Environmental and Social Impact Assessment (ESIA) of Proposed 100 MW Solar PV Power Project at Bhadla, Rajasthan

Plot R3

Clean Solar Power (Bhadla) Private Limited

Final Report

4 November 2019

Project No.: 0495090

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Environmental and Social Impact Assessment (ESIA) of Proposed 100 MW Solar PV Power Project at Bhadla, Rajasthan

Plot R3

Final Final Report – Plot R3

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Acronyms and Abbreviations

Name	Description
AMSL	Above Mean Sea Level
ATS	Agreement to Sell
BGL	Below ground level
BPTPC	Building Material and Technology Promotion Council of India
CHWTSDF	Common Hazardous Waste Treatment, Storage and Disposal Facility
CBIP	Central Board of Irrigation and Power
CEO	Chief Executive Officer
CHC	Community Health Centre
CGWB	Central Ground Water Board
CMD	Chairman and Managing Director
CPCB	Central Pollution Control Board
CPR	Common Property Resources
CSC	Common Service Centre
cu.m	Cubic Metre
DC	Direct Current
DG	Diesel Generator
DISH	Directorate Industrial Safety and Health Department
EIA	Environment Impact Assessment
EHS	Environment Health and Safety
EPC	Engineering Procurement and Construction
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ERM	Environmental Resources Management
ESMP	Environmental and Social Management Plan
FGD	Focussed Group Discussions
GP	Gram Panchayat
GSS	Grid Sub Station
ha	Hectare
ham	Hectare meter
HT	High Tension
IA	Impact Identification
IBBA	Important Bird and Biodiversity Areas
IPA's	Important Plant Areas
IS	Indian Standard
IFC	International Finance Corporation
INR	Indian Rupee
IREDA	Indian Renewable Energy Development Agency Limited
IUCN	International Union for Conservation of Nature
KBA	Key Biodiversity Area
Km	Kilometre
Km/hr	Kilometer per hour
KV	Kilo Volt
KVA	Kilo Volt Ampere
KWh/m^2	Kilo Watt Hour Per Metre Square
LT	Low Tension
MoEFCC	Ministry of Environment Forests and Climate Change
mt	Metric Tonne
MW	Mega Watt
MW/ year	Mega Watt Hour per Year
MRO	Mandal Revenue Officer
NAAQS	National Ambient Air Quality Standards
NH	National Highways
NOC	No Objection Certificate
NFPA	National Fire Protection Authority
NGO	Non-governmental organisation

Name	Description
PCO	Public Call Office
PHC	Public Health Centres
PPE	Personal Protective Equipment
PUC	Pollution Under Control
PV	Photo Voltaic
ROW	Right of Way
NREL	National Renewable Energy Laboratory
O&M	Operations and Maintenance
PCU	Power Conditioning Unit
SC	Scheduled Castes
SCADA	Supervisory Control And Data Acquisition
SEC	Solar Energy Centre
SECI	Solar Energy Corporation of India
SOI	Survey Of India
ST	Scheduled Tribes
WHO	World Health Organisation
WPR	Work Participation Ratio
W_P	Watt Peak Capacity

1. INTRODUCTION

Hero Future Energies (hereinafter referred to as 'HFE') emerged from the Hero Group is an Independent Power Producer (IPP) with an installed capacity of ~1.2 GW of wind and solar power assets across the country (1). Till now, HFE has commissioned a 210 MW Solar Power plant with Karnataka Power Transmission Company Limited (KPTCL) under the state policy and 230 MW Solar PV Projects (3 nos. of 10 MW each) under JNNSM Phase-II Batch-I program. It has implemented 43 MW Project in Madhya Pradesh under state policy and is implementing another 40 MW Project in Telangana under state policy (2). HFE has now proposed to set up a new 100 MW solar power Project in Jodhpur (Rajasthan).

The Project SPV (Special Purpose Vehicle), M/s. Clean Solar Power (Bhadla) Private Limited (hereinafter referred to as 'CSP (Bhadla)', a 100% subsidiary of Hero Future Energies Pvt. Ltd., shall implement the 100 MW grid connected to solar photovoltaic power plant at Bhadla Solar Park. The Project site is located at Phalodi tehsil, Jodhpur district in the state of Rajasthan.

CSP (Bhadla) intends to undertake an Environmental and Social Impact Assessment (ESIA) for the Project in order to understand the environmental and social sensitivities associated with the solar power Project and to implement mitigation measures in order to avoid adverse impacts during the Project's lifecycle. For this purpose, ERM India Private Limited (ERM) has been entrusted to carry out the ESIA study.

ERM had undertaken a site reconnaissance visit to the site on 5th & 6th February 2019 to obtain data on the environmental conditions and collect baseline data for the various identified parameter along with the social survey of the site. Ecological survey of the site was conducted from 12th and 13th February 2019, wherein an analysis was undertaken of ecological sensitivities in the vicinity of the site.

1.1 Project Overview

Table 1.1 provides a snapshot of the proposed Project.

Table 1.1 100 MW Solar Power Project- a Snapshot

Particulars	Description
Location	■ Bhadla Solar Park, Tehsil Phalodi, District Jodhpur in the state of Rajasthan
Capacity	■ 100 MW
PV Modules Details	■ Manufacturer-Telesun/ Jinko/ Trina/ Yingli/ Canadian/ equivalent ■ Wattage- 335 Wp ■ Suitable module mounting structure- 4*15 matrix
Power Evacuation Details	■ Power generated from the solar plant will be evacuated via underground as well as above ground cables through cable tray. ■ Power would be stepped up and transmitted through 220 kV DC line from 220 kV pooling substation of M/s Saurya Urja Company of Rajasthan Limited to 765/400/220 kV Bhadla (PG) grid substation of Power Grid Corporation of India Limited.
Land requirement	■ 200 hectares (sub-lease signed between M/s CSP Bhadla and M/s Saurya Urja Company of Rajasthan Limited)
Internal approach road	■ 7 m width (2 lane paved road)

(1) https://www.herofutureenergies.com/Projects/ accessed on 26 February 2019

(2) Detailed Project Report

Particulars	Description
Utility Corridor	■ Transmission/ Utility corridor of 50 m width running along the boundary
Project Status at the time of ERM site visit	■ Planning phase ■ No construction had started, boundary had already been constructed by Saurya Urja Company of Rajasthan Limited

1.2 Objective and Scope of the Investment

1.2.1 Objective

The main objective of the ESIA study is to assess social and environmental impacts and develop social and environmental management strategies to comply with the reference framework (Section 1.3.3) for the Project. The specific objectives are to:

- Screen the Project with respect to environmental and social sensitivities and define the scope for ESIA study;
- Develop a baseline environmental and social profile of the Project and its surrounding areas;
- Assess environmental and social impacts from the Project on the established environmental and social baseline;
- Provide mitigation and enhancement measures and prepare an Environmental and Social Management Plan (ESMP); and
- Determine the requirements for any specific additional study.

1.2.2 Scope of Work

In order to meet the objectives mentioned above, the scope of work for the ESIA entails:

- **Regulatory Review:** The study assesses the regulatory framework within which the Project will operate by reviewing applicable local, state, national and international environmental and social legislation;
- **Environmental and Social Baseline Generation:** Baseline data collected during the field study with respect to land use, socio-economic profiles and ecology. The baseline supplemented by secondary data obtained through document review with respect to meteorology, soil quality, land-use, geology, geomorphology, hydrology, ecology and socioeconomic profiles in the study area;
- **Identification, prediction and evaluation** of potential aspects and impacts on various environmental and social sensitivities due to the Project activities envisaged during land acquisition, construction, operation and decommissioning stages;
- Ascertain whether Project footprint or its immediate environment is considered to be ecologically sensitive regarding endangered or protected species;
- Recommendation of appropriate mitigation/enhancement measures for identified environmental, ecological and social impacts; and
- Formulation of an Environmental and Social Management Plan (ESMP).

1.2.3 Applicable Reference Framework

ERM has conducted the ESIA study to meet the requirements of the specified framework as follows:

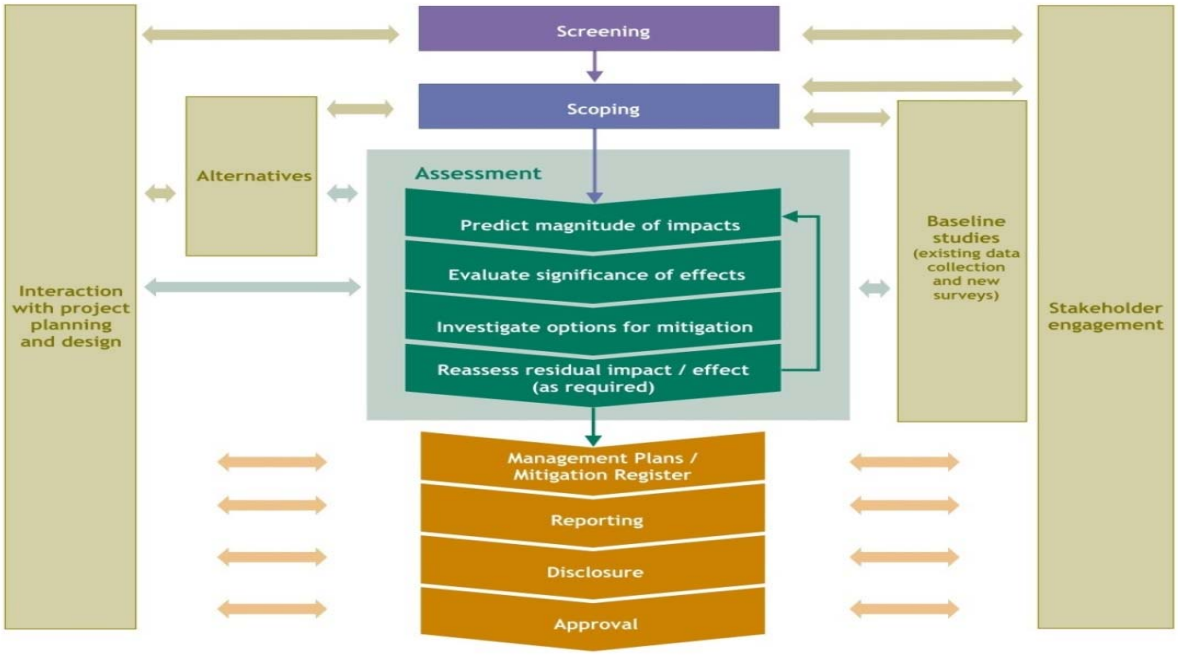
- Applicable local, national and international laws and regulations;
- International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability (2012);
- The applicable IFC/World Bank Guidelines:
  - General Environment, Health and Safety (EHS) Guidelines (2007),
  - Guidelines for Electric Power Transmission and Distribution (2007) [for construction and operation of transmission lines in solar farms].

Note: Solar energy Projects and renewable energy Projects, in India, at present do not require an Environmental Clearance under the EIA Notification, 2006. The ESIA, is thus being undertaken as an internal management tool for HFE. ERM is not preparing the ESIA for any regulatory requirements; hence, if any deliverable is used for the same purpose, ERM needs to be notified by the Client.

1.3 ESIA Methodology

The ESIA methodology follows the overall ESIA approach illustrated in ***Figure 1.1***. The ESIA has been undertaken following a systematic process that predicts and evaluates the impacts the Project could have on aspects of the physical, biological, socio-economic and cultural environment, and identifies measures that the Project will take to avoid, minimise/reduce, mitigate, offset or compensate for adverse impacts; and to enhance positive impacts where practicable. The stages of the ESIA process are described below:

Figure 1.1 The ESIA Process



Source: ERM

1.3.1 Screening

The Project screening is conducted through a desktop study, prior to the site visit to gain a broad level understanding of the Project site and to determine applicable E&S impact assessment requirements. The screening for the Project is provided in ***Section 4*** of this ESIA report.

1.3.2 Scoping

The main objective of the scoping is to ascertain the environmental issues associated with the Project on which the ESIA study will be focused by reviewing the Project information and ascertaining likely environmental issues associated with the Project activities. This process helps in ensuring that all the relevant issues are identified and addressed in an appropriate manner in the ESIA study. For this ESIA study, scoping has been undertaken to identify the potential Area of Influence for the Project (and thus the appropriate study area), to identify potential interactions between the Project and resources/receptors in the Area of Influence and the impacts that could result from these interactions, and to prioritize these impacts in terms of their likely significance. This stage is intended to ensure that the impact assessment focuses on issues that are most important decision-making and stakeholder interest.

The details of screening and scoping exercise are also reported in ***Section 4*** of this ESIA report.

1.3.3 Project Description

In order to set out the scope of the Project features and activities, with particular reference to the aspects which can impact on the environment, a Project description is prepared. This is based on information as provided by the CSP Bhadla. The Project description has been provided in ***Section 2*** of this ESIA report.

1.3.4 Baseline Conditions

Environmental baseline data has been collected through baseline surveys of the study area of 2 km distance from Project area. Secondary information through literature surveys and consultation with stakeholders was also collected for the study area. The detailed baseline characterisation for the Project is provided in ***Section 1*** of this ESIA report.

1.3.5 Stakeholder Consultations and Analysis

An effective ESIA process requires engagement with relevant stakeholders throughout the key stages. This assists in understanding stakeholder views on the Project and in identifying issues that should be taken into account in the prediction and evaluation of impacts.

ERM identified/profiled the various stakeholders of the Project, such as the lessors, developers, local communities, contractors and sub-contractors, organisations and developed an understanding of their stakes, interests and influences on the Project.

Details of the Stakeholder Engagement activities undertaken for this Projects to date are presented in ***Section 6*** of this ESIA report.

1.3.6 Impact Identification (IA) /Prediction

Impact identification and assessment starts with scoping and continues through the remainder of the ESIA Process. It is an iterative process and completes only when the effects of all identified impacts arising out of the Project, including residual impacts, have been assigned a mitigation strategy. The IA comprises of four sequential steps:

- Impact Prediction;
- Impact Evaluation;
- Mitigation and Enhancement; and

- Residual Impact Evaluation.

The detailed IA is presented in ***Section 7*** of this ESIA report.

1.3.7 Environmental and Social Management Plan (ESMP)

The results of the ESIA study form the basis of the Project ESMP. The ESMP will incorporate measures and procedures for the short and long-term environmental and social management of the Project during its various stages. The ESMP in tabular format with defined roles and responsibilities for implementation and supervision is developed for the Project and is presented in ***Section 8*** of this ESIA report.

1.4 Limitations

This report has been developed based on the Project level information provided by CSP Bhadla and is based on certain scientific principles and professional judgment to certain facts with resultant subjective interpretation. Professional judgment expressed herein is based on the available data and information. If information to the contrary is discovered, the findings in this ESIA may need to be modified accordingly.

ERM is not engaged in the impact assessment and reporting for the purposes of advertising, sales promotion, or endorsement of any client's interests, or other publicity purposes. The client acknowledges that any report prepared by ERM are for the exclusive use of the client and agrees that ERM's reports or correspondence will not be used or reproduced in full or in part for such promotional purposes, and may not be used or relied upon in any prospectus or offering circular for commercial purposes.

1.4.1 Uses of this Report

ERM is not engaged in consulting or reporting for the purpose of advertising, sales promotion, or endorsement of any client interests, including raising investment capital, recommending investment decisions, or other publicity purposes. Client acknowledges this report has been prepared for their and their clients' exclusive use and agrees that ERM reports or correspondence will not be used or reproduced in full or in part for such purposes, and may not be used or relied upon in any prospectus or offering circular. Client also agrees that none of its advertising, sales promotion, or other publicity matter containing information obtained from this assessment and report will mention or imply the name of ERM.

Nothing contained in this report shall be construed as a warranty or affirmation by ERM that the site and property described in the report are suitable collateral for any loan or that acquisition of such property by any lender through foreclosure proceedings or otherwise will not expose the lender to potential environmental or social liability.

1.5 Layout of the Report

The structure of the report will be as given in **Table 1.2** and list of Annexes in **Table 1.3.**

Table 1.2 Structure of the ESIA Report

Section	Title	Description
Section 1	Introduction	(*this section*) Introduction to the Project and ESIA scope and methodology adopted.

Section	Title	Description
Section 2	Project Description	Technical description of the Project & related infrastructure and activities.
Section 3	Applicable Legal and Regulatory Framework	Discusses the applicable environmental and social regulatory framework and its relevance for the Project.
Section 4	Screening and Scoping	Discusses the Project screening with respect to environmental, ecological and social risks and scoping outcomes undertaken as part of the ESIA process.
Section 5	Environmental, Ecology and Social Baseline	Outlines Environmental, Ecology and Social Baseline status in the study area of the Project
Section 6	Stakeholder Engagement	Provides an overview of the stakeholder engagement activities undertaken during the ESIA.
Section 7	Impact Assessment and Mitigation Measures	This section includes details of identified environmental impacts and associated risks due to Project activities, assessment of significance of impacts and presents mitigation measures for minimizing and /or offsetting adverse impacts identified.
Section 8	Environmental and Social Management Plan	Outline of the ESMP taking into account identified impacts and planned mitigation measures and monitoring requirements.
Section 9	Conclusion	Summary of impacts identified for the Project and conclusion of the study.

Table 1.3 List of annexes

Annex	Detail
A	Applicable Environmental Standards
B	Environmental Monitoring of Ground water
C	Environmental Monitoring of Noise quality
D	Traffic Study conducted

2. PROJECT DESCRIPTION

2.1 Introduction

This section provides a description of the Project in terms of location, facilities and associated Project infrastructure and activities during the Project lifecycle and facilitates and identification of the potential impacts on resources and receptors that could result from Project activities during the pre-construction, construction, operation and decommissioning stages.

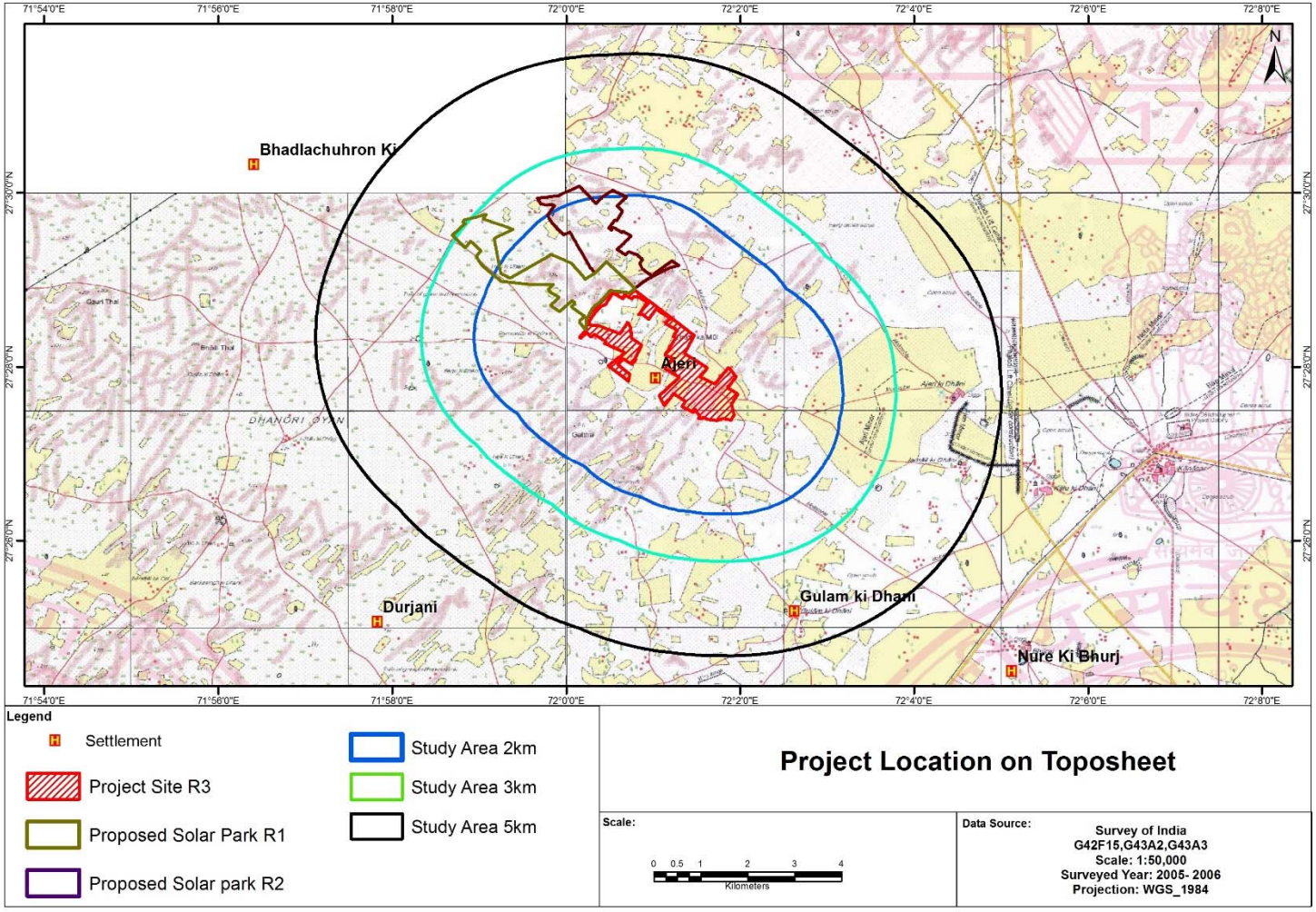
2.2 Location

The 100 MW solar power plant is proposed to be developed on 200 Ha of open scrubland in Bhadla Solar Park located at Bhadla village in Phalodi tehsil of Jodhpur district. Nearest village is Ajeri at a distance of ~ 500 m in west direction. Phalodi is the nearest town at a distance of ~ 50 km from the Project Site. Nearest railway station is also at Phalodi at a distance of ~ 52 km. HFE is also planning to develop 2 other solar power Projects of 100 capacity each, in the immediate vicinity of the proposed Project. These other two Projects are also in planning and land procurement stage.

Site is accessible through road connecting Bhadla to Bap Village. The Project site is also approachable through National Highway (NH) 15. Map showing location of the Project and other two Projects (proposed to be developed by HFE) are presented as **Figure 2.1**

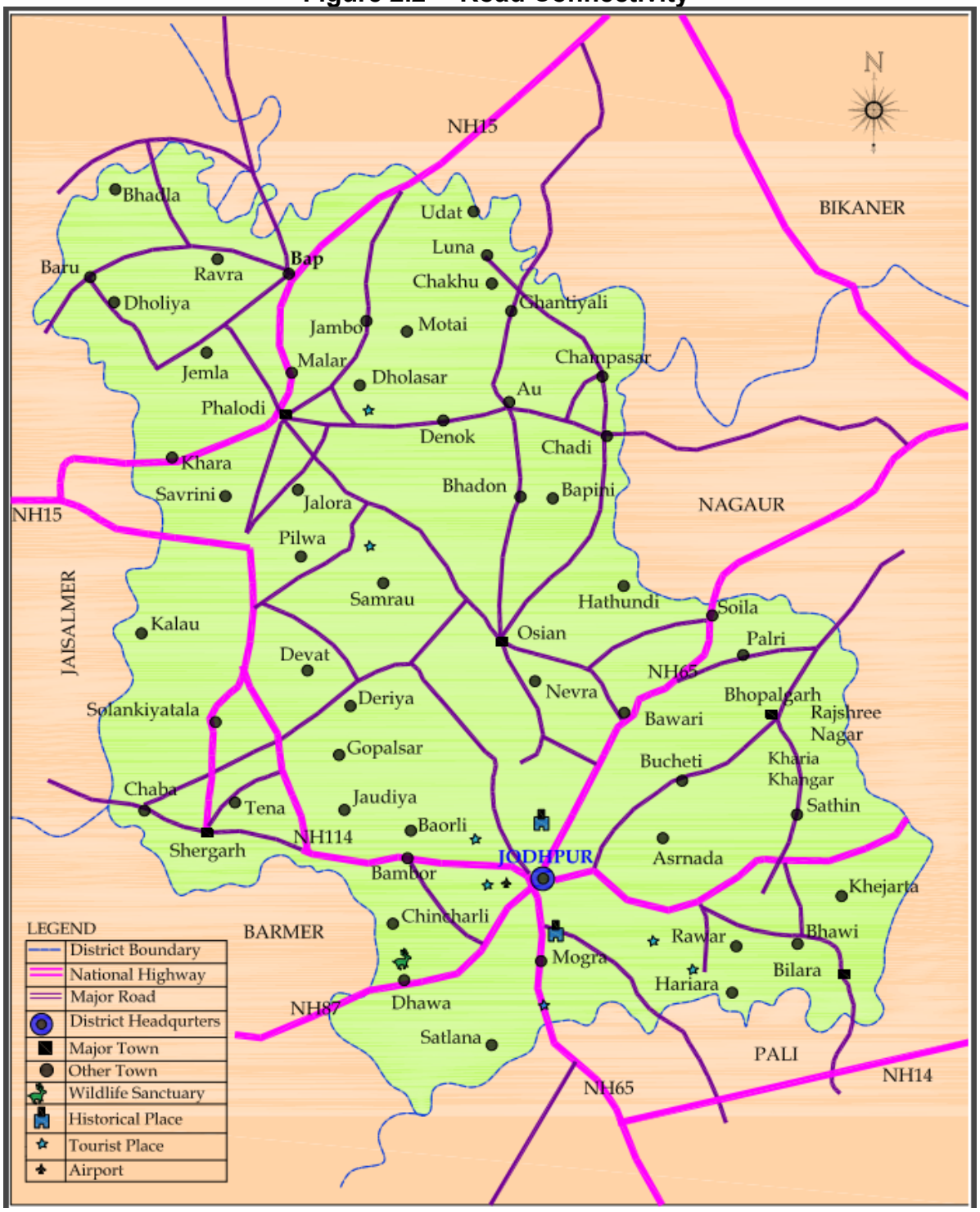
The road connectivity is presented as **Figure 2.2**.

Figure 2.1 Site Location Map on Toposheet



* Toposheet (G42F14 (40M/14) of the topmost left corner is not available in public domain, https://soinakshe.uk.gov.in/Home.aspx

Figure 2.2 Road Connectivity



2.2.1 Site Settings

Land use of the site is scrubland/ open barren land. It is surrounded by open scrubland towards north and east and village road towards south and west direction; and immediately after village road are solar parks of other developers.

The site has mixed topography of terrain (flat land and slightly undulating land). Elevation at Project site ranges from 180 to 190 m above mean sea level.

Indira Gandhi canal, which is one of the longest canal in India, is located at approximately 10 km from the proposed Project site. There is no other source of surface water in the Project area or its vicinity. No reserve forest / protected forest or ecological sensitive area is located near the Project site.

2.2.2 Other Plant in Bhadla Solar Park Phase III

Bhadla Solar Park is one of the largest solar parks in India[2] which is spread over a total area of 10,000 acres (40 km^2) in Bhadla, Phalodi tehsil, Jodhpur district, Rajasthan, India. The park will have ultimate capacity of 2,255 MW. Development at Bhadla Solar Park is proposed into four phases. Phase III of the development is further divided into 2 phases of 500 MW each, comprising of Phase-1 development on left hand side of the road and Phase-2 (development on right hand side), as per the following details.

Bhadla Solar Park Phase III- Capacity of 1000 Mw

- Acme commissions 200 MW Solar Plant
- Soft Bank commissions 500 MW Solar Plant
- SB Energy commissions 300MW Solar Plant

2.3 Description of Project Facilities, Components and Activities

The proposed 100 MW solar power Project will be based on multi crystalline Solar Photo Voltaic technology. CSP Bhadla will develop general layout drawing of array yard, internal road & drainage (ensuring no water logging in the Power Plant Compound) along with sanitary plumbing layout of the Power Plant. It will also include landscaping & beautification of the entire area of the PV Power Plant.

Land utilization shall be done in such a way that complemented with appropriate layout maximum power packaging is done in the proposed site.

Power from the 100 MW solar plant will be evacuated to pooling substation owned by M/s Saurya Urja which will be finally connected to 765/400/220 kV Bhadla substation owned by M/s Power Grid Corporation of India Limited (PGCIL). Key Project components envisaged for this Project are given in table below:

Table 2.1 Project Components

Component	Application
Solar PV Modules	Multi crystalline module for capturing solar energy.
Power Conditioning Unit (PCU) or Inverter	Convert the incoming DC received from PV modules into AC with suitable power quality. The inverter will produce sinusoidal AC waveforms with low harmonic distortion. The inverter will also act as a protective device of the system and will trip if the voltage, current or frequency goes outside acceptable ranges.
Cables	Cables proposed to be used are multi-strand copper cables. The cables exposed to environment will be double sheathed- UV protected ones.
Earthing and Lighting protection	The earthing of all outdoor equipment & provision of associated earthing systems, electrodes & connections will be as per the latest IS 3043 standards.

Component	Application
Power Evacuation	The proposed power Project envisages an export of 193 Mn units from the plant in 1st year of operation. The grid connection will be at 220 kV level in Bhadla substation. The exportable power from the plant shall be evacuated by stepping up the power from 380 kV to 220 kV through transformers. Switchyard and other arrangement will be in line with TRANSCO specification and Grid Code.

Source: Based on DPR

Table 2.2 presents the technical specifications of the Project components (including make, model and number) of the PV modules, inverters, transformers.

Table 2.2 Project Features

SN.	Main Equipment	Description
1.	PV Module Type	Multi crystalline
2.	Proposed Capacity	100 MW AC
3.	Capacity of each module proposed	330 Wp/325 Wp
4.	Number of modules	456640
5.	Module mounting structures	2P X 15 matrix of HFE design
6.	Grid Interactive Inverter: 2500 kW as per system capacity of 10 MW	40 Nos.
7.	String Combiner Boxed	410 Nos.
8.	Inverter Capacity	2500 kWac
9.	Total no. of Inverters	1112
10.	Inverter rating	90 kW
11.	No. of ICR's	16 nos.
12.	Estimated energy generation	271 Million kWh (first year)
13.	Cables	Multi-strand copper cables and UV protected ones
14.	Transformers	16 nos. of inverter Duty Transformers

Source: DPR/ Plant layout

2.3.1 Associated Components

Power Evacuation

Power generated by the 100 MW solar power plant would be stepped up and transmitted through 220 kV DC line from 220 kV pooling substation of M/s Saurya Urja Company of Rajasthan Limited to 765/400/220 kV Bhadla (PG) grid substation of Power Grid Corporation of India Limited. M/s Saurya Urja Company of Rajasthan Ltd. has already obtained approval for transmission line from PSS to GSS. M/s Saurya Urja has also secured permission for connectivity to grid from Power Grid Corporation of India Limited (PGCIL).

Cable trays will be laid down to support insulated above electrical cables within the plants, however at places cable will be underground.

Access Roads

The Project can be accessed via a network on bituminous roads that extend to non-bituminous road. As on date, there are no internal access roads for the Project and the same shall be developed before

start of the construction phase. The Project may also entail improvement works for the existing roads prior to transport of heavy construction equipment and widening of intersections for smooth movement of heavy vehicles.

2.3.2 Project Phase and related Activities

Planning Stage

The planning phase of the Project includes the following components:

- Identification of land area and site;
- Site surveys as topographic, geo-technical investigations, solar radiation and yield study, electrical grid studies, etc.;
- Obtaining all necessary approvals/clearances; and
- Design and finalization of contractors.

Identification and purchase of land is a key component of the planning and pre-construction phase. The process of purchasing land can be divided into two phases (a) land title verification and (b) purchase of land.

The proposed solar power plant is located at the Solar Park, whose land has been sub-leased to CSP Bhadla for setting up the plant. Details of the entire land procurement process and related information has been provided in the subsequent sections.

Construction Phase

Construction phase of Project activities will include the following:

- Contractor mobilization;
- Site Preparation including fencing, clearing of bushes, pit filling, levelling and grading;
- Construction of site office and internal roads;
- Construction of temporary storage facilities;
- Foundation laying for ground mounted structures;
- Storage of PV modules delivery and their installation;
- Laying of internal electrical connections;
- Construction of sub-station and office buildings;
- Installation of inverter and transformers;
- Excavation foundation and setting up of external transmission line towers; and
- Stringing of transmission lines.

Operation and Maintenance

The list of activities to be carried out in the operation and maintenance phase would be:

- Monthly cleaning of PV modules;
- Control of vegetation viz. weeds, bushes etc. within the site and those immediately surrounding it;

- Routine inspection of all PV modules and associated structures viz. cables, transformers, inverters, mounting structures etc.;
- Operation and maintenance of ancillary facilities such as power substation;
- Inspection and maintenance of transmission lines; and
- Inspection and maintenance of internal pathways and access roads.

CSP Bhadla will have a dedicated operations and maintenance (O&M) team comprising of technical staff to conduct the aforesaid activities during operations.

Decommissioning

The average life span of the solar modules is 25 years. At the end of this life cycle, the solar modules will either be revamped or replaced and continue with its operation. If decommissioned, all components including foundations and internal roads of the Project will be removed and the site will be restored to its pre-construction state. The concrete pedestals of the ground mounted structure foundations will be demolished and removed from the sub-surface. The associated infra-structures will be returned to the government for use.

2.4 Resource Requirements

The resource requirements for construction and operation phases of the Project have been made based on assumptions and elaborated below.

