix E: Public Notice Sample

अनुसूची (१०)

सार्वजनिक सूचनाको ढाँचा

(क) प्रस्तावकले प्रकाशित गर्नुपर्ने क्षेत्र निर्धारण सम्बन्धी सार्वजनिक सूचनाको ढाँचा

..... आयोजनाको वातावरणीय प्रभाव मूल्याङ्कन प्रतिवेदन तयारीको लागि क्षेत्र निर्धारण सम्बन्धी सार्वजनिक सूचना

(प्रकाशित मिति .....)

..... प्रदेश..... जिल्लाहरु.....नगरपालिकारगाउँपालिकामा (प्रस्तावकको नाम उल्लेख गर्ने) द्वारा निम्न बमोजिमको प्रस्ताव कार्यान्वयन गर्न लागिएको छ ।

प्रस्तावकको नाम र ठेगाना	.....(नाम), ...(ठेगाना), ...(ई(मेल).....(फोन नं.)
प्रस्तावको व्यहोरा	आयोजनाको मुख्य विशेषताको विषयवस्तु उल्लेख गर्ने

माथि उल्लेखित प्रस्तावको वातावरणीय प्रभाव मूल्यांकन (EIA) अध्ययन सम्बन्धी क्षेत्र निर्धारण (Scoping) गर्ने क्रममा सो क्षेत्रहरुको प्राकृतिक भौतिक प्रणाली, जैविक प्रणाली, सामाजिक प्रणाली, सांस्कृतिक प्रणाली र आर्थिक प्रणाली बीच के कस्तो प्रभाव पर्दछ भनी यकिन गर्न सो स्थानको न. पा./गा.पा. तथा त्यस क्षेत्रका विद्यालय, अस्पताल, स्वास्थ्य चौकी तथा सरोकारवाला व्यक्ति वा संस्थाको लिखित राय सुझाव लिन आवश्यक भएकोले यो सार्वजनिक सूचना प्रकाशन भएको मितिले १५ (पन्ध्र) दिन भित्र निम्न ठेगानामा आई पुग्ने गरी लिखित राय सुझाव उपलब्ध गराई दिनु हुन अनुरोध गरिन्छ ।

राय सुझावको लागि पत्राचार गर्ने ठेगानाहरु :

प्रस्तावकको नाम र ठेगाना	.....(नाम), ...(ठेगाना), ...(ई(मेल).....(फोन नं.)
परामर्शदाताको नाम र ठेगाना	.....(नाम), ...(ठेगाना), ...(ई(मेल).....(फोन नं.)

नोट : नेपाल सरकारद्वारा तोकिएका राष्ट्रिय गौरवका आयोजना, राष्ट्रिय विपद, प्राकृतिक प्रकोप तथा तत्काल कार्यान्वयन गर्नु पर्ने भनी नेपाल सरकारले तोकेका अन्य आयोजना वा कार्यक्रमको हकमा सूचना प्रकाशन भएको मितिले ७ दिन भित्र आफ्नो राय सुझाव पठाउनु पर्नेछ ।

(ख) वन तथा वातावरण मन्त्रालयबाट प्रकाशन गरिने वातावरणीय प्रभाव मूल्यांकन सम्बन्धी सार्वजनिक सूचनाको ढाँचा

नेपाल सरकार

वन तथा वातावरण मन्त्रालय

(वातावरण संरक्षण नियमावली, २०५४ को नियम ११ (२) सँग सम्बन्धित

..... प्रदेश..... जिल्ला.....नगरपालिकारगाउँपालिकामा (आयोजनाको नाम उल्लेख गर्ने) कार्यान्वयन गर्नको लागि प्रस्तावित वातावरणीय प्रभाव मूल्याङ्कन प्रतिवेदनमा राय सुझावको लागि आव्हान गरिएको

सार्वजनिक सूचना

(प्रथम पटक प्रकाशित मिति .....)

