ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)

30 MW Grid-tied Solar Power Plant Project of Intraco Solar Power Limited (ISPL)



Prepared for

Intraco Solar Power Limited (ISPL)

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ABBREVIATION

AIIB	Asian Infrastructure Investment Bank
AEZs	Agro-ecological Zones
AOI	Area of Influence/Interest
ARIPA	Acquisition and Requisition of Immovable Property Act
BBS	Bangladesh Bureau of Statistics
BCCSAP	Bangladesh Climate Change Strategy and Action Plan
BPDB	Bangladesh Power Development Board
CITES	Convention on International Trade in Endangered Species
CoI	Corridor of Impact
DG	Director General
DoE	Department of Environment
DPHE	Department of Public Health Engineering
ECA	Ecologically critical area
ECA 95	Environment Conservation Act,1995
ECC	Environmental Clearance Certificate
ECR	Environmental Conservation Rule
EHS	Environment, Health and Safety
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMF	Environmental and Social Management Framework
ESS	Environmental and Social Standards
EMP	Environmental Management Plan
EPR	Extended Producer Responsibility
ERP	Emergency Response Plan
EQS	Environmental Quality Standards
FGD	Focus Group Discussion
GHGs	Greenhouse Gases
GIS	Geographical Information System
GoB	Government of Bangladesh
GPS	Global Positioning System
GRM	Grievance Redress Mechanism
IEE	Initial Environmental Examination
IUCN	International Union for the Conservation of Nature
IP	Indigenous People
IPCC	Inter-government Panel on Climate Change
IUCN	International Union for Conservation of Nature
MSDS	Material Safety Data Sheet
MoEFCC	Ministry of Environment, Forest and Climate Change
MOHFW	Ministry of Health and Family Welfare
NAPA	National Adaptation Programme on Action
NEMAP	National Environmental Management Action Plan
NOC	No Objection Certificate

OSHA	Occupational Safety and Health Administration
PPR	Public Procurement Rule
PSMP	Power Sector Master Plan
PV	Photovoltaic
RAPSS	Remote Area Power Supply Systems
SEP	Stakeholder Engagement Plan
SLM	Sound Level Meter
SPM	Suspended particulate matter
SRC	Sunny Remote Control
SRDI	Soil Resource Development Institute
SREDA	Sustainable and Renewable Energy Development Agency
TDS	Total Dissolved Solids
TMP	Traffic Management Plan
ToR	Terms of References
UNDP	United Nations Development Program
WB	World Bank

WEIGHTS AND MEASURES

°C	-	Degree Celsius
dB(A)	-	decibel acoustic
GWh	-	giga watt hour
ha	-	hectare
km	-	kilometer
km/h	-	kilometer per hour
kWe	-	kilowatt-electric
KV	-	Kilo volt
m	-	meter
mm	-	millimeter
m^3	-	cubic meter
m^3/hr	-	cubic meters per hour
mg/l	-	milligrams per liter
m/s	-	meters per second
MW	-	megawatt
ppm	-	parts per million
ppt	-	parts per thousand
Rpm	-	revolutions per minute
µg/m^3	-	microgram per cubic meter

GLOSSARY

Adverse impact	An impact that is considered undesirable
Ambient air	Surrounding air
Aquatic	Growing or living in or near water
Bangla	Bengali language
Baseline (or existing)	The 'baseline' essentially comprises the factual understanding and interpretation of existing environmental, social and health conditions of where the business activity is proposed. Understanding the baseline shall also include those trends present within it, and especially how changes could occur regardless of the presence of the project, i.e. the 'No development Option'.
Bazar	Local Market
Beneficial impacts	Impacts, which are considered to be desirable and useful.
Biological diversity	The variety of life forms, the different plants, animals and micro-organisms, genes they contain and the ecosystems they form. It is usually considered at three levels: genetic diversity, species diversity and ecological diversity.
Ecosystem	A dynamic complex of plant, animal, fungal and microorganism communities and associated non-living environment interacting as an ecological unit.
Emission	The total amount of solid, liquid or gaseous pollutant emitted into the atmosphere from a given source within a given time, as indicated, for e.g., in grams per cubic meter of gas or by a relative measure, upon discharge from the source.
Endangered species	Species in danger of extinction and whose survival is unlikely if the existing conditions continue to operate. Included among those are species whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to suffer from immediate danger of extinction.
Environmental effects	The measurable changes, in the natural system of productivity and environmental quality, resulting from a development activity.
Environmental Impact	An estimate or judgment of the significance and value of environmental effects for natural, socio-economic and human receptors.
Environment and Social Management Plan (ESMP)	A Plan to undertake an array of follow-up activities which provide for the sound environmental and social management of a project/intervention so that adverse environmental and social impacts are minimized and mitigated; beneficial environmental and social effects are maximized; and sustainable development is ensured.
Environmental Management	Managing the productive use of natural resources without reducing their productivity and quality
Erosion	Process in which wind and water removes materials from their original place; for instance, soil washed away from an agricultural field.

Evaluation	The process of looking back at what has been really done or accomplished.
Fauna	A collective term denoting the animals occurring in a particular region or period
FGD	Focus Group Discussion
Flora	All of the plants found in a given area
Land use	Types include agriculture, horticulture, settlement, pisciculture and industries.
Mitigation	An action, which may prevent or minimize adverse impacts and enhance beneficial impacts.
Negative Impact	Negative change from the existing situation due to the project.
Public Consultation	A range of techniques that can be used to inform, consult or interact with stakeholders affected / to be affected by a proposal.
Stakeholders	Those who may be potentially affected by a proposal, e.g. Local people, the proponent, government agencies, NGOs, donors and others, all parties who may be affected by the project or to take an interest in it.
Taka	Unit of Bangladeshi currency
Terrestrial	Living on land

EXECUTIVE SUMMARY

Introduction

Energy is a very crucial asset for economic growth of any country. Energy as a form of electricity is most likely to be accepted by any industrial or residential use. That's why adequate electricity generation can have a promising impact on urban and rural development. Due to limited resource and technology, Bangladesh currently does not generate adequate electricity whereas the demand is increasing every day. Solar energy in Bangladesh has a very promising future. The technology of 21st century made it easier to generate electricity from solar energy. With a proper plan and geographical settlings, it is possible to reduce dependency on national grid for electricity.

With the invention of solar based technologies and the current global trend of reduction of solar panel costs, electricity generated using solar based technologies is expected to become cheaper than electricity generated from traditional sources. Thus, different industries are being encouraged to install solar PV based power plants to save electricity expenses in future. Current electricity cost from solar plant is almost similar to grid tariff which is expected to be cheaper than grid tariff in future due to the constant fall in price in solar based technologies vs expected rise in grid tariff to minimize gap between generation cost and tariff.

Due to the inherent nature and adaptability, solar project activities have some environmental and social impacts. According to DoE ECR, 1997 (amended on December 24, 2017; SRO/Law/349), Solar projects of more than 1 MW fall into the 'Orange B' category. For the project proponent, the following ESIA is a planning and decision-making tool.

Project Background

The proposed project of a 30 MW (AC) coupled solar power plant-based Grid-Tied Solar PV Power Plant at Bhotemari union of Kaliganj upazilla of Lalmonirhat district. The proposed system will include 30 MW (AC) on-grid solar power plant. This power plant Installation and supervision is Solarland Engineering & Development Co., Ltd. Equipment Suppliers and Technical Consultant is Antai Technology Co. Ltd. And the equipment manufacturers are China, Malaysia and Germany. The proposed system will include 30 MW on-grid solar PV panels that will be distributed through a transmission line. Intraco Solar Power Ltd. Project authority has leased 58.04 acres of land from the government and bought 39.99 acres of land from the rightful owners.

Scope & Methodology

The main objective of the Environmental and Social Impact Assessment (ESIA) study is to assess both positive and negative environmental impacts due to the project (30 MW Grid-tied Solar Power Plant) activities. Assess the impacts and recommend appropriate mitigation measures during pre-construction, construction and operation phases to minimize negative impacts of the project to acceptable levels. It allows for the identification and management of environmental impacts that may develop during the construction and operation of the project. The ESIA also specifies how the root causes mentioned in the scoping of the report will be handled. Baseline data generation forms an integral part of the ESIA study and helps to evaluate the predicted impacts on the various environmental and social attributes in the study area by using scientifically developed and widely accepted environmental and social impact assessment methodologies. Information was gathered on the existing physical environment related to Physiography, geology, topography, climate, soils, surface water and groundwater quality, air quality and noise level, etc. The study area in the southeast of Bangladesh

experiences a subtropical climate characterized by cool winter, and hot and humid summer and is typically exposed to heavily moisture laden monsoon winds across three main seasons.

Policy, Legal and Administrative Framework

Legislative bases for Environmental and Social Impact Assessment (ESIA) in Bangladesh are the Environment Conservation Act 1995 (ECA'95, as amended in 2010) and the Environment Conservation Rules 1997 (ECR'97). Department of Environment (DoE), under the Ministry of Environment, Forest & Climate Change (MoEFCC) is the regulatory body responsible for enforcing the ECA'95 and ECR'97. It is the responsibility of the proponent to conduct an Environmental Assessment (EA) of development proposal and the responsibility to review ESIAs for the purpose of issuing Environmental Clearance from the DoE. According to the Gazette on 24th December 2017 under Environment Division-3 of Ministry of Environment and Forest, Government of the People's Republic of Bangladesh, any solar power plant project (above 1MW) is considered as the "Orange B category".

The Environmental, Health and Safety (EHS) Guidelines of the World Bank Group (WBG) 2008 contain performance levels and measures that are considered to be achievable in new facilities at reasonable costs using existing technologies. The EHS guidelines have been organized into major four categories: (a) Environment, (b) Occupational Health & Safety, (c) Community Health & Safety, and (d) Construction & Decommissioning. Along with the World Bank's Environmental and Social Standards and AIIB's Environmental and Social Framework is also considered.

Description of the Baseline Environment

Baseline data generation forms an integral part of the ESIA study and helps to evaluate the predicted impacts on the various environmental and social attributes in the study area by using scientifically developed and widely accepted environmental and social impact assessment methodologies.

Information was gathered on the existing physical environment related to Physiography, geology, topography, climate, soils, surface water and groundwater quality, air quality and noise level, etc. The study area in the southeast of Bangladesh experiences a subtropical climate characterized by cool winter, and hot and humid summer and is typically exposed to heavily moisture laden monsoon winds across three main seasons. The field survey and site visit were conducted during 16th to 18th September 2022. The study was based on the primary & secondary data collection from various relevant sources and consultations with various stakeholders were ensured during field visit. Focus Group discussion (FGD) and face to face interaction were also undertaken with Project Proponent, local villagers and project implementation officials. Information and documents were collected from project site and land details as per requirements. The assessment of socio-economic environment was carried out based on the survey with the help of framed questionnaire to conduct community consultation. Secondary data includes Census 2011, information available on the official website of the district of Lalmonirhat and other available data on official Government websites.

Water availability and quality, groundwater contamination, waste and wastewater disposal, ambient air quality, ambient noise levels, vegetation, fauna (terrestrial and aquatic), drainage pattern, hydrology, climate change, socioeconomic, and places of social/cultural importance (religious structures, community) are some of the significant impacts of the proposed project. Adequate mitigation measures such as providing personal protective equipment to the worker, use of waste bin for waste management, air, water and soil pollution reduction etc. are provided in the ESIA report.

Environment and Social Management Plan (ESMP)

The Environmental and Social Management Plan (ESMP) describes mitigation measures for impacts specific to the project activities and also discuss implementation mechanism for recommended mitigation measures along with monitoring plan. A total amount of 7,50,000 Taka per year has been estimated for environmental and social monitoring budget.

The ESIA study has been carried out based on the information of extensive field survey as well as literature review and including the national legislative requirement, the World Bank Policies, World Bank's Environmental Health and Safety (EHS) Guidelines and AIIB's Environmental and Social Framework.

Potential Impact Assessment & Mitigation

Interactions of the Project with physical, ecological or social environment thereby leading to potential impacts to resources/ receptors has been considered in the ESIA report. It has been organized as per the various phases of the Project life cycle to understand the risks and impacts associated with each phase. The scope of the assessment captures the understanding on the envisaged risks and impacts assessed during the scoping exercise of this impact assessment study as well as the risks identified during subsequent physical baseline assessment and impact evaluation process

The potential environmental impacts that are associated with the proposed project activities are classified into different phases of the project work.

During construction phases, the major impact associated with environmental quality like air, noise, water quality might be degraded due to improper management of the generated waste. Dust generated from construction machineries and gaseous emissions from vehicular transport as well machineries may deteriorate the air quality of the local area. Noise quality can be deteriorated due to the operation of various machineries and equipment. Various grease and oily substances may be released from the construction machineries may deteriorate the natural water of the project site. All the impacts will be very much localized in nature. The project contractor is to take responsibility of minimizing environmental impact on the surroundings during construction phases by following the project's environmental and social management plan (ESMP). Other social impacts associated with the visual amenity, health safety of the labors, cultural resources, employment opportunity etc. such type of impacts will be localized in nature and not anticipate to the project. The contractor should follow the rules and guidelines related to the environmental and social mentioned in the ESMP.

During the operation period, the main impact is associated with heat generation and PV panel wash. The heat may be transferred by convection, radiation and conduction method. PV panels should be washed regularly with preventing any risk. To mitigate the impacts the developer should follow the ESMP properly.

Disaster Impact Assessment

The Disaster Impact Assessment methodology is used to evaluate development projects from the perspective of disaster risk reduction by identifying project improvement areas. Based on the study, the project will be revised to reduce disaster risks and mitigate adverse effects related to and resulting from project activities. This section contains an initial draft of the framework for assessing the impact of natural catastrophes. The framework's goal is to assist crisis managers in estimating the effects of disasters in various industries.

The project area located in Lalmonirhat district beside Teesta River may experience hazards like minimal floods. Some mitigations need to be examined during these impacts. Because of urbanization waterlogging is an important issue during heavy rainfall. Rainwater infiltration can

be improved by using flexible dams and grading away from structures, as well as incorporating berms, wetlands and swales into the landscape.

Public Consultations

Public consultation including stake holder identification has been considered in the ESIA report. The contractor will prepare a detail stakeholder engagement plan during the construction phase of the project. As for the required lands for the project, the project authority has bought the required private lands from the respective land owners with such a manner where both of the parties can be benefitted and no one have to suffer.

Labor health, safety, community health safety, working condition, environmental protection all are considered as per guideline of WB and AIIB. The ESIA document have considered all the possible impact that may generate from the project activities and provided the mitigation measures as applicable.

The Project Management has established a GRM committee to answer to project-related queries and address complaints and grievances about any irregularities in application of the guidelines adopted for assessment and mitigation of environmental safeguards impacts. The procedure will help to resolve issues/conflicts amicably and quickly without resorting to expensive, time-consuming legal actions.

Conclusion

Based on visualization and analysis, it is possible to reach in a conclusion that the project stands environmentally sound and sustainable when the recommended mitigation measure and environmental management processes are adopted properly.

The remained construction activities may even have to be stopped during rainy season. So, it is recommended that commencing construction in early winter season may help to reap the benefit of full dry spell of the season.

In order to enhance the occupational health and worker safety during the construction period, construction equipment would have to be kept in good order. Adequate safety measures should be taken and safety related equipment including personal protective and safety equipment (PPE), firefighting equipment etc. must be provided in order to reduce the potential for any kind of accidents

1 INTRODUCTION

Energy as a form of electricity is a very crucial component for human civilization. It creates the impact on urban and rural development of a country. But due to limited resource and technology, Bangladesh currently does not generate adequate electricity whereas the demand is increasing every day. Apart from the traditional technology, solar energy in Bangladesh has a very promising future which can be very useful for electricity generation and can contribute to the national grid of electricity.

In Bangladesh, load shedding is a problematic subject. This problem is caused by the misuse of electricity. Load shedding is also caused by unauthorized electricity connections. Even during peak power use hours, about half of the available power goes unused. However, even in the winter, many individuals do not have access to electricity. In order to secure energy sources in 2022 especially oil, gas and coal, alternate energy sources such as wind, hydro and solar energy has been brought into consideration.

Currently, the economy of Bangladesh is booming. It has an average growth rate of 8%, and demand for electricity is rising fast in a rocketing speed. The total need for electricity in Bangladesh at present is more than 2800 MW. Bangladesh wants to decarbonize and is opening major new solar projects in addition to expanding the use of solar systems. The government has already taken different kinds of projects to produce desired amount of power by using this solar energy potential. Power generated using solar based technologies is predicted to become cheaper than electricity generated from traditional sources, due to the availability and easy installation of solar based technologies. The cost of solar-generated electricity will decrease in the future as solar-based technologies advance and solar panels are becoming more affordable. In order to save electricity expenses in the future, different industries are being encouraged to install solar PV-based power plants. Due to the constant fall in price in solar-based technologies compared to the expected rise of grid tariffs, the current electricity costs from the solar plant are almost identical to grid tariffs. This allows the gap between generation cost and tariff to be minimized in the future. In these circumstances, financing renewable energy-based projects make environmental and financial sense aside from fulfilling the country's goal of ensuring everyone accesses to electricity through renewable energy.

As part of the sustainability and cost-saving initiatives, Intraco Solar Power Limited (ISPL) is planning to install a 30 MW (AC) grid-connected Solar PV-based power generation plant at Sholmari village in Bhotemari union under Kaliganj upazilla of Lalmonirhat district which is located on the island named ‘Charland’ of the Teesta River.

1.1 Project Background

The proposed project of a 30 MW (AC) coupled solar power plant-based Grid-Tied Solar PV Power Plant at Bhotemari union of Kaliganj upazilla of Lalmonirhat district. The proposed system will include 30 MW on-grid solar power plant. This power plant Installation and supervision is Solarland Engineering & Development Co., Ltd. Equipment Suppliers and Technical Consultant is Antai Technology Co. Ltd. and Equipment Manufacturers are China, Malaysia and Germany. Intraco Solar Power Ltd has invested authorized capital of BDT 567,00,00,000. The solar power will be distributed on approximately seven (07) kilometers around the plant area. The project is expected to supply electricity to the adjacent households, shops, social entities including schools, mosques, madrasas, offices, government and non-government institutions, rice mills, husking mills and irrigation pumps.

1.2 Objectives of the ESIA

The main objective of the Environmental and Social Impact Assessment (ESIA) study is to assess both positive and negative environmental impacts due to the project (30 MW Grid-tied Solar Power Plant) activities. Assess the impacts and recommend appropriate mitigation measures during pre-construction, construction and operation phases to minimize negative impacts of the project to acceptable levels. The ESIA will be used as a decision-making tool to ensure that the project design and implementation activities are environmentally sound and sustainable. During the implementation phase, the prepared Environmental and Social Management Plan (ESMP) shall serve as a framework for strengthening the mitigation, enhancement and environmental monitoring measures and system of the solar project. In the preparation phase, The ESIA must fulfill the following objectives:

- To establish the environmental and social baseline in the study area and to identify any significant environmental issue;
- To assess, quantify and design project activities with environmental and social impacts in mind;
- To incorporate social and environmental concerns into project planning and design;
- To identify and assess the project impact associated with proposed development;
- To prepare an inventory of biodiversity (Flora and Fauna) in the region and those likely to be affected due to project activity; and
- To create a suitable management plan for implementing, monitoring and reporting on the recommended environmental and social mitigation and enhancement measures.

1.3 Scope of the ESIA

Scoping will be undertaken to identify the potential Area of Influence for the project to identify potential interactions between the project and resources/receptors in the Area of Influence (AOI) and the potential impacts that could result from these interactions. It also helps in developing and selecting alternatives to the proposed action and in identifying the issues to be considered in an ESIA. Table-1.1 presents the resources/receptors considered in the scoping stage, together with the changes that might indicate a potential project-related impact.

Table 1.1: Example of the Scoping of Potential Risks on Receptors

Resources/Receptors	Changes that May Indicate Potential Impacts
Environmental	
Surface Water	Changes to physical, chemical or biological quality of rivers, lakes, and other surface water bodies; Introduction of exotic species, changes in habitat quality, abundance and diversity
Groundwater	Contamination of shallow or deep groundwater resources, change in ground water resources
Sediments	River/waterbed morphology, physical and chemical properties, benthic organisms.
Noise	Change in noise levels.
Air	Emissions of NOx, SO_x, PM, CO, etc.
Aesthetics	Physical presence of facilities, increased night time light.
Waste	Generation of wastes – hazardous and non-hazardous.
Social	
Job Opportunity	Creating new job opportunity for locals
Grievance Redressal	Identify and redress any grievance that may arise during the project implementation
Community Health and safety	Spread of disease or health deterioration of locals
Ecological	
Fisheries	Changes in fisheries productivity.
Vegetation	Changes to vegetation population, health, species abundance and diversity and impact on endangered and economic species, food chain effects.
Wildlife	Changes to wildlife assemblages, propagation, impact on endangered and economic species, food chain effects.
Community Health and Safety	
Environmental Change	Decreased air quality (e.g., NO_x, SO_x, CO, PM), contamination of surface waters and potable ground water, increased vibration and noise, increased night time light beyond acceptable limits, changes to the visual environment.
Communicable and Non-Communicable Diseases	Change in incidence and/or prevalence of communicable and non-communicable diseases or disease-causing factors
Vector Borne Diseases	Changes in the incidence and or prevalence of vector borne diseases, the density of these vectors and their breeding grounds.

The scoping process of the ESIA study is showing in figure 1.1.

1.4 Approach & Methodology

1.4.1 Approach

The study has been conducted in accordance with the Environment Conservation Rules, 1997, Government of Bangladesh (GoB) EIA Guidelines 2021, WB ESS 1-10 and AIIB's Environmental and Social Framework. The study is based on both primary and secondary data and information. The primary data includes data collected from field observations and secondary data includes review of the Bangladesh statistical and relevant information from Government Departments, newspapers, journals and research papers. Discussions were held with stakeholders including community representatives and a wide range of the locality. The main purpose of this approach was to obtain a fair impression on the people's perceptions of the project and its environmental impacts.

1.4.2 Methodology

In order to establish the baseline biophysical and social conditions within the study area, relevant secondary and primary data were collected and reviewed. Further, a comprehensive field visit was undertaken, and a number of consultations with local people were carried out.

The data generated allowed the environmental team to better understand the complex interplay between the various biotic and abiotic factors within the study area and to establish the baseline conditions. Once this baseline was established it was used as a reference point to identify potential changes to the environment that may occur as a result of the proposed project activities, as well as to allow the development of measures to prevent, mitigate or manage these potential impacts. Furthermore, for establishing social baseline, the stratified random sampling method has been employed in this survey. As the first step, secondary information from various sources including District and Divisional offices and internet were obtained and reviewed. Once the indicators were agreed upon, a questionnaire was developed to collect data. The questionnaire was updated and improved based on the data and feedback received primarily. Then a detailed survey was conducted.

The following methodology was adopted for carrying out the ESIA of the proposed project.

1.4.2.1 Environmental Data Collection and Analysis

This section describes the methods and techniques used to investigate and describe the potential environmental risks of the Project. In order to establish the baseline biophysical conditions within the Project area, relevant secondary and primary data was identified and reviewed, a comprehensive field visit program established, and a number of specialist studies were carried out. This included the gathering of primary and secondary data from various sources including from discussions with groups, discussion with individuals, Government sources.

The assessment of potential environmental impacts requires detailed information on all aspects of the habitats, biodiversity, and physical aspects of the project area. It also requires development of an understanding of how the existing environmental processes work together to form a complex ecosystem. This information can be used to identify potential changes to the environment that may occur because of the project, and to propose measures to prevent mitigate or manage potential environmental impacts.

The potential for environmental impacts was considered for activities during all stages of the proposed Project. This includes site establishment, construction phase, and site decommissioning and decommissioning phases. As the environments within the project area

have not been widely studied in the past, knowledge gaps identified within the consultation phase have been filled through detailed investigations and field visits as part of this more comprehensive ESIA report.

1.4.2.1.1 Secondary Data Collection

A review was conducted of the biophysical, ecological, and legal literature relevant to the Project. The review of secondary sources and informal initial field investigations were undertaken in order to prepare a preliminary assessment of the physical and social environment, biodiversity, and conservation significance of the identified study area. This preliminary literature reviews also assisted in identifying data gaps which would require collection of additional primary information through physical field survey. The following activities were included in this phase of the Project -

- Data and information were collected from various government relating to site aspects climate (weather), groundwater quality and soils; secondary ecological data sources were collected and assessed;
- An appraisal was made of all legislation having direct and indirect relevance to environmental management within the Study Area including aspects such as biodiversity conservation, water quality, waste management, natural resource management and spill response;
- Previous environmental site studies, where available, were reviewed as well as relevant scientific journal articles; and
- Thereafter, an information gap analysis was undertaken to identify the areas where further primary data collection would be required to complete the ESIA.

1.4.2.1.2 Baseline Data Collection and Analysis

Primary data collection was initiated to fill gaps in knowledge resulting from the secondary data review. Further, it aimed to provide a site-specific data set of relevant physical and biological environmental aspects relevant to the Project. The primary data collection program was undertaken in September 2022. During the field visit, stakeholders were consulted, and several important additional secondary sources of environmental information, data and literature were collected.

1.4.2.2 Social Data Collection and Analysis

1.4.2.2.1 Primary Data Sources

1.4.2.2.1.1 Key Informant Interview

The survey team had interviewed the upazila office for suggestions, comments or addressing any issues from them. Two (02) of the officials had a discussion with the survey team and provided their valuable comments regarding the Proposed solar project.

1.4.2.2.1.2 Focus Group Discussion

A stakeholder is defined as any individual or group who is potentially affected by the proposed project or can they affect the proposed project directly or indirectly. Three (03) consultations/FGDs have been arranged during the conduct of the ESIA surveys. The consultations were conducted on three different locations in and around the project location.

1.4.2.2.2 Secondary Data Sources

- Department of Environment (DoE) Housing, Social Services, Social Welfare, Women Affairs, Land, Food, Fisheries, Livestocks, Agriculture, Urban Governance, Upazila Project Development Office etc.;
- Journals, books, websites, newspapers, and magazines;
- Internet searches and libraries etc.

1.4.2.2.2.1 Questionnaire Survey

Questionnaire surveys have been employed by the Project as a component of the social consultation. With the help of the public, the study aimed to collect data from the indigenous population. The general populace in the project intervention area was viewed as the project's major stakeholders, and they expressed both individual and public concerns about the initiative. Through the questionnaire, they expressed their opinions, concerns, and knowledge about the project, which aided the consultant's comprehension of the social criteria.

1.4.2.3 Geographical Information Systems (GIS)

Geographical Information Systems (GIS) was used as a specialized analysis and presentation tool. Before commencing field investigations, spatial analysis of satellite imagery and present administrative areas and other boundaries/constraints was considered for the environmental assessments. For example, forest areas, spawning grounds, infrastructures, environmental protected areas and the alignment were identified. It also supports more detailed on-ground survey, particularly spatial features that may be directly or indirectly influenced by Project activities.

Detailed on-ground validation of spatial information – particularly land use – was undertaken using a hand-held, non-differential GPS. The spatial data acquisition team took detailed transect walks through the Project area in order to identify various land use types and confirm the findings of the satellite imagery analysis. This extensive ground-truthing exercise both validated the land use mapping and identified additional sensitive areas to include within the environmental fieldwork for sampling.

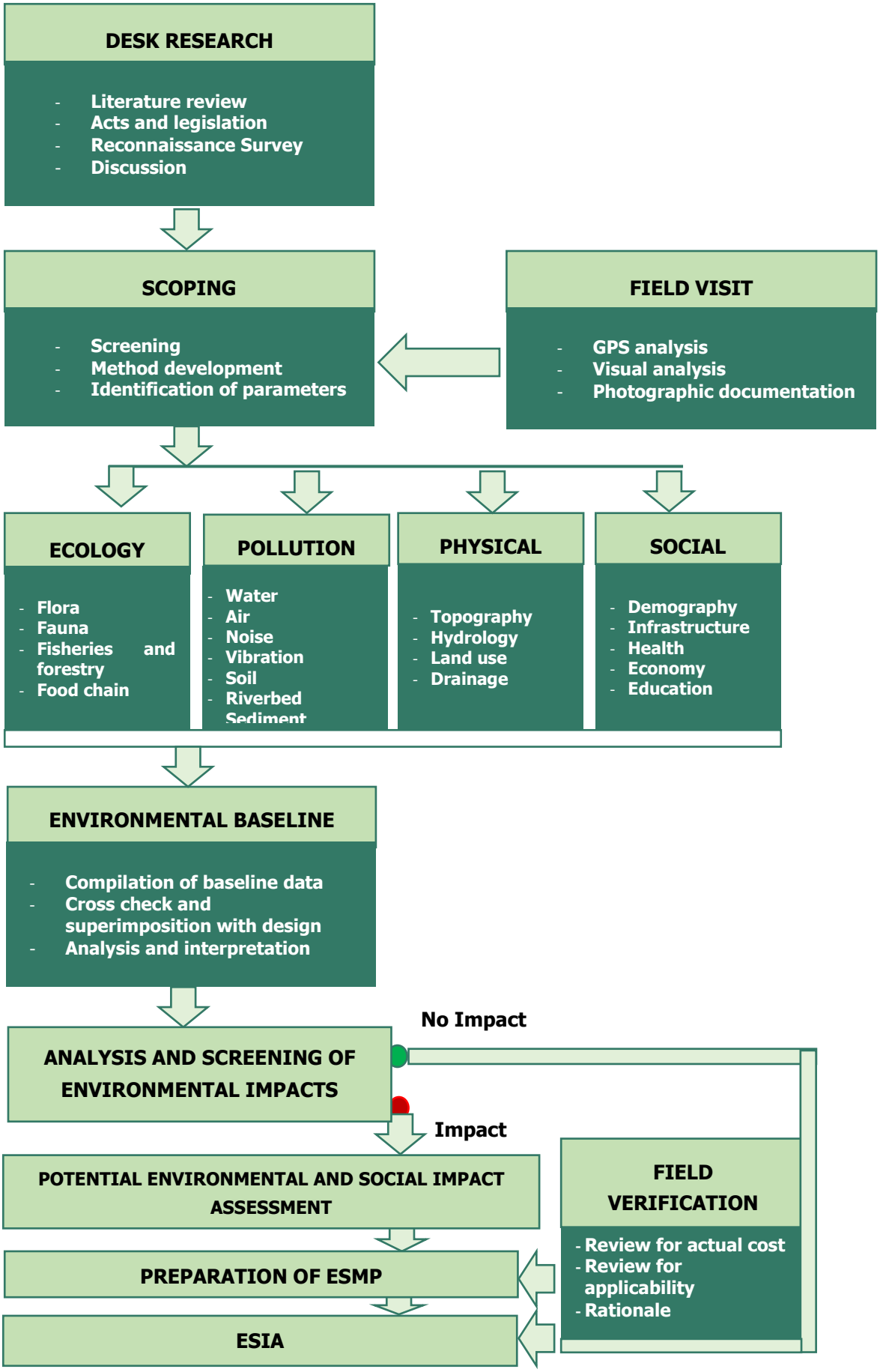


Figure 1.1: Scoping Process of Environmental and Social Impact Assessment (ESIA)

1.4.2.4 Physical Environment Field Survey

To comprehensively evaluate the existing Project area baseline conditions, a field visit and data collection program incorporating a number of biophysical investigations was developed and implemented. A desktop assessment was then prepared to enable the collection of refined and verifiable information. The field survey program was conducted throughout the project area by a specialist environmental team.

This survey aimed to identify important environmental components and environmental issues within the study area. It included investigation and observation of the local landforms, market location, habitat types, drainage patterns, species abundance and distribution, soil types, water quality (surface water and groundwater), air quality, noise, vibration and hydro-morphology.

The study area and surrounds were surveyed on foot and by boat. Important environmental features were identified and logged. Hand-held geographic positioning systems (GPS) were used to identify specific features for mapping and further analysis in the Project office. Features that were recorded or ground-truthed with GPS included:

- Habitation and settlement areas;
- Plantations;
- Habitat areas;
- Sensitive environments; and
- Transportation routes;

Direct observation and key informant interview techniques were employed within the field survey. Direct observations were subject to accessibility and were guided by satellite image maps and local information. Observations were made along project location and transmission line alignment.

1.4.2.5 Ecological Field Survey

Initially, secondary data sources were reviewed in order to compile a potential presence/absence list of significant fauna and flora species. Thereafter two members among the field survey team were deployed to undertake the required sampling and assessment. Sampling and survey were conducted for both aquatic and terrestrial ecosystems; validation checks were confirmed against the earlier-compiled species lists in order to establish a comprehensive baseline.

Activities such as direct observation and interviews with locals were conducted for the ecological information collection.

1.4.2.6 Impact Assessment Methods

The ESIA process for the project identifies the potential environmental impacts that may result from the implementation of the solar project. Both positive and negative potential impacts for the project were identified through the application of standardized international best practice methods of environmental & social impact assessment. Some of the methods of environmental impact assessment utilized include:

- Ad-hoc methods;
- Application of expert judgment;
- Risk based approach including residual risk assessment;
- Systematic and sequential approaches; and
- Spatial analysis methods (including GIS).

Further to these methods, social potential impacts were assessed based on previous experiences and opinions of local people and important stakeholders e.g.; government agencies and through literature review relevant to the Project area. Social impacts were identified through public consultations, focus group discussions and from BBS 2011.

The principal method for assessing the potential impacts of the project on the biophysical and social environments utilized for this ESIA was risk assessment. Details on the risk assessment process and how it was utilized to identify impacts, the likelihood and consequence of the actions and implement appropriate mitigation measures to reduce any potential impacts to an acceptable level is detailed within the following sections.

1.5 The ESIA Study Team

The ESIA study has been conducted by the following experts:

Table 1.2: ESIA Study Team

No.	Name	Position
1.	Mr. Md. Shafiqur Rahman	Team Leader (Senior Environmental Specialist)
2.	Raisin Akhter Feroz	Environmental Specialist
3.	Ms. Mafia Mostafa	Ecologist
4.	Saiful Islam Imran	Mid-level Environmental Specialist
5.	Rajib Roy	Mid-level Environmental Specialist
6.	Mr. Madhu Shudan Das	GIS Expert
7.	Ekram Hossain Riyad	Junior Environmental Engineer (CIVIL)
8.	Emon kumar Rajbongshi	Environmental and Social Surveyor

1.6 Structure of the Report

This report includes the following main elements;

CHAPTER 1: INTRODUCTION

This chapter consists of the background of the project along with the objectives, scope and methodology of preparing the ESIA report. This chapter also includes the organization of the total ESIA report.

CHAPTER 2: POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

In this chapter the national and international laws and policies are described which are relevant to the environmental and social aspects of the project. The relevant guidelines of the funding agency WB and AIIB are also described in this chapter. Finally, the requirements for making ESIA for this project according to DoE, WB and AIIB are described.

CHAPTER 3: DESCRIPTION OF THE PROJECT

This chapter includes the background and objectives of the proposed project. The location of the project, proposed project interventions and project cost are described here. In total, this chapter gives a detailed idea about the project.

CHAPTER 4: ANALYSIS OF ALTERNATIVES

In this chapter, the alternative options of the proposed project are analyzed. It starts from no project alternative and ends at analyzing all the possible alternatives. This chapter concludes by declaring the proposed project as the best solution after analyzing all the other alternatives.

CHAPTER 5: DESCRIPTION OF THE ENVIRONMENTAL & SOCIAL BASELINE

This section provides the definition and baseline conditions or attributes of the study area and its existing physical, biological and socio-economic environment. This section presents both environmental and socio-economic aspects and draws upon both secondary and primary data collection. Maps tables, figures and plates are used to present relevant data about the study area to provide a comprehensive picture of the existing environment before Project implementation.

CHAPTER 6: POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACT

This section identifies the potential positive and negative environmental, physical and socio-economic impacts of the Project. Each key aspect is analyzed and discussed in relation to the Project. For key aspects, the potential impacts are broken down into the different delivery stages of the project.

CHAPTER 7 MITIGATION MEASURES

In this chapter, the possible environmental & social impacts due to the implementation of this project and their mitigation measures have been illustrated. Besides, the restoration process of the loss due to the project activities has also been discussed in this section.

CHAPTER 8 DISASTER IMPACT ASSESSMENT

This chapter represents the plan to minimize the accidental cases or to handle the natural calamities with care. This section also represents the possible scenario of the project in case of an emergency (both accidental or natural) and their handling procedure through proper mitigation measures.

CHAPTER 9 CUMULATIVE ENVIRONMENT & SOCIAL IMPACT

Cumulative impacts are changes to the environment caused by an action (project or project activity) in combination with other past, present, and future human actions. In this chapter the current cumulative impact assessment has been rectified to evaluate the combined effects of proposed developments along with the proposed project.

CHAPTER 10: ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN

This chapter includes the environmental management plan which includes the impacts of the proposed project on the environment and society is described. All the anticipated impacts in the pre-construction stage, construction stage and operational stage are described here.

CHAPTER 11: GRIEVANCE REDRESS MECHANISM

This chapter includes the mechanism to redress the grievances from the local people during the implementation of the project.

CHAPTER 12: INFORMATION DISCLOSURE, CONSULTATION & PARTICIPATION

This section presents the outcomes of the stakeholder engagement and consultation undertaken as part of the ESIA. In this chapter, the consultation process, consultation meetings details, and the outcomes are described.

CHAPTER 13: SOCIAL AND ENVIRONMENTAL BENEFIT

This chapter delineates the social and environmental benefits due to the project interventions as well as after the implementation of the project.

CHAPTER 14: CONCLUSION

This chapter concludes the environment & social aspects of the project area and provides any recommendations if applicable.

2 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

According to DoE ECR, 1997 (amended in December 24, 2017; SRO/Law/349), Solar subprojects of more than 1 MW fall into the **Orange B** category. For **Orange B** category projects. The project authority has already collected Site clearance Certificate along with Environmental Clearance Certificate (ECC) for this project according to the DoE guideline. (Provided in Appendix A)

According to the country's national environmental legislation, all development activities in Bangladesh are subject to various legal and institutional limitations. As a result, before implementing the process or plan, each proposal or developer must research relevant legal laws, policies, methods and institutional concerns. The proponent has to be well aware of these requirements and comply with the provisions as applicable and necessary. Before initiating any development project, it is hence required to fulfill DoE's reequipments as per project category. The Ministry of Environment. Forest and Climate Change (MoEFCC) is the regulatory body responsible for enforcing environmental laws and regulations like ECA'95 (amended in 2010) and ECR'97.

Due to its inherent nature and adaptability, solar project activities have very little environmental and social impacts. Bangladesh's environmental and social policies have improved during the last decade as a result of both local demands and international duties.

For the project proponent, ESIA is a planning and decision-making tool. It allows for the identification and management of environmental impacts that may develop during the construction and operation of the project. An ESIA also specifies how the root causes mentioned in the scoping of the report will be handled.

2.1 National Level

A several number of national level policy, law, regulation and acts are developed for betterment and as a guideline for industrial unit or project. The relevant national policy/law/regulations are summarized and discussed in the table below:

Table 2.1: Relevant National Policy/acts/law appliable for the proposed project

SI	Policy/Acts/Rules	Key provisions and purpose	Applicability to the Project
1.	Bangladesh Wildlife (Conservation & Security) Act, 2012 (previously known as Bangladesh Wildlife (Preservation) Order, 1973; amended as Bangladesh Wildlife (Preservation) Act, 1974	This Order aims to protect and conserve wildlife in Bangladesh. Wildlife preservation, conservation and management fall within the jurisdiction of the Forestry Department. This Act protects 1,307 species of plants and animals under four schedules that mandate imprisonment and fines for wildlife poaching, capturing, trapping, and trading.	This Act is relevant to the sub-project as an intervention may affect wildlife habitation obstruct movement. The Act has adopted new types of protected areas for conservation and protection of wildlife resources, created avenue for community conserved areas and also community-based management of protected areas.
2.	Bangladesh Climate Change Strategy and Action Plan (BCCSAP) 2009	This is a comprehensive strategy to address climate change challenges in Bangladesh. Bangladesh Climate Change Strategy and Action Plan built on and expanded the NAPA.	Relevant as the sub-project area is vulnerable to climate change effect

SI	Policy/Acts/Rules	Key provisions and purpose	Applicability to the Project
3.	Bangladesh Labor Act (Amendment), 2013	The Bangladesh Labor Act (Amendment) Bill was enacted by parliament in 2013, to make the present legislation more time-appropriate for workers' wellbeing. The bill was approved with the conditions of legalizing trade unions in factories, assuring worker safety at work, establishing mandatory group insurance, and prohibiting children from working in dangerous environments.	To carry out the civil works, labor will be required to be hired. Therefore, these laws will be triggered to safeguard the interest of the labor, host community, project authorities, Contractors, and other project stakeholders. The project will ensure that the stipulations of the law are duly followed when it comes to labor-related activities
4.	Cultural Heritage	The Antiques Law of 1968 law consolidates all laws relating to the preservation and protection of antiquities under the auspices of the Department of Archaeology. The law empowers the Director of the Department of Archaeology to take steps necessary for antiquity's custody, preservation, and protection. The Environment Conservation rules (1997) states that GoB will consider the presence of human habitat, ancient monuments, or archeological sites, among other factors, in declaring an area as ecologically critical.	Presence of any cultural heritage is not found near the project location. However, measures must be taken according to the law if any cultural heritage is found.
5.	Environment Conservation Act (ECA), 1995 (with all amendments)	The main objectives of ECA are: • Conservation and improvement of the environment; and • Control and mitigation of pollution of the environment. The main focuses of the Act can be summarized as: • Declaration of ecologically critical areas and restriction on the operations and processes, which can or cannot be carried out/ initiated in the ecologically critical areas (ECA); • Regulations in respect of vehicles emitting smoke harmful to the environment; • Environmental clearance; • Regulation of industries and other development activities' discharge permits; • Promulgation of standards for quality of air, water, noise, and soil for different areas for different purposes; • Promulgation of a standard limit for discharging and emitting waste; and • Formulation and declaration of environmental guidelines.	According to this law, no industrial unit or project shall be established or undertaken without obtaining an Environmental Clearance Certificate/site clearance from the Department of Environment in the manner prescribed by rules.
6.	Environment Conservation Rules, 1997 (with all amendments)	The Environment Conservation Rules, 1997, were issued by the GOB to exercise power conferred under the Environment Conservation Act	Following the Environment Conservation Rules (ECR) of 1997, the Project is classified as Orange B category, requiring a

SI	Policy/Acts/Rules	Key provisions and purpose	Applicability to the Project
		(Section 20), 1995. Under these Rules, the following aspects, among others, are covered: • Declaration of ecologically critical areas; • Classification of industries and projects into four categories; • Procedures for issuing the Environmental Clearance Certificate (ECC); and • Determination of environmental standards.	IEE and EMP for site clearance from DoE.
7.	Environmental Court Act, 2000	This Act sets out policy for effective pursuance and completion of legal proceedings related to environmental crimes. Under this Act, the Director General of the DoE has the power to impose heavy penalties on industrial polluters who are dumping untreated wastewater into the environment or not operating their legally mandated ETPs.	According to this act, the government can take legal actions if any environmental problem occurs due to project interventions.
8.	Guidelines for the Implementation of Solar Power Development Program, 2013	It is mentioned in section 3.8 of guidelines for the implementation of the Solar Power Development Program (2013) that according to the Renewable Energy Policy, to establish a solar mini-grid project with a capacity of up to 5 MW, the entrepreneur will be exempted to get a waiver certificate. Mini-grid projects with a capacity up to 250 MW will not be required any waiver certificate/license, but the entrepreneur will have to inform the Commission by sending a letter. For the implementation and operation of solar mini-grid projects, a license for a period of a minimum of 20 years may be issued with a condition to renew every year.	The proposed 30 MW project should follow the guideline as stated.
9.	National Environmental Policy, 2018	Major elements of the policy are • Natural equilibrium provision and overall development of the country through environmental protection and sustainable management; • Encourage collection and promotion of low carbon emission technology in the country; • Identifying and controlling all types of environmental pollution and degradation activities; • Ensure environmental development in all fields; • Ensure sustainable, long term, and environmentally friendly use of all-natural resources; • Maintain and streamline the environmental policies and strategies among other policy	The environmental policy aims at prevention of pollution and degradation of resources.

SI	Policy/Acts/Rules	Key provisions and purpose	Applicability to the Project
		strategies in the interest of sustainable development; • Ensure the Environmental Impact Assessment and Strategic Environmental Assessment in all necessary sectors; • Actively involve with all international environmental initiatives as much as possible and take necessary actions at local and national levels.	
10.	National Environmental Management Action Plan (NEMAP), 1995	The NEMAP was developed with the following objectives: • to identify key environmental issues affecting Bangladesh; • to identify actions to halt or reduce the rate of environmental degradation; • to improve management of the natural environment; • to conserve and protect habitats and biodiversity; • to promote sustainable development; and • to improve the quality of life.	The plan proposes developing and applying guidelines to avoid environmental pollution due to transport and communication system. It emphasizes different environmental pollution, hampers of natural drainage patterns, and agricultural land acquisition due to the development of the transport system.
11.	The Water Act, 2013	The Act recognizes the significance of managing all water resources in the natural flow of surface water and recharge of groundwater. The private landowners will use the surface water inside their property for all purposes per the Act. No individuals or organizations will be allowed to extract, distribute, use, develop, protect, and conserve water resources, nor will they build any structure that impedes rivers and creeks' natural flow.	To protect the nearest waterbodies and regulate the water quality during the construction phase
12.	The Forest Act (1927) and the Forest (Amendment) Act (2000)	It is the main legislative context for forestry protection and management in Bangladesh. It was enacted to control trespass illegal resources extraction from forests and to provide a framework for the forestry revenue collection system.	The Act is not relevant to the proposed solar project as no trees will be cut during the site preparation time.
13.	The National Energy Policy, 1996 and 2004	The NEP 2004 recognized that "policy formulation is a continuing process for decision making at different levels by different institutions and individuals" and hence for operationalizing the NEP there is a need to ensure that these "decisions are taken in a synchronized manner at the macro level, sectoral level as well as sub-sector (utility) level" to achieve the stated objectives (GoB 2004:17). The NEP also stated that implementation of the NEP "will necessitate the introduction of new Acts and modifications of the relevant Acts and Ordinances in this regard	This is an Energy generation project, and the policy should be followed for maintaining compliance.

SI	Policy/Acts/Rules	Key provisions and purpose	Applicability to the Project
		and Environmental issues to be considered under National Energy Policy are to be mandated under National Environment Policy and Environment Act" (ibid. 22, emphasis added). The NEP 2004 devoted a section on Environment Policy, which deserves closer attention regarding this project.	
14.	National Forest Policy (amendment), 1994	The policy is designed to conserve the existing forest areas, bring about 20% of the country's land area under the Forestation Programme, and increase reserve forests by 10% per year up to 2015.	The Act is relevant to the sub-project as construction of the project intervention will require cutting and trimming some trees.
15.	National Water Policy, 1999	The policy emphasizes efficient and equitable management of water resources, proper harnessing and development of surface and groundwater, availability of water to all concerned, and institutional capacity building for water resource management.	Measures must be taken to minimize disruption to the natural aquatic environment in nearest rivers.
16.	National Fisheries Policy, 1999	National Fisheries Policy focuses on aquaculture and marine fisheries development. The policy suggests, among others, that biodiversity will be maintained in all-natural water bodies and marine environment, and control measures will be taken against activities that harm fisheries, resources, and vice-versa.	The project required proper action to prevent biodiversity in all-natural water bodies and the aquatic environment.
17.	National Land Use Policy, 2001	The main contents of this policy are: • Stopping the high conversion rate of agricultural land to non-agricultural purposes; • Utilizing agro-ecological zones to determine maximum land-use efficiency; • Adopting measures to discourage the conversion of agricultural land for urban or development purposes; • Improving the environmental sustainability of land-use practices.	The proposed project does not affect any nearby land and ensure the environmental sustainability of land-use practices.
18.	National Water Management Plan, 2001 (Approved in 2004)	The plan provides a framework within which all concerned with the development, management and use of water resources water services in Bangladesh can plan and implement their own activities in a coordinated and integrated manner. The planned activity programs have been presented in the eight sub-sectoral clusters: i) Institutional Development, ii) Enabling Environment, iii) Main River, iv) Towns and Rural Areas, v) Major Cities; vi) Disaster Management; vii)	As the project proponent is close to a waterbody, this policy is applicable.

SI	Policy/Acts/Rules	Key provisions and purpose	Applicability to the Project
		Agriculture and Water Management, and viii) Environment and Aquatic Resources. Each cluster comprises of a number of individual programs.	
19.	National 3R Strategy for Waste Management, 2010	The National 3R Strategy for waste management has been established by Department of Environment in December, 2010. Sector specific strategies for promotion of 3R are depicted in this national 3R strategy. The national 3R goal for waste management is to achieve complete elimination of waste disposal on open dumps, rivers, flood plains by 2015 and promote recycling of waste through mandatory segregation of waste at source as well as create a market for recycled products and provide incentives for recycling of waste.	During the panel configuration and electric transmission line development, some solid, non-hazardous waste may generate. So, this policy is fit in this regard.
20.	Protection and Conservation of Fish Act 1950 (Amended 1982)	This is a framework legislation with rulemaking powers. Among others, some of these rules may prohibit the destruction of, or any attempt to destroy, fish by the poisoning of water or the depletion of fisheries by pollution, by industrial effluent, or otherwise.	The project requires proper action to prevent biodiversity in all-natural water bodies and the marine environment.
21.	Public Procurement Rule, 2008	This is the public procurement rules of Bangladesh and this rule shall apply to the Procurement of Goods, Works or Services by any government, semi-government or any statutory body established under any law. Conditions of service and employment including wages and payment, the establishment of Wages Boards, employment of young people, maternity benefits, working hours, and leave; (i) Safeguard the health and safety of all workers working on the Site and other persons entitled to be on it, and to keep the Site in an orderly state and (ii) Protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of the Contractors methods of operation.	Applies to the procurement of goods, works or services including measures regarding the safety, security and protection of the environment in construction works; requires contractors to take all reasonable steps to safeguard the health and safety of all workers on site, protect the environment on and off the site, and avoid damage or nuisance to persons or to property of the public or others.
22.	Renewable Energy Policy of Bangladesh, 2018	The objectives of the Renewable Energy Policy of Bangladesh include: to harness the potential of renewable energy resources and dissemination of renewable energy technologies in rural, peri-urban and urban areas; to enable, encourage and facilitate both public and private sector investment	This renewable energy project should meet up the demand as per the energy policy of 2018.

SI	Policy/Acts/Rules	Key provisions and purpose	Applicability to the Project
		in renewable energy projects; and to develop sustainable energy supplies to substitute indigenous non-renewable energy supplies.	
23.	Remote Area Power Supply Systems (RAPSS) Guideline of 2007	The Remote Area Power Supply Systems (RAPSS) guideline of 2007 allows for private sector participation in the development, operation, and maintenance of electricity generation systems and distribution networks in remote rural areas including isolated islands to supplement GoB efforts at achieving universal access by 2020. However, there has not been much progress in implementing the RAPSS schemes. GoB is in the process to establish the Sustainable and Renewable Energy Development Agency (SREDA) as an autonomous body to lead its efforts in promoting renewable energy and energy efficiency in the country.	The proposed project is in a remote area and a transmission line will carry the electricity to the industry.
24.	Solid Waste Management Regulations 2021	The Solid Waste Management Regulations 2021 were published in Bangladesh on December 23, 2021, under the Bangladesh Environmental Protection Act, 1995. The Regulations define the responsibilities of businesses involved in solid waste management and impose collection, recycling, and disposal obligations according to Extended Producer Responsibility (EPR) on manufacturers of non-biodegradable products such as glass, plastic, and bottles. The Regulations also include provisions for the treatment of solid waste such as composting and energy recover.	This project will produce a certain number of solid wastes. So, this policy is applicable
25.	The Private Forests Ordinance, 1959	An Ordinance to provide for the conservation of private forests and the afforestation in some wetlands in Bangladesh.	According to Section 61 of this Ordinance, any land is required for any of the purposes of this Ordinance; such land shall be deemed to be needed for a public purpose.
26.	The Embankment and Drainage Act, 1952	It provides provision for the construction, maintenance, management, removal, and control of embankments and watercourses for the better drainage of lands.	Disposal of dredged spoil may create drainage obstruction. So, adherence to the relevant section of the Act must be addressed in the environmental and social assessment.
27.	The Acquisition and Requisition of Immovable Property Act 2017 (ARIPA)	It is the principal legislation governing eminent domain land acquisition in Bangladesh. The Act requires that compensation be paid for: (i) land and assets permanently acquired (including standing crops, trees, houses); and (ii) any other damages caused by such acquisition. The Act also provides the acquisition	No land acquisition is applicable under this project. However, the project authority has leased 58.04 acres of land from the government and bought 39.99 acres of land through a win-win approach for both parties.

SI	Policy/Acts/Rules	Key provisions and purpose	Applicability to the Project
		of properties belonging to religious organizations like mosques, temples, pagodas, and graveyards if acquired for the public interest. The Ministry of Land (MoL) is the authorized government agency to undertake the process of land acquisition.	
28.	The Building Construction Act 1952 (with subsequent amendments)	An Act to provide for the prevention of haphazard construction of building and excavation of tanks which are likely to interfere with the planning of certain areas in Bangladesh.	Applicable as the project involves the development of infrastructure.
29.	Wetland Protection Act, 2000	The latest Wetland Act -- The Playground, Open Spaces, Gardens, and Wetland Conservation Act 2000 -- suffers from loopholes and inadequacies regarding the protection of water bodies. Section 1 of this Act suggests that it applies to the water bodies of the cities, divisional and district towns, and municipalities. The water bodies in the rural areas are outside the jurisdiction of this Act.	The Act specifies the fine and imprisonment term for violation of its provisions. It does not direct the government to recover the original characteristics of the water bodies if someone fills them up.

2.2 Relevant International Conventions, Treaties and Protocols

Bangladesh has signed most of the international treaties, conventions and protocols on environment, pollution control, bio-diversity conservation and climate change, including the Ramsar Convention, the Bonn Convention on migratory birds, the Rio de Janeiro Convention on biodiversity conservation and the Kyoto protocol on climate change. An overview of the relevant international treaties and conventions signed by GOB is shown in Table below:

Table 2.2: International Conventions, Treaties and Protocols Signed by Bangladesh

Conventions	Ratified/Accessed (AC)/Accepted (AT)/ Adaptation (AD)	Relevance
International Plant Protection Convention (Rome,) & Plant Protection Agreement for SE Asia and Pacific (1999 Revision)	01.09.1978 04.12.1974 (AC) (Entry into Force)	Assuring that no plant pests are introduced as a result of the Project's activities or building materials
Convention on Wetlands of International Importance ("Ramsar Convention":1971)	20.04.1992 (ratified)	During construction, a substantial wetland is protected, and draining or filling is avoided.
Convention Concerning the Protection of the World Cultural and natural Heritage (Paris, 1972)	03.08.1983 (AT) 03.11.1983 (ratified)	Damage or destruction of culturally and/or historically significant sites, monuments, and other structures is avoided.
Convention on Biological Diversity, (Rio de Janeiro, 1992.)	05.06.1992	Protection of biodiversity during construction and operation.
Convention on Persistent Organic Pollutants, Stockholm.	In process	Restrict use of different chemicals containing POPs.

Conventions	Ratified/Accessed (AC)/Accepted (AT)/ Adaptation (AD)	Relevance
United Nations Framework Convention on Climate Change, (New York, 1992.)	15.04.94	Reduction of emission of greenhouse gases.
Convention on Biological Diversity, (Rio De Janeiro, 1992.)	03.05.94	The preservation of biological variety, the long-term use of its components, and the fair and equitable distribution of the benefits derived from the exploitation of genetic resources are all priorities.
Kyoto protocol to the United Nations Framework Convention on Climate Change (UNFCCC)	21.8.2001 (AC) 11.12.1997 (AD)	Reduction of emission of greenhouse gases.
International Convention for Protection of Birds, (Paris, 1950)	Signed	Protection of the birds in their wild state.
Convention Concerning the Prevention and Control of Occupational Hazards caused by Carcinogenic Substances and Agents, (Geneva, 1974)	Signed	Workers must be protected from the dangers of workplace exposure to carcinogenic chemicals and agents.
Convention Concerning the Protection of Workers Against Occupational Hazards in the Working Environment due to Air Pollution, Noise and Vibration, (Geneva, 1977)	Signed	Protection of workers' health against occupational hazards in the working environment due to air pollution, noise and vibration.
Convention on the Conservation of Migratory Species of Wild Animals, (Bonn,1979)	Signed	Migratory animals and their habitats must be conserved and used sustainably.
Convention Concerning Occupational Safety and Health and the Working Environment, (Geneva, 1981)	Signed	Occupational health and safety is ensured for workers in all sectors of the economy.
Vienna Convention for the Protection of the Ozone Layer, (Vienna, 1985)	02.08.90 (AC) 31.10.90 (Entry into force)	Keeping human activities from having a negative impact on the ozone layer.
Convention Concerning Occupational Health Services, (Geneva, 1985)		Convention Concerning Occupational Health Services, Geneva.
Montreal Protocol on Substances that Deplete the Ozone Layer, (Montreal, 1987)	31.10.90 (Entry into force)	Reduce the quantity of compounds that deplete the ozone layer in the atmosphere, protecting the earth's delicate ozone layer.
Convention Concerning Safety in the Use of Chemicals at Work, (Geneva, 1990)	Signed	Chemical handling in the workplace must be regulated. I've issued an order to safeguard workers from the dangers of these chemicals.
London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, London.	18.03.94 (AC) 16.06.94 (entry into force)	To improve the control mechanism and expand the Montreal Protocol's scope to include additional chemicals.
Preparedness, Response and Cooperation (London, 1990.) 30.11.90 United Nations Framework Convention on Climate Change, (New York, 1992)	15.04.94	Getting greenhouse gas concentrations in the atmosphere to a point where they won't cause harmful anthropogenic influence with the climate system.
Convention on Biological Diversity, (Rio De Janeiro, 1992)	03.05.94	Conservation of biological diversity (or biodiversity) and sustainable use of its components.

Conventions	Ratified/Accessed (AC)/Accepted (AT)/ Adaptation (AD)	Relevance
International Convention to Combat Desertification, (Paris, 1994)	26.01.1996 (Ratification) 26.12.1996 (entry into force)	Combating desertification and mitigating the effects of drought.
Agenda 21, UNCED, (Rio de Janeiro, 1994)	Signed	Ensuring sustainable development.
Copenhagen Amendment to the Montreal protocol on Substances that Deplete the Ozone Layer, (Copenhagen, 1992)	27.11.2000 (AT) 26.2.2001 (Entry into force)	Extending the coverage of Montreal Protocol to new substances
Montreal Amendment of the Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal	27.7.2001 (Accepted) 26.10.2001 (Entry into force)	Controls on the import and export of new, recycled, and recovered ozone depleting compounds, as well as the use of licensing processes to govern the import and export of ozone depleting substances.
International convention on climate changes (Kyoto Protocol) 1997		International treaty on climate change and emission of greenhouse gases

2.3 Development Partner and IDCOL Policies

2.3.1 World Bank's Guidelines on Environmental and Social Safeguards Standards

The Environmental, Health and Safety (EHS) Guidelines of the World Bank Group (WBG) 2008 contain performance levels and measures that are considered to be achievable in new facilities at reasonable costs using existing technologies. The EHS guidelines have been organized into major four categories: (a) Environment, (b) Occupational Health & Safety, (c) Community Health & Safety, and (d) Construction & Decommissioning.

World Bank has 10 environmental & social safeguard policies which are given below:

ESS 1: Assessment and Management of Environmental and Social Risks and Impacts

ESS1 sets out the Borrower's responsibilities for assessing, managing and monitoring environmental and social risks and impacts associated with each stage of a project supported by the Bank through Investment Project Financing (IPF), in order to achieve environmental and social outcomes consistent with the Environmental and Social Standards

ESS 2: Labor and Working Conditions

ESS2 recognizes the importance of employment creation and income generation in the pursuit of poverty reduction and inclusive economic growth. Borrowers can promote sound worker-management relationships and enhance the development benefits of a project by treating workers in the project fairly and providing safe and healthy working conditions.

ESS 3: Resource Efficiency and Pollution Prevention and Management

Recognizes that economic activity and urbanization often generate pollution to air, water, and land, and consume finite resources that may threaten people, ecosystem services and the environment at the local, regional, and global levels.

ESS 4: Community Health and Safety

Addresses the health, safety, and security risks and impacts on project-affected communities and the corresponding responsibility of Borrowers to avoid or minimize such risks and impacts, with particular attention to people who, because of their particular circumstances, may be vulnerable.

ESS 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement

Involuntary resettlement should be avoided. Where involuntary resettlement is unavoidable, it will be minimized and appropriate measures to mitigate adverse impacts on displaced persons (and on host communities receiving displaced persons) will be carefully planned and implemented.

ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

ESS6 addresses the importance of protecting and conserving biodiversity and managing living natural resources. It also addresses the need to consider the livelihood of project-affected parties, including Indigenous Peoples.

ESS 7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities

The Environment Social and Social Responsibility (ESS7) is meant to ensure that the development process fosters full respect for the human rights, dignity, aspirations, identity, culture, and natural resource-based livelihoods of Indigenous Peoples. ESS7 is also meant to avoid adverse impacts of projects on Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities. It aims to minimize, mitigate and/or compensate for such impacts.