2.4.1 Land and its procurement process

It was reported that land would be required for the following Project components:

- Installation of solar modules;
- Site office;
- Inverter room;
- Temporary labour camp;
- Stock yard; and
- Transmission Cable Tray.

The understanding of Project-related land requirement is based on documents shared and the discussions held with representatives of Clean Solar Plant (Bhadla) Pvt. Ltd. and Saurya Urja Company of Rajasthan Limited. The details of the land requirement for various components, present status of land procurement and procurement process followed for the same are captured below.

Applicability of PS 5 (Land acquisition and involuntary resettlement) to the Project

Saurya Urja Company of Rajasthan Limited (SURAJ) is a Joint Venture formed between Government of Rajasthan and IL&FS. The land for the Solar Park has been procured in 2015 by a lease deed signed on 18th November, 2015 between the SURAJ and the Governor of the state of Rajasthan, through District Collector of Jodhpur.

In the current Project, there is no land procurement being undertaken by CSP Bhadla Pvt. Ltd., as the land is being sub leased in a solar park, being developed by Saurya Urja Company of Rajasthan Limited, hereafter referred to as “SURAJ”. Thus there exists no scenario of land transaction with

private land owners and any scope of involuntary resettlement, neither physical nor economic because of the Project. Thus PS 5 does not get triggered for this Project.

Land details

The 1000 MW Solar Power Park has been developed by the Saurya Urja Company of Rajasthan Limited (SURAJ) in Bhadla Solar Park Phase-III. SURAJ gained possession of government land in Nov, 2015.The Park site is located in Phalodi tehsil of Jodhpur district in the state Rajasthan. The Solar Park is further divided into 2 phases of 500 MW each, comprising of Phase-1 LHS and Phase-2 (RHS), where Phase 1 is already commissioned and Phase 2 is under development. The total land area procured for solar park is approx. 2469.48 hectares.

As per the sub lease deed, CSP Bhadla Pvt Ltd has been awarded the Project by SECI in 2017 and allotment letter for **R3 plot** was given in April 2018. The total 300 MW Project is being developed by CSP Bhadla which lies in Phase 2 of Solar Park. The sub lease agreement has been signed for a period of 27 years between Saurya Urja Company of Rajasthan Limited and CSP Bhadla Pvt. Ltd. Furthermore, during the discussions with Hero Future Energy (parent company of CSP Bhadla team, it has been understood that the power generated by the solar plant will be sold to the Uttar Pradesh Power Corporation Limited under National Solar Mission, and the same is also documented in the PPA signed on 27th April 2018. The total land procured by the CSP Bhadla Pvt. Ltd for R3 plot of 100 MW is 200 hectares through lease process. The Table 2.3 has detailed out the requirement of land and status of procurement.

Table 2.3 Summary of Land Requirement

S N	Project Component	Type of Land (Private or Govt.)	Village	Status of procurement	Area	Status of Procurement
1	Solar PV Module	Government land	Bhadla Village	The land has been taken on lease by Clean Solar Power (Bhadla) Pvt. Ltd from Saurya Urja Company of Rajasthan Limited	200 hectare	At the time of ERM site, the R3 plot of 200 hectare has already been on lease and lease agreement were completed.
2	Transmission Cables	Government land	Bhadla Village	The transmission cables are to be laid underground and above through cable tray. The breakup of underground and over ground cables is not provided to ERM till compilation of this report.		

Source: ERM Site Visit, February 2019

Existing Status of Land and various Project components

The physical possession of land has been awarded to CSP Bhadla in June, 2017 and the sub lease deed agreement has been signed at the time of site visit by ERM. During the discussions with the team of the HFE it was mentioned that construction will commence in February 2019 for the Project (hereinafter referred to as R3 plot) and it will start operating from July 2019 tentatively.

Solar module, site office and inverter room

The installation of solar module, site office and inverter room will take place within 200 hectare of R3 plot. The construction work was yet to start at the time of site visit by ERM.

Transmission Cable

The power to be generated by the 100MW AC PV plant is 220kV. It has been understood that the power generated by the solar power plant will be evacuated to PSS owned by M/s Saurya Urja via underground as well as above ground cables through cable tray.

Temporary labour camps

It has been understood through discussion with the team of the CSP Bhadla Pvt Ltd that they have hired various contractors and sub-contractors during the construction phase who are expected to bring in skilled labourers from other states and unskilled labourer will be hired form local villages. No separate labour camp will be set up for the accommodation of the migrant labour as the EPC contractor and their sub- contractors will hire the accommodation for the labourers in the nearby villages during construction phase.

Issues specific to Project Related Land Procurement

Based on the information made available, the key observations pertaining to land procurement for the Project are mentioned below.

Schedule V Area

The Project area does not fall under Schedule V[1] area as defined by the Indian Constitution.

Tribal (Schedule Tribe) Land

CSP Bhadla Pvt Ltd plans to construct the solar power Project on the government land which has been taken on lease from Saurya Urja Company of Rajasthan Limited earlier. During the consultations, it has been understood that there is no Tribal population in the area and the same has been confirmed through Census data of the area. Therefore the possibility of Project impacting tribal land is non-existent.

Landlessness

The Project has been set up on the land owned by Rajasthan government in which Saurya Urja Company of Rajasthan limited has set up the solar park and the land procurement was undertaken by the Rajasthan government in 2015. There is limited information on the extent of landlessness post procurement by the Government as the same was undertaken prior to the current assessment. No documentation of the land take process or SIA done during procurement has been made available to ERM to assess the aspect of landlessness in 2015.

Encroachment

During the consultation with the official of the IL&FS, it has been stated that there were 250 encroachers in entire Bhadla Solar Park Phase-III at the time of procurement by Government in 2015. IL&FS is understood to have paid INR 1.0 lac per family as rehabilitation assistance whereas there are a few families who have received additional amount of approximately INR 50,000 because of the land linked assets such as water tank, borewells, etc. However during the consultation it has also been mentioned by the IL&FS official that there were few cases where forced eviction was applied

(1) The Schedule V areas comprise of the areas identified in the Paragraph 6 of the Fifth Schedule of the Indian Constitution. These areas comprise of those tribal inhabited areas which are located in other parts of the country than North-East India, including areas in Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Himachal Pradesh, Madhya Pradesh, Jharkhand, Maharashtra, Orissa and Rajasthan

with the help of police, as locals were not willing to evict the area, despite the payment of the rehabilitation assistance.

It has been understood that there were no cases of encroachment at site at the time of handover of land to CSP Bhadla team as the physical possession of land by Saurya Urja Company of Rajasthan limited was taken in 2015.

Common Property Resources

No CPRs were observed or reported during community consultations near the Project land.

Cultural Heritage

No structures bearing cultural, historical, religious or spiritual significance are present near the Project foot print.

NoC from Panchayat

The NoC from Gram Panchayat has not been obtained by the Solar Power Park Developer, SURAJ, stating that the same is not required. There is no clarity on requirement of NoC from Gram Panchayats in the state of Rajasthan for solar power Projects. The Rajasthan Solar Policy 2014 and Rajasthan Land Revenue Code, 2007 also does not stipulate the requirement of NoC from Gram Panchayats for Solar Power Projects in Rajasthan.

Rajasthan Solar Energy Policy 2014

Under the Rajasthan Solar Energy Policy[1], revenue land may be allotted to solar park developers as per the provisions of Rajasthan Land Revenue Rules 2007 (allotment of land for setting up power plant based on renewable energy sources). Further, the solar park developers are empowered to sub-lease the land. The process requires the state nodal agency, Rajasthan Renewable Energy Corporation (RREC), to make a recommendation for allotment of government land to the concerned district collector (DC)[2]

Grievance Redressal process and stakeholder engagement

There is Grievance Redressal Mechanism developed by Hero Future Energy that is applicable to its SPVs including CSP Bhadla. The ambit of community grievance redressal comprises of members of the local community, gram panchayat, Project staff and other indirectly impacted stakeholders. It was reported that most of the concerns raised by local communities were relating to plausible impacts on community health and safety and employment opportunities during the construction phase.

CSP Bhadla Pvt Ltd has Grievance Redressal Committee (GRC) consisting of representatives from the contractors and HFE officials. The complaints are escalated to the higher level if the lower level fails to address the grievance to the satisfaction of the complainant. It has been reported by the HFE that the GRC meeting is held at the Project site on monthly basis and on a corporate level as and when the grievance being filed by the workers or persons from the community reaches corporate.

2.4.2 Manpower Requirement

During the discussion with the CSP Bhadla Pvt Ltd team, it has been understood that during the time of the construction and operational phase they have employed 7 people, in which 6 are working as site engineer and one is overall in charge of site.

[1] https://mnre.gov.in/file-manager/UserFiles/Grid-Connected-Solar-Rooftop-policy/Rajasthan-Solar-Energy-Policy-2014.pdf
[2] https://shaktifoundation.in/wp-content/uploads/2018/01/Study-Report-Addressing-Land-Issues-for-Utility-Scale-Renewable-Energy-Deployment-in-India.pdf

Details of EPC Contractors

It was reported that during the construction phase, the Project would employ approximately 800 skilled, semi-skilled and unskilled labourers and arrangement will be made through EPC contractors, the details of EPC contractors and number of labours engaged is given below in ***Table 2.4*** , furthermore there will be 2 -3 staffs who will be engaged in housekeeping, security guards etc. during construction.

Details of EPC contractors hired by the CSP Bhadla Pvt. Ltd and the requirement of manpower for R3 plot are depicted in the ***Table 2.4*****.**

Table 2.4 Details of EPC Contractors

EPC Contractor	Role of EPC Contractor	Phase of Project	Maximum no of contract labour to be employed
Ritis Meera Infra energy Pvt .Ltd	Ritis Meera Infra energy Pvt Ltd will take care of Civil work and Structure	Construction Phase	500
Larsen & Toubro limited Pvt.Ltd	Larsen & Toubro limited Pvt.Ltd will take care of AC and DC	Construction Phase	300

Source: ERM Site Visit from 5th February to 6th February 2018

2.4.3 Water Requirement and Source

Construction Phase

Based on industry practices, it is estimated that approximately 60 KLD of water would be required for civil works during construction stage. The water requirement will be met through tankers supplied by authorised contractors from neighbouring villages. Water will also be required for domestic use by workers at Project site. Considering peak worker requirement of 800 workers, daily water requirement is estimated as 36 KLD. Domestic water requirement will also be met through tankers from authorised contractors from neighbouring villages. Bottled water will be used for drinking purpose.

Operation Phase

The water required during operation phase of the Project will be mainly for washing solar modules. Based on typical industrial practices, it is estimated that approximately 1.5 L of water will be required for cleaning of one module. Considering 4,56,640modules, approximately 685KL of water will be required for module cleaning. Water requirement for domestic use during operation phase, considering 12 workers will be ~ 1 KLD.

Water requirement during operational phase of the Project will be met from water supply by Saurya Urja from the Indira Canal. As reported a total of 58 cusec water is reserved by the Indira Gandhi Nahar Board for solar power plants. There is no other source of water in the area. Project CSP (Bhadla) has proposed use of robotic dry cleaning system for cleaning of solar panels which will reduce the water requirement of the Project. If required tanker water from authorised sources will be used on site.

2.4.4 Raw Material Requirement

Construction Phase

The major raw materials required for the construction phase are fencing material, construction materials like cement, sand, aggregate that will be sourced from local areas. Solar modules for the Project along with associated structures will be obtained from China.

Operation Phase

There will not be any major raw material required during operation except for maintenance purpose viz. consumable spares.

2.4.5 Power Requirement

Construction Phase

Power requirement during the construction phase will be met through Diesel Generators (DG). It is estimated that 6 D.G. sets of capacity 35 kVA each, will be used during construction phase. The exact number of DG sets to be used, as well as the quantity of fuel storage could not be ascertained as the Project is in the planning stages.

Operation Phase

Based on initial assumptions, power requirement during daytime would be met through auxiliary generation. During the night time power requirement would be met through State Electricity supply. DG sets would also be kept at the control room for emergency power backup.

2.4.6 Fire Safety and Security

Construction Phase

Appropriate firefighting system and equipment (such as fire extinguishers, sand buckets and water storage) shall be provided throughout the construction period. The fire extinguishers will be placed at all strategic locations such as site office, storage yard, near construction area, welding area, etc. Besides this, emergency contact numbers shall also be displayed onsite.

Operation Phase

Suitable fire protection and fighting systems viz. portable fire extinguishers, fire buckets and automatic fire detection system will be made available at the entire PV array area, inverter stations, main control room and switchyard. The aforesaid systems and equipment's will conform to National Fire Protection Authority (NFPA) fire safety standards and local fire authority requirements. Firefighting arrangements for electrical utilities like transformers etc. will be in accordance to tariff advisory committee, Central Board of Irrigation and Power (CBIP), Indian Standard (IS) 10028 i.e. Code of practice for selection, installation and maintenance of transformers, National Fire Protection Association (NFPA) 70 and 15 requirements.

2.5 Pollution Streams during Operation Phase

Pollution streams during construction phase will include air emissions, wastewater generation and solid waste generation.

2.5.1 Solid Waste Generation

Construction Phase

Based on assumptions, the key solid wastes that are expected to be generated during construction phase are as follows:

- Domestic waste from temporary site office; hazardous waste such as waste oil, lubricants, oil contaminated rags; electronic waste like broken PV module etc.;
- As a means of best practice, hazardous wastes will be stored onsite at separate designated covered area provided with impervious flooring and secondary containment. The storage containers/ bins/ drum will be clearly marked and identified for their hazards. Before completion of 90 days, hazardous waste materials will be sent to RSPCB/CPCB authorised vendor for eventual disposal at the Common Hazardous Waste Treatment, Storage and Disposal Facility (CHWTSDF). Hazardous waste authorised vendor is yet to be identified as the Project is in the planning phase;
- The broken solar panels, batteries (dry type or wet type), electronics if any, will be sent back to the vendor as part of buyback arrangement;
- Domestic solid waste will be disposed with the help of authorised vendor at authorised disposal ground;
- The transformer oil drums will be disposed through an authorized hazardous waste recycler; and
- All non-recyclables waste will be collected and disposed of by the contractor at designated landfill sites.

Operation phase

Based on ERM's assessment, during operation phase waste generated from the project will include domestic waste at site office, scrap materials like scrap tools, damaged PPEs etc.; hazardous waste like waste oil, lubricants, used transformer oil; damaged batteries; damaged PV modules etc. Following measure will be adopted for disposal of solid waste:

- The hazardous wastes will be stored temporarily onsite at separate designated covered area provided with impervious flooring and secondary containment and will be disposed in accordance with Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016;
- The broken solar panels, batteries (dry type or wet type), electronics if any, will be sent back to the vendor as part of buyback arrangement; and
- Domestic solid waste generated form the site office will be disposed at disposal site of local municipality.

■

2.5.2 Air Emissions

Construction Phase

There will be impact on air quality due to onsite construction activities. The likely emissions from construction activities would include the following:

- Fugitive emissions from site clearing, material handling, transportation, piling, use of construction machinery, etc.;
- Fugitive dust emissions from unpaved roads;
- Vehicular emissions from increased traffic volume from vehicles used for transport of construction material; transportation of PV modules and accessories; and
- Exhaust emissions from operation of diesel generators.

To control air emission during construction phase from operation of D.G. sets, adequate stack height as per CPCB norms will be provided to ascertain regulatory compliance. Fugitive dust emission arising from various activities such as piling, transportation of material (loading and unloading), vehicular movement (on unpaved roads) will be minimized through sprinkling of water and maintaining vehicular speed to 10-15 km/hr. Vehicular emission will be controlled through proper maintenance of vehicles and vehicles with proper PUC (Pollution Under Check certificate) will be operated at Project site.

Operation Phase

Based on assumptions, under normal operating conditions, there would be no gaseous emissions from the operating areas. However, there is a likelihood of gaseous and fugitive dust emissions, albeit in smaller concentrations, owing to the operating of maintenance vehicles. As a means of best practice and adherence to country regulations, well maintained vehicles with proper PUC will only be used for operation and maintenance purposes.

2.5.3 Wastewater Generation

Construction Phase

Liquid effluents generated during the construction phase will include domestic sewage from temporary site office.

As part of the site preparation stage, a drainage and sewerage system will be constructed for the site office. The sewerage system will consist of soak pits for the collection of wastewater from the kitchen and washing areas and Office facility. Sewage from the toilets will go into lined septic tanks. Sewage disposal trucks will be used to periodically remove the sludge/sewage from the site.

Operation Phase

The operational phase will have negligible wastewater generation at site office. Septic tank and soak pits will be provided at the site office for disposal of sewage.

2.5.4 Noise Emissions

Construction Phase

During the construction phase noise will be generated primarily during the day time. Noise will be generated from pilling, moving vehicles as well as construction equipment and machineries, including the DG sets utilized for power. Since there are no settlements in the near vicinity of the construction site, the only receptors of noise pollution are the construction workers.

As a control measure it will be ensured that noise emission from the vehicles and equipment's shall not exceed 91 dB(A) (*for Passenger or commercial vehicles with gross vehicle weight above 12000 kg as specified in Central Motor Vehicles Rules, 1989*). DG sets will be provided with acoustic enclosures and workers near noise generating machines will be provided with earplugs as safeguard against high noise hazards.

Operation Phase

Under normal operations, none of the activities of solar power plant will generate noise. Any activities generating from maintenance work will be restricted to daytime only.

2.6 Analysis of Alternatives and Project Justification

As per IFC Performance Standards, an analysis of probable alternatives for the chosen technology and location of Project site along with other similar factors that contribute to the Project as a whole has been carried out. The following scenarios have been taken into consideration:

- Project vs No Project scenario;
- Alternate Source for Power Generation;
- Alternate Location for Project Site.

2.6.1 Project vs No Project scenario

As per the load generation balance report 2018-19 of the Central Electricity Authority (CEA), actual power supply position in terms of energy requirement vis a vis energy availability of Rajasthan and northern region during the year 2017-2018 was deficit by 0.8 and 1.7% respectively, as presented in ***Table 2.5***.

Table 2.5 Actual Power Supply Position during year 2017-2018

Region	Requirement (MU)	Availability (MU)	Surplus (+)/ Deficit (-)	
			MU	%
Rajasthan	71193	70602	-591	-0.8
Northern Region	**3,71,934**	**3,65,723**	**-6,211**	**-1.7**

Source: Load generation balance report 2018-19 of the Central Electricity Authority

In order to meet the gap in demand and supply, renewable/non-conventional sources of power will be required to supplement the conventional sources. The Project being renewable source of power generation will contribute towards bridging the gap between demand and supply. The Project presents an opportunity to utilize the potential for solar power generation. A "No Project Scenario" will not address the issue of power shortage. An alternative without the Project is undesirable, as it would worsen the power supply-demand scenario, which would be a constraint on economic growth.

State of Rajasthan receives maximum solar radiation intensity in India with very low average rainfall. It also has desert land available in abundance. Therefore Rajasthan is likely to emerge as a global hub for solar power in the country.

2.6.2 Alternate Source for Power Generation

India is a large and fast growing economy, and according to Planning Commission of India, the country's primary energy use is expected to increase by four to five times by 2031-32. Even though India's energy basket has a mix of all resources such as coal, lignite, oil, natural gas, LNG, nuclear, hydro, and wind power, the dominance of coal is conspicuous with a prominent share of approximately 50%.

The efficiency of fuels is compared on the basis of their energy content and oil is considered as the standard for this comparison. One tonne of oil can generate 42 billion Joules or 10 Billion calories of energy whereas one tonne of Indian thermal coal can generate only 4.1 Billion calories. Thus 1 Mt of Indian coal is 0.41 Mtoe (Million tonnes of oil equivalent). Taking the thermal efficiency of the power plant and other losses in the system into consideration, in the case of coal-fired boilers, the equivalence between electricity and fossil fuels is 1 Billion kWh = 0.28 Mtoe. Electrical energy in kWh can be converted to kJ or kcal and can be expressed as Mtoe. One billion KWh of energy generated from wind power is equivalent to 0.086 Mtoe, since the intermediate stages of energy production don't generate any heat.

Table 2.6 Life-cycle Emissions from Power Sources

LCA Emissions (g CO_2 equivalent/kWh)	Wind	Solar	Nuclear	Coal
Implementation	13.7	37.5	1.2	3.6
Operation	4.7	12.0	12.4	918.8
Decommissioning	0.6	0.5	0.4	52.2
Total	**19**	**50**	**14**	**975.3**

Source: Report on developmental impacts and sustainable governance aspects of renewable energy Projects, Ministry of New and Renewable Energy

As evident from the Table above, the emission of CO_2 per kWh of energy generated from a Coal based power plant is more than that of the emission from a solar based power plant. The only emissions from the Renewable energy technologies are the emissions from fossil sources used in the production and manufacturing of equipment, waste disposal during construction, recycling etc. These life-cycle emissions are significantly lower as indicated in the table above.

Table below elaborates upon advantages and disadvantages of various power generation systems.

Table 2.7 Environmental Advantages and Disadvantages of Power Generation System

Mode	Disadvantage	Advantage
Thermal Power Plant	■ High fossil fuel consumption. ■ Large quantities of water requirement for cooling ■ High volume of emissions from operation ■ Accumulation of fly ash (in case of coal powered installations) ■ Upstream impact from mining and oil exploration ■ GHG emission estimated as 228gCeq/kWh	■ Large scale production potential ■ Moderate gestation period ■ Relatively inexpensive ■ Wider distribution potential ■

Mode	Disadvantage	Advantage
Hydropower Plant	■ Site specific, dependent on reservoir/river etc. ■ Downstream impact on flow ■ Long gestation period ■ Acute and chronic social and ecological impacts	■ GHG emission estimated as low as 1.1gCeq/kWh for run of river Projects ■
Nuclear Power	■ Availability of fuel source ■ Hazards associated with radioactive material ■ High cost of Project ■ Long gestation period ■ Risk of fallout and meltdown scearios and its impacts on the local populace and environment.	■ Cheaper power generation ■ GHG emissions as low as 2.5gCeq/kWh
Wind Power	■ Overall land requirement is large ■ Site specific (associated to wind pattern) ■ Expensive installation	■ Pollution levels are insignificant ■ Inexpensive power generation ■ Inexhaustible source ■ GHG emissions as low as 2.5gCeq/kWh for the Production Chain
Solar Power	■ Large land requirement ■ Site specific to solar insolation ■ Expensive installation ■ Concrete foundation on larger area	■ Pollution levels are insignificant ■ Inexpensive power generation ■ Inexhaustible source ■ GHG emissions as low as 8.2gCeq/kWh for the Production Chain

Source: International Atomic Energy Agency (IAEA)

Table 2.8 Green House Emissions from Different Electricity Production Chains

Technology	Mean tonnes (CO_2e/GWh)	Low tonnes (CO_2e/GWh)	High tonnes (CO_2e/GWh)
Lignite	1054	790	1372
Coal	888	756	1310
Oil	733	547	935
Natural Gas	499	362	891
Solar PV	85	13	731
Biomass	45	10	101
Nuclear	29	2	130
Hydroelectric	26	2	237
Wind	26	6	124

Source: World Nuclear Association (WNA)

2.6.3 Alternate Location for Project Site

Solar Projects are non -polluting energy generation Projects, which are site specific and dependent on the availability of solar irradiance resource. Solar irradiance mapping, in India is the responsibility of the Solar Energy Centre (SEC) of India and the National Renewable Energy Laboratory (NREL) of the United States of America as part of the initiatives of the U.S.-India Energy Cooperation /Partnership to Advance Clean Energy (PACE), which is mapped and quantified based on which potential areas that are notified by the SEC, based on hourly data. Based on available data, the current site selected is located in a high solar power potential area with irradiation of 5 to 5.5 kWh/m2/day and availability of 300 sunny days in a year (**Figure 2.4**). Average of daily sum of global horizontal irradiation at Project Site is 5.52, as presented in

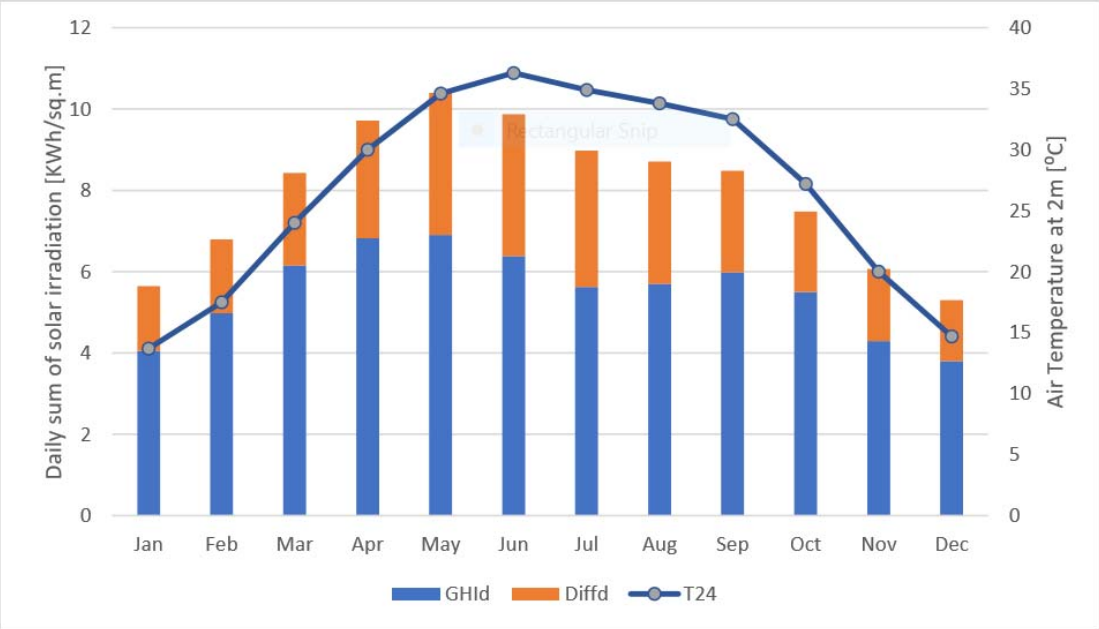
Table 2.9 below.

Table 2.9 Solar Irradiation at Project Site

Month	Average daily sum of global horizontal irradiation [kWh/m^2]	Average monthly (yearly) sum of global horizontal irradiation [kWh/m^2]	Average diurnal (24-hour) air temperature [deg. C]
January	4.05	126	13.7
February	4.98	139	17.5
March	6.15	191	24
April	6.82	205	30
May	6.9	214	34.6
June	6.38	191	36.3
July	5.62	174	34.9
August	5.7	177	33.8
September	5.98	179	32.5
October	5.5	171	27.2
November	4.29	129	20
December	3.8	118	14.7
Year	**5.52**	**2014**	**26.6**

Source: *HFE*

Figure 2.3 Solar Irradiation at Site



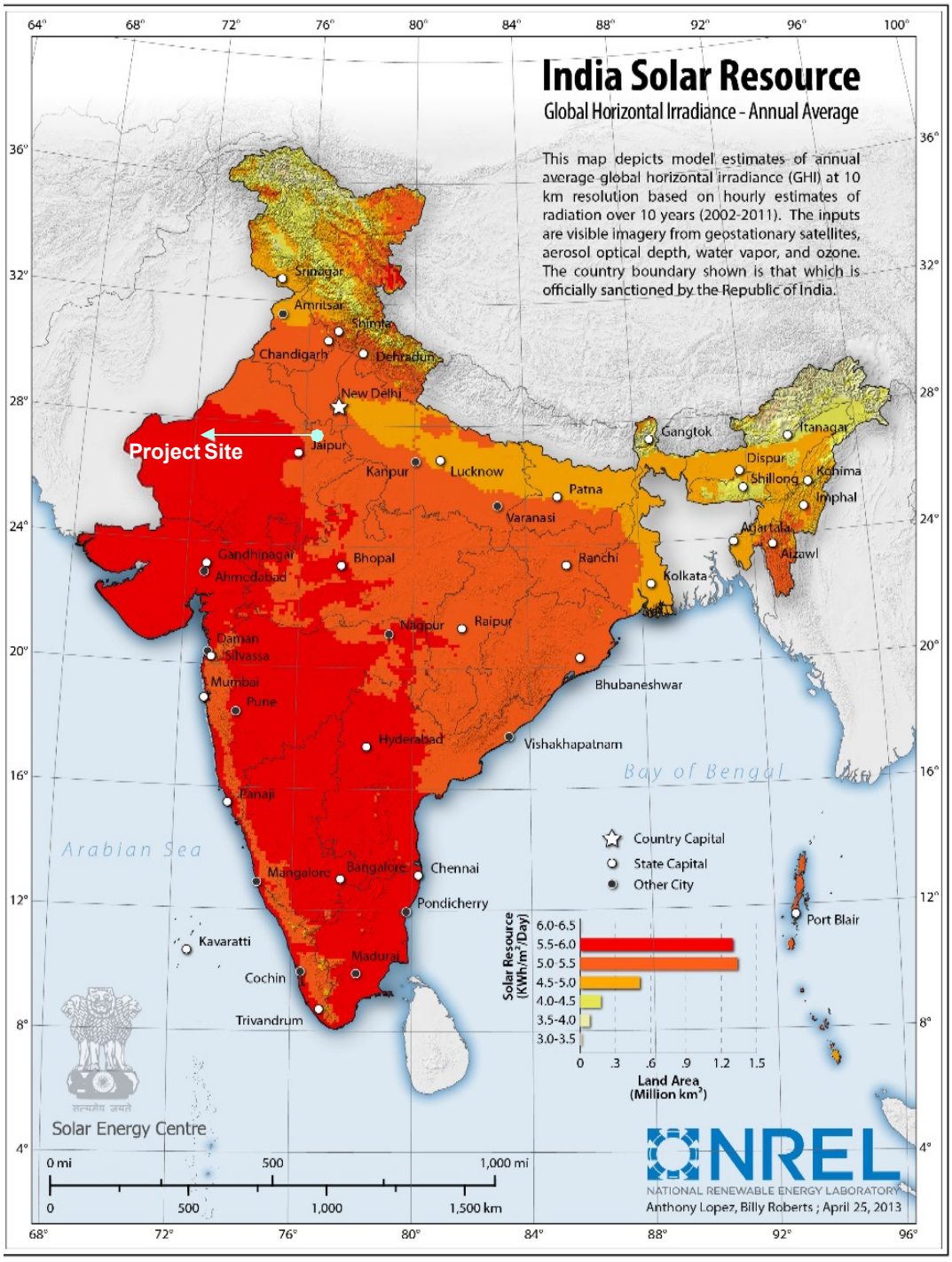
Source: *HFE*

The proposed Project site has the following location advantages:

- Site with high solar irradiation;
- Land has been made available by Government of Rajasthan through its nodal agency Rajasthan Renewable Energy Corporation Limited (RREC) for the entire solar park;
- No cultural property of archaeological importance within 5 km radius;

- There exists no obstacles around the site in the form of trees, buildings etc. that could lead to shading;
- Site is avoid of any habitation;
- Phalodi tehsil is in Jodhpur, buffer zone of Thar Desert area of Rajasthan which experiences high temperature and low rainfall throughout the year. The area is characterised by presence of flat terrain with undulating plains at some areas. Soil is mainly sandy in nature. From the observation of the existing other solar power plants within the solar park, it is anticipated that geology and soil of the area will also support the proposed structures;
- Power from the solar plant will be evacuated to 33/220 kV pooling substation owned by M/s Saurya Urja Company of Rajasthan Limited located adjacent to the site; and
- Site is also approachable through NH-15, connecting site to Phalodi, Rajasthan.

Figure 2.4 Horizontal Solar Resource map showing the Project location



Source: *National Renewable Energy Laboratory*

3. APPLICABLE LEGAL AND REGULATORY FRAMEWORK

3.1 Introduction

This section highlights the environmental and social regulations applicable to the Project. At the outset, it should be emphasized that this administrative framework focuses on:

- Applicable environmental and social regulations and policies in India and the State of Rajasthan;
- Institutional Framework for the implementation of the regulations; and
- International Standards and Conventions including:
  - Applicable Indian national, state and local regulatory requirements;
  - IFC Performance Standards (2012);
  - IFC/World Bank General EHS Guidelines (2007); and
  - IFC/World Bank EHS Guidelines for Electric Power Transmission and Distribution (2007)

3.2 Permitting Status of the Project

As per the EIA Notification (2006) and its amendments, the Solar Power Project does not require any environmental clearance from the Ministry of Environment Forest and Climate Change (MoEFCC) or the State Environmental Impact Assessment Authority (SEIAA). In addition to this, as per latest notification from the CPCB, dated 07/03/2016 (Ref No: B-29012/ ESS (CPA)/2015-2016, “Solar power generation through solar photovoltaic cell, wind power and mini hydel power (less than 25 MW)” has been classified to “white category” from “green category” and therefore “there shall be no necessity in obtaining ‘Consent to Operate” for white category of industries and an intimation to the concerned SPCB and PCC office”. Also as per latest amendment in Hazardous Waste (Management& Transboundary Movement) Rules, 2016, “Industries which do not require consent under Water (Prevention and Control of Pollution) Act 1974 and Air (Prevention and Control of Pollution) Act 1981, are now exempted from requiring authorization also under the Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016, provided that hazardous and other wastes generated by such industries are handed over to the authorized actual users, waste collectors or disposal facilities”.