प्रस्तावक.....(प्रस्तावकको नाम) ले प्रदेश नं.....को..... नगरपालिकारगाउँपालिकाको वडा नं.....मा.....(आयोजनाको नाम) निर्माण तथा सञ्चालनरस्तरोन्नति सम्बन्धी प्रस्ताव पेश गरेको छ।

प्रस्ताव अनुसार.....(आयोजनाको मुख्य विशेषताहरु उल्लेख गर्ने)। यस आयोजनाबाट प्रभाव पर्न सक्ने क्षेत्र .....जिल्लाको .....नगरपालिकारगाउँपालिकाको वडा नं.....रहेको छ

वातावरण संरक्षण ऐन, २०५३ को दफा ६ बमोजिम यस प्रतिवेदनमा राय सुझाव दिनका लागि सर्वसाधारणले प्रतिवेदन आफैले उतार गरी लैजान पाउने व्यवस्था रहेकोले वातावरण संरक्षण नियमावली, २०५४ को नियम ११ (२) बमोजिम यो प्रतिवेदन निम्न स्थानहरुमा सार्वजनिक गरिएको छ। प्रतिवेदनमा उपयुक्त राय सुझाव प्राप्त भएमा यस मन्त्रालयले उक्त प्रस्ताव कार्यान्वयनको लागि स्वीकृति दिने क्रममा त्यस्ता राय सुझावहरुलाई समेत ध्यानमा राख्नेछ। उक्त प्रतिवेदन सम्बन्धमा सर्वसाधारण व्यक्ति वा संस्थाको कुनै राय सुझाव भए यो सूचना यस दैनिक पत्रिकामा प्रथम पटक प्रकाशन भएको मितिले ३० दिन भित्र आफ्नो राय सुझाव निम्न ठेगानामा पठाई दिनु हुन यसै सूचनाद्वारा आव्हान गरिन्छ।

प्रतिवेदन हेर्न वा उतार गर्न सकिने स्थानहरु :

श्री वन तथा वातावरण मन्त्रालयको पुस्तकालय, काठमाडौ।

प्रस्तावसँग सम्बन्धित मन्त्रालय र सम्बन्धित निकाय

श्री त्रिभुवन विश्वविद्यालयको केन्द्रिय पुस्तकालय, किर्तिपुर, काठमाडौ।

श्री संसद सचिवालय, पुस्तकालय, सिंहदरबार, काठमाडौ।

श्री आदिबासी तथा जनजाति महासंघ नेपाल।

प्रस्ताव कार्यान्वयन हुने जिल्लाको जिल्ला समन्वय समितिको कार्यालयरहरु।

प्रस्ताव कार्यान्वयन हुने जिल्लाको नगरपालिकारगाउँपालिकारहरु।

राय सुझाव पठाउने ठेगाना

वना तथा वातावरण मन्त्रालय

वातावरणीय प्रभाव अध्ययन शाखा

सिंहदरवार, काठमाडौ।

फो.नं. ४२११६३८, ४२११६४१, ४२११७३७

फ्याक्स नं. ९७७-१-४२११५९४

नोटः

- नेपाल सरकारद्धारा तोकिएका राष्ट्रिय गौरवका आयोजना, राष्ट्रिय विपद्, प्राकृतिक प्रकोप तथा तत्काल कार्यान्वयन गर्नु पर्ने भनी नेपाल सरकारले तोकेका अन्य आयोजना वा कार्यक्रमको हकमा प्रथम पटक सूचना प्रकाशन भएको मितिले ७ दिन भित्र आफ्नो राय सुझाव पठाउनु पर्नेछ (वातावरण संरक्षण नियमावली (चौथो संशोधन), २०५४)।
- पूरक वातावरणीय प्रभाव मूल्यांकनको हकमा प्रथम पटक सूचना प्रकाशन भएको मितिले १५ दिन भित्र आफ्नो राय सुझाव पठाउनु पर्नेछ (वातावरण संरक्षण नियमावली (पाचौं संशोधन), २०५४)

(ग) सम्बन्धित स्थानीय निकायले दिने सिफारिस पत्रको ढाँचा

(वातावरण संरक्षण नियमावली, २०५४ को नियम १० सँग सम्बन्धित)

(सम्बन्धित नगरपालिका, गाउँपालिका र वडा कार्यालयको प्याडमा)

प. सं

च.नं

श्री .....(प्रस्तावकको नाम)

.....(ठेगाना)