ESS 8: Cultural Heritage

Efforts to ensure that the development process fosters full respect for the human rights, dignity, aspirations, identity, culture, and natural resource-based livelihoods of Indigenous Peoples. ESS7 is also meant to avoid adverse impacts of projects on Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities.

ESS 9: Financial Intermediaries

International Financial Institutions (FIIs) are required to monitor and manage the environmental and social risks and impacts of their portfolio and subprojects. The way in which the FI will manage its portfolio will take various forms, depending on a number of factors, including capacity and scope of funding provided by the FI.

ESS 10: Stakeholder Engagement and Information Disclosure

Recognizes the importance of open and transparent engagement between the Borrower and project stakeholders as an essential element of good international practice. Effective stakeholder engagement can improve the environmental and social sustainability of projects, enhance project acceptance, and make a significant contribution to successful project design and implementation.

2.3.2 AIIB's Environmental and Social Framework

AIIB's Environmental and Social Framework along with other elements comprises of Environmental and Social Policy (ESP). The ESP comprises mandatory environmental and social requirements for each Project and is accompanied by:

(a) Three associated mandatory Environmental and Social Standards (ESSs) setting out requirements applicable to Bank Clients on, respectively, Environmental and Social Assessment and Management; Land Acquisition and Involuntary Resettlement; and Indigenous Peoples; and

(b) An Environmental and Social Exclusion List

Environmental and Social Standard 1: Environmental and Social Assessment and Management

Objectives of ESS 1 are to achieve the environmental and social soundness and sustainability of Projects and to support the integration of environmental and social considerations into the Project decision-making process and implementation.

Environmental and Social Standard 2: Land Acquisition and Involuntary Resettlement

This Environmental and Social Standard (ESS) 2 addresses impacts of Project-related land acquisition, including restrictions on land use and access to assets and natural resources, which may cause physical displacement (relocation, loss of land or shelter), and/or economic displacement (loss of land or assets, or restrictions on land use, assets and natural resources leading to loss of income sources or other means of livelihood).

Environmental and Social Standard 3: Indigenous Peoples

The objectives of this Environmental and Social Standard (ESS) 3 are to design and implement Projects in a way that fosters full respect for Indigenous Peoples' identity, dignity, human rights, economies and cultures, as defined by the Indigenous Peoples themselves, so that they: (a) receive culturally appropriate social and economic benefits;(b) do not suffer adverse impacts as a result of Projects; and (c) can participate actively in Projects that affect them.

The objectives of Environmental and Social Framework are to:

- Reflect institutional aims to address environmental and social risks and impacts in Projects.
- Provide a robust structure for managing operational and reputational risks of the Bank and its shareholders in relation to Projects' environmental and social risks and impacts.
- Support the environmental and social soundness and sustainability of Projects.

- Facilitate the integration of environmental and social aspects of Projects into the decision-making process by all parties.
- Provide a mechanism for addressing environmental and social risks and impacts in Project identification, preparation and implementation.
- Enable Clients (defined below in Section II, Definitions, of the ESP) to identify and manage environmental and social risks and impacts of Projects, including those of climate change.
- Provide a framework for public consultation and disclosure of environmental and social information in relation to Projects.
- Provide a grievance redress mechanism designed to enable Project-affected people to voice their concerns and grievances in connection with the environmental and social aspects of Projects.
- Improve development effectiveness and impact to increase results on the ground, in both the short and long term.
- Support Clients, through Bank financing of Projects, to strengthen their environmental and social management systems.
- Support Clients, through Bank financing of Projects, to implement their obligations under national environmental and social legislation (including under international agreements adopted by the Member) governing these Projects, including commitments relating to climate change.
- Support Clients, where feasible and appropriate, to mobilize resources for technical assistance for the preparation of environmental and social documents and capacity enhancement.
- Facilitate cooperation on environmental and social matters with development partners

Each proposed project is classified into one of the four categories (A, B, C and FI) for determining the type of assessment and instrument required.

2.3.3 Environmental and Social Safeguards Framework (ESSF)/ Environmental and Social Management System (ESMS) of IDCOL

IDCOL has an updated Environmental and Social Safeguards Framework (ESSF), which triggers ESMS for its solar rooftop and solar grid-tied projects, IDCOL has long and praiseworthy history of energy-based development financing. The Environmental and Social Management System (ESMS) is the system developed by IDCOL as an attempt to ensure continuity of its social and environmental commitments in the designing and implementation of its projects and programs. The ESMS focuses on rooftop and grid-tied solar projects in line with the environmental and social risks associated with those projects.

2.4 Applicable Legislation

2.4.1 National Legislation

2.4.1.1 Bangladesh Environmental Conservation Act (ECA) 1995, as amended in 2010

The ECA is currently the main legislation relating to environment protection in Bangladesh. This Act is promulgated for environment conservation, environmental standards development and environment pollution control and abatement.

The main objectives of ECA are:

- Conservation and improvement of the environment; and
- Control and mitigation of pollution of the environment.

The main focuses of the Act can be summarized as:

- Declaration of ecologically critical areas and restriction on the operations and processes, which can or cannot be carried out/ initiated in the ecologically critical areas (ECA);
- Regulations in respect of vehicles emitting smoke harmful for the environment;
- Environmental clearance;
- Regulation of industries and other development activities' discharge permits;
- Promulgation of standards for quality of air, water, noise, and soil for different areas for different purposes;
- Promulgation of a standard limit for discharging and emitting waste; and
- Formulation and declaration of environmental guidelines.

Before any new project can go ahead, as stipulated under the ECA, the project promoter must obtain Environmental Clearance from the Director General (DG) of DoE. An appeal procedure does exist for those promoters who fail to obtain clearance. Failure to comply with any part of this Act may result in punishment to a maximum of 5 years imprisonment or a maximum fine of Tk.100, 000 or both. The DoE executes the Act under the leadership of the DG.

The Project will be undertaken in line with the aims and objectives of the Act by conserving the environment and controlling and mitigating potential impacts throughout the drilling program.

Environment Conservation Act (Amendment 2000)

The Bangladesh Environment Conservation Act Amendment 2000 focuses on ascertaining responsibility for compensation in cases of damage to ecosystems, increased provision of punitive measures both for fines and imprisonment and the authority to take cognizance of offences.

Environment Conservation Act (Amendment 2002)

The 2002 Amendment of the ECA elaborates on the following parts of the Act:

- Restrictions on polluting automobiles;

- Restrictions on the sale, production of environmentally harmful items like polythene bags;
- Assistance from law enforcement agencies for environmental actions;
- Break up of punitive measures; and
- Authority to try environmental cases.

Environment Conservation Act (Amendment 2010)

This amendment of the act introduces new rules and restriction on:

- No individual or institution (Gov. or Semi Gov, / Non-Gov. / Self Governing) can cut any Hill and Hillock. In case of national interest; it can be done after getting clearance from respective the department
- Owner of the ship breaking yard will be bound to ensure proper management of their hazardous wastes to prevent environmental pollution and Health Risk
- No remarked water body cannot be filled up/changed; in case of national interest; it can be done after getting clearance from the respective department; and
- Emitter of any activities/incident will be bound to control emission of environmental pollutants that exceeds the existing emission standards.

2.4.1.2 Bangladesh Environmental Conservation Rules, 1997

The Environment Conservation Rules, 1997 were issued by the Government of Bangladesh in the exercise of the power conferred under the Environment Conservation Act (Section20), 1995. Under these Rules, the following aspects, among others, are covered:

- Declaration of ecologically critical areas;
- Classification of industries and projects into four categories;
- Procedures for issuing the Environmental Clearance Certificate;

Rule 3 defines the factors to be considered in declaring an area ‘ecologically critical area’ (ECA) as per Section 5 of ECA’95. It empowers the Government to declare an area ‘ECA’ if it is satisfied that the ecosystem of the area has reached or is threatened to reach a critical state or condition due to environmental degradation. The Government is also empowered to specify which of the operations or processes shall be carried out or shall not be initiated in the ecologically critical area. Under this mandate, MoEFCC has declared Sundarbans, Cox’s Bazar-Teknaf Sea Shore, Saint Martin Island, Sonadia Island, Hakaluki Haor, Tanguar Haor, Marzat Baor, and Gulshan-Baridhara Lake as ecologically critical areas and prohibited certain activities in those areas.

ECR’97 (Rule 7) classifies industrial units and projects into four categories depending on environmental impact and location for issuance of ECC. These categories are:

- Green
- Orange A
- Orange B, and
- Red

All existing industrial units and projects and proposed industrial units and projects, that are considered to be low polluting are categorized under "Green" and shall be granted

Environmental Clearance. For proposed industrial units and projects falling in the Orange-A, Orange-B, and Red Categories, firstly a site clearance certificate and thereafter an environmental clearance certificate will be issued. A detailed description of those four categories of industries has been given in Schedule-1 of ECR'97.

Department of Environment (DoE), under the Ministry of Environment. Forest and Climate Change (MoEFCC) is the regulatory body responsible for enforcing the ECA'95 and ECR'97. It is the responsibility of the proponent to conduct an Environmental Assessment (EA) of a development proposal and the responsibility to review ESIA to issue an Environmental Clearance Certificate (ECC) from the DOE. According to the Gazette on 24th, December 2017 under Environment Division-3 of Ministry of Environment, Forest and Climate change, Government of the Peoples Republic of Bangladesh, the project is considered as the "Orange B category".

2.4.2 Other Relevant National Policies, Act, Rules, Laws & Ordinances

A considerable number of national policy documents have been prepared during recent years and these have been accepted by the GoB. These policy initiatives, strategies, and plans all emphasize consideration of the environment and natural resources to achieve sustainable development.

Table 2.3 presents an outline of the other national legal instrument that will have relevance to the project concerning the social and environmental considerations. The ESIA is prepared in compliance with these national policies.

Table 2.3: Other Relevant National Act, Rules, Laws, and Ordinances

Act/Rule/Law/Ordinance	Responsible Agency-Ministry/Authority	Key Features-Potential Applicability
The Brick Burning (Control) Act, 1989 The Brick Burning (Control) Amendment Act, 1992 and 2001	Ministry of Environment and Forest	▪ Control of brick burning; ▪ Requires a license from the MOEF for operation; ▪ Restricts brick burning with fuelwood.
Water Supply and Sanitation Act, 1996	Ministry of Local Government, Rural Development and Cooperatives	Management and control of water supply and sanitation in urban areas.
Bangladesh Wildlife Preservation Order 1973 and Revision 2008 (Draft)	Ministry of Environment and Forests (MOEF)	Restricts people from damaging or destroying vegetation in wildlife sanctuaries and hunting and capturing wild animals
Bangladesh Climate Change Strategy and Action Plan (2008)	MOEF Ministry of Environment and forest	Establishment of six strategic pillars for action, including: 1. food security, social protection, and health 2. disaster management 3. protective infrastructure 4. research and knowledge management,

Act/Rule/Law/Ordinance	Responsible Agency-Ministry/Authority	Key Features-Potential Applicability
		5. decreased carbon development, and capacity building and institutional strengthening.
Vehicle Act 1927 and Motor vehicle ordinance 1983	Bangladesh Road Transport Authority (BRTA)	▪ Road/traffic safety; ▪ Vehicular air and noise pollutions; and ▪ Fitness of vehicles and registration.

2.4.3 Gap Analysis

The GoB legislations and ESF, 2018 of World Bank are compared and gaps if any are summarized in the Table-2.4 below.

Table 2.4: Gap Analysis among World Bank's ESS and National Regulations

Sl No	ESS	Equivalent National Environmental Policy and	Policy Gaps and its redressal
1	ESS-1 Assessment and Management of Environmental and Social Risks and Impacts	Environmental Impact Assessment (EIA) ECA 1995 (amendment in 2000, 2002 & 2010 and Environmental Conservation	The ESS 1 requires EA for the project irrespective of its type. While, IEE is required as per ECA 95.
2	ESS-2 Labor and Working Conditions	• Bangladesh Labor Act, 2006 (amended in 2013, 2015 and 2018)	The National legal provisions almost cover all requirements in ESS2 except relating to community workers and a functional GRM for different types of workers. Hence, under this project, a Project's Labor management plan will be prepared to regulate working conditions and management of worker relations including workers specific GRM, terms and conditions of employment, non-discriminations and equal opportunity, protection of work force, prohibition.
3	ESS-3 Resource Efficiency and Pollution Prevention and Management	• Environmental Conservation Act (ECA) 1995 • Noise Pollution Rules (2006)	The majority of ESS3 requirements are addressed by existing regulations and indirectly for resource efficiency and climate change aspects. There is no laws and policy regarding Resource Efficiency.
4	ESS-4 Community Health and Safety	• Noise Pollution Rules (2006) • Environmental Conservation Rule 1997	While other acts cover for all of ESS 4 requirements, gaps exist for Community-community exposure to health issues. The gaps are addressed through suitable provisions in ESMP and contractor obligation as part of C-ESMP for Community health and safety include need for OHS plan, Influx management Plan,

Sl No	ESS	Equivalent National Environmental Policy and	Policy Gaps and its redressal
			Worker's camp management plan, Traffic and road safety management Plan, etc.
5	ESS-5 Land Acquisition Restrictions on Land Use and Involuntary Resettlement	The Land Acquisition/ Requisition of Immovable Property Ordinance, 1982 Act	No land acquisition is required. The project will not cause any physical and economic displacement. No gap is addressed.
6	ESS-6 Biodiversity Conservation and Sustainable Management of Living Natural Resources	Bangladesh Biodiversity Act, 2017	Protection of local biodiversity, endangered species, vulnerable species and avoid any kind of trapping, killing or nest destruction
7	ESS-7 Indigenous Peoples	Not relevant	
8	ESS-8 Cultural Heritage	Not relevant	
9	ESS-9 Financial Intermediaries	No significant adverse impact is anticipated during the project activity.	
10	ESS-10 Stakeholder Engagement and Information Disclosure	• Environmental Conservation Act 1995 • Noise Pollution (2006) • Right to information 2005	The Project will prepare a Stakeholder Engagement Plan (SEP) to engage with all stakeholders relevant to the different components of the project.

In the case of WB ESS and AIIB's ESS no major gaps are found. It is described in the table below,

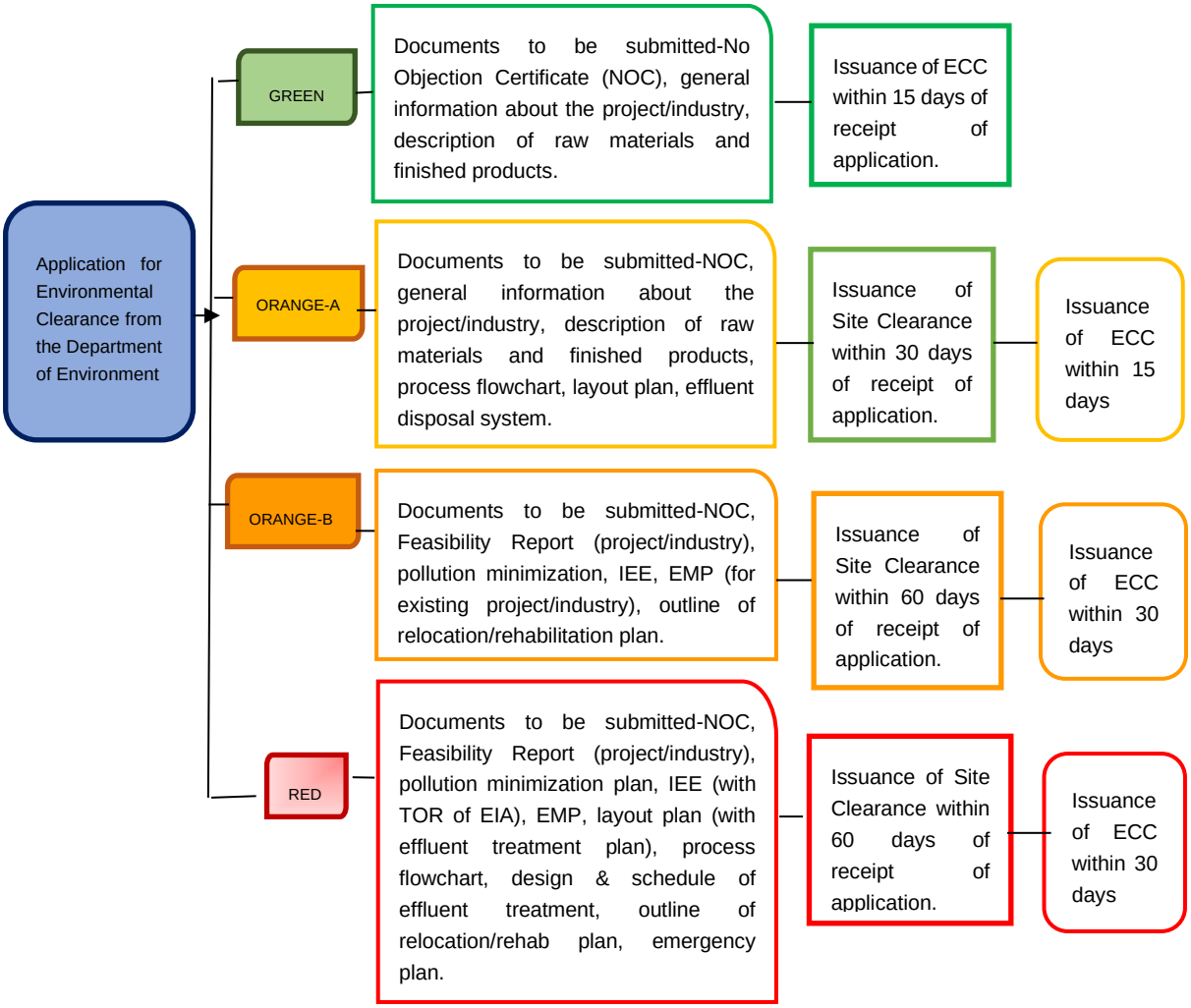
Table 2.5: Gap Analysis among World Bank's ESS and AIIB's ESS

AIIB ESS	WB ESS	Remarks
Environmental and Social Standard 1: Environmental and Social Assessment and Management	ESS-1 Assessment and Management of Environmental and Social Risks and Impacts ESS-2 Labor and Working Conditions ESS-3 Resource Efficiency and Pollution Prevention and Management ESS-4 Community Health and Safety ESS-5 Land Acquisition Restrictions on Land Use and Involuntary Resettlement ESS-6 Biodiversity Conservation and Sustainable Management of Living Natural Resources ESS-7 Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities ESS-8 Cultural Heritage ESS-9 Financial Intermediaries ESS-10 Stakeholder Engagement and Information Disclosure	AIIB's ESS 1 is covered under WB ESS 1-10.
Environmental and Social Standard 2: Land Acquisition and Involuntary Resettlement		AIIB's ESS 2 is covered under WB ESS 5/ OP 4.12. Please Check SLA report.
Environmental and Social Standard 3: Indigenous Peoples		AIIB's ESS 2 is covered under WB ESS 7. No indigenous people live in the project area.

2.4.4 Environmental Clearance

This project is considered as Orange B category as per DoE guidelines of Bangladesh. According to the guideline, this project needs Site clearance before starting of any project activity which should be proceeded by an Initial Environmental Examination (IEE) and EMP.

The project authority already submitted IEE to local DoE and collected Site clearance Certificate along with obtained Environmental Clearance Certificate (ECC) for this project according to the DoE guideline. The received ECC has been given in the Annex.



Source: A Guide to Environmental Clearance Procedure
http://doe.portal.gov.bd/sites/default/files/files/doe.portal.gov.bd/page/71a829c3_6b74_4ee9_90a6_158e2898b228/Environmental%20Clearance%20Procedure.pdf

Figure 2.1: Flow diagram for site clearance as well as environmental clearance

However, the following ESIA document is a decision-making tool prepared for the donor agency. This document will be used by project authority and donor agency for making decisions when any issue raised.

3 DESCRIPTION OF THE PROPOSED PROJECT

3.1 The Proponent

Intraco Group as a whole is to build a prominent local and global presence for all its business concerns. They can achieve this through improved integration between all business entities and a strong focus on building global partnerships. Intraco Group values its society, customers, and employees highly and understands that innovation is the key to the future. Intraco Group believes in innovating its business practices and using the latest in technology to increase efficiency and productivity. Intraco Group aims to build an enterprise that facilitates growth for all customers and employees and all countrymen in general.

The country's Power Development Board had signed a construction agreement with Intraco, as well as a PPA to procure power generated at the plant for 20 years at the rate of $0.16/kWh. The project is being financed by the Dhaka based Infrastructure Development Company, as well as local banks.

The proposed project involves setting up of a 30 MW AC coupled solar photovoltaic based grid by Intraco Solar Power Ltd. at Bhotmari, kaligonj, Lalmonirhat district. The proposed system will include 30MW on-grid solar PV panels that will be distributed through a transmission line.

Some of the site photographs are provided in the below figures:



Figure 3.1: Site Photographs taken by survey Team

3.2 Project Description.

3.2.1 Background

Expansion of rural electrification is the key to the development of rural areas of the country. The Government of Bangladesh has a goal of generating 40 per cent electricity from renewable and clean sources by 2041. However, supply of electricity at subsidized prices with depleting fossil fuel is becoming an ongoing challenge for the government. Only 62% of the population (including renewable energy) has access to electricity most of which are living in urban areas. Given the dispersed nature of rural settlements, grid expansion into those areas is difficult and expensive. Therefore, ensuring electricity through stand-alone renewable energy-based options is being explored. The proposed Project involves setting up of a 30MW AC coupled solar photovoltaic based grid by Intraco Solar Power Ltd. at Bhotemari, Kaliganj, Lalmonirhat district. The proposed system will include 30 MW on-grid solar PV panels.

The items and manufacturer details are provided in the below table:

Table 3.1: Items and Manufacturer details of the Services of the plant

Sl	Service and Items	Manufacturer
01	power plant Installation and supervision	Solar land Engineering & Development Co., Ltd
02	Equipment Suppliers and Technical Consultant	Antai Technology Co., Ltd
03	Equipment Manufacturers	China, Malaysia & Germany

All the above mentioned service and item manufacturers maintain work ethics such as prohibition of child labor and forced labor.

The Major Items for the project are as follows:

Table 3.2: List of major items used for the solar project

Sl	Items	Description
01	Major equipment and accessories	• Transformer, • LT • PFI • Switchgear Panel and • Solar Panel with Inverter

The project budget is about 567,00,00,000 BDT. As per the ISPL, the solar power will be distributed around seven kilometers of the plant area and supply electricity to the adjacent households, shops, social entities including schools, mosques, madrasas, offices, government and non-government institutions etc., rice mills, husking mills, irrigation pumps and other purpose as necessary.

3.2.2 Project Location

The project site is located under Bhotemari union of Kaliganj upazila under Lalmonirhat district of Rangpur Division. The site is located beside the Teesta River and lies about 38.75 km to the west of Kaliganj upazila with a geographic coordinate of Latitude 25°07'48.0"N

and Longitude 89°13'12.0"E. The project location is almost 345 km away from the capital city of Dhaka and local vehicles need to be used after reaching Bhotemari Union to reach to the project site.

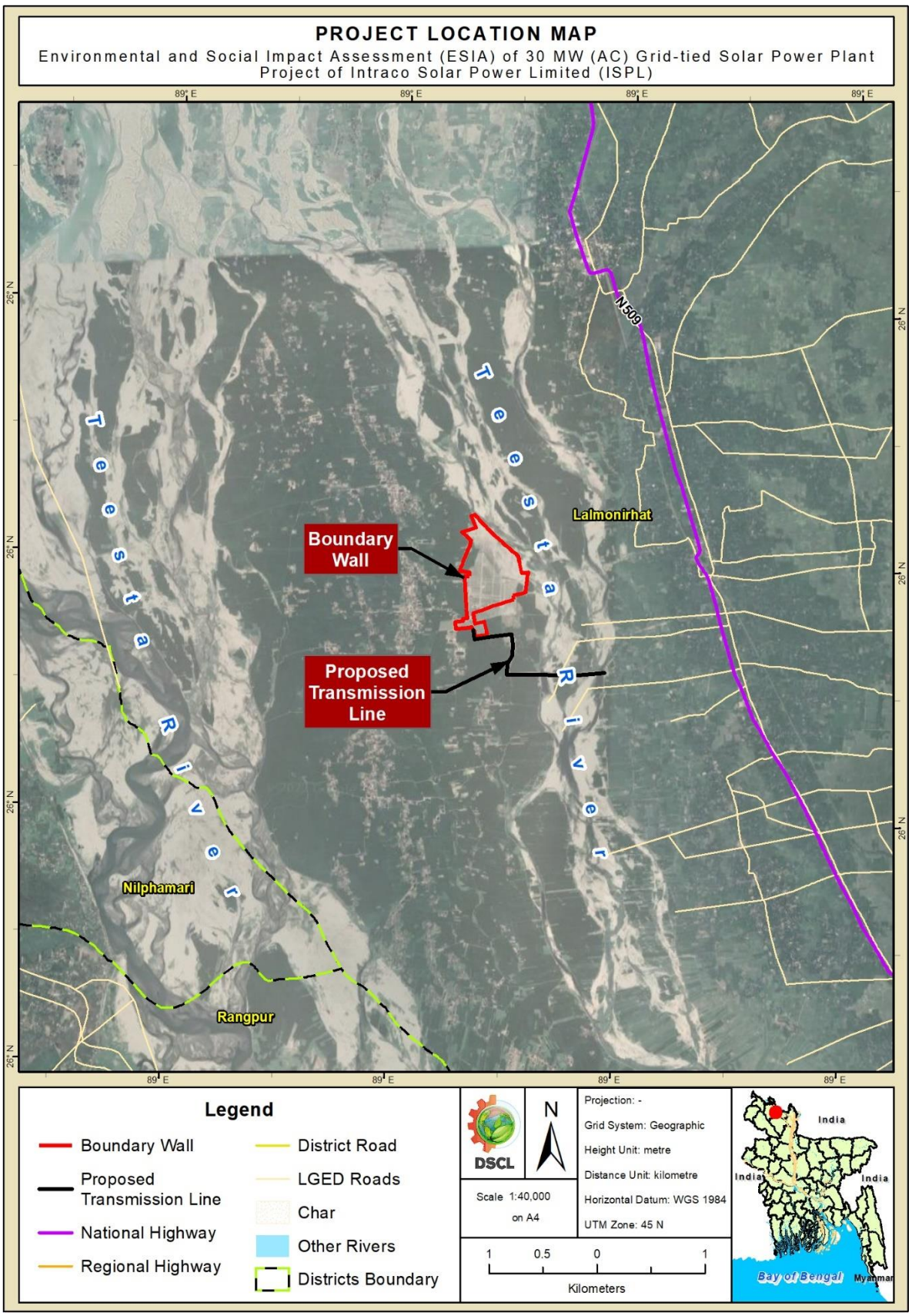


Figure 3.2: Project Location Map

The satellite view of the project location is shown below:

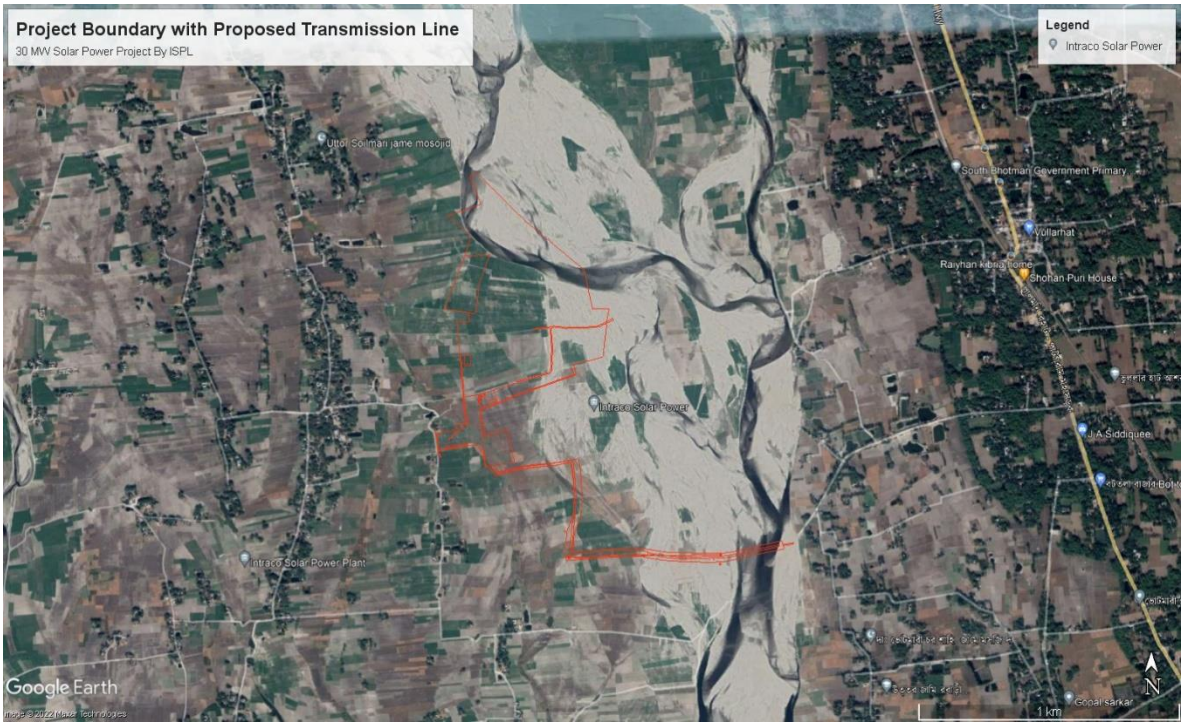


Figure 3.3: Satellite View of the Project Location

The nearest grid from the project area is about 90.3 kilometer away in project. Because of its geographical position, ensuring grid electricity services on the island in the near future seems to be challenging and expensive. Currently, the electricity demand of the area is met by solar home systems, diesel and kerosene lamps. The Global Positioning System (GPS) coordinator of the project site 25°07'48.0"N 89°13'12.0"E, Intraco Solar Power Ltd. Project authority has leased 58.04 acres of land from the government and bought 39.99 acres of land.

The proposed area Bhotemari union, Kaliganj upazila, Lalmonirhat district, Rangpur. Because of its geographical position, ensuring grid electricity services on the island in the near future seems to be challenging and expensive. Currently, the electricity demand of the area is met by solar home systems, diesel and kerosene lamps.

3.3 Land Filling Activities

Environmental survey and assessment team visited the project site in September 2022 to physically verify the suitability of project location for implementation. According to local people, flood occurs irregularly there because of higher elevation and they only experienced flood during most devastating flood in Bangladesh such as, flood in the year of 1998, 2004. During consultation meeting with the local people, it was found that the Bhotemari union was established more than 50 years ago. Total land coverage of the project site is 98.03 acres. The selected land for implementing the Project is elevated compared to the surroundings of project area. The soil filling material will be collected from the nearby private land which is given for a pond. There was a mutual understanding with the private land owner and developer using this land for extraction of soil. No objection was found during field visit time. No anticipated impact was found. The developer will use

dredging machine for extracted soil for land filling of the project site. The extracted soil materials will be deposited in the project site through a long pipe. For land filling of the project site, there will be some anticipated impacts on vegetation and agricultural practices. According to the local people and field visit, Rice production was observed beside the land. The land was mainly used for agricultural practices. But no significant anticipated impact will occur for this activity.

3.4 Details of Transmission and Distribution Line

The details transmission line and distribution line are given in Table 3.3.

Table 3.3: Details of Transmission Line Diagram

Description of Task / Activity	QTY	UNIT
4mm^2,1500V, DC Cable (Copper Cable)	350000	Meter
3CX120mm^2, 1500V, AC, XLPE LV CABLE (Copper Cable)	23000	Meter
1CX300mm^2, 1500V, AC, XLPE LV CABLE (Copper Cable)	4000	Meter
1CX300mm^2, 36KV, AC, XLPE CABLE (Copper Cable)	19000	Meter
1CX630mm^2, 36KV, AC, XLPE CABLE (Copper Cable)	3000	Meter
OPGW (Fiber Optic)-24F	9000	Meter
Optical Fiber for Communication (PPC/SCADA)	15000	Meter

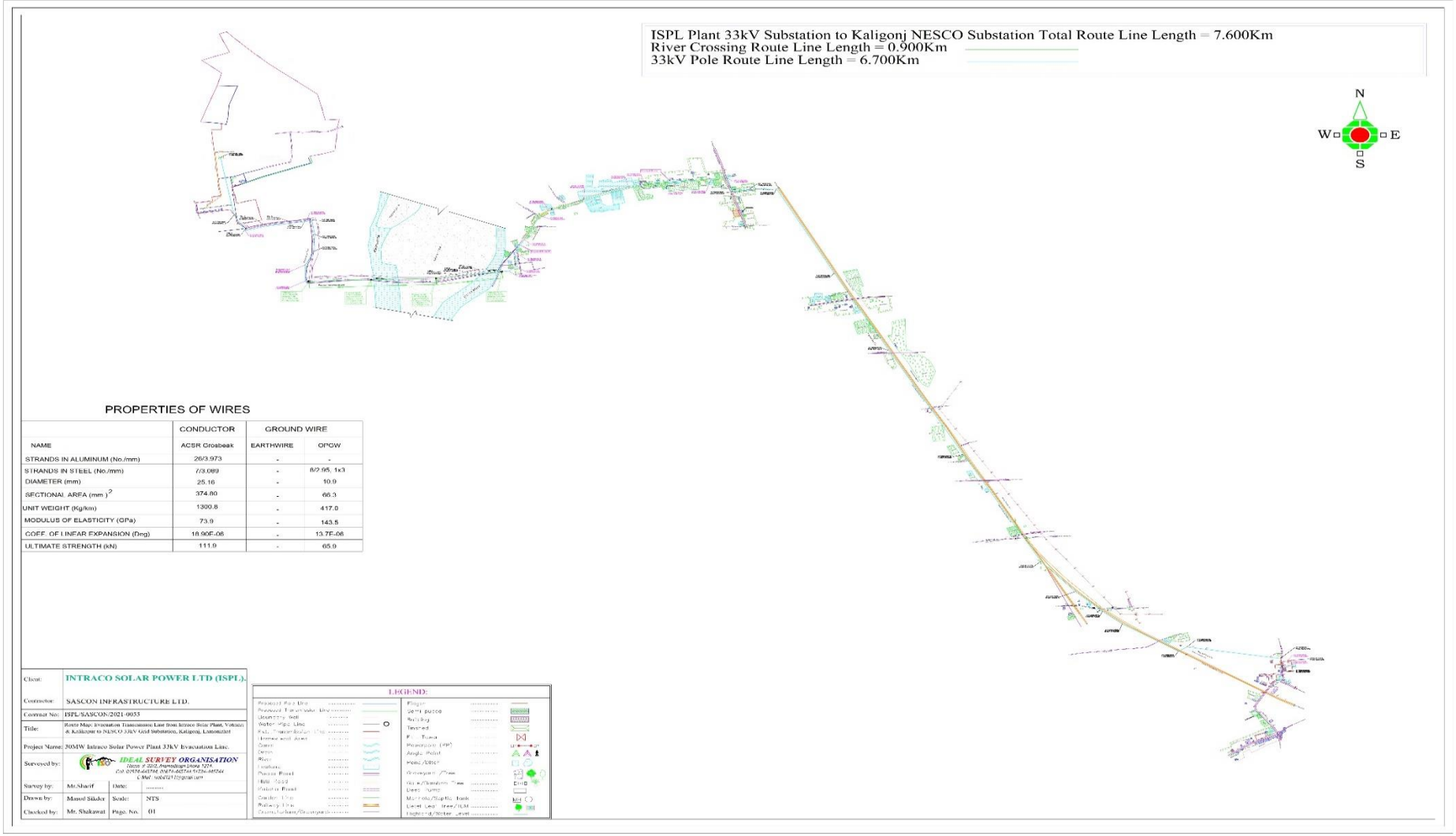


Figure 3.4: Proposed Transmission Line Drawing

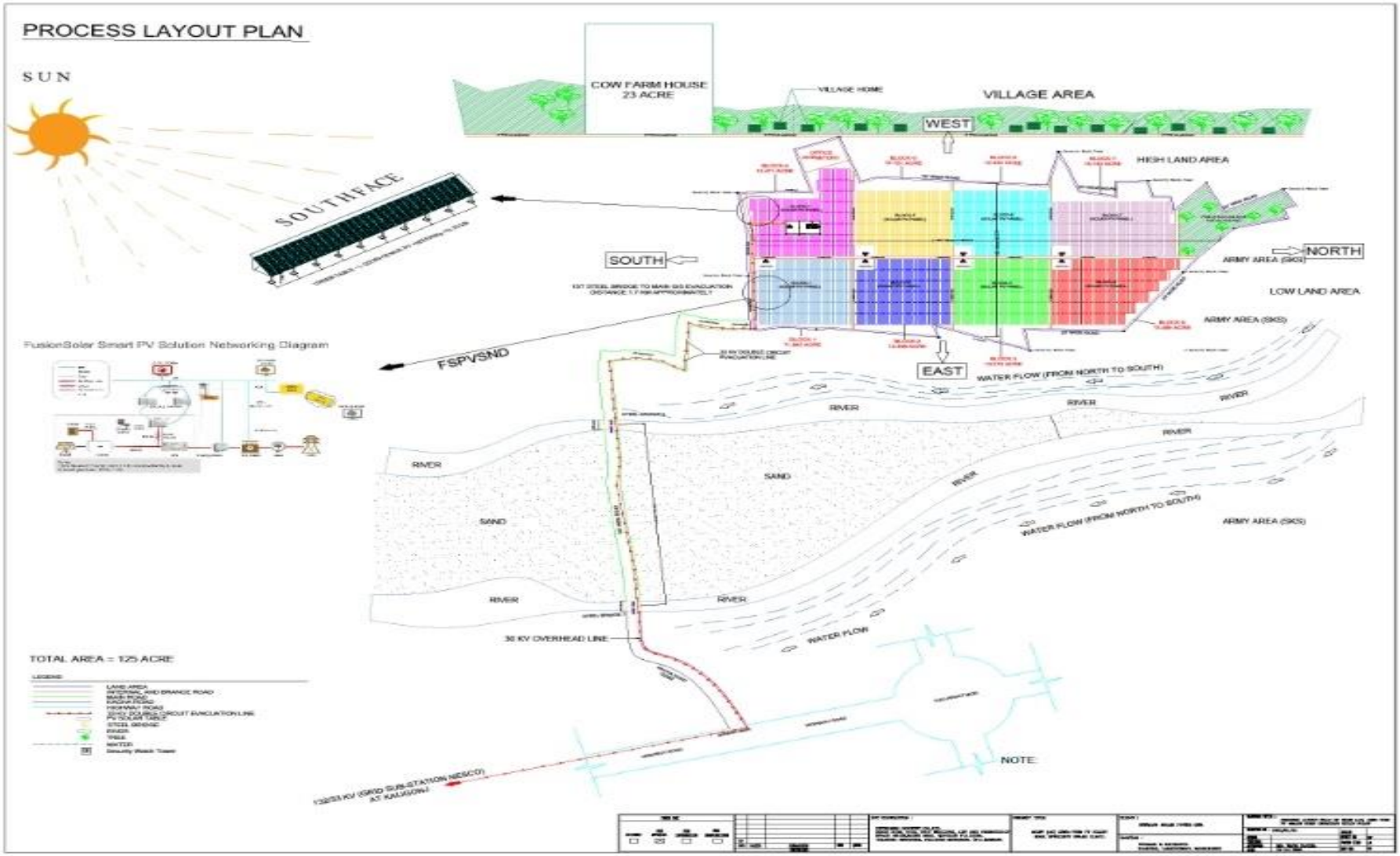


Figure 3.5: Process Layout diagram of Intraco Solar Power Ltd

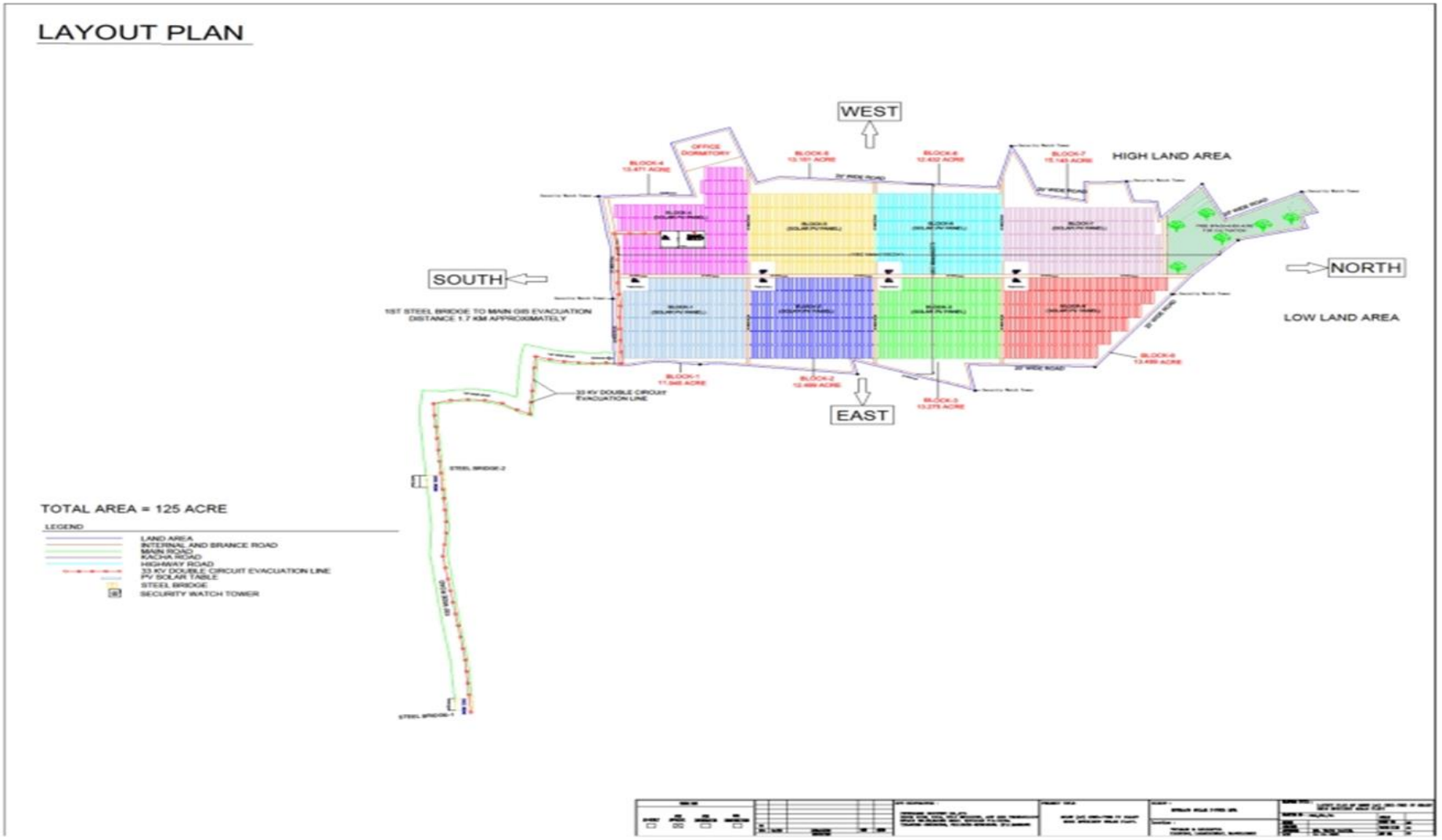


Figure 3.6: Project Layout Diagram

Table 3.4: Details of Task Activity

A) Foreign Portion:			
Sl No.	**Name of Machine**	**Quantity**	
1	**SOLAR PANELS**		
	SOLAR PV PANELS (535Wp) Bifacial Solar Module	44,254	Pcs.
	SOLAR PV PANELS (540Wp) Bifacial Solar Module	44,254	Pcs.
	Spare Solar Module (535Wp)	300	Pcs.
	Spare Solar Module (540Wp)	300	Pcs.
2	**MODULE MOUNTING STRUCTURE**		
	SOLAR PANEL SUPPORT FOR STEEL STRUCTURE	1526	Table
3	**INVERTER**		
	On grid Solar Inverter (200kW), Model-SUN2000-215KTL-H0	218	Nos.
	Spare Inverter (200kW)	14	Nos.
	Smart Communication Units (SmartACU2000D)	10	Nos.
	Management system	1	Nos.
4	**POWER TRANSFORMER**		
	6500 KVA, 33/0.8-0.8kV, Dy11y11, INVERTER DUTY SMART TRANSFORMER	9	Lot
	630KVA, 33KV/415V, Dyn11, DRY TYPE Transformer for auxiliary loads	1	Lot
	200KVA, 33KV/415V, Earthing Transformer	2	Lot
5	**Sub Station Switchgear (33KV/800/415V) CONTROL SYSTEM**		
	33kV Switchgear Panels (Outdoor AIS) at Plant End	1	Lot
	33kV Switchgear Panels (Outdoor AIS) at Grid End	1	Lot
	33kV Control Panels (GIS) For Kaligonj End	17	Lots
	33kV Control Panels (GIS) For ISPL Sub station End	10	Lots
	33kV Ring main Unit (RMU)	2	Lots
	NGR PANELS	18	Lots
	800V LV SWITCHGEAR PANELS FOR 8 BLOCK SUB STATION	1	Lot
	LV (450V) Switchgear Panels with PFI Plant for Auxiliary Loads	1	Lot
	AC/DC Panels for 33kV Control Panels	1	Lot
	BATTERY & BATTERY CHARGER		
6	**CABLES**	1	Lot
	4mm^2,1500V, DC Cable (Copper Cable)	1	Lot
	3CX120mm^2, 1500V, AC, XLPE LV CABLE (Copper Cable)	1	Lot
	1CX300mm2, 1500V, AC, XLPE LV CABLE (Copper Cable)	1	Lot
	1CX300mm^2, 36KV, AC, XLPE CABLE (Copper Cable)	1	Lot
	1CX630mm^2, 36KV, AC, XLPE CABLE (Copper Cable)	1	Lot
	OPGW (Fiber Optic)-24F	1	Lot
	Optical Fiber for Communication (PPC/SCADA)	1	Lot
	ACSR for 36KV Over Head Grosbeak AWG or MCM (636/322.26 mm^2)	1	Lot
	MC Connector for 4mm2 DC Cable (+ Male)	1	Lot
	MC Connector for 4mm2 DC Cable (+ Female)		
7	**SCADA & PPC**	1	Lot
	Solar Power Plant SCADA System	1	Lot
	Power Plant Control System (PPC)	1	Lot
	Grid Substation SCADA System For Two Bays	1	Lot
	AC and DC system	1	Lot
	BATTERY & BATTERY CHARGER	1	Lot
	Power Quality Monitoring Panel	1	Lot
	Site Commissioning Supervision	1	Lot

8	CONTROL MONITORING & WEATHER PROTECTION	1	
	Meteorological Stations (TWS-4B) With all accessories	1	Lot
9	Design & Engineering, Project & Construction Management, Testing, Commissioning by Foreign Contractors	1	Lot

B) Local Portion:			
Sl No.	**Name of Machine**	**Quantity**	
1	SPC Pile (300mm dia), Length 8 Meter Each	1	Lot
2	Materials for Building Contructions	1	Lot
3	Plant Earting & Lighting Protections	1	Lot
4	CIVIL WORK	1	Lot
5	33 KV Double Circuit Transmission Line as per BPDB/NESCO Guideline & Specifications	1	Lot
6	Revenue Meter (Panel with Metering System) as per BPDB Guideline & Specifications	1	Lot
7	Fire Protection system	1	Lot
8	Fire Detection system	1	Lot
9	CCTV	1	Lot
10	Black Starter Generator (500kVA), 415V, 50Hz.	1	Lot
11	Cable Tray (Turnkey)	1	Lot
12	Air Conditioner (AC) FOR EACH SUB STATION & OFFICE	1	Lot
13	FORK LIFTS	1	Lot
14	PILEING MACHINE	1	Lot
15	PV Panel Cleaning machine	1	Lot
16	Vehicle for Plant monitoring	1	Lot
17	Watch Tower	1	Lot
18	Street Lighting	1	Lot
19	Project & Construction Management, Installations, Testing & Commissioning of above items by Local Contractors	1	Lot
C) INSTALLATIONS, TESTING & COMMISSIONING			
1	Installations, Testing & Commissioning of PV Module panels	1	Job
2	Installations, Testing & Commissioning of Inverters	1	Job
3	Installations, Testing & Commissioning of 33kv panels	1	Job
4	Installations, Testing & Commissioning of LV Panels	1	Job
5	Installations, Testing & Commissioning of Transformers	1	Job
6	Installations, Testing & Commissioning of Cables	1	Job
7	Installations, Testing & Commissioning of all Monitoring System	1	Job
8	Installations, Testing & Commissioning of other Auxliary works	1	Job
D) CIVIL WORK			
1	Civil Work for Panel Stand	1	Lot
2	Civil Work for Sub-station	1	Lot
3	Civil Work for Control Room	1	Lot
4	Civil Work for Road Upgrading	1	Lot
5	Civil Work for Weather Station	1	Lot
6	Civil Work for Office & Accomodations	1	Lot
7	Boundaries	1	Lot

3.5 Technological Aspects

3.5.1 Solar Grid

A grid is a scale electricity network fed by solar energy. The generated electricity is supplied directly or indirectly to clients who are connected to this grid electricity network. A group of people, who live close to each other, in for instance a village, can be easily connected to the grid.

The advantage of a solar grid is that it can meet higher energy demands by for instance local businesses. A solar grid boosts business activities in rural areas but can only be realized economically if the distance between clients is relatively small.

3.5.2 Working principle of solar Grid

Solar panels capture sunlight, which is converted to electricity. The electricity then goes to an inverter that converts direct current into alternating current, which is then fed directly or indirectly into the electricity network. The electricity reaches all customers connected to the network. A diesel generator is used as a backup for the solar power plant. The generator will feed the network during low energy production times

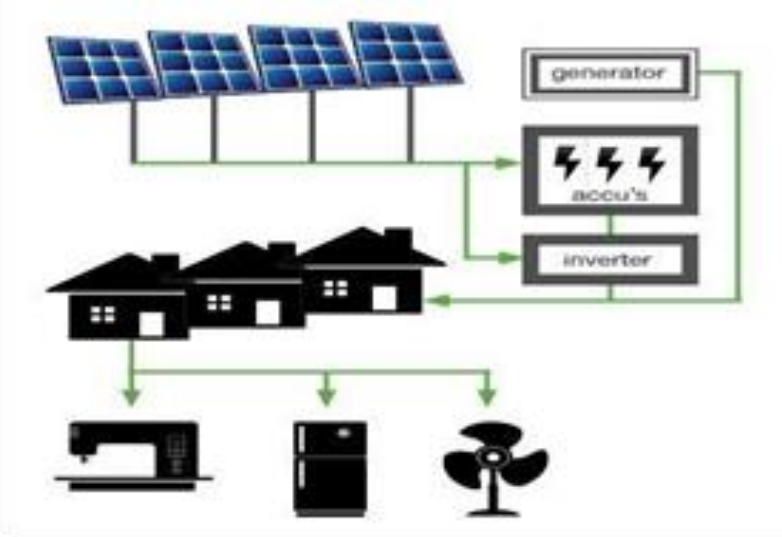


Figure 3.7: Working of a Solar Grid

When the solar energy production is insufficient. To allow the grid of the electricity network to be recharged, customers will not have access to the network for a period of time.

3.5.3 Advantage of Grid

- Provides a higher power level
- Little maintenance
- No emission of pollutants
- No dependence on the import of diesel and fluctuating energy prices

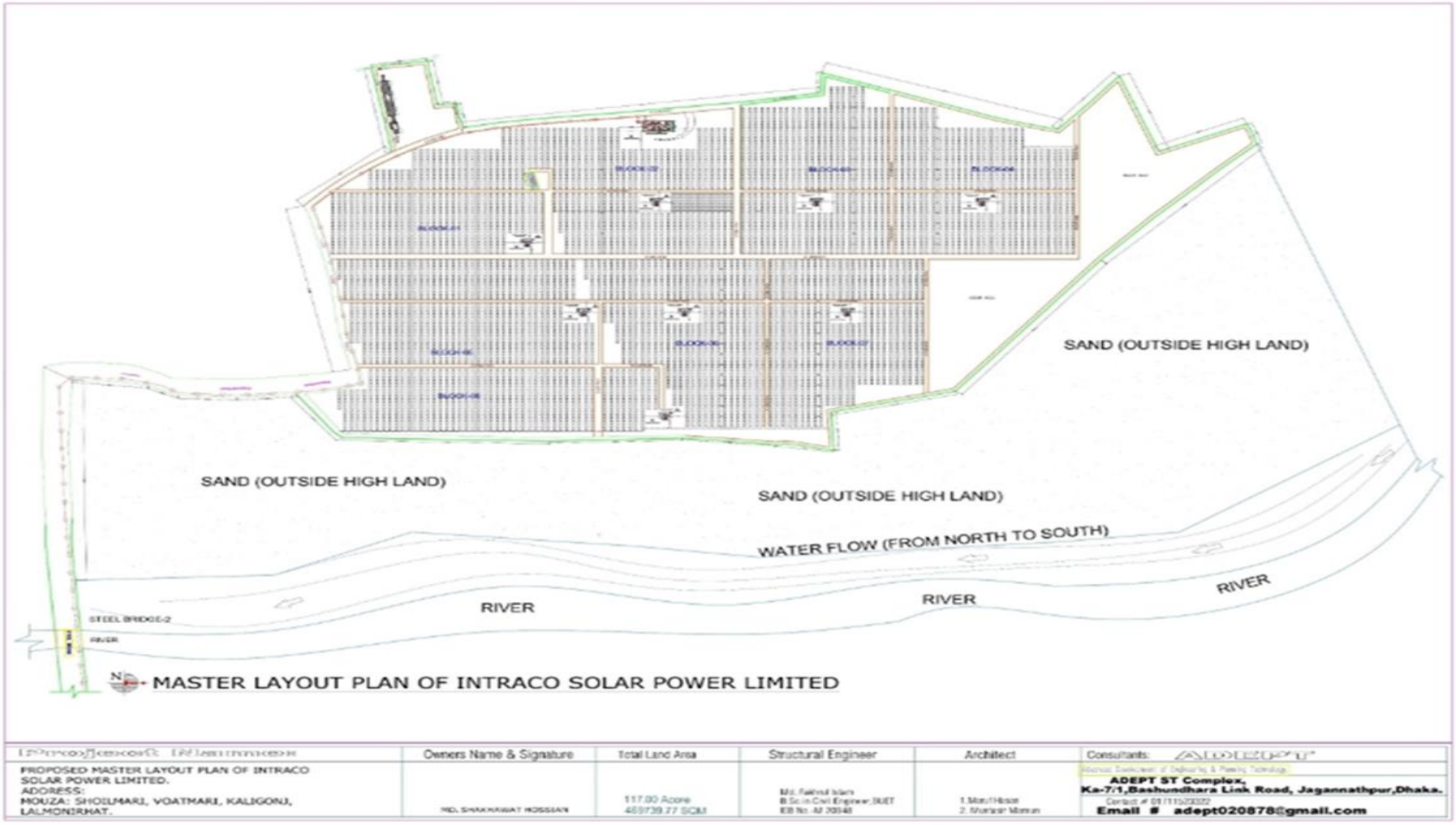


Figure 3.8: Master Layout plant of the Proposed Project

The proposed Project will have the following components:

a) Solar PV modules and grid connected inverters

Solar PV modules with a total capacity of 30MW will be installed to supply electricity to the grid while ten (10) grid connected inverters will be installed to convert DC output from solar panels to grid quality AC electricity. Solar PV modules are the main sources of power generation during daytime. Electricity generated from solar PV modules is converted to AC electricity through the inverters and then supplied at 500V~1500V through 1-phase distribution line. However, electricity will be supplied to the customers at 230V using single phase & 1-phase distribution line.

b) Multi-cluster box

Multi-cluster box is an interface for all the connectors and control. It is completely wired and fitted to make all the connections easier. Multi-cluster box is equipped with connection facility for external generator, load distribution and PV system.

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3.5.4 Plant Capacity Selection

Plant capacity selection is determined based on the load survey and optimization parameters. The survey mechanism is discussed in detail in Chapter 5. Optimization parameters for selecting plant capacity are chosen carefully to ensure satisfactory plant performance. The optimization parameters used by the sponsor are (a) consumption of diesel fuel over the year as percentage of the total consumption, (b) unused solar energy as percentage of total solar generation and (c) ratio between capacities of grid-tied inverters and bi-directional inverters. The trade-off analysis of these three parameters is discussed below:

1. Energy supplied by diesel generator

Diesel generator (DG) will be used as backup to meet the supply and demand gap throughout the year. The diesel generator will run in such cases as lack power supply during, rainy and foggy days. Under-sizing the plant capacity will result in excessive usage of the diesel generator. Purposes of installing a grid tied solar pv power project will be hampered if diesel.

generator is used most of the time. Hence, minimization of usage of diesel generator is an important optimization parameter. The parameter will be defined as follows:

$$\text{Percentage of energy supplied by DG} = \frac{\text{Annual Consumption from Energy from Diesel Generator x100}}{\text{Total Annual Consumption of Energy from the Plant}}$$

2. Unused solar energy

Increasing the plant capacity will certainly decrease the percentage of diesel consumption annually. However, it can lead to the wastage of excessive solar energy during peak solar irradiation. Minimizing the excessive unusable energy will restrain the sponsor from overdesigning the system. There is a trade-off between minimization of unused solar energy and diesel consumption. The parameter of unused solar energy is defined as follows:

$$\text{Percentage of unused solar energy} = \frac{\text{Annual Unused Solar Energy from the Plant x100}}{\text{Total Generation of Solar PV Modules}}$$

3. Ratio between capacities of grid-tied inverters and bi-directional inverters

The proposed design of the grid tied AC system. To ensure safety of the plant, extreme situations need to be analyzed and kept into design consideration. If the loads are disconnected in any case, the bi-directional inverters should be capable of handling the AC input power from the grid-tied inverters before necessary measures are taken. Hence, the ratio of grid-tied inverters and bi- directional inverters is an important parameter. Since the bi-directional inverters can take up to twice its power, the ratio of grid-tied inverter and bi-directional inverter capacity should not cross the value of 2. The parameter can be defined as:

$$\text{Ratio} = \frac{\text{Capacity of a Grid tied Intverter x No of Grid tied Inverter}}{\text{Rated Capacity of Bi directional Inverter x No of Bi directional Inverter}}$$

4 ANALYSIS OF ALTERNATIVES TO THE PROPOSED PROJECT

4.1 General

The range of feasible alternatives is selected and discussed in a manner to foster meaningful public participation and informed decision making. Among the factors that may be taken into account when addressing the feasibility of alternatives are environmental impacts, site suitability, economic viability, social and political acceptability, technological capacity, availability of infrastructure, general plan consistency, regulatory limitations, jurisdictional boundaries, and whether the proponent could reasonably acquire, control, or otherwise have access to an alternative site. An ESIA need not consider an alternative whose effects could not be reasonably identified, whose implementation is remote or speculative, and that would not achieve the basic project objectives. An ESIA should describe a range of reasonable alternatives to the proposed project or to the location of the proposed project site that could feasibly avoid or lessen any significant environmental impacts of the proposed project while attaining most of the project's basic objectives. An ESIA also must compare and evaluate the environmental effects and comparative merits of the alternatives. This chapter describes alternatives considered but eliminated from further consideration (including the reasons for elimination), and compares the environmental impacts of several alternatives retained with those of the proposed project. The proposed project has the potential to have significant adverse effects on visual amenity, air quality, noise, biological resources, cultural resources, geology/soils, hazards and hazardous materials, hydrology, land use and planning, noise and public services, transportation and traffic and utilities and service systems within the area. Even with the mitigation measures described in the report further ESIA, impacts in some of these issue areas would be significant and unavoidable. Therefore, this section discusses alternatives that are capable of avoiding or substantially lessening effects on these resources.

4.2 Alternatives Eliminated from Further Consideration

Alternatives may be eliminated from detailed consideration in an ESIA if they fail to meet most of the project objectives, are infeasible, or do not avoid or substantially reduce any significant environmental effects. Alternatives that are remote or speculative, or the effects of which cannot be reasonably predicted, also do not need to be considered. Intraco Solar Power Ltd. Considered several alternatives to reduce project impacts on aesthetics and agriculture resources, and cumulative impacts on aesthetics, agriculture resources, air quality, and biological resources. The following alternatives were initially considered but were eliminated from further consideration in this ESIA because the alternatives do not meet project objectives or were infeasible.

4.3 Energy (Wind) Alternative

This alternative would involve the use of wind energy as an alternative to development of a solar site. Similar to solar power, power from the wind is an alternative to energy production from nonrenewable resources like coal and oil, or nuclear sources. Wind energy provides several benefits, including, but not limited to the following:

- Wind is a renewable and infinite resource.

- The generation of wind energy does not produce any air emissions, including carbon dioxide.
- Although wind energy requires a significant upfront capital investment, it is a free resource after the capital cost of installation (excluding maintenance).
- In addition, energy production from wind power would not require the significant water usage associated with coal, nuclear, and combined-cycle sources.