3.3 SOLAR POLICIES AND REGULATIONS SPECIFIC TO THE GOVERNMENT OF RAJASTHAN

3.3.1 Rajasthan Solar Energy Policy, 2014

In order to promote Solar Power Projects, and meeting the energy requirements of Rajasthan and India, the Government of Rajasthan have Rajasthan Solar Energy Policy, 2014[1]. The policy aims to promote widespread usage of solar power and to meet the following objectives:

- Developing a global hub of solar power of 25,000 MW capacity to meet energy requirements of Rajasthan and India.
- Contributing to long term energy security of Rajasthan as well as ecological security by reduction in carbon emissions.
- Providing a long term sustainable solution for meeting energy needs and considerably reducing dependence on depleting fossil fuel resources like coal, oil and gas

[1] https://mnre.gov.in/file-manager/UserFiles/Grid-Connected-Solar-Rooftop-policy/Rajasthan-Solar-Energy-Policy-2014.pdf
Accessed on 9 March 2019

- Generating direct and indirect employment opportunities in all activities related to the generation of solar power.
- Envisaging a solar centre of excellence that would work towards applied research and commercialization of nascent technologies to accelerate the march to grid parity

According to this policy, Rajasthan Renewable Energy Corporation shall act as nodal agency for clearance of the Projects:

- Registration of Projects;
- Approval of the Projects;
- Facilitating allotment of Government land;
- Facilitating water allocation for Solar Thermal Power Plants;
- Facilitating approval of power evacuation plan and allotment of bays, etc.;
- Facilitating execution of PPA/ WBA with Discoms of Rajasthan/ RVPN/ NVVN (as may be applicable);
- Accreditation and recommending the solar power Project for registration with Central Agency under REC mechanism.

3.4 National Administrative Requirements

A brief description of the relevant enforcement agencies with respect to the institutional framework is described in the following ***Table 3.1***.

Table 3.1 Enforcement Agencies relevant to the Project

Agency	Functions
Central Level	
Ministry of Environment Forests and Climate Change (MoEFCC)	The Ministry of Environment and Forests (MoEFCC), Government of India is responsible for the environment management at Union of India level. The specific functions of MoEFCC are as follows: ■ Environmental policy planning; ■ Effective implementation of legislation; ■ Issuing guidelines under EP Act for environment protection; ■ Monitoring and control of pollution through Central Pollution Control Board and State Pollution Control Boards; ■ Environmental clearance for industrial and development Projects covered under EIA Notification; ■ Monitoring of compliance conditions stipulated in Environmental clearance through its regional offices; ■ Promotion of environmental education, training and awareness; ■ Forest conservation, development, and wildlife protection; and ■ Protection of Coastal areas. MoEFCC is responsible for the implementation and enforcement of the Environment Protection Act, 1986, and Rules issued under the Act, including the

Agency	Functions
	EIA notification. Under sections 3 and 5 of the EP Act, 1986, it retains enormous powers to issue directions in the interests of environment protection.
Central Pollution Control Board	The Central Pollution Control Board (CPCB) has been constituted for the control of water, air and noise pollution, land degradation and hazardous material and waste management. The specific functions of CPCB are as follows: ■ Prevent pollution of streams and wells; ■ Advise the Central Government on matters concerning prevention, control and abatement of water and air pollution; ■ Co-ordinate the activities of SPCB's and provide them with technical and research assistance; ■ Establish and keep under review quality standards for surface and groundwater and for air quality; ■ Planning and execution of national programme for the prevention, control and abatement of pollution through the Water and Air Acts.
Ministry of New and Renewable Energy (MNRE)	The Ministry of New and Renewable Energy (MNRE) is the nodal Ministry of the Government of India for all matters relating to new and renewable energy. The broad aim of the Ministry is to develop and deploy new and renewable energy for supplementing the energy requirements of the country. The Ministry facilitate research, design, development, manufacture and deployment of new and renewable energy systems/devices for transportation, portable and stationary applications in rural, urban, industrial and commercial sectors.
Central Electricity Authority (CEA)	The Central Electricity Authority (CEA) is a statutory organization constituted under Section 3 of the repealed Electricity (Supply) Act, 1948, here in after replaced by the Electricity Act, 2003. Some of the functions performed by CEA include the following: ■ Advise the Central Government on the matters relating to the national electricity policy, formulate short-term and perspective plans for development of the electricity system and coordinate activities of the planning agencies for the optimal utilization of resources to sub-serve the interests of the national economy and to provide reliable and affordable electricity to all consumers; ■ Specify the technical standards for construction of electrical plants, electric lines and connectivity to the grid; ■ Specify the safety requirements for construction, operation and maintenance of electrical plants and electric lines; ■ Promote and assist in the timely completion of schemes and Projects for improving and augmenting the electricity system; ■ Collect and record the data concerning the generation, transmission, trading, distribution and utilization of electricity and carry out studies relating to cost, efficiency, competitiveness and such like matters; ■ Make public from time to time the information secured under this Act, and provide for the publication of reports and investigations; ■ Advise any State Government, licensees or the generating companies on such matters which shall enable them to operate and maintain the electricity

Agency	Functions
	system under their ownership or control in an improved manner and where necessary, in coordination with any other Government, licensee or the generating company owning or having the control of another electricity system; etc.
State Level	
State Energy Development Agency	Different states have created Energy Development Agency as the designated agency to co-ordinate, regulate and enforce the provisions of the Energy Conservation Act and implement schemes under the said Act within the State. The objective is to undertake development of renewable energy and facilitate energy conservation, as a state nodal agency under the umbrella of the MNRE.
State Environment Department	The Environment Department is the apex body in the States for implementation of all the environment related matters including Environment (Protection) Act, 1986, which is an umbrella Act on environment in the country. The main mandate of the Department is to achieve the sustainable development in the State and introducing the sound environmental management practices. Activities like pollution Control & Monitoring of Water, Air, Noise and other related areas, Conservation of Natural resources, Environment Monitoring, Environment Education etc. are co-ordinated by this department.
State Pollution Control Board	State Pollution Control Boards are responsible for implementing various environmental legislations in the state, mainly including Water (Prevention and Control of Pollution) Act, 1974, Air (Prevention and Control of Pollution) Act, 1981, and some of the provisions under Environmental (Protection) Act, 1986 and the rules framed there under like, Biomedical Waste (M&H) Rules, 1998; Hazardous Waste (M&H) Rules, 2008; Municipal Solid Waste Rules, 2000 etc. SPCBs functions under the administrative control of Environment Department of the State.
State Labour Department	The Department of Labour is responsible for formulation, implementation, and enforcement of the labour laws in the Rajasthan state. It also undertakes prevention and settlement of industrial disputes, Industrial safety, Health and promotes welfare of workers in the undertakings falling within the sphere of the State.
Directorate Industrial Safety and Health Department (DISH)	The Directorate Industrial Safety and Health Department enforces the provisions of Factories Act 1948 and State Factories Rules and the rules made there under to ensure the safety health and welfare of the workers. It also plays a significant role in regularizing working hours, and working conditions and reducing the accident and dangerous occurrences in the factories, redressal of the grievances of the workers in respect of Safety Health and Welfare through a set of policies and programs developed by both the Central and State Government. Some of the functions of DISH are ■ Eliminating inequality and discrimination in the work place; ■ Enhancing occupational health and safety awareness and compliance in the workplace; ■ Workforce and community participation, to employers, employees, workplaces, communities, businesses and unions; and ■ Providing policy advice and analysis to government on labour and employment related matters.

3.5 APPLICABLE REGULATORY/ POLICY FRAMEWORK

Table 3.2 summarizes the key regulations that are relevant to the Project across its lifecycle. This table should be used to update/develop a comprehensive legal register for the Project which can be regularly monitored for compliance as well as updated to reflect changes/non-applicability of regulations, policies and standards.

Table 3.2 Applicability of Key Legislations in India and Reference Framework in the different phases of life cycle of Project

Topic and Reference	Pre-construction	Construction	Operations	Decommissioning	Agency Responsible	Remarks
Indian laws, regulations and policies						
The Electricity Act 2003	√	√	√	√	Central Electricity Authority	Generating company deemed to obtain a license under this Act and also to comply with all safety requirement as per rule 29 to 46 under chapter 6.
Rajasthan Solar Energy Policy, 2014	√	√	√	√	Government of Rajasthan	Refer ***3.3.1***
Environment Protection						
Environment Protection Act, 1986 and as amended The Air (Prevention And Control Of Pollution) Act, 1981 The Water (Prevention And Control Of Pollution) Act 1974	√	√	√	√	Rajasthan State Pollution Control Board (RSPCB) MoEFCC CPCB	Permissible limits for ambient air quality, water quality, noise limits has been laid down by CPCB under EP Act, 1986 which requires to be complied with.
The Noise (Regulation & Control) Rules, 2000 and as amended up to 2010 Ambient Noise Standards	√ X	√ √	√ √	√ X	RSPCB RSPCB MoEFCC	Per the Act, ambient noise levels are to be maintained as stipulated in the rules for different categories of areas such as residential, commercial, and industrial and silence zones. Considering the context of the Project, *CSP (Bhadla) Pvt. Ltd.* and their contractors will need to abide by the limits prescribed for residential zones.

Topic and Reference	Pre-construction	Construction	Operations	Decommissioning	Agency Responsible	Remarks
						As the Project is in rural/residential set up, noise standards for residential area will be applicable for the Project.
Solid Waste Management Rules 2016	X	√	√	√	RSPCB /local municipal bodies	All bio-degradablea and non-biodegradable solid wastes generated from the Project will be managed by CSP (Bhadla) Pvt. Ltd. (the waste generator) in accordance to the relevant provision of this Rule.
Manufacture, Storage and Import of Hazardous Chemicals (MSIHC) Rules, 1989 and as amended	X	√	√	X	RSPCB	Rules will be applicable during construction and operation phases if chemicals are stored at site. Project needs to satisfy the criteria laid down in the Rules.
The Batteries (Management and Handling) Rules 2001 as amended later	X	√	√	X	RSPCB	Rules will be applicable during construction and operation phases as the Project will use Batteries for power back up. Filing of Half Yearly return by bulk consumers and auctioneers of batteries to State Pollution Control Board as per Form 8 and 9 under Rules10 (2) (ii) and 11 (ii) respectively
E-waste (Management) Rules, 2016	X	X	√	√	RSPCB	Rules will be applicable as electrical and electronics as listed in the Schedule I of the aforesaid rules will be used and will require replacement within the lifecycle of the whole Project as well during decommissioning.
Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 as amended	X	√	√	√	RSPCB	Generation of waste oil and transformer oil at site attracts the provisions of Hazardous and Other Wastes Rules, 2016. The hazardous wastes have to dispose through approved recyclers only.

Topic and Reference	Pre-construction	Construction	Operations	Decommissioning	Agency Responsible	Remarks
The Factories Act, 1948 and Rajasthan Factories Rules, 1951	X	X	√	X	Deputy Chief Inspector of Factories	*CSP (Bhadla) Pvt. Ltd.* will need to comply to all requirement of factories rules and participate in periodic inspection during the Operations Phase
Building and Other Construction Workers Act, 1996; Inter-state Migrant Workers Act, 1979; Contract Labour Act, 1970	X	√	X	√	Labour and Employment Department, Rajasthan	*CSP (Bhadla) Pvt. Ltd.* will need to comply to the requirements of the these regulations
The Child Labour (Prohibition and Regulation) Act, 1986; Bonded Labour (Abolition) Act 1976; Minimum Wages Act, 1948; Equal Remuneration Act 1976; Workmen's Compensation Act, 1923; Maternity Benefit Act, 1961.	X	√	√	√	Labour Welfare Board, Rajasthan	*CSP (Bhadla) Pvt. Ltd.* and their contractors will need to comply to the requirements of these regulations
Companies Act, 2013	X	X	√	X	*CSP (Bhadla) Pvt. Ltd.*	According to Schedule 135 sub-section 1, the companies meeting the threshold criteria specified should spend in every financial year, at least 2% of the average net profits of the company made during the three immediately preceding financial years, in pursuance of CSR Policy. The Project will need to comply with the requirements as stated in the law.

Topic and Reference	Pre-construction	Construction	Operations	Decommissioning	Agency Responsible	Remarks
International treaties and conventions						
Conventions on the Conservation of Migratory species of wild animals and migratory species	√	√	√	√	State Forest Department	Migratory bird in the Project area bears protection from killing under Convention of Migratory Species (CMS) to which India is a signatory
Kyoto Protocol: The 3rd Conference of the Parties to the Framework Convention on Climate Change (FCCC) in Kyoto in December 1997 introduced the Clean Development Mechanism (CDM) as a new concept for voluntary greenhouse-gas emission reduction agreements.	√	√	√	√	MoEFCC, Government of India	-
International Standards and Guidelines						
IFC Performance Standards, 2012	√	√	√	√	Project Proponent and Lenders	The methodology of the ESIA has been developed on the basis of the IFC Performance Standards.
IFC General EHS Guidelines, 2007	X	√	√	√		

Topic and Reference	Pre-construction	Construction	Operations	Decommissioning	Agency Responsible	Remarks
IFC EHS Guidelines for Power Transmission and Distribution, 2007	X	√	√	√		During the construction, operation and eventual decommissioning of the site, the following guidelines will need to be followed.
IFC/WB Air Emissions and Ambient Air Quality Standards	X	√	X	√		
IFC/WB Guidelines for treated sanitary sewage discharges	X	√	√	√		
IFC/WB Noise Standards	X	√	√	√		

3.6 NATIONAL ENVIRONMENTAL STANDARDS

The Central Pollution Control Board (CPCB) has stipulated different environmental standards w.r.t. ambient air quality, noise quality, water and waste water for the country as a whole under EP Act, 1986. Following standards are applicable to the Project and need to be complied with during the Project life cycle.

- National Ambient Air Quality Standards (NAAQ Standards), as prescribed by MoEFCC vide, Gazette Notification dated 16th November, 2009;
- Drinking water quality- Indian Drinking Water Standard (IS 10500: 2012);
- General standards for discharge as prescribed under the Environment Protection Rules, 1986 and amendments (G.S.R 422 (E) dated 19.05.1993 and G.S.R 801 (E) dated 31.12.1993 issued under the provisions of E (P) Act 1986);
- Noise standards specified by the MoEFCC vide Gazette notification dated 14th February, 2000 (Noise Pollution (Regulation and control) Rules, 2000); and
- Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

3.7 Screening Methodology

For the screening exercise, ERM undertook discussions with the Project team and a review of the documents available. The following sub sections provide an understanding of the methodology followed.

3.7.1 Kick-off Meeting

The ERM team had a brief kick-off meeting with the HFE team prior to site reconnaissance visit. A discussion was also held with regard to the expectations from this assessment in terms of scope of work, deliverables, timeline and the methodology to be followed for the same.

3.7.2 Document Review

Desk based review of the relevant documents of the Project and its surroundings were undertaken to have a clear understanding of the Project and their impacts. Further, review of the secondary information available on the Project areas, the administrative block, the district and the state was undertaken to substantiate the primary data.

3.8 International Safeguard Requirements

3.8.1 IFC Requirements

IFC applies the Performance Standards [(1)] to manage social and environmental risks and impacts and to enhance development opportunities in its private sector financing in its member countries eligible for financing. The Performance Standards may also be applied by other financial institutions choosing to support them in the proposed Project. These performance standards and guidelines provide ways and means to identify impacts and affected stakeholders and lay down processes for management and mitigation of adverse impacts. Together, the Client is required to meet the stipulations of all the eight Performance Standards throughout the life of an investment in the case such an investment is being sought either form IFC or any other institution which follows IFC standards (***Table 3.3)***

(1) http://www.ifc.org/ifcext/sustainability.nsf/Content/PerformanceStandards

Table 3.3 IFC Performance Standards

IFC PS No.	Description	Objectives
1	Assessment and Management of Environmental and Social Risks and Impacts	■ To identify and evaluate environmental and social risks and impacts of the Project; ■ To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize and, where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment; ■ To promote improved environmental and social performance of clients through the effective use of management systems; ■ To ensure that grievances from Affected Communities and external communications from other stakeholders are responded to and managed appropriately; and ■ To promote and provide means for adequate engagement with Affected Communities throughout the Project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.
2	Labour and Working Conditions	■ To promote the fair treatment, non-discrimination, and equal opportunity of workers; ■ To establish, maintain, and improve the worker-management relationship; ■ To promote compliance with national employment and labor laws; ■ To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain; ■ To promote safe and healthy working conditions, and the health of workers; and ■ To avoid the use of forced labor.
3	Resource Efficiency and Pollution Prevention	■ To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from Project activities; ■ To promote more sustainable use of resources, including energy and water; and ■ To reduce Project-related GHG emissions.
4	Community Health, Safety and Security	■ To anticipate and avoid adverse impacts on the health and safety of the Affected Community during the Project life from both routine and non-routine circumstances; and ■ To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities.

IFC PS No.	Description	Objectives
5	Land Acquisition and Involuntary Resettlement	■ To avoid, and when avoidance is not possible, minimize displacement by exploring alternative Project designs; ■ To avoid forced eviction; ■ To anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost4 and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected; ■ To improve, or restore, the livelihoods and standards of living of displaced persons; and ■ To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.
6	Biodiversity Conservation and Sustainable Management of Living Natural Resources	■ To protect and conserve biodiversity; ■ To maintain the benefits from ecosystem services; and ■ To promote the sustainable management of living natural resources through the adoption of practices that integrates conservation needs and development priorities.
7	Indigenous Peoples	■ To ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples; ■ To anticipate and avoid adverse impacts of Projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimize and/or compensate for such impacts; ■ To promote sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner; ■ To establish and maintain an ongoing relationship based on Informed Consultation and Participation (ICP) with the Indigenous Peoples affected by a Project throughout the Project's life-cycle; ■ To ensure the Free, Prior, and Informed Consent (FPIC) of the Affected Communities of Indigenous Peoples when the circumstances described in this Performance Standard are present; and ■ To respect and preserve the culture, knowledge, and practices of Indigenous Peoples.
8	Cultural Heritage	■ To protect cultural heritage from the adverse impacts of Project activities and support its preservation; and ■ To promote the equitable sharing of benefits from the use of cultural heritage.

Source: *IFC Performance Standards on Environmental and Social Sustainability*

4. E&S SCREENING & SCOPING

4.1 Project Categorization

4.1.1 IFC Project Categorisation

IFC's Environmental and Social Review Procedure Manual (1) has provided a provisional categorization tool for Projects. The tool assigns an E&S category based on risk inherent to the particular sector, as well as on the likelihood of a development taking place and on what can be reasonably ascertained about the environmental and social characterization of the Project's likely geographical setting. The categories are defined as follows:

1. **Category A:** Projects with potential significant adverse environmental or social risks and/or impacts that is diverse, irreversible or unprecedented.
2. **Category B:** Projects with potential limited adverse environmental or social risks and/or impacts that is few in number, generally site-specific, largely irreversible and readily addressed through mitigation measures.
3. **Category C:** Projects with minimal or no adverse environmental or social risks and/or impacts.

The proposed Project has been categorized as falling under **Category B** as per the guidelines.

The rationale for classifying the Project as **Category B** is provided below:

- **Potentially limited risks/impacts and reversible**: Impacts relating to environment, social and ecology, are anticipated during the construction phase and will encompass changes in land-use, increased noise levels, changes in air quality, use and changes in water quality, impacts on terrestrial ecology, occupational health & safety, etc. It is imperative to note that there is no physical displacement involved in this Project. Most of these impacts are limited to the Project site and its immediate vicinity. Therefore the impacts, if any, can be minimized through application of mitigation measures as proposed in the Environment and Social Management Plan, which has been elaborated upon in ***Section 8*** of the ESIA report.
- **Unprecedented**: Development of solar power Projects is occurring in large numbers in the last decade and therefore several such Projects are located across India. A solar power Project can therefore not be considered an unprecedented activity. Based on information in the public domain and the latest satellite imagery, there are several solar Projects (upcoming as well as operational) within the 5 km radius of the proposed Project.
- **Limited adverse impacts on the baseline**: Solar based energy development is a non-polluting source of energy and thus is not likely to lead to any adverse impacts on the baseline environment during the operation phase. In addition, dry robotic cleaning for washing of module is proposed. In terms of social impacts, the land required is comprised of government land of Rajasthan Government allotted to M/s Saurya Urja Company of Rajasthan limited to set up the solar park. The Project reportedly did not involve any involuntary physical displacement. The Project reportedly also did not involve any land belonging to ST family.

(1) Environmental and Social Review Procedures Manual: Environment, Social and Governance Department (2012): http://www.ifc.org/wps/wcm/connect/190d25804886582fb47ef66a6515bb18/ESRP%2BManual.pdf?MOD=AJPERES. Accessed on 06.09.2016.

4.2 Scoping Methodology

For this ESIA study, scoping has been 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 and the impacts that could result from these interactions, and to prioritize these impacts in terms of their likely significance. This stage is intended to ensure that the impact assessment focuses on issues that are most important decision-making and stakeholder interest. The scoping exercise was undertaken on the basis of the information available on the Project, the discussions with the Project team and the prior understanding of ERM of solar power Projects. Potential impacts have been identified through a systematic process whereby the features and activities (both planned and unplanned) associated with the operation and maintenance and decommissioning phases of the Project have been considered with respect to their potential to interact with resources/ receptors.

Potential impacts have each been classified in one of three categories:

- **No interaction**: where the Project is unlikely to interact with the resource/ receptor (e.g., wholly terrestrial Projects may have no interaction with the marine environment);
- **Interaction likely, but not likely to be significant**: where there is likely to be an interaction, but the resultant impact is unlikely to change baseline conditions in an appreciable/detectable way; and
- **Significant interaction**: where there is likely to be an interaction, and the resultant impact has a reasonable potential to cause a significant effect on the resource/receptor.

As a tool for conducting scoping, the various Project features and activities that could reasonably act as a source of impact were identified, and these have been listed down the vertical axis of **a Potential Interactions Matrix.** The resources/receptors relevant to the Baseline environment have been listed across the horizontal axis of the matrix.

Each resulting cell on the Potential Interactions Matrix thus represents a potential interaction between a Project feature/activity and a resource/ receptor.

4.2.1 Scoping Matrix

All environmental and social impacts and risks described in IFC's Performance Standards and E&S Guidelines have been considered for the interaction matrix. The Potential Interactions Matrix for Project activities and likely impacted resources/ receptors is presented in **Table 4.1**.

The interaction matrix has been colour coded to indicate those interactions that are relevant to the Project (coloured in black), possible (coloured in grey) or scoped-out (coloured in white). This ESIA report includes a discussion that presents the evidence base (e.g., past experience, documented data, etc.) used to justify the basis upon which this decision was made.

Interactions that are likely to lead to significant impacts are presented in **Table 4.2** and will be the focus of the impact assessment. Owing to site conditions there are certain possible interactions that will not take place. As a result these interactions have been "scoped out" and are presented in **Table 4.3**.

4.2.2 Cumulative Impacts

A cumulative impact is one that arises from a result of an impact from the Project interacting with impact from other similar activities to create an additional impact. It was observed during site reconnaissance survey, that the Project falls in Bhadla Solar Park and has many solar plants in 5 km

radius and many are in pipeline. Cumulative impacts will also be assessed and discussed in this report.

Table 4.1 Activity-Impact Interaction Matrix for Planning, Construction, Operation & Maintenance and Decommissioning Phases

Environmental and Social Resources/Receptors / Project Activity/ Hazards	Topography and Drainage	Land Environment	Land scape – Visual Impact	Soil Environment	Groundwater resources	Surface Water	Air Environment	Noise Environment	Terrestrial Ecology	Aquatic Ecology	Loss of land base livelihood	Employment Opportunity	Infrastructure and services	Occupational Health and safety	Community Health and safety
Pre-construction phase															
Land procurement		■													
Construction Phase															
Strengthening of access roads	▒	▒		▒			▒	▒	▒	▒				▒	
Site clearance and site preparation		▒		▒			▒	▒	▒					▒	
Transportation of construction materials				▒			▒	▒	▒					▒	
Mobilising and operating construction equipment, machinery and DG sets				▒			▒	▒	▒						
Transportation of solar modules and ancillary facilities							▒	▒	▒					▒	
Foundation excavation, piling and construction for solar mounts, site office, Transformer	▒		▒	▒			▒	▒	▒					▒	
Electrical cable laying and installation of PV module				▒					▒					▒	
Operation and Maintenance Phase															
Washing of solar modules					■				▒	▒				▒	
Grass cutting														▒	
Regular Inspection and Maintenance of equipment									▒					▒	
Decommissioning															
Removal of PV Modules									▒					▒	
Removal of ground mounted structures, ancillary facilities		▒	▒	▒			▒	▒	▒					▒	

□ = Represents “no” interactions is reasonably expected
▒ = Represents interactions reasonably possible but none of the outcome will lead to significant impacts
■ = Represents interactions reasonably possible with one of the outcomes leading to potential significant impact

Table 4.2 Identified interactions with potential significant impacts

S. No.	Interaction (between Project activity and Resource/Re ceptor)	Justification for Expectation of Potentially Significant Impacts
1	Changes in Land Use	Construction of temporary structures – stockyard etc., would lead to changes in the land use albeit for a short period; Clearing of vegetation for Project related activities; Installation of solar panels and other components, paving and widening of access roads, setting up site office will lead to permanent change in land use; and Restoration of solar plant site after Project cycle will reverse the land use to the original one.
2	Alteration of Topography and drainage	Analysis of the Project site as well as its surrounding area exhibits primarily flat terrain with slight undulation. Project activities (e.g., site development, construction of access roads) are likely to result in alteration in the topography and drainage of this area.
3	Impact on Soil / Land Environment	Vegetation clearance and construction can change the soil properties and negatively affect soil stability in the area; Vehicle movement can compact or erode soil further; Improper waste disposal can contaminate soil and groundwater; Storage and handling of hazardous waste (e.g. fuel and lubricant) and accidents/negligence leading to leaks and soil contamination; Generation of hazardous waste during operation of the Project e.g. small amounts of waste oil; and Restoration of site after Project life cycle.
4	Impact on Air Quality	Operation of D.G. sets, vehicular movement and construction activities can cause fugitive and point source emission.
5	Impact on Water Environment	Construction of the Project will require water from local sources to carry out its activities. Further, PV module cleaning will require large quantity of water. Therefore, there can be impact on surface/ground water resource. Surface and ground water quality can also be impacted due to improper waste disposal or leaks/spills and runoff.
6	Increased Ambient Noise Levels	Operation of construction equipment, machinery, piling, D.G. sets, vehicular movement and maintenance activities would increase the ambient noise levels. Local communities may be disturbed due to higher than anticipated noise.
7	Ecology	Few species of avifauna, reptiles, and mammals were identified. Limited desert flora was identified. Clearing of scrub habitat may lead to loss of habitats for the fauna. Electrocution risks may increase.
8	Demography (Influx and Displacement)	Majority of the workers/ labours hired during construction phase will be of local origin. The labour for the construction phase will primarily be recruited from the local community, the influx of population in the study area due to the Project is expected to be restricted to the skilled employees of CSP Bhadla and its contractors. Project
9	Local Economy and Employment	The Project will provide employment and business opportunities to locals during construction phase by hiring vehicles, local labours, providing contracts, etc. In operation phase also labour from local community will be hired for modules cleaning and labour.
10	Natural/Common Property Resources	No CPRs were observed or reported during community consultations near the Project land.
11	Land-based Livelihoods	The farm based activities comprise of agriculture, agricultural labour and livestock rearing.
12	Community Health & Safety	Community will be exposed to accidents that may occur due to transportation of heavy material for the Project through village roads. In addition, the level of interface that locals have with the migrant workers of the Project may determine spread of communicable diseases.
13	Labour and Human Rights	The internal policies of the developer, contractors and subcontractors will largely determine the labour and working conditions practiced in the Project throughout its lifecycle. However, the scale of impacts either positive or negative will be observed mainly during the construction stage when the number of workers engaged is the highest compared to other stages of the Project. Project
14	Cultural Heritage	No structures bearing cultural, historical, religious or spiritual significance were observed near the Project foot print.

Table 4.3 Scoped-out Interactions

SN.	Impact Title	Reason for Scoping-Out
1.	Impact on ambient air quality during operation phase	The power generation process will not have any air emissions. The site activities will be mainly scheduled maintenance work and cleaning of solar PV modules.
2.	Indigenous People	According to the Census records and consultations with the local community, the study areas do not report a significant presence of Scheduled Tribe population within the study area. No direct impacts on indigenous people are envisaged.
3.	Impact on cultural resources and heritage structures	No structures bearing cultural, historical, religious or spiritual significance were reported to be located within the vicinity of the Project. Community consultations and discussions with the site team of CSP (Bhadla) Pvt. Ltd. also confirmed that the Project would not impact any such structure.

5. BASELINE SETTINGS- ENVIRONMENT, ECOLOGY AND SOCIAL PARAMETERS

This section presents environment, ecological and socio economic baseline of the study area for the 100 MW solar power capacity of CSP Bhadla in Bhadla Solar Park, in district Jodhpur of Rajasthan, India. The Project footprint covers villages/ dhanis falling under Tehsil Phalodi of Jodhpur District.

5.1 Context

Baseline refers to the physical, biological, cultural and human conditions that will prevail in the absence of the Project, including interactions amongst them. Establishing baseline helps in understanding the prevailing environmental, ecological and socio-economic status of the study area. It provides requisite information of the biophysical and social environment for decision makers to take appropriate measures regarding the Project.

Establishing the baseline also provides the background environmental and social conditions for prediction of the future environmental characteristics of the area before setting up of the Project. It also helps in environmental and social management planning and provides a basis to finalize a strategy for minimizing any potential impact due on surrounding environment due to setting up of the Project.

This section establishes the baseline environmental, ecological and socio-economic status of the proposed solar power plant and surrounding area to provide a context within which the impacts of the Project are to be assessed.

5.2 Area of Influence

For the purpose of the baseline establishment and impact assessment, an Area of Influence (AoI) has been identified. This sub section provides an understanding of the AoI thus identified and the reasons for the same.

5.2.1 Study Area

The study area considered for ESIA, include an area within 5 km radius from farthest of WTGs. The study area of 5 km has been selected based on the location of Project site and its footprint, nature and spatial distribution of potential social and environmental impacts (based on similar type of Projects).

5.2.2 Project footprint Area

The Project Footprint is the area that may reasonably be expected to be physically touched by Project activities, across all phases. Fencing for the Project Site boundary is already done and hence it is not contiguous with the rest of the area. The Project Footprint for Project includes land used for the setting up the Solar PV's, transformer rooms, storage of materials, site office, access roads, and internal and external transmission lines.

5.2.3 Project Area of Influence

The effects of the Project and Project activities on a particular resource or receptor will have spatial (distance) and temporal (time) dimensions, the scale of which is dependent on a number of factors. These factors are incorporated in the definition of the Project's Area of Influence (AoI).

The AoI considered for the existing Project with respect to the environmental and social resources was based on the following reach of impacts:

- **Environmental parameters:** Project site boundary, immediate vicinity, access road and surroundings, i.e. a study area of approximately 5 km (hereafter referred to as the AoI) distance from Project line has been used to depict these parameters;
  - Air Quality: Dust emissions, fugitive dust- typically up to 100 m from operations and maintenance area;
  - Noise: Noise impact area (defined as the area over which an increase in environmental noise levels due to the Project can be detected) –typically 1 km from operations;
  - Land environment: The impacts on soil and land- typically up to 100 m from Project foot print area;
- **Ecological Environment (Terrestrial and Aquatic):** This includes: (a) the direct footprint of the Project comprising the solar plant; (b) The areas immediately adjacent to the Project footprint within which a zone of ecological disturbance is created through increased dust, human presence and Project related activities (e.g., trampling, transportation activities);
- **Social and Cultural:** the AoI for the Project is identified as the area within a 5 km radius from the Project footprint area. This is elaborated further in this section.

5.2.4 Core and Buffer Zone

This AoI is in turn, divided into a core and buffer zone. This division of the AoI into two zones is based on the understanding that the majority of the impacts from the Project (during the mobilization, construction, operations and decommission phase) would be contained within a 1 km radius from the Project Footprint in terms of spread and intensity, with the buffer zone appearing to have limited interaction with the Project.

5.2.5 Primary Baseline Data Collection

CEG Test House and Research Centre was engaged for collection of baseline information on ambient noise quality, ground water quality and traffic survey. Rapid ecological surveys and consultations were conducted to collect the information related to the biological environmental conditions of the study area.