विषय : - सिफारिस गरिएको बारे ।

प्रस्तुत विषयमा तहाँबाट मिति ..... मा यस कार्यालयमा ..... (प्रस्तावक र आयोजनाको नाम) कार्यान्वयनको वातावरणीय प्रभाव मूल्याङ्कन प्रतिवेदन सम्बन्धमा सिफारिश गरिदिन अनुरोध भइआएकोमा तहाँबाट मिति ..... मा आयोजना गरिएको सार्वजनिक सुनुवाई कार्यक्रममा सरोकारवालाहरुबाट उठान भएका विषयहरुलाई समेत सम्बोधन गर्ने र वातावरणीय प्रभाव मूल्यांकन प्रतिवेदनमा उल्लेखित सकारात्मक प्रभाव अभिवृद्धि र नकारात्मक वातावरणीय प्रभावहरुलाई न्यूनिकरण गरी वातावरणमा न्यूनतम असर पर्ने गरी प्रस्ताव आयोजना कार्यान्वयन गर्नको लागि सिफारिस गरिएको व्यहोरा अनुरोध छ ।

हस्ताक्षर :

पदाधिकारीको नाम :

पद :

मिति :

नोट : कार्यालयको छाप अनिवार्य रुपमा हुनु पर्नेछ ।

कार्यालयको शर्तहरु रहेको अवस्थामा शर्तसहित सिफारिस दिन सकिनेछ ।

(घ) वातावरण संरक्षण नियमावली, २०५४ को नियम ७ (२) संग सम्बन्धित सूचना टाँसेको मुचुल्काको ढाँचा

(१) सार्वजनिक स्थलमा सूचना टाँसेको पत्रिकाको ढाँचा

लिखितम्.....(प्रस्तावकको नाम र ठेगाना) रहेको .....(सूचना प्रकाशन गरेको पत्रिकाको नाम) दैनिक पत्रिकामा मिति.....गते प्रकाशित.....(आयोजनाको नाम) को वातावरणीय प्रभाव मूल्यांकन प्रतिवेदन तयार गर्ने सिलसिलामा क्षेत्र निर्धारण सम्बन्धी सार्वजनिक सूचनाको प्रतिलिपी थान १ (एक) यस .....जिल्ला.....न.पा.रगा.पा., वडा नं..... मा आज मिति.....गते दिनको .....बजे हामीहरुको रोहवरमा टाँस गरि यो मुचुल्का सहिछाप गरिदियौं ।

तर्पासिलः

..... जिल्ला..... न.पा.रगा.पा., वडा नं..... बस्ने वर्ष.....को .....

.....जिल्ला..... न.पा.रगा.पा., वडा नं..... बस्ने वर्ष.....को .....

इति सम्वत्.....साल.....महिना.....गते रोज.....शुभम्

(२) कार्यालयमा सूचना टाँसेको मुचुल्काको ढाँचा

श्री ..... (व्यक्तिको नाम) ले निम्नानुसारको सूचना यस ..... (नाम) ..... कार्यालयको सूचना पाटीमा टाँसेको ब्यहोरा प्रमाणित गरिन्छ ।

प्रस्तावकको नाम :

प्रस्तावको नाम :

Appendix F: Format of Scoping Document for Environmental Impact Assessment

Front page of the report should be presented in the following format by mentioning the name and address of the agency, including its telephone, fax and email etc., to which the report is submitted.

Scoping Document for Environmental Impact Assessment

of.....(Name of Proposal)

.....

(Name and Address of Agency to which the document is submitted-Submitted to) here will be written the Ministry of Forests and Environment

Name and Address of Agency through which the document is submitted- Submitted through) here will be written the name of concerned Ministry

Submitted by: Proponent

.....(Name and Address of Proponent).....

.....(Month, Year).....

Acronyms/Abbreviations

Chapter 1. Name and address of the person/agency preparing the document

1.1 Name, address, e-mail, phone number of proponent

1.2 Name, address, e-mail, phone number of consultant

Chapter 2. Introduction

2.1 Background

2.2 Information of the proposal

2.3 Objectives of Scoping

2.4 Relevancy of Project

2.5 Legal Rationality

Chapter 3. Project Information

3.1 Description of the project:

3.2 Location/Accessibility:

3.3 Type/Nature:

3.4 Salient features of the project and project components: (describe as per location map)

3.5 Project Activities: (during the construction, operation and maintenance stages)

3.6 Construction Planning

3.6.1 Land (Area, type along with permanent or temporary, and ownership) in tabular format

3.6.2 Project's (human resources, construction materials including quantity and source, construction schedule, energy to be used- its source and consumption, its application), associated/ancillary facilities)