Commercial wind farms typically use three-bladed turbines that range in size from 300 feet up to 500 feet in height, with blades of 150 feet in length that are pointed into the wind by computer-controlled motors. The wind farm would consist of a group of wind turbines placed where sufficient and consistent wind resources exist and electrical power transmission infrastructure is located. The individual turbines would be interconnected with a medium voltage power collection system and a communications network. Similar to solar energy production facilities, wind energy production facilities also require substations, which would increase the medium-voltage electrical current through a transformer before connection to the high-voltage transmission system. Compared with traditional energy sources, the environmental effects of wind power are relatively minor. Unlike the proposed project, wind turbines would have the potential to impact avian species in the local area. The development of wind farms would also typically result in greater adverse aesthetics impacts due to the height of the turbines. Agriculture resources would also still be impacted by the presence of wind turbines and associated facilities. Additionally, wind energy production facilities do not reduce short-term construction-related air quality emissions. While the project area has been identified as suitable for solar projects based on the solar insolation levels (the amount of solar radiation energy) in the area, wind energy production is not well-suited to the project site due to relatively low wind speeds and directionality sufficient to drive wind turbines. No significant facilities have been developed in the project vicinity due to the lack of adequate wind resources. As noted above, alternatives may be eliminated from detailed consideration in an ESIA if they fail to meet most of the project objectives, are infeasible, or do not avoid or substantially reduce any significant environmental effects. Therefore, this alternative was eliminated from further consideration because:

- It would result in additional/greater impacts than the proposed project (aesthetics and biological resources);
- It would not substantially reduce the significant environmental impacts associated with aesthetics, agriculture resources, air quality and biological resources;
- It would fail to meet the objectives for the proposed project; and
- The project site is not suited for wind energy production; therefore, a wind energy production facility would not generate as much electricity as solar equipment.
- Wind energy is uncommon in Bangladesh and the production material is not available.

4.4 Alternative Site

Relocation option to a different site is an option available for the project implementation. At the moment, there are no alternative sites for the proposed development (i.e. the project proponent doesn't have an alternative site). This means that the proponent has to look for the land if relocation is proposed and land is not available and if available it will be too expensive for the proponent to realize his dream. Looking for the land to accommodate the

scale and size of the project and completing official transaction on it may take a long period. In addition, it is not a guarantee that such land would be available. It's also worth noting that the said project is already underway in terms of seeking development approvals in various government departments. The project proponent would spend another long period of time on design and approvals of the plans by the relevant government departments. The project design and planning before the stage of implantation would call for cost; already encountered in the proposed development i.e., whatever has been done and paid to date would be counted as a loss to the proponent. Assuming the project will be given a positive response (after relocation) by the relevant authorities including DoE, it (project) would have been delayed for a long period before implementation. This would also lead to a situation like No Action Alternative. In consideration of the above concerns and assessment of the current proposed site, relocation is not a viable option.

4.5 Alternatives Selected for the Site

The following four alternatives have been determined to represent a reasonable range of alternatives that have the potential to feasibly attain most of the basic objectives of the proposed project but which may avoid or substantially lessen any of the significant impacts of the proposed project. The following alternatives are analyzed in detail below:

Alternative A: No Project

Alternative B: Reduced Project (Avoid Williamson Act Contract and Prime Agricultural Lands)

Alternative C: Build-Out of Existing Land Use

Alternative D: No Utility-Solar Development—Distributed Commercial and Industrial Rooftop Solar Only

Table 4.1 provides a summary of the relative impacts and feasibility of each alternative. A complete discussion of each alternative is provided below:

Table 4.1: Summary of alternatives sites of the proposed project

Alternative	Description	Basis for Selection and Summary for Analysis
Proposed Project	30MW standalone AC coupled solar photovoltaic grid tied power plant on 98.03 acres	-
Alternative A: No Project Alternative	• Existing land use designations and zoning designations would remain. • No Development would occur on site. • Site would remain as agricultural land.	Avoids significant impacts.
Alternative B: No Utility Solar Development – Distributed Commercial and Industrial	30 MW of photovoltaic solar distributed	Avoids significant impacts to visual amenity, air quality and ecological resources

4.5.1 Alternative A: No Project Alternative

The No Project Alternative in respect to the proposed project implies that the status quo is maintained. This option is most suitable alternative from an extreme environmental

perspective as it ensures non-interference with the existing conditions. However, the project activities have already been started. This option will however, involve several losses both to the project proponent and the donor organization. The property will remain under-utilized. The No Project Option is the least preferred from the socio-economic and partly environmental since if the project is not done.

- The economic benefits especially during construction i.e., provision of jobs for skilled and non-skilled workers will not be realized.
- There will be no generation of income by the developer to the Government.
- The local skills would remain under-utilized.
- No employment opportunities will be created who will work in the project area.
- Discouragement for donors to allot this level of standard and affordable developments.

The No Project Alternative would reduce the significant and unavoidable impacts of the proposed project related to air quality (project-level and cumulative). This alternative would also result in fewer impacts to archaeological and cultural resources, water quality, land use, and traffic, but would result in greater long-term impacts associated with air quality and exhaust emissions.

Alternative A, the No Project Alternative, would not meet any of the project objectives.

4.5.2 Alternative B: Reduced Project Alternative

Under the Reduced Project Alternative. The project under this alternative would consist of an approximate 30 MW solar PV generating facility on 98.03 acres. Under this alternative, the following specific project components could be reduced in number or size in comparison to the proposed project:

A solar field of PV panels and associated improvements (e.g., access roads, fencing, secondary access drives, combiners, etc.), An electrical collection system (transformer and inverter) that aggregates the output from the PV panels and converts the electricity from DC to AC,

Compared to the proposed project, the reduced project alternative would result in fewer impacts to aesthetics, terrestrial ecology, air quality (construction period/short-term), archaeological and cultural resources and traffic, but would result in greater long-term impacts associated with air quality and exhaust emissions.

Alternative B, the Reduced Project Alternative, meets all project objectives. However, it meets certain objectives to a lesser degree than the proposed project. Among these are:

- Assist in achieving exhaust emissions reduction objectives to the maximum extent possible based on anticipated transmission facility capacity and reserved queue position.
- Ensure that the project can be constructed, and power provided at a competitive price.

4.5.3 Alternative C: Build-Out of Existing Land Use Alternative

Under Alternative C: Build-Out of Existing Land Use Alternative, the project site could be developed to the maximum intensity allowed under the land use designations of the plan of Intraco Solar Power Ltd. This alternative would yield a number of residential units with agricultural and grazing uses, including breeding and/or grazing of animals. Under this alternative, no utility scale solar PV panels would be developed, as those entitlements do not currently exist on-site.

While this alternative would reduce impacts to agricultural lands, biological resources, and land use and planning the Build-Out of Existing Land Use Alternative would not avoid the significant and unavoidable impacts of the proposed project related to air quality. The Build out of Existing Land Use Alternative would also result in fewer impacts to land use and planning as compared to the proposed project. However, these alternative increases project impacts related to air quality, exhaust emissions, waste generation, water quality and traffic.

Alternative C, the Build-Out of Existing Land Use Alternative, would not meet any of the project objectives.

The Build-Out of Existing Land Use Alternative would reduce impacts associated with agricultural lands, biological resources, and land use and planning when compared to the proposed project. The Build-Out of Existing Land Use Alternative would have similar impacts associated with visual amenity, cultural resources, soils, noise, when compared to the proposed project. This alternative would result in greater impacts to air quality, emissions, waste generation, water quality, and traffic than the proposed project.

4.5.4 Alternative D: No Utility Scale Solar Development Distributed Commercial and Industrial Rooftop Solar Only Alternative

This alternative would involve the development of a number of geographically distributed small to medium solar PV systems within existing developed areas, typically on the rooftops of commercial and industrial facilities situated throughout the project area. Under this alternative, no new land would be developed or altered. However, depending on the type of solar modules installed and the type of tracking equipment used (if any), a similar or greater amount of acreage (i.e., greater than 116 acre of total rooftop area) may be required to attain proposed project's capacity of 30MW of solar PV generating capacity. Because of space or capital cost constraints, many rooftops solar PV systems would be fixed axis systems or would not include the same type of sun-tracking equipment that would be installed in a freestanding utility-scale solar PV project and, therefore, would not attain the same level of efficiency with respect to solar PV generation. This objective would enable the generation of 30MW of electricity, but it would be for on-site use only. This alternative assumes that rooftop development would occur primarily on commercial and industrial structures due to the greater availability of large, relatively flat roof areas necessary for efficient solar installations. This alternative would involve a number of installation locations across the area, many of which would require discretionary action, such as design review, or zone variances, depending on local jurisdictional requirements. Similar to the proposed project, this alternative would be designed to operate year-round using PV panels to convert solar energy directly to electrical power. Power generated by such distributed solar

PV systems would typically be consumed on site by the commercial or industrial facility without requiring the construction of new electrical substation or transmission facilities. Like utility-scale PV systems, the area of rooftops or other infrastructure required per kWP of electricity produced is wide ranging, which is largely due to site-specific conditions (e.g., solar insolation levels, intervening landscape or topography, PV panel technology, etc.).

This alternative would result in fewer impacts to ecological resources, archaeological and cultural resources, soils, and traffic. Similar impacts compared to the proposed project would result from this alternative in the areas of air quality, exhaust emissions, water quality, and land use. Therefore, for most environmental issue areas, this alternative would result in fewer environmental impacts for both short-term and long-term, when compared to the proposed project.

Alternative D, the No Utility-Scale Solar Development Alternative, would not meet the following project objectives:

- Locate solar power plant facilities as near as possible to electrical transmission facilities with anticipated capacity and reserved queue position.
- Ensure that the project can be constructed, and power provided at a competitive price.

The No Utility-Scale Solar Development Alternative would reduce impacts associated with ecological resources, archaeological and cultural resources, soils, and traffic when compared to the proposed project. Impacts related to air quality, exhaust emissions, water quality, and land use would be similar to those of the proposed project. Additionally, this alternative would achieve most of the project objectives, such as assisting in achieving the State's RPS and GHG reduction objectives, siting panels on disturbed areas and using a proven and available solar PV technology. This alternative however includes a number of drawbacks, including, but not limited to the following:

- There would be difficulties with respect to build out of the system within a timeframe that would be similar to that of the proposed project.
- Given the distributed nature of such a network of facilities, management and maintenance would not be as efficient, and total capital costs would likely be higher.
- The requirement to negotiate with a large number of individual property owners to permit placement of solar panels on rooftops.
- The difficulty of ensuring proper maintenance of a large number of smaller solar installations.
- The lack of an effective electricity distribution system for large numbers of small electricity producers.

Given the size of the proposed project, the project objectives, the need to arrange a suitable assemblage of participating commercial and industrial properties and the challenges stated above, it is impractical and infeasible to propose a distributed generation project of this type and still proceed within a reasonably similar timeframe.

4.6 Comparison of Alternatives

The following table compares the 4 alternatives options for the proposed project.

Table 4.2: Comparison of the Alternatives

Environmental Resource	Alternative A: No Project	Alternative B: Reduced Project	Alternative C: Build Out of Existing Land Use	Alternative D: No Utility Scale Solar Development
Visual Amenity Reduce	Fewer	Fewer	Similar	Similar
Air Quality	Fewer	Fewer	Fewer	Fewer
Ecological	Greater	Fewer	Greater	Similar
Archaeological and Cultural Resources	Fewer	Fewer	Fewer	Fewer
Soils	Fewer	Fewer	Similar	Fewer
Dust & Exhaust Emissions	Similar	Similar	Similar	Fewer
Waste Generation	Similar	Similar	Greater	Fewer
Water Quality	Fewer	Similar	Greater	Similar
Land Use	Fewer	Similar	Fewer	Similar
Noise	Fewer	Fewer	Similar	Greater
Traffic	Fewer	Fewer	Greater	Fewer
Meet Project Objectives?	NO	YES	NO	NO
Significant and Unavoidable Impacts?	YES	YES	NO	YES

4.7 Environmentally Superior Alternative

As presented in the comparative analysis above, and as shown in Table 5.2, the Environmentally Superior Alternative for the proposed project would be Alternative A, or the No Project alternative. This alternative would avoid all significant and unavoidable impacts that would occur under the proposed project. No substantially adverse and long-term impacts would occur to the environment as a result of this alternative. This alternative would also result in fewer impacts to visual amenity, agricultural and forest resources, biological resources, cultural resources, hydrology and water quality, land use, noise, and traffic as compared to the proposed project, but the failure to construct a renewable energy production facility results in increased impacts in the long-term to air quality and exhaust emissions. Alternative D, or the No Utility-Scale Solar Development—Distributed Commercial and Industrial Rooftop Solar Only, similarly avoids significant impacts to agriculture resources, biological resources, cultural resources, public services and traffic and transportation.

5 DESCRIPTION OF THE ENVIRONMENTAL AND SOCIAL CONTEXT

This section describes the major features of the physical environment of the project site. Information was gathered on the existing physical environment related to Physiography, geology, topography, climate, soils, surface water and groundwater quality, air quality and noise level, etc.

5.1 Physical Environment

5.1.1 Topography

Topography is the configuration of a land surface including its relief and contours, the distribution of mountains and valleys, the patterns of rivers, and all other features, natural and artificial, that produce the landscape. Although Bangladesh is a small country, it has considerable topographic diversity. It has three distinctive features: (i) a broad alluvial plain subject to frequent flooding, (ii) a slightly elevated relatively older plain, and (iii) a small hill region drained by flashy rivers.

From the Topographic Map of the Project Area, it is evident that the topographic elevation is 30-75 m, which falls under the second category of the three distinctive features stated above.

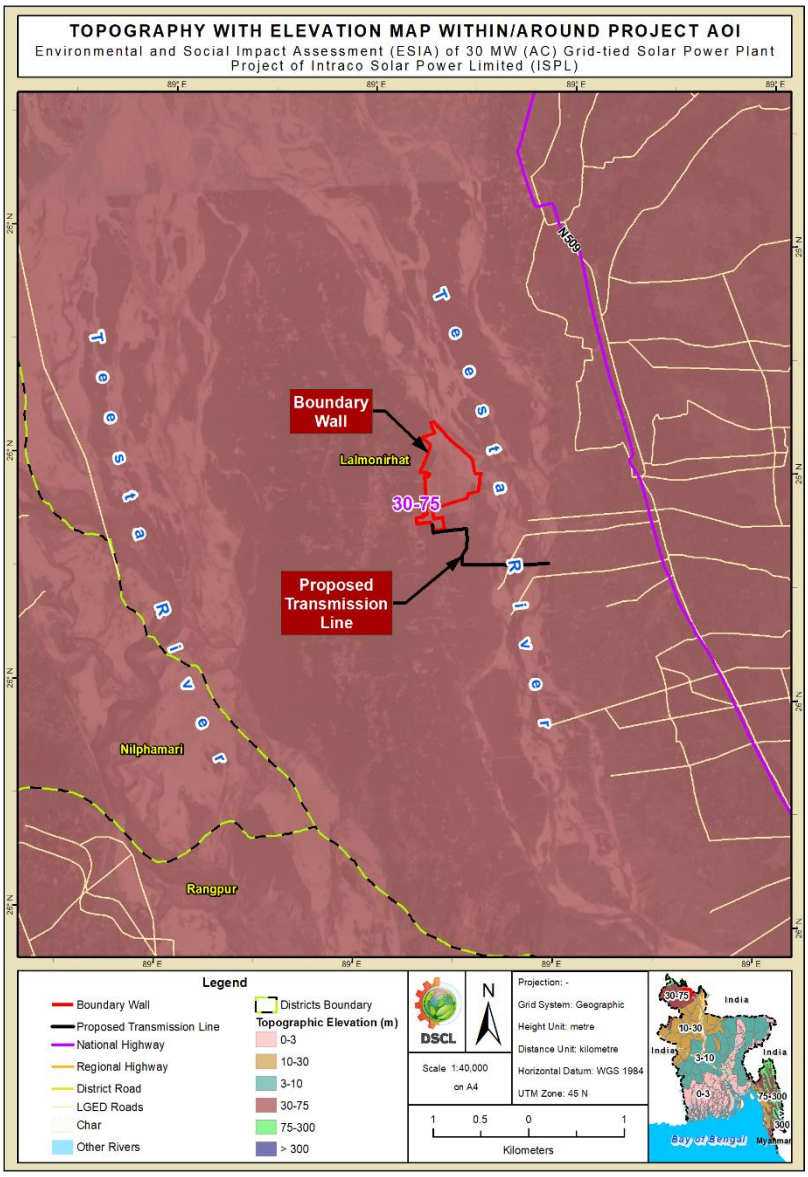


Figure 5.1: Topographic Map of the Project Area

5.1.2 Physiography

In the context of physiography, Bangladesh can be divided into three broad categories based on topography, physical features and geological history (Brammer, 1996):

- Floodplains
- Terraces
- Hills

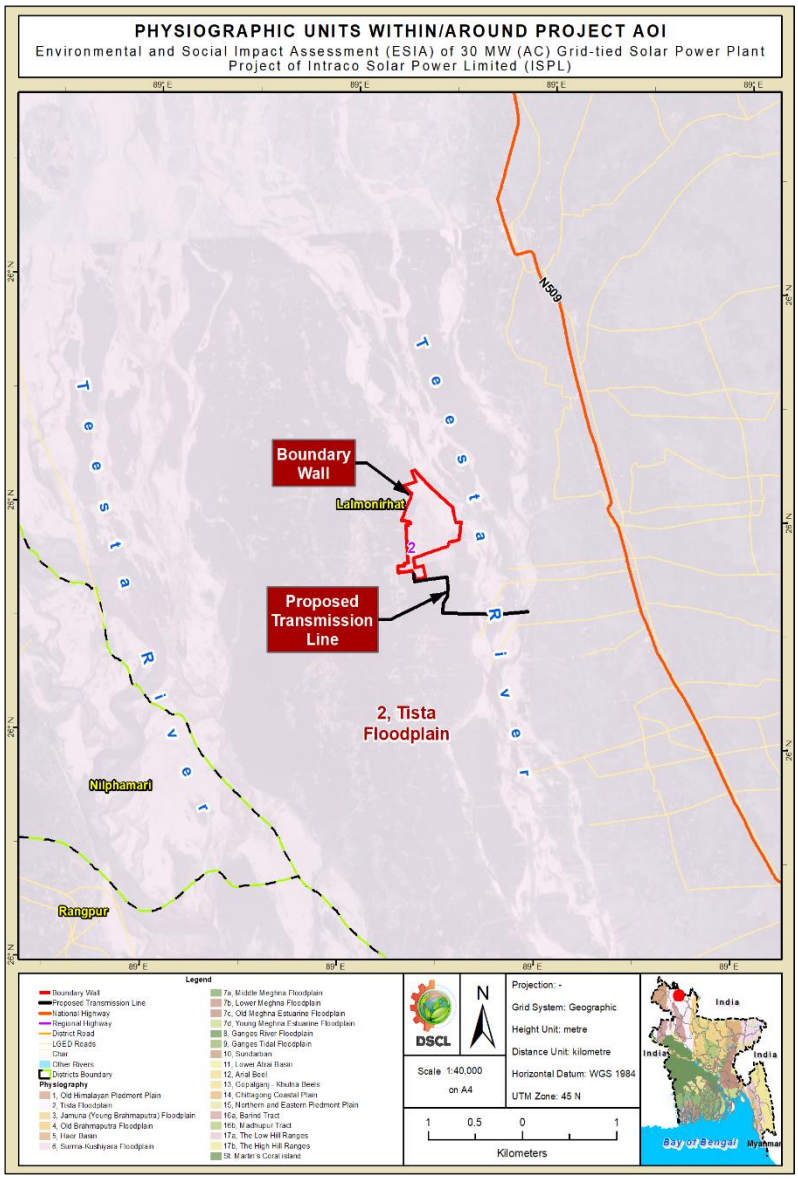


Figure 5.2: Physiographic Map of the Project Area

Within these 3 broad categories, a number of authors have further divided the land surface into a series of Physiographic Units based on a combination of topographical/landscape features, underlying geology and surface soils (Brammer, 1996, Rashid, 1991, Morgan and McIntyre, 1959). The most recent study was undertaken by the Soil Resource Development Institute (SRDI) who further refined the previous classifications into 26 Physiographic Units (20 primary units and 6 sub-units) based on an assessment of more recent and detailed data (SRDI, 1997).

The project lies depends on the Teesta River for water supply and drainage, the project site falls in the Testa floodplain.

5.1.3 Geology

Bangladesh is situated to the east of the Indian sub-continental plate. Nearly 85% of Bangladesh is underlain by deltaic and alluvial deposits of the Ganges, Brahmaputra, and Teesta River systems.

Rangpur Saddle represents Indian Platform and connects the Indian Shield with the Shillong massif and the Mikir Hills. Shillong Massif is a large thrust block of the Indian Shield. In Rangpur Saddle the basement is the most uplifted and is covered with thin sedimentary deposits. In Madhyapara area of Dinajpur the basement is only 130m deep

from the ground surface and is overlain by Dupi Tila Sandstone and Madhupur Clay of Pleistocene age. Rangpur Saddle can be divided into 3 parts- Rangpur Saddle, Northern Slope of Rangpur Saddle and Southern Slope of Rangpur Saddle. It is evident from seismic data acquired out by OGDC (Oil and Gas Development Corporation) during 63-64 in Rangpur, Dinajpur districts that both the northern and the southern slopes of Rangpur Saddle are quite gentle. The basement plunges gently from Madhyapara towards the southeast upto the Hinge Zone, which is known as the Southem Slope of Rangpur Saddle. The tentative boundary of the Rangpur Saddle with the northern and the southern slopes has been marked at approximately 700m contour line on the basement. It separates the Bengal Foredeep and the Himalayan Foredeep. The Northern Slope of Rangpur Saddle also known as Dinajpur Slope, occupies the north western part of Rangpur-Dinajpur districts and gently slopes towards the Sub-Himalayan Foredeep with dips 3-4' which sharply increases in Tetulia area. The only well drilled in 1988 located on the north-western most tip of Bangladesh at Salbanhat by Shell for oil and gas exploration to probe a carbonate reef ended in basement with depth 2518m penetrating the Mio-Pliocene sequence without encountering Eocene Limestone. The nature of junction between the Dinajpur Slope and the Sub-Himalayan Foredeep is not clear. (Banglapedia, 2015). The generalized geological feature of the project area is shown in the geological map of Bangladesh (Figure-5.3).

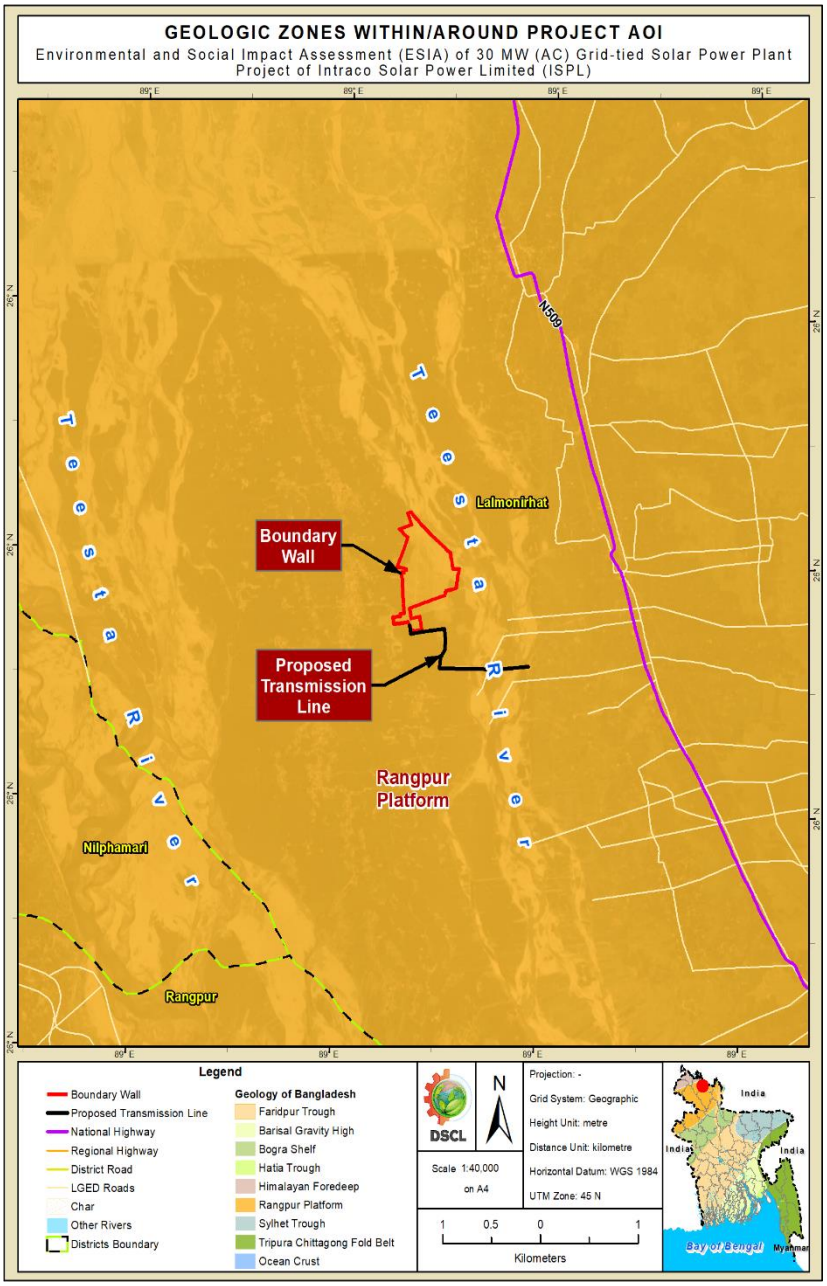


Figure 5.3: Geological Map of the Project Area

5.1.4 Soil Type

The soil of the project area falls in Calcareous Alluvium category of Bangladesh soil types (Figure-5.4)

The project area falls in Non-calcareous and Calcareous Brown Floodplain soil class.

Non-calcareous Alluvium Soil: They are similar to calcareous alluvium; except they are non-calcareous in soil profiles. These soils occupy extensive areas on the active Tista and Brahmaputra-Jamuna floodplains. They are sandy or silty, grey or olive, neutral to slightly alkaline. Most of these soils have been included as Eutric Fluvisols.

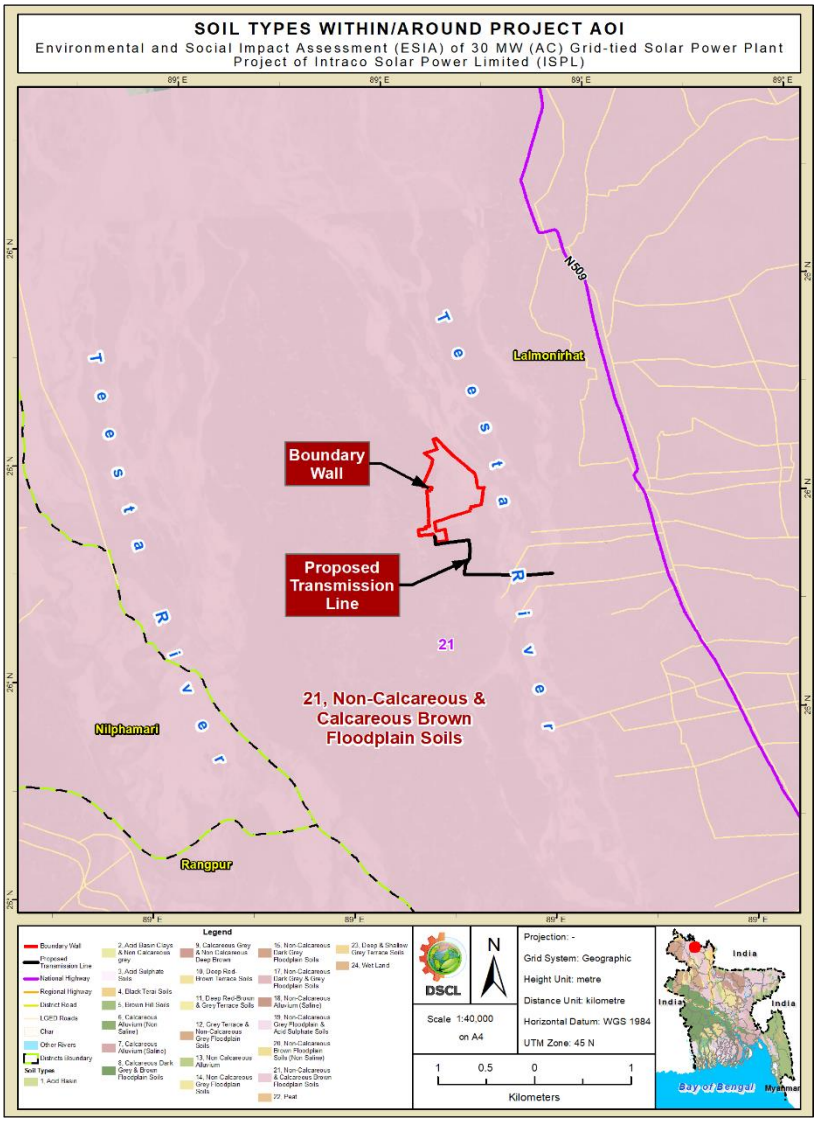


Figure 5.4: Soil Type Map of the Project Area

Calcareous Brown Floodplain soils: They have cambic B-horizon that is predominantly oxidised, containing lime in the profiles. They comprise pale brown to olive brown, friable, loamy and clay soils occurring on the upper parts of ridges on the Ganges River floodplain and on the river bank of the Ganges tidal floodplain. Most of these soils belong to Calcaric Gleysols. (Banglapedia, 2015).

5.1.5 Seismicity

Bangladesh is situated in one of the most tectonically active regions in the world. Here is where three major plates meet (the Indian Plate, the Tibet Sub-Plate, and the Burmese Sub-Plate). The project area is located over the Indian Plate, which is moving north. However due to the location of relevant plates, fault lines and hinge zones, Bangladesh itself is divided into four seismic zones (Table 5.1), based on the ranges of the seismic coefficient (note: the seismic coefficient is a measure of how strong an earthquake has the potential to be based on a combination of the mass of the plate and the seismic forces acting on it, as well as how frequently these quakes are likely to occur.

Table 5.1: Seismic Co-efficient

Zones	Seismic Intensity	Bask Seismic Coefficient
Zone-1	Low	0.12
Zone-2	Moderate	0.20
Zone-3	Severe	0.28
Zone-4	Very Severe	0.36

According to the BNBC 2020, it is found that the project is under the Seismic zone 3 with a seismic coefficient of 0.28.

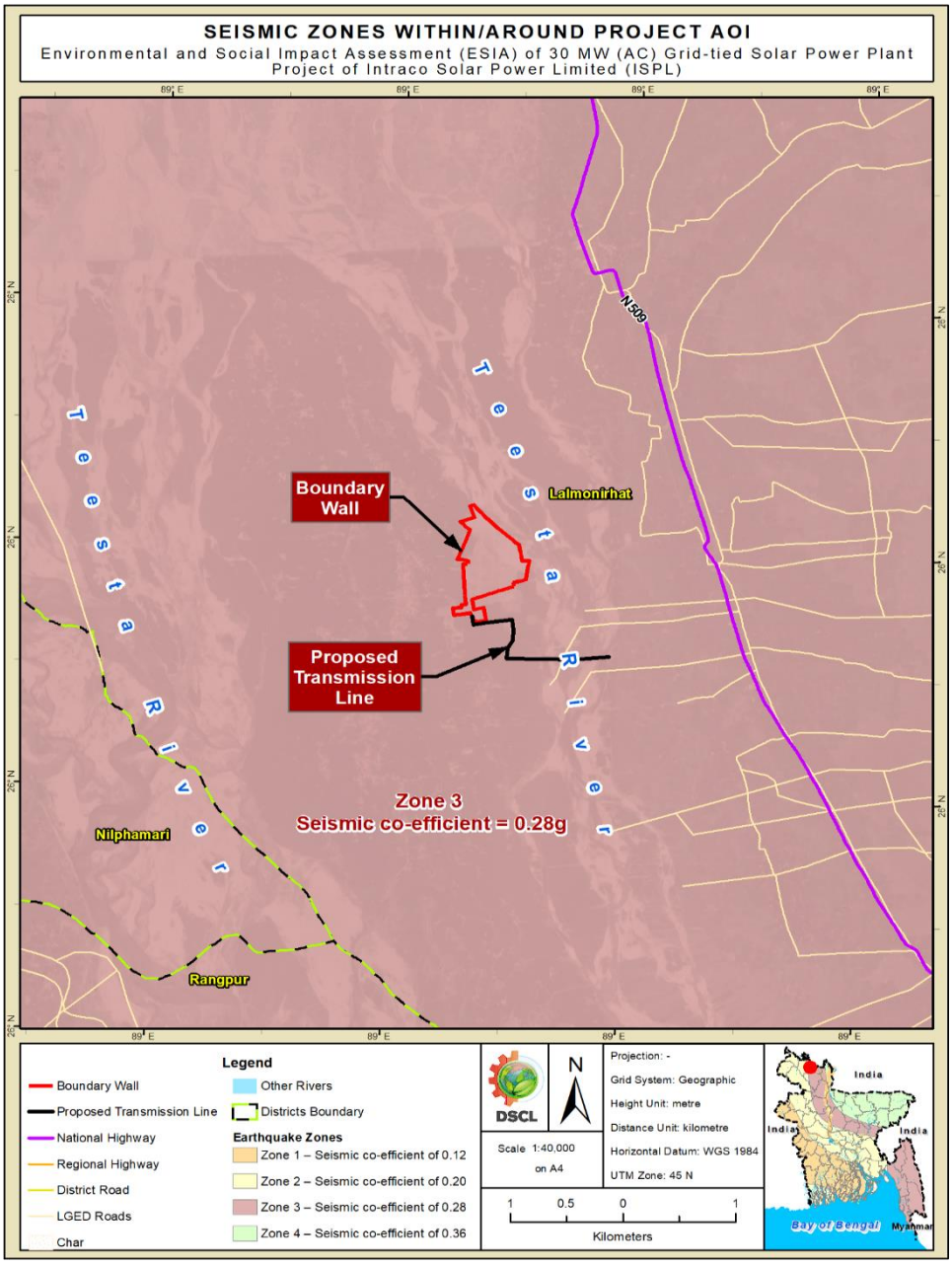


Figure 5.5: Seismic Map of the Project Area

5.1.6 Existing Infrastructure

The plant is situated near to the Sholemari village, Bhotemari union, Lalmonirhat district. The plant area located in an island of Teesta River. The authority backfilled the island area and made a permanent land for the project purpose. The area is quite isolate. The nearest habitant of Sholmari village is far from more than 1 km. On the other side of the project there is South Bhotemari village. In order to crossing over the mighty river Teesta, the people of South Bhotemari village use machine boats. The housing condition of both of villages are tin shed and non-concrete dwelling. No concrete structures were noticed in the area during the survey period.

5.1.7 Climate

Although less than half of Bangladesh lies within the tropics, the presence of the Himalaya Mountain range has created a tropical macroclimate across most of the east Bengal land mass. Bangladesh can be divided into seven climatic zones (Rashid 1991). According to the classification, the project area is located in the Northern part of the northern region climatic zone (Figure 5.6).

- **Northern part of the northern region:** The Northern part of the northern region of Bangladesh is an area of extremes with a mean maximum temperature of above 32°C during summer and mean minimum temperature below 10°C. The summer is dry, with a scorching westerly wind, but the rainy season is very wet, with 2,000 to 3,000 mm of annual rainfall.

Like other parts of the country, the project area is heavily influenced by the Asiatic monsoon and it has these three distinct seasons:

- Pre-monsoon hot season (from March to May),
- Rainy monsoon season (from June to October), and
- Cool dry winter season (from November to February).

The pre-monsoon hot season is characterized by high temperatures and thunderstorms. April is the hottest month in the country with mean temperatures ranging from 27°C in the east and south, to 31°C in the west-central part of the country. After April, increasing cloud-cover reduces the temperature. Wind direction is variable during this season, especially during the early part. Rainfall, mostly caused by thunderstorms, at this time can account for 10 to 25 percent of the annual total.

The rainy monsoon season is characterized by southerly or south-westerly winds, very high humidity, heavy rainfall and long periods of consecutive days of rainfall. The monsoon rain is caused by a tropical depression that enters the country from the Bay of Bengal. About 80% of the annual precipitation occurs during the five-month monsoon season from May to September.

The cool dry season is characterized by low temperatures, cool air blowing from the west or northwest, clear skies and meager rainfall. The average temperature in January varies from 17°C in the northwest and north-eastern parts of the country to 20°C to 21°C in the coastal areas. Minimum temperatures in the extreme northwest in late December and early January reach between 3°C to 4°C.

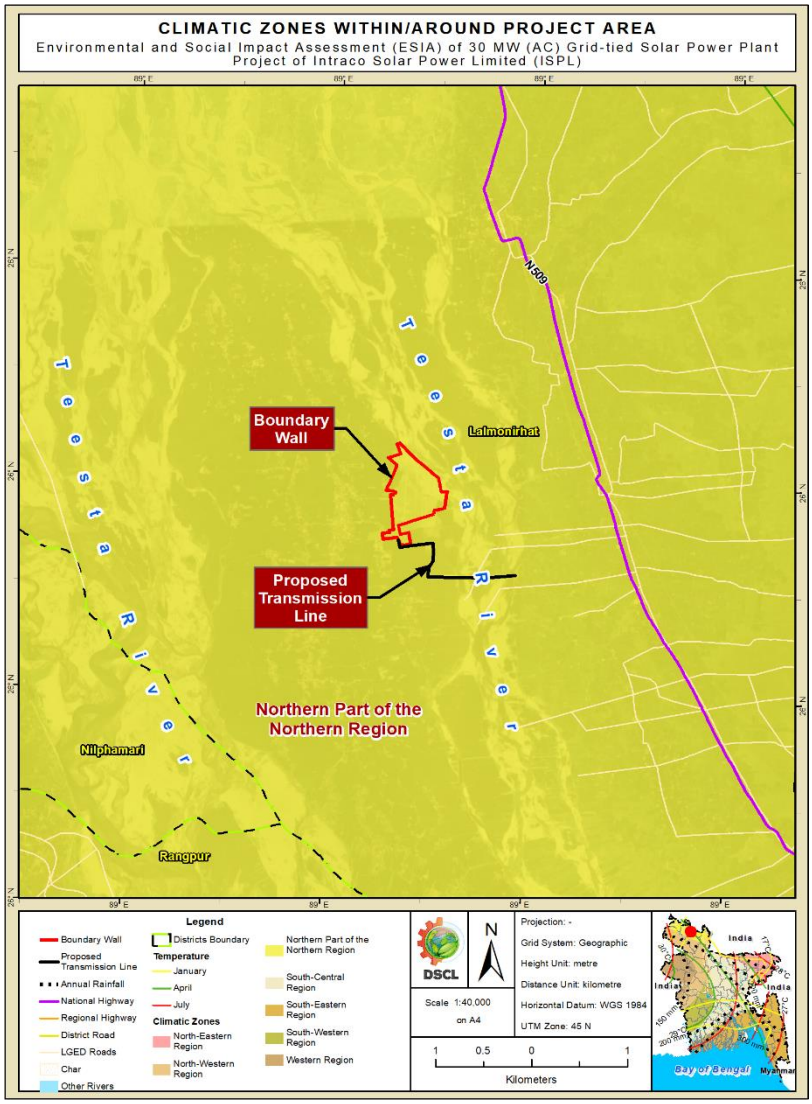


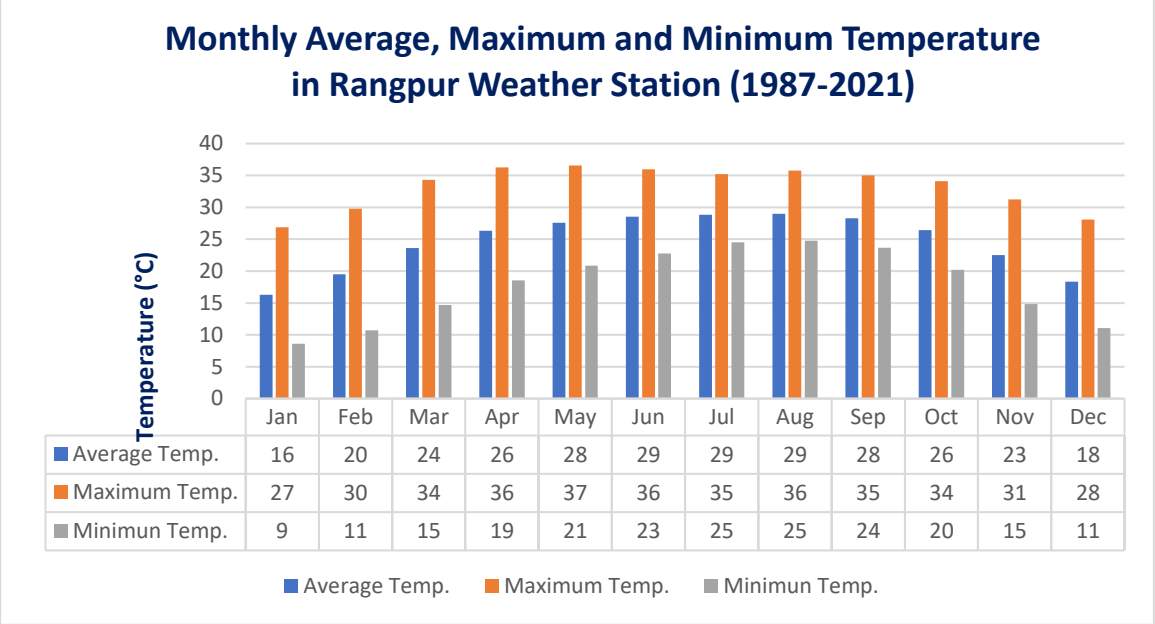
Figure 5.6: Climatic Zones of Bangladesh

The rainy monsoon season is characterized by southerly or south-westerly winds, very high humidity, heavy rainfall and long periods of consecutive days of rainfall. The monsoon rain is caused by a tropical depression that enters the country from the Bay of Bengal. About 80% of the annual precipitation occurs during the five-month monsoon season from May to September.

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5.1.7.1Temperature

Long-term average monthly temperature data (1987-2021) collected at Rangpur weather station of Bangladesh Meteorological Department. The highest average recorded temperature in this weather station was 29°C in June to August. The lowest average recorded temperature was found in the month of January which was 16°C. The average monthly temperature graph shows that this area faces high temperature from May to September and lowest temperature during winter remains from December to February in the year.

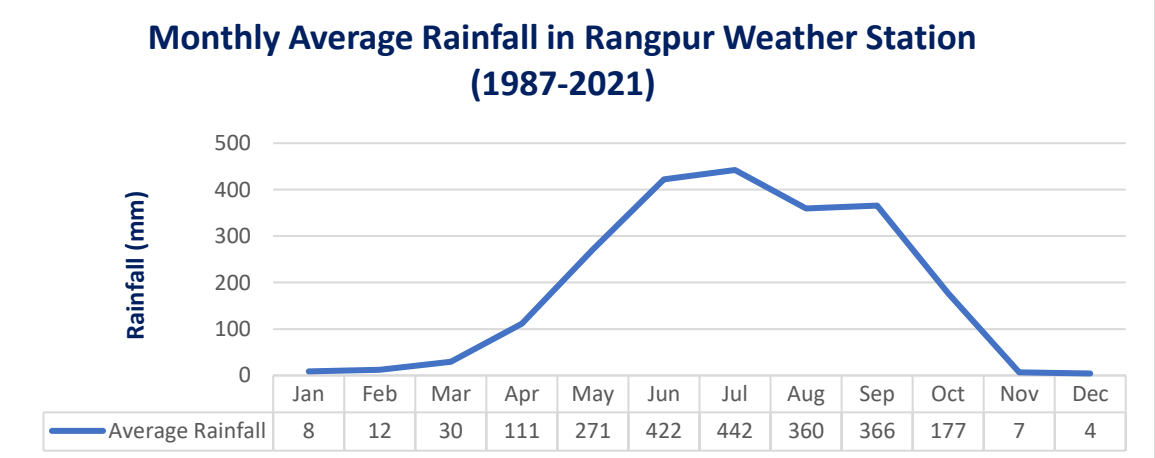


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Temp.	16	20	24	26	28	29	29	29	28	26	23	18
Maximum Temp.	27	30	34	36	37	36	35	36	35	34	31	28
Minimun Temp.	9	11	15	19	21	23	25	25	24	20	15	11

Figure 5.7: Monthly Average, Maximum and Minimum Temperature in Rangpur Weather Station (1987-2021)

5.1.7.2 Rainfall

The rainfall data collected from the above stated station represents that maximum rainfall occurs during April to October and the lowest rainfall occurs in November to February during



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Rainfall	8	12	30	111	271	422	442	360	366	177	7	4

Figure 5.8: Monthly Average Rainfall in Rangpur Weather Station (1987-2021)

winter season. Statistical data of 1987 to 2021 shows that Rangpur stations experience maximum rainfall 442 mm during monsoon in July. In the month of December, the rainfall becomes 4 mm.

5.1.7.3 Humidity

Humidity remains high in summer and comparatively low in winter season. The statistical data of humidity from 1987 to 2021 indicates that humidity in the above stated areas maximized in June to October in the year which is ranges from 84% to 83%. On the other hand, humidity falls 69% in March during the winter season in the Rangpur station area.

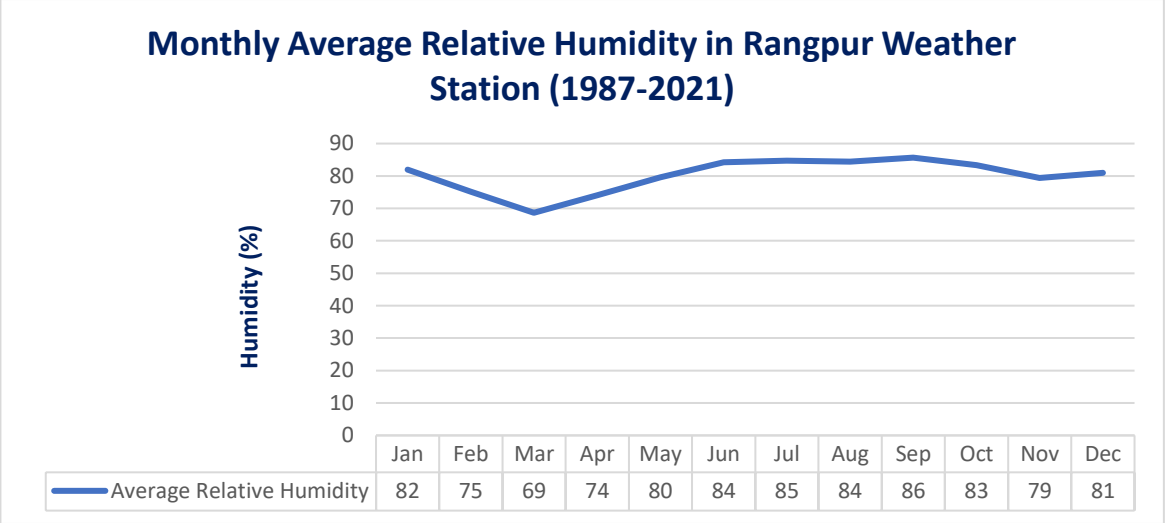


Figure 5.9: Monthly Average Relative Humidity in Rangpur Weather Station (1987-2021)

5.1.7.4 Wind Speed

The statistical wind speed data from 1987 to 2021 shows that average wind speed remained maximum with 3 m/s knots in most of the months in the year. The maximum wind speed was 4 m/s in the month of March and April in the area of Rangpur weather station.

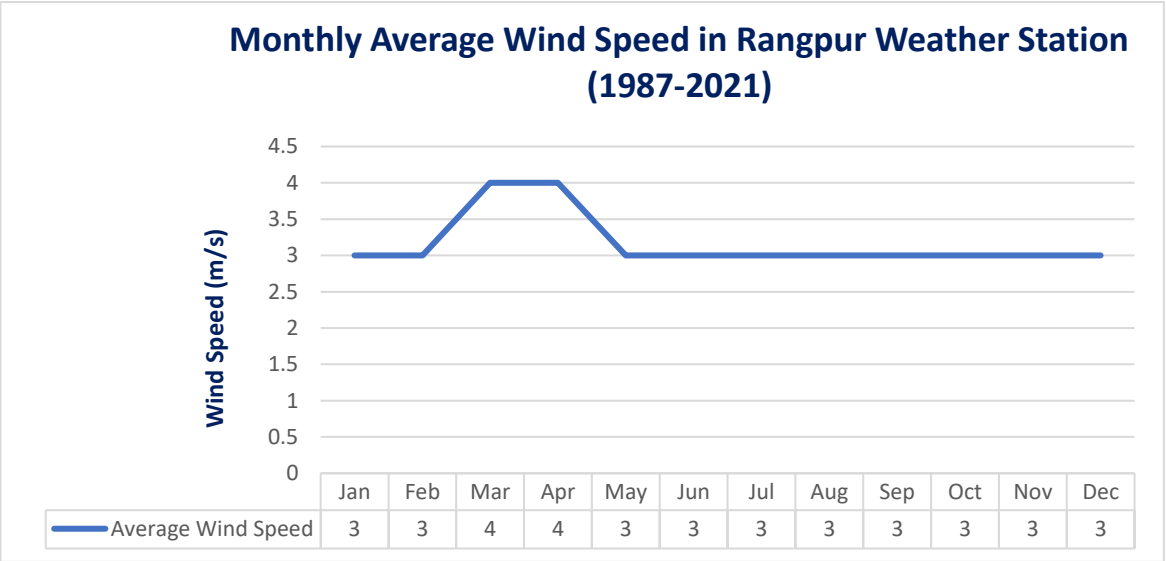


Figure 5.10: Monthly Average Wind Speed in Rangpur Weather Station (1987-2021)

Wind Direction in Rangpur Weather Station (1987-2021) represents that the average direction of the wind is north-eastward in the month of February. The following figure shows the detailed illustration of the wind direction:

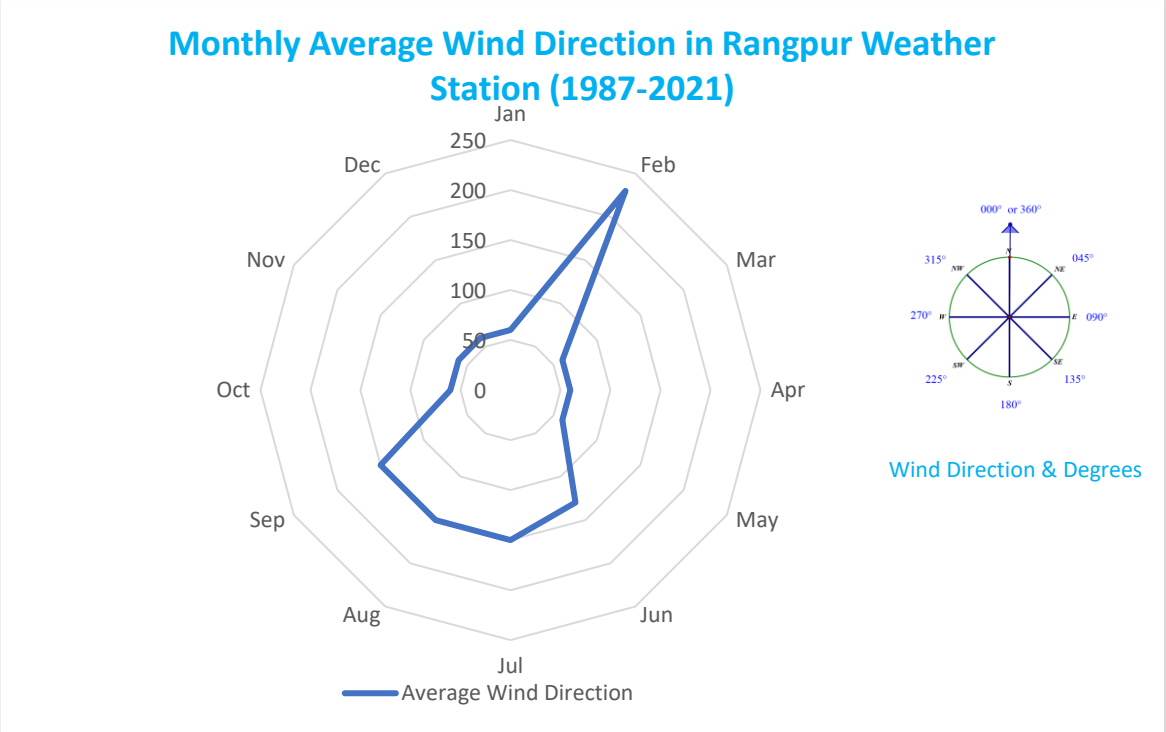


Figure 5.11: Monthly Average Wind Direction in Rangpur Weather Station (1987-2021)

5.1.8 Environmental Quality Testing

5.1.8.1 Air Quality

The background air quality levels in a region are characterized by concentrations of various contaminants in the atmosphere and are referred to as ambient air quality. The presence of air pollutants and their concentrations is influenced by the type of polluting sources as well as other factors that affect their flow and dispersion.

The main air pollutants in Bangladesh are nitrogen oxides (NOx), Sulphur dioxide (SO_2), $PM_{2.5}$ (particulate matter with diameter of 2.5 microns or smaller) and PM_{10} (particulate matter with diameter of 10 microns or smaller), Carbon Monoxide (CO). Air quality test has been conducted on 16th and 17th September 2022 (Figure-5.12) at the project. Results of the air quality were monitored at the three of the project locations have been showed in Table-5.2.



Beside Control Room of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat



Beside Labor Camp of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat



5 No. Ward, Sholmari (inside proposed transmission line), Bhotemari Union, Kaliganj, Lalmonirhat

Figure 5.12: Ambient Air Quality Monitoring in the Project Corridor

Table 5.2: Ambient Air Quality Test Result

Parameter	Unit	ISPL_AAQ_01	ISPL_AAQ_02	ISPL_AAQ_03	Bangladesh Standard**	Duration (hours)	Method of Analysis
		16.09.22	16.09.22	17.09.22			
		Beside Control Room of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat	Beside Labor Camp of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat	5 No. Ward, Sholmari (inside proposed trans. line), Bhotemari Union, Kaliganj, Lalmonirhat			
		25.997594˚N 89.152774°E	26.000257°N 89.153608°E	25.990555°N 89.160833°E			
$PM_{2.5}$	µg/m^3	42.40	43.61	45.33	65	24	Oceanus Portable Gas Detector OC-300
PM_{10}	µg/m^3	82.64	88.32	90.22	150	24	
SOx	µg/m^3	28.32	21.27	28.32	80	24	Oceanus Portable Gas Detector OC-905
NOx	µg/m^3	31.08	22.73	31.08	80	24	
CO*	ppm	<1	<1	<1	5	8	
Weather Condition		Sunny	Sunny	Sunny			

*NYS – Not Yet Standardized

** The Bangladesh National Ambient Air Quality Standards have been taken from the Air Pollution Control Rules, 2022 Department of Environment (DOE), Bangladesh

* CO concentrations and standards are 8 hours only

The measurement results showed achievement of all air quality standards. Based on the ambient air quality standard of DoE. All the values of the parameters are in between the DoE standard. The air quality in the project site can be stated as in good condition. The Laboratory Test result given in Appendix C of the report.

5.1.8.2 Noise Measurement

Excessive noise is a potential issue for both human and biological receivers and can cause a range of negative issues, from mild annoyance and moderately elevated levels of aggression to significant disturbance of behavioral patterns and in severe cases temporary or permanent hearing loss. According to World Health Organization's Guidelines for Community Noise (1999), daily sound pressure levels of 50 decibels (dB) or above can create discomfort amongst humans, while ongoing exposure to sound pressure levels over 85 dB is usually considered the critical level for temporary hearing damage.

Noise Level Measurement was analyzed at twelve (12) project influenced locations on 16th and 17th September 2022 in both day and nighttime (Figure-5.13). Results of the noise level monitored at the project locations have been showed in Table-5.3. The Standard and the Land use category of the study area is based on the classification provided in the Noise Pollution Control Rules, 2006.

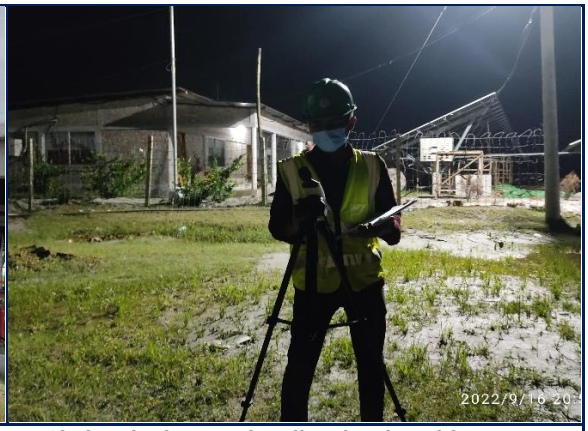


Beside Control Room of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat



Beside Substation-08 of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat





Beside Sub station-04 of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat





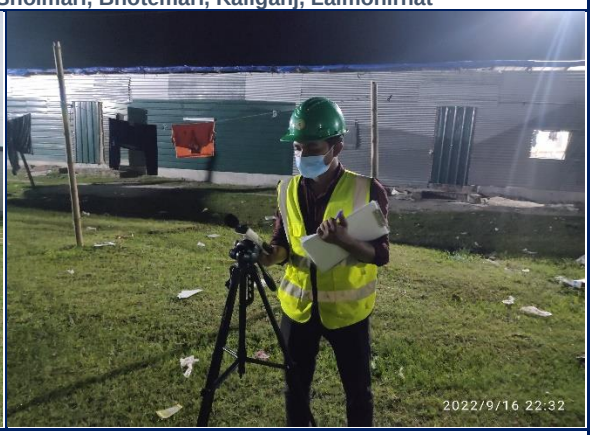
Beside Sub station-07 of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat





Entry Point of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat





Beside Labor Camp of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat





Beside Karimpur Dakhil Madrasa, South Bhotemari, Kaliganj, Lalmonirhart





South Bhotemari, Modati Union, Kaliganj, Lalmonirhat





South Bhotemari Char (near proposed no-04), Kaliganj, Lalmonirhat





Sholmari (in between proposed no 02 and 03), Bhotemari Union, Kaliganj, Lalmonirhat

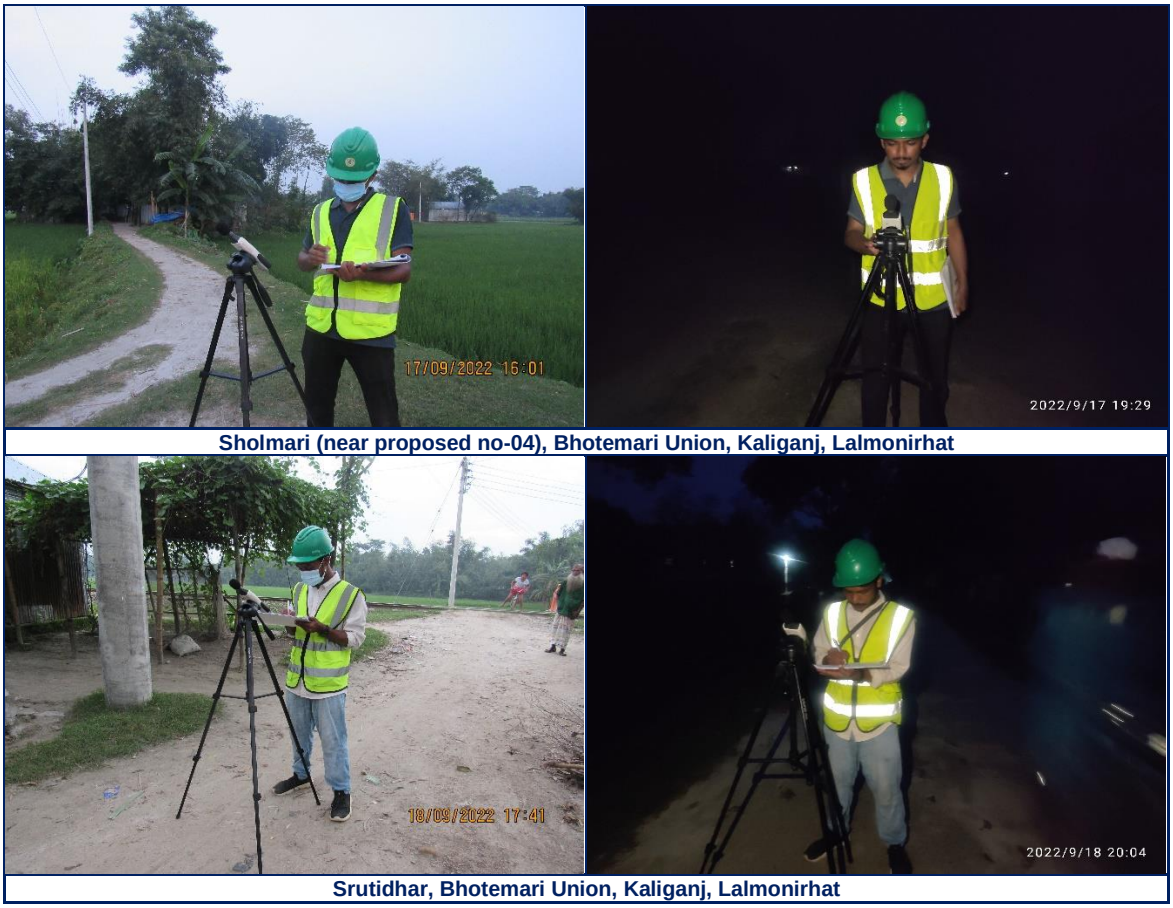


Figure 5.13: Noise Level Measurement in the Project Corridor

Table 5.3: Noise Level Measurement Test Result

Sample ID	Sample Location	GPS Location	Date	Land Use Category	Day Time		Noise Level (dBA) (LAeq)	Night time		Noise Level (dBA) (LAeq)
					Start	End		Start	End	
ISPL_NM_01	Beside Control Room of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat	25.997764°N 89.152387°E	16.09.22	Residential	11:30 am	12:00 pm	54.5	07:31 pm	08:00 pm	40.1
ISPL_NM_02	Beside Substation-08 of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat	25.996964°N 89.152745°E	16.09.22	Residential	01:30 pm	02:00 pm	40.8	08:10 pm	08:40 pm	37.8

Sample ID	Sample Location	GPS Location	Date	Land Use Category	Day Time		Noise Level (dBA) (LAeq)	Night time		Noise Level (dBA) (LAeq)
					Start	End		Start	End	
ISPL_NM_03	Beside Substation-04 of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat	25.996329°N 89.153886°E	16.09.22	Residential	02.21 am	02.45a m	53.6	08.51 pm	09.15 pm	41.1
ISPL_NM_04	Beside Substation-07 of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat	25.996598°N 89.155874°E	16.09.22	Residential	03:16 pm	03:46p m	56.7	09:25 pm	09:45 pm	45.6
ISPL_NM_05	Entry Point of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat	25.998469°N 89.157026°E	16.09.22	Residential	04:00 pm	04:30 pm	40.9	09:50 pm	10:10 pm	32.2
ISPL_NM_06	Beside Labor Camp of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat	26.000257°N 89.153608°E	16.09.22	Residential	04:48 pm	05:18 pm	64.6	10:20 pm	10:50 pm	58.2
ISPL_NM_07	Beside Karimpur Dakhil Madrasa, South Bhotemari, Kaliganj, Lalmonirhart	25.969188°N 89.200169°E	17.09.22	Commercial	10:30 am	11:00 am	51.3	07:21 pm	07:51 pm	40.7
ISPL_NM_08	South Bhotemari, Modati Union, Kaliganj, Lalmonirhat	25.992450°N 89.166031°E	17.09.22	Mixed	11:28 am	11:52 am	41.1	21:45 pm	22:10 pm	35.9
ISPL_NM_09	South Bhotemari Char (near proposed no-04), Kaliganj, Lalmonirhat	25.991111°N 89.164444°E	17.09.22	Silent	12:45 pm	01:15 pm	41.3	20:05 pm	20:30 pm	36.2

Sample ID	Sample Location	GPS Location	Date	Land Use Category	Day Time		Noise Level (dBA) (LAeq)	Night time		Noise Level (dBA) (LAeq)
					Start	End		Start	End	
ISPL_NM_10	Sholmari (in between proposed no 02 and 03), Bhotemari Union, Kaliganj, Lalmonirhat	25.990555°N 89.160833°E	17.09.22	Silent	02:10 pm	02:40 pm	44.1	20:45 pm	21:15 pm	38.9
ISPL_NM_11	Sholmari (near proposed no-04), Bhotemari Union, Kaliganj, Lalmonirhat	25.990833°N 89.156666°E	17.09.22	Silent	04:00 pm	04:30 pm	43.2	22:25 pm	22:55 pm	39.4
ISPL_NM_12	Srutidhar, Bhotemari Union, Kaliganj, Lalmonirhat	25.976388°N 89.189166°E	18.09.22	Mixed	05:15 pm	05:45 pm	48.9	08:05 pm	08:35 pm	43.1

Notes:

- *The sound level standard and Land use category is based on the classification provided in the Noise Pollution Control Rules (2006)*
- *The sound level standards for residential area are 55 at day and 45 at night.*
- *The sound level standards for commercial area are 70 at day and 60 at night*
- *The sound level standards for mixed area are 60 at day and 50 at night*
- *The sound level standards for silent area are 50 at day and 40 at night*
- *Noise Level is the average noise recorded over the duration of the monitoring period*

The result shows that time weighted average value of the noise monitored inside the project site are within the standard set for residential, commercial, mixed and silent area. The reason could be for isolate area in the island. Vehicle and people movement was low. Construction machineries were observed also. The details analysis of the result is given in Appendix D of this report.