Stakeholder consultations were carried out by ERM to collect information on socio-economic status of the study area. The primary baseline data was collected for various baseline components as detailed out in ***Table below.***

Table 5.1 Primary Baseline Data Collection

S. No.	Environmental Attribute	No. of Locations	Remarks
1.	Ground water	2	Ground water samples were collected from Pannu ki Nadi Dhani and Sardar Market within the AoI of the Project
2.	Noise	3	Noise monitoring locations were set up in the Project AoI, near Mathar Market, near site office of Ritis Meera Infra Energy, Karnanio ki Dhani Kunjal, and Pannu ki Nadi Dhani near the Bhadla Solar Park
3.	Flora and Fauna Survey of the study area to	Study area in 5 km radius	

S. No.	Environmental Attribute	No. of Locations	Remarks
	■ Identify endangered or protected or endemic floral species prevailing in the study area. ■ Identify any endemic fauna in the study area. ■ Identify vegetation cover and current status of natural habitats or species. ■ Identify and assessing ecological resources within the study area.		
4.	Traffic survey	Study area in 5 km radius	24 hrs Traffic survey was conducted on the Bap- Bhadla road

5.2.6 Secondary Baseline Data Collection

Secondary baseline data collection involved identifying and collecting available published material and documents. Information's on various environmental aspects like soil, geology, hydrogeology, hydrology, drainage pattern, ecology, meteorology, etc. Type of secondary data and their different sources is as given in ***Table 5.2.***

Table 5.2 Source of Secondary Data Collection

S. No.	Attribute	Source
1.	Long term meteorological data	■ India Meteorological Department (IMD) ■ District Statistical Handbook
2.	Geology, Hydrogeology and hydrology	■ District Resource Map ■ Geological Survey of India ■ Central Ground Water Board
3.	Land Use	■ Satellite Imagery
4.	Flora and Fauna	■ Department of Forest, Rajasthan
5.	Natural Hazards	■ Building Material and Technology Promotion Council of India (BMTPC) ■ India Meteorological Department (IMD)

5.3 Physical Environment

A brief description of the existing physical environment within the Project site is detailed in this section.

5.3.1 Land use and Land cover

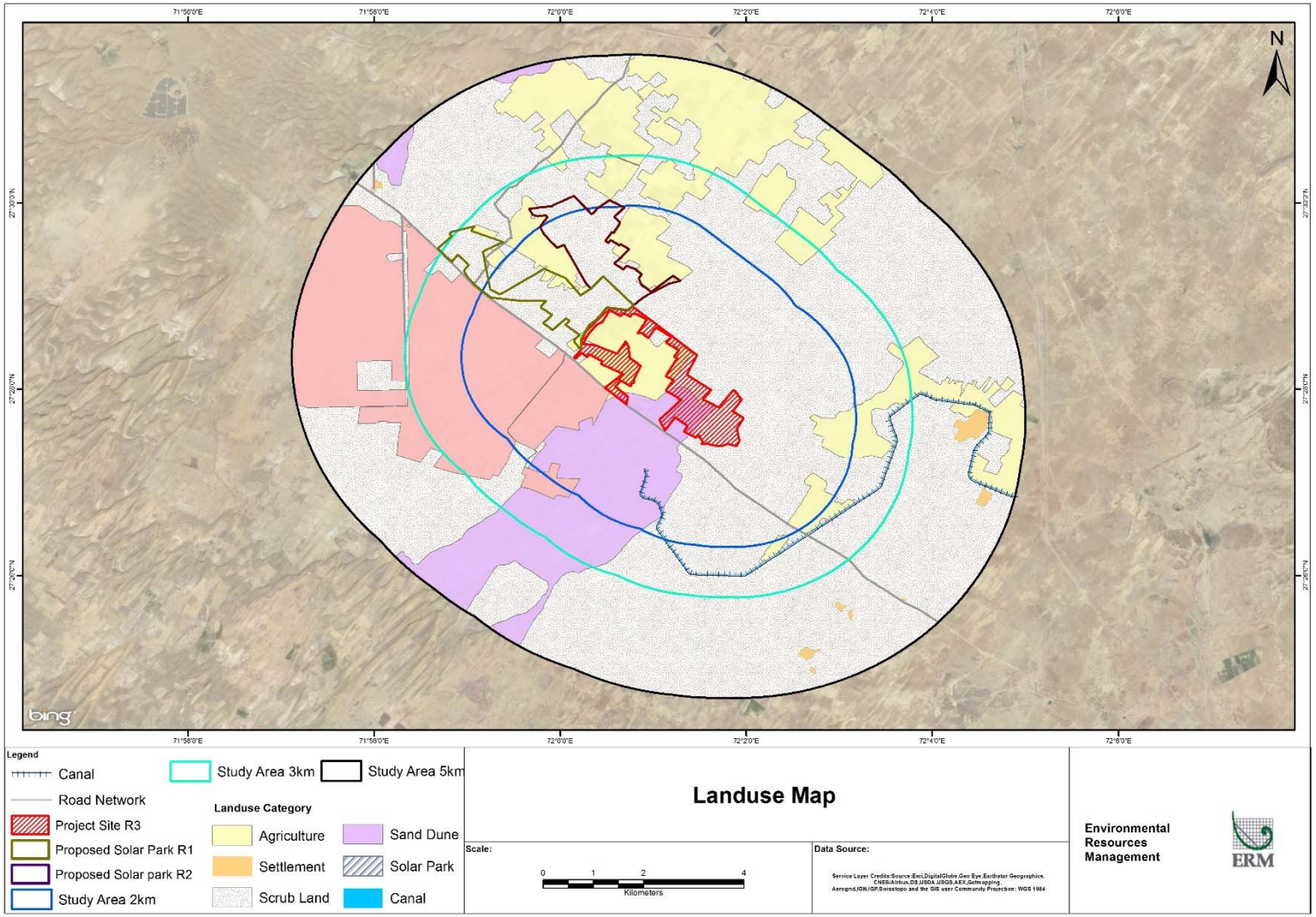
Land use/ cover inventories are an essential component in land resource evaluation and environmental studies due to the changing nature of land use patterns in the AoI especially for any water bodies etc. During site visit to the Project site it was observed that, the Project area mainly consist of scrub land.

Scrub land constitutes ~ 79.69% of the total area followed by agricultural land (~18.97%) and solar park (~ 16.78%). Settlements constituted lowest i.e. 0.42 % of the total area. The land use statistics of the Project AoI has been elaborated upon in **Table 5.3** and a map highlighting the same has been presented in **Figure 5.1**.

Table 5.3 Land use break up

Land Use Category	Area in Sq km	Percentage
Agriculture	18.97	14.97%
Canal	0.12	0.10%
Road Network	0.14	0.11%
Sand Dunes	10.57	8.35%
Scrub Land	79.69	62.90%
Settlement	0.42	0.33%
Solar Park	16.78	13.24%
	126.70	100.00%

Figure 5.1 Land use within Project AOI



5.3.2 Topography

The topography of the Project site is moderately undulating with elevation ranging from 181 to 205 m above mean sea level (amsl). The slope of site is towards south east. The Digital Elevation Map (DEM) as well as the contour map of the study area is presented in **Figure 5.2** and **Figure 5.3** respectively.

Figure 5.2 Digital elevation map of the study area

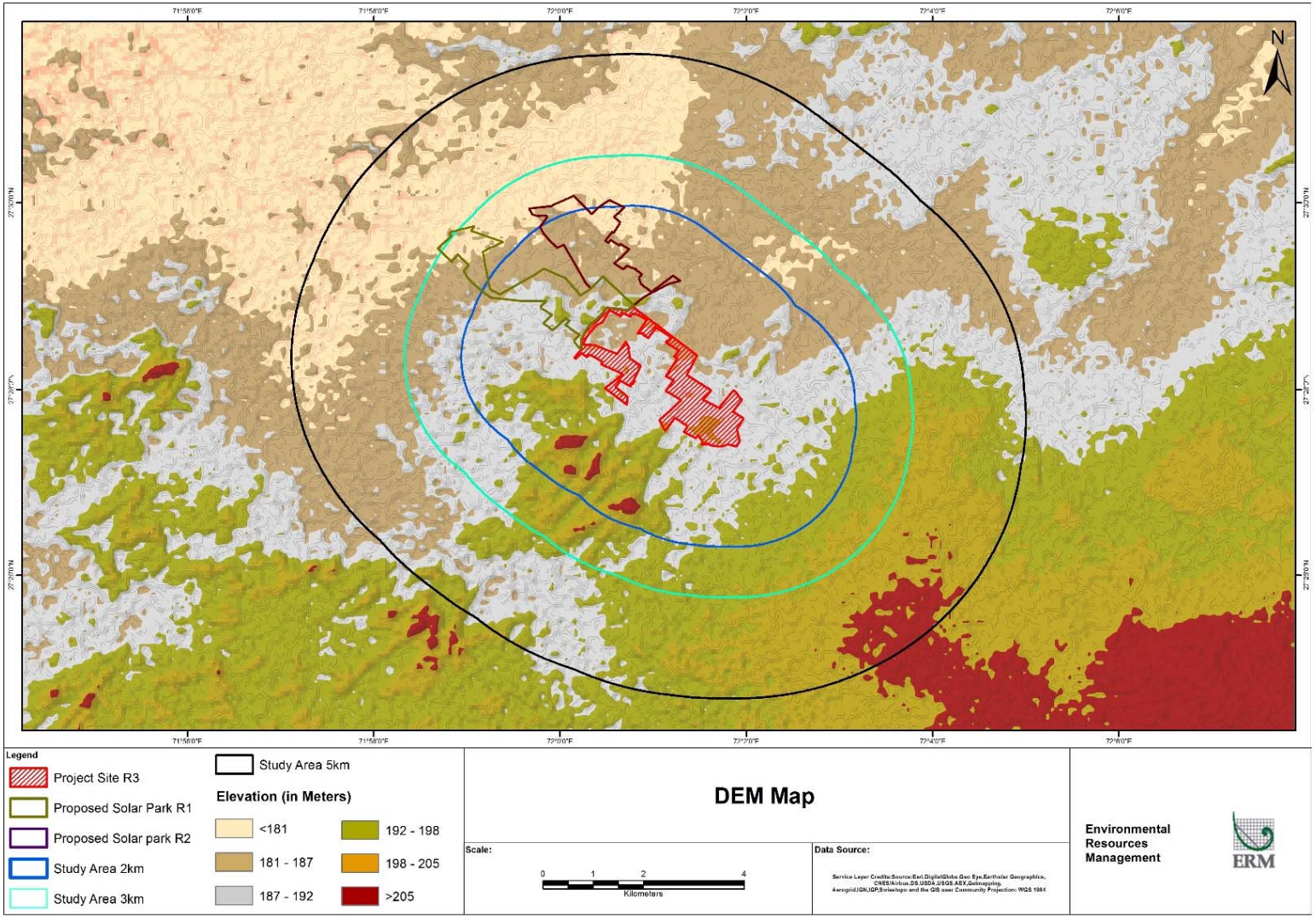
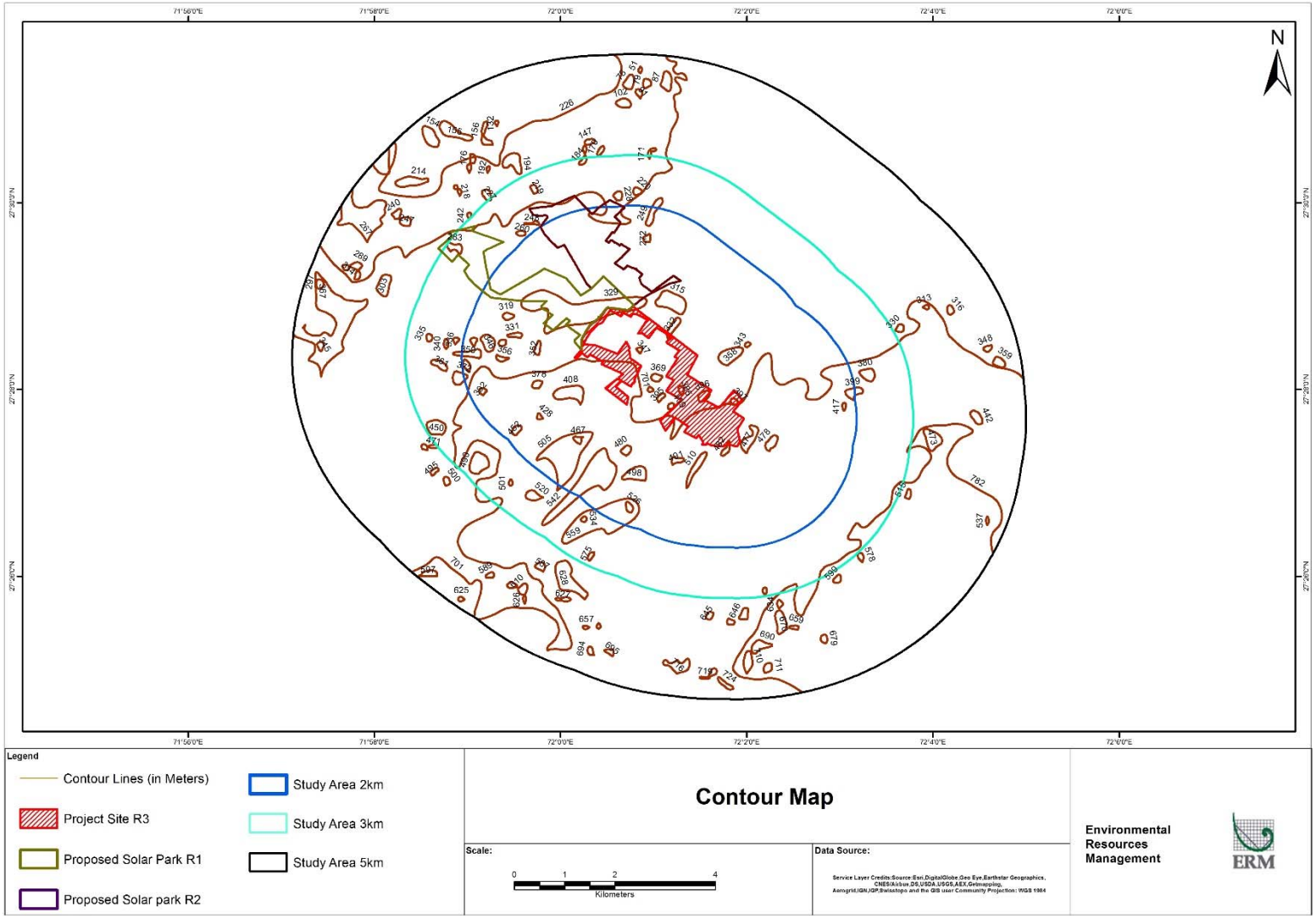


Figure 5.3 Contour Map of the Project Study Area



5.3.3 Geology

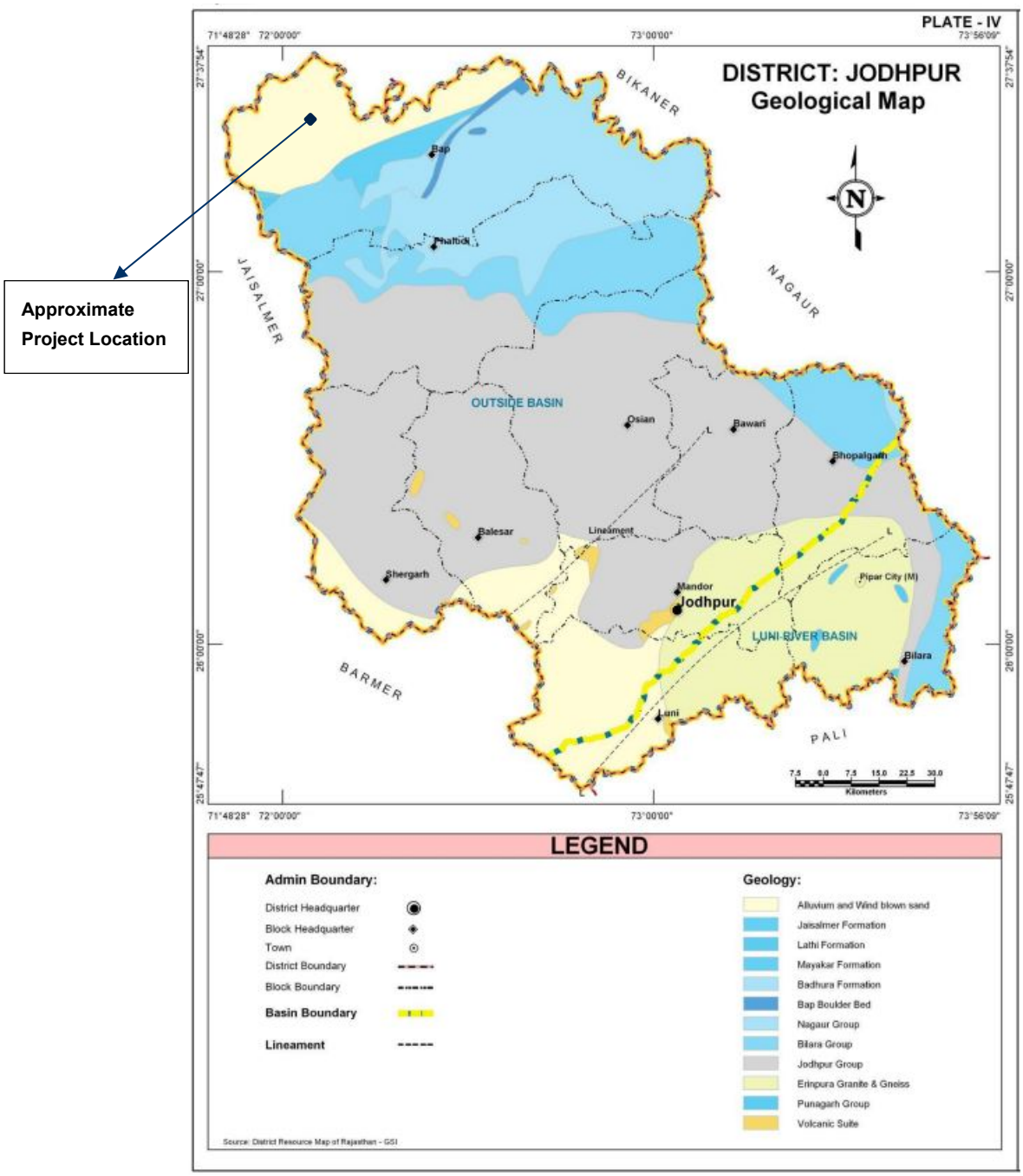
Based on information that is reported in the Hydrogeological Atlas of Rajasthan, Jodhpur district, by the Ground Water Department, Rajasthan (2013), the geological configuration of the district is represented by rocks ranging from Pre-Cambrian to Recent age. The regional geological set up indicates that the older rocks of Delhi Super Group represented by Punagarh Group include basic volcanics whereas of the Marwar Super Group, present in major part of the district is represented by Jodhpur-Bilara and Nagaur Groups. The igneous phase is represented by Erinpura Granites and Gneisses. The Palaezoic Era is represented by sandstone (Badhura formation and Bap boulder beds) of Permo-Carboniferous System. The Jurassic Era is represented by Lathi, Mayeker and Jaisalmer formations, which consist of Sandstone, Grit and Conglomerate. Alluvium and wind-blown sand cover large parts of the district. The district is traversed by major lineaments: Jaisalmer Barwani lineaments trending NW-SE, Luni- Sukri lineament trending North East-South West.

The major rock types found in the district include, but are not limited to the following types:

- Sandstone
- Shale
- Gypsum
- Limestone
- Siltstone
- Granite
- Gneiss
- Phyllite

The map below shows the geology of the district:

Figure 5.4 Geological Map of Jodhpur District



Source: Hydrogeological Atlas of Rajasthan Jodhpur District

5.3.4 Water Quality

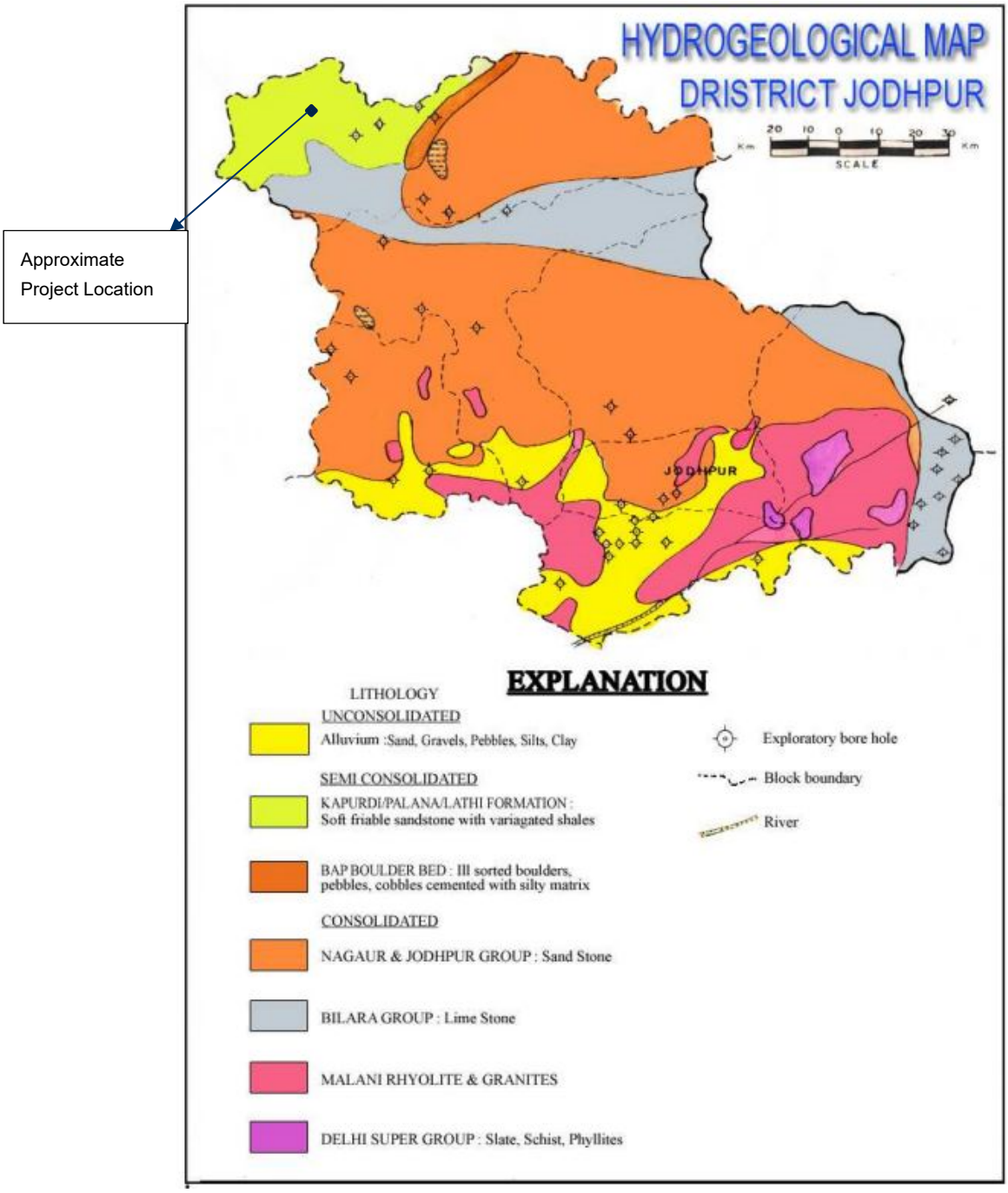
Drainage and Surface water resources

Jodhpur district falls in the Luni & Barmer Basins. Major River of the district is Luni, which flows in ENE – WSW direction. At the time of the ERM visit, no surface water body was found within the AoI of the Project. There is no surface water body within the AoI of the Project. Indira Gandhi canal, which is one of the longest canal in India, is located at approximately 10 km from the proposed Project site.

Project Hydrogeology

Ground water occurs under unconfined to semi-confined conditions in rocks of Delhi Super Group, Jodhpur sandstone, Bilara limestone, Nagaur sandstone, Lathi sandstone and unconsolidated sediments (valley fills and alluvium). These form the chief source of ground water in the district. Confined condition is also met sometimes at deeper levels in the north western part of the district. Bap boulder bed occurs in narrow stretch in northern part of the district having NE-SW extension. It consists of ill-sorted boulders, pebbles, cobbles embedded in silty matrix. Ground water occurs under unconfined condition. The hydrogeology map of Jodhpur district is shown below in Figure below.

Figure 5.5 Hydrogeology map of Jodhpur with Project site



Source: *Central Ground Water Brochure, Jodhpur District, 2013*

http://cgwb.gov.in/District_Profile/Rajasthan/Jodhpur.pdf assessed on 15th March 2019

Delhi Super Group: Rocks comprising of schists, phyllites, slates and quartzites form aquifer in isolated patches in small area in south-eastern part of the district. These patches occur within the granitic terrain. These generally form poor aquifer. Ground water occurs under unconfined condition in weathered mantle and fractured zone.

Granites and Rhyolites: Granites and rhyolites covering a vast area in the southern part of the district, form poor aquifers. Ground water occurs under unconfined conditions in secondary spaces in weathered and fractured zones.

Jodhpur and Nagaur Sandstone: Jodhpur and Nagaur sandstones form aquifer over a large area in central and northern parts of the district. These cover maximum area among all aquifers. These are generally hard and compact layered rocks with intermittent shale and clay layers. Softer and friable sandstone layers and patches do occur in these formations making it a good yielding aquifer tapped by open wells and bore wells.

Bilara limestone: Bilara limestone is the most potential aquifer in the district. The limestone exposures are found between Khawaspura & Bilara in eastern part of the district and between Phalodi & Chadi in northern part. Siliceous and cherty limestone and dolomites with association of shale beds are quite common.

Bap boulder bed: Bap boulder bed occurs in narrow stretch in northern part of the district having NE-SW extension. It consists of ill-sorted boulders, pebbles, cobbles embedded in silty matrix. Ground water occurs under unconfined condition.

Paleocene and associated formation: Semi-consolidated formations comprising of soft, friable sandstone, grit and conglomerate ranging from Permian to Paleocene age form aquifer in extreme north- western part of the district. There is association of varying amount of shales and clays with the above sediments, which causes great variation in the yield of wells.

Unconsolidated sediments: The unconsolidated Quaternary sediments comprising of alluvium, valley fills and aeolian sands form important aquifers in some parts of the district mainly in Shergarh, Luni and Bilara blocks. In major part of the area, these sediments occur as thin blanket over the older sediments but in certain areas, they are upto 70 m thick and as such form aquifers.

Groundwater Resources

As per the information provided by CGWB in the groundwater brochure for Jodhpur district (2013), the overall stage of ground water development of the district is 208%. The stage of ground water development of Phalodi tehsil, where the study area falls is reported to be 104.09 % and marked as **Over Exploited**.

According to the study undertaken by CGWB for Jodhpur district in 2013, depth to water level in the district generally ranges from less than 1m to more than 100 m below ground level (mbgl). Furthermore, the depth to water level in the district ranges from 0.01 to 82.51 m bgl and 0.01 to 114.9 m bgl during pre-monsoon (May) and post monsoon (November), respectively.

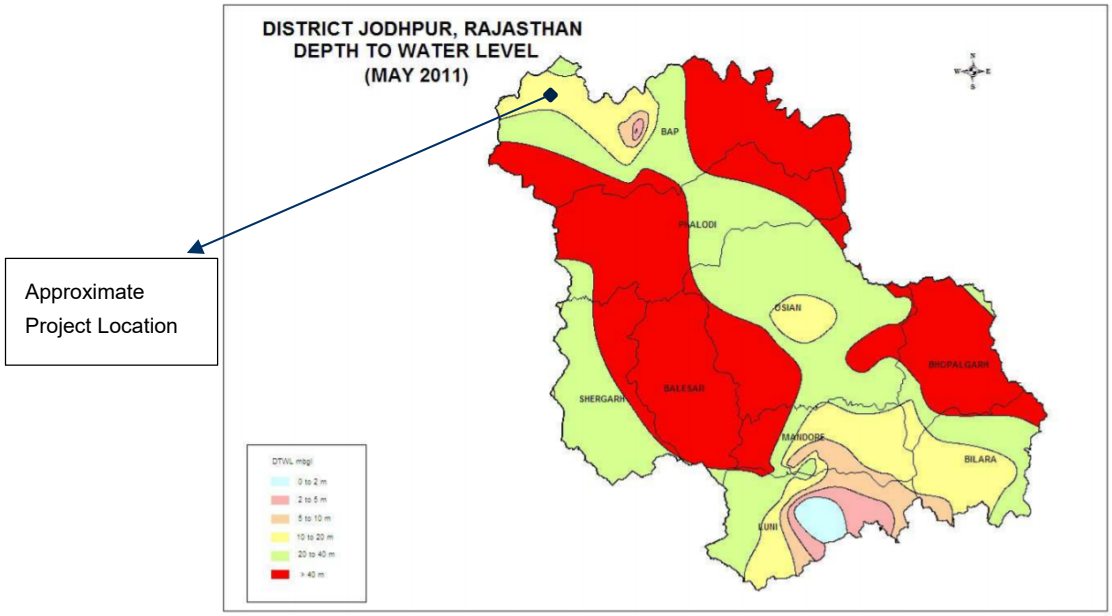
During Pre-monsoon, depth to water level in major part of the district varied from 20 m to more than 40 m bgl except for parts of Luni, Mandore, Bilara, Osian, Bhopalgarh and Bap blocks where shallower water levels upto 20 m bgl were observed. Whereas during Post-monsoon, shallow water level upto 20 m bgl has been observed in western half of Bap, central part of Osian, southern part of Balesar, southern and eastern parts of Mandore and major parts of 9 Luni and Bilara blocks. Water levels in the remaining areas have been found to be 20 to more than 40 m bgl.

Depth to water level for Pre-monsoon and Post Monsoon in Jodhpur district is as presented in **Figure 5.6** and **Figure 5.7** respectively.

Depth to Water level

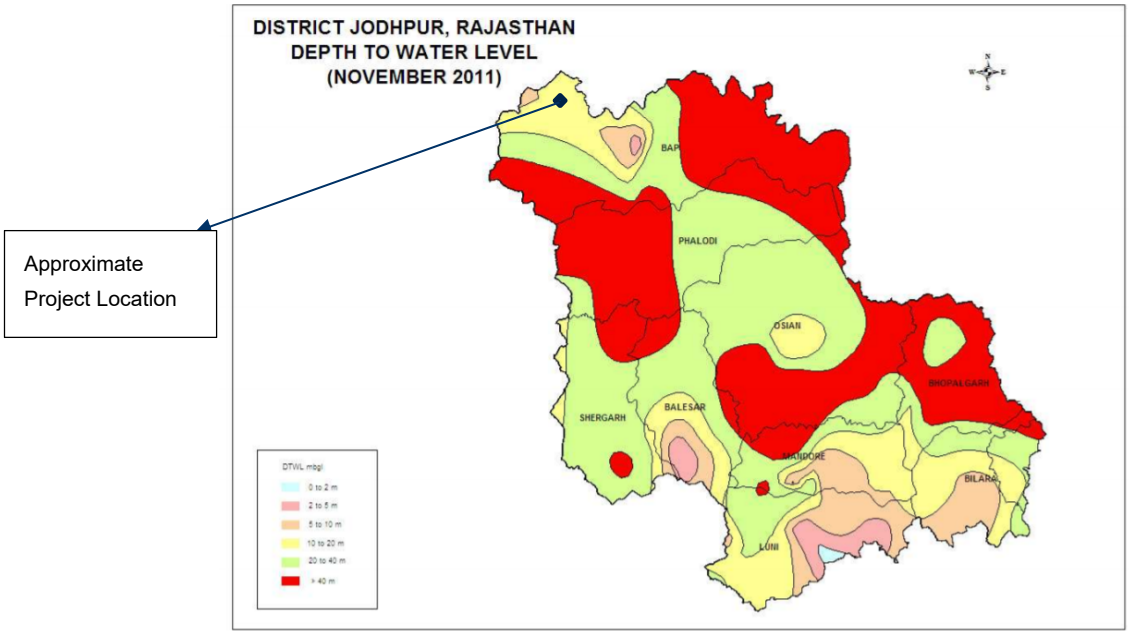
As per district groundwater brochure of Jodhpur (2013), depth to water level in the district generally ranges from less than 1m to more than 100 m below ground level (mbgl). It varied from and 0.01 to 82.51 m during pre-monsoon (May, 2011). Depth to water level in major part of the district varied from 20 m to more than 40 m bgl except for parts of Luni, Mandore, Bilara, Osian, Bhopalgarh and Bap blocks where shallower water levels upto 20 m bgl were observed.