3.6.3 Project implementation schedule

Chapter 4. Methods for conducting scoping

The scoping should be done using the following methods

- Literature review
- Impact Area Delineation
- Field Study (Field study, consultation with stakeholders)
- Physical-Chemical Issues Collection Method (walkthrough /direct observation, water, air noise soil noise sampling and analysis , public consultations, sediment simulation models
- Biological Environment data/sample collection and analysis: (Reconnaissance survey, walk-through/direct observation, transect survey, sampling method/census, focus group discussion, Key informant interview)
- Socio-economic and cultural environment data collection and analysis (walk through/direct observation, survey i.e sample/census by using questionnaire , rapid rural appraisal /participatory rural appraisal by using checklist, interview (group interview/open interview/key informat interview) by using interview guide/checklist
- Consultations/Participations (General consultancy/Focus Group Discussions)
- Audio-visual method
- Case study

Chapter 5. Policies, Laws, Rules and Guidelines/Manuals to be considered while preparing report

(Required to conduct review based on the nature of the proposal and the area concerning thereto)

Constitution	
Policies	
Acts	
Rules	
Strategies	
Guidelines	
Standards	
Conventions	

Chapter 6. Existing Environmental Conditions

The existing conditions should cover the following components and parameters

Table: Various sectors and types of necessary baseline data or parameters

Components	Parameters
Physical/Chemical Environment	
Climate/Weather (minimum of 30 years data is required)	• Rainfall/Precipitation • Air temperature • Relative humidity and evapo-transpiration • Wind speed and direction • Atmospheric pressure
Hydrology	• River/Lake (main/secondary) geographic features • Riverine area (upstream and downstream) • Watershed • Seasonal flows (i.e. velocity, volumes, duration of high and low flows, timing, frequencies, predictability and permeability) • Discharge measurement and river morphology • Drainage pattern • Flood • GLOF • Groundwater flow regime, wetland and glaciers
Air Quality and Noise level	• Ambient air quality background and point and non-point sources • Project level air quality management practices • Noise pollution sources and ambient sound pressure level (equivalent sound pressure level-Leq, daytime sound pressure level-Ld, night time sound pressure level-Ln, avera day-night sound pressure level-Ldn, background sound pressue level-L90, subjective annnoyance level-L10, maximum sound pressure level-Lmax and minimum sound pressure level-Lmin at sensitive receptors
Water quality	• Surface, subsurface and groundwater quality • Temperature, pH and other parameters (settleable and non-settleable solids, total phosphorous, Total Dissolved Solids, Suspended Solids, Sulphide, Dissolved Carbon dioxide) to be monitored as per required for relevant governmental standards and guidelines best on upstream water uses
Geology	• Rock and soil type • Geological structure, lithology, stratigraphy and seismicity • Geological hazards (earthquake, avalanche, debris flow and faultlines) • Landslides and erosion
Land	• Topography and land stability • Landuse and landcover • Land declared as special or critical for various reasons by the national law
Soil and Sediment	• Soil Type and quality (characteristics micro and macro nutrients, pH, SAR, Organic Matter and major contaminants-lead, copper, iron, manganese, arsenic, zinc, cadmium, nickle and chromium) • River gradient • Settling rate and sediment load • Sediment transportation • Sedimentation risk and sedimentation load assessment

Biological Environment	
Terrestrial, riparian, aquatic flora	• Forest type Conservation and encroachmentstatus and livelihoods • Illegal trading • Terrestrial Plant Species • Endangered Species • Protected flora • Medicinal Plants • NTFP, Ethnobotanically important Plant Species • Agro-biodiversity • Aquatic Plant Species • Invasive Alien Species • Sensitive Natural Habitats and Biodiversity Hotspots • Economic assessment
Terrestrial, riparian, aquatic fauna	• Terrestrial, riparian and aquatic species • Conservation and livelihoods • Illegal trading • Protected fauna • Avian fauna • Reptile • Wildlife movements, corridor, habitat and condition • Status of hunting, poaching and illegal trading • Local, migratory and non-migratory species
Fishery/Aquatic Life	• Species of fish (types, spawning areas, habitat type and status) • Fish movement
Socio-Economic and Cultural Environment	
Demography	• Population • Gender and sex ratio socially dependent groups (differently abled, children, women) • Birth and death rates • Age • Ethnicity and Caste • Religion • Occupation • Language • Household • Average family size • Migration (in and out-migration) • Vulnerable and marginalized population • Community security agencies
Education	• Literacy • Number and types of educational institutions • Educational status (According to Level of Degree)
Health and Sanitation	• Status and services of project effected area • Existing health care services • Communicable and non-communicable diseases • Water borne diseases • Potable water supply and sanitation status • Waste management(solid waste-including hazardous and effluent)