5.1.8.3 Surface Water Quality

Most of the water bodies contain minimum amount of water during the dry season and gets water in rainy season. People use the water for various purposes from the canal and ponds for washing, bathing and irrigation. The water samples were collected on 16th and 17th September 2022 (Figure-5.14). The surface water quality test results are shown in the Table-5.4.



Figure 5.14: Surface Water Sample Collection in the Project Corridor

Table 5.4: Surface Water Test Result

Parameters	Unit	ISPL_SW_01 26.003360˚N 89.160648˚E Teesta River, Kaliganj, Lalmonirhat	ISPL_SW_02 25.995500°N 89.169199°E Baniar Badh Omar Hajir Pukur, South Bhotemari, Kaliganj, Lalmonirhat	Standards for Inland Surface Water** (Best fishing practice)	Analysis Method
pH*	-	8.22	8.71	6.5-8.5	Multimeter
Temperature*	℃	32.4	30.6	NYS	Multimeter
Electricity Conductivity*	µs/cm	23.9	12.34	NYS	Multimeter
Salinity*	mg/L	10.9	7.16	NYS	Multimeter
Dissolved Oxygen (DO)*	mg/L	7.3	6.8	5 or more	DO Meter
Oxidation-Reduction Potential (ORP)*	mg/L	-135.9	-133.6	NYS	Multimeter
Calcium (Ca)	mg/L	3.65	1.78	75	Acid Digestion
Manganese (Mn)	mg/L	<0.05	<0.05	NYS	Acid Digestion
Arsenic (As)	mg/L	<0.02	<0.02	NYS	Acid Digestion
Biological Oxygen Demand (BOD_5)	mg/L	12	16	0.2	APHA/SM 5210B
Chemical Oxygen Demand (COD)	mg/L	45	65	4.0	APHA/SM 5220D

Parameters	Unit	ISPL_SW_01 26.003360˚N 89.160648˚E Teesta River, Kaliganj, Lalmonirhat	ISPL_SW_02 25.995500°N 89.169199°E Baniar Badh Omar Hajir Pukur, South Bhotemari, Kaliganj, Lalmonirhat	Standards for Inland Surface Water** (Best fishing practice)	Analysis Method
Phosphate (PO_4^{2-})	mg/L	<0.1	<0.1	10	Photometric Method
Sulphate (SO_4^{2-})	mg/L	17	<10	NYS	Photometric Method
Chloride (Cl^-)	mg/L	12.5	12.5	NYS	Titrimetric Method
Total Suspended Solids (TSS)	mg/L	117	48	5	APHA/SM 2540D

**Standards for inland surface water is followed by Environment Conservation Rule (ECR)'97
*On-site Test Result.
Source: Laboratory Test, September 2022

From the test results it is found that, TSS, BOD_5 and COD value did not maintain the national standard set by DoE for both of the project locations. The values of these have been exceeded. Higher BOD indicates more oxygen is required, which is less for oxygen-demanding species to feed on and signifies lower water quality. Adding hydrogen peroxide to the wastewater solution. The hydrogen peroxide will chemically attack the organics in the wastewater, degrading them and reducing the measured BOD_5. Higher COD levels mean a greater amount of oxidizable organic material in the sample, which will reduce dissolved oxygen (DO) levels. Infusing the wastewater solution with hydrogen peroxide. By chemically attacking the organics in the wastewater, the hydrogen peroxide will degrade them and lower the reported COD. If TSS is high and then light from the sun will not travel well through the water, making it difficult for plants and algae to grow. This can reduce productivity (the amount of plant and animal life that a river or lake can support) and oxygen generation. Filtration is the use of a medium through which stormwater passes in order to remove various pollutants.

5.1.8.4 Groundwater Quality

The groundwater samples were collected from two (02) different sources within the project influenced areas on 16th and 18th September 2022 (figure-5.15). The test results are given below in Table-5.5.



Behind Control Room of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat



Beside Labor Camp of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat

Figure 5.15: Groundwater Sample Collection in the Project Areas

Table 5.5: Groundwater Quality Test Result

Parameters	Unit	ISPL_GW_01 25.997331°N 89.152356°E Behind Control Room of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat	ISPL_GW_02 26.000501°N 89.153257°E Beside Labor Camp of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat	Standards for Groundwater**	Analysis Method
pH*	-	7.17	7.09	6.5-8.5	Multimeter
Temperature*	°C	27.2	27.1	20-30	Multimeter
Electricity Conductivity*	mg/l	13..33	13.31	NYS	Multimeter
Salinity*	mg/l	7.87	7.89	NYS	Multimeter
Total Dissolved Solids (TDS) *	mg/l	8.78	8.79	1000	Multimeter
Total Suspended Solid (TSS)	mg/L	2	3	NYS	APHA
Oxidation-Reduction Potential (ORP)*	mg/l	-65.9	-54.5	NYS	Multimeter
Calcium (Ca)	mg/L	3.93	0.66	75	ICP Analysis

Parameters	Unit	ISPL_GW_01 25.997331°N 89.152356°E Behind Control Room of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat	ISPL_GW_02 26.000501°N 89.153257°E Beside Labor Camp of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat	Standards for Groundwater**	Analysis Method
Arsenic	mg/l	<0.02	<0.02	0.05	ICP Analysis
Iron (Fe)	mg/l	2.30	2.34	0.3-1	ICP Analysis
Manganese (Mn)	mg/l	<0.5	<0.5	0.1	ICP Analysis
Chloride (Cl^-)	mg/l	12.5	12.5	150-600	Titrimetric
Total Coliform	mg/l	0	0	0	USEPA
Fecal Coliform	mg/l	0	0	0	Membrane Filtration

**Standards for groundwater is followed by Environment Conservation Rule (ECR)'97
*On-site Test Result.
Source: Laboratory Test, September 2022

5.1.8.5 Riverbed Sediment Quality

Sediment is solid material that is moved and deposited in a new location. Sediment can consist of rocks and minerals, as well as the remains of plants and animals. Sediment moves from one place to another through the process of erosion. Ekman Bottom Grabs sampler were used to collect riverbed sediment samples from the project area. The samples were first placed in plastic zipped lock bags and then transferred to hard plastic jars. The samples were collected on 16th and 17th September 2022 (figure-5.16).



Teesta River, Kaliganj, Lalmonirhat



Baniar Badh Omar Hajir Pukur, South Bhotemari, Kaliganj, Lalmonirhat

Figure 5.16: Riverbed Sample Collection in the Project Corridor

Table 5.6: Result of Riverbed Sediment Quality Analysis

Parameters	Unit	ISPL_PT_01	ISPL_PT_02	USEPA Standards for Sediment*	Analysis Method
		Teesta River, Kaliganj, Lalmonirhat	Baniar Bandh Omar Hajir Pukur, South Bhotemari, Kaliganj, Lalmonirhat		
		26.000113°N 89.159582°E	25.995623°N 89.170134°E		
Total Arsenic (As)	mg/kg	<5	<5	NYS	Acid Digestion Method
Total Mercury (Hg)	mg/kg	<2.5	<2.5	NYS	Acid Digestion Method
Total Zinc (Zn)	mg/kg	<10	<10	459	Acid Digestion Method
Total Lead (Pb)	mg/kg	<5	<5	128	Acid Digestion Method
Total Cadmium (Cd)	mg/kg	<0.05	<0.05	4.98	Acid Digestion Method
Total Chromium (Cr)	mg/kg	<5	<5	NYS	Acid Digestion Method

All the parameters are within the USEPA standards for riverbed sediment.

5.1.8.6 Plankton Quality

Plankton are incredibly important to the aquas ecosystem and very sensitive to changes in their environment including in the temperature, salinity, pH level and nutrient concentration of the water. Plankton samples were collected on 17th and 18th September 2022 from the project corridor (figure-5.17). Results of plankton analysis are given in Table-5.7.



Figure 5.17: Plankton Sampling in the Project Corridor

Table 5.7: Result of Plankton Sample Analysis

Location & Sample ID	Ecosystem	Results	Comments (If any)
Teesta River, Kaliganj, Lalmonirhat **(ISPL_PT_01)**	Teesta River	Phytoplankton Pandorina sp. (Volvocaceae)- 3 Zooplankton: Nauplius (Crustacean)- 1 Cyclops (Copepoda)- 1	Phytoplankton: 3,600 indv./ cu.m. Zooplankton: 2,400 indv./ cu.m
Baniar Badh Omar Hajir Pukur, South Bhotemari, Kaliganj, Lalmonirhat **(ISPL_PT_02)**	Local Waterbody near Teesta River	Phytoplankton: Volvox sp. (Volvocaceae)- 8 Zooplankton: Nauplius (Crustacean)- 3 Cyclops (Copepoda)- 2	Phytoplankton: 8,000 indv./ cu.m. Zooplankton: 5,000 indv./ cu.m

NB: Results are analyzed based on the plankton diversity Species in One ml sample (random)

5.1.8.7 Benthos Quality

Benthos is the community of organisms that live on, in, or near the seabed, river, lake or stream bottom, also known as the benthic zone. The quality of the local benthos was

identified to investigate the current condition and compare it with the baseline status to see if any alteration occurred due to the ongoing construction and if so then to take appropriate mitigation measures. Benthos samples were collected on 17th and 18th September 2022 from the project corridor (Figure-5.18).



Figure 5.18: Benthos Sampling in the Project Corridor

During the survey period, the survey team could not find any live benthic species from the project area. However, several, broken mollusk species are noticed in the project area during the sampling. The contractor should take measures for benthic analysis of the project area during the construction stage as per the monitoring and management plan.

5.1.9 Hydrology

The sources of water in Bangladesh are surface water, groundwater and rainwater. The Ganges- Brahmaputra-Meghna River system discharges huge amount of surface water through Bangladesh, a part enters into ground to form groundwater. About 93% of the stream flow passing through the country originates from outside the Bangladesh (Khan, 1993). Rainfall within country contributes to the total water available in Bangladesh, a part of which infiltrates into ground to recharge existing groundwater and the remaining rainwater flows as surface run-off. These sources of water available for the development of water supplies have their relative advantages and disadvantages in Bangladesh context.

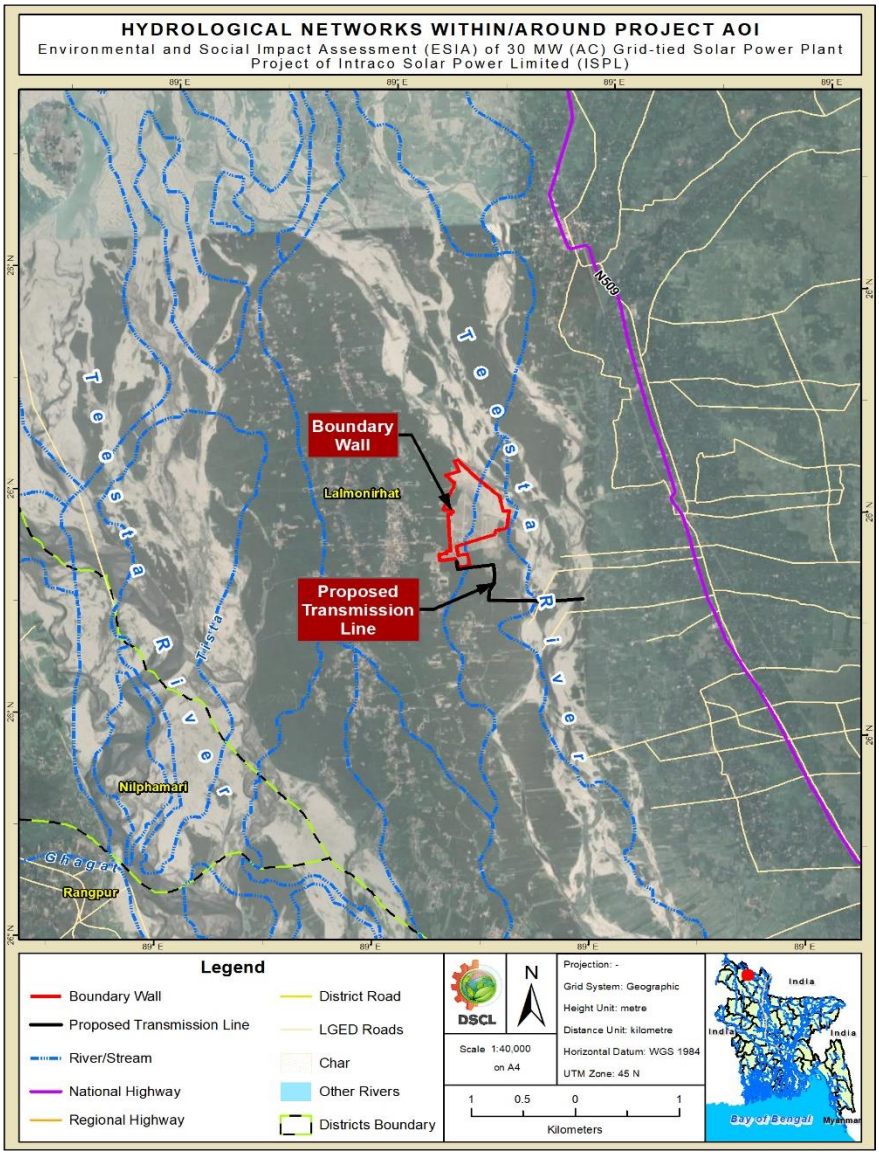


Figure 5.19: Hydrological Map of the Project Area

The project area is surrounded by the Teesta River. There are also significant numbers of natural water bodies around the project location. Most of the water bodies near the project location become dry during dry season or contain minimum amount of water and full of water in rainy season. People use the water from the river and ponds for washing, bathing and irrigation purposes. In the wet season, substantial amount of the land in the area is inundated due to flood.

5.1.10 Agro-ecological Zones

A 1988 study carried out by the United Nations Development Program (UNDP) classified Bangladesh into a series of Agro-ecological Zones (AEZs) based on an assessment of commonalities in characteristics such as physiography, soil types, climate and drainage. In total, 34 regions were identified and characterized. The purpose of assessing the AEZs within the project area is to establish a broad overview of expected soil conditions which can be compared against more detailed, Upazila-level data sources.

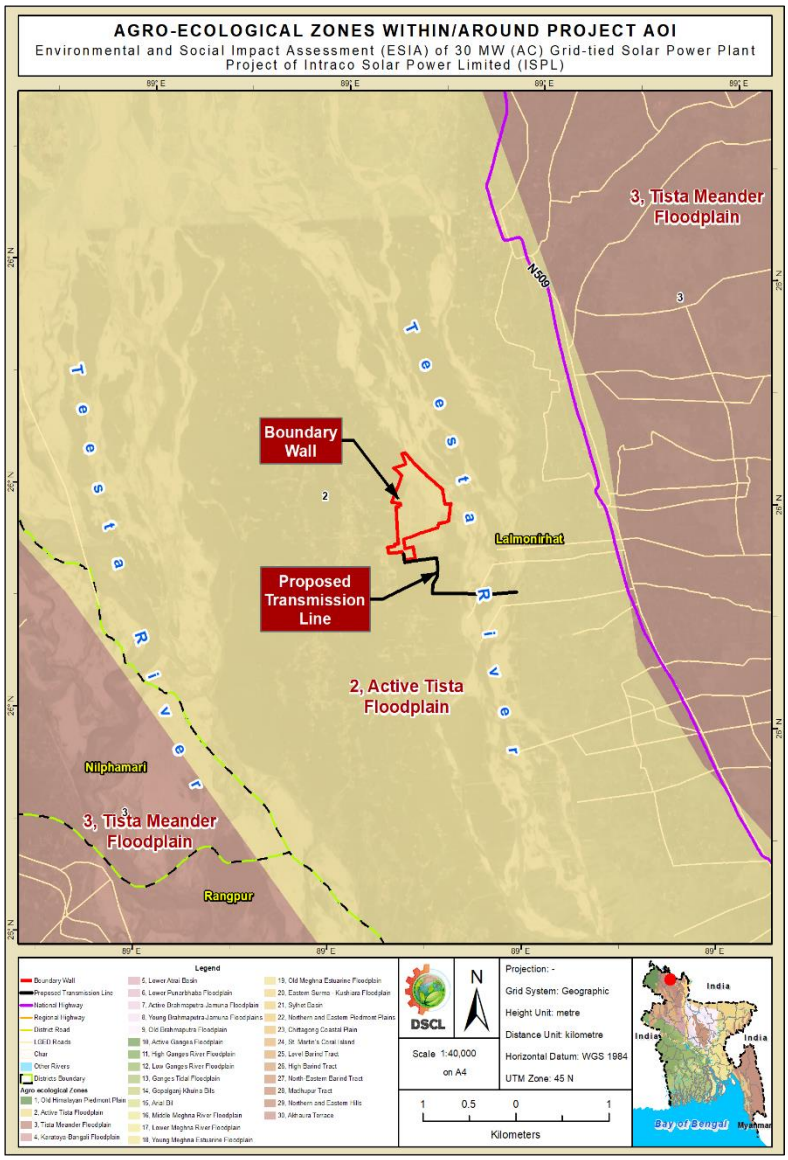


Figure 5.20: Agro-ecological Map of the Project Area

The project area falls under the active Tista Floodplain as per the classification which is mainly occupied by the Recent alluvial and floodplain sediments. Tista floodplain covers most of Rangpur and adjoining regions that actually lies in the younger part of Tista alluvial fan that covers several different landscapes. Physically, the floodplain stretches between the Himalayan Piedmont Plain in the west and the right-bank of the north-south flowing Brahmaputra in the east. monsoon climate dominates this region where rainfall is abundant. The average annual rainfall in this region is little over 1,900 mm. Tista is the prominent river of this region, which has a mean monthly discharge of about 2,430 cumec

5.2 Ecological Environment

In order to provide representative ecological status for the project a study area is defined for ecological study. Therefore, project development area and 1.5-km radius surrounding the project site is considered as the "buffer zone" or the zone of influence of the project.

Baseline survey was carried out to determine the existing ecological conditions and was designed to fill any data gaps, and to facilitate an adequate assessment of the project's impacts upon ecology and the development of appropriate mitigation measures. Survey was conducted in 28th -30th August 2020 for Fishing survey, flora & faunal diversity in the study area. Baseline survey has two parts- (i) Secondary data collection and (ii) Primary data collection.

To achieve the above objectives, floristic and ecological survey covering 1.5 km radius around the proposed site was carried out. The survey included:

- Reconnaissance Survey;
- Generation of primary data to understand baseline ecological status of floral and faunal diversity, sensitive habitats and rare species;
- Interviews and discussion with local informants;
- Review of IUCN-Bangladesh Red Data Book relevant to the area.

5.3 Terrestrial Flora and Fauna

5.3.1 Flora Survey

The field surveys involve the preparation of an inventory of different species of plants including trees, shrubs, economic plants in the plant community of the area. The observations were also made on the agricultural patterns, agricultural weeds and cultivated and introduced plant species. The documentation of the plant communities was done by random walk through the study area and visual observations. Some of the floral Species found in the Study area is presented in Table 5.8 below.

Table 5.8: List of identified Terrestrial Flora in and around the Project Area

Species Name	Local Name	Family
Albizia saman	Rain Tree	Fabaceae
Abroma augusta	Ulat kambal	Malvaceae
Acacia moniliformes	Akashmoni	Leguminosae
Areca catechu	Supari	Palmae
Azadirachta indica	Neem	Meliaceae
Borassus flabellifer	Taal	Arecaceae
Cocos nucifera	Narikel	Palmae
Artocarpus heterophyllus	Kanthal	Moraceae
Bambusa vulgaris	Bansh	Poaceae
Ficus benghalensis	Bot	Moraceae
Carica papaya	Pepe	Caricaceae

Species Name	Local Name	Family
Ficus religiosa	Oshwoth	Moraceae
Mangifera indica	Aam	Anacardiaceae
Shorea robusta	Shal	Dipteocarpaceae
Salmaliama labarica	Shimul	Malvaceae
Phoenix sylvestris	Khejur	Palmae
Streblus asper	Shewra	Moraceae
Swietenia macrophylla	Mahogony	Meliaceae
Tamarindus indica	Tentul	Leguminosae
Terminalia arjuna	Arjun	Combretaceae
Tectonia grandis	Shegun	Lamiaceae
Psidium guajava	Peyara	Myrtaceae
Albizia lebbeck	Koroi	Fabaceae

Legend: C=Climber, CH=Climbing Herb, CS=Climbing Shrub, D=Dicot, F=Fern, FH=Fern Herb, G=Gymnosperm, M=Monocot, SS=Scandens Shrub, ST=Small Tree, T=Tree

In figure 5.21, there are some photographs s of floras inside the project area.


Castor Bean


Weeds


Weeds


Castor Bean


Vati Flower


Banana


Bamboo


Banana+ German Lata


Royna

		
Jibon	Paddy	Paddy
		
Bean	Banana+Woodapple	Sisso+Mahagony
		
Sisso+Mahagony	Pomelo	Ipill ipill
		
Pumpkin	Cardamom	Fern
		
Sisso	Mango+Royna	Pomelo

		
Bean+Turmeric	Bean	Wildbean

Figure 5.21: Identification of some Flora of the Project Area

5.3.2 Fauna Survey

Terrestrial fauna survey studies help to understand the wellbeing of a nature and functioning of ecosystems. It helps to monitor biological richness or heritage quality, habitat change and quantifying threatening species. Animals and birds in the study area were documented using following means:

- Secondary sources and published literature
- By interviewing local people
- Actual sighting
- Indirect evidence (pallets, dung, droppings, scat, marking on the trunks etc.)
- Nesting (birds, burrows for small mammals)

The records for the birds, mammals and other faunal groups were made at the same site where vegetation observation was carried out. Most of the records of the mammalian and reptilian fauna are opportunistic, nonetheless very useful to understand habitat specificity and interrelationship between certain floral and faunal elements and also between certain geological and faunal features. Some of the faunal Species found in the Study area is presented in Table-5.9 below.

Table 5.9: List of Fauna in the Project Influenced Area

Species Name	English Name	Local Name
Class: Amphibian		
Rana tigrina	Indian bull frog	Kula bang
Bufo melanostictus	Common toad	Kuno bang
Rhacophorus leucomystax	Tree frog	Gecho bang
Class: Mammalia		
Mus musculus	Mouse	Nengtiindur
Capra aegagrushircus	Goat	Chagol
Canis lupus familiaris	Dog	Kukur
Ovis aries	Sheep	Bhera
Bos tauras	Cow	Goru
Bubalus bubalis	Wild buffalo	Mohish
Herpestese dwardsii	Mongoose	Beji
Sciurus carolinensis	Grey Squirrel	Kath birali
Canis aureus	Jackal	Sheyal
Macaca fascicularis	Monkey	Banor
Rattus rattus	Rat	Indur
Viverra zibetha	Large Indian Civet	Khatash
Felis chaus	Jungle cat	Bon biral
Class: Aves		
Spilopelia chinensis	Spotted dove	Tilaghughu
Passer domesticus	House sparrow	Charui
Milvus migrans	Black kite	Cheel
Amaurornis phoenicurus	Water fowl	Dahuk
Anatidae anatidae	Duck	Hash
Picononotus barbatus	Common bulbul	Bulbuli
Acrido therestristis	Common myna	Shalik
Copsychus saularis	Magpie robin	Doyel
Eudynamys scolopacea	Asian cuckoo	Kokil
Egretta garzetta	Little egret	Bok
Corvus splendens	Crow	Kaak
Tyto alba	Barn owl	Pecha
Gallus gallus	Wild cock	Murgi
Melopsittacu sundulatus	Budgerigar	Tia pakhi
Orthoto mussutorius	Common tailorbird	Tuntuni

In figure 5.22, there are some figures of faunas inside the project area.



Hen



Duck



China-duck

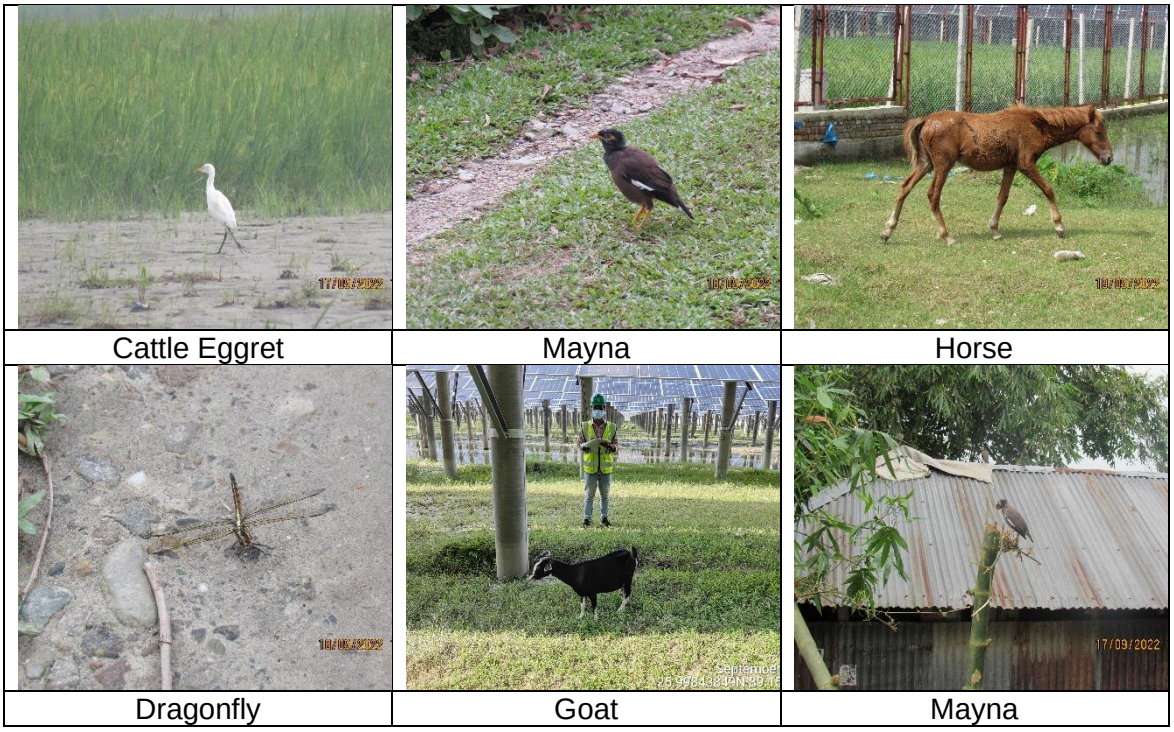


Figure 5.22: Identification of some Fauna of the Study Area

5.4 Aquatic Flora and Fauna

5.4.1 Aquatic Flora

Aquatic Floras are plants that have adapted to living in aquatic environments (saltwater or freshwater). They are also referred to as hydrophytes or macrophytes. These plants require special adaptations for living submerged in water, or at the water surface. The most common adaptation is aerenchyma, but floating leaves and finely dissected leaves are also common. Aquatic plants can only grow in water or in soil that is permanently saturated with water.

Different types of aquatic flora species were recorded in the project area. Some of the flora Species found in the Study area is presented in Table 5.10 below.

Table 5.10: List of identified Aquatic Flora in and around the Project Area

Sl. No.	Scientific Name	Local Name	Type	Habit	Family
1.	*Alternanthera philoxeroides*	Helencha	D	H	Amaranthaceae
2.	*Catharanthus roseus*	Nayan tara	D	H	Apocynaceae
3.	*Centella asiatica*	Thankuni	D	H	Apiaceae
4.	*Eriochloa procera*	Nalghas	M	H	Poaceae
5.	*Ipomoea mauritiana*	Kolmi	D	H	Convolvulaceae

Legend: C=Climber, CH=Climbing Herb, CS=Climbing Shrub, D=Dicot, F=Fern, FH=Fern Herb, G=Gymnosperm, M=Monocot, SS=Scandens Shrub, ST=Small Tree, T=Tree

Some photographs of aquatic flora are given below in Figure 5.23.

		
Water lily	waterhyacinths	Kalmi-lata

Figure 5.23: Identification of some Aquatic Flora of the Study Area

5.4.2 Aquatic Fauna

Aquatic Faunas are therefore a common component of wetlands. An aquatic fauna is an animal, either vertebrate or invertebrate, which lives in water for most or all of its life. Many insects such as mosquitoes, mayflies, dragonflies and caddisflies have aquatic larvae, with winged adults. Aquatic faunas may breathe air or extract oxygen from that dissolved in water through specialized organs called gills, or directly through the skin. Different types of aquatic fauna species were recorded in the project area. Photographs of several fishes are shown below in figure 5.24.

		
Thai-Puti	Rui	Ziol

Figure 5.24: Identification of Aquatic Fauna of the Study Area

5.5 Cultural Heritage

Primary data have been collected by the environmental survey team to find out about the cultural heritage of the project area. A 1.5 km buffer from the project location and 500-meter buffer along the transmission line is followed for identification of the cultural heritage as well as environmentally sensitive features. As per the observation, no known remarkable archeological or historically important structure and protected areas are reported in the project site.

5.6 Environmental and Social Hotspot/Sensitive location:

Primary data was collected in and around the project location regarding the identification of sensitive location or environmental and social hotspot of the project area. 1.5 km buffer zone area are considered for the survey. Under the project upazila, (Lalmonirhat) there are seven (07) colleges, thirty-nine (39) secondary schools, one hundred and thirty (130) primary school, and one seventy-four (174) madrasas are present. However, the nearest identified features are provided in the figures 5.25.

	
Shrutidhar Talim Ul Quran Madrasa, Shrutidhar, Lalmonirhat	Kaliganj Upazilla Health Complex, Kaliganj, Lalmonirhat
	
Late Ibrahima Jame Mosque, Tushabhander, Lalmonirhat	Late Ibrahima Jame Mosque Graveyard, Tushabhander, Lalmonirhat
	
Kashiram Shatirpar Govt Primary School, Kaliganj, Lalmonirhat	Bot Tola Jame Mosque, Kaliganj, Lalmonirhat

	
Union Health and Family Planning Development Center, Bhotemari, Lalmonirhat	1 No. Bhotemari Union Parishad, Bhotemari, Lalmonirhat
	
Ali Fruits and Cold Storage, Bhullar Hat, Lalmonirhat	Shrutidhar Jamirbari Primary School, Shrutidhar, Lalmonirhat
	
Bot Tola Eidgah Field, Bhullar Hat, Lalmonirhat	Bhullar Hat Islamia Dakhil Madrasa, Bhullar Hat, Lalmonirhat

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<tr><td>South Bhotemari Jame Mosque, Bhotemari, Kaliganj, Lalmonirhat</td><td>South Bhotemari Eidgah Field, Bhotemari, Kaliganj, Lalmonirhat</td></tr>
<tr><td> 
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<tr><td>Shrutidhar Islamic Foundation, Shrutidhar, Lalmonirhat</td><td>South Kashiram Gofur Govt Primary School, Tushbhander, Lalmonirhat</td></tr>
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<tr><td>Karimpur Dakhil Madrasa, South Bhotemari, Kaliganj, Lalmonirhart</td><td>Shrutidhar Choumohuni Solimuddin Forkania Madrasa, Shrutidhar, Lalmonirhat</td></tr>
</table>

Figure 5.25: Photographs of Important Institutions around the project area

A location map is provided with the calculated distance from project area to the nearest environmental and social features in the below figure.

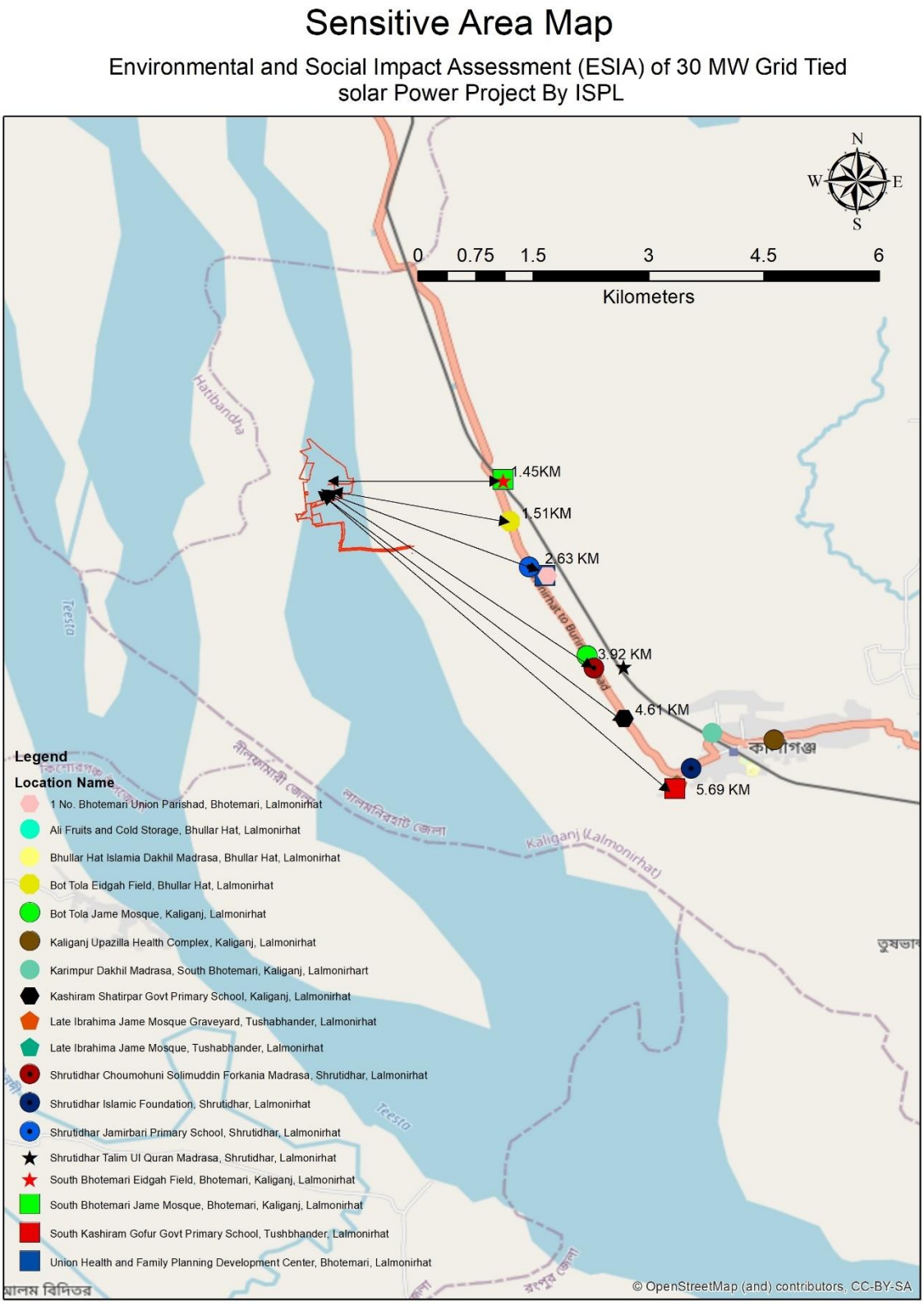


Figure 5.26: Sensitive Area Map with distance from the Project Area

5.7 Socioeconomic Study

5.7.1 Information from Secondary Source

Information about the socioeconomic status of the project location is collected from the Secondary source like Bangladesh Bureau of Statistics (BBS),2011 and relevant documents of the upazila and union. Some of the key statuses of the socioeconomic features are discussed in below sections.

5.7.1.1 Demography

Kaliganj Upazila covers an area of 62575 acres, located in between 25°54' and 26°04' north latitudes and in between 89°07' and 89°22' east longitudes. It is bounded by Hatibandha upazila and West Bengal of India on the north, Gangachara and Aditmari upazilas on the south, Aditmari upazila on the east, Kishoreganj (Nilphamari district) and Jaldhaka upazilas on the west. This upazila consist of 58138 households with a total population of 2,45,595 person.

(Source: BBS, 2011)

5.7.1.2 Religion

The Muslims are major in number on the perspective of religious belief and activities in the Kaliganj upazilla, Lalmonirhat district. Below table shows the population ratio according to the different religions.

Table 5.11: Population Distribution by Religion

Total Population	Muslim	Hindu	Buddhist	Christian	Others
245595	202623	42561	182	22	207

Source: BBS,2011

5.7.1.3 Transportation

Kaliganj is one of the upazillas located under Lalmonirhat district. The district is connected by two Roadways; one is from Rangpur via N506 which go towards Lalmonirhat from Mostofi bus stand. Another one is from Paglapir (N5) to Lalmonirhat Sadar over Gangachara Sheikh Hasina Bridge.

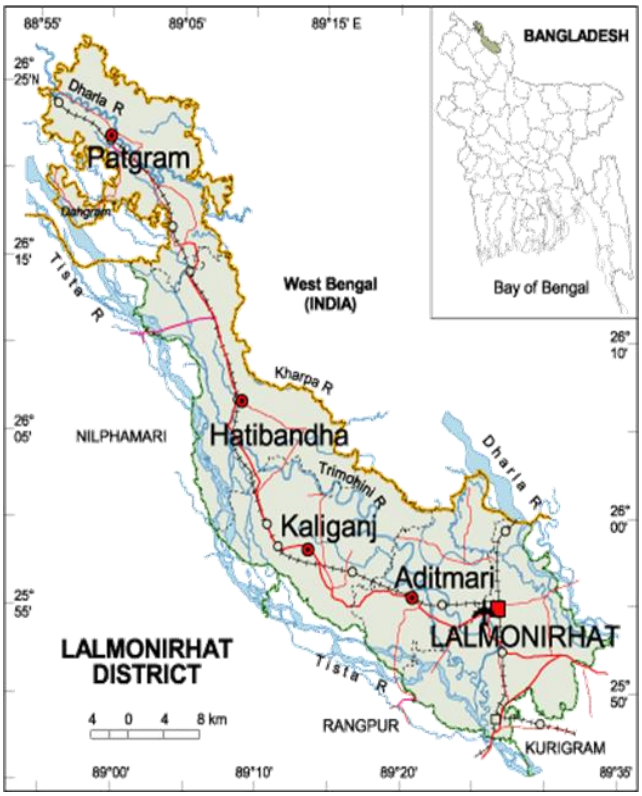


Figure 5.27: Road Map of Lalmonirhat district

Roads and Highways Department has a plan to improve the condition of Nageshwari-Kashipur-Fulbari-Kulaghat-Lalmonirhat District Highway (Project Code-224317300). The project will be funded by Bangladesh Government.

Table 5.12: Sub-project List of Improvement of Nageshwari-Kashipur-Fulbari-Kulaghat-Lalmonirhat District Highway

RHD code	Project name	Executing office
0418 -89537	Improvement of Nageshwari-Kashipur-Fulbari-Kulaghat-Lalmonirhat District Highway. (Project Code-224317300)	Rangpur
0418 -89560	Improvement of Nageshwari-Kashipur-Fulbari-Kulaghat-Lalmonirhat District Highway. (Project Code-224317300)	Lalmonirhat
0418 -89564	Improvement of Nageshwari-Kashipur-Fulbari-Kulaghat-Lalmonirhat District Highway. (Project Code-224317300)	Kurigram

Source:https://www.rhd.gov.bd/Project%20Monitoring/SingleProjectDetails.asp?SelectedProjectID=4660&SelectedFiscalYear=2022

The main modes of public transport in this region are rickshaws and intercity buses. Cycle rickshaws are widely used for short trips. In recent years the auto rickshaw has also become very popular. Traffic management is almost non-existent. Safety signs and road markings are also inadequate. The central bus terminal is located in Phulbari road. There are no formal parking facilities for rickshaws, auto-rickshaw and trucks, which usually occupy significant road space in the city area. The main railway station is located in 31.6 km far from the Kaliganj Sadar upazilla. By the turn of the century Lalmonirhat district had emerged as an important railway center.

5.7.1.4 Access to Electricity

According to Banglapedia, all the wards and unions of the whole Lalmonirhat district are under electrification network. However, 13.26% of the dwelling households have access to electricity.

5.7.1.5 Solid waste disposal

The proposed project involves setting up of a 30 MW (AC) coupled solar photovoltaic based grid by Intraco Solar Power Ltd. at Bhotemari, Kaliganj, Lalmonirhat district. The proposed system will include 30 MW on-grid solar PV panels. The wastages will be dumped in a designated area inside ISPL premises and later it will be dumped to the government approved site of Lalmonirhat district. The project authority will also ensure the reuse or recycle of the wastage material for minimum impact to the environment.

5.7.1.6 Land Resource

The project is a private investment project and the project authority does not have any land acquisition issue for this solar project. Project authority has leased 58.04 acres of land from the government and bought 39.99 acres of land. The project authority has bought the required private land from the respective owners of kaligonj upazila under Lalmonirhat district with a win-win approach where both of them can be benefitted. As most of the land is barren land the land owners have willingly sold them to the Intraco Solar Power Limited.

5.7.1.7 Indigenous People

As per the survey team's observation and consultation with local people, no indigenous people were observed in the project area.

5.7.2 Information from Primary Source (Survey)

Primary data collection was conducted by the environmental and social survey team in the Botemari union (the project area) in order the find out about the quality of life of the people living in the project area. A questionnaire is developed in this regard which is followed during the survey. The respondents were selected from the surrounding area to understand and assess the socio-economic conditions of the project area.

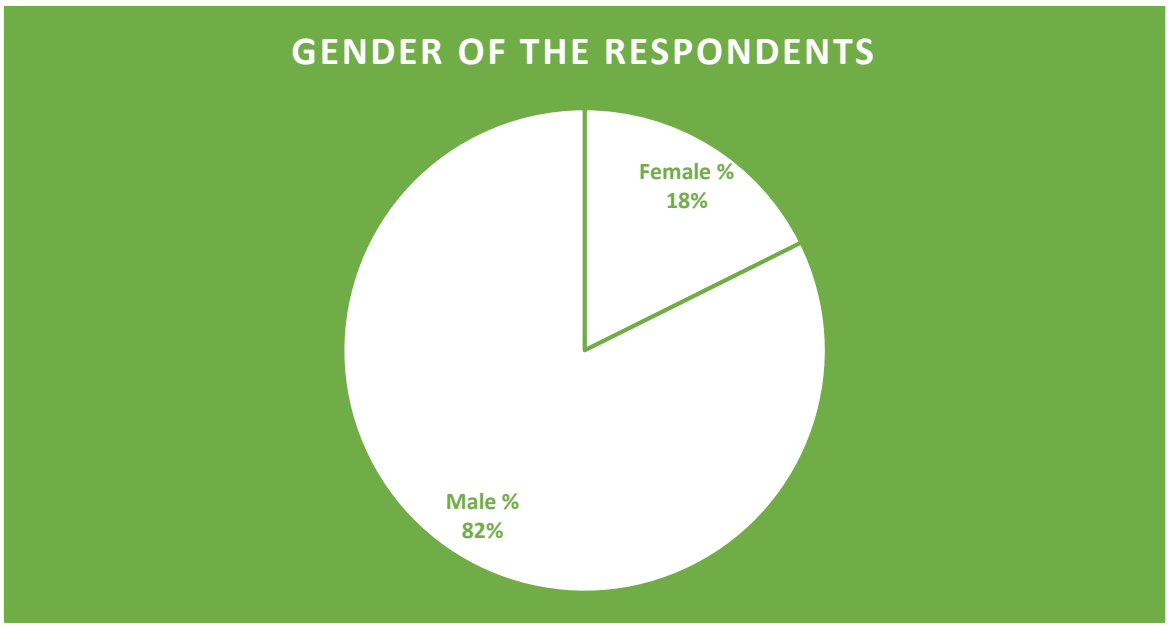
pedestrians survey and several household surveys were conducted during the site visit. Old personnel, women, children, labors and people from various other professions are considered in the survey. Some photographs of the survey are provided in the below figure (Figure 5.28). The questionnaire of the socio-economic survey is added in the Appendix J of this report.



Figure 5.28: Socio-economic Survey in the project area

5.7.2.1 Gender Distribution

From the survey data analysis, it is found that, only 18% female of the project area responded to the questions of the study whereas males were 82%. The gender distribution of the respondents in the project area is represented in the following pie chart.

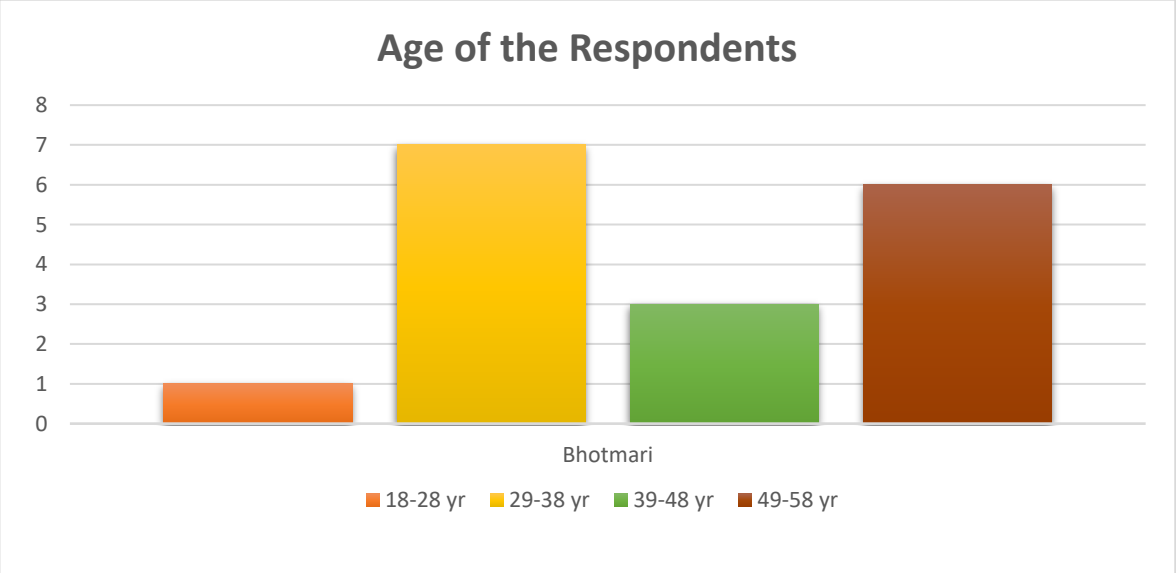


Source: DSCL Census and SES survey, 2022

Figure 5.29: Gender of the Respondents

5.7.2.2 AGE

The surveyed people were from the age of 18 to 58 years old. However, it is found that 29-38 years old people were the majority of the respondents.

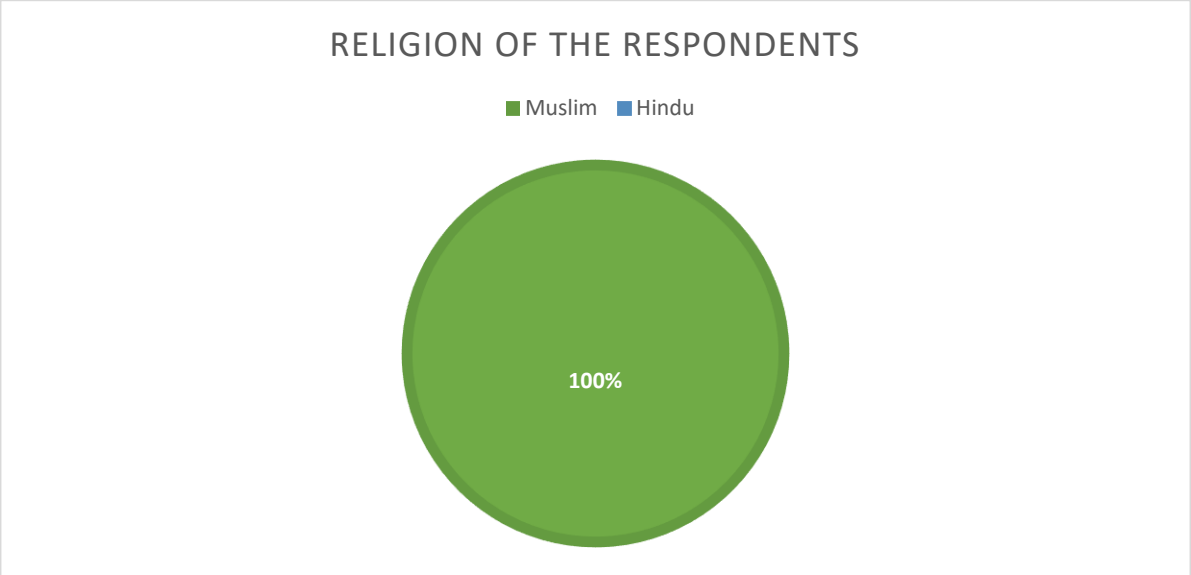


Source: DSCL Census and SES survey, 2022

Figure 5.30: Age of the Respondents

5.7.2.3 Religion

The survey was conducted in a random sampling method, and it is found that all the respondents of the survey were Muslims.

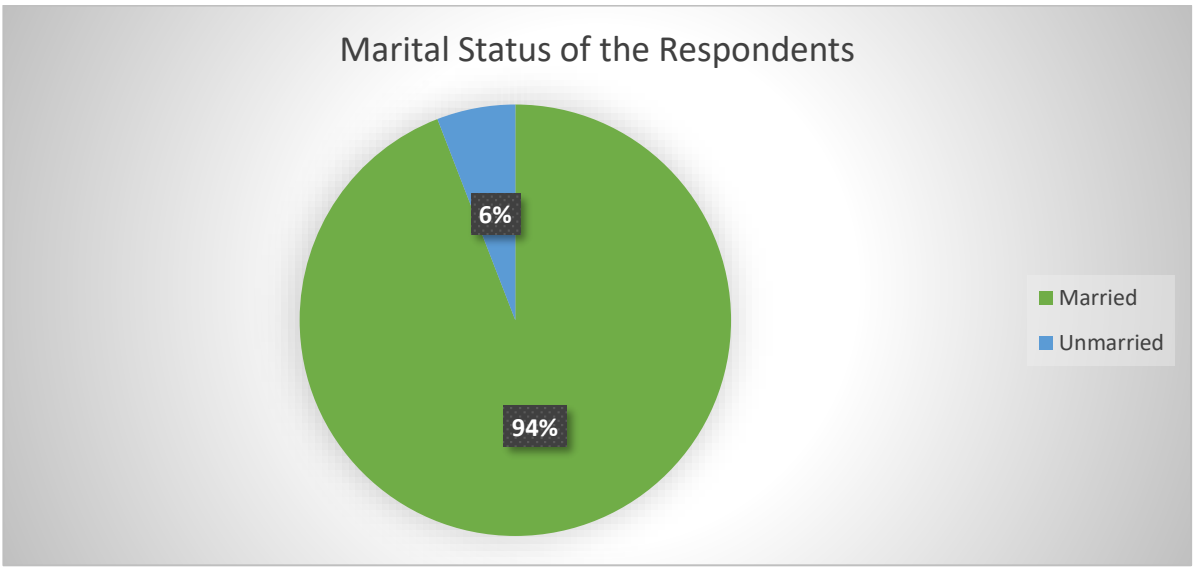


Source: DSCL Census and SES survey, 2022

Figure 5.31: Religion of the Respondents

5.7.2.4 Marital status

The designing of the survey, collection and analyzation of data was undertaken in such a way which adequately identify gender differences and gender specific impacts. The distribution of the total respondents' actual marital status; wherefrom is evident that 6% respondents were unmarried, whereas 94% of them were married

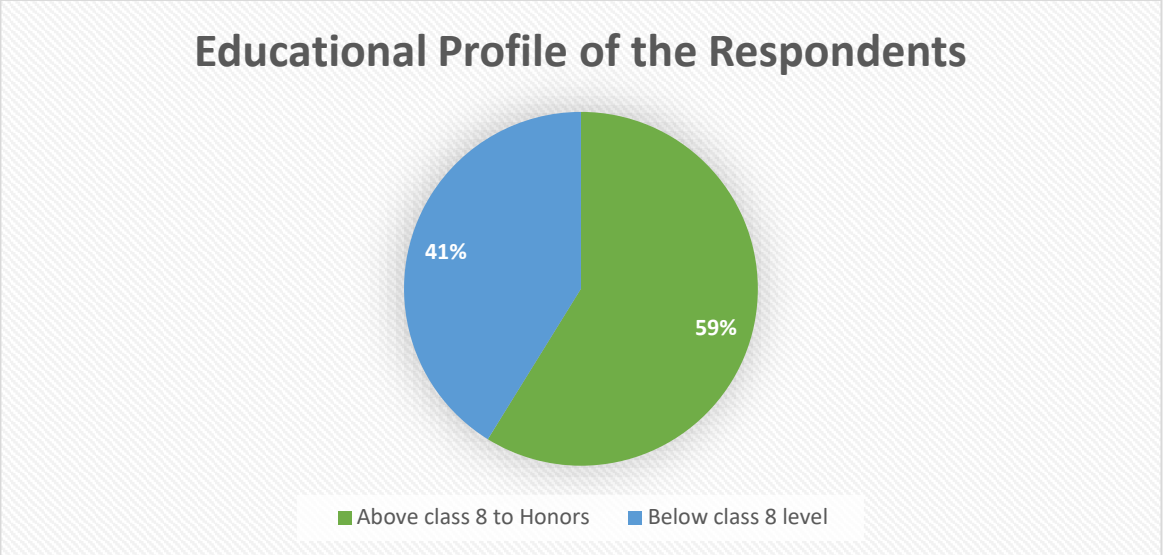


Source: DSCL Census and SES survey, 2022

Figure 5.32: Marital Status of the Respondents

5.7.2.5 Education

The level of education was identified through seriocomic survey in the project area, from the survey it is found that, about 59% of the people have average literacy with class 8 to honors level of education, whereas 41% of the surveyor are below the level of class 8 education level.

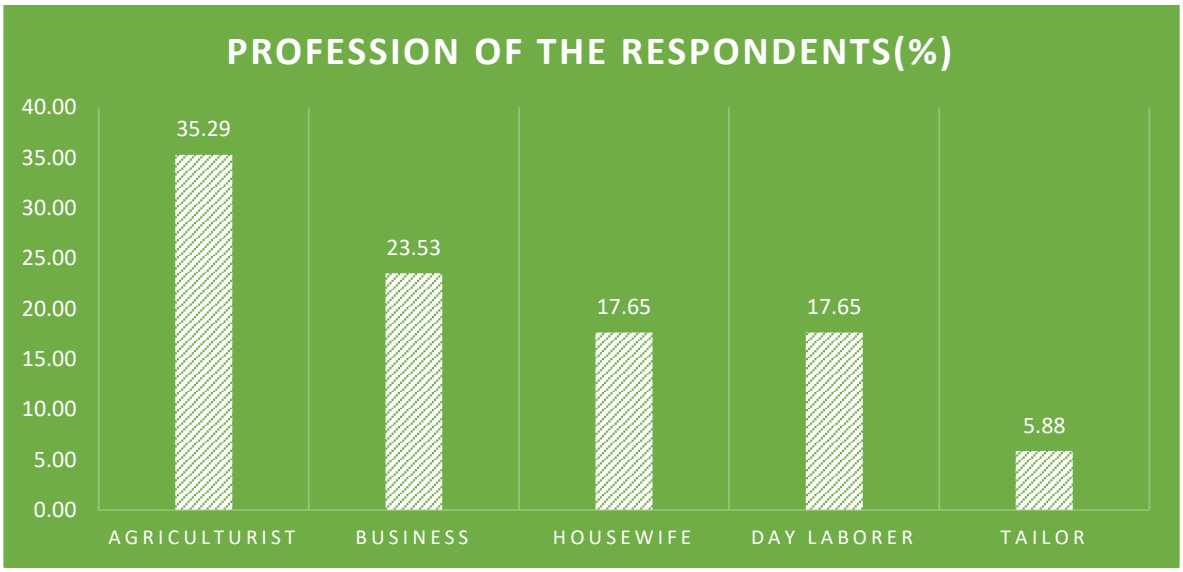


Source: DSCL Census and SES survey, 2022

Figure 5.33: Education Profile of the Respondents

5.7.2.6 Profession

The following graph presents the distribution of profession among the respondents of the project area survey It is found that, about 35.29% of the respondents are agriculturist, 23.53% are businessman, 17.65% are housewives, 17.65% are day labour and 5.88% work as a tailor.