Figure 5.6 Depth to Water Level in Jodhpur District in Pre Monsoon (May-2011)



Source: Central Ground Water Brochure, Jodhpur District, 2013

Figure 5.7 Depth to Water Level in Jodhpur District in Post Monsoon (Nov-2011)

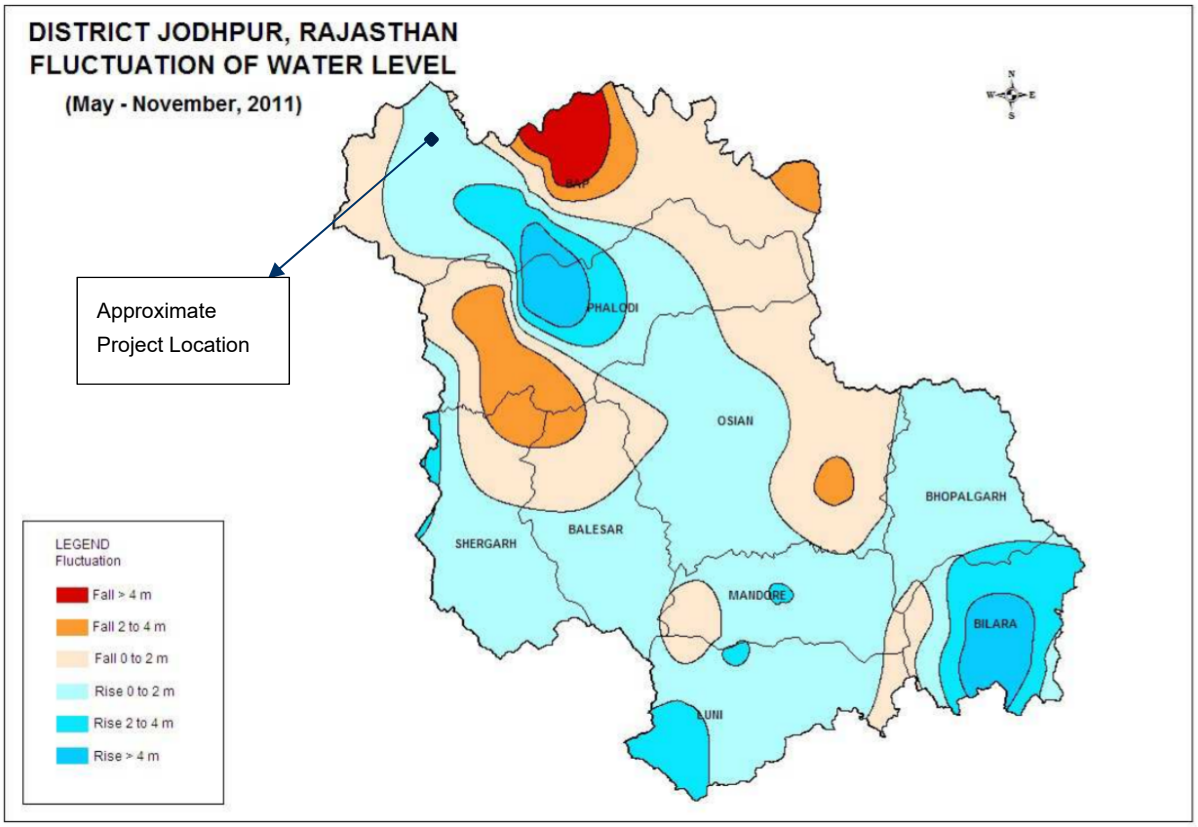


Source: Central Ground Water Brochure, Jodhpur District, 2013

Water level fluctuations

Analysis of Pre- and Post-monsoon water level data of 2011 (May and November) indicates that there has been rise of upto 2 m in major part of the district. Rise of 2 to 4 m has been noticed in parts of **Phalodi**, Luni, Mandore and Bilara blocks and that of more than 4 m has been noticed from isolated pockets in **Phalodi** and Bilara blocks. Decline in ground water levels of upto 2 m has been observed in along the western boundary and eastern half of **Bap**, western and eastern parts of **Phalodi**, eastern half of Osian, northern parts of Balesar and Shergarh and small pockets in Mandore, Luni, Bhopalgarh and Bilara blocks.

Figure 5.8 Seasonal Water Level Fluctuation (Pre & Post Monsoon), 2011



Source: Government of India. Ministry of Water Resources. Central Ground Water Board. District Groundwater Brochure, Groundwater Scenario Jodhpur District, Rajasthan, 2013

Groundwater Quality Sampling

Ground water samples were collected from various points within the Project area of influence and assessed against the CPCB water quality criteria[1]. The sampling locations for this study are discussed below.

[1] Guide Manual: Water And Wastewater Analysis, CPCB, 2012; http://www.cpcb.nic.in/Water_Quality_Criteria.php

Figure 5.9 Map showing monitoring locations

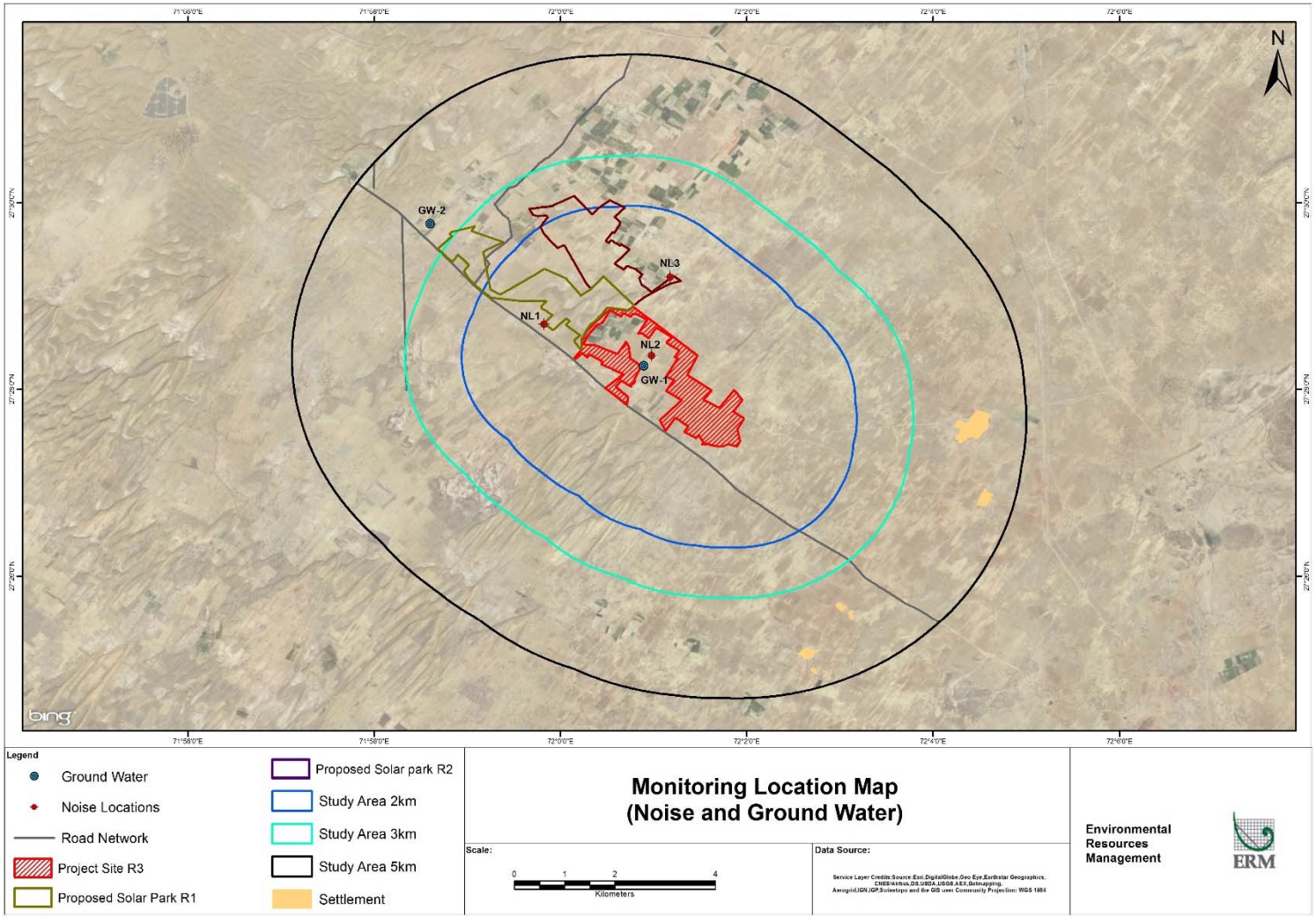


Table 5.4 Primary Monitoring Location for Water Quality

Location Code	Location	Selection Criteria
GW-1	Pannu Ki Nadi	Understanding the existing ground water quality in the nearby habitation and assess any impact on ground water quality due to proposed Project
GW-2	Sardar market	

Table 5.5 Water Analysis in the Study Area

SL No.	Parameter	Unit	GW-1	GW-2	Specification as per IS 10500:2012		Test Method
					Desirable	Permissible	
1.	pH Value	-	7.87	7.83	6.5- 8.5	No relaxation	IS:3025(Part 11)
2.	Temperature	˚C	24.7	24.8	Not specified	Not specified	IS:3025 (Part-9)-1984, RA 2006
3.	Turbidity	NTU	<1.0	< 1.0	1	5	IS:3025(Part 10)
4.	Electrical Conductivity	µs/cm	4400.0	5010	Not specified	Not specified	IS:3025 (Part-14)- 1984, RA 2013
5.	Colour	Hazen	<1.0	< 1.0	5	15	IS:3025(Part 4)
6.	Total Hardness	mg/L	660.0	670.0	200	600	IS:3025(Part 21)
7.	Total Alkalinity	mg/L	359.79	335.67	200	600	IS:3025(Part 23)
8.	Total Dissolved Solids	mg/L	2130.0	2310.0	500	2000	IS:3025(Part 16)
9.	Salinity	PSU	0.878	0.891	Not specified	Not specified	APHA 3rd Edition 2017
10.	Dissolved Oxygen (DO)	mg/L	7.2	7.4	Not specified	Not specified	IS:3025 (Part-38)- 1989, RA 2014
11.	BOD	mg/L	BDL (DL 2.0)	BDL (DL 2.0)	Not specified	Not specified	IS:3025 (Part-44)- 1993, RA 2014
12.	COD	mg/L	BDL (DL 2.0)	BDL (DL 2.0)	Not specified	Not specified	IS:3025 (Part-58)- 2006, RA 2012

SL No.	Parameter	Unit	GW-1	GW-2	Specification as per IS 10500:2012		Test Method
					Desirable	Permissible	
13.	Chloride	mg/L	486.37	493.32	250	1000	IS:3025 (Part-32)- 1988, RA 2014
14.	Calcium (as Ca)	mg/L	123.44	149.09	75	200	IS:3025(Part 40)
15.	Magnesium (as Mg)	mg/L	87.71	72.56	30	100	IS:3025(Part 46)
16.	Sulphate	mg/L	650.82	672.92	200	400	IS:3025(Part 24)
17.	Fluoride (as F)	mg/L	1.3	1.3	1.0	1.5	IS:3025(Part 60)
18.	Nitrate	mg/L	19.30	25.56	45	No relaxation	IS:3025(Part 34)
19.	Phenolic Compound	mg/L	ND (DL 0.005)	ND (DL 0.005)	0.001	0.002	IS:3025(Part 43)
20.	Phosphate	mg/L	2.82	2.70	Not specified	Not specified	IS:3025(Part 31)
21.	Arsenic (as As)	mg/L	ND (0.005)	ND (0.005)	0.01	0.05	IS:3025(Part 37)
22.	Cadmium (as Cd)	mg/L	ND (0.001)	ND (0.001)	0.003	No relaxation	IS:3025(Part 41)
23.	Mercury (as Hg)	mg/L	ND (0.005)	ND (0.005)	0.001	No relaxation	IS:3025(Part 48)
24.	Nickel (as Ni)	mg/L	ND (0.005)	ND (0.005)	0.02	No relaxation	IS:3025(Part 54)
25.	Manganese (as Mn)	mg/L	ND (0.005)	ND (0.005)	0.1	0.3	IS:3025(Part 59)
26.	Lead (as Pb)	mg/L	ND (0.005)	ND (0.005)	0.01	No relaxation	IS:3025(Part 47)
27.	Iron (as Fe)	mg/L	ND (DL 0.1)	ND (DL 0.1)	0.3	No relaxation	IS:3025(Part 53)
28.	Copper (as Cu)	mg/L	ND (DL 0.005)	ND (DL 0.005)	0.05	1.5	IS:3025(Part 42)

SL No.	Parameter	Unit	GW-1	GW-2	Specification as per IS 10500:2012		Test Method
					Desirable	Permissible	
29.	Zinc (as Zn)	mg/L	ND (DL 0.005)	0.03	5	15	IS:3025(Part 49)
30.	Total Coliform	Per 100 ml	Present	Absent	Absent	-	IS 1622:1981 (RA 2009)
31.	Faecal Coliform	Per 100 ml	Present	Absent	Absent	-	IS 1622:1981 (RA 2009)

Source: Primary monitoring, 2019

ND=Not Detected; **BDL**=Below Detection Limit; **DL**= Detection Limit; **BLQ**=Below Limit of Quantification; **LOQ**= Limit of Quantification.

Based on the baseline monitoring results obtained, the following observations were made:

- pH of the groundwater samples were found to be 7.87 & 7.83, which are in in compliance with the IS 10500 standard of 6.5 to 8.5;
- Total dissolved solids of both the samples were found exceeding the desirable limit of 500 mg/L, as well as permissible limit of 2000 mg/L as stipulated in IS 10500 standards;
- Hardness of water is considered to be an important factor to determine the portability and its domestic usage particularly for washing. Total hardness of water is correlated to the presence of bivalent metallic ions *viz*. calcium and magnesium. Total hardness values in the groundwater samples were found to 660 mg/l & 670 mg/l and exceeded both the acceptable i.e. 200 mg/l, and the permissible limits of IS 10500 600 mg/l;
- Total Alkalinity values of the ground water samples were found to be 359.79 mg/l and 335.67 mg/l and was found to exceed the acceptable limit (200 mg/l) of IS 10500 (600 mg/l);
- Concentration of fluoride in groundwater samples were found to be 1.3 mg/l and were found to exceed the desirable limit of 1.0mg/l but is within the permissible limit of 1.5 mg/l of IS 10500;
- Concentration of magnesium in ground water sample was found to be 87.71 mg/l and 72.56mg/l and exceeds the acceptable limit of 30 mg/l, but falls within the permissible limit of 100 mg/l of IS 10500;
- Concentration of toxic substances such as cadmium, lead, mercury, molybdenum, nickel, arsenic and chromium were found to be below the detectable limit while no presence of cyanide was obtained;
- The total coliform & faecal coliforms were found present in the one of the groundwater samples was which exceeds both the acceptable and permissible limits as specified by IS 10500.

5.3.5 Ambient Noise Quality

Noise levels were recorded at 3 locations once during the study period with the aid of a digital noise level meter. Noise levels were recorded for 24 hours and the noise quality has been reported as L_{eqday} and $L_{eqnight}$ for each of the locations. Daytime is considered from 0600 to 2200 hours and night from 2200 to 0600 hours.

The details of noise monitoring locations are given in **Table 5.6**. The noise level in the study area is detailed in **Table 5.7**. A map of the noise monitoring locations has been presented in **Figure 5.10**.

Table 5.6 Details of Noise Monitoring locations

Sr. No.	Location code	Location	Remarks
1	NL1	Mather Market	Samples were analysed to obtain an understanding of the existing ambient noise conditions within the Project AoI and assess any added impacts that may be caused due to Project activities.
2	NL2	Pannu ki Nadi	
3	NL3	Kujal ki Dhani	

Figure 5.10 Map showing noise monitoring locations

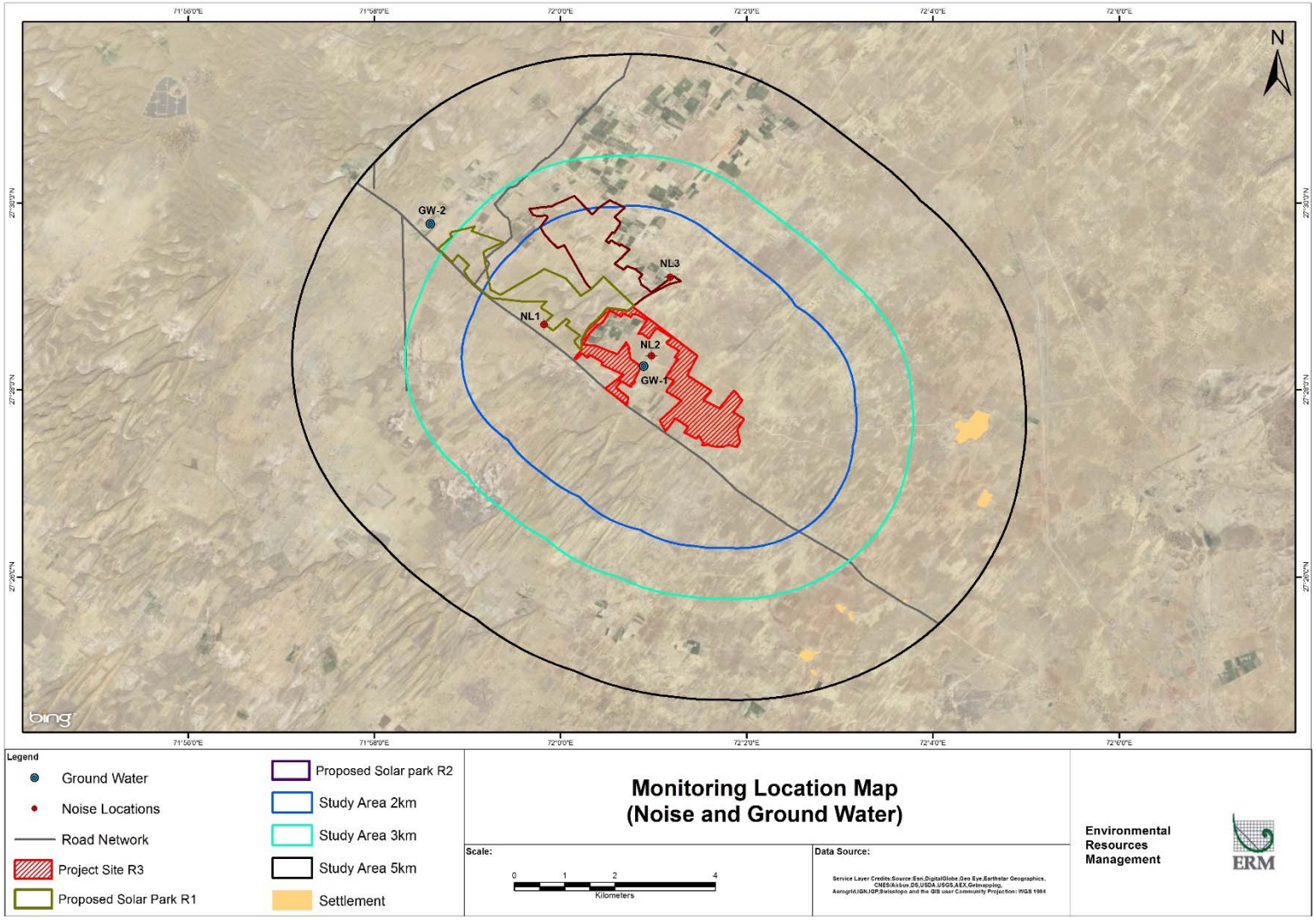


Table 5.7 Noise Level in the Study area

Sr. No.	Location	Equivalent Noise Levels Day Time & Night Time (dBA)				CPCB and WHO limits* Leq day	CPCB and WHO limits* Leq night
		Leq day	Lmax	Lmin	Leq night		
1	Mather Market	64.1	71.0	31.6	58.6	65-Commercial Area	55-Commercial Area
2	Pannu ki Nadi	53.7	65.4	33.1	41.3	55- Residential Area	45- Residential Area
3	Kujal ki Dhani	49.9	58.8	30.3	36.4	55- Residential Area	45- Residential Area

* Note: As per CPCB, Day time is considered from 6 am to 10 pm and night time is considered from 10 pm to 6am;

As per WHO limits, Day time is considered from 7 am to 10 pm and night time is considered from 10 pm to 7 am

Interpretation of noise monitoring results

The observations from noise monitoring at 3 locations in the study area indicate the following:

- The L_{eq} values for day for NL1 were observed to be within the commercial area limit of 65 dB(A), however exceeds the night time limit of 55 dB (A) at the Mather market, near the site office of Ritis Meera Infra Energy where sampling was carried out. This may be attributed to higher vehicular movement and other commercial activities in that area.
- The L_{eq} values for day and night for NL2 were observed to be within the residential area limit of 55 dB(A) and 45 dB (A) near the habitation (Dhani), Pannu ki nadi where sampling was carried out.
- The L_{eq} values for day and night for NL3 were observed to be within the residential area limit of 55 dB(A) and 45 dB (A) at the Dhani (Kujal Ki Dhani) where sampling was carried out.

5.3.6 Climate and Meteorology

As per the information provided by CGWB in the groundwater brochure for Jodhpur district (2013), the district of Jodhpur experiences arid to semi-arid type of climate. Mean annual rainfall of the district is 363-374 mm with probability of annual rainfall exceeding 650 mm only 10%. However, there is 90% probability that the annual rainfall will be more than 190 mm. The probability of occurrence of mean annual rainfall is 45%. Rainy days are limited to maximum 15 in a year. Almost 80% of the total annual rainfall is received during the southwest monsoon, which enters the district in the first week of July and withdraws in the mid of September.

Drought analysis based on agriculture criteria indicates that the district is prone to mild and normal type of droughts. Occurrence of severe and very severe type of drought is very rare. As the district lies in the desert area, extremes of heat in summer and cold in winter are the characteristic of the desert. Both day and night temperatures increase gradually and reach their maximum in May and June respectively. The temperature varies from 49^{o}C in summer to 1^{o}C in winter. Atmosphere is generally dry except during the monsoon period. Humidity is the highest in August with mean daily relative humidity at 81%. The annual maximum potential evapotranspiration in the district is quite high and is highest (264.7 mm) in the month of May and lowest (76.5 mm) in the month of December.

Table 5.8 Average Monthly Rainfall and Temperature, Jodhpur

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	3	3	3	2	7	31	123	125	57	4	3	2
Temperature (ºC)	16.9	19.9	25.1	30.2	34.4	34.1	31.2	29.1	29.3	27.6	22.5	18.4

5.3.7 Traffic Monitoring

Traffic survey was conducted at the access road near the Bhadla solar park within the study area to assess the traffic scenario of the area. Detail of traffic survey locations is given in **Table 5.9** below.

Table 5.9 Description of Traffic Count Survey Location

Sampling Location	Distance & Direction w.r.t Project Site	Justification for Selection of Location
Near Bhadla Solar Park	Adjacent to the Project site	Access road to the Project site

The summarised results of the traffic survey are given in ***Tables 5.10*** *&* ***5.11.*** Refer **Annex D** for detail results of traffic survey.

Table 5.10 Existing Traffic (Motorised) Volumes in Study Area

Description	Access road
Total Traffic (Nos.)/24 Hours (To & fro)	2920
Average Traffic Flow/Hr	122
Max Traffic Flow (Nos)/Hr	327
Min Traffic Flow (Nos)/Hr	0
Max Traffic Flow (Time- hours)	10:00- 11:00 hrs
Min Traffic Flow (Time-hours)	1:00- 02:00 hrs

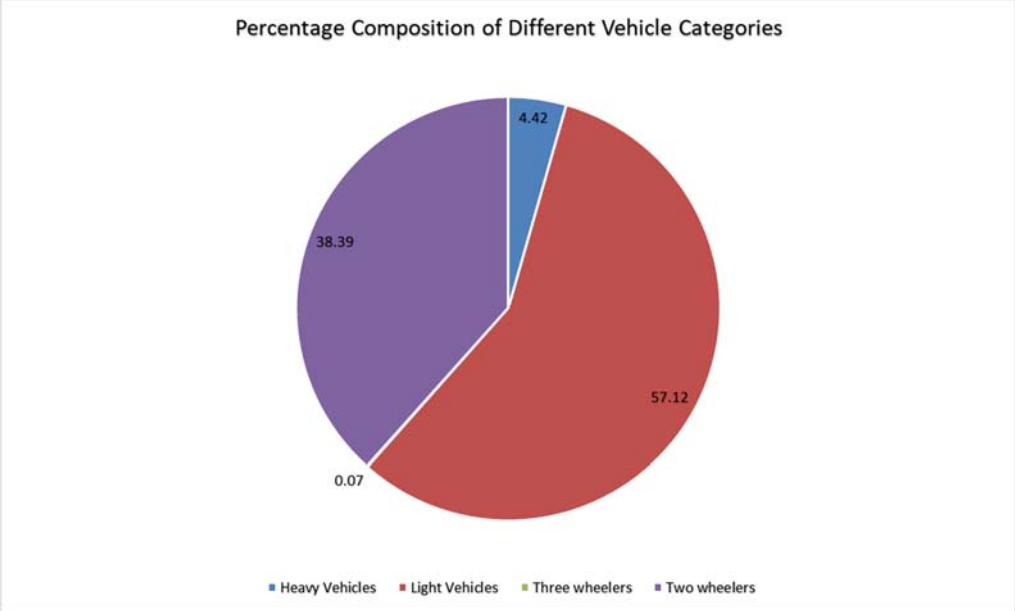
Table 5.11 Percentage Composition of Vehicles in Study Area

Location	Percentage Composition			
	Non-Motorised	Two/ Three Wheeler	LMV	HMV
Access road near Bhadla Solar Park	0	38.46%	57.12%	4.42%

Note: Non-Motorised includes cycles, rickshaws, bullock carts, horse carts; Two/Three wheelers include scooters, motorcycles, Mopeds and autos; Light motor vehicles (LMVs) include passenger cars, metadors, tractors, tempos, jeeps, van.; Heavy Motor Vehicles (HMVs) include buses, trucks, dumpers, tankers and trailers.

The percentage composition of different vehicle categories in the total traffic at monitored locations is shown in **Figure 5.11**.

Figure 5.11 Percentage Composition of Different Vehicles Categories



Light motor vehicles contribute to the maximum (more than 50%) of traffic on the roads followed by 2/3 wheelers vehicles and Heavy motor vehicles. No non-motorised vehicles were recorded on the access road.

5.3.8 Natural Hazards

Disaster Management, Relief & Civil Defence Department Rajasthan and Building Materials & Technology Promotion Council (BMTPC), Government of India, have published hazard maps of Rajasthan. As per these maps the study area falls under the respective hazard zones as given in **Table 5.12**. Hazard zonation maps of the state for earthquake, wind/cyclone, flood and drought, showing Project location, are presented in **Figure 5.12**, **Figure 5.13**, **Figure 5.14** and **Figure 5.15** respectively.

Table 5.12 Natural Hazard Details, Jodhpur

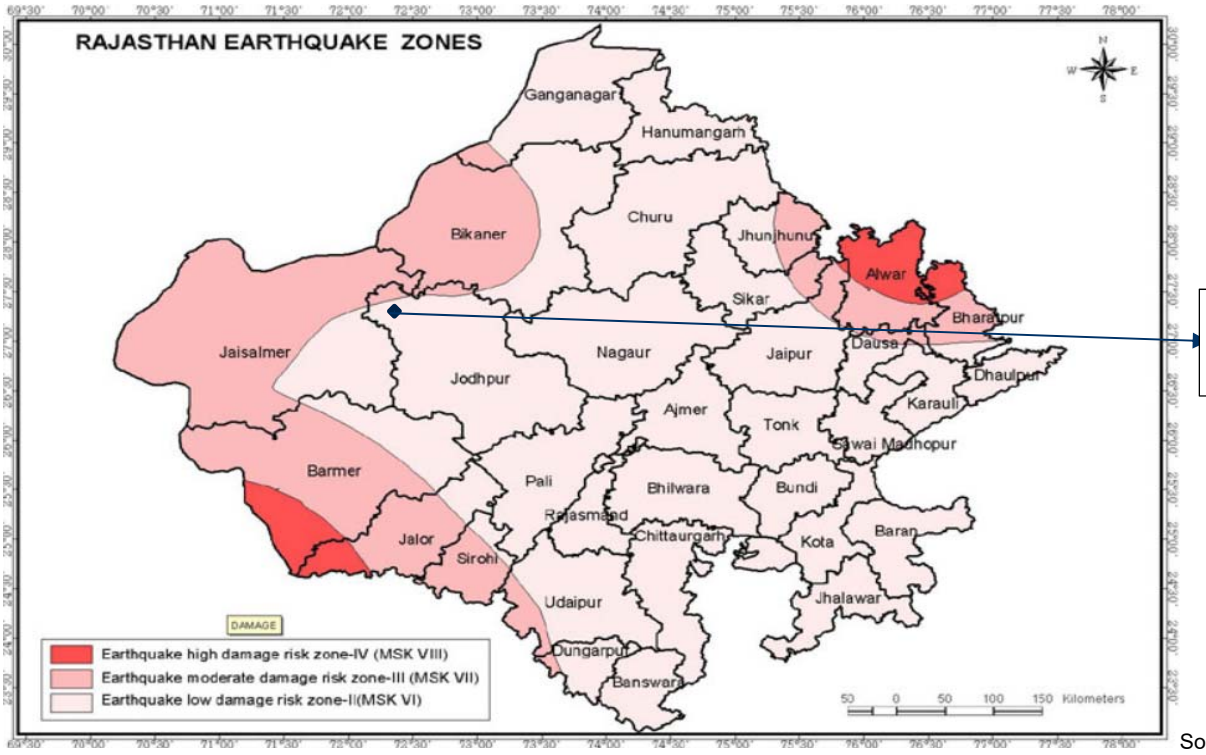
Characteristics	Details
Seismic	As per the data released by Building Materials & Technology Promotion Council (BMTPC) of Government of India and Disaster Management, Relief & Civil Defence Department of Government of Rajasthan[1], the Project is located in an area that is designated as Zone II that corresponds to MSK VI. This is classified as a low damage risk zone in terms of earthquake occurrence.
Wind/cyclone	As per the data released by Building Materials & Technology Promotion Council (BMTPC) of Government of India and Disaster Management, Relief & Civil Defence Department of Government of Rajasthan, the Project site is located in a an area that experiences high wind velocities Vb= 47 m/s and the zone is classified as high damage risk zone for cyclones.
Flood	As per the data released by Building Materials & Technology Promotion Council (BMTPC) of Government of India and Disaster Management, Relief & Civil Defence Department of Government of Rajasthan, the Project site falls in an area which is not prone to flooding incidents.

[1] Disaster Management, Relief & Civil Defence Department of Government of Rajasthan Link: http://www.dmrelief.rajasthan.gov.in/

Characteristics	Details
Drought	As per the data released by Disaster Management, Relief & Civil Defence Department of Government of Rajasthan, the Project site is located in an area where drought frequency is once in 3 years.

Source: Disaster Management, Relief & Civil Defence Department Rajasthan and Building Materials & Technology Promotion Council (BMTPC), Government of India.