Physical/Community Infrastructure	• Status of transport infrastructure • Conventional and non-conventional energy (• Communication media • Potable water supply • Business centers • Industrial Areas • Governmental and non-governmental services • Recreational centers • Funeral services • Traditional water mill
Economy	• Income sources • Land ownership • Agriculture and livestock • Livestock
Water Use	• Potable, irrigation, aquaculture, electricity businesses • Recreation
Culture	• History, archeology, culture and religion • Cultural norms and values
Language	• Mother tongue
Festivals and rituals	• Celebrations • Rituals

Chapter 7. Environmental Issues and Concerns:

The environmental issues and concerns should be based on the following:

7.1 Issues and concerns identified by the study team

7.2 Issues and concerns raised by the stakeholders

7.3 Issues and concerns prioritized for the EIA study

Note: Environmental issues should be addressed as follows:

	Beneficial Issues	Adverse Issues	
Construction Phase			
Physical/Chemical			
Biological			
Socio-economic and Cultural			
Operational Phase			
Physical/Chemical			
Biological			
Socio-economic and Cultural			

Chapter 8. Reference

APA 6th edition.

Appendix G: Terms of Reference for Environmental Impact Assessment

Terms of Reference for Environmental Impact Assessment

of.....(Name of Proposal)

.....

(Front page of the report may be presented in the following format by mentioning the name and address of the agency, including its telephone, fax and email etc., to which the report

is submitted).

(Name and Address of Agency to which the report is submitted to) here will be written the Ministry of Forests and Environment

Name and Address of Agency through which the report is submitted through) here will be written the name of concerned Ministry

Submitted by: Proponent

.....(Name and Address of Proponent).....

.....(Month, Year).....

Table of Content

Acronyms
Acronyms/Abbreviations

Chapter 1. Title of the Proposal, Name and Address of the Individual or Institution Preparing the Report

1.1 Background

1.2 Name, address, e-mail, phone number, fax of the proponent

1.3 Name, address, e-mail, phone number, fax of consultant

1.4 Objectives of Terms of Reference

1.5 Objectives of EIA

1.6 Legal rationality for EIA Study

Chapter 2. Project Information

2.1 General introduction of the project

2.2 Project's objectives, need and relevancy

2.3 Location and Accessibility:

2.4 Type/Nature:

2.5 Salient features of the project and project components: (include a map with labels showing the delineated catchment area, proposed location of the weir/dam, powerhouse, headrace, and tailrace, substation and transmission lines; including project support facilities)

2.6 Project Activities: (during the construction, operation, maintenance and decommissioning stages)

2.7 Construction Planning

2.7.1 Land (Area, type, requirements, along with permanent or temporary, and ownership) in tabular format

2.7.2 Project's (human resources, construction materials including quantity and source, construction schedule, energy to be used- its source and consumption, its application), associated/ancillary facilities)

2.7.3 Project implementation schedule

Chapter 3. Required information/data and collection methods

(should be site specific avoiding generic information and maintaining coherency with impact, mitigation and EMP preparation)

3.1 Required data and information for preparing the report

The following information/data shall be collected during EIA study categorizing into following three areas:

3.1.1 Physical and chemical environment

3.1.2 Biological Environment

3.1.3 Socio-economic and cultural environment

Table: Various sectors and types of necessary baseline data or parameters (not exhaustive)