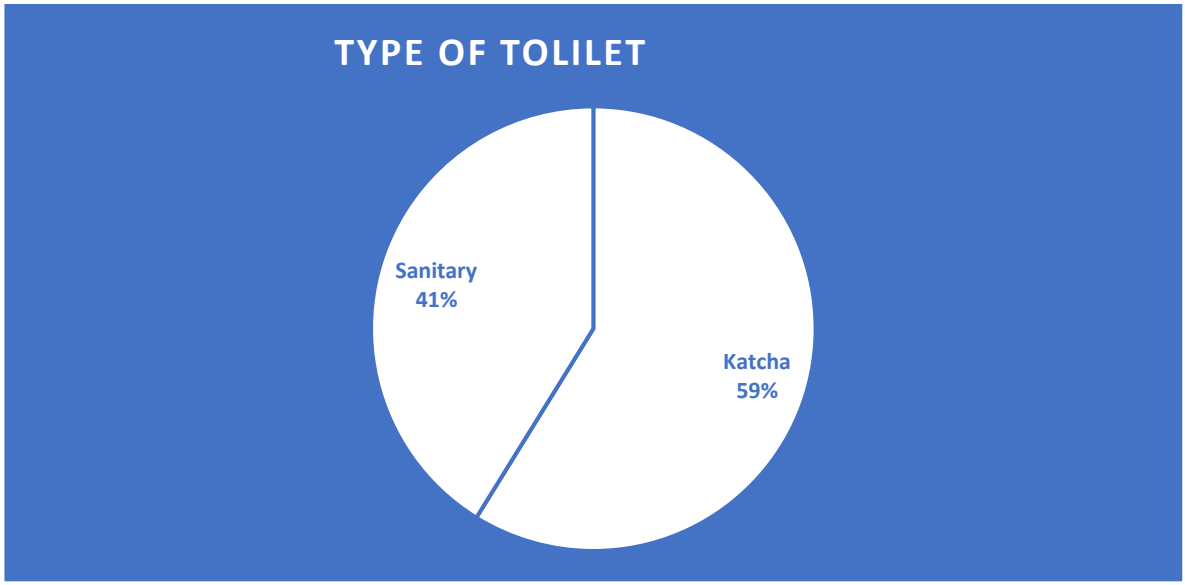


Source: DSCL Census and SES survey, 2022

Figure 5.34: Profession of the Respondents (%)

5.7.2.7 Type of Toilet

From the survey of the project area, it is found that, about 41% of survey respondents' use sanitary latrines whereas about 59% use katcha latrines in the project area.

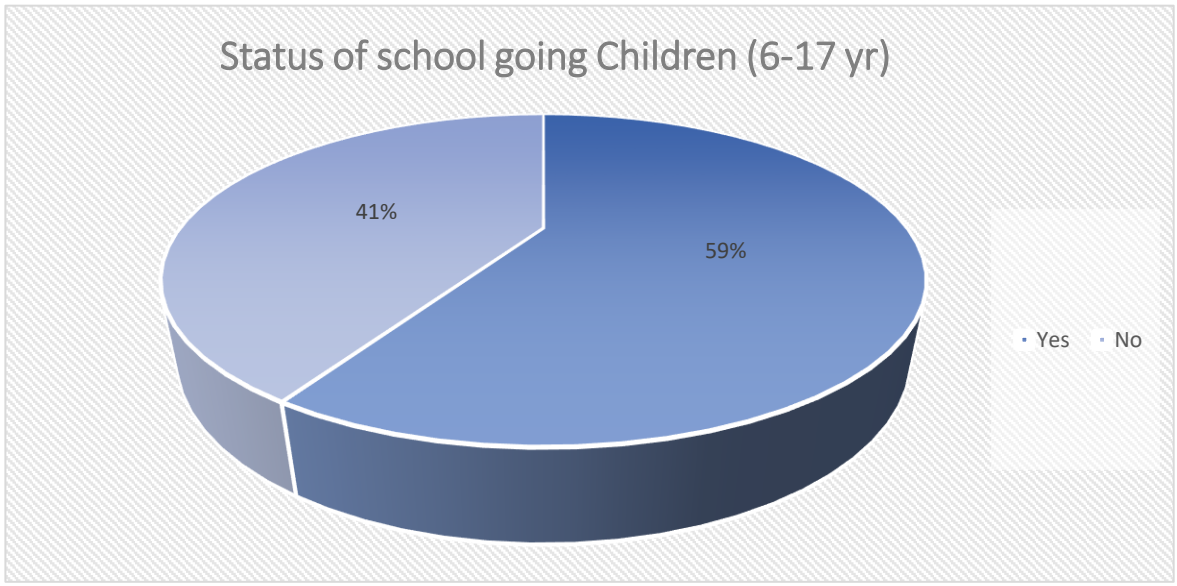


Source: DSCL Census and SES survey, 2022

Figure 5.35: Type of Toilet in the project area

5.7.2.8 Child education

As shown in below figure, 59% of the child with an age of (6-17) go to Scholl, whereas about 41% do not go to school.

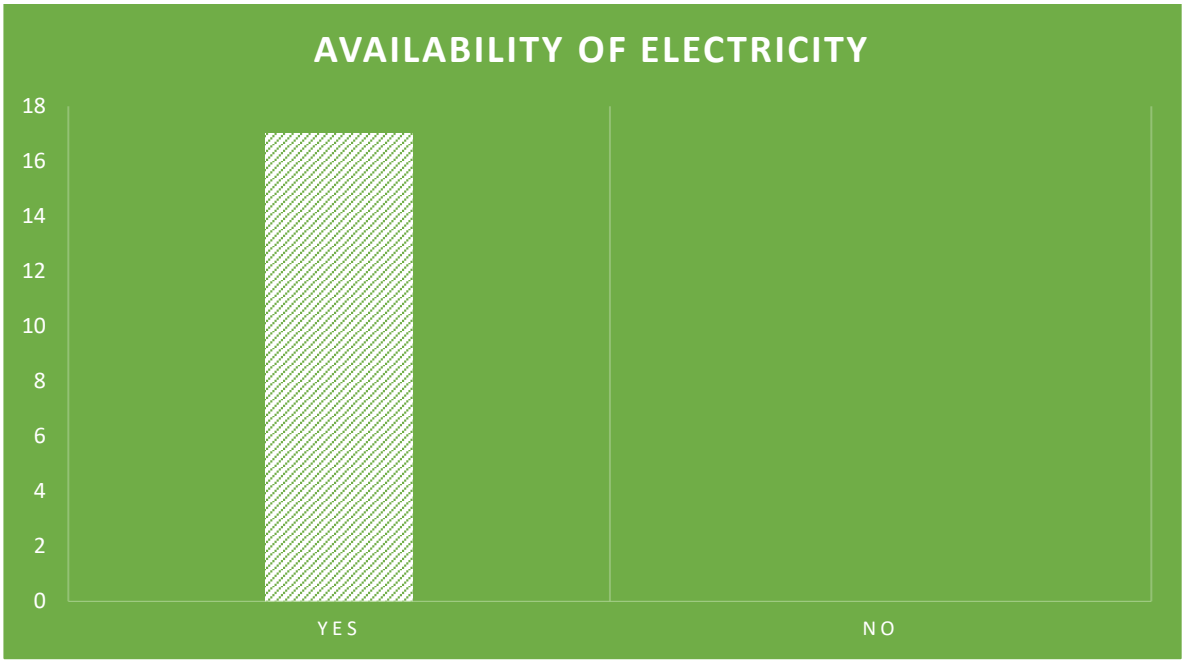


Source: DSCL Census and SES survey, 2022

Figure 5.36: Status of Scholl Going Children

5.7.2.9 Status of Electricity

As per the information from the survey respondents, it is found that, almost all of the households have electric connection, although they do not get sufficient amount of electricity due to high demand of whole country.

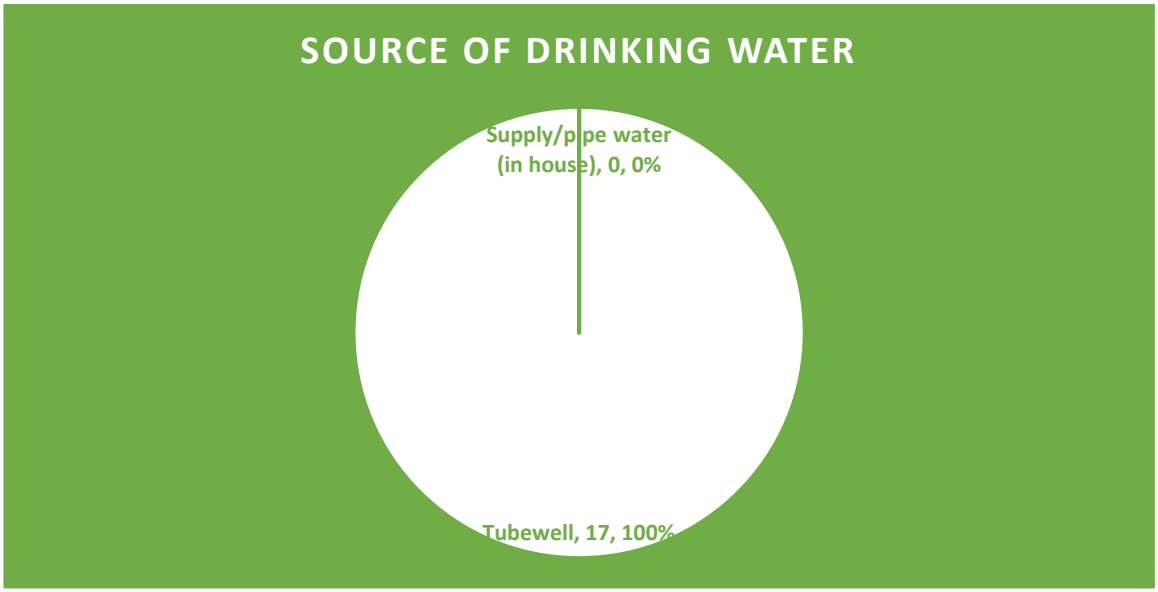


Source: DSCL Census and SES survey, 2022

Figure 5.37: Availability of Electricity in the project area

5.7.2.10 DW Source

100% of the people of the survey respondents says that they use tube well water for drinking purpose as show in the below figure.



Source: DSCL Census and SES survey, 2022

Figure 5.38: Source of Drinking water in the Project area

5.7.2.11 Availability of Livestock

As a part of socioeconomic survey, 82.35% respondents' responses that they have livestock in their households whereas 17.65% responses for not having any livestock

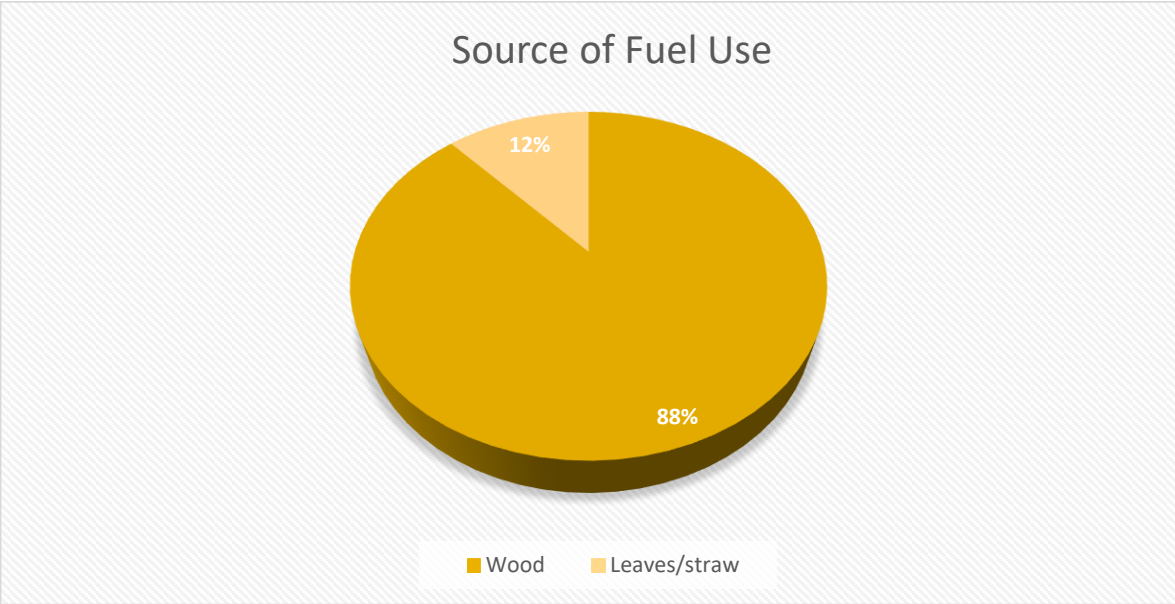


Source: DSCL Census and SES survey, 2022

Figure 5.39: Availability of Livestock

5.7.2.12 Source of fuel

Based on the socio-economic survey data gathered from the project area, it is found that about 88% of the respondents use wood as a source of fuel whereas 12% respondents use leaves/straw for cooking purpose.

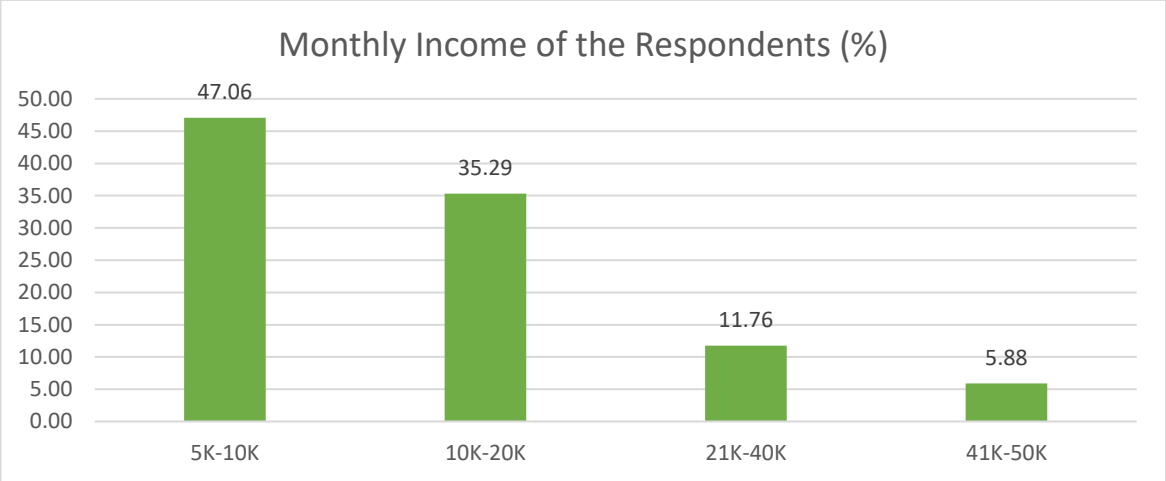


Source: DSCL Census and SES survey, 2022

Figure 5.40: Source of Fuel used by people in the project area

5.7.2.13 Income status

As per the survey data, it is found that, about 47.06% of the people has income over 5-10 Thousand taka, 35.29% has income over 10-20 Thousand taka, 11.76% has income over 21-40 Thousand taka and 5.88% people have income over 41-50 Thousand taka per month.

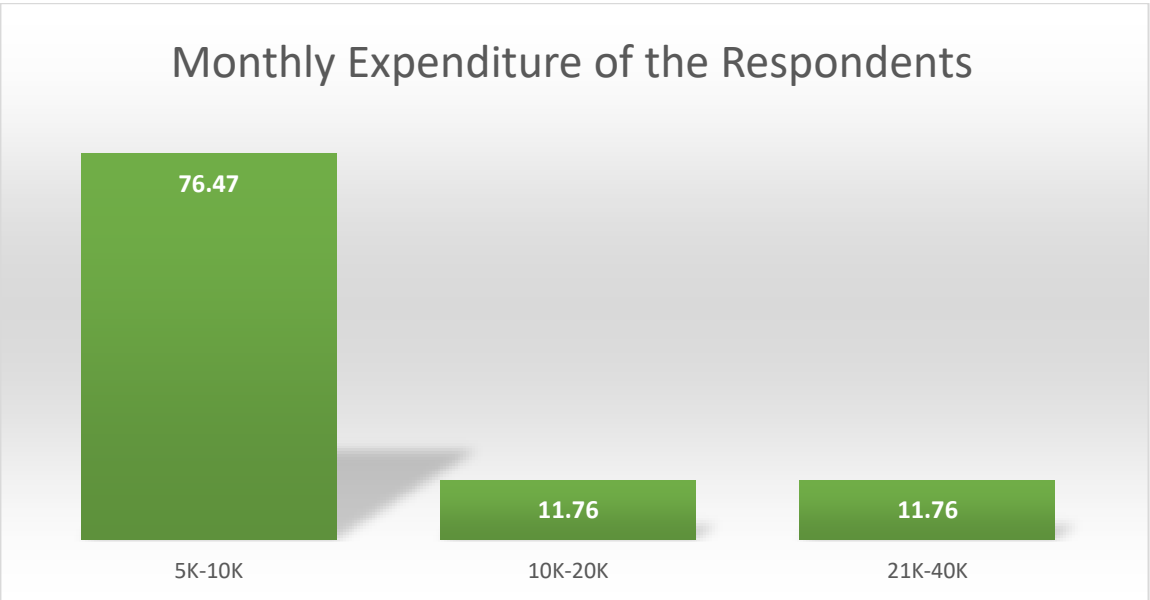


Source: DSCL Census and SES survey, 2022

Figure 5.41: Income status of the people of the project area

5.7.2.14 Expenditure

From the view of expenditure of the respondents, it is found that, 76.47% of the respondents have an expenditures of 5-10 thousand taka, 11.76% has a 10-20 Thousand taka and other 11.76% has an expenditure of 21-40 Thousand taka.



Source: DSCL Census and SES survey, 2022

Figure 5.42: Monthly Expenditure of the Respondents

5.7.2.15 Access to health center

The respondent of the socioeconomic survey revealed that about 52.9% of them have proper access to nearest health center, whereas 47.1 % responses that they don't have proper access to health center.

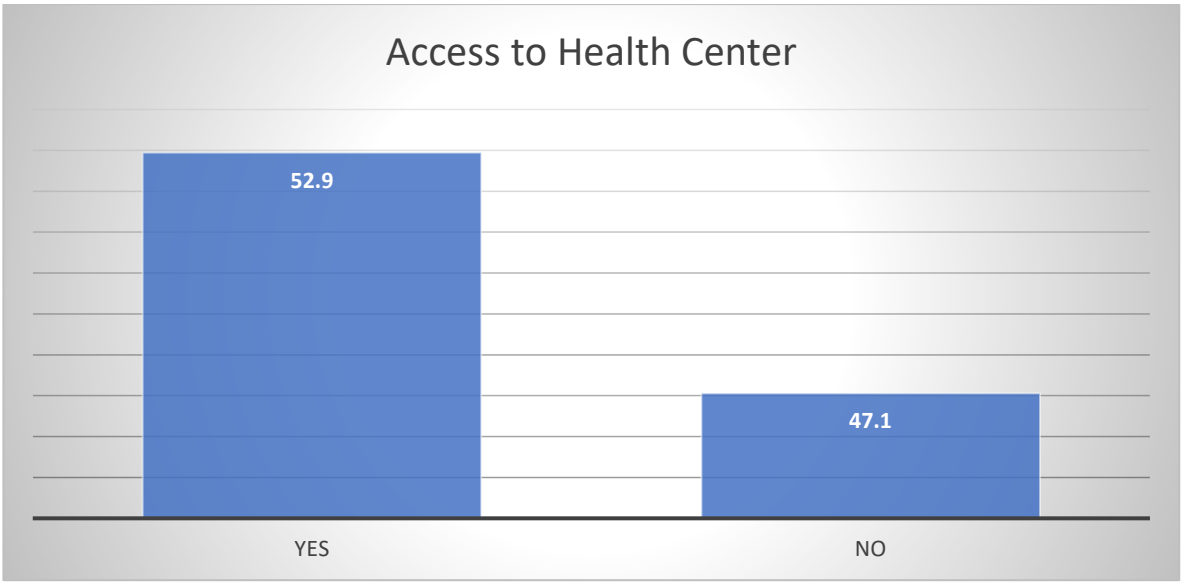
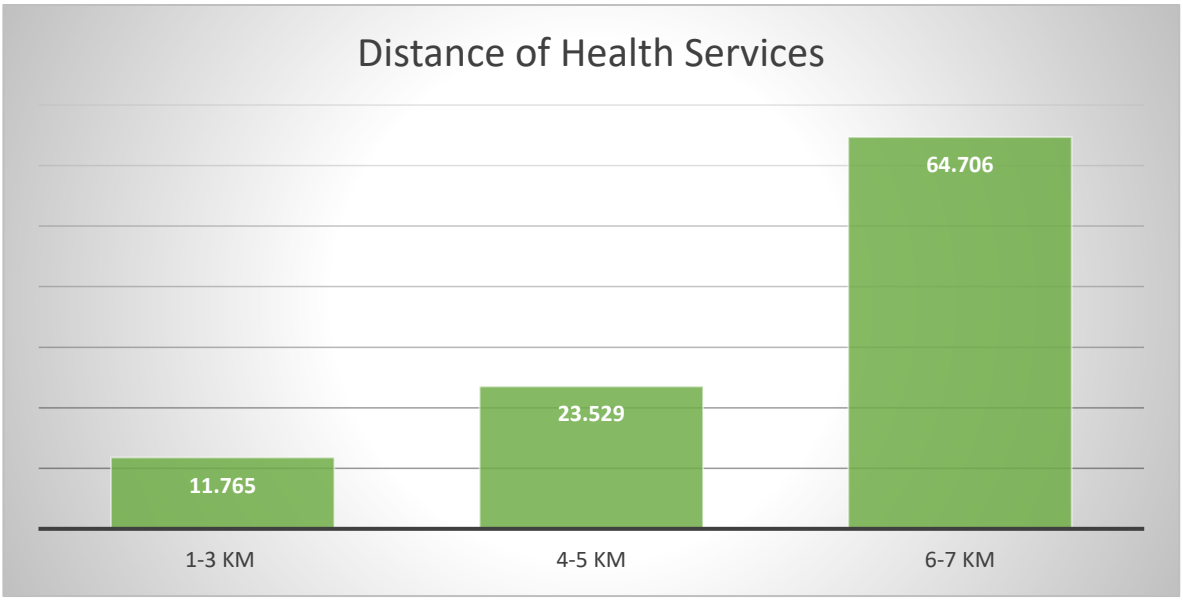


Figure 5.43: Access to health center

5.7.2.16 Distance of Health service

As per the survey from the project area it is found that, 64.70% people have health service with a distance of 6-7km, 23.52% has it (health service) within 4-5km and 11.76% has it within 1-3km.

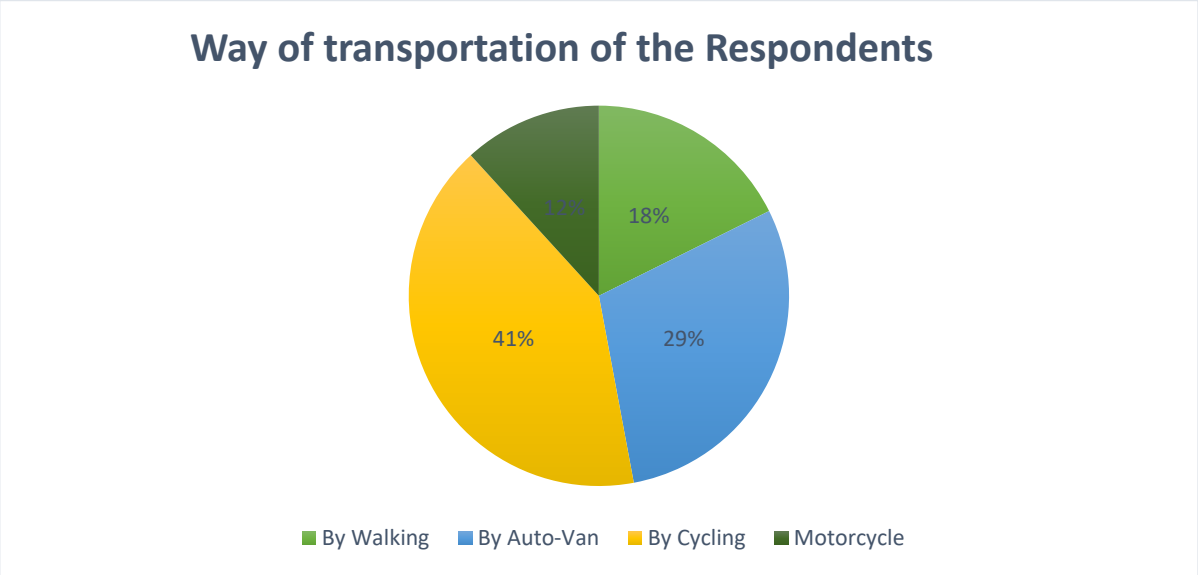


Source: DSCL Census and SES survey, 2022

Figure 5.44: Distance of Health Services

5.7.2.17 Way of transportation

As for the way of transportation, 41% respondent use bicycle, 29% use auto-rickshaw, 18% use motorcycle and 12% walks.

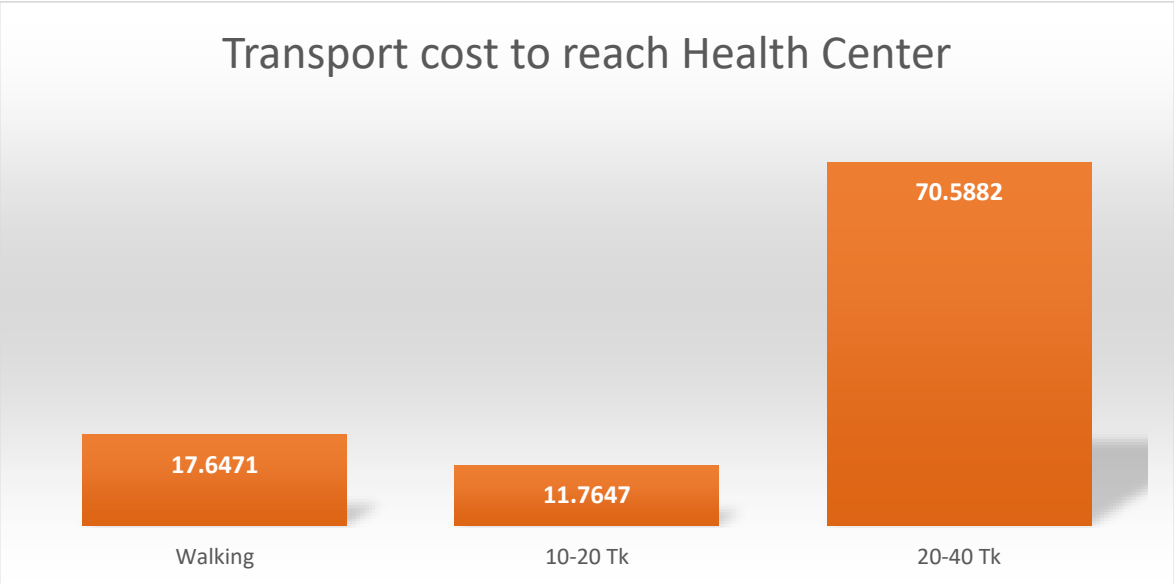


Source: DSCL Census and SES survey, 2022

Figure 5.45: Way of transportation of the respondents

5.7.2.18 Transportation cost to reach health center

About 70.58% of the respondents says that, they require 20-40 taka, 11.76% says that they require 10-20 taka to reach to the nearest health center. The Rest of the 17.64% says that they walk to the health center.

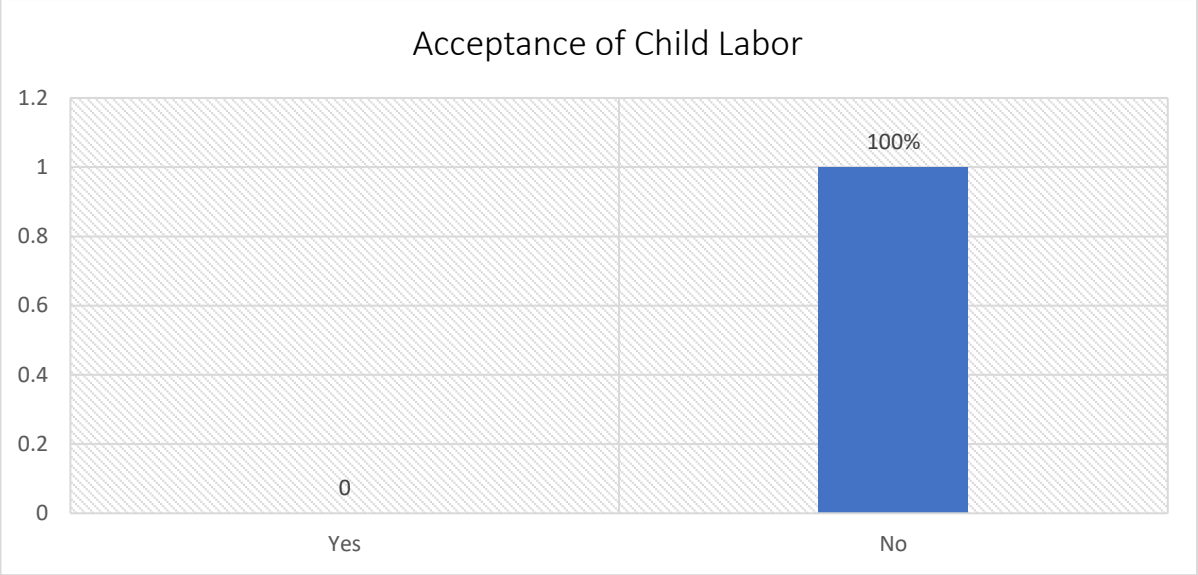


Source: DSCL Census and SES survey, 2022

Figure 5.46: Transport Cost to the Health Center

5.7.2.19 Acceptance of child labor

The survey revealed that, 100% of the respondent has zero tolerance over child labour.

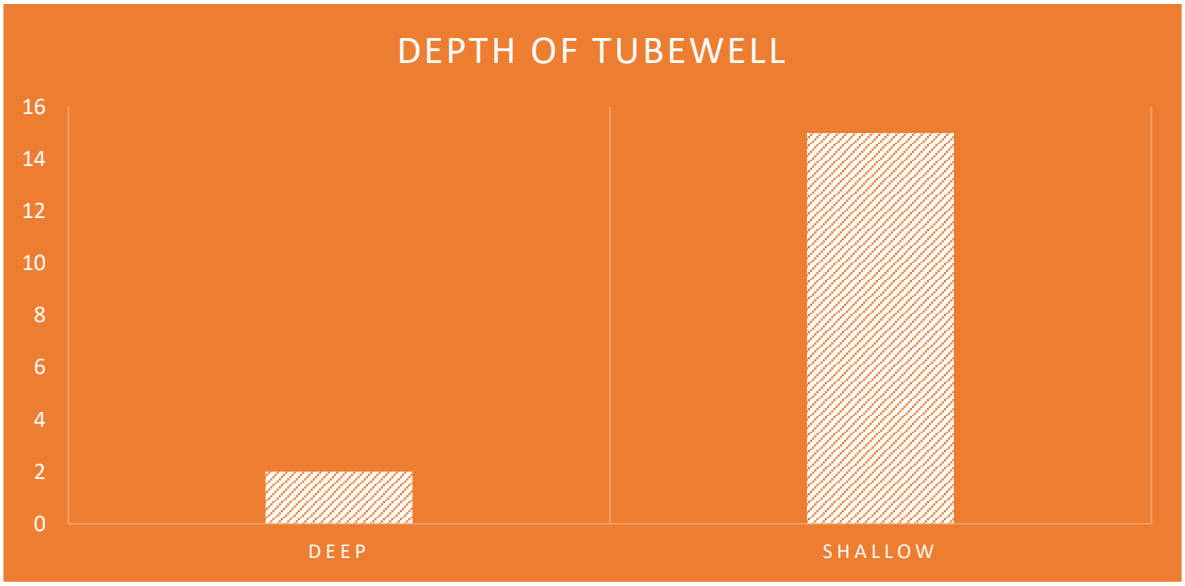


Source: DSCL Census and SES survey, 2022

Figure 5.47: Acceptance of Child labor

5.7.2.20 Average Depth of Tube well

As previously mentioned, that the people of the project area use tube well water as a ground water source, however the average depth of the tube well are as follows.



Source: DSCL Census and SES survey, 2022

Figure 5.48: Average Depth of the tube well

5.7.2.21 Record of Harassment

The socioeconomic survey revealed that, the project area is free from any kind of harassment.



Source: DSCL Census and SES survey, 2022

Figure 5.49: Record of Harassment in the project area

5.7.2.22 Perspective of Ecological Change

100% of the survey respondent responses that, the project will not alter any ecology of the project area.

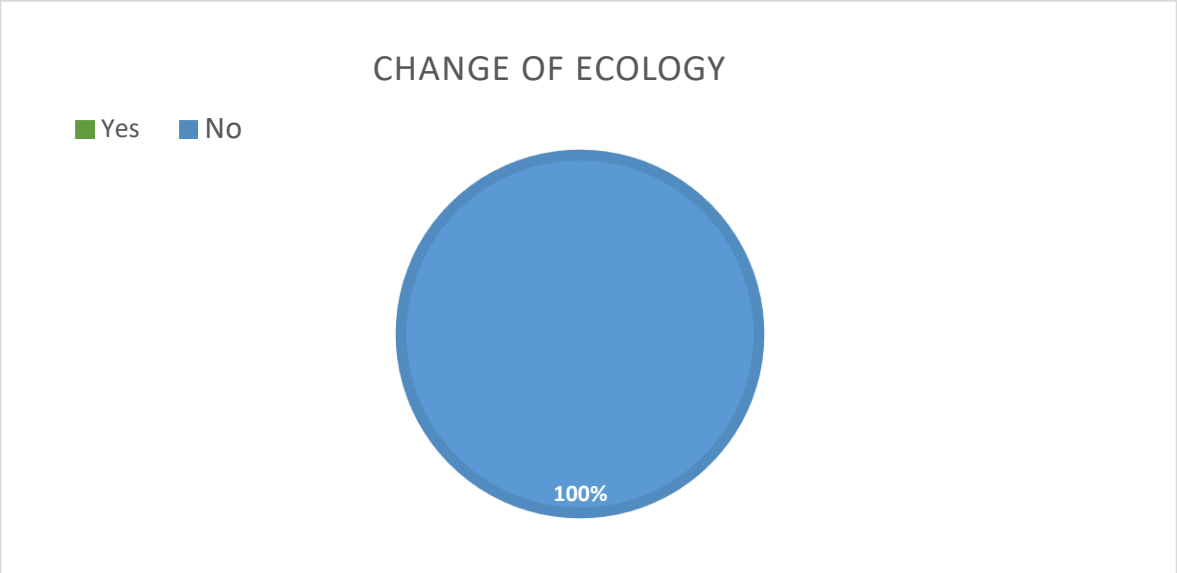


Figure 5.50: Perspective of Ecological Change

6 POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

6.1 Impacts Related to Assessment and Management of E&S risk and impact (ESS 1)

The proposed solar project activities at Bhotemari union, Kaliganj upazilla, Lalmonirhat district are anticipated to have some environmental and social risks with no significant residual environmental or social risks. These risks need to be managed by the PIU, which has some existing capacities for managing environmental and social risks, but these need to be further developed. The ESMP provided in this ESIA will need to be adapted after the contractor is assigned to develop the Contractor's ESMP.

The environmental and social assessment has determined that the only associated facility with the project is the transmission lines.

Daily basis environmental monitoring with specific team. The project authority has established an individual monitoring team for the regular monitoring purposes. It is the responsibility for the monitoring team to ensure the daily compliance.

6.1.1 Potential impacts of Transmission Lines

The physical presence of transmission lines can influence wildlife. These potential effects include long-term changes to habitat, bird strikes, access issues, noise effects and associated avoidance behavior, and electric and magnetic fields.

Two (02) key concepts are associated with the long-term presence of transmission line rights-of-way in wildlife habitat: **edge effect** and **habitat fragmentation**. While the mixture of habitats created by rights-of-way can allow greater density and diversity of wildlife to be present, transmission lines may also produce a negative edge effect for some species which require large, undisturbed habitat.

The edge effect resulted from a transmission line access could disturb animal breeding and nesting. The total production of animals and available harvest opportunities for different species depend on the quality and quantity of wildlife habitat crossed by the transmission line right-of-way. While habitat fragmentation refers to plant communities that have become divided or isolated. Individual transmission line projects may fragment the landscape by dividing large blocks of forested habitat into smaller blocks which can result in a decline in species within the surrounding area.

Furthermore, open or loose wire from the transmission line may create accident or even life loss. Lack of signboards, with possible danger sign could lead people to danger.

6.2 Impacts Related to Labor and Working Conditions (ESS 2)

Intraco Solar Power Limited (ISPL) will appoint contractors to carry out civil works, to support core functions, primary suppliers of material/equipment, and as well as for other implementation support. Construction work will necessitate the use of labor and associated goods and services. Construction Contractors are expected to set up construction campsites, material stockyards, and workforce camps at suitable and pre-determined /approved locations along the respective road corridors and nearby locations. The workforce camps will provide housing for both skilled and unskilled laborers. Furthermore,

the influx of labor during construction phase may also affect the sub-project area on public infrastructures such as health services, utilities such as water and electricity, housing, and social dynamics. Other related issues could include an increased risk of communicable disease spread and an increase in illicit behavior and crime.

Before the project appraisal, a Labor Management Procedure (LMP) should be prepared and this should be included in the project bidding documents. Following the hiring of the contractor, but before the commencement of civil works, the contractor will be required to prepare the contractor's ESMP, OHS plan, water and waste management plan, labor management plan, worker's camp management plan, Traffic and road safety management plan, the establishment of GRM for labor, and site restoration plan, among others, following the GoB and ESS2 of WB. Before the start of construction, the PIU will review and approve all such plans prepared by the Contractor.

The ISPL will hire local labors as unskilled labor force in the project with a focus to create local job influx. As the project location is on Sholmari village in Bhotemari Union, maximum laborer will be appointed from this area, so that the unemployment will be eradicated for a short period of time.

Occupational Health and Safety (OHS) Plan will be prepared and implemented by each Contractor based on the ESS 2, WBG EHS Guidelines (1997), ESCoPs, mitigation plan, and other relevant GoB laws, rules and policies. The Plan will be submitted for review and approval to Paramount Group before Contractor mobilization. The OHS measures outlined in the Labor Management Procedures will be implemented by PIU.

1. Potential labor risks: The potential risks are associated with workers/laborers engaged in construction works.
    i. Safety issues while at work like injuries/accidents/ fatalities leading to even death, while at work;
    ii. Short terms effects due to exposure to dust and noise levels while at work
    iii. Long term effects on life due to exposure to chemical /hazardous wastes
    iv. Inadequate accommodation facilities at workforce camps, including inadequate sanitation and health facilities
    v. Non-payment of wages by Employer
    vi. Non-payment of benefits (compensation, bonus, maternity benefits, etc.) by Employer
    vii. Discrimination in Employment (e.g., abrupt termination of the employment, working conditions, wages or benefits, etc.)
    viii. Engagement of child labor
    ix. Sexual harassment at work
    x. Forced labor trafficking
    xi. Security of women workforce
    xii. Inadequate facilities for pregnant women and lactating mothers
    xiii. Inadequate facilities for the children of the workforce at workforce campsites
    xiv. Absence or inadequate or inaccessible emergency response system for the rescue of labor/workforce in situations of natural calamities like earthquake, caving in/landslides, fire outbreak, floods, cloud bursts, etc.

xv. Health risks of labor relating to HIV/AIDS and other sexually transmitted diseases
xvi. Unclear terms and conditions of employment
xvii. Discrimination and denial of equal opportunity in hiring and promotions/ incentives/ training opportunities
xviii. Denial for workers' rights to form workers' organizations, etc.
xix. Absence of a grievance mechanism for labor to seek redressal of their grievances/issues

6.3 Impacts Related to Resource Efficiency and Pollution Prevention and Management (ESS 3)

1. Impact on Physiography

The maximum land on this project area was isolate. So, there will be no significant impact on the region's physiography due to this project.

2. Impact on Geology

Different materials, such as earth, aggregate, boulders and sand that occur naturally and whose formation process is slow and takes years, will be required for the construction work. Furthermore, development has put a strain on these finite natural resources, posing a recent availability challenge. Taking these factors into account and minimizing the impact of construction on natural resources is a fundamental design principle for pavement and structures. There is no impact on geology during construction as the proposed project area is geomorphologically stable.

3. Impact on Soil

Compaction of soil caused by installing plant, stockpiles, and temporary facilities is also likely to impact soil structure, affecting organism activity, water retention capacity and nutrient retention. The soil characteristics of the native soil may also be changed due to the import of soil for filling and leveling purposes.

4. Impact on Water Resources

There is a river beside the sub-project intervention area named 'Teesta'. This river is non-tidal. The proposed alignment is mostly surrounded by the river. The Teesta River cannot pose any significant impact on the project site or on the project activities as the project does not involve any interaction with the river. Similarly, the project activities will not pose any threat to the river, since the construction and project activities are temporary and does not involve any interaction with the river as well. Thus, no adverse impact is anticipated on or by the river due to the project activities.

5. Impact on Physical Environment

a. Ambient Air Quality

The sub-project area's existing baseline conditions show that air quality parameters (PM10, PM2.5, SO2, NO2, and CO) are not within the prescribed standards of the DoE. The main reasons are that there are so many stone crushing machines running throughout the project influence area. Major imported item is stone, boulder, limestone. This can be attributed to dust pollution. The high volume of traffic is also responsible for this. Under particular circumstances, construction activities can give rise to dust emissions if not effectively managed. The air quality impact will be moderate to substantial during construction activities, but the impact will be reduced during operation. Construction activities can affect receptors near the main construction sites due to dust generated from site preparation, site excavation, and construction activities.

Earthworks will result in exposed soil areas that will generate dust when it is windy, with dust potentially being generated when winds blow at all times of day or night, not just during active construction periods. The level and distribution of dust emissions will vary according to the duration and location of the activity, weather conditions and the effectiveness of suppression measures. Generally, additional vehicle movements generated during the construction phase will potentially influence local air quality at sensitive receptors located close to project AOI, and pollutant concentration is likely to reduce when the expanded area's operational activity begins. In the operational phase, air emission causes only by vehicular movement though the concentration of pollutants will be lower than the construction period. Furthermore, if we consider the sub-project AOI, air pollutants may be dispersed from Bangladesh to India during the construction period. These factors have a transboundary impact; however, it is marginal.

b. Noise & Vibration

The existing area is generated a little amount of noise due to machine boat and cattle movement. Also, the principal noise source would be equipment, machinery, and vehicles during the construction activities. The noise levels may not rise during the operation phase. This will be limited to the adjacent area, and its significance is low.

6.4 Impacts Related to Community Health and Safety (ESS 4)

1. Infrastructure and Services

There will be increased demand for electricity, water and health facilities during the construction phase. The exact nature of these demands is unknown at this time, but Contractors are expected to use both the electricity grid and on-site generators. If the influx of workers and the nature of the civil works cause stress on existing infrastructure and natural resources such as water, conflict with the local communities may arise.

2. Transport, Accessibility and Health

As it is located in an island so there will be low traffic movement. A traffic management plan would not be necessary. In particular, the community may be exposed to increased construction-related traffic and equipment. Furthermore, dust from earthworks, noise and vehicle idling may become common in sub-project areas.

3. Hazardous and non-hazardous wastes

During the pre-construction period, solid waste from site clearing will be generated. The project will generate some solid non-hazardous and hazardous wastes during the construction phase. Excavated material, construction material, Municipal solid waste and wastewaters are among the non-hazardous wastes expected. The handling, storage and disposal of waste, both on and off-site, may pose several risks to human health and the environment. Incorrect handling and storage could lead to cross-contamination of air, soil, and water resources and direct and indirect health effects. The operation of construction worker camps may result in environmental pollution from organic and inorganic waste generated by project activities. The authority should build up an emergency medical team in case of instant response regarding any kind of accident.

4. Natural Hazard and Vulnerability

The impact due to the construction of this project does not significantly alter the vulnerability status of the region as a whole. The site investigation observed and identified the risk of natural disasters like flood. Such events would have potential health and safety hazards to personal or workforce or labor or community in the vicinity and may get stranded at operational sites.

5. Sexual Exploitation and Abuse (SEA)/ Sexual Harassment (SH)

A consolidated Gender Action Plan (GAP) and SEA/SH Management Plan will be prepared by contractor for the project. The SEA/SH Plan will include a Code of Conduct (CoC) for all the workers in the project. The CoC will be included in the bidding documents, and the Contractor(s) deployed for construction and supervision-related activities of the project will have an obligation to comply with provisions for all its workers.

6.5 Impact related to Land & Assets (ESS 5)

The Acquisition and Requisition of Immovable Property Act 2017 (ARIPA) is the principal legislation governing eminent domain for land acquisition and requisition in Bangladesh. ARIPA 2017, detailed the land acquisition process from section 4 to section 19 and land requisition process from section 20 to section 28. However, this is the private investment project and the project authority does not have any land acquisition issue for this solar project. Rather the project authority needed 98.03 acres (58.04 acres land leased from government and 39.99 acres purchased land) land for the solar project under Bhotemari union of Lalmonirhat district. The project authority has bought the required private land from the respective owners of Kaliganj upazila under Lalmonirhat district with a win-win approach where both of them were benefitted. As most of the land is barren land the landowners have willingly sold them to the Intraco Solar Power Limited. Furthermore, there will be no land acquisition required for the project construction and implementation and so no impacts will be occurred related to the land acquisition.

6.6 Impacts Related to Bio-diversity & Living Natural Resources (ESS 6)

The site clearance activities for construction will not involve removing vegetation and felling trees. The baseline survey results indicate that the project influence on the fish culture of the Sholmari village people. Most of the people used to catch fishes during rainy season.

The ecological investigations have indicated no rare, endangered, and threatened species in the project influence area, and there are no environmentally sensitive areas. No indication of forestation is observed around the sub-project area. There is no National Park or wildlife sanctuary within 10 km from the project influence area or any habitats of known biodiversity within the sub-project area.

Due to the transmission line, birds may get trapped if there is any leak in the wire or without any insulation. Sometimes bigger animal like monkey can be injured if there is any such case like that.

6.7 Impacts Related to Tribal/Indigenous Population (ESS 7)

The surveys indicated no tribal or indigenous people within the project influence area.

6.8 Impact Related on Impacts on Cultural Heritage (ESS 8)

The transmission line alignment of the project does not have any ancient monuments and the archaeological sites; Thus, no impacts are foreseen on ancient monuments and archaeological sites due to the construction of the solar power plants. However, the impact assessment survey has identified a few mosques, schools, madrasa and Eidgah field in the project influenced area.

6.9 Impacts Related to Financial-Intermediaries (ESS 9)

The project is being done through IDCOL which is a financial intermediary. No adverse impacts on the project is anticipated related to financial intermediaries.

6.10 Impacts Related to Stakeholder Engagement and Information Disclosure (ESS 10)

In this project, a wide category of stakeholders will be engaged during the project cycle. A standalone stakeholder engagement plan is prepared which identifies the different categories of stakeholders, details the relevant methods and approaches of engagement including a grievance management setup, mechanisms for receiving feedbacks from the stakeholders and closing the feedback loops. It will be disclosed on the website upon approval.

6.11 Risk Assessment for the Project

Table 6.1 present a summary of the anticipated risks during the planning and construction, operation, and decommissioning phase of the Solar Power Plant Project.

Table 6.1: Risk Assessment for the Solar Power Plant Project

ESF Standards, Environmental and Social Risks, and impacts	Risk Rating		Rationale
	Construction stage	Operation stage	
ESS1 Assessment and Management of E&S Risks and Impacts			
Vulnerable groups	Low	Low	The project area is in a char land and there are no household nearby, for this the risk of being vulnerable due to project activities are low. However, during the construction period, local peoples may face some social problem due to labor influx, spread of disease or in terms of gender equity. However, the project is likely to benefit the locals economically, and the impact on them during operation is likely to be minimal.
Cumulative Impacts	Moderate	Low	There are currently no major projects ongoing in the project surrounding area. The cumulative impact of the project is most likely to be felt during the construction stage. Positive cumulative impacts, on the other hand, are expected to outweigh any cumulative negative impacts, as the region is expected to be economically transformed once the project is completed.
Associated Facilities	Moderate	Low	The physical presence of transmission lines can have potential effects such as long-term changes to habitat, bird strikes, access issues, noise effects and associated avoidance behavior, and electric and magnetic fields. It can also cause health and safety issues.
ESS 2 Labour and Working Conditions			
Working conditions	Moderate	Low	Poor working conditions are a common issue with large-scale construction projects throughout Bangladesh. In other ongoing projects of the project authority, there are labor friendly working conditions provided for the quality outcome from the laborers. Since the living facilities within the project area are not limited therefore the additional workforce may provide extra benefit.
Worker accommodation	Substantial	Low	Proper workers accommodation must be ensured in the project site for a proper and environmentally friendly site. better accommodation will reduce the risk of health deterioration,

ESF Standards, Environmental and Social Risks, and impacts	Risk Rating		Rationale
	Construction stage	Operation stage	
			and increase the work efficiency. However, the project authority will ensure hiring local labors, which will reduce the risk of having bad workers accommodation.
Child Labour	Low	Low	There is no risk of using children in any stages of the project. According to the social survey, there is no sign of likelihood that children from the local community will be involved in the project as child laborers.
Labor influx	Moderate	Low	The project authority will encourage employment of local labor, except those that are not available locally in the district. The skilled and experienced labor who are willing to work for the project will be hired by the contractor. The Labor Management Plan including specific risk mitigation and management measures as prepared during the construction phase specially will reduce the risk of labor influx.
Occupational Health and Safety	Substantial	Moderate	Workers may be exposed to various health risks and hazards while working on a construction site. Accidents and health hazards are likely during panel configuration, operation of construction vehicles and connecting of electric lines. Without adequate safety measures, workers may sustain injuries and accidents (sometimes resulting in fatalities). The main health complex is far from the project area which is situated in Kaliganj upazilla. Though the medical team has an emergency medicine kit and first aid box for the preliminary treatment.
ESS 3 Resource Efficiency and Pollution Prevention Management			
Landscape aesthetic	High	Substantial	The permanent solar panel structure, stockpiling materials, installment of poles for transmission lines etc. are related to the general aesthetics. In severe case, alteration of river course may impact the local landscape and fisheries habitat.

ESF Standards, Environmental and Social Risks, and impacts	Risk Rating		Rationale
	Construction stage	Operation stage	
Air pollution	Moderate	Low	Exhaust emissions are likely to be generated by the construction equipment during the construction phase of proposed solar plant. Transportation vehicles for material carrying would cause air quality impact by emitting pollutants through exhaust emissions.
Potential hazards caused by the toxic chemicals	Low	Low	No hazardous chemical will be used during the project work, however oil and chemicals from machineries or project vehicles may create risk if not properly maintained.
Noise pollution	Substantial	Low	Possible noise emissions to the environment from the construction activities which will likely include the use of machinery and equipment such as generators, hammers, and compressors and other activities.
Solid waste management	Moderate	Low	Construction activities will generate solid wastes. The direct disposal of waste from construction camps and yards during the construction period may contribute to solid waste pollution. Not dumping to the appropriate location also create risk of pollution.
Pollution of water resources	Moderate	Low	Water quality in the existing Teesta River is likely to deteriorate, particularly during construction, due to the disposal of soil and chemical wastes from construction sites and camps. During operations, the impact on water sources from pannel washing, poor sanitation practices of the workers etc. may contribute to the pollution.
Ecosystem Services	Low	Low	Construction activities could disturb existing habitats (flora, fauna, and avifauna) and any threatened or endangered species that might be present within the Project site. In addition, other impacts could be from improper management of the site (e.g., improper conduct and housekeeping practices).
ESS4 Community Health and Safety			

ESF Standards, Environmental and Social Risks, and impacts	Risk Rating		Rationale
	Construction stage	Operation stage	
Traffic and Road Safety	Low	Low	Uncontrolled traffic movement through village road may create accidents and health hazards, especially to locals. Flag man with proper traffic management knowledge should be available in the project site to reduce the risk
Community Exposure to Health Issues	Moderate	Low	Labor influx is anticipated to be low to moderate but the local host communities may still be at risk of contracting various communicable diseases, including STDs. Poor sanitation practices by the outside labor force in camps and construction sites are likely to cause community health issues. On the other hand, the social surveys indicated that the community would accommodate the project workers and that with various safeguards in place, such as GRM, enforcement of Code of Conduct, etc. the likelihood of conflict would be low. Separate worker housing/labor camps will improve relations between migrant labor and the community.
Hazardous Materials	Low	Low	The handling and movement of hazardous materials during the construction period possess some risks and impact. The hazardous waste management will be maintained. So, hazardous materials are not likely to create major risks and impacts in the sub-project area. Also, the electric wiring will be done by trained professionals.
Emergency Preparedness and Response	Substantial	Substantial	The project poses several risks to local communities, including frequent traffic accidents for reckless driving, disaster, or any health hazards creating the need to establish emergency preparedness and response along the project intervention area.
ESS 5: Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement			
Land Acquisition	Low	Low	A total area of 98.03 acres of land will be required by the project. Project authority has leased 58.04 acres of land from the government and bought 39.99 acres of land from the rightful owners with a win – win approach. So, no severe issue will arise regarding land acquisition.

ESF Standards, Environmental and Social Risks, and impacts	Risk Rating		Rationale
	Construction stage	Operation stage	
ESS 7: Indigenous Peoples			
No indigenous people live in that area			
ESS 8: Cultural Heritage			
Tangible Heritage	Low	Low	No impact is expected based on the preliminary socio-economic survey at the proposed area. The current project boundaries may not impact some mosques/madrasas as the sensitive areas are keeping a smart distance from the project area.
Intangible Heritage	Low	Low	No impact is expected based on the socioeconomic survey.
ESS 9 Financial Intermediary			
No significant adverse impact is anticipated during the project activity.			
ESS 10: Stakeholder Engagement and Information Disclosure			
Continues engagement of stakeholders during implementation	Moderate	Low	GRM and compensation system, accidents, health hazards etc.
Issues Related to the project	Moderate	Low	Risks of migrant labors, SEA/SH/GBV, the establishment of GRM, hiring of local labor, community health and safety.

7 MITIGATION MEASURES

7.1 Mitigation Measures for Environmental & Social Risks (ESS-1)

Primary sources of these adverse/negative impacts can be categorized into three types: (a) location of the project; (b) project activity; and (c) Transportation and demobilization.

The location of the project is in a barren island of Tista River, it must be ensured that no activity should impact the regular course of the river. During the construction activity in order to mount the solar panel with ground level structure land filling, improving drainage system, waste management system should be developed. Transport of material may create environmental and social risk inside the project area which needs to be carefully assess and mitigate.

Any vulnerable groups' concerns and needs will be addressed through a combination of measures and additional assistance from project authority. Impacts on such vulnerable people will be mitigated through provisions and measures as per GRM. In the absence of the project, the overall quality of the environment and social conditions along the project area would deteriorate. Undertaking this project, road conditions will improve and people will get access to newer facilities which will create new job opportunities and employment.

Under this project and in accordance with the ESF, Project shall define vulnerable person includes Children, people with disabilities and persons above the age of 65 years irrespective of their physical status. Needs and concerns of the local people including the disadvantaged group like people with disabilities will be considered with provisions of universal access (ramp) with railing and other facilities. These concerns and needs of vulnerable groups will be addressed through a mix of measures that includes additional assistances.

7.1.1 Mitigation Measures for Transmission Lines

Proper wiring, insulation and signboards must be ensured for the transmission line in the project location. Possible danger should be mentioned in the signboards for anyone to understand the risk. To enhance wildlife movement across the right-of-way, mitigation measures may also include establishing wildlife corridors. Minimizing the potential for habitat and breeding disturbance can be obtained by seasonal monitoring by natural resource officers, especially during the breeding and nesting seasons.

7.2 Mitigation measures for Labor risk and Susceptible working Conditions (ESS 2)

A Labor Management plan (LMP) will be prepared by the contractor of the project. The key provisions of the LMP, such as workers' Code of Conduct, labor GRM, will be including in the bid documents. The LMP is intended to integrate the GoB's environmental, social, occupational health, and safety principles and the requirements outlined in ESS 2 of the World Bank through this guideline and associated standard operating procedures. It will define the requirements for providing employment terms and conditions, promoting non-discrimination and equal opportunity, and organizing workers.

The Civil Works Contractor's contractual obligations to manage these negative impacts would be clearly stated, with appropriate mechanisms in place to address non-compliance in the bid documents. Further the bid documents will also include the environmental, social, health, and safety (ESHS) requirements, such as a list of applicable labor laws and provisions and metrics for Contractor reporting regularly.

To address labor influx, the Contractor will:

- Reduce labor influx into the project area, If unavailable locally, skilled labor would be brought in from outside the sub-project area, either within or outside the district.
- Develop a Workers' Camp Management Plan that addresses specific aspects of the establishment and operation of workers' camps, such as separating labor camps and material storage areas;
- Conduct awareness campaigns on HIV/AIDS, STDs, COVID-19, and other communicable diseases.
- Create a system for handling labor-related complaints at the project level.
- Provide information about the Contractor's policies and Worker Code of Conduct to the communities in the project area host communities.

Worker's accommodation facilities, proper sanitation facilities, drinking water facilities, health and treatment facilities, PPE etc. must be ensured during the construction and operation phases of the project. The ESS guideline of WB should be followed in case of any issue arise.

7.3 Mitigation Measures for Community Health & Safety (ESS 4)

During the construction phase, dust will generate from vehicle movements in the roads and construction yard. Oil and grease may wash trough water and contaminate the surface waters of nearby streams.

Leakage and spillage of generator fuels may also contaminate surface water. The laborers and the people living around the developing project will be exposed to additional health risks in the construction phase. People should be aware of Community Health and Safety (CHS). For extra precautionary measures, water spraying air emission control is undertaken. Traffic rules should be strictly maintained in front of schools and colleges. A flag man should be engaged by the project authority if required. Spreading awareness of HIV-AIDS/STDs among labors and local community must be ensured. Emergency safety features should be available in case of emergency situation or disaster.

To mitigate potential impacts to the health and safety of villagers, the Contractor will be required to develop a community health and safety risk assessment and plan (specific attention will be given to Covid-19 risks and mitigations) for approval before construction works that incorporate good international practices and recognized standards such as emergency response and preparedness procedures, communication systems and protocols to report any emergency, including interaction with the commune and provincial emergency and health authorities.

The risk assessment should be undertaken through a facilitated risk assessment workshop involving the Contractor, Intraco, and project implementation unit. The detailed design will incorporate community health and safety measures, e.g., such as fencing and signage. Waste management and minimizing potential impacts during construction activity will depend on implementing appropriate procedures, protocols, and monitoring of materials being delivered, handled, and stored before disposal. In order to ensure the safety of the workforce at operational sites and the safety of the personnel at the camp site, an Emergency Response Plan shall be prepared and followed whenever the situation warrants.

7.4 Mitigation Measures for Pollution Prevention (ESS 3)

Air Pollution:

Emissions of dust from vehicle movements handling equipment can be sources of air pollution. Dust will generate due to construction materials (sand, aggregates). During the operational phase, the pollution will be lower. Among the air pollutants, dust levels of particulate matter 2.5 and 10 micron are the most significant concern. To prevent and control the dust levels, the following measures are to be strictly adhered to:

- Any kind of stockpiles shall be covered with tarpaulins. Water should be sprayed and temporary service and access roads. After compacting, water should be sprayed on the earthwork regularly to prevent dust. Construction equipment will be maintained to a good standard, and the idling of engines discouraged. Machinery causing excessive pollution (e.g., visible clouds of smoke) will be banned from construction sites
- Air pollution monitoring shall be carried out as per the monitoring plan, and corrective action shall be taken in case of deviation.
- The Contractor shall provide a wind barrier, depending on the most prevailing wind direction and presence of sensitive receptors at the downwind side, at the perimeter of all plant sites to arrest or blow suspended particles.

At the moment, combustion of fossil fuels is mostly responsible for the carbon emissions. However, the solar panel used in this project will emit a very less amount of CO_2 which is built with modern technology for a better sustainable environment.

Noise Pollution:

Traffic movement, generator and panel configuration work may create noise in the project area, a boundary should be installed around the project area so that no one can be impacted due to the noise generation of the project. Beside all workers should use ear plug who works very close to major noise source.

Regular noise monitoring should be done as per monitoring plan and budget and further measures should be taken based on the result.

Groundwater Pollution

- Groundwater pumping should be from shallow aquifers to supply safe water for workers and engineer.

- Tube wells will be installed regarding the surface environment, groundwater protection from surface contaminants, and aquifer cross-contamination.
- Protect groundwater supplies of adjacent lands.

Surface water Pollution

- The Contractor shall comply with the national legislation and other regulations in Bangladesh related to water pollution control.
- The Contractor shall ensure that all existing watercourses and drains within and adjacent to (within 100m) the site are kept safe and free from any debris and any excavated materials arising from the works.
- The earthwork sites where the exposed land surface is vulnerable to runoff, etc. shall be consolidated and covered;
- All drainage facilities and erosion and sediment control structures shall be regularly inspected and maintained to ensure proper and efficient operation, particularly following rainstorms.
- Construction wastes shall be collected and re-used wherever possible. Otherwise, it should be disposed of in the small deposit area invulnerable to surface run-off, along with soil erosion prevention measures.
- The Contractor shall ensure that no tools or machinery are washed in any water source or areas that drain into an existing watercourse.
- The Contractor should not set up a labor camp beside the water bodies as wastes generated from labor camps can pollute the water.
- Dumping wastes toxic substances properly. Spillage from the vehicles will be managed accordingly.

Soil Pollution

- Oil and spillage from the machineries and toxic chemicals spillage may pollute the soils of the project area.
- Spill management plan should be implemented by the project authority.
- Proper personnel with training should only be allowed to handle toxic substances and chemicals.