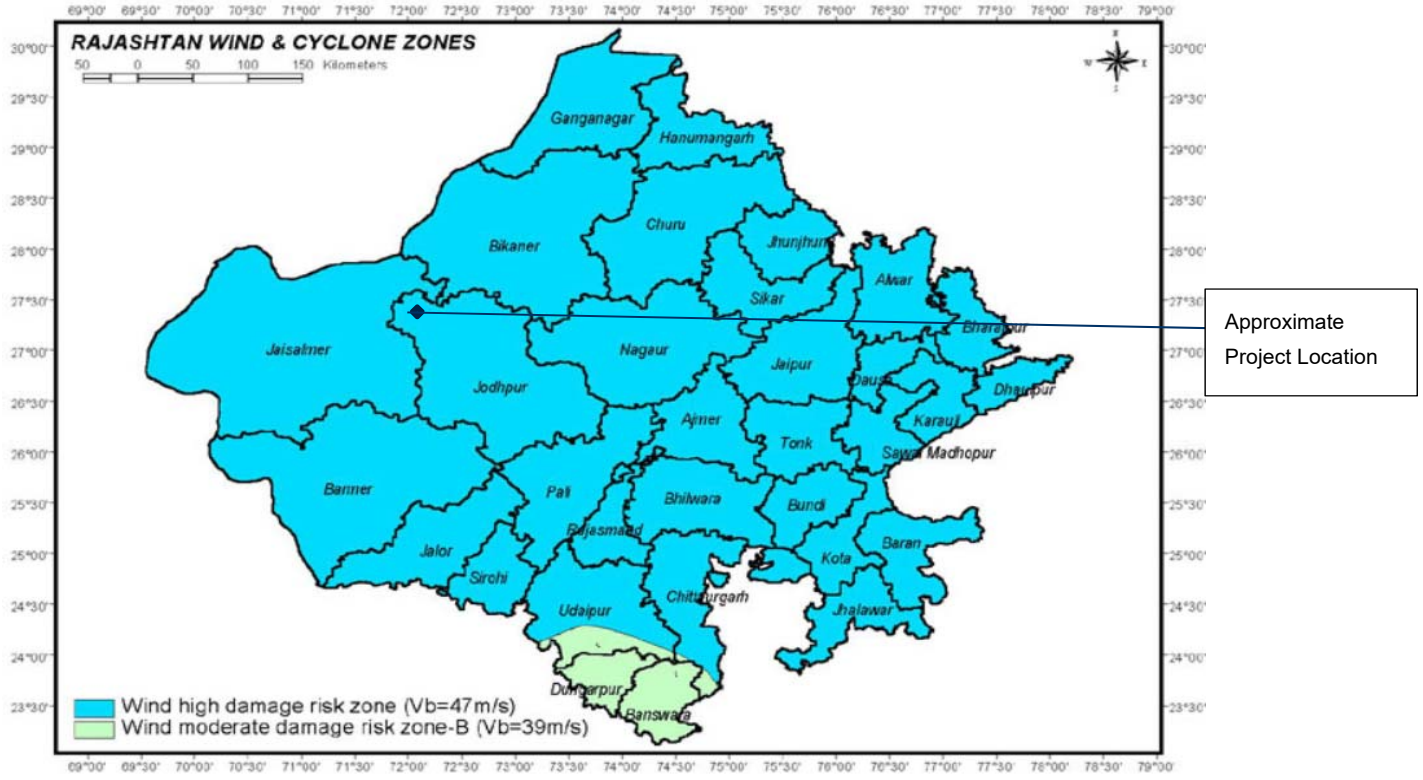
Figure 5.12 Map Showing Earthquake Zones in Rajasthan



Source:

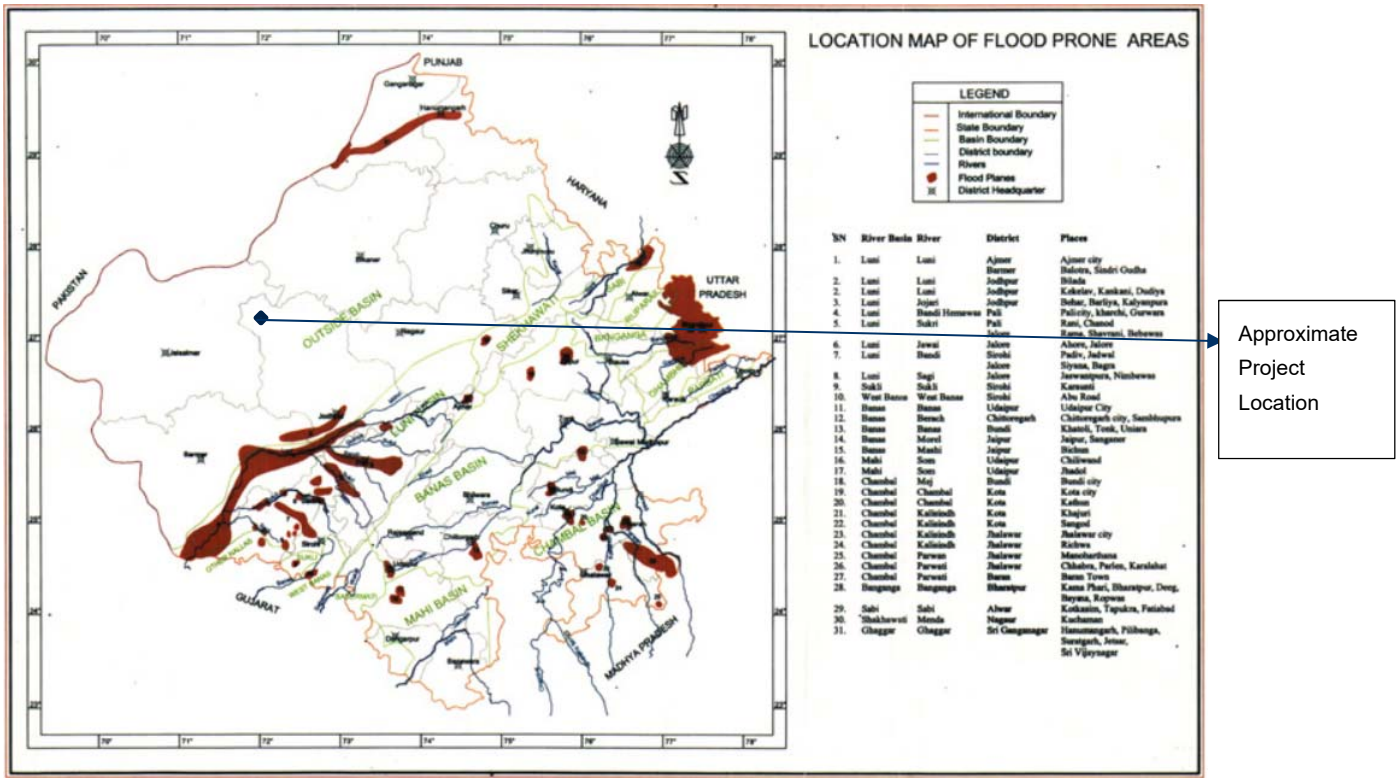
Source: *Disaster Management, Relief & Civil Defence Department, Government of Rajasthan*

Figure 5.13 Map Showing Wind and Cyclone Zones in Rajasthan



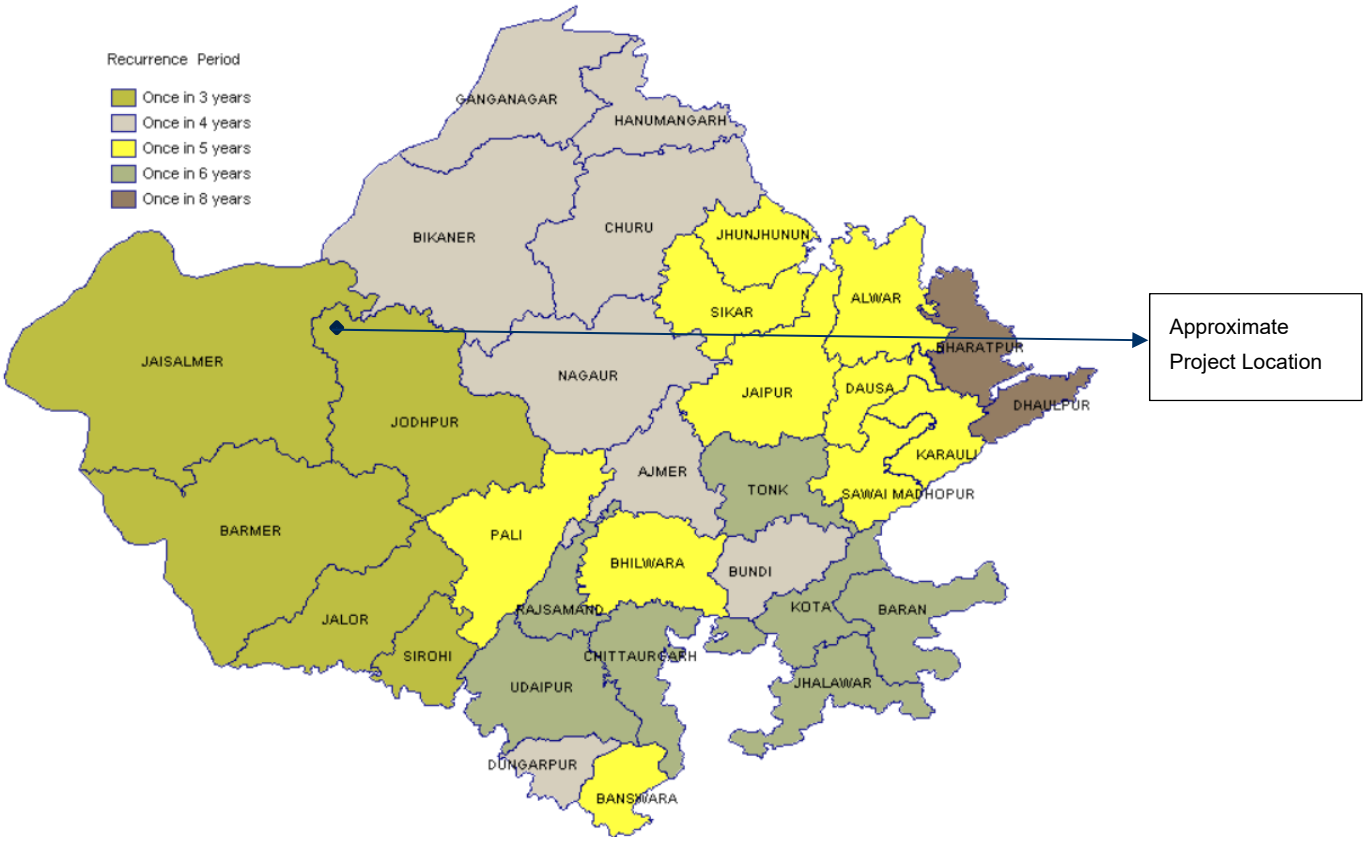
Source: *Disaster Management, Relief & Civil Defence Department, Government of Rajasthan*

Figure 5.14 Map showing Flood Prone Areas, Rajasthan



Source: *Disaster Management, Relief & Civil Defence Department, Government of Rajasthan*

Figure 5.15 Map Showing Drought Frequency in Rajasthan



Source: *Disaster Management, Relief & Civil Defence Department, Government of Rajasthan*

5.4 Ecological Baseline

An ecological survey was undertaken during second week of March 2019 at the 100 MW Solar Power Project Site of and surrounding areas located in Phalodi tehsil, Jodhpur district, Rajasthan. Badla region is located along the border of Jodhpur and Bikaner districts. The purpose of the survey was to establish an ecological baseline of the study area and to understand the impacts of the Project on species and habitats in the surrounding areas.

5.4.1 Objectives of the Ecological Study

The ecological surveys were conducted with following objectives:

Flora

- Identification of sensitive habitats, and forest land falling within the determined study areas (core + buffer zone);
- Classification of flora for any threatened, protected or endemic floral species prevailing in the study areas (including solar farm) based on field surveys;
- Identification of areas protected under international conventions, national or local legislation and those recognized nationally and internationally for their ecological, landscape, cultural or other related value; and
- Identification of aquatic flora in the water bodies falling in the study areas.

Fauna

- Identification of fauna (specifically amphibians, birds, mammals and reptiles) based on direct sightings, calls, pug marks, droppings, nests, etc.;
- Identification and classification of any species recognized as threatened (in accordance with the IUCN Red List V 2017.2 and according to the schedules of the Indian Wildlife (Protection) Act 1972 and amendments);
- Identification of areas which are important or sensitive for ecological reasons including their breeding, nesting, foraging, resting, over wintering areas including wildlife migratory corridors /avian migratory routes; and
- Identification and assessment of aquatic ecological resources within the study areas.

5.4.2 Ecological Baseline Approach and Methodology

Desktop Review

A desktop review (published document) was carried out to determine the land use and land cover (Topo sheet, Satellite imagery), vegetation type (Champion and Seth, 1962) and floral and faunal species assemblage in the study area. Information provided by developer was also considered during desktop review process.

Determining Study Area

To conduct the survey, a core and buffer zone was delineated, so that ecological receptors and impacts on them can be established during the ESIA process. The core and buffer zone is as follows:

- Core Zone: The area of the solar plant
- Buffer Zone: 5 km radius from the solar power plant

The above core and buffer zones were established based on sensitivities identified during desktop review and experience gathered from multiple solar farm ecological assessments carried out by ERM in the last few years.

Baseline Ecological Survey

A baseline survey was carried out to determine the existing ecological conditions and to facilitate an adequate assessment of the Project's impacts upon ecology and development of appropriate mitigation measures. The baseline survey had two parts-

(i) Secondary data collection and (ii) Primary data collection

i. Secondary Data Collection

Secondary baseline data regarding sensitive ecological habitat (National Park, Sanctuary, Ecological Sensitive Area, Migratory Corridor, habitat of endangered, vulnerable and range restricted species etc.), flora & fauna in the study area, forest cover was collected from reliable sources like published documents, the ENVIS portal on Wildlife and Protected area in India, wetland atlas, IBA etc. Consultations were carried out with local people to understand major flora & fauna in the study area, presence of any Schedule I species or other species having conservation value and pressures on forest resources,

ii. Primary Survey

a) *Habitat survey*

Different habitats identified by the desktop review were visited. Data regarding the type and quality of habitat with reference to flora and fauna supported, were collected.

b) *Floral Survey*

Major floral species in different types of habitats were visually identified using published manuals and recorded.

c) *Faunal Survey*

Faunal species from the study areas were recorded based on direct sightings, indirect evidences such as dung, droppings, scats, pugmarks, scratch signs, burrows, nests etc. Consultations with local communities were carried out to by displaying pictorial representations of species anticipated in the area to confirm whether there have been any recent sightings. The species occurring within the study area were surveyed using the below methods:

Amphibians

Amphibians are often restricted to natural and constructed ponds during the hottest parts of the day [(1)]. All such water bodies were visited during the hottest parts of the day to determine the presence of amphibians along the shaded ledges of the water body.

Reptiles

Reptile presence was determined through the use of Intensive Time Constrained Search Methods [(2) (3).] The method was adapted for the terrain by targeting rocks and logs located around water bodies or recently dried streams, hedges and along the trunks of higher vegetation.

Avifauna

Any avifaunal species that was identified by visually sighting or hearing bird calls was recorded. Birds were identified along motorable roads, around water bodies and in

(1) Knutson et. al. 2004. Agricultural ponds support amphibian populations. Ecological Applications. 14 (3): 669-684
(2) Welsh, H.H., jr. 1987. Monitoring herpetofauna in woodlands of north western California and south west Oregon: a comparative strategy. Pp. 203-213. In. Multiple – Use Management of Califirnia's hardwood resources. T.R. Plumb, N.H. Pillisbury (eds. Gen. Tech. Regional Environmental Planning. PSW – 100) US Department of Agriculture, Forest Service.
(3) Welsh, H.H. Jr. and Lind, A. 1991. The structure of the herpetofaunal assemblage in the Douglas-fir/hardwood forests of northwestern California and south western Oregon. Pp: 395-411. In: Wildlife and vegetation of unmanaged Douglas-fir forests. (Tech. Coords). L.F. Ruggiero, K.B. Aubry, A.B. Carey and M.H. Huff. Ge. Tech. Rep. PNW-GTR-285. Portland, OR: US. Department of Agriculture, Forest Service.

clumps of higher vegetation during the hottest parts of the day. Binoculars and standard field guides (1) were used for avifaunal identification.

Mammals

Mammal surveys were conducted along motorable roads, near water bodies and in grassy terrain. Individuals were identified through direct (visual sighting) and indirect (pellets, tracks, paw marks and scat) methods. Species were then identified using standard literature. (2) (3).

5.4.3 Habitat Assessment

According to the Biogeographic provinces of India published by Wildlife Institute of India (Rodgers, Panwar and Mathur, 2002), the Project site falls under the Biogeographic Province – 3A – Thar Desert. This biogeographic province is characterised by scanty rainfall, received mostly between July and September months. Weather mostly remains dry and hot, particularly during long summer months. Soil is loose having low moisture retaining capacity, occasionally surface is defined by sand dunes.

Types of habitat in the study area

Scrublands and Sand Dunes

Major portion of the study area can be classified as scrubland and Sand dune, in fact the Project area is located on sand dunes. The natural vegetation in this areas consists of tropical thorn forests composed of *Ziziphus nummularia, Suaeda fruticose, Vachellia jacquemontii, Vachellia nilotica Calotropis gigantean, Prosopis juliflora, Prosopis cineraria, Salvadora persica, etc.* Sanddunes where these three Projects a coming up, has already been cleared of vegetation and construction activity is in very advance stage.

Agricultural Fields

In major part of the study area agriculture is highly dependent on rain. Consultation with local villagers have revealed that, crops like Bajra or Pearl Millet (*Pennisetum glaucum*), Jeera or Cumin (*Cuminum cyminum*), Mustard, Isabgol (*Plantago ovata or Plantago psyllium), Castor (Ricinus communis)* are mostly cultivated between July to December. But during field survey it was observed that occasionally Wheat (*Triticum sp)* is grown using ground water.

Aquatic Habitat

No waterbody was recorded from the study area during the course of survey.

Figure 5.16 Pictures of Project site and study area

Sand Dunes with Natural Vegetation | Project Site

(1) Grimmet, R. Inskipp, C. and Inskipp, T. 2013. Birds of the Indian Subcontinent - Second Edition. Published by Christopher Helm, 49-51 Bedford Square, London.
(2) Prater, S.H. 2005. The Book of Indian Animals. Bombay Natural History Society and Oxford University Press - 12th Edition. pp 316
(3) Menon, V. 2003. A field guide to Indian Mammals. Dorling Kindersley (India) Ltd. New Delhi, 201 p

Adjacent Solar Power Sites

Agricultural field in the study area

5.4.4 Faunal Assessment

A faunal assessment was carried out based on the aforementioned search techniques *for* each of the target class of fauna – herpetofauna (amphibians and reptiles), avifauna and mammals. The subsequent sections describe the fauna found on the site:

Amphibians

No Amphibian was recorded during the course of the survey but secondary information (1) (2) supports probable presence of following amphibians in wells, agricultural fields and probably seasonal waterbodies in the study area.

Table 5.13 Probable Occurrence of Amphibians in the Study Area

Sn	Common Name	Scientific name	Family	WPA 1972 Schedule	IUCN Status (Version 2019-1)
1.	Skittering Frog	*Euphlyctis cyanophlyctis*	Dicroglossidae	-	LC
2.	Common Indian Toad	*Duttaphrynus stomaticus*	Bufonidae	-	LC

Moreover a perineal source of water the Indira Gandhi Canal is located about 11 km north of the Project site. Irrigation canal from the main canal flows through the northern and east part of the study area. Indira Gandhi Canal has induced change (3) in desert landscape, in terms of availability of water, and thus provide favourable habitat for amphibians.

(1) H.S. Banyal, S. Kumar. A Perspective on Anuran Diversity of Western Rajasthan. Desert Regional Centre, Zoological Survey of India. 2017

(2) M. R. Mansukhani, T.S.N. Murthy. Fauna of Rahasthan, India. part 6. Amphibia

(3) H.S. Banyal, S. Kumar. A Perspective on Anuran Diversity of Western Rajasthan. Desert Regional Centre, Zoological Survey of India. 2017

Reptiles

Though only two reptilian species were recorded during the course of survey, tracks on loose sand provide evidence of high reptilian diversity in the study area. Based on primary site observation and secondary information [(1)(2)], a comprehensive list of reptiles is provided below.

Table 5.14 Reptiles recorded from the study area

Sn	Common Name	Scientific name	Family	Source	WPA 1972 Schedule	IUCN Status (Version 2019-1)
1.	Leith's Sand Snake	*Psammophis leithii*	Lamprophiidae	PS	IV	-
2.	Glossy-bellied racer	*Coluber ventromaculatus*	Colubridae	SS	IV	-
3.	Red-spotted royal snake	*Spalerosophis arenarius*	Colubridae	SS	IV	-
4.	Schokari sand racer	*Psammophis schokari*	Lamprophiidae	SS	IV	-
5.	Common krait	*Bungarus caeruleus*	Elapidae	SS	IV	-
6.	Saw-scaled viper	*Echis carinatus*	Viperidae	SS	IV	-
7.	Keeled rock gecko	*Cyrtopodion scabrum*	Gekkonidae	PS	-	LC
8.	Rajasthan Sand Gecko/ Sind gecko	*Crossobamon orientalis*	Gekkonidae	SS	-	-
9.	Yellow-Bellied House Gecko	*Hemidactylus flaviviridis*	Gekkonidae	SS	-	-
10.	Indian Garden Lizard	*Calotes versicolor*	Agamidae	SS	-	-
11.	Brilliant Agama	*Trapelus agilis*	Agamidae	SS	-	-
12.	Spiny-Tailed Lizard	*Uromastyx hardwickii*	Uromastycidae	SS	II	-
13.	Indian-Fringe Toed Lacertid Lizard	*Acanthodactylus cantoris*	Lacertidae	SS	-	-
14.	Common Indian Monitor	*Varanus bengalensis*	Varanidae	SS/CC	I	LC
15.	Desert Monitor	*Varanus griseus*	Varanidae	SS	I	-

Notes: LC-Least Concern, SS-Secondary Sources; PS-Primary Survey; CC-Community Consultation

None of the species reported or recorded from the study area is threatened [IUCN Status (Version 2019-1]. Two species are categorised as Schedule I species (under 1972 Wildlife Protection Act of India, Sch I species provided highest degree of protection), viz Common Indian Monitor (*Varanus bengalensis)* and Desert Monitor (*Varanus griseus)*. Community consultation also concurred presence of monitor lizards in the landscape but exact species could not be narrowed down via community consultation.

Figure 5.17 Reptiles Recorded from Study Area

Leith's Sand Snake (*Psammophis leithii)*

Keeled rock gecko (*Cyrtopodion scabrum)*

(1) S. Biswas, DP Sanyal. Fauna of Rajasthan, India, Part. Reptilia. Zoological Survey of India, Calcutta. 1977

(2) SK Das. Checklist and Distribution of Saurian faauna in the Thar desert of Rajasthan. 2007.

Source: Primary site survey

Avifauna

A total of twenty three (23) bird species were recorded in the study area. Three (03) species, the Short toed Snake Eagle (*Circaetus gallicus*) [LC IUCN (Version 2019-1)], Long-legged buzzard (*Buteo rufinus)* [LC IUCN (Version 2019-1)], and Indian peafowl (*Pavo cristatus)* [LC IUCN (Version 2019-1)] are listed under Schedule I of the Indian Wildlife Protection Act, 1972 and amendments, and are accorded the highest protection.

No Threatened species (IUCN version 2019-1), was recorded from the study area.

Five migratory species were recorded viz. Long-legged buzzard, Common stonechat (*Saxicola torquatus)* [LC IUCN (Version 2019-1)], Variable Wheatear (*Oenanthe picata)* [LC IUCN (Version 2019-1)], Lesser whitethroat (*Sylvia curruca)* [LC IUCN (Version 2019-1)] and Demoiselle crane (*Grus virgo)* [LC IUCN (Version 2019-1)]. Demoiselle crane are locally known as “Kurze” and in the desert landscape of Rajasthan, large number of Demoiselle crane congregate in “community feeding grounds”, which are designated bird feeding grounds, generally near a temple, where local people feed birds, including 100s and 1000s of migratory Demoiselle crane. Nearest such feeding ground is located in Kanasar village, in Zambeswar Mata Temple, located about 7.6km south east of plot R3.

There are historic records (1) (up to 2008) of seven species of vultures from the desert landscape of Bikaner and Jodhpur districts of Rajasthan, viz. Indian Vulture (*Gyps indicus)* [CR IUCN (Version 2019-1)], White-rumped Vulture (*Gyps bengalensis)* [CR IUCN (Version 2019-1)], Red-headed Vulture (*Sarcogyps calvus)* [CR IUCN (Version 2019-1)], Egyptian Vulture (*Neophron percnopterus))* [EN IUCN (Version 2019-1)], Himalayan Griffon (*Gyps himalayensis))* [NT IUCN (Version 2019-1)], Eurasian Griffon (*Gyps fulvus))* [LC IUCN (Version 2019-1)] and Cinereous Vulture (*Aegypius monachus)* [NT IUCN (Version 2019-1)]. Of these seven species Eurasian Griffon, Himalayan Griffon and Cinereous Vulture are winter migratory species in this landscape. But no vultures were recorded during the survey period. And consultation with local people revealed that Vultures (locally known as “Giddh) are very rare and hardly ever seen. During survey period few cow carcass were identified and monitored regularly, but vultures were never recorded. Past two decade has witnessed a sharp decline in all vulture population (2) particularly White rumped Vulture, Indian Vulture, Red-headed vulture in India, with Rajasthan being no exception. Decline in Vulture population in Jorbeer dead animal dump site (located about 144km North West), reported from 2009-2010 (3), provide further evidence of vulture population decline in this landscape.

In 2014 Forest Department of Rajasthan along with Wildlife Institute of India, conducted survey (4) for Great Indian Bustard (*Ardeotis nigriceps*)[Critically Endangered (Version 2019-1)] and Associated Wildlife in Thar desert landscape of Rajasthan. Based on this survey Great Indian Bustards is no longer found in this landscape. Consultation with local people during site visit also concurred that Great Indian Bustard (locally known as “Godawan”) is not found in study area for more than past 10 years.

Table 5.15 Avian Species observed from the study area

SN	Common Name	Scientific Name	Family	Migratory Status	Habitats	IUCN (Version 2019-1)	WPA, 1972
1	Black-crowned sparrow-lark	*Eremopterix nigriceps*	Alaudidae	R	T	LC	IV
2	Short toed Snake Eagle	*Circaetus gallicus*	Accipitridae	R	T	LC	I
3	Long-legged buzzard	*Buteo rufinus*	Accipitridae	M	T	LC	I

(1) AK Chhangani. Present Status of Vultures in the Great Indian Thar Desert. 2008

(2) Ak Chhangani. Population Ecology of Vultures in Western Rajasthan, India. 2005.

(3) DL Bohra. Vulture decline in Bikaner, Jorbeer, Rajasthan.

(4) "Status of Great Indian Bustard and Associated Wildlife in Thar". Wildlife Institute of India & Rajasthan Forest Department. 2014

SN	Common Name	Scientific Name	Family	Migratory Status	Habitats	IUCN (Version 2019-1)	WPA, 1972
4	Red-naped ibis	*Pseudibis papillosa*	Threskiornithidae	R	A/T	LC	IV
5	Indian Peafowl	*Pavo cristatus*	Phasianidae	R	T	LC	I
6	Demoiselle crane	*Grus virgo*	Gruidae	M	T/A	LC	IV
7	Eurasian Collared Dove	*Streptopelia decaocto*	Columbidae	R	T	LC	IV
8	Green Bee-eater	*Merops orientalis*	Meropidae	R	T	LC	IV
9	Grey Francolin	*Francolinus pondicerianus*	Phasianidae	R	T	LC	IV
10	Bay-backed Shrike	*Lanius vittatus*	Laniidae	R	T	LC	IV
11	Southern Grey Shrike	*Lanius meridionalis*	Laniidae	R	T	LC	IV
12	House Sparrow	*Passer domesticus*	Passeridae	R	T	LC	IV
13	Common stonechat	*Saxicola torquatus*	Muscicapidae	M	T	DD	IV
14	Indian Silverbill	*Lonchura malabarica*	Estrildidae	R	T	LC	IV
15	Variable Wheatear	*Oenanthe picata*	Muscicapidae	M	T	LC	IV
16	Lesser whitethroat	*Sylvia curruca*	Sylviidae	M	T	LC	IV
17	Laughing Dove	*Spilopelia senegalensis*	Columbidae	R	T	LC	IV
18	Green bee-eater	*Merops orientalis*	Meropidae	R	T	LC	IV
19	Plain Prinia	*Prinia inornata*	Cisticolidae	R	T	LC	IV
20	White-Eared Bulbul	*Pycnonotus leucotis*	Pycnonotidae	R	T	LC	IV
21	Red-wattled Lapwing	*Vanellus indicus*	Charadriidae	R	A	LC	IV
22	Eurasian-collared Dove	*Streptopelia decaocto*	Columbidae	R	T	LC	IV
23	White Throated Kingfisher	*Halcyon smyrnensis*	Halcyonidae	R	A	LC	IV

Source: Primary site survey

Migratory Status: R- Resident, M-Migrant; IUCN: EN- Endangered, NT-Near Threatened, LC-Least Concern; WPA, 1972 (Indian Wildlife Protection Act -1972): Schedule – I, IV; Habitats: A-Aquatic, T-Terrestrial

Figure 5.18 Avian fauna Recorded from the Study Area

Southern Grey Shrike

short-toed snake eagle

Variable Wheatear

Bay-backed Shrike

Demoiselle crane

Indian peafowl


Black-crowned sparrow-lark


Long-legged buzzard


Common Stonechat


Grey Francolin


Eurasian-collared Dove


Red-naped ibis


Lesser Whitethroat


White Throated Kingfisher


Green bee-eater

Source: Primary site survey

5.4.4.1 Mammals

A total of eight (08) mammalian species can be found in the study area. Out of eight species four (04) were directly recorded during primary survey. Details provided in **Table 5.16**.

In Bhadla solar power site, lot of large scale solar power sites are already operational. High concentration of ground burrowing, Indian Desert Gerbil (*Meriones hurrianae)*[LC IUCN(Version 2019-1)] were found to create colonies around these operational solar power sites.

Table 5.16 Mammals reported from the study area

S. No	Common Name	Scientific Name	Source	WPA Schedule	IUCN Status (Version 2019-1)
1.	Chinkara/ Indian gazelle	*Gazella bennettii*	PS	I	LC
2.	nilgai or Blue Bull	*Boselaphus tragocamelus*	CC	-	LC
3.	Indian Wolf	*Canis lupus pallipes*	CC	I	LC
4.	Northern plains gray langur	*Semnopithecus entellus*	PS	II	LC
5.	Indian Fox	*Vulpes bengalensis*	CC	II	LC
6.	Desert Fox	*Vulpes vulpes pusilla*	CC	I	DD
7.	Indian Desert Gerbil	*Meriones hurrianae*	PS	-	LC
8.	Grey Mongoose	*Herpestes edwardsii*	PS	II	LC

Notes: IUCN-International Union for Conservation of Nature, WPA-Wildlife Protection Act, 1972, LC-Least Concern, NT- Near Threatened, EN-Endangered; SS-Secondary Sources, PS-Primary Survey; CC-Community Consultation

Figure 5.19 Mammals Recorded

Chinkara/ Indian gazelle

Grey Mongoose

Indian Desert Gerbil

Northern plains gray langur

5.4.5 Protected Areas

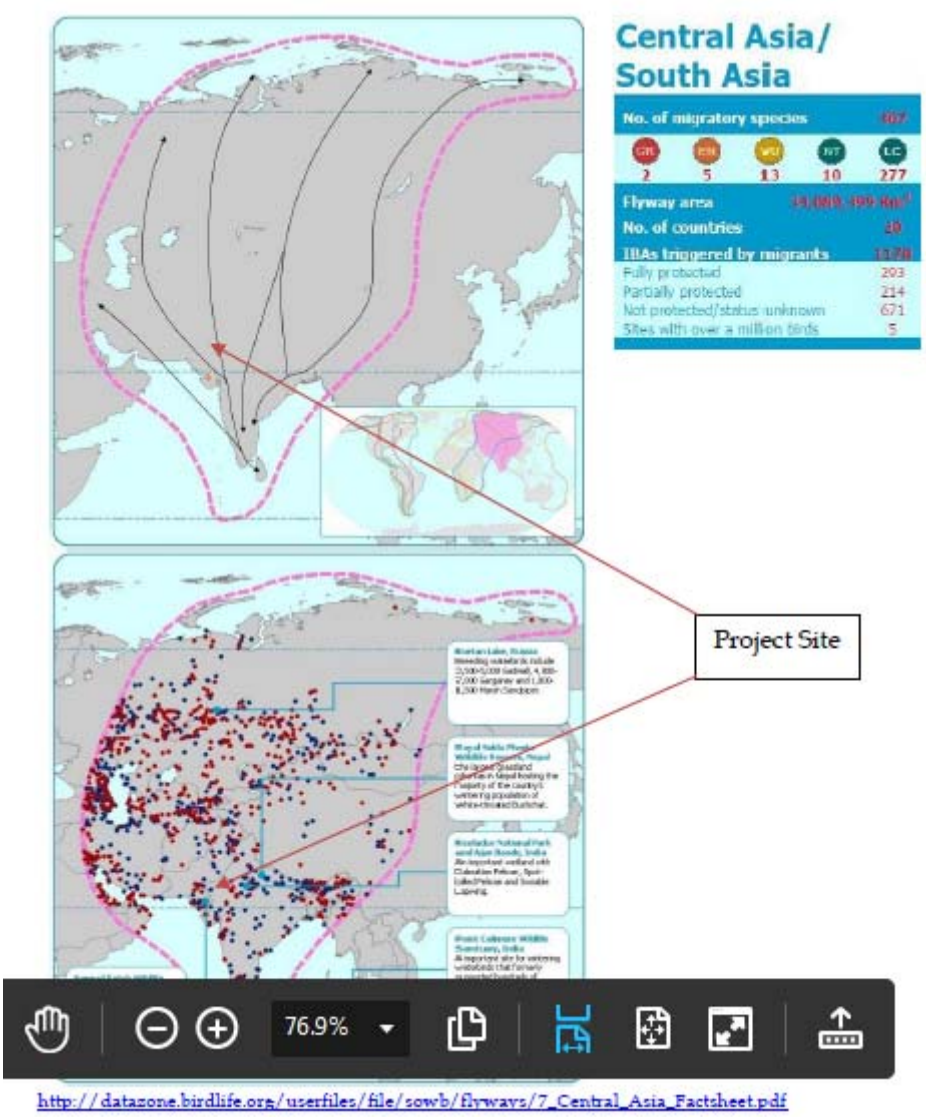
No protected area is located within 10km of the study area. Also no internationally recognised area having special biodiversity value like Important Bird Area, Key Biodiversity Area or Alliance for Zero Extinction is located within 10 of the study area.

5.4.6 Migratory Route

India lies along the Central Asian Flyway, a global migratory pathway that connects the Palearctic (Europe and Northern Asia) to the Indian subcontinent. The birds that utilize this flyway congregate at key water bodies around India.

The site is located along the Central Asian Flyway. This statement is further supported by presence of Five migratory species were recorded viz. Long-legged buzzard, Common stonechat (*Saxicola torquatus),* Variable Wheatear (*Oenanthe picata),* Lesser whitethroat (*Sylvia curruca)* and Demoiselle crane (*Grus virgo).*

Figure 5.20 Project Area With respect to Migratory Flyway



5.5 Socio-Economic Baseline

Social –Economic baseline of the villages in the Project area, the social groups present, the vulnerable groups identified, the livelihood profile of the community, the land use patterns in the area, the social and physical infrastructure available in terms of the education and health infrastructure, the water supply for irrigation and drinking purposes, sanitation facilities and connectivity.

This understanding is based on the secondary information available on the state, district and block level as well as the primary consultations undertaken in the study area by ERM during the site visit. Due to the nature of the study area, the following discussion will be concentrated on the study area with comparisons being drawn to the block and district where appropriate.

5.5.1 Approach and Methodology

The socio-economic baseline for this Project has been developed on the basis of a combination of secondary literature review, as well as the inferences drawn from the consultations with different stakeholders including the local community during site visit by ERM team.

5.5.2 Review of secondary information

A review and assessment of the available secondary data and information for the study area was undertaken in order to substantiate and corroborate the understanding gained through stakeholder consultations, understand the performance of the area on socio-economic parameters as well as allow for a

comparative assessment of the Project area vis-à-vis the block and district level socio economic baseline information. For the purpose of the desk based assessment, following documents and literature have been reviewed:

- Primary Census Abstract data, 2011;
- Jodhpur District Census Handbook, 2011;
- Village Directory Data, 2011.