Components	Parameters
Physical/Chemical Environment	
Climate/Weather (minimum of 30 years data is required)	• Rainfall/Precipitation • Temperature • Humidity and Evapo-transpiration • Wind Direction/pressure • Local scale climate change projections/resilience
Hydrology	• River/Lake (main/secondary) geographic features • Riverine area (upstream and downstream) • Watershed and erosion potential • Seasonal flows (i.e, velocity, volumes, duration of high and low flows, timing, frequencies, predictability etc) • Discharge measurement and river morphology • Drainage pattern • Flood • GLOF • Other Water Resources
Air Quality and Noise level	• Air quality conditions and point sources • International good practices • Noise point sources and ambient noise levels at sensitive receptors
Water quality	• Surface, subsurface and ground water quality • Number, location, seasonal flows and water quality of any aquifers, wells or springs relied on by local communities potentially affected • Temperature , pH and other parameters to be monitored as per required for HPP

Components	Parameters
Geology	• Rock and Soil Type • Geological Structure • Likely geological risks • Vulnerability of project area to geo-hazards like landslides, soil erosion, earthquakes, GLOFs, ground movement, extreme flood events, liquefaction, and subsidence, among others • Debris Flow • Proximity of project activities to active faults
Land	• Topography • Total land requirement and types • Land Use pattern • Land declared as special or critical for various reasons by the national law • Sensitive areas, sacred sites
Sediment	• River gradient • Sedimentation load • Sediment carrying capacity of river • Areas prone to erosion and deposition • Sedimentation risk and sedimentation load assessment
Biological Environment	
Terrestrial, riparian, aquatic flora	• Forest Type (based on vegetation and Climate) • Status of conservation (Forest management status) • List of Major Terrestrial Plant Species • List of protected flora • Economically valuable flora • NTFP, Ethnobotanically important Plant Species • Agro-biodiversity • List of Aquatic Plant • Invasive species • Natural and sensitive habitats (biodiversity hotspots, biological corridors) • Economic valuation of flora and fauna affected by the project
Terrestrial, riparian, aquatic fauna	• Types of Wildlife (Mammals) • Wildlife movements/corridor • Avifauna • Reptile • Wildlife Habitat/Condition • List of protected fauna • Current status of hunting, poaching and illegal trading • Migratory species
Fishery/Aquatic Life	• Fish Species (types, spanning areas, habitat type and status) • Fish Movement • Habitat Status/Condition
Flora and fauna species status	• Rare • Endangered • Protected • Threatened • Endemic

Components	Parameters
Socio-Economic and Cultural Environment	
Demography	• Population • Gender • Birth rate/death rate • Age • Ethnicity/Caste • Religion • Occupation • Language • Household • Average family size • Migration (in and out migration) • Immigration and Population dynamics • Vulnerable and marginalized population
Education	• Number and Type of Educational Institutions • Literacy Rate • Educational Status (According to Level of Degree)
Involuntary displacement	• Community severance and demographic shifts • Resettlement and rehabilitation of affected households
Disruption to livelihoods and assets	• Changes to: • Access to sources of livelihoods • Homes, farmlands, gardens • Community infrastructure • Common property resources (e.g. traditional grazing, common agricultural farms, community resting place) • Land and productive resources (may lead to loss of livelihood) • Availability of infrastructure, facilities, services and utilities (roads, water supply, rural electrification, education, health facilities, etc.)
Health and Sanitation	• General Health Condition • Types of Common Diseases • Water borne diseases • Status of Health Institutions • Status of drinking water • Status of sanitation and hygiene • Status of waste management • Safety risks from construction activities
Physical/ Community Infrastructure	• Status of transport infrastructure • Energy • Communication (Telephone, Post Office) • Drinking Water Supply • Market • Industry/Factory • Banks and Financial institutions • Community building • Police/Security Agencies • Resting places • Cremation places • Water mill

Components	Parameters
Economy	• Employment/occupation/business • Land Ownership • Agriculture productivity • Animal Husbandry • Horticulture • Income and Expenditure • Other productions
Water Use	• For drinking purpose • Agricultural Purpose/Irrigation • Water transport • Business based on water resources (like water mill, micro hydro, fishing) • Recreational activities • Status of Upstream and Downstream Water Use (including in the dewatered zone – drinking, water supply, irrigation, energy generation, water transport, recreational activities, fishing, etc.)
Environmental flows	• Changes to environmental flows affecting the physical/chemical, biological, socio-economic and/or cultural environments
Gender and Vulnerability	• Sex Ratio • Socially Dependent Groups (Children, Women) • Issues of relevance to vulnerable people
Culture	• Historical and religious infrastructures • Archeological important places • Culturally and historically important open spaces • Important religious places • Cultural norms, values and practices including indigenous knowledge and practices
Languages	• Local Languages • Communities that Speak Mother Tongue
Festivals and Other Practices	• Main Festivals and Celebrations • Sites and Rituals for Funeral Rites