7.5 Mitigation Measures for Occupational Health & Safety

Temperature checks, regular health checkup etc. are to be carried out at the worksite with a regular interval and the data should be recorded. Suspected and confirmed cases should get treatment with proper care. Safety signage and barriers should be available in the project area so that anyone can guess the possible risk of the work.

Require workers to observe the EHS Guideline on Construction and Demolition. Personnel must have a record of attending an appropriate course on electrical safety and working at height, and they must be adequately trained and qualified to operate on electrical equipment and at height. No compliance with PPE standards will result in disciplinary action (e.g., immediate removal from site).

7.5.1 Health and safety

The proposed 30 MW solar power plant has a complex design and maintenance work which needs a huge amount of labour force to complete and take up to the operation phase. Safety and signage are a major issue during any kind of construction phase. Safety and signage will provide onsite information about the information and possible risk about the site work. This will help reducing any unplanned activity and accidents. Labour and Engineers will be aware from the signage will take action as applicable. Safety signs mentioning possible risks must be mentioned in the project site. unauthorized access, Traffic movement speed, hot surface, possible electrocution, deep hole, slippery road, high altitude etc. are some of the signs that can be used in the construction area. Some of the sample signage is shown in below figure:



Figure 7.1: Sample Safety and Signage for the construction area

7.6 Mitigation Measures for Land Acquisition & Involutory Resettlement

The project authority does not acquire any land, Rather the ISPL authority has leased 58.04 acres of land from the government and bought 39.99 acres of land from the rightful owners with a win -win approach.

The project authority has bought the required private land from the respective owners of kaligonj upazila under Lalmonirhat district with a win-win approach where both of them were benefitted. As most of the land is barren land the land owners have willingly sold them. Paramount group always ensure that Nobody will lose their land or be adversely affected as a result of land acquisition. As of the most recent data, People came to an agreement to sell their land. There will be no forceful attempt to purchase the lands. However, few large, medium, and small trees will be impacted within the proposed land, that's why compensation is paid at the current fair market value. As well as land purchased will be done in win-win situation. The village chairmen and local elite persons were consulted

during the land reclamation process, and during the land purchase procedure. However, any grievance issue related to land and resettlement will be settled by GRM system of the project. There would be no physical displacement. Rehabilitation and augmentation work will be confined to the existing facilities without having any additional impacts.

7.7 Mitigation Measures for Loss of Bio-diversity and natural resources (ESS 6)

Only local species that use less water and have been approved by the forest department should be used. To prevent the spread of invasive species, all invasive species within the impact zone and right of way must be removed/cleared and replanted with native species. The campsites and workforce camps shall be access-controlled and well-lit to avoid/prevent the entry of wild animals. Trapping of animal and birds must be prohibited among the workers and labors.

For transmission line, it is a must to properly insulated the wires, also the wire level in the poles should be kept in a height where no local vehicle or animal can reach. Failing to do so may cost fatality or severe accidents due to electric shock.

7.8 Mitigation measures Related to Tribal/Indigenous Population (ESS 7)

The surveys indicated no tribal or indigenous people within the project influence area.

7.9 Mitigation Measures for Restoration of Cultural Heritage (ESS 8)

No cultural heritage will be physically affected due to the project activity. The ESMP will include chance find procedures, and chance find clauses will be included in work contracts with Contractors.

7.10 Mitigation Measures Related to Financial-Intermediaries (ESS 9)

There are no significant adverse impacts anticipated during the project activities under this ESS, thus no mitigation measures are necessary.

7.11 Mitigation Measures Related to Stakeholder Engagement and Information Disclosure (ESS 10)

The contractor will prepare a stakeholder engagement plan regarding the project implementation. All stakeholders will be identified and will be engaged in the different level of the project. Any grievance issue related to the project will be solved by the GRM committee of the project. The ESS guidelines should be followed for the settlements of any issue.

8 DISASTER IMPACT ASSESSMENT

Disaster is another significant factor considered in the Environmental/Ecological Assessment in a disaster-prone country like Bangladesh. Disaster impact assessment is done to provide assurance that possible disaster and natural hazards are being appropriately considered in the design of the proposed project.

8.1 Objectives

The specific objectives of the Disaster Impact Assessments are as follows:

- Identification of significant disasters that should be assessed for the project.
- Assessment of the significant impacts of considered disasters and suggesting general management and mitigation measures for the disasters.

8.2 Approach and Methodology

The current assessment is conducted by disaster related investigation based on globally and nationally published disaster related reports focusing particularly on flooding, waves, cyclones, tsunami and earthquakes.

Literature review has been conducted available from different national climate change relevant agencies, such as Department of Disaster Management, Department of Environment, and Bangladesh Meteorological Department. This disaster impact projection information will help in making the proposed project climate resilient.

8.3 Disaster Impact Assessment Framework

In this section, a first draft of the framework for natural disasters impact evaluation is present. The objective of the framework relays on helping crisis managers to estimate disasters' impacts in different sectors.

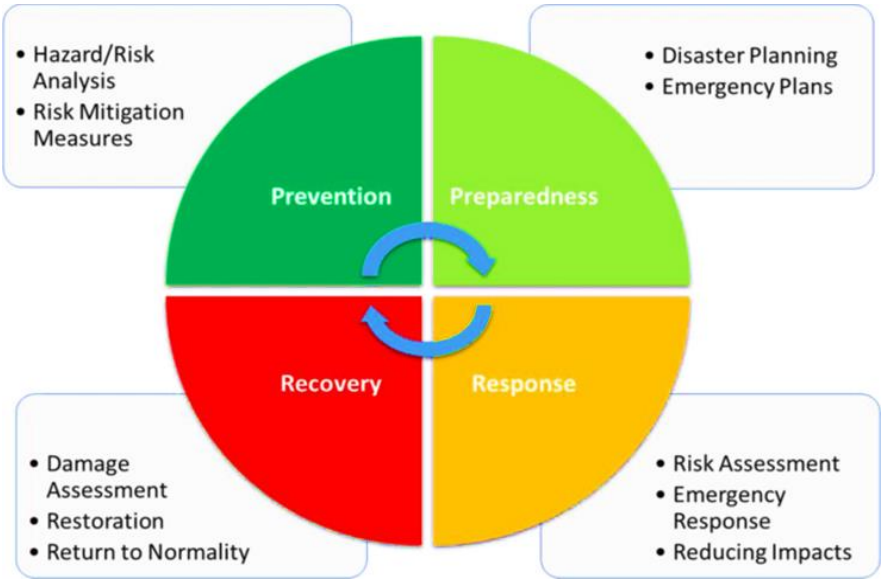


Figure 8.1: Disaster impact and risk management

8.4 Impact Analysis of the Project Area

Disasters mainly occurs in this region from the event of natural hazards which is a naturally occurring physical phenomena. They can be: Geophysical: (a hazard originating from solid earth such as earthquakes, landslides) Hydrological: caused by the occurrence, movement and distribution of water on earth (such as floods).

Being in a low-lying area and beside the bank of the Teesta River the project area is most likely to cause flood almost in every year. River erosion is another natural event that take place in this region. As per the BNBC 2022, the project area also falls under the seismic zone-3 with a seismic co-efficient of 0.28g.

8.4.1 Flood

Bangladesh is one of the first line victims of ongoing and upcoming threats of climate change due to its geographical location, poverty and higher dependence on climate sensitive sectors like agriculture. The Merciless face of climate change and sea level rise reflects in the form of intense and frequent cyclone with tidal surge, subsequent flooding, salinity regression, extreme temperature and precipitation along with local problems like river erosion, water logging and weak institutional framework poses the highest vulnerability in Bangladesh. Flooding is caused downstream from dams when reservoirs, which normally help to prevent downstream areas of rivers from flooding, are opened due to unusually high levels of precipitation to prevent the reservoir from overflowing the dam.

A summary of year-wise percentage of areas inundated by flood is given in below Table:

Table 8.1: Year wise Percentage of Area Inundated by Flood in Bangladesh

Year	Flood Affected Area		Year	Flood Affected Area		Year	Flood Affected Area	
	Square KM	% of area inundated		SquareKM	% of area inundated		Square KM	% of area Inundated
1954	36,800	25	1975	16,600	11	1995	32,000	22
1955	50,500	34	1976	28,300	19	1996	35,800	24
1956	35,400	24	1977	12,500	8	1998	1,00,250	68
1960	28,400	19	1978	10,800	7	1999	32,000	22
1961	28,800	20	1980	33,000	22	2000	35,700	24
1962	37,200	25	1982	3,140	2	2001	4,000	2.8
1963	43,100	29	1983	11,100	7.5	2002	15,000	10
1964	31,000	21	1984	28,200	19	2003	21,500	14
1965	28,400	19	1985	11,400	8	2004	55,000	38
1966	33,400	23	1986	6,600	4	2005	17,850	12
1967	25,700	17	1987	57,300	39	2006	16,175	11
1968	37,200	25	1988	89,970	61	2007	62,300	42.21
1969	41,400	28	1989	6,100	4	2008	33,655	22.80
1970	42,400	29	1990	3,500	2.4	2009	28,593	19
1971	36,300	25	1991	28,600	19	2010	26,530	18
1972	20,800	14	1992	2,000	1.4	2011	29,800	20
1973	29,800	20	1993	28,742	20	2012	17,700	12
1974	52.600	36	1994	419	0.2	2013	15,650	10.6

Source: FFWC, 2012

The project areas are located in low river flooding areas. Floods have a devastating impact on the displaced population. Majority of the people have been moving from one place to

another. They tend to have experienced changes in their lifestyle with intensity and number of incidences of disaster events. It was clear that households cope differently when affected by this disaster. The communities should be encouraged to build houses using durable materials and away from the disaster-prone area as a way of coping with this disaster. A map is provided below that shows the magnitude of the flood impact in the project area.

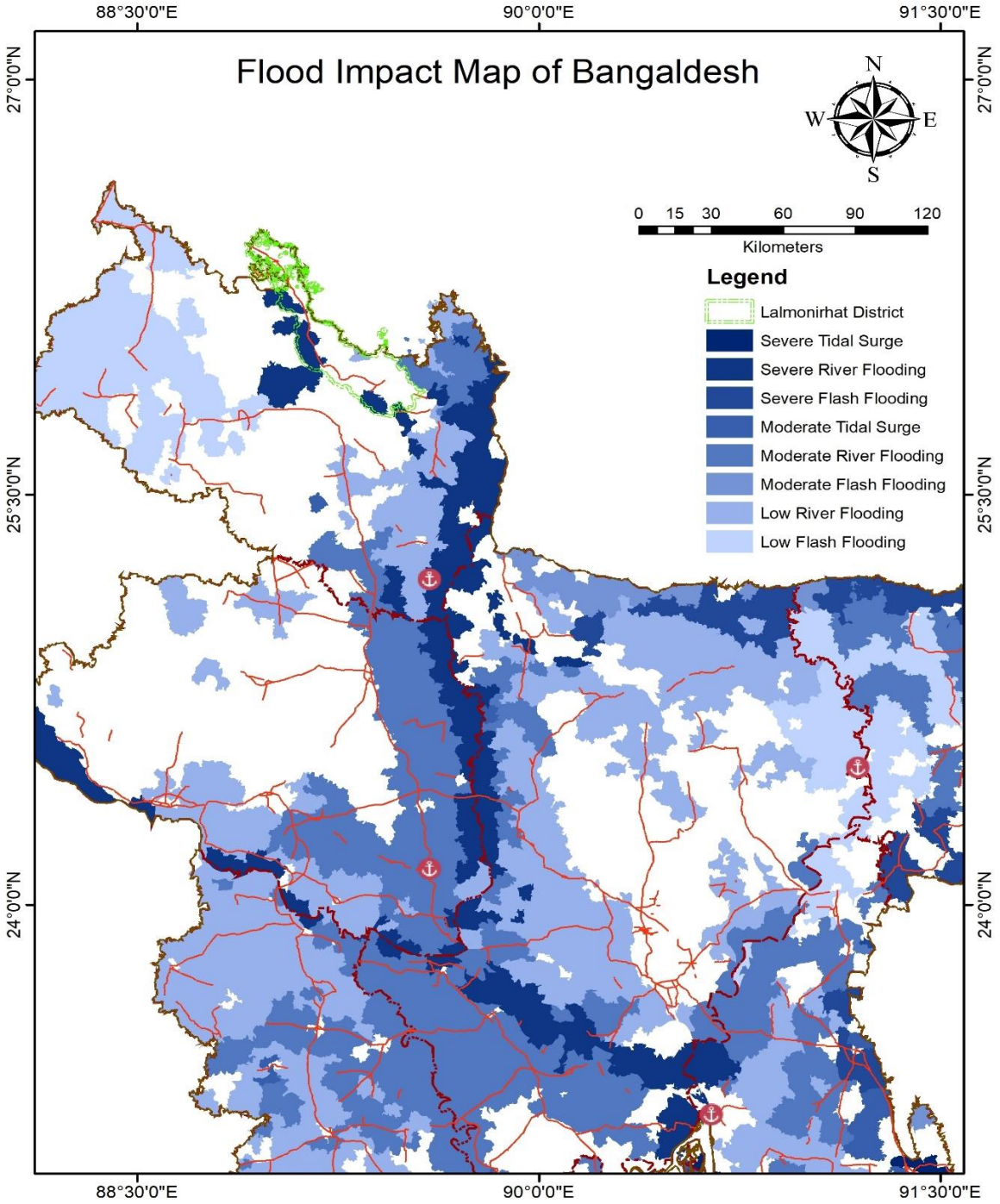


Figure 8.2: Flood Impact Zone of the Project area.

8.4.2 River Erosion

Riverbank erosion is in second place, not in terms of deaths, but in terms of the process of impoverishment and landlessness of the many people affected.

According to the water development board, due to the flash flood incident in Teesta River it is often to occur river erosion on the bank of Teesta making many people landless.



Source: The daily Star, 28 June 2022

Figure 8.3: River erosion on the Bank of Tista River

8.4.3 Tsunami and Earthquakes

Mega thrust faults occur at subduction zones, where Earth's tectonic plates are colliding with each other, and one plate is moving (or "subducting") under another. These faults produce the largest earthquakes, reaching and even exceeding 9.0 magnitude, with recent examples being the 2011 Japan earthquake and tsunami, as well as the 2004 Banda Aceh earthquake and resulting Indian Ocean tsunami.

A vast majority of these mega thrust faults and their resulting earthquakes occur under the ocean, which is why they can unleash tsunamis. It is rare to find these types of faults under land, and even more rare -- and potentially catastrophic -- to have one directly underneath such a major population center. The study indicates that more than 140 million people live within 100 kilometers (60 miles) of this fault in Bangladesh, India and Myanmar.

Bangladesh is situated in one of the most tectonically active regions in the world where three major plates meet (the Indian Plate, the Tibet Sub-Plate, and the Burmese Sub-Plate). The project area is located over the Indian Plate, which is moving north. However, due to the location of relevant plates, fault lines and hinge zones, Bangladesh itself is divided into four seismic zones based on the ranges of the seismic coefficient (note: the seismic coefficient is a measure of how strong an earthquake has the potential to be based on a combination of the mass of the plate and the seismic forces acting on it, as well as how frequently these quakes are likely to occur). As per the seismic zone classifications the project areas fall in Zone-III means moderate seismic intensity

Table 8.2: Major Earthquakes around Bangladesh

Sl. No.	Date (D/M/Y)	Lat (°N)	Long (°E)	Magnitude (Richter Scale)	Location of Epicenter
1	10-01-1869	24.79	93.17	7.5	Kachar, Assam, India
2	14-07-1885	24.70	89.55	7.0	Eastern Province, Nepal
3	12-06-1897	25.84	90.38	8.8	Shilang, Meghalaya, India
4	08-07-1918	24.16	91.75	7.6	Dauki, Meghalaya, India
5	02-07-1930	25.95	90.04	7.1	Dhubri, Assam, India
6	15-01-1934	26.60	86.8	8.3	Bihar-Nepal Border
7	23-10-1943	26.80	94.00	7.2	Assam, India
8	15-08-1950	28.79	95.62	8.6	Tibet, China
9	21-03-1954	25.86	94.00	7.2	Assam, India
10	08-07-1975	25.58	92.60	6.5	Assam, Sillon
11	06-08-1988	25.13	95.15	6.6	Manipur-Myanmar Border
12	21-11-1997	22.07	92.75	8.5	Arakan, Myanmar
13	11-08-2009	15.01	92.30	7.8	Andaman Islands

Tsunami is a series of very long waves generated by any rapid, large-scale disturbance of the sea or by sea floor displacements from large undersea earthquakes. Thus, tsunami is defined as a large destructive ocean wave caused by an underwater earthquake or some other movement of the earth's surface or some geologic processes like undersea landslide or volcanic eruption.

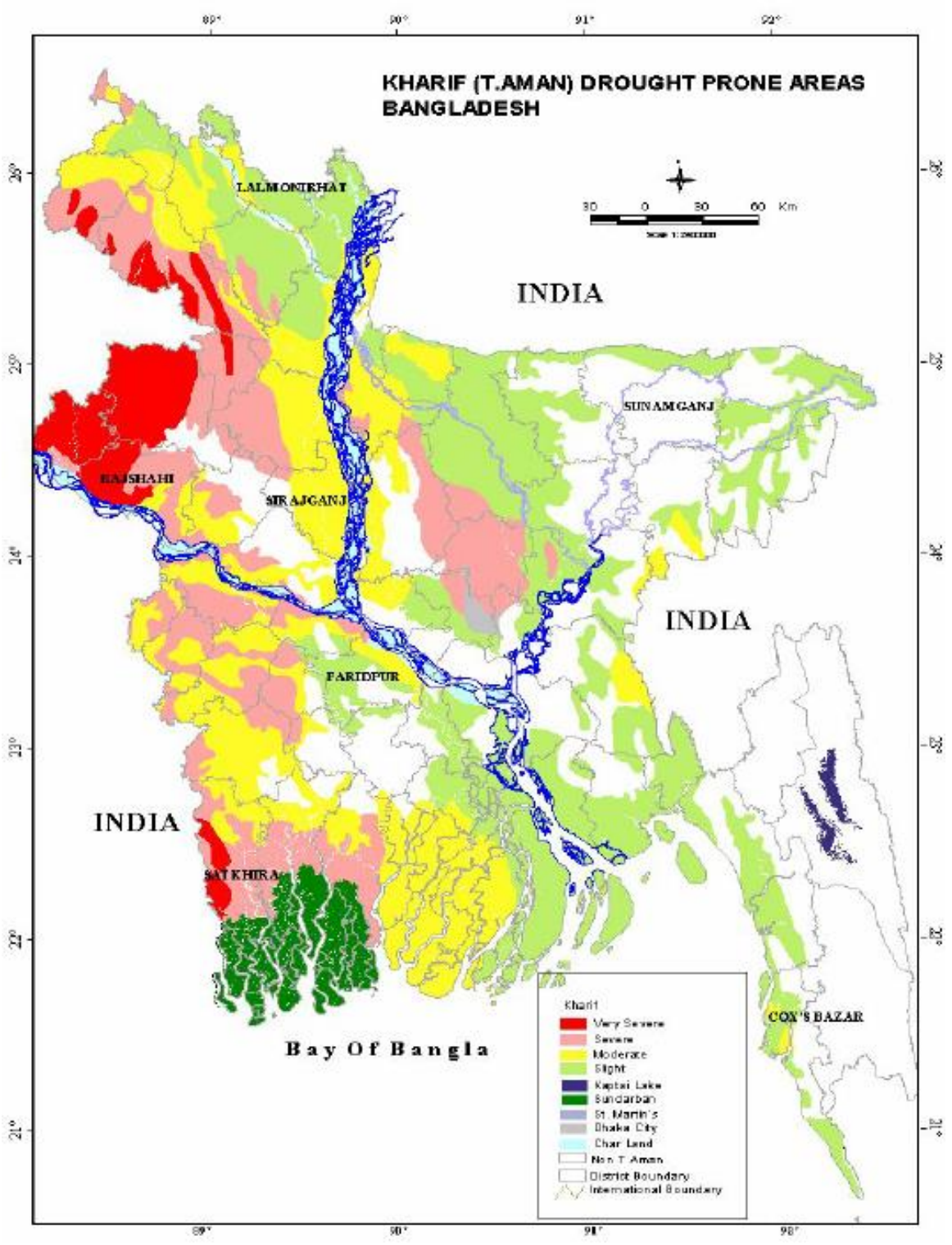
Tsunamis can cause great destruction and loss of life within a minute on shores near their source. They are capable of obliterating coastal settlements and may cause severe coastal flooding and ecological disruption of coastal areas. It is very hard to escape violent disasters caused by tsunami.

However, it is very important to create public awareness, improved tsunami detection, mitigation and warning system for avoiding huge loss of life and property. Experts have suggested the following steps:

- Preservation of coral reef and natural mangrove forests;
- Afforestation in coastal areas;
- To keep a pollution free sea;
- Stop excessive fishing and introduce modern sustainable fish catching methods;
- public dwellings should be kept at least 500 meters away from a seashore, coastal embankment etc.

8.5 Draughts

Due to the scarcity of rainfall and unavailability of surface water in this region during the month of April to July, the Lalmonirhat district severely affect by drought almost every year. Practice to withdraw groundwater also sometimes being impossible due to lower acquirer and fuel price increase.



(Source: SDRI,2001)

Figure 8.4: Draught status of the project area

Thousands of hectors of sun burnt cultivable lands develop cracks as soil moisture come to the lowest level. Adequate Rainfall restores the draught situation in this region during monsoon season.

8.6 Impact Mitigation

The mitigation measures that should be taken for the mitigation or preparedness of disaster impacts are:

- Analyze the annual disaster trends of the project area and identify the most disastrous months.
- Avoid construction works during that period.
- Use earthquake resistant construction materials.
- Design and implement the project keeping in mind about the possible disaster and their impacts.

8.7 Emergency Response plan (ERP)

8.7.1 Introduction

The initial response to an incident is a critical step in the overall emergency response. The responders often have minimal information and must make rapid decisions to ensure safety of the public and the response teams themselves. As a rule, the initial response is guided by three priorities:

1. People
2. Property
3. Environment

It is also important to remember that emergency response must be adapted to individual circumstances and may require creative solutions to difficult problems. Further, to improve the response capabilities, cooperative arrangements and organizations must be established for providing the appropriate equipment and expertise.

Nature of emergency and hazardous situations may be of any of the following categories.

1) **Emergency**

- Fire
- Explosion
- Medical emergency
- Leaks and other releases of hazardous substances
- Spillage of toxic chemical, and electrocution

2) **Natural disasters**

- Flood
- Earthquake/cyclone
- Storm/ Typhoon/ Tornados, and
- Cloud burst lightning

3) **External factors**

- Food poisoning
- Sabotage, and
- War

The following framework should be followed in the project site in order to reduce risk and response in an emergency situation.

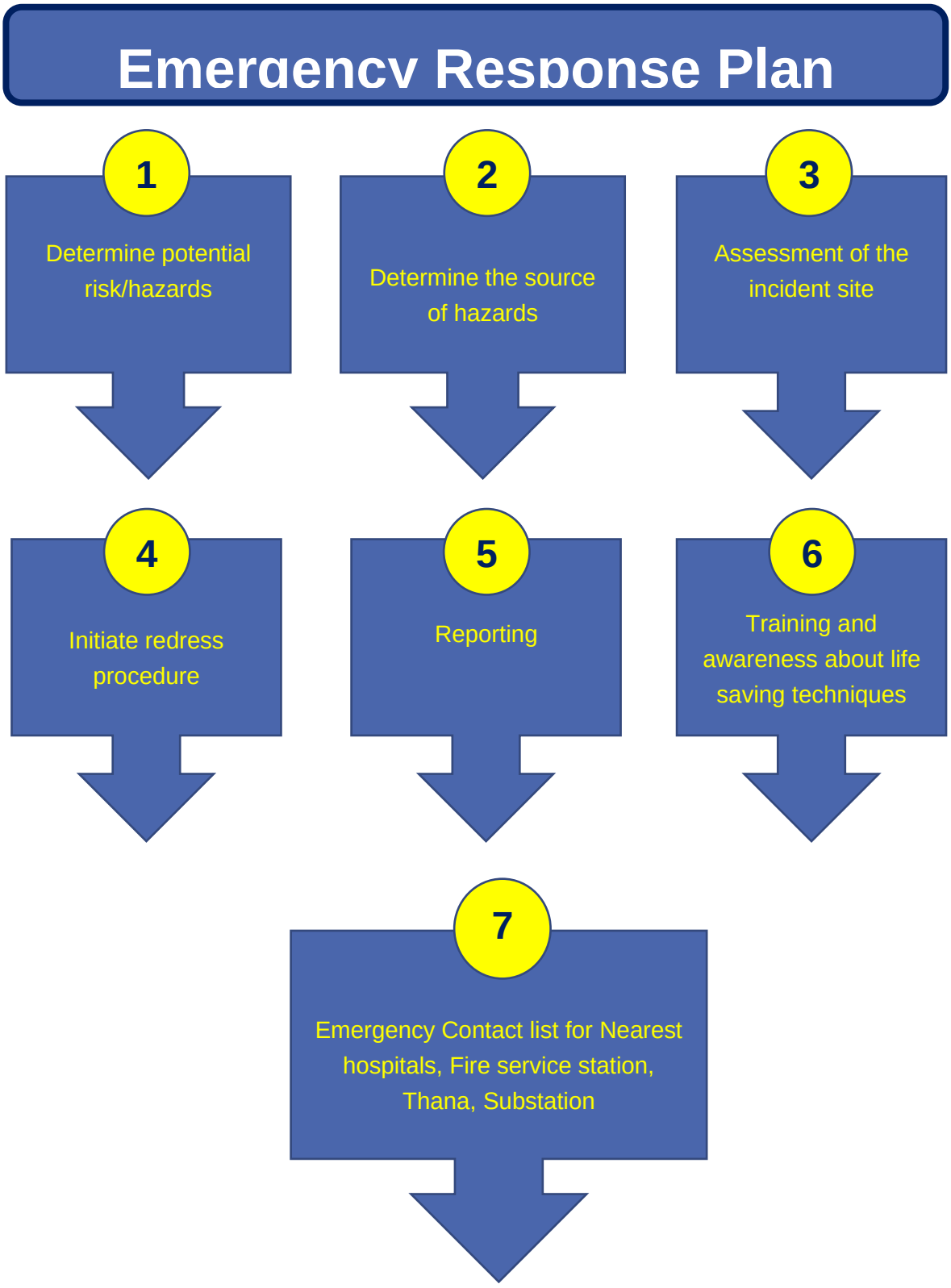


Figure 8.5: Framework for Emergency Response Plan

8.7.2 Seven steps in emergency response

Step-1

a) Determine the potential hazards and take appropriate action to identify the type and qualities of dangerous goods.
b) Determine potential hazards from local conditions such as inclement weather water bodies

Step-2

Determine the source/ cause of the event resulting to the emergency and prevent further losses.

Step-3

An assessment of the incident site for any further information on hazards or remedies.

Step-4

Initiate redress procedure.

Step-5

Report the incidence procedures and any further assistance required etc. to the appropriate company, government and/or land owner.

Step-6

Create awareness and training programme for workers for emergency situation and life saving techniques.

Step-7

Collect information about the nearest hospitals, fire service, police station, substation for emergency situation. Make available the information in the project site via signboard, poster etc.

8.7.3 Emergency Response Planning

The objective of an Emergency Response Plan (ERP) is to describe the procedures to ensure the health and safety of staff.

Three levels of planning may be used depending on the particular circumstance, potential incidence rate and the location and number of residents living in the community/ locality in close proximity along the project sites. The scope of the ERP depends on the potential impact of the project activities, complexity of evacuation logistics and proximity to public facilities. A key feature of all plans is the Emergency Planning Zone which defines the area to be evacuated or protected in the event of an emergency. Another fundamental requirement of Emergency Response Planning is that discussions occur with local residents and public within the Emergency Planning Zone and must include any pertinent health factors which must be considered.

The procedure should have an action plan to address the emergency. This includes defining the "Stages of Alert" that may be applicable for various aspects of the work.

Another essential component of an ERP is the responsibility of the emergency response personnel including; off-site and on-site personnel, team coordinators, safety and evacuation personnel, monitoring crews, public relations and government personnel.

The roles and responsibilities for the various government departments are to be defined and coordinated within the plan should include the provision for the company/government to establish an on-site command post and a main control headquarters to provide advice.

8.7.3.1 Specialized equipment

All relevant emergency equipment should be maintained on site throughout the project. This includes items such as fire extinguishers self-contained breathing apparatus and personal protective gear etc.

8.7.3.2 Training

In-house training programs should be held by the company and designated first responders to test their capabilities. Response teams have to be assembled both on company and community cooperative basis to deal with potential emergency situations. A 2- day training program that includes two field exercises would be effective for the attendees.

8.7.3.3 Safety orientation

Safety orientation is one of the most important aspects of any safety program. Employees and contractors must receive some level of basic training, specific to the facility and nature of the job. It must be ensured that appropriate orientation is given to all employees, contractor's sub-contractors and visitors.

The orientation should include:

- Company safety policy and procedures;
- Specific job hazards;
- Safety precautions,
- Job responsibilities,
- Regulatory requirements;
- Company enforcement policy; and
- Worker's right-to-know and authority to refuse unsafe work.

8.7.3.4 Level of incidents

The affected area can be classified the following four classes In the event of a disaster at any Location within the workplace.

- **Level-I:** Operator level
- **Level II:** Local/community level
- **Level-III:** Regional/National level
- **Level-IV:** International level

Only Level-I and Level-II class of incidents or accidents will applicable within the proposed Solar Project.

Level-I, disasters may be the result of fires, explosions, oil spillages and spontaneous ignition of inflammable' materials. This may affect persons working in and around moving machinery, other plant and various sites which have been mentioned as potential hazard areas.

Level-II disasters may happen due to sabotage or complete failure of all automatic control/warning systems.

8.7.4 Incident/Accident Investigation and Reporting System

A routine system should be enforced to ensure that all accidents are investigated and reported to the plant supervisors in a specified format such as the following:

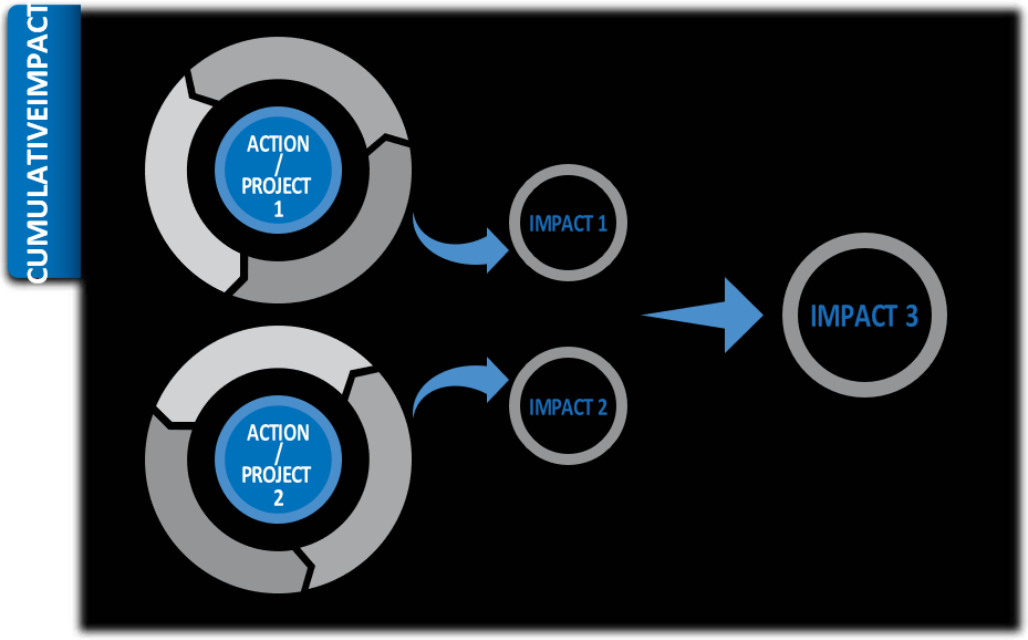
- Description of incident or episode;
- Immediate cause;
- Background on the factors that might have made the incident possible;
- What form of energy release or toxic substance was involved?
- What was done to prevent accident (who responded and how)?
- What effect did it produce on the immediate and surrounding environment?
- What repercussions did the incident have?
- Cost estimates of damage done and repairs need.

Registers of all incidents should be kept and should be analyzed on a regular basis (at least monthly) to identify trends or patterns in incident occurrence in particular cases.

9 CUMULATIVE ENVIRONMENTAL & SOCIAL IMPACTS

The World Bank's "good practice handbook: cumulative impact assessment and management - guidance for the private sector in emerging markets (English)" proposes a six-step process to assist private sector companies in emerging markets identify cumulative impacts and guide them in the effective design and implementation of measures to manage such cumulative effects. This handbook is based on IFC's experience in applying its performance standards and is non-prescriptive in its approach. It should be used in conjunction with the Performance Standards, their guidance notes, and the World Bank Group environmental, health, and safety guidelines, which contain basic requirements and good international practices to be followed when designing, developing, and/or implementing projects. This document is not intended to duplicate requirements under the existing IFC sustainability framework. Its purpose is to provide practical guidance to companies investing in emerging markets to improve their understanding, assessment, and management of cumulative environmental and social impacts associated with their developments.

According to the handbook, Cumulative impacts are changes to the environment caused by an action (project or project activity) in combination with other past, present, and future human actions. It should be noted that the terms "impact" and "effect" are often used interchangeably in this guideline. In general, both of these terms aim to describe any change that the project may cause in the environment.



The objective of the current cumulative impact assessment is to evaluate the combined effects of proposed developments along with the proposed project. The project adverse impacts have been broadly classified as impacts on land, structures (residential, commercial, residential cum commercial, and others) impacts on other immovable assets, impacts on other property assets, impact on community property resources (religious structures, madrasah, school, passenger shelter, etc.), impacts on livelihood, etc.

9.1 Cumulative Negative Impacts and Mitigation Measures

9.1.1 Residual Impacts

After analysis of the air quality, the concentrations of CO, SO_2, NOx, PM_{10}, and $PM_{2.5}$ have been recorded. This project will contribute insignificantly of pollutants to the ambient environment.

From the cumulative impact assessment, it can be concluded that the proposed project will not contribute significantly during the initial stages.

9.1.1.1 Noise Level

There are no other development works are going on nearby the location. The proposed project will create some noise during the construction period. However, during the operation stage, there is no such possibility.

9.1.1.2 Mitigation Measures

Construction-related cumulative impacts would be effectively minimized by adopting proper mitigation measures, including:

- coordination between all project components and other projects (if any) in the area of influence in terms of the construction schedule, possible access road and disposal sites sharing;
- contractors will develop material transport plan with the consultation of the local community;
- enforcement of good construction management to minimize dust, noise, and waste generation;
- education of construction workers to minimize social disturbance and cultural conflict;
- provision of temporary access to local traffic;
- Proper maintenance of the access roads and timely restoration/strengthening upon completion. With the effective implementation of good construction management measures, these common construction-related cumulative impacts can be adequately mitigated to acceptable levels.

9.1.1.3 Cumulative Beneficial Impacts

The cumulative beneficial impact of the project will result in

- increased employment
- Reduce dependency on National electricity grid
- Sustainable use of natural resources

9.1.2 Deterioration of Roadside Air Quality

Construction activities of the project will generate air emissions including dust that will affect the population and communities. However, during the operational stage, no extra air pollution is expected.

9.1.3 Employment

Employment generation will occur due to the project implementation and in the increased commercial and business activities induced with electricity supply.

9.1.4 Deterioration of Surface Water Quality

The proposed project will generate several types of wastes during their construction and O/M stages. Typical wastes are likely of solid and liquid that may further be classified as hazardous/toxic and non-hazardous/non-toxic. Disposal of these wastes without treatment will contaminate the surface water surrounding the dumping sites. Contamination of surface water quality will have a potentially significant negative impact on the biological functions of surface water as well as fish/aquatic life resources therein.

9.1.5 Deterioration of Groundwater Quality

Deterioration in groundwater quality is likely to occur due to the dumping of untreated wastes. Leachate of wastes that contains hazardous elements will percolate soils reaching groundwater contaminating the natural resources.

9.1.6 Wastes

Wastes will be generated during the construction and O/M of the proposed project, and unless they are properly managed, they will cause a severe impact on the environment. Particularly hazardous wastes would affect the safety and health of the workers as well as will contaminate soil and water at their dumping locations.

9.1.7 Mitigation Measures

The proposed project will not have any significant impacts. Only some impacts may generate if there are any improper management of the project. So, the proper management and monitoring and following the ESMP during the project implementation will reduce the possibility of the induced impacts.

9.2 Summary of Cumulative Impacts

The types of environmental and social cumulative impacts with their magnitude of impacts are summarized in the table below:

Table 9.1: summary of cumulative impacts and magnitude

Environmental and Social issues	Magnitude of Impacts						
	Positive Impact			No Impact	Negative Impact		
	Low	Moderate	High		Low	Moderate	High
Pre-Construction Stage							
Impact on air quality					√		
Quality of surface water						√	
Loss of agricultural land					√		
Impact on land resources					√		
Quality of Soil					√		
Impact on drainage				√			
Impact on eco-system					√		
Construction Stage							
Quality of Surface water						√	
Impact on air						√	
Quality of soil						√	
Drainage congestion				√			
Loss of aquatic biota					√		
Impact on noise						√	
Impact on agriculture				√			
Job opportunity		√					
Operation Stage							
Quality of air					√		
Noise level				√			
Soil quality				√			
Impact on climate change		√					
Loss of natural drainage				√			
Job opportunity	√						

10 ENVRIONMENTAL AND SOCIAL MANAGEMENT PLAN

This chapter presents the Environment and Social Management Plan (ESMP) for the proposed Project. It specifies measures for addressing the limited negative risks and impacts and for enhancing the beneficial impacts. In addition, organizational capacity and training requirements, required to check and ensure effectiveness of the plan throughout the lifecycle of the project, have also been discussed.

An effective environmental management system is a dynamic, continuous process initiated by management and involving communication between the project proponent, the workers, and the local communities directly affected by the project. The ESMP includes proposed mitigation measures, environmental monitoring and reporting requirements, training measures, implementation schedule and cost estimates.

ISPL is committed to execute all construction and operation related activities for the proposed Grid Tied Solar Project as per the best established environmental, health and safety standards and also it should be aligned with upcoming project to be implemented at asset level. Mitigation measures are proposed for impacts which are identified and quantified. Some residual impact will however persist after the all-mitigation measures are employed, the Environmental and Social Management Plan intends to delineate monitoring and management measures to minimize such impacts by allocating management responsibility and suggesting skill requirement for implementation of these measures during all phases of the project.

10.1 Objectives

The objective of this ESMP is to specify the standards and controls required to manage and monitor environmental and social impacts during construction and operation phase. To achieve this, the ESMP identifies potential adverse impacts from the planned activities and outlines mitigation measures required to reduce the likely negative effects on the physical, and social environment. Thus, the objectives of ESMP for the present project would be,

- Mitigation measures to reduce or eliminate negative impacts
- Enhancement measures to maximize positive impacts
- Monitoring requirement and
- Monitoring indicators

Feasible and economically expedient measures are planned to be implemented at ESMP which can reduce to a reasonable level and/or exclude possible essential negative consequences of environmental impact. At ESMP, in particular:

- expected adverse environmental impacts at construction stage and operation are identified and generalized;
- impact reduction measures are described;
- interrelation with existing impact reduction plan is established;
- parameters subject to measurement, monitoring methods to be applied, places of supervision, frequency of measurements are specified.

The environmental and social management plan includes the following elements facilitating it's timely and effective realization:

- **Management System** - reflects implementation mechanism of ESMP;
- **Roles and Responsibilities** - identify persons responsible for realization of measures on impact reduction and monitoring;
- **Impact Importance Assessment** - is intended for timely reveal of aspects invoking particular measures on impact reduction;

environmental and social management plan includes the list of actions on impact decrease, monitoring, and also amount of expenses for their realization.

10.2 Environmental and social Management Plan

In order to minimize adverse impacts during different phases of project lifecycles, mitigation measures and responsibilities for its implementation during pre-construction, construction, operation, and decommissioning phase are given in table below

Table 10.1: Environment and Social Management Plan (ESMP)

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
Pre-construction Phase						
Site Preparation	The proposed project is a charland, site preparation will have impact the local air quality.	Dust control via water spray is needed during site preparation	Once	Better air quality will have better impact on health	Contractor	ECR,97
Hiring Labour	Skilled and unskilled labors will be needed for the project works and maintenance	Unskilled labors will be taken from local area and skilled labour will be taken based on availability. For employment, women will have equal opportunities for employment as well as there will be benefits/incentives for female workers.	As needed	Hiring local labors will create local employment	Contractor	▪ Bangladesh Labor Law, 2006
Land Development	Total land should be developed as per project design and layout	Avoid destruction of any ecological habitat if available, avoid interrupting the course of the Tista River	Once	River does not lose its own course	Contractor	▪ Environment Conservation Rules (ECR), 1997 ▪ National Biodiversity Strategy and Action Plan, 2004
Construction Phase						
Visual Amenity	Visual impacts from construction activities such as materials lay down, infrastructure development, etc.	The contractor shall ensure general cleanliness and good housekeeping practice at the project site at all times.	Daily	Good housekeeping and tidiness of work areas within the project site.	Contractor	▪ National Land use Policy, 2001 ▪ National Environmental Policy, 2008 ▪ National Environmental Management Action Plan, 1995
Transmission Line	Long-term changes to habitat, bird strikes, access issues, noise effects and associated avoidance behavior, and electric and magnetic fields etc.	The contractor shall: • Ensure proper wiring and insulation • Signboards must be ensured for the transmission line and possible danger should be mentioned in the				

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
		signboards for anyone to understand the risk. • Establish wildlife corridors • Minimizing the potential for habitat and breeding disturbance can be obtained by seasonal monitoring by natural resource officers, especially during the breeding and nesting seasons.				
Water Resources	As the amount of water requirement is too little, the impact on water resources is not that significant.	• The contractor will dispose of the debris material to a designated disposal site. • All reasonable measures will be taken to prevent the wastewater generation and direct dumping into nearest surface water body. ▪ Contractor's camp will be provided with sanitary latrines that do not pollute surface waters. ▪ The ground water in the project area has been used for different purposes like drinking and irrigation, hence proper mitigation measures must be ensured at construction site to avoid any spillage and leakage of oil from machineries. ▪ All the staffs at construction areas must be refrained of discharge any liquid wastes on the ground.	Daily	Compliance with DoE and National guideline limits for Environmental noise at sensitive receptors.	Contractor	▪ Environmental Pollution Control Ordinance, 1977
Noise	Increased noise levels during to the panel configuration and structure development process	▪ avoid use of old generators, and machineries. ▪ Also make sure to lubricate the parts that makes noise	Regularly	Compliance with DoE and National guideline limits for Environmental noise at sensitive receptors.	Contractor	▪ Noise Pollution Control Rules (2006)

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
Air Quality	▪ Dust generation due to construction activities. ▪ Exhaust Emissions due to operation of construction plant and machinery.	▪ Regular water spray on the site is required. ▪ Unnecessary handling of dusty materials will be avoided such as minimizing drop heights when loaders dump soils into trucks. ▪ Train workers to handle construction materials and debris during construction to reduce fugitive emissions. ▪ Maintain vehicles to reduce air pollutants.	Regularly	▪ Regular machineries maintenance records. ▪ Air quality analysis	Contractor	▪ Environmental Pollution Control Ordinance, 1977 ▪ Environment Conservation Rules (ECR),97 ▪ Environment Court Act, 2000 ▪ Bangladesh Climate Change Strategy and Action Plan (2008)
Soil Pollution	Soil disturbance due accidental spillage	▪ A spill prevention and response plan shall be prepared by the contractor in order to control any inadvertent leakage or spillage. Spill response measures shall be implemented (as necessary) to contain and clean up any contaminated soil. ▪ Any spilled chemical shall be immediately collected and disposed of in accordance with Spill Prevention and Response Plan and MSDS.	Regularly	▪ Number of spills or incidents to be recorded during onsite audits.	Contractor	▪ Environmental Pollution Control Ordinance, 1977 ▪ The Environment (Pollution Control) Act, 1995
Waste Generation	Improper management and handling of hazardous and non-hazardous waste during panel configuration.	▪ The contractor shall segregate storage for different types of wastes, such as hazardous, non-hazardous recyclable construction material, plastic, paper, etc. to facilitate proper disposal. ▪ The contractor shall provide a separate storage area for hazardous materials. The hazardous materials/products must be labeled with proper identification of its hazardous properties.	Daily	▪ Compliance with Waste management procedures. ▪ Current and Complete records of regular waste pickup and disposal.	Contractor	▪ Environmental Pollution Control Ordinance, 1977 ▪ The Environment (Pollution Control) Act, 1995 ▪ Environment Conservation

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
		▪ Chemical waste shall be stored in accordance with the provisions of Material Safety Data Sheets (MSDS). The contractor shall keep MSDS onsite. ▪ The contractor shall establish regular intervals for waste collection and disposal as per contractor's waste management procedures.				Rules (ECR), 1997 ▪ Solid Waste Management Rules, 2021
Health and Safety risks	**Occupational Health and Safety:** ▪ Potential of exposure to safety events such as tripping, fire from hot works, smoking, failure in electrical installation, vehicles, and electrical shocks. ▪ Exposure to health events during construction activities such as manual handling and musculoskeletal disorders, hand-arm vibration, temporary or permanent hearing loss, heat stress, and dermatitis. **Community health and safety:** ▪ If the influx of workers and the nature of the civil works cause stress on existing infrastructure and natural resources such as water; conflict with the local communities may arise. ▪ The community may be exposed to increased construction-related traffic and equipment. ▪ Dust from earthworks, noise and vehicle idling may become common in sub-project areas. ▪ The operation of construction worker camps may result in environmental pollution from	▪ All the construction equipment used for the execution of the project works shall be fit for purpose and carry valid inspection certificates and insurance requirements. ▪ Risk assessment shall be prepared and communicated prior to commencement of work for all types of work activities on site. ▪ Provide walkways that are clearly designated as a walkway; all walkways shall be provided with good conditions underfoot; signposted and with adequate lighting. ▪ Signpost any slippery areas, ensure proper footwear with a good grip is worn for personnel working within slippery areas. ▪ Avoid work at height where it reasonably practicable to do so, e.g., by assembly at ground level. ▪ Carry out fire risk assessment for the construction areas, identify sources of fuel and ignition and establish general fire precautions including, means of escape, warning and fighting fire. ▪ Set up a system to alert workers on site. This may be temporary or	Regularly	▪ Total Recordable Incidence Rate (TRIR) ▪ Lost Time Incidence Frequency ▪ Fatal Accident Rate ▪ Number of safety Training performed ▪ Number of nonconformance events Reports. ▪ Medical Treatment Case (MTC) ▪ HSE Training Hours	Contractor	▪ Bangladesh Labor Law, 2006

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
	organic and inorganic waste generated by project activities. ▪ Sexual Exploitation and Abuse (SEA)/ Sexual Harassment (SH) may arise within the workers and also within the communities. The project workers may raise issues regarding potential transmission risks for COVID-19 both within the worksite and for nearby communities. These risks are not only from workers that are mobilized locally but also from workers moving from other regions/countries.	permanent mains operated fire alarm. ▪ Fire extinguishers should be located at identified fire points around the site. The extinguishers shall be appropriate to the nature of the potential fire. ▪ Ensure all plant machines and vehicles are regularly inspected, serviced and maintained; ensure all staff assigned is trained and competent to operate plant machines and vehicles. ▪ Electrical equipment must be safe and properly maintained; works shall not be carried out on live systems. ▪ Only competent authorized persons shall carry out maintenance on electrical equipment, adequate Personal Protective Equipment (PPE) for electrical works must be provided to all personnel involved in the tasks. ▪ Lock-Out / Tag-Out (LOTO) system shall be implemented during any electrical works. ▪ Adequate number of staff and first aiders shall be on site in accordance with Bangladesh Labor Law requirements. ▪ First aid kit with adhesive bandages, antibiotic ointment, antiseptic wipes, aspirin, non-latex gloves, scissors, thermometer, etc. shall be made available by the contractor on site. ▪ Awareness training sessions should be established and provided to all personnel involved during the construction phase in order to				

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
		highlight the heat related illnesses of working in hot conditions such as heat cramps, heat exhaustion, heat stroke, dehydration. ▪ Ensure adequate quantities of drinking water are available at different locations within the site, ▪ Eliminate the risk of exposure whenever possible, provide proper PPE wherever necessary and to ensure that there are satisfactory washing and changing facilities. ▪ Ensure that all workers exposed to a risk are aware of the possible dangers. They should be given thorough training in how to protect themselves and there should be effective supervision to ensure that the correct methods are being used. ▪ The worker influx should be checked, and proper management should be implemented as to avoiding conflicts with the local communities. ▪ A traffic management system should be implemented to avoid / mitigate traffic jam and other relevant consequences. ▪ Dust from earthworks and noise should be regularly monitored and kept below the standard. Idling vehicles should also be checked as to reduce traffic jam and facilitate community passages. ▪ A waste management plan will be implemented throughout the whole project period to manage organic and inorganic wastes of the project. ▪ A GBV plan should be implemented to avoid sexual exploitation and				

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
		abuse (SEA)/ sexual harassment (SH). ▪ Possible incidents, accidents, and disasters will be monitored and recorded. The project has to notify IDCOL within 48-72 hours of occurrence of any accidents or incidents to facilitate root-cause analysis and IDCOL will notify it to the relevant development partners. ▪ The national COVID-19 response protocol along with the relevant guidelines will be adopted.				
Traffic	Additional traffic load due to transport of equipment and materials	▪ The contractor to ensure that all trucks and vehicles accessing the facility are operated by licensed operators. ▪ Pedestrians Safety: All project vehicles and trucks shall comply with the proposed speed limits ▪ Ensure adequate maintenance and inspection of vehicles ▪ Presence of flagman at the entrance and exit of the project site in order to control vehicles and truck movement.	Regularly	▪ No complains or concerns from traditional users of the area's roads routes are received during the construction activities. ▪ No incidents or accidents (collisions) are recorded	Contractor	
Operation Phase						
Visual Amenity	Reflection from the solar panel will create visual intrusion.	The used technology has Anti-Reflective coating (ARC) that significantly reduces the reflectance of the Panels (from 2.5% to 2.6% only).	N/A	N/A	Project Authority	▪ National Land use Policy, 2001 ▪ National Environmental Policy, 1992 ▪ National Environmental Management Action Plan, 1995

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
Heat Generation	▪ Potential glare from PV panels and Reflected Heat.	▪ As the site location is in open area, no significant impact will be caused	N/A	▪ No heat generation and complains from the worker.	Project Authority	▪ Environmental Pollution Control Ordinance, 1977
Terrestrial Ecology	Potential disturbance and harm to birds	▪ Ground nests found on site shall be translocated outside the project boundary. ▪ Waste shall be stored on site within closed container, especially food remnants to avoid attracting birds on site.	Regularly	No reported harm to birds.	Project Authority	▪ Bangladesh Wildlife Preservation Order 1973 and Revision 2008 (Draft); ▪ National Biodiversity Strategy and Action Plan, 2004
Occupational and Community Health and Safety risks	▪ Potential exposure to safety events such as tripping, fire from hot works, smoking, failure in electrical installation, vehicles, and electrical shocks. ▪ Environmental pollution from waste generated by project activities. ▪ Sexual Exploitation and Abuse (SEA)/ Sexual Harassment (SH) may arise within the workers and also within the communities. ▪ The project workers may raise issues regarding potential transmission risks for COVID-19 both within the worksite and for nearby communities. These risks are not only from workers that are mobilized locally but also from workers moving from other regions/countries.	▪ Provide walkways that are clearly designated as walkways; all walkways shall be provided with good conditions underfoot; signposted and with adequate lighting. ▪ Signpost any slippery areas, ensure proper footwear with a good grip is worn for personnel working within slippery areas. ▪ Avoid work at height where it reasonably practicable to do so, e.g., by assembly at ground level. ▪ Set up a system to alert workers on site. This may be temporary or permanent mains operated fire alarm. ▪ Fire extinguishers should be located at identified fire points around the site. ▪ Ensure all plant machines and vehicles are regularly inspected, serviced and maintained; ensure all	Regularly	▪ Total Recordable Incidence Rate (TRIR) ▪ Lost Time Incidence Frequency ▪ Fatal Accident Rate ▪ Number of safety Training performed ▪ Number of nonconformance events Reports. ▪ Medical Treatment Case (MTC) ▪ HSE Training Hours	Contractor	▪ Bangladesh Labor Law, 2006

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
		staff assigned are trained and competent to operate plant machines. ▪ Electrical equipment must be safe and properly maintained; works shall not be carried out on live systems. ▪ Only competent authorized persons shall carry out maintenance on electrical equipment, adequate Personal Protective Equipment (PPE) for electrical works must be provided to all personnel involved in the tasks. ▪ Lock-Out / Tag-Out (LOTO) system shall be implemented during any electrical works. ▪ Adequate number of staff and first aiders shall be on site in accordance with Bangladesh Labor Law requirements. ▪ First aid kit with adhesive bandages, antibiotic ointment, antiseptic wipes, aspirin, non-latex gloves, scissors, thermometer, etc. shall be made available by the contractor on site. ▪ Ensure adequate quantities of drinking water are available at different locations within the site. ▪ A waste management plan will be implemented throughout the whole project period to manage wastes of the project. ▪ A GBV plan should be implemented to avoid sexual exploitation and abuse (SEA)/ sexual harassment (SH). ▪ Possible incidents, accidents, and disasters will be monitored and recorded. The project has to notify				

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
		IDCOL within 48-72 hours of occurrence of any accidents or incidents to facilitate root-cause analysis and IDCOL will notify it to the relevant development partners. ▪ The national COVID-19 response protocol along with the relevant guidelines will be adopted.				
PV panels	The most significant source of soil pollution is the damage of PV panels in case of major accidents. These contain chemicals and may be harmful for soil quality. There will be environmental impacts of emission of greenhouse gas, Ozone depletion, photochemical smog, eutrophication and acidification and also health effects on people. Wasted PV modules few other solid wastes generated during the operational stage. These include end-of-life solar PV modules, electrical wastes, metallic wastes and stationary wastes of office works etc.	Photovoltaic (PV) is now a proven technology which is inherently safe as opposed to some dangerous electricity generating technologies. Photovoltaic systems make no air pollution and cause no pollution in operation. PV panel should be clean and maintenance regularly for dust free. The supplier will collect wastage PV panels for maintenance and destroy and they will be responsible for management of PV panels. The project proponent should check these devices regularly and have to replace the damaged and expired or bad devices. However, if possible, the damaged and expired devices should be maintained properly and recycled.	Regularly	Compliance with DoE Regular machineries maintenance records.	Project Authority	▪ Environmental Pollution Control Ordinance, 1977 ▪ Environment Conservation Rules (ECR), 1997 ▪ Environment Court Act, 2000
Decommissioning Phase						
▪ The solar power plant facility is considered a large-scale long-term investment that will contribute to economic benefits to the country through provision of power supply, designed in accordance with best practice, taking into account all relevant national and internal codes and legislation. ▪ As can be noted from the impact assessment chapter no impacts with high significance are anticipated to take place during decommissioning of the project since all facilities will be removed, solar power plant decommissioned, and PV panels will be dismantled and sent for recycling or disposal. ▪ The main mitigation and monitoring measures to minimize or reduce the environmental and social impacts during decommissioning are anticipated to be similar to those identified for the construction phase. ▪ The solar PV panels that will be used in the project will have a life span of 25 years. Disposal of wasted solar PV modules is very important because if not properly decommissioned, the greatest health risk from end-of-life crystalline solar modules arises from lead containing solders. Under the right conditions it is possible for the lead to leach into landfill soils and eventually into water bodies. ▪ While the solar cell is the heart of a photovoltaic system, on a mass basis it accounts for only a small fraction of the total materials required to produce a solar panel. The outer glass cover constitutes the largest share of the total mass of a finished crystalline photovoltaic module (approximately 65%), followed by the aluminum frame (~20%), the ethylene vinyl acetate encapsulates (~7.5%) and the polyvinyl fluoride substrate (~2.5%), and the junction box (1%). The solar cells themselves only represent about four percent (4%) of the mass of a finished module.					

Aspect	Key Potential Impact	Mitigation Measures	Frequency	Performance Indicator	Responsibility	Legal Requirements
Proper decommissioning and recycling of solar panels both ensures that potentially harmful materials are not released into the environment and reduces the need for virgin raw materials. In recognition of these facts, the photovoltaic industry is acting voluntarily to implement product take-back and recycling programs at the manufacturing level.						

10.3 Monitoring Program

Environmental and Social Monitoring Plan will be prepared to provide guidelines for environmental management plan during the construction and operation phases of the proposed 30 MW solar power plant project. The environmental components that will be monitored are those that will be positively or negatively affected, or expected to be affected, by construction activity. Environmental management is a sustainable way of planning, arranging, supervising, organizing, and developing the environment for the maintenance of the preservation of natural resources and the prevention or reduction of damage to the environment. The major environmental impact, monitoring method, responsible organization, and expense for each environmental item in the construction and operation phases for the proposed development are listed in Table below:

Table 10.2: Environmental and Social Monitoring Plan

Environmental Components	Parameters/ Units	Standards/ Guidelines	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
				Implementation	Supervision
PRE-CONSTRUCTION STAGE					
Air Quality	$PM_{2.5}$, PM_{10}, SO_x, NO_x, CO	Air quality standard by DoE, Bangladesh	Once	Contractor	ISPL
Noise Level	dB(A)	Noise Pollution Control Rules (2006)	Once	Contractor	ISPL
Surface water Quality	Temperature, pH, EC, salinity, DO, ORP, TSS, Calcium, Manganese, Arsenic, BOD, COD, Phosphate, Sulphate, Chloride	Surface water quality standard by DoE, Bangladesh	Once	Contractor	ISPL
Groundwater Quality	Temperature, pH, EC, salinity, TDS, TSS, ORP, Calcium, Arsenic, Iron, Manganese, Chloride, TC, FC	Groundwater quality standard by DoE, Bangladesh	Once	Contractor	ISPL
Benthos & Plankton	Benthos & Plankton species	-	Once	Contractor	ISPL
CONSTRUCTION STAGE					
Air Quality	$PM_{2.5}$, PM_{10}, SO_x, NO_x, CO	Air quality standard by DoE, Bangladesh	Twice	Contractor	ISPL
Dust	Dust control	Air quality standard by DoE, Bangladesh	Regularly	Contractor	ISPL
Noise Level	dB(A)	Noise Pollution Control Rules (2006)	Twice	Contractor	ISPL
Surface water Quality	Temperature, pH, EC, salinity, DO, ORP, TSS, Calcium, Manganese, Arsenic, BOD, COD, Phosphate, Sulphate, Chloride	Water quality standard by MoEF, Bangladesh	Twice	Contractor	ISPL
Groundwater Quality	Temperature, pH, EC, salinity, TDS, TSS, ORP, Calcium, Arsenic, Iron, Manganese, Chloride, TC, FC	Groundwater quality standard by DoE, Bangladesh	Twice	Contractor	ISPL
Soil Pollution	• Check liquid waste is carried out by experienced personnel and in proper way • Careful and proper handling of oil and other hazardous liquids	Monitoring	Regularly	Contractor	ISPL
Waste	• Check storage, transportation, disposal, handling of hazarders waste	Monitoring	Weekly	Contractor	ISPL

Environmental Components	Parameters/ Units	Standards/ Guidelines	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
				Implementation	Supervision
	• Waste and effluents to be collected and disposed safely from camp. • Wastes and garbage from construction sites to be disposed safely				
Community Health and Safety	• Check the influx of workers and the nature of the civil works; • Construction-related traffic and equipment should be checked. • Dust from earthworks, noise and vehicle idling should be checked. • The environmental pollution from organic and inorganic waste generated by project activities should be checked. • Sexual Exploitation and Abuse (SEA)/ Sexual Harassment (SH) should be checked. • Relevant Covid 19 measures should be checked.	Monitoring	Regularly	Contractor	ISPL
Occupational Health & Safety	• Personal protection equipment (PPE) for workers is checked on the job sites. • Check for a safe water supply, a sanitary toilet at the camp, and the building of a drain at the camp site. • Check the food and lodging quality at the construction camp; • Heavy construction materials must be carefully handled and stored, with due regard for public safety. • First-Aid Kit with all necessary equipment and medications;	Monitoring	Regularly	contractor	ISPL

Environmental Components	Parameters/ Units	Standards/ Guidelines	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
				Implementation	Supervision
	• Make sure there are bathrooms close to the building site. • Heavy construction materials must be carefully kept and handled on the job site. • Relevant Covid 19 measures should be checked.				
Accident and Public Safety	• Record of accidents, different level of disabilities/fatalities.	None Specific	---	ISPL	WB/AIIB/ISPL
Labor Standards	• Random check of 10% of the labor force, and check that laborer have contract letters and check age, • working conditions and documentation	Monitoring	Regularly	Contractor	ISPL
OPERATION STAGE					
Air Quality	$PM_{2.5}$, PM_{10}, SO_x, NO_x, CO	Air quality standard by DOE, Bangladesh	1/year (5 year)	ISPL	WB/AIIB/ISPL
Noise Level	dB(A)	Noise Pollution Control Rules (2006)	1/year (5 year)	ISPL	WB/AIIB/ISPL
Surface water Quality	Temperature, pH, EC, salinity, DO, ORP, TSS, Calcium, Manganese, Arsenic, BOD, COD, Phosphate, Sulphate, Chloride	Water quality standard by DOE, Bangladesh	1/year (5 year)	ISPL	WB/AIIB/ISPL
Groundwater Quality	Temperature, pH, EC, salinity, TDS, TSS, ORP, Calcium, Arsenic, Iron, Manganese, Chloride, TC, FC	Water quality standard by DOE, Bangladesh	1/year (5 year)	ISPL	WB/AIIB/ISPL

Environmental Components	Parameters/ Units	Standards/ Guidelines	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
				Implementation	Supervision
Community and Occupational Health & Safety	• The environmental pollution from waste generated by project activities should be checked. • Sexual Exploitation and Abuse (SEA)/ Sexual Harassment (SH) should be checked. • Personal protection equipment (PPE) for workers is checked on the job sites. • Check for a safe water supply, a sanitary toilet at the camp, and the building of a drain at the camp site. • Check the food and lodging quality at the construction camp; • Heavy construction materials must be carefully handled and stored, with due regard for public safety. • First-Aid Kit with all necessary equipment and medications; • Make sure there are bathrooms close to the building site. • Heavy construction materials must be carefully kept and handled on the job site. • Relevant Covid 19 measures should be checked.	Monitoring	Regularly	ISPL	WB/AIIB/ISPL
Accident and Public Safety	Record of accidents, different level of disabilities/fatalities.	None Specific	----------	ISPL	WB/AIIB/ISPL
Solar PV panels	Chemicals		1/year (5 year)	ISPL	WB/AIIB/ISPL
Soil Quality	Heavy metals		1/year (5 year)	ISPL	WB/AIIB/ISPL
DECOMMISSIONING STAGE					
Air Quality	PM2.5, PM10, SO_x, NOx, CO	Air quality standard by DoE, Bangladesh	Once	Contractor	ISPL
Noise Level	dB(A)	Noise Pollution Control Rules (2006)	Once	Contractor	ISPL

Environmental Components	Parameters/ Units	Standards/ Guidelines	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
				Implementation	Supervision
Surface water Quality	pH, EC, DO, TDS, TSS, ammonia, Cl_2, Hardness, Manganese, Nickel, Turbidity, COD, BOD, color	Surface water quality standard by DoE, Bangladesh	Once	Contractor	ISPL
Groundwater Quality	Temperature, pH, EC, DO, TDS, TSS, As, TC, FC, BOD, COD, Alkalinity, Fe, Cl^-, ammonia, Hardness, Manganese, Turbidity, Fe	Groundwater quality standard by DoE, Bangladesh	Once	Contractor	ISPL
Soil Pollution	• Check liquid waste is carried out by experienced personnel and in proper way • Careful and proper handling of oil and other hazardous liquids • Careful and proper handling of PV panels.	Monitoring	Regularly	Contractor	ISPL
Waste	• Check storage, transportation, disposal, handling of hazarders waste • Careful and proper handling of PV panels. • Waste and effluents to be collected and disposed safely from camp. • Wastes and garbage from worker sites to be disposed safely	Monitoring	Weekly	Contractor	ISPL
Health and Safety	• Check quality of food and accommodation at worker camp; • Check safe water supply, hygienic toilet at camps, construction of drain at camp sites; • Check toilets are close to construction site; • First Aid Box with required tools and medicines; • The heavy construction material to be handled and stored safely putting due care on public safety; and • Check of personal protective equipment (PPE) for worker at the sites	Monitoring	Regularly	Contractor	ISPL

Environmental Components	Parameters/ Units	Standards/ Guidelines	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
				Implementation	Supervision
Accident and Public Safety	• Record of accidents, different level of disabilities/fatalities.	None Specific	----------	ISPL	WB/AIIB/ISPL

10.4 Environmental and Social Monitoring Budget

The following table shows the projected expenditure for implementing the mitigation and monitoring actions recommended in the ESMP. The ESMP's total costs will be as follows:

- Environmental monitoring through sample collection and analysis;
- Any remedial measures necessary to reduce or avoid environmental damage;
- Designing and implementing all mitigating and enhancement measures;

The total budget is estimated as BDT. 7,50,000 per year. This budget does not include the decommissioning stage since the minimum operation period is 20 year and the rate will vary largely from the present cost.