5.5.3 Mapping and consultation

The stakeholders for this Project differ in terms of the degree of impact, interest and influence over the Project. The stakeholder mapping and its analysis was conducted with the objective of identifying each stakeholder group; studying their profile, characteristics and the nature of their stakes; gauging their influence on the Project; and understanding the specific issues, concerns as well as expectations of each group from the Project.

Local Community was consulted during the study process. The consultation process was also undertaken with the aim of informing the stakeholders about the Project, its proposed activities, while assessing the awareness levels about the Project in the community and simultaneously identifying some of the key issues, concerns and expectations of the community.

5.5.4 Primary data/information collection/ Site surveys and consultations

Under this phase, consultation of key informants in the study area including local communities was undertaken with the objective of building ground level understanding of the concerned issues and also in parallel gather primary data wherever feasible to support the observations gained through these consultations. The ***Table 5.17*** has detailed out the consultation with the Statement.

Table 5.17 Stakeholder Consultation Details

Date	Stakeholder Details
04.2.2019	Opening meeting with the land team of CSP Bhadla Pvt Ltd.
05.2.2019	FGD in Bhadla Village.
05.2.2019	Community consultations in various Dhanis.

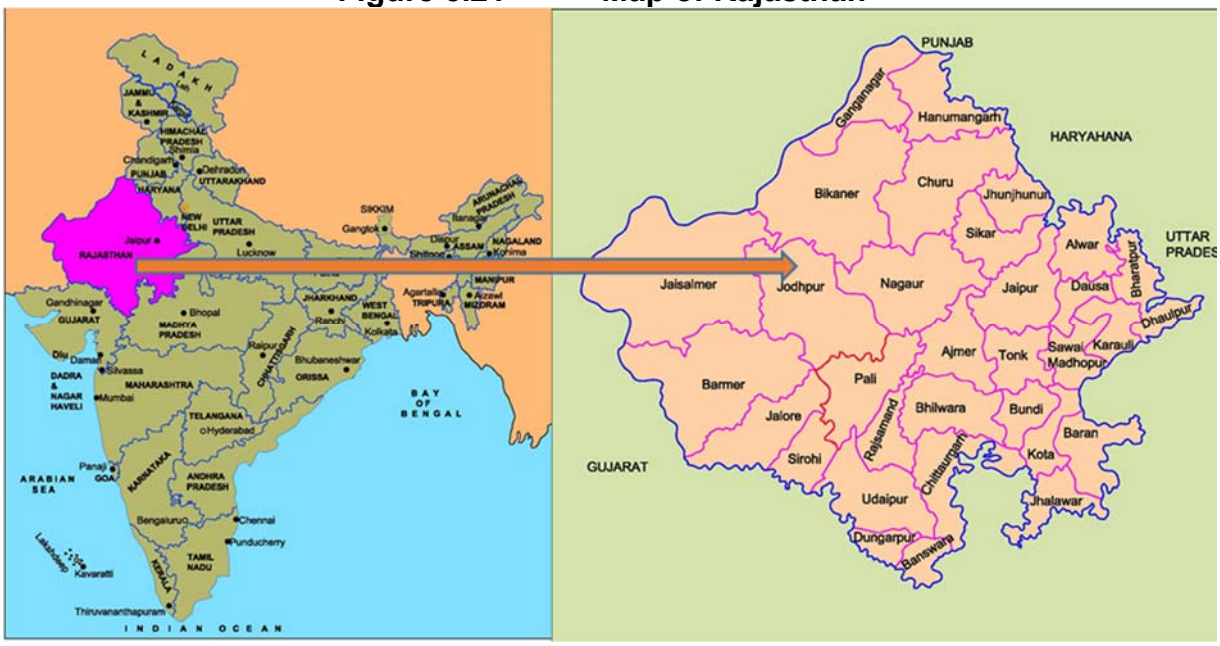
As part of these consultations, an attempt was made to develop an understanding of each identified stakeholder group's key concerns and expectations from the Project, the stakeholder group's perception of the Project and to consolidate the secondary information available on the area.

Details of various stakeholders consulted are provided in the later sections of this report.

5.5.5 State Profile Rajasthan

Covering an area of 342,239 sq. km, Rajasthan is the largest state in India. The state has 33 administrative districts. Jaipur is the state capital; Jaisalmer, Udaipur, Jodhpur, Ajmer, Bikaner, Alwar, Amber and Chittorgarh. Rajasthan shares its borders with the Pakistani provinces of Punjab and Sindh and the Indian states of Punjab, Haryana, Uttar Pradesh, Madhya Pradesh and Gujarat. There are two major rivers flowing through Rajasthan: the Chambal and the Luni.

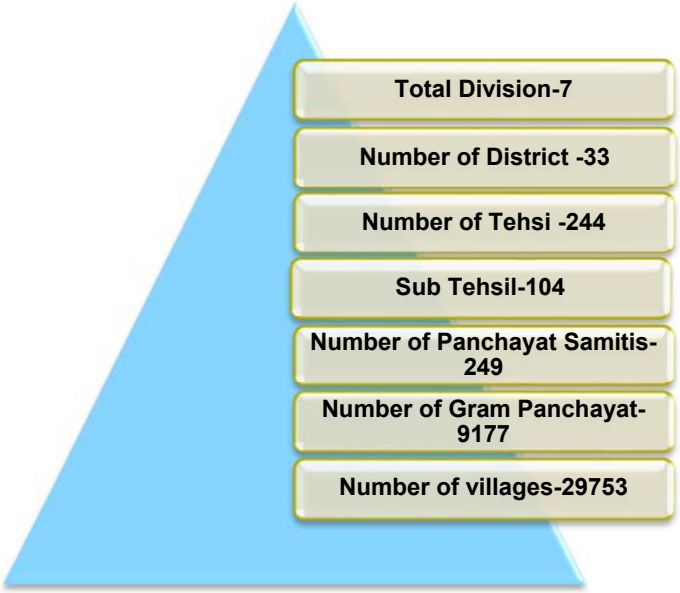
Figure 5.21 Map of Rajasthan



Source: Map of India

Rajasthan has total 7 divisions, 33 districts, number of tehsil 244, and number of sub tensil-104, number of panchayat samitis-249 and number of villages 39753. The **Figure 5.22** has shown the administrative structure of Rajasthan and **Table 5.18** is showing the demographic details of Rajasthan viz-a-viz India.

Figure 5.22 Rajasthan Administrative Structure



Source: http://rajasthangk.com/gk-rajasthan-general-knowledge/4-administrative-structure-of-rajasthan

It has been understood from ***Table 5.18*** that the rural population of India is 68.84% which is comparatively lower to the population of Rajasthan State 75.13%, however the ratio of SC population is almost equivalent in India 16.6% and Rajasthan17.8 %, but in term of ST population the ratio is significantly higher in the Rajasthan state 30.2% than in India 8.6%. The ***Table 5.18*** has depicted that the sex ratio is more positive in India 943 females per 1000 males than the Rajasthan state 928 females per 1000 males and in term of literacy rate it has been observed that India has 74% of literacy rate which is higher than the Rajasthan state 66.11%.

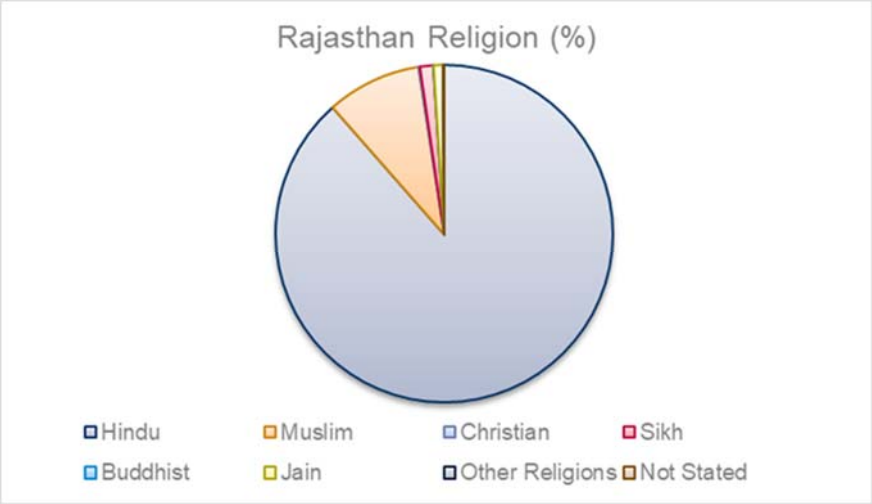
Table 5.18 Demographic details of Rajasthan w.r.t. India

Attribute	India	Rajasthan
Population	1,210,193,422	68,548,437
Population Density	382 persons per km^2	200 persons per km^2
% of SC population	16.6%	17.8%
% of ST population	8.6%	30.2%
Sex Ratio	943	928
% total literacy rate	74.0%	66.11 %
% female literacy rate	65.5%	52.12 %
% rural population	68.84%	75.13

Source: Census Data 2011

It can be observed in **Figure 5.23** that Hinduism is the dominant religion in the state of Rajasthan followed by Islam that is the second most popular religion. However, through census 2011 data of Rajasthan it has been noted that other religions like Christianity, Jainism, Sikhism and Buddhism are not followed by a large number of population. The most commonly spoken language of the Rajasthan state is Hindi. Marwari, Jaipuri (Dhundhari), Mewari and Malvi are the other dialects popular in the state[1].

Figure 5.23 Religion Details of Rajasthan



Source: Census Data 2011

5.5.6 District Profile

Jodhpur District is situated in the western side in the State of Rajasthan. The city of Jodhpur is the administrative headquarters of the district. The district is bounded by Bikaner District on the north, Nagaur District on the northeast, Pali District on the southeast and south, Barmer District on the southwest, and Jaisalmer District on the west and northwest.

Jodhpur district of Rajasthan has total population of 3,687,165 as per the Census 2011, out of which 1,923,928 are males while 1,763,237 are females. In 2011 there were total 649,013 families residing in Jodhpur district. The average sex ratio of Jodhpur district is 916 females per 1000 males. The total literacy rate of Jodhpur district is 65.94%. The male literacy rate is 65.79% and the female literacy rate is 43.43% in Jodhpur district. The **Table 5.19** presents demographic details of Jodhpur.

Table 5.19 Demographic details of Jodhpur

Attribute	Jodhpur District
Population	3687165
Population Density	161 persons per km^2

[1] https://www.census2011.co.in/census/state/rajasthan.html

Attribute	Jodhpur District
% of SC population	16 %
% of ST population	3%
Sex Ratio	916
% total literacy rate	65%.
% female literacy rate	43%
% rural population	65.70 %

Source: Census Data 2011

5.5.7 Study Area

The area of up to 5 km radius from the Project boundary has been demarcated as "Study Area" for the Project by considering the extent of Project impacts in terms of water resources, human settlement, cultural heritage sites, location of labour camps, location of the access roads, CPRs, etc., besides considering the actual land for both the Project and its associated components.

The distance up to 1 km radius from Project boundary has been considered as "Core zone", while the area from 2 km to 5 km is considered as the "Buffer Zone" for the Project. It is understood that the magnitude of impact in this Core zone is likely to be more pronounced than the remaining portion of study area. The study area includes 7 villages – 3 villages in the core zone and 4 villages in the buffer zone. Although not all villages' data is available in the Census data 2011.

The villages which have been found on the map of the study are following: - Ajeri, Tirath ka, Gaita, Bhadlachuhron, Gulam ki Dhani, Ajeri ki Dhani, Ismail ki Dhani. However, not all the villages were found in the census 2011 data like Tirath ka, Gaita, Gulam ki Dhani and Ajeri ki Dhani. The villages that were found in census 2011 data, the details has been provided in the ***Table 5.20.***

5.6 Demographic Profile

This section provides a demographic overview of the study area to provide a clear understanding of the socio-economic and cultural context within which the Project is located. The **Table 5.20**, provides broad demographic features of the region wherein Project study area is located.

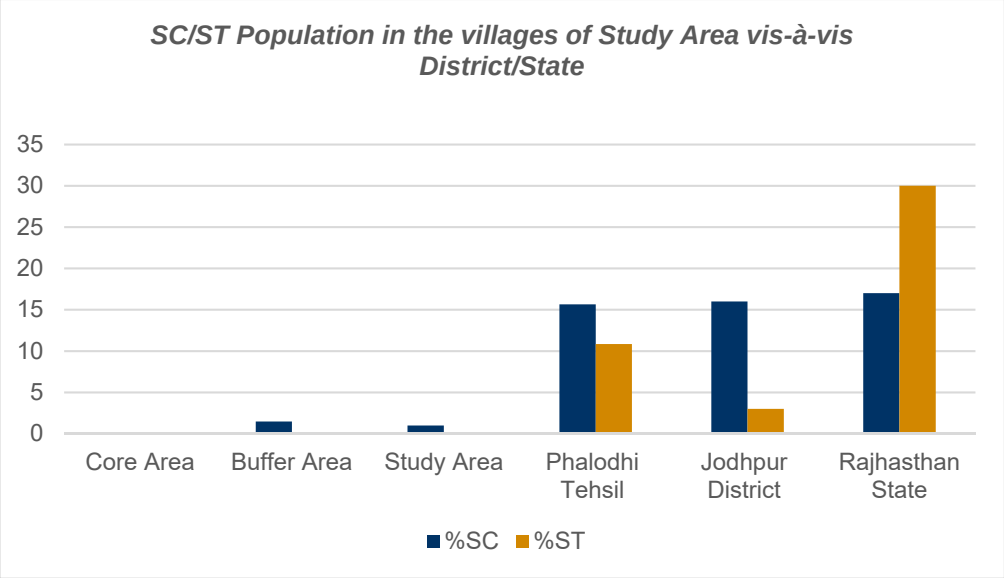
Table 5.20 Demographic Profile of Study Area

Name of Village	Number of Household	Total Population	Sex Ratio	%SC	%ST	Literacy Rate %	Female Literacy Rate%
Core Area							
Ajeri	169	811	968	0	0	51.5	37.1
Buffer Area							
Ismile Khan Ki Dhani	6	27	421	0	0	36.4	0
Bhadlachuhron Ki Basti	281	1610	881	1.5	0	25	16.9
Buffer Area	287	1637	871	1.5	0	25.1	16.9
Study Area	456	2448	902	1	0	34	24

Source: Census Data 2011

The study area has a total population of 2448 and total households are 456 and through **Figure 5.24** it has been observed that the SC population in the study area is 1%; however as per census data 2011, no ST population resides in this area and the same has been confirmed through community consultation. Similar trend has been observed in the census data 2011 of Jodhpur district where SC population is 16% and ST population is 3%. It has been understood through consultation that the area is dominated by the Muslim community.

Figure 5.24 Details of SC/ST Population

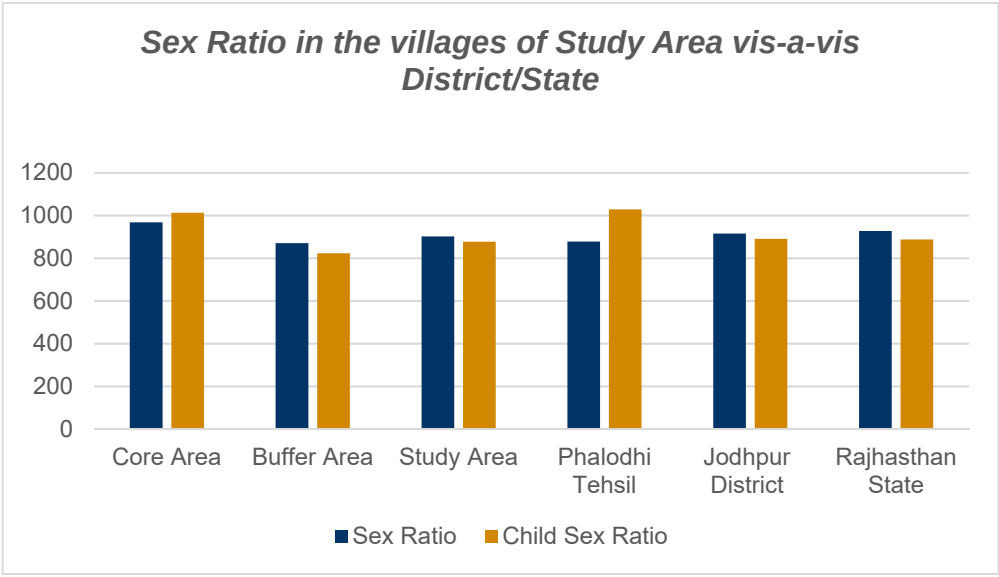


Source: Census Data 2011

It can be observed in the ***Table 5.20*** that In the buffer zone, Bhadlachuhron Ki Basti is the largest village in terms of population and lowest is Ismile khan ki Dhani. The average sex ratio in the core area is observed 968 females per 1000 males which reflects a positive scenario as compared to the buffer zone figure of 871 females per 1000 males. However the sex ratio of Rajasthan state is 928 females per 1000 males and Jodhpur district 916 females per 1000 males which is relatively more positive than the study area figure of 902 females per 1000 males.

In case of the Child sex ratio it has been understood that an average child sex ratio in the core area is observed 1013 females per 1000 males which is skewed towards female children as compared to the buffer area where the Child Sex ratio is 825 females per 1000 males. Through it has been noted that child sex ratio is relatively more positive in Phalodi tehsil 1029 females per 1000 males than the Jodhpur district 891 females per 1000 males and Rajasthan state 888 females per 1000 males.

Figure 5.25 Sex Ratio in the village of Study Area Vis-a -vis District/State



Source: Census Data 2011

It has been observed during consultations that the role of women is limited to domestic chores such as collecting water, cooking, washing utensils, taking care of the children, cleaning, etc. The decision making power of the households and financial control lies with the male members of the family and there is traditionally limited involvement of females in the same. There is limited social awareness amongst women and reportedly there are no NGOs working on the empowerment of the women in the Project area. None of the women are found to be members of any self-help group or any civil society organisations. Most of the women are from Muslim community; however Burkha (veil) system is not so prevalent.

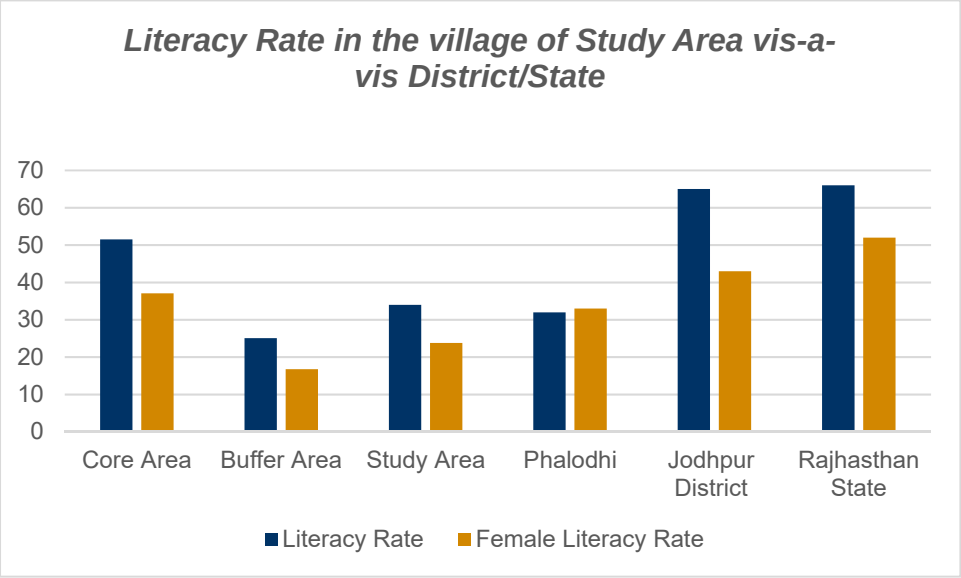
5.7 Literacy and Education Profile

5.7.1 Literacy

It can be observed through the ***Figure 5.26*** that the total literacy rate in the core area is 51.5% which is comparatively higher than the buffer area figure of 25%. Similarly, the female literacy rate is comparatively higher in core area at 37% than the buffer area17% and so is the case of male's literacy rate, which is lower in the buffer area 32.4% than the core area figure of 65.4%.

The average literacy rate in the study area is 34% which is significantly lower than the district literacy rate 66% and in study area female literacy rate is nearly 24%% which is comparatively very low than the district female literacy figure of 43.43%

Figure 5.26 Literacy profile of Study Area Vis a Vis tehsil, district and state



Source: Census Data 2011

It has been understood through consultations that there are high levels of enrolment at primary level, however dropouts increase in middle and secondary schools, as there is no middle school, secondary or senior secondary school in the proximity of the study area. The only high school available is at a distance of 10 km from the study area in Noore ki bhurj. The lack of availability of schools in the proximity and traditional mind set of locals has led to low literacy rate.

Similarly in case of females, the people abstain from sending their girl children to schools and the maximum education attain by the girl child in the area is till class 5th whereas in case of male child it is class 8$^{th.}$ The following reasons for the students to drop the school are enlisted below.

- Lack of high schools close to village;
- Lack of Public Transport;
- Early Marriage;

- Support in Household Chores;
- Conservative thinking.

Reasons for male dropout are:

- Lack of financial support from the family;
- Early responsibility for providing financial support to family;
- Become economically independent;
- Lack of avenues of jobs; and
- Lack of aspiration.

5.7.2 Educational Infrastructure

It can be observed from the **Table 5.21** that there are 2 primary schools in the study area, rest there are no government pre-primary schools, middle school, secondary and senior secondary schools in the study area.

Table 5.21 Status of Government School in the Study Area

Name of Villages	No. of Pre-primary schools	No. of Primary schools	No. of Middle schools	No. of Secondary schools	No. of Senior secondary schools
Core Area					
Ajeri	0	1	0	0	0
Buffer Area					
Ismile Khan Ki Dhani	0	0	0	0	0
Bhadlachuhron Ki Basti	0	1	0	0	0
Buffer Area	0	1	0	0	0
Study Area	0	2	0	0	0

Source: Village Directory, 2011

5.8 Occupational and Livelihood Profile

It can be observed from the **Table 5.22** that the study area has 53.10% working population, where the WPR in core area is almost equivalent to the buffer area 53.15%, though the highest WPR is recorded in Ismile Khan ki Dhani at nearly 63% which is in the buffer area.

However, in case of main work population[1], marginal workers[2] and non- workers[3], it has been noted that in the study area the main work population 7.15% which is significantly less as comparative to the marginal 45% and non-workers 46% the reasons has been elaborated in the sections below.

The area has witnessed economic activity in form of solar Projects coming up over a period of 2 years. The presence of solar Projects has led to a shift from complete dependence on agriculture to partial dependence to farm and non-farm based activities. Some of the key economic opportunities resultant from the solar Projects in the area comprise of locals securing jobs as security guards, housekeeping staff, etc.

Table 5.22 Occupational Work Pattern in Study Area

Name Of Villages	Total Population	Workers Participate Rate	Main Work Population	Marginal Worker	Non Worker
Core Area					
Ajeri	811	53.02	17.76	35.27	47.0
Buffer Area					
Ismile Khan Ki Dhani	27	62.96	59.26	3.70	37.0

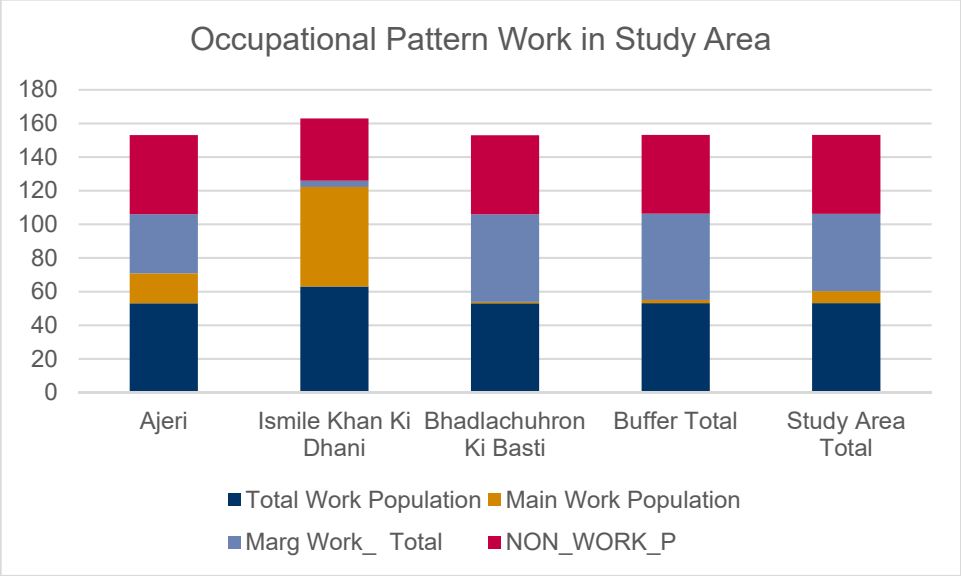
[1] **Main Workers**- Those workers who had worked for the major part of the reference period (i.e. 6 months or more) are termed as Main Workers.
[2] **Marginal Workers**- Those workers who had not worked for the major part of the reference period (i.e. less than 6 months) are termed as Marginal Workers
[3] **Non Workers**- A person who did not at all work during the reference period was treated as non-worker.

Name Of Villages	Total Population	Workers Participate Rate	Main Work Population	Marginal Worker	Non Worker
Bhadlachuhron Ki Basti	1610	52.98	0.93	52.05	47.0
Buffer Area	1637	53.15	1.89	51.25	46.9
Study Area	2448	53.10	7.15	45.96	46.9

Source: Primary Census Abstract, Census of India 2011

It can be observed in **Figure 5.28** that in the study area the population engaged as cultivators[1] is 33.9% is comparatively higher than the proportion of agricultural labour[2], comprising of 6.8%. During community consultations, it has been noted that most of the households in local community have marginal to small landholdings which might not be sufficient to earn their livelihood, thus the practice of working on farmlands of other farmers as agricultural labourers is prevalent and aids income of the household. It has also been observed that the population engaged in [3]other works 12% is higher as compare to the population engaged in the household industry[4] 0.6%. The details of "Other workers" have been elaborated in ***Section 5.8.2***.

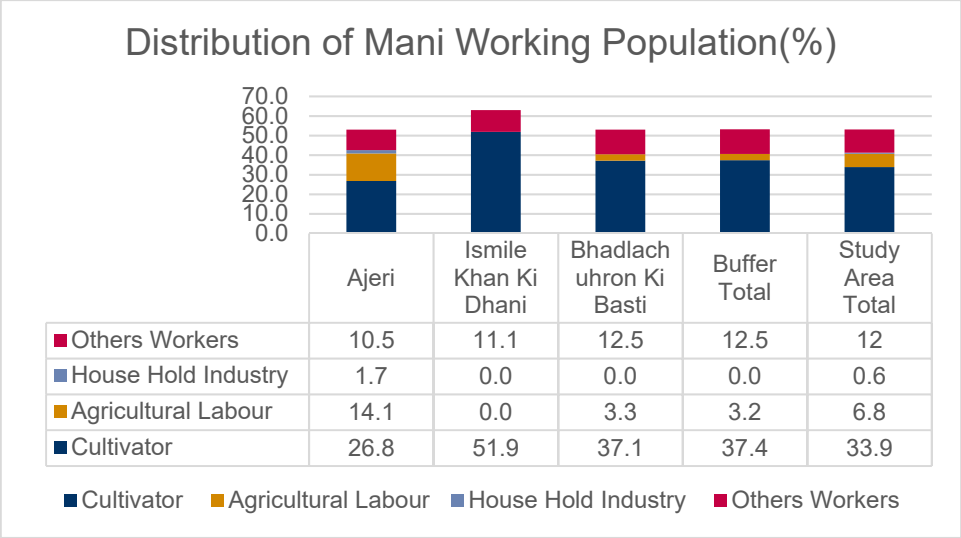
Figure 5.27 Occupational Pattern in Study Area



Source: Primary Census Abstract, Census of India 2011

[1] **Cultivator**- For purposes of the census a person is classified as cultivator if he or she is engaged in cultivation of land owned or held from Government or held from private persons or institutions for payment in money, kind or share
[2] **Agricultural Labourers**- A person who works on another person's land for wages in money or kind or share is regarded as an agricultural labourer. She or he has no risk in the cultivation, but merely works on another person's land for wages.
[3] **Workers other than** cultivators, agricultural labourers or workers in Household Industry, as defined above are termed as 'Other Workers' (OW).
[4] **Household Industry Workers**- Household Industry is defined as an industry conducted by one or more members of the household at home or within the village in rural areas and only within the precincts of the house where the household lives in urban areas.

Figure 5.28 Main Working Population in the Study Area



	Ajeri	Ismile Khan Ki Dhani	Bhadlach uhron Ki Basti	Buffer Total	Study Area Total
Others Workers	10.5	11.1	12.5	12.5	12
House Hold Industry	1.7	0.0	0.0	0.0	0.6
Agricultural Labour	14.1	0.0	3.3	3.2	6.8
Cultivator	26.8	51.9	37.1	37.4	33.9

Source: Primary Census Abstract, Census of India 2011

The occupational activities of the population in the Study area can be categorised as Farm based and Non-farm based and the same have been covered in detail below.

5.8.1 Farm based Livelihood

The farm based activities comprise of agriculture, agricultural labour and livestock rearing. The primary crops in the region comprises of Millets, Cumin, Arandi (Castor), Isabgol (Psyllium husk), Mustard and wheat, however through consultation it has been noted that the larger population practices subsistence agriculture because of low agricultural yield and the lack of irrigation facilities. As stated by the locals during the consultation that the facility of the bore well is not available in all the villages and the location of local market for selling agricultural produce is not nearby as the nearest Mandi from the study area is in Naachna which is 38km and in Bap which is 35km. During site consultation with the locals it has been understood that there is no systematic irrigation support in the area due to which the locals are dependent on monsoons and practice rain fed water for agriculture. It was noted during consultation in Bhadla village that the water is supplied from a tube well for approximately for 6 hours either in morning or evening for an agricultural purpose but it is not sufficient, stated by the locals. The depth of ground water demonstrates significant variations within the study area. Ground water in some villages is reported to be around 400 ft to 1000ft. These factors collectively lead to lower inclination towards practicing agriculture on commercial scale.

Apart from agriculture, the livestock holdings play an important part in the livelihoods of the community, although in the study area it has been noted that it doesn't provide any extra income but help to meet the nutritional intake of the household. The main livestock holdings in the area comprise of cows, sheep and goats. During community consultations, it has been understood that the milk of cow and goat is mainly used for self-consumption, per family has on an average 1 cows, 2-10 goat and 10 sheep.

5.8.2 Non-Farm based Livelihood

The setting up of solar power plants in the area has provided employment opportunities, as understood through consultations. It has been noted that majority locals in the area are engaged in other solar park Project and are able to earn approximately INR 12000 per month.

Although it has been understood that the issues of job security and regular payment of wages has been reported as a challenges that locals are facing because the youth might get engaged in the Project-related activities during construction phase but the scenario changes in the operational phase as the requirement of the skilled labour is more in comparison to unskilled labours and there are apprehensions of losing jobs once the Project is in operations phase.

It has been reported during consultation that most of the locals are educated till class 5th and for skilled jobs the eligibility is higher education, for example for the post of the security guard the eligibility is 10th class which most of the locals fail to meet. It has also been reported that there are few males which are settled in the Dubai they work over there as driver, helper or security guard and in every two years they return to Bhadla and then go back to Dubai.

5.9 Land use pattern

Ajeri is the largest village and Bhadiachuhron ki basti the smallest village in the study area, in term of total geographical area. It is important to note that there is no forest area[1] in the Study area, as reflected from **Table 5.23.** Also, there is no land under miscellaneous tree crop and no culturable waste land in the study area, as depicted in the table. The total net area sown[2] is 17% which is comparatively more than the land under non-agricultural[3] usage proportion of 0.28%. The consultations with local communities in the study area indicate that the land holding pattern in study area ranges from medium[4] to small[5] and according to census definition small land holding indicates that farmers having between one and two hectares of land and medium land holding indicates farmers having between four and ten hectares of land. Through census 2011 data it has noted that the majority of land in study area is under the current fallows[6] area 43% followed by fallow land other than current fallows area 37%.

5.9.1 Land Holding Pattern

According to the census 2011 data, it has been noted that there is no data available for the irrigated land, although during consultations with local communities in the study area it has been noted that the landholding pattern in Dhanis ranges from small to medium[7].

Table 5.23 Land Use Pattern in Study Area

Name of the Villages	Total Geographical Area Hectare)	Forest Area	Area under Non-Agricultural Uses	Barren & Un-cultivable Land Area	Permanent Pastures and Other Grazing Land Area	Land Under Miscellaneous Tree Crops etc. Area	Culturable Waste Land Area	Fallows Land other than Current Fallows Area	Current Fallows Area	Net Area Sown
	Core Area									
Ajeri	2145	0	13	0	0	0	0	751	680	701
	Buffer Area									
Ismile Khan Ki Dhani	627	0	23	0	0	0	0	4981	6098	1566
Bhadlachuhron Ki Basti	12668	0	50	44	3	0	0	49	0	481
Buffer Area	13295	0	73	44	3	0	0	5030	6098	2047
Study Area Total	15440	0	86	44	3	0	0	5781	6778	2748

Source: Primary Census Abstract, Census of India 2011

[1] **Forest-** This includes all area actually under forest on land so classed under any legal enactment or administered as forest.