3.2 Methods of Data Collection

- Literature review secondary sources of information related to the project and its influences areas should be reviewed (topographical, aerial, google, etc), RM/municipal profile, ward profile, CBS data etc, preparation of checklist and matrix , and questionnaire should be developed
- Impact Area Delineation
- Field Study (Field study, observation of site, checklist, sample collection, photographic evidences, questionnaires)

A) Field visit: The study team should conduct preliminary study during the scoping phase and detail study should be carried out during the EIA study.

B) Stakeholders consultations: Consultations and interactions with local level stakeholders including GOs, NGOs, CBOs, experts shall be carried out and recorded.

During the field study, the physical, biological and socio-economic and cultural environmental data should be collected by using the following methods (as applicable)

- Physical-Chemical Issues Collection Method (walkthrough /direct observation, water, air noise soil noise sampling and analysis, public consultations, sediment simulation models

- Biological Environment data/sample collection and analysis: (Reconnaissance survey, walk-through/direct observation, transect survey, sampling method/census, focus group discussion, Key informant interview)
- Socio-economic and cultural environment data collection and analysis (walk through/direct observation, survey i.e sample/census by using questionnaire, rapid rural appraisal /participatory rural appraisal by using checklist, interview (group interview/open interview/key informant interview) by using interview guide/checklist
- Consultations/Participations (General consultancy/Focus Group Discussions)
- Audio-visual method
- Case study
- The following constitution, Policy, Act, Regulations should be reviewed. The following plan, policies, act, regulations and guidelines should be reviewed

Chapter 4. Policies, Acts, Rules and Guidelines/Manuals to be considered while preparing report

The review of local, state, national and international legislation relevant to hydropower project and its associated impacts should be conducted based on the nature of the proposal in the following format

Constitution
Policies
Acts
Rules
Strategies
Guidelines
Standards
Conventions

Chapter 5. Time, Budget and Human Resources required for preparing the report.

Chapter 6. Issues Identified for EIA study

Prioritized issues during scoping phase should be listed in section.

Chapter 7. Environmental Impacts due to implementation of the project

As per the issues identified in section 6 above, the impact identification, prediction and evaluation methods and indicators should be well defined. The impacts during pre construction, construction, and operation phase should be assessed based on the matrix (as shown in example below).

(should be site specific avoiding generic information and maintaining coherency with impact, mitigation and EMP preparation)

Environmental Impact Ranking

On the basis of magnitude (High/Major-60, Moderate-20, and Minor-10), extent (Regional-60, Local-20, and Site-Specific-10) and duration (Long-Term-20, Medium-Term-10, and Short-Term-5) the impacts likely to be caused on the environment shall be ascertained.

Proposal Activity	Environmental Impact Direct	Impact Ranking/Rating							
		Direct	Indirect	Beneficial	Adverse	Magnitude	Extent	Duration	Total Numerical Values (s)
Construction Period									
Physical/Chemical Environment									
1.									
2.									
Biological Environment									
1.									
2.									
Socio-economic and Cultural Environment									
1.									
2.									
Operation Period									
Physical/Chemical Environment									
1.									
2.									
Biological Environment									
1.									
2.									
Socio-economic and Cultural Environment									
1.									
2.									

(s) The total numerical values of each impact shall be mentioned by calculating the numerical values fixed according to the scale of adverse impacts.

Chapter 8. Alternatives of Project Proposal

The alternative analysis should be carried out as following:

- Alternative hydropower schemes, technologies and modes of operation, such as storage, peaking, run-of-river generation
- Technical criteria such as capacity, difference in head and accessibility
- Alternative options for associated facilities/ancillary elements (dam sites, transmission line routes, roads, raw materials to be used, sources of energy to be used for the project, etc.)
- Financial considerations such as capital requirements, operating costs, environmental and social costs and relative returns on investment.
- Alternative options on the basis of magnitude, extent and duration of the environmental impacts
- Project management options: project phasing or schedule.
- Alternatives of the project and forest land
- Alternative of structure design, location
- Alternative of access road

Chapter 9. Beneficial and Adverse Impacts due to Implementation of the Project including maximizing positive impacts and minimizing adverse impacts

(should be site specific avoiding generic information and maintaining coherency with impact, mitigation and EMP preparation)

The following methods should be used to minimize the adverse impacts.