Table 10.3: Environmental and Social Monitoring Budget

Task No.	Mitigation and Monitoring Items	Unit	Cost/Unit	Total Unit	Total Cost
01	**Pre-construction Period**				
1.1	Landscape/Topography	Included in engineering cost			0
1.5	Water Bodies and Fisheries	Included in engineering cost			0
1.6	Labor Standard	Included in engineering cost			0
1.7	Capacity Enhancement	No.	10000	1	10000
02	**Construction Period – (Per year)**				
2.1	Landscape/Topography	Monitoring by EHSO			0
2.2	Loss of Top Soil	Monitoring by EHSO			0
2.3	Sediment Quality	No.	5000	1	5000
2.4	Soil Erosion and Siltation	Monitoring by EHSO			0
2.5	Air Pollution and Dust	No.	15000	02	30000
2.6	Noise and Vibration	No.	8000	02	16000
2.7	Surface Water Quality	No.	20000	02	40000
2.8	Groundwater Quality	No.	20000	02	40000
2.9	Drainage Congestion	Monitoring by EHSO			0
2.10	Vegetation	Monitoring by EHSO			0
2.11	Terrestrial Fauna	Monitoring by EHSO			0
2.12	Aquatic Species	No.	5000	02	10000
2.13	Fisheries	Monitoring by EHSO			0
2.14	Pollution from Wastes	Lump-sum			20000
2.15	Construction Waste Disposal (Waste water, Oil, Hazardous Waste etc.)	Lump-sum			30000
2.16	Construction Yards	Monitoring by EHSO			0
2.17	Occupational Health and Safety (OHS)	Month	3000	12	36000
2.18	Community Health and Safety	Month	2000	12	24000
2.29	COVID-19 Measures	Month	5000	12	60000
2.20	Traffic Congestion	Will be managed through existing TMP			
2.21	Income/Job Opportunities	Monitoring by EHSO			0
2.22	Tree Plantation	No.	300	100	30000
2.23	Environmental Monitoring Report	Prepared by EHSO			0
3	**Other Expenses during Construction Period**				
3.1	Water Spray for dust suppression	Month	2000	12	24000
3.2	Reporting and Report Production	No.	1000	12	12000

Task No.	Mitigation and Monitoring Items	Unit	Cost/Unit	Total Unit	Total Cost
3.3	Remuneration of EHSO	Month	25000	12	300000
4	**Operating Period (per Year)**				
4.1	Construction Period Decommissioning	Included in engineering cost			0
4.2	Landscape/Topography	Included in engineering cost			
4.3	Air Quality	No.	15000	Annually	15000
4.4	Noise and Vibration	No.	8000		8000
4.5	Water pollution (surface and groundwater)	No.	20000		20000
		No.	20000		20000
4.6	Income/Job Opportunities	Monitoring by Company			0
5	**MITIGATION AND MONITORING**				
5.1	**Pre-Construction Period**				**10,000.00**
5.2	**Construction (Per Year)**				**6,77,000.00**
5.3	**Operating Period (per year)**				**63,000.00**
	Total				**7,50,000.00**

10.5 Institutional Arrangements

The Environmental and Social Cell of the project implementation unit (PIU) shall monitor the implementation of ESMP properly. The roles and responsibilities of PIU and its consultants are presented in Table below.

Table 10.4: Roles and Responsibilities of PIU and its Consultants

Organizations	Roles and Responsibilities
PIU/ISPL	• **Ensure that all project activities are well-managed and coordinated.** • **Procurement of works and goods.** • **Recruitment and supervision of Construction Supervision Consultants (CSC)** • **Recruitment and supervision of external monitor and independent panel of experts** • **Carry out environmental assessment.** • **All the actions related to ensure compliance with ESMP as directed by PIU and preparatory studies based on the world bank/AIIB and other Agency required.**
E&S Cell within PIU	• **Responsible for assisting PM and hiring of consultants to carry out any required environmental assessment work for subprojects and also for preparatory studies, reviewing consultant deliverables related to environmental assessment, reviewing bid documents for inclusion of ESMP measures, supervising construction activities, producing periodic monitoring reports,** • **Ensuring inclusion of ESMP in bidding documents** • **Providing training on ESMP principles and requirements to CSC, contractors, field staff, and others as needed to ensure effective implementation of ESMP** • **Supervising CSC for the implementation of ESMP** • **Closely coordinate with other concerned agencies, local governments and communities to support implementation of ESMP**

Organizations	Roles and Responsibilities
	• **Preparation of progress reports on implementation of ESMP.** • **Ensure effective implementation of ESMP components not directly tasked to the contractor including components dealing with indirect, induced and cumulative effects, as well as operations and maintenance stage plans and measures.** • **Ensure compliance of the studies comply with World Bank/AIIB and other agency requirements.**
EHS Officer	• **Responsible for implementing standard environmental code of practices during operation stage of solar projects.** • **Implementation of mitigation and monitoring measures during operation stage (monitoring of dust, OHS issues, etc.)**
Contractor	• **Responsible for implementation of mitigation and monitoring measures proposed in the ESMP** • **The contractor will recruit an Environmental, Health, and Safety (EHS) Manager, who will be responsible for implementing the contractors' environmental, health and safety responsibilities, and liaising with PIU. S/he will have adequate number of staff to support him/her for these tasks.**

11 GRIEVANCE REDRESS MECHANISM

Public consultation and disclosure meeting was held to share information among all stakeholders of the project with an additional objective to gather information about the grievance. However, during the implementation of the project, there may be unforeseen issues that may arise from locals which needed to resolve. To settle such issues effectively, an effective and transparent channel for lodging complaints and grievances will be established. The grievance redress mechanism should be scaled to the risks and adverse impacts of the project. It should address affected people's concerns and complaints promptly, using an understandable and transparent process. It should also be readily accessible to all sections of the community at no cost and without retribution.

The Grievance Mechanism will be implemented during both the construction and operational period of the project to ensure that all complaints from local communities are dealt appropriately, with corrective actions being implemented, and the complainant being informed of the outcome. It will be applied to all complaints from affected parties.

The mechanism will be accessible to diverse members of the community, including more vulnerable groups such as women and youth. Multiple means of using this mechanism, including face-to-face meetings, written complaints, telephone conversations should be available. Confidentiality and privacy for complainants should be honored where this is seen as necessary or important.

A grievance redress mechanism & procedure is setup to provide opportunity for project affected persons to settle their complaints and grievances amicably. The established grievances redress procedures and mechanism ensures that project affected persons are provided with the appropriate compensations and that all administrative measures are in line with the law. It also allows project affected persons not to lose time and resources from going through lengthy administrative and legal procedures. Grievances are first preferred to be settled amicably.

11.1 Objectives

The objective of grievance redress mechanism (GRM) is to improve the response efficiency and accountability level to the project beneficiaries, ensuring the prompt complaints and feedback consideration and processing, as well as problems identification and finding their solutions together with the stakeholders.

11.2 Steps Of Redressing/Resolving Grievance

The Developers while developing the Grievance Mechanism are required to adhere to the following steps:

11.2.1 Development of Procedures

The GRC should ensure that procedures for lodging and registering of grievances are in place before the plan is implemented at the site level. The procedures of Grievance Mechanism should comprise of identifying the personnel (Grievance Officer at Site level) who will be responsible for receiving and addressing the grievances at the site level and handle the cases at the escalation level. The procedures to be developed should include assessment procedures, procedure to determine the appropriate resolution process, procedures for making decisions on proposed settlements, appropriate time frames for

each step in the grievance resolution process and notification procedure to the complainant about eligibility, assessment results, proposed settlements and the like.

11.2.2 Develop Resolution Options and Response

Once the GRC develop the procedures, formal and informal resolution options should also be developed along with preparation of formulating a response. General approaches to grievance resolution many include proposing a solution, reaching a resolution through discussion or negotiation, using a third party to either informally or formally resolve the matter through mediation and through traditional and customary practices.

11.2.3 Publicize the Grievance Mechanism

Once the procedures for Grievance Mechanism have been developed by the developers, it has to be publicized through various stakeholder engagement activities as detailed out in the Stakeholder Engagement Plan and should be disseminated to the developer as well. The GRC should inform the local community in the first instance and then on remind them of this mechanism on a regular basis during the project construction and operation phases. Various communicative methods can be adopted in disseminating the information like printed materials, displays, face to face meetings and website updating. The grievances redress mechanism (GRM) shall be documented in English and Bangla and copies shall be kept at the project site office and corporate office. The GRM is also to be displayed at notice board at the project site office and training on the GRM shall also be provided during orientation. The GRC is to ensure that the contractor would keep the workers informed about the grievance mechanism at the time of recruitment and make it easily accessible to them. All the relevant contact numbers to be made available to them.

11.2.4 Recording of Grievances

Once the stakeholders are aware of the mechanism and access it to raise grievances, The GRC is required to acknowledge the same and keep the complainant's identity anonymous. Consequently, GRC is required to collect grievances by checking the grievance boxes once every fifteen days, record and register the grievances that have come in as per the identified formats and track them throughout the redressal process to reflect on their status and important details. A Grievance Log or database emphasizing the records and status of the grievance is to be maintained by the identified Grievance Officer at the site level. The Grievance Log can be used to analyze information about grievance and conflict trends, community issues and project operations to anticipate the kinds of conflicts that ISPL might expect in the future both to ensure that the grievance mechanism is set up to handle such issues and to propose organizational or operational changes.

11.2.5 Appeal

If the grievance redressal solution is not acceptable or agreed by the complainant, the complainant should be offered to an appeal process. Circumstance revolving around when an appeal can be made should be set by the developers so that accountability and transparency is promoted by them in every step.

11.2.6 Resolve and Follow Up

Once the corrective action has been agreed upon, a good practice is to collect proof of those actions in terms of taking photographs, documentary evidence, getting confirmation from the complainant and filing the same within the case documentation. In addition, monitoring and follow up on the resolution agreed upon should be conducted once to close

the case accordingly. Developers are required to provide regular (yearly) reports to ISPL that track the number of complaints received, resolved, not resolved and referred to a third party. In addition, the funding agency also needs to be constantly apprised of the yearly reports in order to support identification of developing risks

11.3 Proposed Grievance Redress Mechanism for ISPL

The Grievance Redress Mechanism outlines the process for lodging of grievances, steps to be taken for subsequent action and the time limit within which the issue would be resolved to the satisfaction of the complainant (community members, project affected persons and workers). All complaints shall be recorded and addressed in a uniform and consistent manner.

The GRM for the proposed project is presented below with time bound schedules and specific persons to address grievances.

11.3.1 Grievance Redress Committee

A site level approach is proposed to be developed for redressing of all cases of grievances. All grievances are to be redressed at this stage. The representatives proposed for the grievance committee is provided below,

- Site Supervisor
- EHS Manager
- Admin Officer and
- Safety Officer.

The functions of GRC are as follows:

- To provide support to affected communities on problems arising from environmental or social impacts;
- To record grievances of the affected community by categorizing and prioritizing them, and provide solutions within a stipulated time period; and
- To report to the aggrieved parties, developments regarding their grievances and decisions of the GRC.

The steps of grievance redressal for Developer have been provided below:

11.3.1.1 Receive and Register a Complaint

The developers in order to implement the Grievance Redress Mechanism is required to nominate a Grievance Officer for registering the grievances, initiating the process of registering and action taken thereon for the resolution of the grievance and the timeline required in each step. The contact details of the Grievance Officer shall be maintained and updated in the following format displayed at prominent places available to public and the project area.

Table 11.1: Contact Details of Grievance Officer

Sl. No.	Name	Designation	Mobile Number	Signature

- Any stakeholder such as worker, person from local community or any other stakeholder, with concerns pertaining to onsite work such as community health and safety, local employment, community risk, migrant labor or any issues etc., may register their complaint in writing to the nominated person/grievance officer at site level;
- Secured grievance boxes shall be placed at the entrance of the site office;
- If any stakeholder or community member wishes to remain anonymous, he/she can write down the grievances and drop in the available complaint box; and
- Once a complaint has been received it shall be recorded in the grievance log register or data system.

Details of grievance received shall be maintained by the Grievance Officer in a register as per the following format.

Table 11.2: Grievance Record

Sl. No.	Date of Receipt	Particulars of Complainant				Particulars of Grievance			
		Name	Address	Contact No	Whether acknowledgement given at time of receipt	Subject of the Grievance	Office	Brief Description	Date of acknowledgement/ Date of redress

12 INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

12.1 Introduction

This chapter will describe the process undertaken during project design and preparation for engaging stakeholders, including information disclosure and consultation with affected people and other stakeholders. It will also summarize comments and concerns received from affected people and other stakeholders and how these comments have been addressed in project design and mitigation measures, with special attention paid to the needs and concerns of the project affected peoples. Besides, this chapter will describe the planned information disclosure measures (including the type of information to be disseminated and the method of dissemination) and the process for carrying out consultation with affected people and facilitating their participation during project implementation.

Stakeholders Consultation is a means of involving all primary and secondary stakeholders in the project's decision-making process in order to address their concerns, improve project design, and give the project legitimacy. Stakeholder consultation, if conducted in a participatory and objective manner, is a means of enhancing project sustainability.

Information disclosure is one of the most important aspects of any consultation or engagement process. This process is not only part of certain regulatory requirements but also a requirement of the investors in the project. The process of information disclosure can be undertaken in two manners, either voluntary disclosure or disclosure as part of the regulatory requirements.

Public consultation and participation have been viewed as a continuous two ways process involving, promoting of public understanding of the processes and mechanisms through which developmental problems and needs are investigated and solved. It is a requirement of the national ESIA legislative framework in Bangladesh, as well as the World Bank (WB) Policy on Environmental & Social Safeguards and AIIB's Environmental and Social Framework, that stakeholders be involved in ESIAs. Based on ESIA obligations for impacted individuals, the Project's consultation program is fair and inclusive, relying on informed consultation. During the ESIA's environmental survey in September 2022, consultation activities were undertaken.

12.2 Purpose of Public Participation

For projects that have environmental and social impacts, consultation is not a single conversation but a series of opportunities to create understanding about the project among those it will likely affect or interest, and to learn how these external parties view the project and its attendant risks, impacts, opportunities, and mitigation measures. Listening to stakeholder concerns and feedback can be a valuable source of information that can improve project design and outcomes and help a company to identify and control external risks. It can also form the basis for future collaboration and partnerships. For stakeholders, a company's consultation process is an opportunity to get information, as well as to educate company staff about the local context in which a project will take place, to raise issues and concerns, ask questions, and potentially help shape the project by making suggestions for the company to consider and respond to.

The purpose of public consultation is to make sure that a participation methodology is used, which in turn documents the concerns of all stakeholder groups and ensures that such concerns are considered, addressed, and incorporated into the development's decision-making process. Following are the main purposes of the consultation:

- Promote public awareness and improve understanding of the local people about the proposed project;
- To have interaction for primary and secondary data collection with project beneficiaries, affected populations, and other stakeholders;
- Assessment of possible requirement of improvements;
- Solicit the views of affected communities/individuals on environmental and social problems;
- Improve environmental and social soundness;
- To settle problems with mutual consent; and
- Create accountability and sense of local ownership during project implementation.

12.3 Approach and Methodology for Consultation

Primary stakeholders were consulted during informal and formal meetings held in the project area. The consultation process was carried out in the Bangla languages. During

these meetings a simple, non-technical, description of the project was given, with an overview of the project's likely human and environmental impact. This was followed by an open discussion allowing participants to voice their concerns and opinions. In addition to providing communities with information on the proposed project, their feedback was documented during the primary stakeholder consultation. The issues and suggestions raised were recorded in field notes for analysis, and interpretation.

The following important processes were engaged in the approach taken for information disclosure and consultation:

- Identification of the relevant stakeholders including all those individuals, groups and organizations potentially affected by or interested in the project;
- Imparting information about the project and its potential impacts on their lives in local and simple language;
- During the consultation process the project plan was clearly explained;
- Recording of their concerns and aspirations through survey and discussions;
- Responding to their queries in a neutral manner.
- It was important not to raise community expectations unnecessarily or unrealistically during the stakeholder consultation meetings in order to avoid undue conflict with local leaders or local administrators. The issues recorded in the consultation process were examined, validated, and addressed in the ESIA report.

In the primary survey a list of open-ended questionnaires is used in both the focus group discussions and the individual interviews. A three-person survey team carried out the discussions and the interviews. The list of persons involved in the public consultation is limited to those who were willing to allow their name to be added in the document

12.4 Stakeholder Assessment

A stakeholder is defined as "a person, group, or organization that has direct or indirect stake in a project/organization because it can affect or be affected by the Project or its Proponent's actions, objectives, and policies." Stakeholders vary in terms of degree of interest, influence, and control they have over the Project or the proponent. In the present study, all the stakeholders have been primarily categorized into two categories that have been identified as:

- Primary Stakeholders (people, groups, institutions that either has a direct influence or impact on the project or by the project).
- Secondary Stakeholders (people, groups, institutions that has an indirect influence or impact on the project or by the project).

The influence and priority have both been primarily rated as:

- High Influence/Priority: This implies a high degree of influence of the stakeholder on the project in terms of participation and decision making or high priority for the project proponent to engage that stakeholder.
- Moderate Influence/Priority: This implies a moderate level of influence and participation of the stakeholder in the project as well as a priority level for the project

proponent to engage the stakeholder who is neither highly critical nor are insignificant in terms of influence.

- Low Influence/Priority: This implies a low degree of influence of the stakeholder on the project in terms of participation and decision making or low priority for the project proponent to engage that stakeholder.

The intermediary categories of low to medium or medium to high primarily imply that their influence and importance could vary in that particular range subject to context specific conditions or also based on the responses of the project towards the community.

The coverage of stakeholders as stated above includes any person, group, institution or organization that is likely to be impacted (directly or indirectly) or may have interest/influence over project. Keeping this wide scope of inclusion in stakeholder category and the long life of project, it is difficult to identify all potential stakeholders and gauge their level of influence over project at the outset of the project. Therefore, the project proponent is advised to consider this stakeholder mapping as a live document which should be revised in a timely manner so as to make it comprehensive for any given period of time.

12.5 Consultation

12.5.1 Key Informant Interview

During the field visit of the proposed solar project the survey team had interviewed the upazila office for suggestions, comments or addressing any issues from them. Two of the officials had a discussion with the survey team and provided their valuable comments regarding the Proposed solar project.



Mr. Abdur Razzak
Upazilla Social Welfare Officer, Kaliganj, Lalmonirhat



Mr. Md. Lokman Alam
Upazilla Agriculture Officer, Kaliganj, Lalmonirhat

Figure 12.1: KII with the Kaliganj Upazila officials

The meeting reveals that, the officials have already known about the project activity and they are thinking very positively about the project. They optimistically told the survey team that, after the successful implementation of the project, the people of Sholmari, Shrutidhar village under Bhotmari union will be very much benefited by sufficient electricity. They hope that the areas which were out of the electric network will be covered by the flap of electricity.

12.5.2 Focus Group Discussion (FGD)

12.5.2.1 Introduction

A stakeholder is defined as any individual or group who is potentially affected by the proposed project or can they affect the proposed project directly or indirectly. Stakeholder consultation is an inclusive process for sharing information that enables stakeholders to understand the risks, impacts and opportunities of a development or project, allowing them to express their views and articulate their perceptions towards it.

12.5.2.2 Summary of the Consultation

Three (03) consultations/FGDs have been arranged during the conduct of the ESIA surveys. The consultations were conducted on three different locations in and around the project location. The location details are provided in the table below.

Table 12.1: FGD location details

FGD No.	Location	Type of Participants	GPS	No. of Participants
1	Conference Room of Intraco Solar Power Plant Ltd	Project authority	25.997418°N 89.152620°E	11

FGD No.	Location	Type of Participants	GPS	No. of Participants
2	Sholmari, Bhotemari Union, Kaliganj upazilla, Lalmonirhat	Local People	25.992222°N 89.165833°E	13
3	1 No. Bhotemari Union Parishad, Kaliganj, Lalmonirhat	Chairman, Secretary and people of union parishad	25.987717°N 89.181084°E	14
	Total			**38**

The photographs of FGDs are given below in figure:





Conference Room of Intraco Solar Power Plant Ltd





Sholmari, Bhotemari Union, Kaliganj upazilla, Lalmonirhat





1 No. Bhotemari Union Parishad, Kaliganj, Lalmonirhat

The key issue raised in the meeting and participants suggestions, response, consultants' response etc. are described in the below table

Table 12.2: Summary Findings of the Public Consultation

Sl. No	Concerns & Expectations/ Key Issues Raised	Participant's opinion, comments and suggestions
02.	How the project will impact on surrounding environment? Please mention both positive and negative sites.	By limiting public access to the site and having a boundary will create less environmental impact on the environment.
03.	Any air pollution in the area due to the project activities? If yes, how to mitigate?	Because the project site is far away from residential dwellings, there is a small chance of anticipated impact, but proper care of panels, sensitive equipment, and other items should reduce it.
04.	Any impact on the surface water body? If yes, how to mitigate?	It is to be observed that the river does not lose its regular course due to any kind of sedimentation or obstacle.
05.	Any noise- impact of the project during construction and operation at the locality? If yes how to mitigate?	Because of the construction machinery and workers, the noise level will increase a little bit. Fortunately, the effects will only last for the construction period. This means that when all work is completed, the noise level will return to its previous level of comfort.
06.	Will the upcoming solar power plant create employment opportunities for the local people?	During construction period, the locals are expected to have priority for having job opportunity. It is suggested to the ISPL for giving priority for local people for skilled and unskilled workforce.
07.	Will the solar power plant project pose a risk to human health and the environment?	No. It is considered safe to human health and the environment. It does not present any risks to public health and the environment.
08.	Is the proposed area inundated during flood? If yes, how much?	The project area is a char land/island. So it is high and there is no risk of being flooded.
09.	Is there any particular sensitive area nearby the project that you think should be protected? If yes, where & how far from the project location?	No particular sensitive area nearby the project area. But there are schools, mosques, graveyards and bazar within 1 km radius.
10.	Are you in favor of this project? Why?	The project will reduce energy demand from national grid and will use renewable energy source for power generation. This is positive for human and environmental condition. So, everyone is in favor of this project.

The participant list of the FGD's is attached in appendix B of the Report.

12.5.3 Questionnaire Survey

The Project has implemented Questionnaire Surveys as part of the social consultation. The objective of the survey was to gather information from the indigenous people in the form of public participation. The people in general around the project intervention area were considered as primary stakeholders and shared their individual and public concerns about the project. They shared their views, concerns and knowledge about the project through the questionnaire which helped the consultant for better understanding of the social criteria.

12.6 Outcome of the Consultation

Solar power plant project has minimum environmental impacts whereas the positive environmental and social impacts are many. From the several public consultations, FGD, KII and socio-economic survey in the project area it is found out that the people of the project area are very much optimistic and appreciates the project from environmental and social perspective.

13 SOCIAL AND ENVIRONMENTAL BENEFIT

Solar energy systems/power plants do not produce air pollution or greenhouse gases. Using solar energy can have a positive, indirect effect on the environment when solar energy replaces or reduces the use of other energy sources that have larger effects on the environment. The electricity produced by solar panels is clean, renewable and emission free. Whereas most of the electricity generated is produced by burning fossil fuels like coal and natural gas, generating electricity with solar power and other renewable resources–such as wind and hydropower–does not result in any emissions of carbon dioxide or local air pollutants. And while extracting and using fossil fuels is expensive and harmful to the environment, solar energy is free and readily abundant. Furthermore, community-based solar initiatives can have positive social impacts, from decreased heating bills for low-income individuals, decreased dependency on public utilities, an improved environment from reduced pollution.

13.1 Energy And Climate Concern

13.1.1 Reduction of Air Pollution

Sulfur dioxide, nitrogen oxide and carbon dioxide are just three of the pollutants that end up in our air when fossil fuels are burned. Solar panels are the products of modern innovation driven by concern for the environment. Solar panels are a clean, renewable energy source. They are an alternative way of generating energy while not polluting our air. Using solar energy can have a positive, indirect effect on the environment when solar energy replaces or reduces the use of other energy sources that have larger effects on the environment. According to an article in the website of nonprofit organization Earth Runs, a 5,000-watt solar electric array on a roof that is 80% of an ideal site in terms of output, will generate about 4,800 kWh per year. Therefore, this solar energy will prevent 5,760 pounds of CO_2 pollution from going into the atmosphere, every year.

13.1.2 Reduction of Water Pollution

In thermoelectric plants, coal, natural gas, oil and nuclear energy require cooling — and this requires vast amounts of water. Generating energy from renewable sources rather than fossil fuels dramatically improves public health and river ecosystems. Unlike conventional energy sources, solar power generates clean and sustainable electricity without toxic pollution or greenhouse gas emissions. Solar energy, such as solar photovoltaic (PV) panel cells, requires neither water nor the combustion of fossil fuels in order to generate electricity. Another pressing issue with fossil fuels is their non-renewability and finitude. Sooner or later, they will be exhausted or extremely expensive to obtain, a particular challenge for less wealthy nations. Solar energy, on the other hand, is getting cheaper and the most abundant energy resource available. Moreover, nations like Pakistan, India, and Bangladesh constantly struggle with acute water shortages due to droughts, growth in population, and demand for electricity. Switching to solar energy would go a long way to mitigating the water scarcity crisis.

13.1.3 Reduction of Hazardous Waste

Estimates suggest that more than 400 million tons of hazardous waste is produced every year, according to the United Nations Environmental Program. However, not all waste is

disposed of safely. For example, 30% of waste producers fail to meet government guidelines for correct disposal protocols. Nuclear fission products, for example, continue to be radioactive for thousands of years, meaning they could have a negative effect on human health and the environment. Unlike dirty energy sources, solar power doesn't need fuel to generate electricity, disposing of the problem of radioactive waste storage and fuel transportation.

13.1.4 Land Use and Ecological Impacts

In the point of generating electricity at a utility-scale, solar energy facilities necessitate large areas for collection of energy. Due to this, the facilities may interfere with existing land uses and can impact the use of areas such as wilderness or recreational management areas. As energy systems may impact land through materials exploration, extraction, manufacturing and disposal, energy footprints can become incrementally high. Thus, some of the lands may be utilized for energy in such a way that returning to a pre-disturbed state necessitates significant energy input or time, or both, whereas other uses are so dramatic that incurred changes are irreversible.

13.2 Energy And Livelihood Concern

The technological innovation of solar energy enables solar panels to capture the heat of the sun and utilize the energy to generate power and electricity for homes, buildings and cities. Solar panels help maximize the earth's resources and conserve energy.

13.2.1 Job Creation

When Intraco Solar Power limited decided to build and operate solar energy facilities, the project will often help to create numerous jobs. For instance, workers are needed to plan the project, develop and implement the project, build the solar energy plant, manage the equipment and operate the facility. Thus, many new jobs can be fulfilled by workers. Using solar energy facilities to generate electricity for the area, and this would in turn help decrease the unemployment rate of the area.

13.2.2 Health Safety

Generating energy from solar panels emits very little pollution into the air, and thus solar energy is a much cleaner source of energy than the burning of fossil fuels. Use of solar energy to power the buildings would thus enjoy a cleaner quality of air in the region, which in turn can make the citizens and workers in the area healthier. However, because solar panels emit very low amount of hazardous pollution into the air, solar energy does not damage the atmosphere or cause global warming. Thus, if areas decide to use solar energy to generate electricity, the shift will help diminish the effects of global warming, such as the sea levels rising and storms intensifying.

13.2.3 Ethnic Value

This project holds humanistic values as central to the ethical criteria upon which solar energy policy should be based. The relative simplicity and accessibility of many solar technologies open the door to a broad range of desirable terminal values. Adoption of decentralized solar technologies may directly contribute to self-reliance, rewarding employment opportunities, and creativity. Personal freedom and growth, leading to

enhanced aesthetics and cultural evolution, are envisioned as the logical and desirable end result.

13.2.4 Radicalism

Many advocates of a "solar culture" argue for radical change of values, technology, and the economy. A comprehensive review of social priorities has been cited as necessary to the adoption of solar energy in a manner consistent with the values of environmental harmony, justice, simplicity, security, and conservation.

13.3 Energy And Economy Concern

13.3.1 Lower Fuel Cost

Despite a more rapid rise for renewables and a structural decline for coal, the IEA says it is too soon to declare a peak in global oil use, unless there is stronger climate action. Similarly, it says demand for gas could rise 30% by 2040, unless the policy response to global warming steps up. This means that, while global CO_2 emissions have effectively peaked, they are far from the immediate peak and decline needed to stabilize the climate. The IEA says achieving net-zero emissions will require “unprecedented” efforts from every part of the domestic economy, not just the power sector.

13.3.2 Efficiency

To advocates, efficiency is an instrumental value. It is a matter of fact that that solar power technologies can utilize scarce capital more efficiently, particularly when net energy production is considered. Decentralization is also efficient as competition is enhanced and energy producing capacity can be adjusted in finer increments. Hence, advocates value the notion of appropriate scale.

13.3.3 Equity

Adopting solar energy will lead inherently to a more equal distribution of wealth within the project area. Factors cited include the labor intensity of solar technologies, creating both skilled and unskilled jobs; decentralization of economic power; and the creation of small businesses. Commoner speaks of an economic democracy created by the solar transition.

13.3.4 Growth versus Sufficiency

Economic growth is less clearly valued by advocates as compared to policy makers. Personal and cultural growth may be attainable by the adoption of solar energy but conventional economic measures would not "capture" this improvement. Material growth for those who most need it may be enhanced via the potential job, business, and foreign market creation of solar energy.

14 CONCLUSION

The electricity produced by solar panels is clean, renewable and emission free. Whereas most of the electricity generated is produced by burning fossil fuels like coal and natural gas, generating electricity with solar power and other renewable resources–such as wind and hydropower–does not result in any emissions of carbon dioxide or local air pollutants. And while extracting and using fossil fuels is expensive and harmful to the environment, solar energy is free and readily abundant – if we could capture all of the sun's energy shining on the Earth for just one hour, we could power the entire world for one year. Furthermore, community-based solar initiatives can have positive social impacts, from decreased heating bills for low-income individuals, decreased dependency on public utilities, an improved environment from reduced pollution.

The ESIA study of Intraco solar power project has been conducted in accordance with the administrative framework, identified herein, including national legislative requirement, the World Bank Policies, World Bank's Environmental Health and Safety (EHS) Guidelines and AIIB's Environmental and Social Framework.

The ESIA study has been carried out based on the site visit, baseline environmental and social condition survey, stakeholder consultation, analysis of the possible project intervention and finally experts identified and evaluated potential environmental impact associated with all aspects of the proposed project

The environmental and social analysis has revealed that the project can be set-up according to the proposed design and configuration in the proposed site and location. The environmental impacts are of limited nature, whereas the benefits of the project are many.

Appendix

Appendix A: Received Environmental Clearance Certificate (ECC) from DoE



গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
পরিবেশ অধিদপ্তর
রংপুর জেলা কার্যালয়
বাড়ী নং-৯০/১, রোড নং-০৬, ওয়ার্ড নং-১৮
থানাঃ কোতয়ালী, রংপুর
www.doe.gov.bd

পরিবেশগত ছাড়পত্র

ছাড়পত্র নং: ২২-৮২৭০৪

পরিবেশগত ব্যবস্থাপনা নিশ্চিতকরণ সাপেক্ষে সংযুক্ত শর্তে নিম্নবর্ণিত প্রতিষ্ঠান/প্রকল্পের অনুকূলে পরিবেশগত ছাড়পত্র প্রদান করা হলো :

প্রতিষ্ঠান/প্রকল্পের নাম	:	Intrako Solar Power Ltd
উদ্যোক্তার নাম	:	Md.Sakhawat Hossain
সনাক্তকরণ নং	:	১২৫৯২৮
প্রতিষ্ঠান/প্রকল্পের কার্যক্রম	:	Solar Power Plant
প্রতিষ্ঠান/প্রকল্পের শ্রেণী	:	Orange-B
প্রতিষ্ঠান/প্রকল্পের ঠিকানা	:	Sholmari, Kaliganj,Lalmonirhat
প্রদানের তারিখ	:	২৮ অগাষ্ট ২০২২
মেয়াদ উত্তীর্ণের তারিখ	:	২৭ অগাষ্ট ২০২৩

এ ছাড়পত্র সনদের সাথে পৃথকভাবে সংযুক্ত প্রদত্ত শর্তাবলী যথাযথভাবে প্রতিপালন করতে হবে, অন্যথায় ছাড়পত্র বাতিল/ক্ষতিপূরণ আদায়সহ যে কোন আইনানুগ ব্যবস্থা গ্রহণ করা হবে।

বিঃদ্রঃ এটি একটি সিস্টেম জেনারেটেড ছাড়পত্র এবং এতে কোনোরূপ স্বাক্ষরের প্রয়োজন নেই।

Appendix B: List of participants in the FGDs

THE WORLD BANK

IDCOL

Environmental and Social Impact Assessment (ESIA) of 30 MW Grid-tied Solar Power Plant Project of Intraco Solar Power Limited (ISPL)

List of Participants for Focus Group Discussion (FGD)/Public Consultation

Address Conference Room, ISPL Control Office, Shoulmari, Bhotemari, Kaliganj

GPS Location 25.997418 °N 89.152620 °E

Date 18.09.22 **Time** 11.45 am

SL No.	Participant's Name	Age	Occupation	Telephone No.	Signature
1	A.K.M. Muhammaduzzaman	28	Engineer	01750418701	
2	Sheikh Sanekamuz Rahman	28	Engineer	01728-004101	
3	Md. Rezaul Karim	25	Electrician	01767-229515	
4	Md: Rashed Mia	24	Electrician	01727633691	
5	Md. Rashidul Islam	06	Electric Helper	01737112358	
6	Kuzi Rubel Hossain	24	Electrician	01854399691	
7	Md: Akherazzaman	20	Electricial	01707117811	
8	Md: Ariful Islam	27	Electrical	01737777915	
9	Md. Akash Ahmed	22	Admin & HR	01324437719	
10	Md: Monowar Hossin	24	Labor	01744862743	
11	Md: Roswon Ali	24	Worker	01786981986	
12					
13					
14					
15					

Facilitator Ekram Hossain Riyad

Signature

Organized by PARAMOUNT GROUP **Facilitated by** DSCL

THE WORLD BANK

IDCOL

Environmental and Social Impact Assessment (ESIA) of 30 MW Grid-tied Solar Power Plant Project of Intraco Solar Power Limited (ISPL)

List of Participants for Focus Group Discussion (FGD)/Public Consultation

Address Sholmari, Bhotemari, Kaliganj, Lalmonirhat

GPS Location 25.992222° N 89.165833° E

Date 18-09-22 **Time** 3:19 pm

SL No.	Participant's Name	Age	Occupation	Telephone No.	Signature
1	Aminul Islam	23	Shopkeeper	01951902210	Aminul
2	Mojidul	35	ব্যবসা	01781108755	মজিদুল
3	Romjan Ali	61	Farmer	01793894866	রমজান
4	Md. Kohinur Islam	19	Student	01322624925	কহিনুর
5	Md Najir Hossain	18	student	01920661	নাজির
6	Md Sohel Rana	17	Auto Driver	01785059[illegible]	সোহেল
7	Md. AL-Amin Islam	18	Farmer	01760982878	আল আমিন
8	[illegible]	18	Farmer	01720457200	[illegible]
9	Md: Sahejahan	38	Tailor	01740646262	[illegible]
10	Md. Samsul Hoque	58	shop owner	01750-864568	Samsul
11	Mst Labli	55	Housewife		লাবলী
12	Mst Akhi Khatun	23	shop owner		আখি
13	Md Alauddin	41	Driver	01775136708	ALAUDDIN
14					
15					

Facilitator Ekram Hossain Riyad

Signature Riyad

Organized by PARAMOUNT GROUP

Facilitated by DSCL

THE WORLD BANK

IDCOL

Environmental and Social Impact Assessment (ESIA) of 30 MW Grid-tied Solar Power Plant Project of Intraco Solar Power Limited (ISPL)

List of Participants for Focus Group Discussion (FGD)/Public Consultation

Address 1no Bhotemari Union Parishad, Kaligonj, Lalmonirhat

GPS Location 25.987717, 89.181084

Date 18/09/2022 **Time** 4:29 pm

SL No.	Participant's Name	Age	Occupation	Telephone No.	Signature
1	Md. Farhad Hossain	50	Chairman Bhotmaryup	01727855415	
2	Md Toriful	16	Farmer	01708187455	
3	Shohidul Islam	30	Farmer	01758291322	
4	Shakilurzaman	26	Student	0174-8420474	Shakil
5	Md Easin Ali	20	Student	01722702867	Yeasin
6	Md Kamruzzaman	45	ব্যবসা	01729630150	
7	Alom Badsha	21	Student	01797762160	
8	Sherajul Islam	45	Farmer	01744800433	
9	Tohin Mia	18	ছাত্র	01877434814	
10	Md Saju Mia	21	ছাত্র	01767182582	Saju
11	মোঃ আইয়ুব আলী	89	অবসরপ্রাপ্ত	01731440928	
12	Helal Uddin	40	Service	01617385880	Helal Uddin
13	Shahabuddin	35	Police	01552302983	
14	আকাব্ব মিয়া	89	কৃষক	01689869981	
15					

Facilitator Emon Kumar Rajbongshi

Signature Emon

Organized by PARAMOUNT GROUP

Facilitated by DSCL

Appendix C:Ambient Air Quality Monitoring

DSCL

Development Solutions Consultant Limited

Multidisciplinary Development Consultants

Name of the Project	Environmental and Social Impact Assessment (ESIA) of 30 MW (AC) Grid-tied Solar Power Plant Project of Intraco Solar Power Limited (ISPL)
Description of Sample	Ambient Air Quality
Sample Collector	Collected by DSCL Personnel
Sampling Date	16 September 2022

Test Result of Ambient Air Quality Analysis

Parameter	Unit	ISPL_AAQ_01 Beside Control Room of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat 25.997594°N 89.152774°E	Bangladesh Standard**	Duration (hours)	Method of Analysis
$PM_{2.5}$	µg/m³	42.40	65	24	Oceanus Portable Gas Detector OC-300
PM_{10}	µg/m³	82.64	150	24	
SOx	µg/m³	28.32	80	24	Oceanus Portable Gas Detector OC-905
NOx	µg/m³	31.08	80	24	
CO*	ppm	<1	5	8	

*NYS – Not Yet Standardized

** The Bangladesh National Ambient Air Quality Standards have been taken from the Air Pollution Control Rules, 2022 Department of Environment (DOE), Bangladesh

* CO concentrations and standards are 8 hours only

Description of the surrounding Environment

Location	Sample Site Description
Beside Control Room of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat **(ISPL_AAQ_01)**	❖ People movement low. ❖ Frequent tractor movement inside the project boundary. ❖ Construction work was on going. ❖ Weather condition sunny.

Test Performed By:
Ekram Hossain Riyad
Jr. Environmental Engineer

Development Solutions Consultant Limited ★ DSCL ★

Checked By:
Md Mashiur Rahman
Deputy Manager

House# 734 (1-A), Road# 10, Avenue# 04, DOHS Mirpur Dhaka-1216, Bangladesh
Tel: +8809617035444; +8801822758548; Email: dscl@dsclbd.com Web: www.dsclbd.com

IAF IAS ACCREDITED BQSR ISO 9001:2015 ISO 45001:2018

DSCL

Development Solutions Consultant Limited

Multidisciplinary Development Consultants

Name of the Project	Environmental and Social Impact Assessment (ESIA) of 30 MW (AC) Grid-tied Solar Power Plant Project of Intraco Solar Power Limited (ISPL)
Description of Sample	Ambient Air Quality
Sample Collector	Collected by DSCL Personnel
Sampling Date	16 September 2022

Test Result of Ambient Air Quality Analysis

Parameter	Unit	ISPL_AAQ_02 Beside Labor Camp of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat 26.000257°N 89.153608°E	Bangladesh Standard**	Duration (hours)	Method of Analysis
$PM_{2.5}$	µg/m³	43.61	65	24	Oceanus Portable Gas Detector OC-300
PM_{10}	µg/m³	88.32	150	24	
SOx	µg/m³	21.27	80	24	Oceanus Portable Gas Detector OC-905
NOx	µg/m³	22.73	80	24	
CO*	ppm	<1	5	8	

*NYS – Not Yet Standardized

** The Bangladesh National Ambient Air Quality Standards have been taken from the Air Pollution Control Rules, 2022 Department of Environment (DOE), Bangladesh

*CO concentrations and standards are 8 hours only

Description of the surrounding Environment

Location	Sample Site Description
Beside Labor Camp of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat **(ISPL_AAQ_02)**	❖ The weather was sunny. ❖ Visual dust particles were low. ❖ No construction was ongoing. ❖ People movement was moderate.

Test Performed By:
Ekram Hossain Riyad
Jr. Environmental Engineer

Development Solutions Consultant Limited * DSCL *

Checked By:
Md Mashiur Rahman
Deputy Manager

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Name of the Project	Environmental and Social Impact Assessment (ESIA) of 30 MW (AC) Grid-tied Solar Power Plant Project of Intraco Solar Power Limited (ISPL)
Description of Sample	Ambient Air Quality
Sample Collector	Collected by DSCL Personnel
Sampling Date	17 September 2022

Test Result of Ambient Air Quality Analysis

Parameter	Unit	ISPL_AAQ_03 5 No. Ward, Sholmari (inside proposed trans. line), Bhotemari Union, Kaliganj, Lalmonirhat 25.990555°N 89.160833°E	Bangladesh Standard**	Duration (hours)	Method of Analysis
$PM_{2.5}$	µg/m³	45.33	65	24	Oceanus Portable Gas Detector OC-300
PM_{10}	µg/m³	90.22	150	24	
SOx	µg/m³	28.32	80	24	Oceanus Portable Gas Detector OC-905
NOx	µg/m³	31.08	80	24	
CO*	ppm	<1	5	8	

*NYS – Not Yet Standardized

** The Bangladesh National Ambient Air Quality Standards have been taken from the Air Pollution Control Rules, 2022 Department of Environment (DOE), Bangladesh

* CO concentrations and standards are 8 hours only

Description of the surrounding Environment

Location	Sample Site Description
5 No. Ward, Sholmari (inside proposed trans. line), Bhotemari Union, Kaliganj, Lalmonirhat **(ISPL_AAQ_03)**	❖ Visual dust particle was low. ❖ Weather condition sunny. ❖ No construction ongoing. ❖ People movement was moderate.

Test Performed By:
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Appendix D: Noise Quality Measurement

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Name of the Project	Environmental and Social Impact Assessment (ESIA) of 30 MW (AC) Grid-tied Solar Power Plant Project of Intraco Solar Power Limited (ISPL)
Description of Sample	Noise Level Measurement
Sample Collector	Collected by DSCL Personnel
Sampling Date	16 to 18 September 2022

Test Result of Noise Level Analysis

Sample ID	Sample Location	GPS Location	Date	Land Use Category	Day Time		Noise Level (dBA) (LAeq)	Night time		Noise Level (dBA) (LAeq)
					Start	End		Start	End	
ISPL_NM_01	Beside Control Room of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat	25.997764°N 89.152387°E	16.09.22	Residential	11:30 am	12:00 pm	54.5	07:31 pm	08:00 pm	40.1
ISPL_NM_02	Beside Substation-08 of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat	25.996964°N 89.152745°E	16.09.22	Residential	01:30 pm	02:00 pm	40.8	08:10 pm	08:40 pm	37.8
ISPL_NM_03	Beside Substation-04 of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat	25.996329°N 89.153886°E	16.09.22	Residential	02.21 am	02.45 am	53.6	08.51 pm	09.15 pm	41.1
ISPL_NM_04	Beside Substation-07 of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat	25.996598°N 89.155874°E	16.09.22	Residential	03:16 pm	03:46 pm	56.7	09:25 pm	09:45 pm	45.6
ISPL_NM_05	Entry Point of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat	25.998469°N 89.157026°E	16.09.22	Residential	04:00 pm	04:30 pm	40.9	09:50 pm	10:10 pm	32.2

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Sample ID	Sample Location	GPS Location	Date	Land Use Category	Day Time		Noise Level (dBA) (LAeq)	Night time		Noise Level (dBA) (LAeq)
					Start	End		Start	End	
ISPL_NM_06	Beside Labor Camp of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat	26.000257°N 89.153608°E	16.09.22	Residential	04:48 pm	05:18 pm	64.6	10:20 pm	10:50 pm	58.2
ISPL_NM_07	Beside Karimpur Dakhil Madrasa, South Bhotemari, Kaliganj, Lalmonirhart	25.969188°N 89.200169°E	17.09.22	Commercial	10:30 am	11:00 am	51.3	07:21 pm	07:51 pm	40.7
ISPL_NM_08	South Bhotemari, Modati Union, Kaliganj, Lalmonirhat	25.992450°N 89.166031°E	17.09.22	Mixed	11:28 am	11:52 am	41.1	21:45 pm	22:10 pm	35.9
ISPL_NM_09	South Bhotemari Char (near proposed no-04), Kaliganj, Lalmonirhat	25.991111°N 89.164444°E	17.09.22	Silent	12:45 pm	01:15 pm	41.3	20:05 pm	20:30 pm	36.2
ISPL_NM_10	Sholmari (in between proposed no 02 and 03), Bhotemari Union, Kaliganj, Lalmonirhat	25.990555°N 89.160833°E	17.09.22	Silent	02:10 pm	02:40 pm	44.1	20:45 pm	21:15 pm	38.9
ISPL_NM_11	Sholmari (near proposed no-04), Bhotemari Union, Kaliganj, Lalmonirhat	25.990833°N 89.156666°E	17.09.22	Silent	04:00 pm	04:30 pm	43.2	22:25 pm	22:55 pm	39.4
ISPL_NM_12	Srutidhar, Bhotemari Union, Kaliganj, Lalmonirhat	25.976388°N 89.189166°E	18.09.22	Mixed	05:15 pm	05:45 pm	48.9	08:05 pm	08:35 pm	43.1

Notes:

- *Land use category is based on the classification provided in the Noise Pollution Control Rules (2006)*
- *The sound level standards for residential area are 55 at day and 45 at night.*
- *The sound level standards for commercial area are 70 at day and 60 at night*
- *The sound level standards for mixed area are 60 at day and 50 at night*
- *The sound level standards for silent area are 50 at day and 40 at night*
- *Noise Level is the average noise recorded over the duration of the monitoring period*

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Description of the Surrounding Environment

Location	Sample Site Description
Beside Control Room of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat **(ISPL_NM_01)**	❖ Tractor movement was present. ❖ People movement low. ❖ Residential area. ❖ Construction ongoing.
Beside Substation-08 of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat **(ISPL_NM_02**	❖ People movement low. ❖ Construction ongoing. ❖ Machine movement was noticed.
Beside Substation-04 of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat **(ISPL_NM_03)**	❖ People movement high. ❖ Construction ongoing. ❖ Moderate traffic movement was noticed.
Beside Substation-07 of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat **(ISPL_NM_04)**	❖ No construction work was ongoing. ❖ People movement moderate. ❖ Machine movement was present.
Entry Point of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat **(ISPL_NM_05)**	❖ Beside the entry point of the plant area. ❖ Vehicle moderate. ❖ People high.
Beside Labor Camp of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat **(ISPL_NM_06)**	❖ Cattle were seen in the area. ❖ Vehicle moderate. ❖ No construction.
Beside Karimpur Dakhil Madrasa, South Bhotemari, Kaliganj, Lalmonirhart **(ISPL_NM_07)**	❖ Commercial area. ❖ Beside Dakhil mardarasa. ❖ Beside rail crossing.
South Bhotemari, Modati Union, Kaliganj, Lalmonirhat **(ISPL_NM_08)**	❖ Area was residential. ❖ People high. ❖ Traffic moderate.
South Bhotemari Char (near proposed no-04), Kaliganj, Lalmonirhat **(ISPL_NM_09)**	❖ People low. ❖ Cattle moderate. ❖ Vehicle only means shallow boat.
Sholmari (in between proposed no 02 and 03), Bhotemari Union, Kaliganj, Lalmonirhat **(ISPL_NM_10)**	❖ Silent area. ❖ The sound source was quite a few. ❖ People low.
Sholmari (near proposed no-01), Bhotemari Union, Kaliganj, Lalmonirhat	❖ In an island. ❖ A very few amounts t of people was seen. ❖ The area is a silent area.

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Location	Sample Site Description
(ISPL_NM_11)	❖ People movement low.
Srutidhar, Bhotemari Union, Kaliganj, Lalmonirhat **(ISPL_NM_12)**	❖ People movement moderate. ❖ Beside a mosque. ❖ No construction ongoing. ❖ The area is a mixed area.

Test Performed By:
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Checked By:
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Appendix E: Surface Water Quality

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Name of the Project	Environmental and Social Impact Assessment (ESIA) of 30 MW (AC) Grid-tied Solar Power Plant Project of Intraco Solar Power Limited (ISPL)
Description of Sample	Surface Water Quality
Sample Collector	Collected by DSCL Personnel
Sampling Date	16 September 2022

Test Result of Surface Water Quality

Parameters	Unit	ISPL_SW_01 26.003360°N 89.160648°E Teesta River, Kaliganj, Lalmonirhat	Standards for Inland Surface Water** (Best fishing practice)	Analysis Method
pH*	-	8.22	6.5-8.5	Multimeter
Temperature*	°C	32.4	NYS	Multimeter
Electricity Conductivity*	mg/L	23.9	NYS	Multimeter
Salinity*	mg/L	10.9	NYS	Multimeter
Dissolved Oxygen (DO)*	mg/L	7.3	5 or more	DO Meter
Oxidation-Reduction Potential (ORP)*	mg/L	-135.9	NYS	Multimeter

Note:
*** The standard for inland surface water have been taken from the Environmental conservation rules, 1997*
NYS: Not Yet Standardized

Description of the Surrounding Environment

Location	Sample Site Description
Teesta River, Kaliganj, Lalmonirhat **(ISPL_SW_01)**	❖ People use for washing and bathing purpose ❖ Vegetation high. ❖ Fish Culture during fishing season.

Test Performed By:
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Checked By:
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Name of the Project	Environmental and Social Impact Assessment (ESIA) of 30 MW (AC) Grid-tied Solar Power Plant Project of Intraco Solar Power Limited (ISPL)
Description of Sample	Surface Water Quality
Sample Collector	Collected by DSCL Personnel
Sampling Date	18 September 2022

Test Result of Surface Water Quality

Parameters	Unit	ISPL_SW_02 22.190045°N 90.754336°E Baniar Badh Omar Hajir Pukur, South Bhotemari, Kaliganj, Lalmonirhat	Standards for Inland Surface Water** (Best fishing practice)	Analysis Method
pH*	-	8.71	6.5-8.5	Multimeter
Temperature*	°C	30.6	NYS	Multimeter
Electricity Conductivity*	µs/cm	12.34	NYS	Multimeter
Salinity*	ppt	7.16	NYS	Multimeter
Dissolved Oxygen (DO)*	mg/L	6.8	5 or more	DO Meter
Oxidation-Reduction Potential (ORP)*	mg/L	-133.6	NYS	Multimeter

Note:
*** The standard for inland surface water have been taken from the Environmental conservation rules, 1997 which was amended on 19 July 2005 S.R.O. No. 220-Law/2005.*
NYS: Not Yet Standardized

Description of the Surrounding Environment

Location	Sample Site Description
Baniar Badh Omar Hajir Pukur, South Bhotemari, Kaliganj, Lalmonirhat **(ISPL_SW_02)**	❖ The embankment was constructed during 1988 flood. ❖ Approximately 12 m deep. ❖ Several fishes are found here. ❖ Used for animal bathing sometimes. ❖ Toilet distance is far from 10 m.

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Test Performed By:
Ekram Hossain Riyad
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TEST REPORT NO: 1001700137 **Sep.30,2022**

UL ORDER NO: 14511206

Applicant :	DEVELOPMENT SOLUTIONS CONSULTANT LIMITED	**Test Date :**	Sep.25 -30, 2022
Address :	HOUSE-734, 1-A, ROAD-10, AVENUE-4, DOHS MIRPUR, DHAKA-1216, BANGLADESH		
Contact Person :	PINON NATH		
Sample Description:	SURFACE WATER		
Testing Protocol:	Self-Reference		
Project Name:	Environmental and Social Impact Assessment (ESIA) of 30 MW (AC) Grid-Tied of Intraco Solar Power Limited (ISPL)		
Sample ID:	SW-01, SW-02		
Location:	Teesta River, Bhotemari, Upa: Kaliganj; Dist: Lalmonirhat, Baniar Bodh Omar Hajir Pukhur, South Bhotemari, Upa: Kaliganj; Dist: Lalmonirhat		

Sample Information :

Sample ID	Description	Equivalent Code / Color
001	SURFACE WATER SAMPLE	SW-01
002	SURFACE WATER SAMPLE	SW-02

For and on behalf of
UL VS Bangladesh Ltd.

Md. Nur Alam – Lab Technical & Operations Manager

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TEST REPORT NO: 1001700137 **Sep.30,2022**

UL ORDER NO: 14511206

TEST	Sample ID	
	001	002
Total Suspended Solid (TSS)	NC	NC
Chemical Oxygen Demand (COD)	NC	NC
Biological Oxygen Demand (BOD) (5-day)	NC	NC
Phosphate (PO_4)	NC	NC
Sulphate (SO_4)	NC	NC
Total Arsenic (As)	NC	NC
Total Calcium (Ca)	NC	NC
Total Manganese (Mn)	NC	NC
Chloride (Cl)	NC	NC

Note: **P = Pass ; F = Fail ; NC = No Comment ; NA = Not Applicable ; ** = test result(s) will be added later**

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(01) Total Suspended Solid (TSS)

Test Method: With reference APHA/SM 2540D

Sample ID	Ref. Sample ID	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	SW-01	5	117	-	**NC**
002	SW-02	5	48	-	**NC**
"<" means "less than" ; "mg/L" means "milligram per litre;					

(02) Chemical Oxygen Demand (COD)

Test Method: With reference APHA/SM 5220D

Sample ID	Ref. Sample ID	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	SW-01	5	45	-	**NC**
002	SW-02	5	65	-	**NC**
"<" means "less than" ; "mg/L" means "milligram per litre;					

(03) Biological Oxygen Demand (BOD) (5-day)

Test Method: With reference APHA/SM 5210B

Sample ID	Ref. Sample ID	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	SW-01	2	12	-	**NC**
002	SW-02	2	16	-	**NC**
"<" means "less than" ; "mg/L" means "milligram per litre;					

(04) Phosphate (PO_4)

Test Method: Analysis by Photometric Method

Sample ID	Ref. Sample ID	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	SW-01	0.1	<0.1	-	**NC**
002	SW-02	0.1	<0.1	-	**NC**
"<" means "less than" ; "mg/L" means "milligram per litre;					

(05) Sulphate (SO_4)

Test Method: Analysis by Photometric Method

Sample ID	Ref. Sample ID	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	SW-01	10	17	-	**NC**
002	SW-02	10	<10	-	**NC**
"<" means "less than" ; "mg/L" means "milligram per litre;					

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TEST REPORT NO: 1001700137 **Sep.30,2022**

UL ORDER NO: 14511206

(06) Total Arsenic (As)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	SW-01	Arsenic (As)	7440-38-2	0.02	<0.02	-	NC
002	SW-02	Arsenic (As)	7440-38-2	0.02	<0.02	-	NC
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

(07) Total Calcium (Ca)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	SW-01	Calcium (Ca)	7440-70-2	0.5	3.65	-	NC
002	SW-02	Calcium (Ca)	7440-70-2	0.5	1.78	-	NC
"<" means "less than" ; "mg/L" means "milligram per litre;							

(08) Total Manganese (Mn)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	SW-01	Manganese (Mn)	7439-96-5	0.5	<0.5	-	NC
002	SW-02	Manganese (Mn)	7439-96-5	0.5	<0.5	-	NC
"<" means "less than" ; "mg/L" means "milligram per litre"							

(09) Chloride (Cl)

Test Method: Analysis by Titrimetric Method

Sample ID	Ref. Sample ID	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	SW-01	10	12.5	-	NC
002	SW-02	10	12.5	-	NC
"<" means "less than" ; "mg/L" means "milligram per litre;					

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TEST REPORT NO:	1001700137	Sep.30,2022
UL ORDER NO:	14511206	



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Appendix F: Groundwater Quality

DSCL

Development Solutions Consultant Limited

Multidisciplinary Development Consultants

Name of the Project	Environmental and Social Impact Assessment (ESIA) of 30 MW (AC) Grid-tied Solar Power Plant Project of Intraco Solar Power Limited (ISPL)
Description of Sample	Groundwater Quality
Sample Collector	Collected by DSCL Personnel
Sampling Date	18 September 2022

Test Result of Groundwater Quality

Parameters	Unit	ISPL_GW_02 26.000501°N 89.153257°E Beside Labor Camp of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat	Standards for Potable Groundwater**	Analysis Method
pH*	-	7.09	6.5-8.5	Multimeter
Temperature*	°C	27.1	20-30	Multimeter
Electricity Conductivity*	mg/l	13.31	NYS	Multimeter
Salinity*	mg/l	7.89	NYS	Multimeter
Total Dissolved Solids (TDS)*	mg/l	8.79	1000	Multimeter
Oxidation-Reduction Potential (ORP)*	mg/l	-54.5	NYS	Multimeter

Note:
*** The standard for groundwater has been taken from the Environment Conservation Rules, 1997*
NYS: Not Yet Standardized

Description of the Surrounding Environment

Location	Sample Site Description
Beside Labor Camp of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat **(ISPL_GW_02)**	❖ Established more than one year ago. ❖ Depth is 30 feet. ❖ Nearer toilet distance is 10 m. ❖ Purpose is drinking and washing only.

Test Performed By:
Ekram Hossain Riyad
Jr. Environmental Engineer

Development Solutions Consultant Limited * DSCL *

Checked By:
Md Mashiur Rahman
Deputy Manager

House# 734 (1-A), Road# 10, Avenue# 04, DOHS Mirpur Dhaka-1216, Bangladesh
Tel: +8809617035444; +8801822758548; Email: dscl@dsclbd.com Web: www.dsclbd.com

IAF IAS ACCREDITED BQSR ISO 9001:2015 ISO 45001:2018

DSCL

Development Solutions Consultant Limited

Multidisciplinary Development Consultants

Name of the Project	Environmental and Social Impact Assessment (ESIA) of 30 MW (AC) Grid-tied Solar Power Plant Project of Intraco Solar Power Limited (ISPL)
Description of Sample	Groundwater Quality
Sample Collector	Collected by DSCL Personnel
Sampling Date	16 September 2022

Test Result of Groundwater Quality

Parameters	Unit	ISPL_GW_01 25.997331°N 89.152356°E Behind Control Room of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat	Standards for Groundwater**	Analysis Method
pH*	-	7.17	6.5-8.5	Multimeter
Temperature*	°C	27.2	20-30	Multimeter
Electricity Conductivity*	mg/l	13..33	NYS	Multimeter
Salinity*	mg/l	7.87	NYS	Multimeter
Total Dissolved Solids (TDS)*	mg/l	8.78	1000	Multimeter
Oxidation-Reduction Potential (ORP) *	mg/l	-65.9	NYS	Multimeter

Note:
*** The standard for groundwater has been taken from the Environment conservation rules, 1997*
NYS: Not Yet Standardized

Description of the Surrounding Environment

Location	Sample Site Description
Behind Control Room of Intraco Solar Power Plant, Sholmari, Bhotemari, Kaliganj, Lalmonirhat **(ISPL_GW_01)**	❖ Toilet is far from 10 m. ❖ Purpose is drinking and washing. ❖ The source is used for drinking by the staffs through filtering process.

Test Performed By:
Ekram Hossain Riyad
Jr. Environmental Engineer

Development Solutions Consultant Limited ★ DSCL ★

Checked By:
Md Mashiur Rahman
Deputy Manager

House# 734 (1-A), Road# 10, Avenue# 04, DOHS Mirpur Dhaka-1216, Bangladesh
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TEST REPORT NO: 1001700129 **Oct.2,2022**

UL ORDER NO: 14511209

Applicant :	DEVELOPMENT SOLUTIONS CONSULTANT LIMITED	**Test Date :**	Sep.25 – Oct.2,2022
Address :	HOUSE-734, 1-A, ROAD-10, AVENUE-4, DOHS MIRPUR, DHAKA-1216, BANGLADESH		
Contact Person :	PINON NATH		

Sample Description:	GROUNDWATER
Testing Protocol:	Self-Reference
Project Name:	Environmental and Social Impact Assessment (ESIA) of 30 MW (AC) Grid-Tied of Intraco Soalr Power Limited (ISPL)
Sample ID:	GW-01, GW-02
Location:	Behind the Control Room, Bhotemari; Upa: Kaliganj; Dist: Lalmonirhat, Beside the labour Camp, Bhotemari; Upa: Kaliganj; Dist: Lalmonirhat,

Sample Information :

Sample ID	Description	Equivalent Code / Color
001	GROUNDWATER SAMPLE	GW-01
002	GROUNDWATER SAMPLE	GW-02

For and on behalf of
UL VS Bangladesh Ltd.

Md. Nur Alam – Lab Technical & Operations Manager

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TEST REPORT NO: 1001700129 **Oct.2,2022**

UL ORDER NO: 14511209

TEST	Sample ID	
	001	002
Chloride (Cl)	NC	NC
Total Coliform (TC) ♦	NC	NC
Faecal Coliform (FC) ♦	NC	NC
Total Suspended Solid (TSS)	NC	NC
Total Arsenic (As)	NC	NC
Total Iron (Fe)	NC	NC
Total Manganese (Mn)	NC	NC
Total Calcium (Ca)	NC	NC

Note: **P = Pass ; F = Fail ; NC = No Comment ; NA = Not Applicable ; ** = test result(s) will be added later**
♦ Marked test was subcontracted to an ISO 17025 accredited laboratory.

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TEST REPORT NO: 1001700129 **Oct.2,2022**

UL ORDER NO: 14511209

(01) Chloride (Cl)

Test Method: Analysis by Titrimetric Method

Sample ID	Ref. Sample ID	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	GW-01	10	12.5	-	NC
002	GW-02	10	12.5	-	NC
"<" means "less than" ; "mg/L" means "milligram per litre;					

(02) Total Coliform (TC)

Test Method: With reference USEPA 9132

Sample ID	Ref. Sample ID	Result, CFU/100mL	Requirement, CFU/100mL	Comment
001	GW-01	0	-	NC
002	GW-02	0	-	NC
"<" means "less than" ; "CFU" means "colony forming units"				

(03) Faecal Coliform (FC)

Test Method: Membrane Filtration

Sample ID	Ref. Sample ID	Result, CFU/100mL	Requirement, CFU/100mL	Comment
001	GW-01	0	-	NC
002	GW-02	0	-	NC
"<" means "less than" ; "CFU" means "colony forming units"				

(04) Total Suspended Solid (TSS)

Test Method: With reference APHA/SM 2540D

Sample ID	Ref. Sample ID	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	GW-01	5	2	-	NC
002	GW-02	5	3	-	NC
"<" means "less than" ; "mg/L" means "milligram per litre;					

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TEST REPORT NO: 1001700129 **Oct.2,2022**

UL ORDER NO: 14511209

(05) Total Arsenic (As)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	GW-01	Arsenic (As)	7440-38-2	0.02	<0.02	-	NC
002	GW-02	Arsenic (As)	7440-38-2	0.02	<0.02	-	NC
"<" means "less than" ; "mg/L" means "milligram per litre"							

(06) Total Iron (Fe)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	GW-01	Iron (Fe)	7439-89-6	0.5	2.30	-	NC
002	GW-02	Iron (Fe)	7439-89-6	0.5	2.34	-	NC
"<" means "less than" ; "mg/L" means "milligram per litre;							

(07) Total Manganese (Mn)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	GW-01	Manganese (Mn)	7439-96-5	0.5	<0.5	-	NC
002	GW-02	Manganese (Mn)	7439-96-5	0.5	<0.5	-	NC
"<" means "less than" ; "mg/L" means "milligram per litre"							

(08) Total Calcium (Ca)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	GW-01	Calcium (Ca)	7440-70-2	0.5	3.93	-	NC
002	GW-02	Calcium (Ca)	7440-70-2	0.5	0.66	-	NC
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TEST REPORT NO:	**1001700129**	**Oct.2,2022**
UL ORDER NO:	**14511209**	



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Appendix G: Riverbed Sediment Quality

TEST REPORT NO: 1001700147 **Sep.30,2022**

UL ORDER NO: 14511211

Page : 1 of 5

Applicant :	DEVELOPMENT SOLUTIONS CONSULTANT LIMITED	**Test Date :**	Sep.25 – 30,2022
Address :	HOUSE-734, 1-A, ROAD-10, AVENUE-4, DOHS MIRPUR, DHAKA-1216, BANGLADESH		
Contact Person :	PINON NATH		

Sample Description:	Riverbed Sediments
Testing Protocol:	Self-Reference
Project Name:	Environmental and Social Impact Assessment (ESIA) Of 30 MW (AC) Grid-Tied of Intraco Solar Power Limited (ISPL)
Sample ID:	RBS-01, RBS-02
Location:	Teesta River, Bhotemari, Upa: Kaliganj; Dist: Lalmonirhat, Baniar Bodh Omar Hajir Pukhur, South Bhotemari, Upa: Kaliganj; Dist: Lalmonirhat

Sample Information :

Sample ID	Description	Equivalent Code / Color
001	Riverbed Sediment	RBS-01
002	Riverbed Sediment	RBS-02

For and on behalf of
UL VS Bangladesh Ltd.

Md. Nur Alam – Lab Technical & Operations Manager

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TEST REPORT NO: 1001700147 **Sep.30,2022**

UL ORDER NO: 14511211

TEST	Sample ID	
	001	002
Total Cadmium (Cd)	NC	NC
Total Chromium (Cr)	NC	NC
Total Lead (Pb)	NC	NC
Total Zinc (Zn)	NC	NC
Total Arsenic (As)	NC	NC
Total Mercury (Hg)	NC	NC

Note: **P = Pass ; F = Fail ; NC = No Comment ; NA = Not Applicable ; ** = test result(s) will be added later**

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TEST REPORT NO: 1001700147 **Sep.30,2022**

UL ORDER NO: 14511211

(01) Total Cadmium (Cd)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RBS-01	Cadmium (Cd)	7440-43-9	0.5	<0.5	-	NC
002	RBS-02	Cadmium (Cd)	7440-43-9	0.5	<0.5	-	NC
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

(02) Total Chromium (Cr)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RBS-01	Chromium (Cr)	16065-83-1	5	<5	-	NC
002	RBS-02	Chromium (Cr)	16065-83-1	5	<5	-	NC
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

(03) Total Lead (Pb)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RBS-01	Lead (Pb)	7439-92-1	5	<5	-	NC
002	RBS-02	Lead (Pb)	7439-92-1	5	<5	-	NC
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

(04) Total Zinc (Zn)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RBS-01	Zinc (Zn)	7440-66-6	10	<10	-	NC
002	RBS-02	Zinc (Zn)	7440-66-6	10	<10	-	NC
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

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TEST REPORT NO: 1001700147 **Sep.30,2022**

UL ORDER NO: 14511211

(05) Total Arsenic (As)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RBS-01	Arsenic (As)	7440-38-2	5	<5	-	**NC**
002	RBS-02	Arsenic (As)	7440-38-2	5	<5	-	**NC**
"<" means "less than" ; "mg/L" means "milligram per litre"							

(06) Total Mercury (Hg)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RBS-01	Mercury (Hg)	7439-97-6	2.5	<2.5	-	**NC**
002	RBS-02	Mercury (Hg)	7439-97-6	2.5	<2.5	-	**NC**
"<" means "less than" ; "mg/L" means "milligram per litre"							

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UL VS Bangladesh Ltd
The Pearl Trade Center (5th,14th&15th floor), Cha- 90/3, Progoti Sharani, North Badda, Dhaka 1212, Bangladesh.
M: +88-01730087201, 01730087200 for CS Hotline & +8801730317241 for sample pick / Web: www.ul.com

TEST REPORT NO:	1001700147	Sep.30,2022
UL ORDER NO:	14511211	



***** End of Report *****

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The Pearl Trade Center (5th,14th&15th floor), Cha- 90/3, Progoti Sharani, North Badda, Dhaka 1212, Bangladesh.
M: +88-01730087201, 01730087200 for CS Hotline & +8801730317241 for sample pick / Web: www.ul.com

Appendix H: Test results of Plankton analysis

Department of Zoology
University of Dhaka
Analysis of Plankton Samples

Sampling procedure : Unknown
No of Samples : 2
Sample received on : 29th September 2022
Sample analyzed by : 6th October 2022
Locations : Lalmonirhat
Client : DSCL, Development Solutions Consultant Ltd.
Working reference : Environmental and Social Impact Assessment (ESIA) of 30MW Grid-tied Solar Power Plant Project of Intraco Solar Power Limited (ISPL)

No	Sample ID	Ecosystem	**Results:** Plankton diversity *Species in One ml sample (random):*	Total count
1	ISPL_PT_01	**River:** Teesta River, Bhotemari, Kaliganj, Lalmonihat	Phytoplankton *Pandorina* sp. (Volvocaceae)- 3 Zooplankton: *Nauplius* (Crustacean)- 1 *Cyclops* (Copepoda)- 1	Phytoplankton: 3,600 indv./ cu.m. Zooplankton: 2,400 indv./ cu.m
2	ISPL_PT_02	**Pond**: Baniyar Bandh Omar Hajir Pukur, South Bhotemari, Kalikapur, Kaliganj, Lalmonihat	Phytoplankton: *Volvox* sp. (Volvocaceae)- 8 Zooplankton: *Nauplius* (Crustacean)- 3 *Cyclops* (Copepoda)- 2	Phytoplankton: 8,000 indv./ cu.m. Zooplankton: 5,000 indv./ cu.m

M Niamul Naser PhD

Appendix I: Calibration Certificates for Environmental Quality Testing Equipments

Calibration certificated of Air quality Measurement equipment

CALIBRATION TECHNOLOGY PVT. LIMITED
Vivek Biponon Tower, Level-2
13/P, Biponon C/A, Mymensing Lane
Banglamotor, Dhaka-1000, Bangladesh.
Mobile: +8809643220000; www.caltechbd.com
Accredited to **ISO 9001:2015 & ISO/IEC 17025:2017**

CERTIFICATE OF CALIBRATION

Certificate No. CTPL(22-23)-2055

Calibration Performed For :

Development Solution Consultant Limited.
H#734, Road#10, Ave # 04,Mirpur DOHS, Dhaka, Bangladesh.
Phone : +880 1752 018922
Mail Address : rroy@dsclbd.com
Contact Person : Rajib Roy

Equipment Details :

Description : Portable Gas Detector
Manufacturer : Henan Oceanus
Model No. : OC-905/CO2
Serial No. : OC20210305173103
Asset /ID No : N/P
Range (ppm) : 0~10000
Readability (ppm) : 1

Calibration Statics:

Received On : 30 Jun 2022
Date Serviced : 01 Jul 2022
Due on : 30 Jun 2023
Issued on : 03 Jul 2022
Received Condition : In Tolerance
Returned Condition : In Tolerance
Interval : 12 Months
Performed By : Md. Golam Rabbani Mondal
Performed At : CalTech Laboratory
Environmental Conditions : Temp: 25.0 °C & RH: 57.8%
CalTech Procedure : CTPL-WI-126

Comments/Notes

Uncertainty taken into account for the declaration of result as per **ANAB AR 2251** and **ILAC-G8:2019 (Binary).**
The result of calibration is satisfactory.
Any section marked
N/P= Not Provided,
N/S= Not Submitted
UUC= Unit Under Calibration

CalTech hereby certifies that...

The above described instrument met or exceeded all established specifications at the time of calibration specified above; and the calibration results published in this certificate obtained using equipment capable of producing results that are traceble through NIST to the International System of Units (SI) or have been derived from accepted values, physical constants, by ratio or self calibration techniques. All Calibration activities performed are in compliance with **Comparison method** and **ISO 17025:2017** when specified as well as national/ international system guidelines. The quality system is ISO 9001:2015 certified. This report shall not be reproduced, except in full, without the written permission of CalTech.

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Calibration Points : **Result Column : P= Pass, F= Fail, A= Adjusted, D= No Result drawn due to tolerance N/S**

Sl. No.	Description	Nominal (ppm)	Standard Solution (ppm)	As found UUC (ppm)	Error (ppm)	Tolerance (±) (ppm)	Result	Uncertainty (±)
01	Fresh Air	0.00	0.00	0.00	0.00	N/A	A	------
02	Carbon Dioxide	1000.00	1000.00	1000	0.00	N/A	P	0.02 % Rdg.

Standard Used to Calibrate Equipment

Sl. No.	Description	Manufacturer	Model	Serial	Calibrated from	Cal. Due on
01	Standard Gas	Snaptech Products , UK	Y186951	N/P	NIST Traceable	May 2024

Calibration Performed By :
Calibration Engineer

Authorized By :
Laboratory Manager
Md. Rezaul Hossain

[END]

Frm1(7.8/00/C) 1 of 1

CALIBRATION TECHNOLOGY PVT. LIMITED
Vivek Biponon Tower, Level-2
13/P, Biponon C/A, Mymensing Lane
Banglamotor, Dhaka-1000, Bangladesh.
Mobile: +8809643220000; www.caltechbd.com
Accredited to **ISO 9001:2015 & ISO/IEC 17025:2017**

CERTIFICATE OF CALIBRATION

Certificate No. CTPL(22-23)-2057

Calibration Performed For :

Development Solution Consultant Limited.
H#734, Road#10, Ave # 04,Mirpur DOHS, Dhaka, Bangladesh.
Phone : +880 1752 018922
Mail Address : rroy@dsclbd.com
Contact Person : Rajib Roy

Equipment Details :

Description : Portable Gas Detector
Manufacturer : Henan Oceanus
Model No. : OC-905/NO2
Serial No. : OC20210305173104
Asset /ID No : N/P
Range (ppm) : 0~20
Readability (ppm) : 0.01

Calibration Statics:

Received On : 30 Jun 2022
Date Serviced : 01 Jul 2022
Due on : 30 Jun 2023
Issued on : 03 Jul 2022
Received Condition : In Tolerance
Returned Condition : In Tolerance
Interval : 12 Months
Performed By : Md. Golam Rabbani Mondal
Performed At : CalTech Laboratory
Environmental Conditions : Temp: 25.0 °C & RH: 57.8%
CalTech Procedure : CTPL-WI-126

Comments/Notes

Uncertainty taken into account for the declaration of result as per **ANAB AR 2251** and **ILAC-G8:2019 (Binary).**
The result of calibration is satisfactory.
Any section marked
N/P= Not Provided,
N/S= Not Submitted
UUC= Unit Under Calibration

CalTech hereby certifies that...

The above described instrument met or exceeded all established specifications at the time of calibration specified above; and the calibration results published in this certificate obtained using equipment capable of producing results that are traceble through NIST to the International System of Units (SI) or have been derived from accepted values, physical constants, by ratio or self calibration techniques. All Calibration activities performed are in compliance with **Comparison method** and **ISO 17025:2017** when specified as well as national/ international system guidelines. The quality system is ISO 9001:2015 certified. This report shall not be reproduced, except in full, without the written permission of CalTech.

All Calibrations, unless otherwise noted, are performed using accuracies of less than or equal to one quarter of the specification of the unit under calibration. The measurement uncertainties include a coverage factor of K=2, having a confidence level of 95%.

Calibration Points **Result Column : P= Pass, F= Fail, A= Adjusted, D= No Result drawn due to tolerance N/S**

Sl. No.	Description	Nominal (ppm)	Standard Solution (ppm)	As found UUC (ppm)	Error (ppm)	Tolerance (±) (ppm)	Result	Uncertainty (±)
01	Fresh Air	0.00	0.00	0.00	0.00	N/A	A	------
02	Nitrogen Dioxide	100.00	100.00	100.00	0.00	N/A	P	0.02 % Rdg.

Standard Used to Calibrate Equipment

Sl. No.	Description	Manufacturer	Model	Serial	Calibrated from	Cal. Due on
01	Standard Gas	Snaptech Products , UK	YY751244	N/P	NIST Traceable	Nov 2024

Calibration Performed By :
Calibration Engineer

Authorized By :
Laboratory Manager
Md. Reza Hossain

[END]

CALIBRATION TECHNOLOGY PVT. LIMITED
Vivek Biponon Tower, Level-2
13/P, Biponon C/A, Mymensing Lane
Banglamotor, Dhaka-1000, Bangladesh.
Mobile: +8809643220000; www.caltechbd.com
Accredited to **ISO 9001:2015 & ISO/IEC 17025:2017**

CERTIFICATE OF CALIBRATION

Certificate No. CTPL(22-23)-2054

Calibration Performed For :

Development Solution Consultant Limited.
H#734, Road#10, Ave # 04,Mirpur DOHS, Dhaka, Bangladesh.
Phone : +880 1752 018922
Mail Address : rroy@dsclbd.com
Contact Person : Rajib Roy

Equipment Details :

Description : Portable Gas Detector
Manufacturer : Henan Oceanus
Model No. : OC-905/SO2
Serial No. : OC20210305173102
Asset /ID No : N/P
Range (ppm) : 0~20
Readability (ppm) : 0.01

Calibration Statics:

Received On : 30 Jun 2022
Date Serviced : 01 Jul 2022
Due on : 30 Jun 2023
Issued on : 03 Jul 2022
Received Condition : In Tolerance
Returned Condition : In Tolerance
Interval : 12 Months
Performed By : Md. Golam Rabbani Mondal
Performed At : CalTech Laboratory
Environmental Conditions : Temp: 25.0 °C & RH: 57.8%
CalTech Procedure : CTPL-WI-126

Comments/Notes

Uncertainty taken into account for the declaration of result as per **ANAB AR 2251** and **ILAC-G8:2019 (Binary).**
The result of calibration is satisfactory.
Any section marked
N/P= Not Provided,
N/S= Not Submitted
UUC= Unit Under Calibration

CalTech hereby certifies that...

The above described instrument met or exceeded all established specifications at the time of calibration specified above; and the calibration results published in this certificate obtained using equipment capable of producing results that are traceble through NIST to the International System of Units (SI) or have been derived from accepted values, physical constants, by ratio or self calibration techniques. All Calibration activities performed are in compliance with **Comparison method** and **ISO 17025:2017** when specified as well as national/ international system guidelines. The quality system is ISO 9001:2015 certified. This report shall not be reproduced, except in full, without the written permission of CalTech.

All Calibrations, unless otherwise noted, are performed using accuracies of less than or equal to one quarter of the specification of the unit under calibration. The measurement uncertainties include a coverage factor of K=2, having a confidence level of 95%.

Calibration Points **Result Column : P= Pass, F= Fail, A= Adjusted, D= No Result drawn due to tolerance N/S**

Sl. No.	Description	Nominal (ppm)	Standard Solution (ppm)	As found UUC (ppm)	Error (ppm)	Tolerance (±) (ppm)	Result	Uncertainty (±)
01	Fresh Air	0.00	0.00	0.00	0.00	N/A	A	------
02	Sulpher Dioxide	10.00	10.00	10.00	0.00	N/A	P	0.02 % Rdg.

Standard Used to Calibrate Equipment

Sl. No.	Description	Manufacturer	Model	Serial	Calibrated from	Cal. Due on
01	Standard Gas	Snaptech Products , UK	Y811255	N/P	NIST Traceable	Nov 2024

Calibration Performed By :
Calibration Engineer

Authorized By :
Laboratory Manager
Md. Rezo Hossain

[END]

CALIBRATION TECHNOLOGY PVT. LIMITED
Vivek Biponon Tower, Level-2
13/P, Biponon C/A, Mymensing Lane
Banglamotor, Dhaka-1000, Bangladesh.
Mobile: +8809643220000; www.caltechbd.com
Accredited to **ISO 9001:2015 & ISO/IEC 17025:2017**

CERTIFICATE OF CALIBRATION

Certificate No. CTPL(22-23)-2056

Calibration Performed For :

Development Solution Consultant Limited.
H#734, Road#10, Ave # 04,Mirpur DOHS, Dhaka, Bangladesh.
Phone : +880 1752 018922
Mail Address : rroy@dsclbd.com
Contact Person : Rajib Roy

Equipment Details :

Description : Portable Gas Detector
Manufacturer : Henan Oceanus
Model No. : OC-905/CO
Serial No. : OC20210305173105
Asset /ID No : N/P
Range (ppm) : 0~1000
Readability (ppm) : 1

Calibration Statics:

Received On : 30 Jun 2022
Date Serviced : 01 Jul 2022
Due on : 30 Jun 2023
Issued on : 03 Jul 2022
Received Condition : In Tolerance
Returned Condition : In Tolerance
Interval : 12 Months
Performed By : Md. Golam Rabbani Mondal
Performed At : CalTech Laboratory
Environmental Conditions : Temp: 25.0 °C & RH: 57.8%
CalTech Procedure : CTPL-WI-126

Comments/Notes

Uncertainty taken into account for the declaration of result as per **ANAB AR 2251** and **ILAC-G8:2019 (Binary).**
The result of calibration is satisfactory.
Any section marked
N/P= Not Provided,
N/S= Not Submitted
UUC= Unit Under Calibration

CalTech hereby certifies that...

The above described instrument met or exceeded all established specifications at the time of calibration specified above; and the calibration results published in this certificate obtained using equipment capable of producing results that are traceble through NIST to the International System of Units (SI) or have been derived from accepted values, physical constants, by ratio or self calibration techniques. All Calibration activities performed are in compliance with **Comparison method** and **ISO 17025:2017** when specified as well as national/ international system guidelines. The quality system is ISO 9001:2015 certified. This report shall not be reproduced, except in full, without the written permission of CalTech.

All Calibrations, unless otherwise noted, are performed using accuracies of less than or equal to one quarter of the specification of the unit under calibration. The measurement uncertainties include a coverage factor of K=2, having a confidence level of 95%.

Calibration Points **Result Column : P= Pass, F= Fail, A= Adjusted, D= No Result drawn due to tolerance N/S**

Sl. No.	Description	Nominal (ppm)	Standard Solution (ppm)	As found UUC (ppm)	Error (ppm)	Tolerance (±) (ppm)	Result	Uncertainty (±)
01	Fresh Air	0.00	0.00	0.00	0.00	N/A	A	------
02	Carbon Monoxide	100.00	100.00	100	0.00	N/A	P	0.02 % Rdg.

Standard Used to Calibrate Equipment

Sl. No.	Description	Manufacturer	Model	Serial	Calibrated from	Cal. Due on
01	Standard Gas	Snaptech Products , UK	Y118787	N/P	NIST Traceable	Nov 2024

Calibration Performed By :
Calibration Engineer

Authorized By :
Laboratory Manager
Md. Reza Hossain

[END]

Frm1(7.8/00/C) 1 of 1

CALIBRATION TECHNOLOGY PVT. LIMITED
Vivek Biponon Tower, Level-2
13/P, Biponon C/A, Mymensing Lane
Banglamotor, Dhaka-1000, Bangladesh.
Mobile: +8809643220000; www.caltechbd.com
Accredited to **ISO 9001:2015 & ISO/IEC 17025:2017**

CERTIFICATE OF CALIBRATION

Certificate No. CTPL(22-23)-2057A

Calibration Performed For :

Development Solution Consultant Limited.
H#734, Road#10, Ave # 04,Mirpur DOHS, Dhaka, Bangladesh.
Phone : +880 1752 018922
Mail Address : rroy@dsclbd.com
Contact Person : Rajib Roy

Equipment Details :

Description : Gas Detector (Air Particle Counter)
Manufacturer : Henan Oceanus
Model No. : OC-300
Serial No. : 00210337853
Asset /ID No : N/P
Range (µg/m3) : 0~999
Readability (µg/m3) : 0.01

Calibration Statics:

Received On : 30 Jun 2022
Date Serviced : **01 Jul 2022**
Due on : **30 Jun 2023**
Issued on : 03 Jul 2022
Received Condition : In Tolerance
Returned Condition : In Tolerance
Interval : 12 Months
Performed By : Md. Golam Rabbani Mondal
Performed At : CalTech Laboratory
Environmental Conditions : Temp: 25.0 °C & RH: 57.8%
CalTech Procedure : **CTPL-WI-126**

Comments/Notes

Uncertainty taken into account for the declaration of result as per **ANAB AR 2251** and **ILAC-G8:2019 (Binary).**
The result of calibration is satisfactory.
Any section marked
N/P= Not Provided,
N/S= Not Submitted
UUC= Unit Under Calibration

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Calibration Points **Result Column : P= Pass, F= Fail, A= Adjusted, D= No Result drawn due to tolerance N/S**

For PM 2.5 µm

Sl. No.	Description	Nominal (µg/m3)	Standard Solution (µg/m3)	As found UUC (µg/m3)	Error (µg/m3)	Tolerance (±) (µg/m3)	Result	Uncertainty (±)
01	Fresh Air	0	0	0	0	3% FS	P	------
02	Calibration Gas	100	100	102	2	3% FS	P	0.02 % Rdg.
03	Calibration Gas	500	500	503	3	3% FS	P	0.02 % Rdg.

For PM 10 µm

Sl. No.	Description	Nominal (µg/m3)	Standard Solution (µg/m3)	As found UUC (µg/m3)	Error (µg/m3)	Tolerance (±) (µg/m3)	Result	Uncertainty (±)
01	Fresh Air	0	0	0	0	3% FS	P	------
02	Calibration Gas	100	100	102	2	3% FS	P	0.02 % Rdg.
03	Calibration Gas	500	500	502	2	3% FS	P	0.02 % Rdg.

CALIBRATION TECHNOLOGY PVT. LIMITED
Vivek Biponon Tower, Level-2
13/P, Biponon C/A, Mymensing Lane
Banglamotor, Dhaka-1000, Bangladesh.
Mobile: +8809643220000; www.caltechbd.com
Accredited to **ISO 9001:2015 & ISO/IEC 17025:2017**

CERTIFICATE OF CALIBRATION

Certificate No. CTPL(22-23)-2057A

Standard Used to Calibrate Equipment

Sl. No.	Description	Manufacturer	Model	Serial	Calibrated from	Cal. Due on
01	Standard Gas	Snaptech Products , UK	YY72345	N/P	NIST Traceable	Apr 2023

Calibration Performed By :
Calibration Engineer

Authorized By :
Laboratory Manager
Md. Rezaul Hossain

[END]

CALTECH
Calibration Technology Pvt. Limited

Calibration certificated of Noise Measurement equipment

CALIBRATION TECHNOLOGY PVT. LIMITED
Vivek Biponon Tower, Level-2
13/P, Biponon C/A, Mymensing Lane
Banglamotor, Dhaka-1000, Bangladesh.
Mobile: +8809643220000; www.caltechbd.com
Accredited to **ISO 9001:2015 & ISO/IEC 17025:2017**

CERTIFICATE OF CALIBRATION

Certificate No. CTPL(22-23)1785

Calibration Performed For :

Development Solution Consultant Limited.
H#734, Road#10, Ave # 04,Mirpur DOHS, Dhaka, Bangladesh.

Phone	: +880 1752 018922
Mail Address	: rroy@dsclbd.com
Contact Person	: Rajib Roy

Equipment Details :

Description	: Digital Sound Level Meter
Manufacturer	: HTC
Model No.	: SL-1352
Serial No.	: 202008686
Asset /ID No	: N/P
Range (dB)	: 30~130
Readability (dB)	: 0.1

Calibration Statics:

Received On	: 15 Jun 2022
Date Serviced	: **15 Jun 2022**
Due on	: **14 Jun 2023**
Issued on	: 15 Jun 2022
Received Condition	: In Tolerance
Returned Condition	: In Tolerance
Interval	: 12 Months
Performed By	: Md. Habibur Rahman Shuvo
Performed At	: CalTech Laboratory
Environmental Conditions	: Temp: 25.0 °C & RH: 57.8%
CalTech Procedure :	: **CTPL-WI-025**

Comments/Notes

Uncertainty taken into account for declaration of result as per **ANAB AR 2251** and **ILAC-G8:2019 (Binary).**
The result of calibration is satisfactory.
Any section marked **N/P**= Not Provided,
N/S= Not Submitted.
UUC= Unit Under Calibration

CALTECH Calibration Technology Pvt. Limited

CalTech hereby certifies that...

The above described instrument met or exceeded all established specifications at the time of calibration specified above; and the calibration results published in this certificate obtained using equipment capable of producing results that are traceble through NIST to the International System of Units (SI) or have been derived from accepted values, physical constants, by ratio or self calibration techniques. All Calibration activities performed are in compliance with **IEC 61672:2013** and **ISO 17025:2017** when specified as well as national/ international system guidelines. The quality system is ISO 9001:2015 certified. This report shall not be reproduced, except in full, without the written permission of CalTech.

All Calibrations, unless otherwise noted, are performed using accuracies of less than or equal to one quarter of the specification of the unit under calibration. The measurement uncertainties include a coverage factor of K=2, having a confidence level of 95%.

Calibration Points **Result Column : P= Pass, F= Fail, A= Adjusted, D= No Result drawn due to tolerance N/S**

Sound "A" Weighting

Sl. No.	Description	Nominal (dB)	As found (Corrected) (dB)	UUC (dB))	Error (dB)	Tolerence (±) (dB)	Result	Uncertainty (±) (dB)
01	Sound	94	93.9	94.0	0.1	1.5	P	0.46
02	Sound	104	103.9	104.0	0.1	1.5	P	0.46
03	Sound	114	114.0	114.0	0.0	1.5	P	0.46

CALIBRATION TECHNOLOGY PVT. LIMITED
Vivek Biponon Tower, Level-2
13/P, Biponon C/A, Mymensing Lane
Banglamotor, Dhaka-1000, Bangladesh.
Mobile: +8809643220000; www.caltechbd.com
Accredited to **ISO 9001:2015 & ISO/IEC 17025:2017**

CERTIFICATE OF CALIBRATION

Certificate No. CTPL(22-23)1785

Sound "C" Weighting

Sl. No.	Description	Nominal (dB)	As found (Corrected) (dB)	UUC (dB)	Error(dB)	Tolerance (±) (dB)	Result	Uncertainty (±) (dB)
01	Sound	94	94.0	94.0	0.0	1.5	P	0.46
02	Sound	104	103.9	104.0	0.1	1.5	P	0.46
03	Sound	114	113.9	114.0	0.1	1.5	P	0.46

Standard Used to Calibrate Equipment

Sl. No.	Description	Manufacturer	Model	Serial	Calibrated from	Cal. Due on
01	Sound Calibrator	Lutron	SL-4010	Q662278	MSME	10 Dec 2023

Calibration Performed By :
Asst. Technical Manager

Authorized By :
Laboratory Manager

Md. Reza Hossain

[END]

Calibration certificated of onsite water testing equipment

CALIBRATION TECHNOLOGY PVT. LIMITED
Vivek Biponon Tower, Level-2
13/P, Biponon C/A, Mymensing Lane
Banglamotor, Dhaka-1000, Bangladesh.
Mobile: +8809643220000; www.caltechbd.com
Accredited to **ISO 9001:2015 & ISO/IEC 17025:2017**

CERTIFICATE OF CALIBRATION

Certificate No. CTPL(22-23)-1786

Calibration Performed For :

Development Solution Consultant Limited.
H#734, Road#10, Ave # 04,Mirpur DOHS, Dhaka, Bangladesh.
Phone : +880 1752 018922
Mail Address : rroy@dsclbd.com
Contact Person : Rajib Roy

Equipment Details :

Description : MULTI-Meter
Manufacturer : EZ DO
Model No. : 8200
Serial No. : 0008483
Asset /ID No : N/P
Range : Ref. On Obs.
Readability : Ref. On Obs.

Calibration Statics:

Received On : 15 Jun 2022
Date Serviced : **15 Jun 2022**
Due on : **14 Jun 2023**
Issued on : 15 Jun 2022
Received Condition : In Tolerance
Returned Condition : In Tolerance
Interval : 12 Months
Performed By : Md. Habibur Rahman Shuvo
Performed At : CalTech Laboratory
Environmental Conditions : Temp: 25.3 °C & RH: 57.9%
CalTech Procedure : **CTPL-WI-126**

Comments/Notes

Uncertainty taken into account for the declaration of result as per **ANAB AR 2251** and **ILAC-G8:2019 (Binary).**
The result of calibration is satisfactory.
Any section marked
N/P= Not Provided,
N/S= Not Submitted
UUC= Unit Under Calibration

CalTech hereby certifies that...

The above described instrument met or exceeded all established specifications at the time of calibration specified above; and the calibration results published in this certificate obtained using equipment capable of producing results that are traceble through NIST to the International System of Units (SI) or have been derived from accepted values, physical constants, by ratio or self calibration techniques. All Calibration activities performed are in compliance with **Comparison method** and **ISO 17025:2017** when specified as well as national/ international system guidelines. The quality system is ISO 9001:2015 certified. This report shall not be reproduced, except in full, without the written permission of CalTech.

All Calibrations, unless otherwise noted, are performed using accuracies of less than or equal to one quarter of the specification of the unit under calibration. The measurement uncertainties include a coverage factor of K=2, having a confidence level of 95%.

Calibration Points **Result Column : P= Pass, F= Fail, A= Adjusted, D= No Result drawn due to tolerance N/S**

Standard Buffer Solution at 25°C (During Calibration)

Sl. No.	Description	Nominal (pH)	Standard Solution (pH)	As found UUC (pH)	Error (pH)	Tolerance (±) (pH)	Result	Uncertainty (±)
01	pH	4.01	4.01	4.01	0.00	N/A	A	0.2 % Rdg.
02	pH	7.01	7.01	7.00	-0.01	N/A	A	0.2 % Rdg.
03	pH	10.01	10.01	10.0	0.00	N/A	A	0.2 % Rdg.

CALIBRATION TECHNOLOGY PVT. LIMITED
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Mobile: +8809643220000; www.caltechbd.com
Accredited to **ISO 9001:2015 & ISO/IEC 17025:2017**

CERTIFICATE OF CALIBRATION

Certificate No. CTPL(22-23)-1786

Standard Solution at 25°C (During Calibration)

Sl. No.	Description	Nominal (µS/cm)	Standard Solution	As found UUC	Error	Tolerance (±)	Result	Uncertainty (±)
01	Conductivity (µS/cm)	1413	1413	1412.0	-1.00	N/A	A	0.2 % Rdg.
02	Conductivity (mS/cm)	12.88	12.88	12.8	-0.08	N/A	A	0.2 % Rdg.

Standard Used to Calibrate Equipment

Sl. No.	Description	Manufacturer	Model	Serial	Calibrated from	Cal. Due on
01	pH 4.01	HANNA	HI7004/1L	5889	NIST Traceable	30 Nov 2025
02	pH 7.01	HANNA	HI7007/1L	4910	NIST Traceable	31 Jan 2025
03	pH 10.01	HANNA	HI7010/1L	5919	NIST Traceable	30 Nov 2022
04	Conductivity 1413 µS/cm	HANNA	HI7031L	N/P	NIST Traceable	31 Jul 2024
05	Conductivity 12880 µS/cm	HANNA	HI7031L	N/P	NIST Traceable	31 Aug 2025

CALTECH Calibration Technology Pvt. Limited

Calibration Performed By :
Calibration Engineer

[END]

Authorized By :
Laboratory Manager

Md. Reza Hossain

Calibration Technology Pvt. Limited, 13/P, Level-2, Biponon C/A, Banglamotor, Dhaka

BAB certificate of the Testing Lab

GLOBAL ACCEPTANCE
BAB
BANGLADESH ACCREDITATION BOARD

ACCREDITATION CERTIFICATE

Issued under the authority of Bangladesh Accreditation Act, 2006
by Bangladesh Accreditation Board (BAB), Ministry of Industries to

UL VS Bangladesh Ltd.

The Pearl Trade Center (5th, 14th and 15th floor)

Cha-90/3, Progoti Sharani, North Badda, , Dhaka-1212, Bangladesh

This is to certify that this

Testing Laboratory
is accredited in accordance with the international standard

ISO/IEC 17025:2017
in respect of the associated scope, subject to the terms and conditions governing the relevant conformity assessment body (CAB) accreditation.

CERT. NO. 01.030.15
BAB
BANGLADESH ACCREDITATION BOARD
Accredited for ISO/IEC 17025:2017

Certificate Number	:	**01.030.15**
Accreditation Date	:	**10 September 2015**
Date of Issuance	:	**30 September 2021**
Date of Expiration	:	**09 September 2024**

GLOBAL BAB ACCREDITED ACCEPTANCE

Md. Monwarul Islam
Director General

This certificate must be returned on request; reproduction must follow BAB guidelines. For the specific scopes to which this accreditation applies, please refer to the Directory of CABs at BAB website.

Appendix J: Questionnaires of the Socioeconomic Survey

Environmental and Social Impact Assessment (ESIA) of Grid-tied Solar Power Plant Project of Intraco Solar Power Limited (ISPL)

প্রকল্প এলাকার মধ্যে অবস্থিত ব্যাক্তিবর্গের আর্থ সামাজিক জরীপ

(Interviewers: নিচের অংশটি উত্তরদাতার কাছে পরিষ্কারভাবে বর্ণনা করুন এবং তার অনুমতি নিয়ে আরম্ভ করুন।)

[উত্তরদাতার অনুমতি সাপেক্ষে তথ্য নেয়া শুরু করুন]

সাক্ষাৎকার গ্রহনের তারিখ ঃ				সাক্ষাৎকার শুরুর সময় ঃ				
	দিন	মাস	বছর			ঘন্টা	মিনিট	
সাক্ষাৎকার গ্রহনকারীর নাম ঃ					কোড ঃ			
উত্তরদাতার নাম (খানা প্রধান/বয়স্ক/জ্ঞানী ব্যক্তি) ঃ								
গ্রামের/ ওয়ার্ডের নাম ও কোড ঃ								
বিস্তারিত ঠিকানা ঃ	ওয়ার্ড ঃ -- -- -- -- -- - ইউনিয়ন ঃ -- -- -- -- -- -- -- -- -- থানা/উপজেলাঃ -- -- -- -- -- -- -- -- -- -- জেলাঃ -- -- -- -- -- -- -- ---- -- বিস্তারিত ঃ -- - - --							
উত্তরদাতার মোবাইল নাম্বার:	[1]					[2]		
উত্তরদাতা এই এলাকায় কত বছর ধরে বসবাস করছেন? [সব সময় বসবাস করে থাকলে 95 লিখুন]								
উত্তরদাতার লিঙ্গঃ	1= পুরুষ ; 2= নারী							
উত্তরদাতার বয়স								
বৈবাহিক অবস্থা	1= বিবাহিত; 2 = অবিবাহিত ; 3= বিচ্ছেদ							
উত্তরদাতার ধর্ম	1 = মুসলিম; 2 = হিন্দু; 3 = বৌদ্ধ; 4 = খ্রীষ্টান; অন্যান্য (উল্লেখ করুন)							
শিক্ষাগত যোগ্যতা	1= ভর্তি হয়নি/কখনও স্কুলে যায়নি; 2 = ভর্তি এবং নিয়মিত; 3 = ভর্তি কিন্তু অনিয়মিত (এক মাসে 10 দিনের কম); 4= ভর্তির অপেক্ষায়; 5= ড্রপ আউট; 6= পড়াশুনা শেষ							
উত্তরদাতার পেশা	কৃষক = 1, শিক্ষক = 2, প্রবাসী = 3, পরিষেবা = 4, গৃহিণী = 5, জেলে = 6, ব্যবসা = 7, দিনমজুর = 8, ড্রাইভার = 9, রাজমিস্ত্রি = 10, ছুতার = 11, বেকার = 12, দর্জি = 13, ডাক্তার = 14, অন্যান্য চিকিত্সক = 15, বোটম্যান = 16, ছাত্র = 17, রিকশা/ভ্যান চালক = 18, (উল্লেখ							
উত্তরদাতার জাতি	1 = বাঙ্গালি; 2 = চাকমা ; 3 = মারমা 4= ত্রিপুরা; 5= গারো ; 6= অন্যান্য (উল্লেখ করুন)							

1. Poverty Status

ক্রম.	প্রশ্ন	কোড	কোডের তালিকা
	1	2	3
01.	এই খানার সদস্যরা কি ধরনের পায়খানা ব্যবহার করেন?		1= খোলা মাঠ, 2= কাঁচা 3= স্যানিটারি
03.	আপনার খানার ৬ থেকে ১৭ বছর বয়সের সকল শিশু কি স্কুলে যায়?		1= হ্যঁ 2= না 99= প্রযোজ্য নয়
04.	আপনার খানায় কি বিদ্যুৎ সংযোগ আছে?		1= হ্যাঁ 2= না
05.	আপনার খানায় কি নিজস্ব কোনো গবাদি পশু আছে?		
07.	আপনাদের খানার খাবার পানির প্রধান উৎস কি?		1= সাপ্লাই/ পাইপের পানি (বাড়িতে) 2= সাপ্লাই/ পাইপের পানি (বাড়ির বাইরে) 3= সরকারি কল 4= ঝর্ণা 5= নলকূপ 6= পুকুর/নদী/খাল 7= কুয়া/ কূপ অন্যান্য (নিদিষ্ট করুন)
08.	আপনাদের খানার জ্বালানীর প্রধান উৎস কি?		1 = লাকড়ি/ কাঠ/ খড়ি 2 = কয়লা 3= পাতা, খড়, ঘুটে ইত্যাদি 4 = গ্যাস/ বায়োগ্যাস/ এলপিজি 5 = কেরোসিন 6= বিদ্যুৎ অন্যান্য (নিদিষ্ট করুন)
10.	বিগত ১২ মাসে এ অবস্থার কেমন পরিবর্তন হয়েছে?		1= উন্নতি হয়েছে, 2= অবনতি হয়েছে 3= একই রকম আছে
11.	বিগত ১২ মসের গড় আয় বিবেচনা করলে একটি সাধারন মাসে আপনার খানার মোট আয় কত?		
12.	বিগত ১২ মসের গড় ব্যয় বিবেচনা করলে একটি সাধারন মাসে আপনার খানার মোট ব্যয় কত?		

2. Access to Health Services:

স্বাস্থ্যসেবা প্রদানকারী প্রতিষ্ঠানের নাম	আছে কিনা? 1= হ্যাঁ 2= না 3= জানি না	দুরত্ব (কিমি :)	সেবা নেয়া হয় কিনা? 1= হ্যাঁ 2= না 3= প্রয়োজন নেই	যাতায়াতের বাহন/ মাধ্যম (সর্বাধিক ব্যবহৃত)	যাতায়াত খরচ (সর্বাধিক ব্যবহৃত)
কমিউনিটি হেলথ ক্লিনিক					
ইউনিয়ন পর্যায়ে হেলথ কমপ্লেক্স					
নগর মাতৃসদন কেন্দ্র *(ম্যাটারনিটি ক্লিনিক)*					
উপজেলা স্বাস্থ্যকেন্দ্র					
সদর হাসপাতাল					
এনজিও পরিচালিত স্বাস্থ্যকেন্দ্র					
বেসরকারী হাসপাতাল					

দক্ষ বেসরকারী চিকিৎক					
হাঁতুড়ে ডাক্তার					
অন্যান্য (উল্লেখ করুন)					

যাতায়াত ব্যবস্থা:

1=পায়ে হেঁটে, **5=অটো-ভ্যান,**
2=সাইকেল, **6=বাস,**
3=রিকশা, **7=ট্রেন,**
4=ভ্যান, অন্যান্য (উল্লেখ করুন)

3. General Opinion

ক্রম	প্রশ্ন	কোড	কোড লিখুন
1.	আপনার খানা কত বছর ধরে এই এলাকা/ কমিউনিটিতে বসবাস করছেন? **(উত্তরদাতা যত বছর ধরে কমিউনিটিতে বসবাস করছেন সেই সময় বছরে লিখুন)**		
5.	প্রকল্প এলাকায় কোনো ঐতিহাসিক/ দর্শনীয় / সাংস্কৃতিকভাবে গুরুত্বপূর্ণ স্থান আছে? ***(না হলে ৭ নং প্রশ্নে যান)***	**1** = হ্যাঁ **2** = না	
12.	প্রকল্প এলাকায় জমি ব্যবহারের উপর কোনো ধরনের বাধ্যবাধকতা আছে? ***(না হলে ১৪ নং প্রশ্নে যান)***	1 = হ্যাঁ 2 = না	
17.	প্রকল্প এলাকায় কোনো ক্ষুদ্র নৃ-গোষ্ঠীর বসবাস আছে? ***(না হলে ২০ নং প্রশ্নে যান)***	1 = হ্যাঁ 2 = না 3= জানিনা	
18.	বসবাসকারী ক্ষুদ্র নৃ-গোষ্ঠীর নাম কি?		
34.	আপনাদের এলাকায় স্থাপিত টিউবওয়েলগুলোর গভীরতা কেমন?	**1** = গভীর **2** = অগভীর	
36	প্রকল্প এলাকায় হয়রানির শিকার কোনো রেকর্ড আছে কিনা?	**1** = হ্যাঁ **2** = না	
37	প্রকল্প এলাকায় সরকারি/বেসরকারি GBV পরিষেবা কেন্দ্রের উপস্থিতি দেখা যায়?	**1** = হ্যাঁ **2** = না	
38.	এই এলাকায় এমন কোনো প্রাণী/মাছ/পাখি আছে যা, ১০ বছর পূর্বেও দেখা যেত কিন্তু বর্তমানে খুবই কম দেখা যায় বা প্রায় নেই বললেই চলে?	**1** = হ্যাঁ **2** = না	
39.	'হ্যাঁ' হলে, তাদের নাম উল্লেখ করুন:		

Appendix K: Sample Dalil and List of Landowners

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার

৳ ৫ ৳ ৫

পাঁচ টাকা

ক ২৭৩৬৫৬৮

ক্রমিক নং ২৫৩৪ বহি নং ১ দলিল নং ২৫৩৮

১। রেজিষ্ট্রী অফিসের নামঃ- তুষভান্ডার সাব-রেজিষ্ট্রী অফিস, লালমনিরহাট।

২। দলিলের সার সংক্ষেপ ঃ-

দলিলের প্রকৃতিঃ- সাব কবলা পত্র।

মৌজার নামঃ- ভোটমারী।

ইউনিয়ন/ওয়ার্ড ঃ- ০১নং ভোটমারী।

উপজেলাঃ- কালীগঞ্জ।

জেলাঃ- লালমনিরহাট।

হস্তান্তরিত সম্পত্তির পরিমাণঃ-৬১ (একষট্টি) শতক।

শ্রেণীঃ- ডাঙ্গা।

মূল্য(অংকে ও কথায়)ঃ-১০,০০,০০০/- দশ লক্ষ টাকা।

"দেশপ্রেমের শপথ নিন, দুর্নীতিকে বিদায় দিন"

মৌজাঃ কালিকাপুর ও ভোটমারী, ইউনিয়নঃ ভোটমারী, উপজেলাঃ কালীগঞ্জ, জেলাঃ লালমনিরহাট

ক্রম নং	দলিল নং	দাতা	ঠিকানা	জমির পরিমান (শতক)
১	২৫৩৮	(১)মোঃ বুলু পিতাঃ- মোঃ আঃ ছাওার (২)মোঃ লুৎফর রহমান পিতাঃ- কেরামত আলী	গ্রামঃ- শৌলমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	৬১
২	২৫৯৯	আবু খালেদ মোঃ অলিউল্লাহ্ পিতাঃ- মোঃ আব্দুল মালেক	গ্রামঃ- ভোটমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	১১৭
৩	২৮১৮	মোঃ আহাম্মদ হোসেন পিতাঃ- আকবর আলী	গ্রামঃ- ভোটমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	২৮
৪	৩৬৩০	(১) মোছাঃ হালিমা বেগম, পিতাঃ- হাফেজ আলী (২) মোঃ হামিদুল হক, পিতাঃ- মৃত- আফতাব হোসেন (৩) মোঃ হুমায়ূন কবির, পিতাঃ- মৃত-আফতাব আলী (৪) মোছাঃ আক্তারা বেগম, পিতাঃ- মৃত-আফতাব আলী	গ্রামঃ- ভোটমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	৩৫
৫	২৮১৯	(১) মোঃ নুর ইসলাম, (২) মোঃ নজরুল ইসলাম, পিতাঃ- মৃত- আফছার আলী	গ্রামঃ- ভোটমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	১১৮
৬	২৯০৮	(১) মোঃ জাহেদুল ইসলাম, পিতাঃ- মৃত: মকবুল হোসেন (২) মোছাঃ জিন্না খাতুন পিতাঃ- মৃত: মাহাম্মদ আলী	গ্রামঃ- ভোটমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	৫৪
৭	২৯১০	(১)মোঃ আলী আকবার (২)মোঃ আজিজার রহমান (৩)মোঃ আনছার আলী (৪) মোঃ আজগার আলী সর্ব পিতাঃ- ছকোর মিয়া ওরফে সফি উদ্দিন	গ্রামঃ- ভোটমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	১৪৮
৮	৩৬২৯	মোঃ আফজাল হোসেন পিতাঃ- ওমর আলী	গ্রামঃ- ভোটমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	১০৪
৯	৩৬৭৫	(১)মোঃ আজিজুল ইসলাম (২)মোঃ আনারুল ইসলাম	গ্রামঃ- ভোটমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	৭৯

		পিতাঃ- আব্দুল শেখ		
১০	৩৭১৪	(১)মোঃ গোলাফফর হোসেন (২)মোঃ মোজাফফর হোসেন (৩)মোঃ মজিদুল ইসলাম পিতাঃ– মৃত- হাছান সরকার	গ্রামঃ- ভোটমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	৭০০
		(৪)মোছাঃ আশনা বেগম স্বামীঃ- মোঃ মহোসিন আলী	গ্রামঃ- গোলাপপুর(ভোটমারীপাড়া), ডাকঘরঃ- শেখেরহাট, উপজেলাঃ- বদরগঞ্জ, জেলাঃ- রংপুর	
		(৫)মোঃ আশেদুল হক (৬)মোঃ আশরাফুল ইসলাম পিতাঃ- মোঃ মহোসিন আলী	গ্রামঃ- গোলাপপুর(ভোটমারীপাড়া), ডাকঘরঃ- শেখেরহাট, উপজেলাঃ- বদরগঞ্জ, জেলাঃ- রংপুর	
১১	৩৭২২	(১)মোঃ আইয়ুব আলী মিয়া (২)মোঃ বাদশাহ আলী পিতাঃ- মৃত- আব্দুল গফুর	গ্রামঃ- ভোটমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	১৭৮.৫০
১২	৩৭৮৬	মোঃ রঞ্জু মিয়া পিতাঃ- মজিবর রহমান	গ্রামঃ- দক্ষিণ মুশরত মদাতী, ডাকঘরঃ- মদাতী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	১০০
১৩	৩৮৯৭	(১)মোঃ নজমুল হক এডভোকেট পিতাঃ- আলহাজ্জ মোঃ আব্দুর রাজ্জাক মিয়া	গ্রামঃ- কিসামত মদাতী, ডাকঘরঃ- মদাতী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	১২০
		(২)মোঃ বুলু পিতাঃ- মোঃ আঃ ছাত্তার	গ্রামঃ- শৌলমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	
১৪	৫৪১৬	(১)মোছাঃ সাহিদা বানু স্বামীঃ- মৃত- মকলেছার রহমান ওরফে মোখলেছার রহমান	গ্রামঃ- ভোটমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	৩৬৪
		(২)মোছাঃ মকসুদা আক্তারী (৩)মোছাঃ মাসুদা আক্তারী (৪)মোছাঃ মেহেতারা আক্তারি (৫)মোঃ শরিফুজ্জামান (৬)মোঃ আরিফুজ্জামান পিতাঃ- মৃত- মকলেছার রহমান ওরফে মোখলেছার রহমান		
১৫	৫৭২৮	(১)মোঃ জাহেদুল ইসলাম পিতাঃ- ওমর আলী	গ্রামঃ- ভোটমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	৫২
		(২)মোঃ আমিনুর রহমান পিতাঃ- মনছুর হক	গ্রামঃ- উত্তর ঘনেশ্যাম, ডাকঘরঃ- তুষভান্ডার, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	
		(৩)মোঃ নুর ইসলাম পিতাঃ- নছর উদ্দিন	গ্রামঃ- ভোটমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	

১৬	৬৬১০	(১)মোছাঃ জোসনা বেগম স্বামীঃ- মৃত-নজরুল ইসলাম (২)মোঃ জিল্লুল হাইরাজি (৩)মোঃ জিল্লুল রহমান সিদ্দিকী পিতাঃ- মৃত-নজরুল ইসলাম	গ্রামঃ- ভোটমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	১০৩
১৭	৬৬৩৯	(১)মোঃ কামাল হোসেন পিতাঃ- মৃত- মোজাহার হোসেন (২)মোঃ শাহাজামাল (৩)মোঃ আব্দুস সালাম পিতাঃ- মৃত- শমসের আলী	গ্রামঃ- ভোটমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	৮৬.৯০
১৮	৬৬৫৭	মোঃ বাবুল হোসেন পিতাঃ- মৃত- মহাম্মদ আলী	গ্রামঃ- ভোটমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	৫৪
১৯	৪২২	ব্র্যাকের পক্ষে- সোলায়মান হোসেন পিতাঃ- মোহাম্মদ আব্দুল ওয়াদুদ	গ্রামঃ- চালাষ পূর্বপাড়া, ডাকঘরঃ- ধনবাড়ী-১৯৯৭, উপজেলাঃ- টাঙ্গাইল, জেলাঃ- টাঙ্গাইল	৪৯৯
২০	৯৮০	(১)মোঃ এমদাদুল হক (২)মোঃ ফজরুল করিম (৩)মোঃ নজরুল হক (৪)মোহাম্মদ আলী পিতাঃ- মোঃ আব্দুল গফুর (৫)মোঃ মোমেদ আলী (৬)মোঃ মমিনুল রহমান পিতাঃ- মোঃ নুরল হক	গ্রামঃ- শৌলমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	১০০.৫০
২১	১২৭১	(১)মোঃ আব্দুস সোবাহান (২)মোঃ আব্দুল মজিদ (৩)মোঃ তছলিম উদ্দিন ওরফে কছির উদ্দিন (৪)মোঃ আব্দুল গনী (৫)মোঃ মনিরুজ্জামান (৬)মোঃ মুসা শেখ পিতাঃ- মৃত- নাড্ডা সেখ ওরফে মামুদ আলী	গ্রামঃ- শৌলমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	১৯০
২২	১৮৫২	(১)মোঃ আকরাম আলী (২)মোঃ লিটন মিয়া পিতাঃ-মোঃ শাহাবুদ্দিন	গ্রামঃ- ভোটমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	৫০
২৩	১৫৮৩	(১)মোঃ দুলাল মিয়া পিতাঃ- মোঃ আব্দুস ছাত্তার (২)মোছাঃ তহুরা বেগম স্বামীঃ মোঃ আব্দুস ছাত্তার	গ্রামঃ- শৌলমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	৮১
২৪	২২৭৫	মোঃ বাবুল হোসেন পিতাঃ- মোঃ মহাম্মদ আলী	গ্রামঃ- ভোটমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	২.০৩

২৫	২৬৪২	মোঃ বুলু পিতাঃ- মোঃ আব্দুস ছাত্তার	গ্রামঃ- শৌলমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	৬৫
২৬	২৬৯৪	(১)মোঃ মানিক মিয়া (২)মোঃ হাবলু মিয়া পিতাঃ- মৃত- মতিয়ার রহমান	গ্রামঃ- শৌলমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	৭৯.৪০
২৭	২৮৭৮	(১)মোঃ নুরুজ্জামান (২)মোঃ নুর আলম পিতাঃ- মোঃ কেচু মিয়া (৩) মোঃ আবুল কালাম পিতাঃ- নুর হোসেন	গ্রামঃ- ভোটমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	৪৯
২৮	২৮৯০	(১)মোঃ মমিনুর ইসলাম (২)মোঃ মোতাজ হোসেন (৩)মোঃ আমিনুর রহমান পিতাঃ- মৃত- ফজলুল হক	গ্রামঃ- ভোটমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	১
২৯	২৮৯৬	(১)মোঃ মজিবর রহমান (২)মোঃ আব্দুল মান্নান (৩)মোঃ মোন্নাফ হোসেন (৪)মোঃ ফজলু মিয়া (৫)মোঃ নজরুল ইসলাম পিতাঃ- মৃত- সৈয়দ আলী	গ্রামঃ- ভোটমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	৪০
		(৬)মোঃ আবুল কালাম পিতাঃ- কেরামত আলী ওরফে কেয়াম আলী	গ্রামঃ- দালাল পাড়া, ডাকঘরঃ- মাদাতী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	
৩০	১৬৩১	মোঃ আবুল কালাম পিতাঃ-মোঃ মোসলেম উদ্দিন	গ্রামঃ- শৌলমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	৫৪
৩১	১৯৫১	মোঃ ওমর আলী পিতাঃ- মৃত- নিরাশা শেখ	গ্রামঃ- ভোটমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	১৫
৩২	২০৫৯	মোঃ আবুল কালাম পিতাঃ- মৃত- কেরামত আলী ওরফে কেয়াম আলী	গ্রামঃ- দালাল পাড়া, ডাকঘরঃ- মদাতী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	১৫
৩৩	২০৮২	(১)মোঃ শাহাজামাল পিতাঃ- মৃত- শমসের আলী (২)মোছাঃ দুলালী বেগম পিতাঃ- মোঃ ইসরাইল	গ্রামঃ- ভোটমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	৮০.৩৬
৩৪	২০৮৩	মোঃ লুৎফর রহমান পিতাঃ- মৃত- কেরামত আলী	গ্রামঃ- শৌলমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	৮২
৩৫	২১৭০	মোঃ করিম বকস পিতাঃ- মৃত- গফুর	গ্রামঃ- শৌলমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	৮২
৩৬	৫৬০৫	মোঃ মানিক মিয়া পিতাঃ- মোঃ মতিয়ার রহমান	গ্রামঃ- শৌলমারী, ডাকঘরঃ- ভোটমারী, উপজেলাঃ- কালীগঞ্জ, জেলাঃ- লালমনিরহাট	১১