- Preventive
- Corrective
- Compensatory

Chapter10. Environmental Management Plan (EMP)

(should be site specific avoiding generic information and maintaining coherency with impact, mitigation and EMP preparation). This section should also include a Disaster Preparedness and Management Plan to ensure project staff, project infrastructure and local communities are well equipped and well prepared to deal with emergency events like floods, earthquakes, GLOF, landslides, etc. This plan should identify potential risks, possible impact zones and measures that will ensure the management systems and local capacity are enhanced and remains up to speed.

The following table could be used for maximization of beneficial and minimization of adverse impacts.

Maximization of beneficial impacts

S.N	Positive impact	Positive impact maximization methods	Place of Implementation	Implementation duration	Tentative Cost	Implementation agency	Remarks

Minimization of adverse impacts

S.N	Adverse impact	Adverse impact minimization methods	Place of	Implementation duration	Tentative Cost	Implementation agency	Remarks

Chapter 11. Environmental Monitoring

The monitoring of the project should be done as per following matrix:

Monitoring Matrix

S.N	Monitoring parameters	Monitoring Indicators	Methods	Location/ Place	Schedule	Estimated Budget/Cost	Monitoring Agency
Baseline Monitoring							
1							
2							
Compliance Monitoring							
1							
2							
Impact Monitoring							
1							
2							

Chapter 12. Environmental Audit

The proposal should spell out who and when environmental audit will be conducted.

Chapter 13. Other Necessary Matters

Chapter 14. Table of Contents for EIA Report

Executive Summary in English and Nepali: This section should reflect a gist of every chapter of EIA report

Table of Contents

Acronyms/Abbreviations

1. Name, address, e-mail, phone, fax of the person/agency preparing report:

- 1.1 Name, address, e-mail, phone number of proponent
- 1.2 Name, address, e-mail, phone number of consultant
- 1.3 Relevancy of EIA Study
- 1.4 Objectives of EIA
- 1.5 Limitation of Study

2. Introduction of the proposal

- 2.1 Background
- 2.2 Project description
- 2.3 Project objectives, need and relevancy

2.4 Location and Accessibility
2.5 Type/Nature
2.6 Salient features of the project and project components (include a map with labels showing the delineated catchment area, proposed location of the weir/dam, powerhouse, headrace and tailrace, substation and transmission lines; including projectsupport facilities)
2.7 Project Activities (during construction, operation, maintenance and decommission ing stages)
2.8 Construction Planning
2.8.1 Land (Area, type, requirements, along with permanent or temporary, and ownership in tabular format)
2.8.2 Project's human resources, construction materials including quantity and source, construction schedule, energy to be used – its source and consumption, its applica tions, associated/ancillary facilities
2.9 Project implementation schedule

3. Methods for preparing the report
4. Baseline information of the project
5. Identification of Environmental Impacts (physical and chemical, biological, socio-economic, cultural)
6. Alternative Analysis
7. Methods for maximization of beneficial impacts and minimization of adverse impacts
8. Environmental Management Plan (along with cost)
8.1 Disaster Preparedness and Management Plan
8.2 Resettlement and Rehabilitation Plan (if requiring involuntary resettlement)
8.3 Benefit sharing Plan
8.4 Corporate Social Responsibility (CSR) and Community Support Program (CSP) Plan

9. Review of Plans, Policies, Acts, Regulations, Guidelines, Standards, Convention
10. Environmental Monitoring
11. Environmental Audit
12. Conclusions
13. References
14. Annexes

Chapter 15. Annexes

The following documents should be included in the report.

- Project related legal documents/approval/license/ recommendation/permission etc
- Land use, land type, land formation related maps and drawings, photographs
- Questionnaire, checklist, table of contents for field study
- Public deed of inquiry
- Recommendation letter
- Other related documents

GOVERNMENT OF NEPAL
MINISTRY OF FORESTS AND ENVIRONMENT

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