[2] **Net Sown Area**- This consists of area sown with field crops and area under orchards and plantations counting only once the area sown more than once in the same year /season.

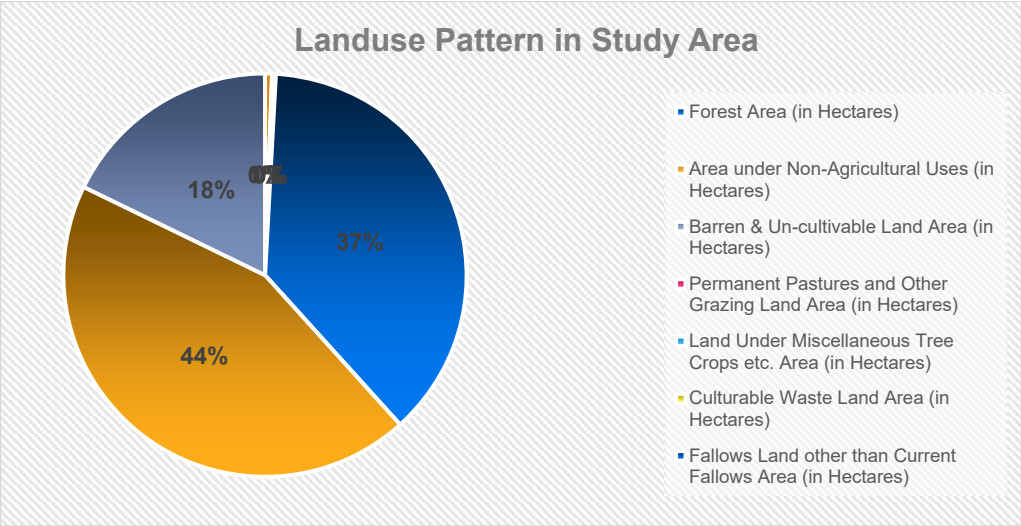
[3] **Land Put To Non-Agricultural** Uses -This includes all land occupied by buildings, paths, etc., or under water (tanks, wells, canals etc.) and land put to uses other than agricultural uses.

[4] **Medium farmers** (having landholding between 4 to 10 hectares)

[5] **Small farmers** (having land holding between 1 to 2 hectare);

[6] **Current Fallow**- This comprises cultivable areas which are kept fallow during the current agricultural year. If any seedling area in the current agricultural year is not cropped again in the same year, it is also treated as current fallow.

Figure 5.29 Land Use Pattern of Study Area (%)



Source: Primary Census Abstract, Census of India 2011

5.10 Water and Sanitation Facilities

5.10.1 Drinking water facilities

Through consultation in the study area it has been understood that the source of water in the area is bore well, tube well and tank and each family stores water at home in underground tanks or above ground water tank

Government provides the facility of pipeline for drinking purpose but it is not accessible to all and supply of water usually doesn't have any fixed time. The drinking water source in the area is Indira Gandhi Canal. The locals have to call water tankers in all the seasons which cost them approximately from INR. 500 to INR 1000 per tank and quantity of water varies from 4000l -6000 l. depending on the capacity of the tank. It has been understood through consultations that one household is able to sustain for approximately for 10 days on 1 tank.

Table 5.24 Water Facilities in the Study Area

Name of Villages	Tube Wells/Borehole (Status A(1)/NA(2))	Spring (Status A(1)/NA(2))	River/Canal (Status A(1)/NA(2))	Tank/Pond/Lake (Status A(1)/NA(2))	Others (Status A(1)/NA(2))
Core Area					
Ajeri	NA	NA	NA	NA	1
Buffer Area					
Ismile Khan Ki Dhani	NA	NA	NA	1	NA
Bhadlachuhron Ki Basti	1	NA	1	NA	1
Buffer Area	1	NA	1	1	1
Study Area	1	NA	1	1	2

Source: Census data 2011 /Note- NA- Not Available

5.10.2 Sanitation facilities

It has been observed through census 2011 data that there are open drainage and no closed drainage in the study area villages. Similarly, there are no rural production centers or sanitary hardware[1] outlets and no community toilets[2] in the study area; except in Bhadlachuhron Ki Basti village.

In the study area all the drainages are open and do not have the provision of open kuccha drainage nor has pucca drainage which indicates that the water is directly discharged in the nearby water bodies and same been confirmed through consultation.

Further it has been understood through consultations that the majority of locals don't have facility of toilet in the study area, despite of Swachh Bharat Abhiyan. Open defecation is reportedly a common practice in the area. Through consultation it has been understood that the reason behind of open defecation could be lack of toilet structure and water availability in the study area.

5.11 Health

It can be observed through **Table 5.25** that there is no Community Health Centers (CHC), no Primary Health Centre (PHC)[3], no TB clinic, no alternative hospital, no dispensary, no mobile health clinic and no Allopathic hospital in the study area villages. It has been noted through census 2011 data that there is 1 Primary Health Sub Centre (PHC) in Ajeri with two Primary Health Sub Centre Para Medical Staff. During the consultations with the locals it has been stated that PHC is still under construction and the nearest government hospital is located in Bap tehsil which is 47 km away followed by another hospital in Naachna 34 km and another hospital Phalodi at approx. 68 km.

Table 5.25 Health Facilities in the Study Area

Name of Village	Community Health Centre	Primary Health Centre	Primary Heallth Sub Centre (Numbers)	Primary Heallth Sub Centre Para Medical Staff In Position (Numbers)	Maternity And Child Welfare Centre (Numbers)	TB Clinic (Numbers)	Hospital Allopathic (Numbers)
Core Zone							
Ajeri	0	0	1	2	0	0	0
Buffer Zone							
Ismile Khan Ki Dhani	0	0	0	0	0	0	0
Bhadlachuhron Ki Basti	0	0	0	0	0	0	0
Buffer Area	0	0	0	0	0	0	0
Study Area	0	0	1	2	0	0	0

Source: Census Data 2011

It has been reported by the locals that during the time of an emergency, the locals go for treatment to Jaisalmer which is 143 km or Bikaner which is 180 km. However, there are few private clinics in the study

[1] **Rural Sanitary Mart or Sanitary Hardware Outlet (RSM):** It is an outlet dealing with the materials, hardware and designs required for the construction of not only sanitary latrines but other sanitary facilities such as compost pit, washing platform and other sanitation and hygiene accessories required for individuals, households and the environment in the rural areas.

[2] **Community Toilet Complex** : Community Toilet may be constructed and maintained by Gram Panchayats or Private NGOs like Sulabh Sauchalaya or likes

[3] **Primary Health Sub Centres and Public Health Centres (PHC**). While the sub centres cater to a population of 5,000 individuals, the PHCs are for a population of 10,000-30,000 individuals. While the PHCs are mostly for OPD (Out Patient Department) and basic IPD (Indoor Patient Department) cases, sub centres usually have a delivery room and 2 resident nurses (one male and one female). Each PHC has 5-6 sub centres under them. In turn, a cluster of 6-10 PHCs come under a CHC (Community Health Centre), which caters to a population exceeding 1 lakh, and also provides emergency services. The CHCs in turn report to the public hospitals at the district level.

area but their consultation and treatment fees are not pocket friendly for the locals as it ranges from INR 500 – INR 1000I as stated by the locals. During the discussion with the IL&FS officials they stated that they are running the mobile dispensary which generally visits villages once a month and covers 16 villages per month, this information has been confirmed by the locals during the consultation.

The facility of the ambulance is not available in the study area as the roads are not well developed. However it has been understood through consultations that even if the facility of ambulance would have been available, the women would have still been reluctant in using it, as the pregnant women are reportedly more comfortable in going in the private hired car for the delivery of child and the average cost of hired vehicle is approx. 2000 INR. However, it has been mentioned by the locals that ratio of women going to the hospital is comparatively less than the ratio of women delivering babies in the home. There is one Aganwadi in the study area which provides supplementary nutrition, immunization, health check-ups, and nutrition and health education for mothers/pregnant women, nursing mothers, as stated by the local's women in the study area.

It has been noted through consultations that common disease in this area are Typhoid, Malaria, Dengue, Diabetes, and other common ailment such as cold, cough, fever.

5.12 Other Physical Infrastructure

5.12.1 Road & Transportation

The study area is connected through kaccha/ rural road and for the local transportation, the locals use car or bus, as stated by the locals.

5.12.2 Electricity

During the consultation with the locals, it has been understood that in the study area Dhanis don't have existing electricity supply networks, due to which there is no provision of power supply; however work on the same has been reportedly ongoing. The scenario of Bhadla village is slightly different, the electricity is available but only for 6 hours, 3 hours in morning and 3 hours in evening stated by the villagers

5.12.3 Postal Service, Bank, Telecommunication

As per 2011 census data, none of the villages in the study area have post office and operational branches of banks. Mobile phone is the prominent source of communication in the villages in study area.

6. STAKEHOLDER ENGAGEMENT

6.1 Introduction

“A stakeholder is defined as a party that has an interest in an enterprise or Project. The primary stakeholders in a typical corporation are its investors, employees, customers and suppliers. However, modern theory goes beyond this conventional notion to embrace additional stakeholders such as the community, government and trade associations”.

Stakeholder identification and their inclusion in the decision making process is critical in prioritizing, analysing and addressing issues; and developing management systems and mechanisms to address their respective concerns as well as apprehensions.

Stakeholder mapping refers to the process of identifying individuals or groups having influence over a Project and assessing the effects of their actions on the Project. Stakeholder mapping helps in identifying different stakeholders as primary or secondary based on the degree of influence on a Project and by analysing the stakes or interest each of them has in the Project and the manner in which both the stakeholder group as well as the Project can benefit from each other.

For the purpose of the Project, stakeholder mapping has been carried out with the following objectives:

- Identify relevant stakeholder groups;
- Study the profile and characteristics and the nature of stakes each stakeholder group has;
- Assess their respective influence levels on the Project; and
- Appreciate the precise issues and concerns as well as the expectations from the Project that each group possesses.

6.2 Stakeholder Consultation and disclosure requirement for the Project

The disclosure of Project information and consultations with stakeholders has been increasingly emphasized by Project finance institutions and government regulatory bodies. A brief overview of the requirements of public disclosure and stakeholder consultation applicable to this Project is provided below:

Table 6.1 Overview of Disclosure and Stakeholder consultation requirement as per IFC Performance Standards

Reference Regulation/ Standard	Requirements
PS-1 (Assessment and Management of Environmental and Social Risks and Impacts)	Community engagement is to be undertaken with the affected communities and must be free of external manipulation, interference, or coercion, and intimidation. Furthermore, in situations where an affected community may be subject to risks or adverse impacts from a Project, the proponent must undertake a process of consultation so as to provide the affected communities with an opportunity to express their views on the Project risks, impacts, and mitigation measures, as well as allow the proponents to consider and respond to them. Informed participation: For Projects with significant adverse impacts on affected communities, the consultation process must ensure that free, prior and informed consultation with affected communities occurs and that processes exist to facilitate participation by those affected.

Reference Regulation/ Standard	Requirements
	Apart from such a consultation process, the Project proponents are also to establish a Grievance Redressal Mechanism, which will allow the affected communities' concerns and grievances about the Project proponent's environmental and social performance to be received and allow for steps to be taken to resolve the same Broader stakeholder engagement: The proponent must identify and engage with stakeholders that are not directly affected by the Project but those that have established relationships with local communities and/or interest in the Project – local government, civil society organizations, etc. – and establish a dialogue.

6.3 Stakeholder Categorisation

A stakeholder is "any identifiable group or individual who can affect the achievement of an organization's objectives or who is affected by the achievement of an organization's objectives"[1].Stakeholders thus vary in terms of degree of interest, influence and control they have over the Project. While those stakeholders who have a direct impact on or are directly impacted by the Project are known as **Primary Stakeholders,** those who have an indirect impact or are indirectly impacted are known as **Secondary Stakeholders**. Keeping in mind the nature of the Project and its setting, the stakeholders have been identified and listed in **Table 6.2.**

Table 6.2 Stakeholder Group categorisation

Stakeholder Groups	Primary Stakeholders	Secondary Stakeholders
Community	■ Land lessor ■ Developers and Contractors ■ Local Laborers	■ Local Community ■ Vulnerable Communities ■
Institutional Stakeholders	■ Gram Panchayats	■ Civil Society/ Local NGOs
Government Bodies	■ Regulatory Authorities ■ District Administration	■
Other Groups	■ Migrant Workforce	

6.4 Approach and Methodology for Stakeholder Analysis

The significance of a stakeholder group is categorized considering the magnitude of impact (type, extent, duration, scale and frequency) or degree of influence (power and proximity) of stakeholder group and urgency/likelihood of the impact/influence associated with the particular stakeholder group in the Project context. The magnitude of stakeholder impact/influence is assessed taking the power/responsibility[2] and proximity[3] of the stakeholder group and the group is consequently categorized as negligible, small, medium or large. The urgency or likelihood of the impact on/influence by the stakeholder is assessed on a scale of low, medium and high. The overall significance of the stakeholder group is assessed as per the matrix provided in **Table 6.2**

Table 6.3 Stakeholder Significance and Engagement Requirement

		Likelihood of Influence on/ by Stakeholder		
		Low	Medium	High
Magnitude of	Negligible	Negligible	Negligible	Negligible

1. Freeman, R. and Reed, D. (1983). Stockholders and Stakeholders: A new perspective on Corporate Governance. *California Management Review.* pp. 88 – 106.
2. Power/Responsibility: Those stakeholders to whom the organisation has, or in the future may have, legal, financial, and operational responsibilities in the form of regulations, contracts, policies or codes of practice.
3. Proximity: indicates stakeholders that the organisation interacts with most, including internal stakeholders, those with long-standing relationships and those the organisation depends on its day-to-day operations.

		Likelihood of Influence on/ by Stakeholder		
		Low	Medium	High
Influence/ Impact	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Urgent
	Large	Moderate	Urgent	Urgent

6.5 Stakeholder Analysis

The table below has been used to classify the identified stakeholders (directly or indirectly impacting the Project) in accordance to their levels of influence on the Project. The influence and priority have both been primarily rated as:

- ***High Influence:*** This implies a high degree of influence of the stakeholder on the Project in terms of participation and decision making or high priority to engage with the stakeholder;
- ***Medium Influence:*** Which implies a moderate level of influence and participation of the stakeholder in the Project as well as a priority level to engage the stakeholder which is neither highly critical nor are insignificant in terms of influence; and
- ***Low Influence:*** This implies a low degree of influence of the stakeholder on the Project in terms of participation and decision making or low priority 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.

Table 6.4 Stakeholder Analysis

Relevant Stakeholders	Profile/Status	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
Primary Stakeholders					
Lessors	■ Lessors for the Project is Saurya Urja Company of Rajasthan Limited (SURAJ). The Lessor is a 50:50 joint venture Company of Govt. of Rajasthan and IL&FS. ■ The solar park, being developed by Saurya Urja Company of Rajasthan Limited; ■ The stakeholder group is responsible for creation of infrastructure in the Solar Park and undertaking regular maintenance.	The Project is expected to have a positive impact on the Lessor through smooth operations and uninhibited flow of revenue (tariffs) at pre fixed intervals form the Solar Power plant developers.	■ The stakeholder group is expected to have a positive influence on the Projects by undertaking regular maintenance of Solar Park infrastructure and troubleshooting needs for the Project developer, in order to ensure smooth operations of the Solar Power Plants; ■ Any kind of legacy of conflict ridden relationship with local communities may intervene with the smooth operations of the Project.	■ The interest of the lessor, who is also the developer of the Solar Park, is the smooth operations of the Park and constant cash flow as determined at the time of agreements with Solar Power developers. .	High
Developer	■ CSP Bhadla, Pvt Ltd is the developer of the Project and is responsible for construction, operations and maintenance of the Solar Power Project.	■ The Project is expected to have a positive impact on the developer bringing in steady cash flows through sale of electricity.	■ Not meeting the community expectations might lead to agitations and eventually stopping of operations of the power plant.	■ The contractors hired by the developer play an important role during the Project construction phase for timely commissioning of the Project with quality construction and within the stipulated budgetary provisions; ■ Additionally, the interaction of the contractors with the nearby community should be limited and	Medium

Relevant Stakeholders	Profile/Status	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
				hassle free, without causing any reputational damage to the Project.	
Contractors and Sub-Contractors	■ This stakeholder group comprises of agencies/organizations engaged by CSP Bhadla Pvt. Ltd for the various stages of the Project. The contractors hired by the CSP Bhadla Pvt Ltd are detailed in section **0**	The primary concerns and expectations of the group from the Project include: ■ The role of the Project in continued economic opportunity and work generation; ■ Any reputational risks associated with the Project due to any community unrest or Project activities may lead to difficulties in operation and making accommodation arrangement for labourers in the nearby villages; ■ Clarity in terms of scope of work, expectations, key performance indicators and timelines; ■ Timely and adequate disclosure of information to allow the Project activities to be carried out.	■ This stakeholder group is critical for the smooth functioning and timely implementation of the Project; ■ This group may also play an important role in the formation of public opinion towards the Project.	■ The expectation of this stakeholder group is continued business opportunities and regular payments for the agreed scope of work at pre-determined intervals.	High
Local Labourers	A considerable section of the working population of the local area are Other workers comprising of 12% which may be engaged during the construction phase. However,	The Project can serve as added source of livelihood for the local community, where locals will get employment opportunities during the construction phase which will	■ During the construction phase of Project most of the unskilled labourer will be hired from the local area. This will reduce expenditure and will add to the goodwill to the Project	The major concerns of this stakeholder group includes; ■ Regular payment of wages for the work rendered;	Medium

Relevant Stakeholders	Profile/Status	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	local labourer are available in the study area, which are working as a construction labourer in other solar park as well. They can be used during the construction phase of solar power Projects. Through there will be a significant reduction in the number of labourer during the operational phase, as the requirement is less , however some of the locals can be employed for the jobs like security guards, housekeeping etc., as a semi-skilled labourer	be reduced during the operational phase, as the requirement is less.	.However, it should be clearly communicated to the locals during the construction phase that it is a temporary job and there should be no expectation of continuation of the job beyond the construction phase.	■ Continued employment even beyond the completion of construction work. Health and Safety issues at work; and Holidays and leaves as per labour laws applicable etc.	
Gram Panchayats (GPs)	■ Constituting the lowest strata of Decentralized Local Governance in the Country, a typical Panchayat consists of one or more revenue villages. This body of local governance was created through the 73rdAmendment to the Constitution of India; ■ As, part of this, most of the rural development schemes and funds for central schemes channelled through	■ The Project will create collective benefit for the local community through extending support in community development activities and by strengthening their role in entire process of facilitation.	■ GPs play an important role in overall mobilization and shaping the perception and opinions of the people in the Project area. They also serve as the official forum for consent and approval required for the Project.	The expectations/ concerns of the GPs include: ■ Employment Opportunities for the Local Youth; ■ CSR activities for development of local area; and ■ Nature of impact that the Project would have on the livelihoods of communities.	Medium

Relevant Stakeholders	Profile/Status	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	this body of governance; ■ Sarpanch and other members of the Gram Panchayat need to be actively involved in various activities relating to the economic development and social justice of their Panchayat. The smooth and hassle-free functioning of the Project is also the onus of the Panchayats.				
Regulatory Authorities	■ This stakeholder group is comprised of the central, state and district level regulatory authorities; ■ These authorities influence the Project in terms of establishing policy, granting permits and approvals for the Project, monitoring and enforcing compliance with the applicable rules and regulations.	The key expectations and concerns of the group from the Project include: ■ Project's compliance to the regulatory requirements; ■ Timely disclosure of information and provisioning of update throughout the Project lifecycle.	■ The ability of the Project to comply with the various rules and regulations applicable is instrumental for the timely implementation of the Project; ■ This stakeholder group is also critical for the obtaining of the various permits/clearances required for the commissioning of the Project.	■ The influence of the Project on the stakeholders pertains to the role the Project will play in the development of solar energy in the area.	High
District/Tehsil Administration	■ The Project area is administered at three levels by different Government Bodies: at the district level, at the block/tehsil level and at the Panchayat level in	■ The Project is expected to have a positive influence over the local administration by extending support through these authorities or by collaborating to undertake	■ There are several permissions and regulatory approvals that are required prior to as well as after the construction of the Project from the District Administration. ■ Delay in issuance of the relevant permits can adversely	■ Matters concerning local employment; ■ Preference to local youths in aspects of contractor-ship or vehicle hire, etc.; and local area development through CSR interventions.	Low

Relevant Stakeholders	Profile/Status	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	each village/or cluster of villages; ■ In this context, local administration refers to the district level comprising of the office of the Deputy Commissioner and block level administration comprising of the offices of the Sub-divisional Magistrate, Tehsildar, and Revenue officer etc.	community development activities.	impact the timely execution of the Project.		
Migrant Workforce	■ The nature of activities in the construction phase requires skilled labourers for certain specific tasks which are not understood to be locally available; ■ To bridge the skill gap, labourers skilled in specific tasks would be brought in by the contractors/ sub-contractors from other areas; ■ These migrant workers will be accommodated in the villages near the Project location	■ Migrant workers may see this as a better economic and livelihood opportunity for them; and ■ The fluctuation of the supply of local labour in harvest and other agricultural peak seasons can be met by deployment of migrant workers.	■ Retaining the migrant workforce, especially during the construction phase of the Project is extremely critical. ■ This is because there are similar experiences of the lack of availability of manpower in the local area.	The major concerns of this stakeholder group may include: ■ Regular payment of wages for the work rendered; ■ Continued employment even beyond the completion of construction work; ■ Health and Safety issues at work; ■ Holidays and leaves as per labour laws applicable etc.; and ■ Issues relating to conflicts with the local labour and host community.	Low
Secondary Stakeholders					

Relevant Stakeholders	Profile/Status	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
Local Community	■ The stakeholder group comprising of local communities around a radius of 5 kms inhabit the villages Ajeri, Ismile Khan Ki Dhani, Bhadlachuhron Ki Basti. It is a Muslim dominated area. ■ In the study area there are 1% of SC community and no ST population. ■ The community in the study area is primarily engaged as cultivators is 33.9% which is comparatively higher than the proportion of agricultural labour , comprising of 6.8%, however the other works comprises of 12% which is higher as compare to the population engaged in the household industry 0.6%.	■ The Project will have a positive influence over the local community in terms of generating additional local employment; ■ There may be several community members who own small businesses like grocery, transport service providers, etc, which may indirectly benefit from the influx of population from outside; ■ In addition, there will be developmental and CSR activities conducted will focus on education and health, and might also target at the neighbouring villages and the immediate local community which will lead to improvement in livelihood, education and health.	■ The support of the local community to the Project and its activities play an essential role to ensure smooth functioning of the Project ■ During the consultation it has been noted that during the construction phase, the labourers might be hired from local community.	■ Expectations of getting employment benefits from the Project; and ■ Contributing positively through targeted community development activities would be also among the key expectations.	Low
■ Village Institutions	■ This stakeholder group is comprised of health and education institutions at the	■ The main concerns and expectations of the group from the Project pertain to:	■ The influence of the group on the Project pertains to the role of the played by these institutions in the opinion	■ The influence of the Project on the group pertains to the role of the Project in the development of these institutions	Low

Relevant Stakeholders	Profile/Status	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	village level. The institutions in the immediate proximity of the Project are the primary schools in the villages	■ Adequacy of community development activities in the area ■ Contribution of the Project towards the overall development of the area ■ Involvement in the formulation and implementation of the community development activities ■ Timely and adequate disclosure of information pertaining to the Project	formation and implementation of community development programmes and CSR activities		
■ Opinion Makers and Community Leaders	■ This stakeholder group is comprised of those individuals of the local community who hold traditional and rational power. These stakeholder group members include the elders, community and political leaders in the village and play a critical role in the decision making in the local community	■ The expectations and concerns of this group from the Project: ■ Receiving benefits from the Project in terms of employment and development of infrastructure and the community ■ Preference to the local community in contractor and employment opportunities from the Project ■ Regular updates on the Project activities and the opportunities from the same ■ Minimal disturbance to the community in regards to access issues, pollution	■ This group may play a critical role in the opinion formation towards the Project and the achievement of a 'social license to operate' ■ In the past, the local community has been reported to create road blockades and disrupt other Project activities in cases where the local community was not given preference in economic opportunities ■ The stakeholder may also an important role in the implementation of the development and CSR activities planned and the implementation of the management plans such as	■ Preference in developmental activities and advice/ opinion prior to commencement of developmental activities in the area.	Low

Relevant Stakeholders	Profile/Status	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
		and influx of migrant workers	stakeholder engagement and grievance management		
■ Media	■ The media, comprising of both print and visual media, has a significant presence in the district. They are known to have played an extremely important role in generating awareness amongst the community.	■ The main expectations and concerns of the stakeholder from the Project include: ■ Compliance to the regulatory requirements for the Project ■ Project's role in the development of the area ■ Maintenance of positive relationship with the local community and other stakeholders ■ Timely disclosure of information in regards to the Project activities	■ The influence of the stakeholder group on the Project is likely to pertain to the opinion formation amongst other stakeholders towards the Project	■ The influence of the Project on the stakeholder is likely to be extremely limited due to the nature of the Project activities	Low

The **Table 6.5** has demonstrated the summary of overall stakeholder influence

Table 6.5 Summary of Overall Stakeholder Influence

Stakeholder Category	Relevant Stakeholders	Magnitude of Influence/Impact	Likelihood of Influence on/by Stakeholder	Overall Rating of Stakeholder Influence
Primary stakeholder	Lessors	High	High	High
	Developer	Medium	Medium	Medium
	Contractors and Sub-Contractors	Medium	High	High
	Local Labourers	Small	Medium	Minor
	Gram Panchayats	Medium	Low	Minor
	Regulatory Authorities	Medium	Medium	Medium
	District/Tehsil Administration	Negligible	Low	Negligible
	Migrant Workforce	Medium	Low	Minor
Secondary Stakeholders	Local Community	Small	Low	Negligible
	Village Institution	Negligible	Low	Negligible
	Opinion Makers and Community Leaders	Small	Low	Negligible
	Media	Negligible	Low	Negligible

7. IMPACT ASSESSMENT AND MITIGATION MEASURES

7.1 Introduction

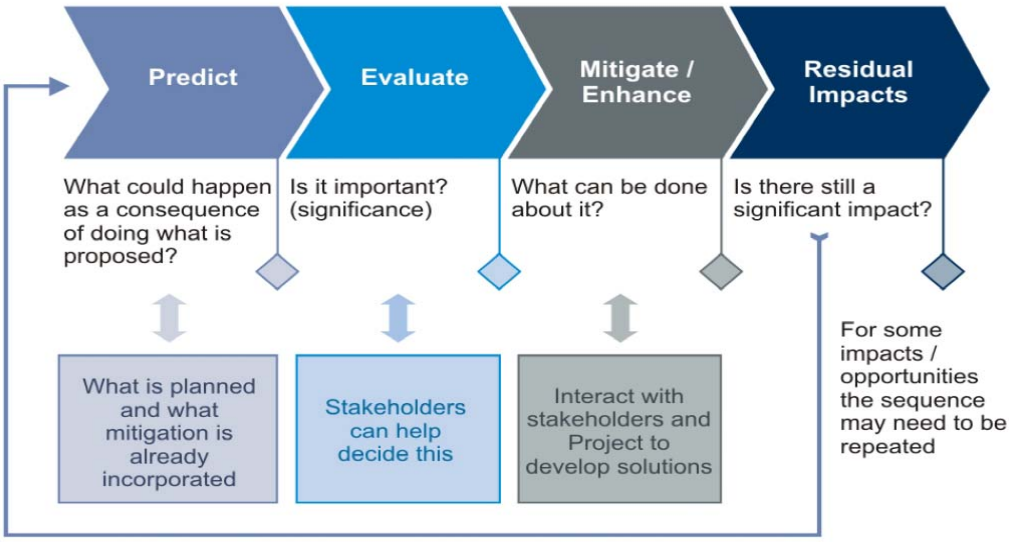
This section assesses the manner in which the Project will interact with elements of the physical, ecological or social environment to produce impacts to resources/ receptors. It has been organized as per the various phases of the Project life cycle to understand the risks and impacts associated with each phase.

7.2 Assessment Methodology

Impact identification and assessment starts with scoping and continues through the remainder of the Impact Assessment (IA) Process. The principal IA steps are summarized in ***Figure 7.1*** and comprises of

- **Impact prediction**: to determine what could potentially happen to resources/receptors as a consequence of the Projects and its associated activities.
- **Impact evaluation**: to evaluate the significance of the predicted impacts by considering their magnitude and likelihood of occurrence, and the sensitivity, value and/or importance of the affected resource/receptor.
- **Mitigation and enhancement**: to identify appropriate and justified measures to mitigate negative impacts and enhance positive impacts.
- **Residual impact evaluation**: to evaluate the significance of impacts assuming effective implementation of mitigation and enhancement measures.

Figure 7.1 Impact Assessment Process



Prediction of Impacts

Prediction of impacts was carried out with an objective to determine what is likely to happen to the environment as a consequence of the Project and its associated activities. From the potentially significant interactions identified in scoping, the impacts to the various resources/receptors were elaborated and evaluated.

Evaluation of Impacts

Each impact was described in terms of its various relevant characteristics (e.g., type, scale, duration, frequency, extent). The terminology used to describe impact characteristics is shown in ***Table 7.1.***

Table 7.1 Impact Characteristic Terminology

Characteristic	Definition	Designation
Type	A descriptor indicating the relationship of the impact to the Project (in terms of cause and effect)	Direct Indirect Induced
Extent	The "reach" of the impact (e.g., confined to a small area around the Project Footprint, Projected for several kilometres, etc.)	Local National Global
Duration	The time period over which a resource/ receptor is affected.	Temporary Short-term Long-term Permanent
Scale	The size of the impact (e.g., the size of the area damaged or impacted, the fraction of a resource that is lost or affected, etc.)	[no fixed designations; intended to be a numerical value or a qualitative description of "intensity"]
Frequency	A measure of the constancy or periodicity of the impact.	[no fixed designations; intended to be a numerical value or a qualitative description]

The definitions for the type designations are given in **Table 7.2**. Definitions for the other designations are resource/receptor-specific.

Table 7.2 Impact Type Definitions

Type	Definition
Direct	Impacts that result from a direct interaction between the Project and a resource/ receptor
Indirect	Impacts that follow on from the direct interactions between the Project and its environment as a result of subsequent interactions within the environment
Induced	Impacts that result from other activities (which are not part of the Project) that happen as a consequence of the Project.

The above characteristics and definitions apply to planned and unplanned events. An additional characteristic that pertains only to unplanned events is likelihood. The likelihood of an unplanned event occurring was designated using a qualitative scale, as described in ***Table 7.3.***

Table 7.3 Definitions of Likelihood Designations

Likelihood	Definition
Unlikely	The event is unlikely but may occur at some time during normal operating conditions (probability less than 20%)
Possible	The event is likely to occur at some time during normal operating conditions (probability greater than 20% and less than 50%)
Likely	The event will occur during normal operating conditions (probability greater than 50%

Once an impact's characteristics were defined, each impact was assigned a 'magnitude'. Magnitude is typically a function of a combination (depending on the resource/receptor in question) of the following impact characteristics:

- Extent
- Duration
- Scale
- Frequency

In case of unplanned events only, magnitude incorporates the 'likelihood' factor discussed above.

Magnitude essentially describes the intensity of the change that was predicted to occur in the resource/receptor as a result of the impact. As discussed above, the magnitude designations themselves are universally consistent, but the descriptions for these designations vary on a resource/receptor-by-resource/receptor basis. The universal magnitude designations are:

- Positive
- Negligible
- Small
- Medium
- Large

In the case of a positive impact, no magnitude designation (aside from 'positive') was assigned. It was considered sufficient for the purpose of the IA to indicate that the Project was expected to result in a positive impact, without characterising the exact degree of positive change likely to occur.

In the case of impacts resulting from unplanned events, the same resource/ receptor-specific approach to concluding a magnitude designation was followed, but the 'likelihood' factor was considered, together with the other impact characteristics, when assigning a magnitude designation.

In addition to characterising the magnitude of impact, the other principal impact evaluation step was definition of the sensitivity/ vulnerability/ importance of the impacted resource/receptor. There are a range of factors that was taken into account when defining the sensitivity/ vulnerability/ importance of the resource/receptor, which may be physical, biological, cultural or human. Other factors were also considered when characterising sensitivity/ vulnerability/importance, such as legal protection, government policy, stakeholder views and economic value. The sensitivity/ vulnerability/importance designations used herein for all resources/receptors are:

- Low
- Medium
- High

Once magnitude of impact and sensitivity/ vulnerability/ importance of resource/ receptor have been characterised, the significance was assigned for each impact. Impact significance is designated using the matrix shown in ***Figure 7.2..***

Figure 7.2 Impact Significance

		Sensitivity/Vulnerability/importance of Resource/Receptor		
		Low	Medium	High
Magnitude of Impact	Negligible	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

The matrix applies universally to all resources/receptors, and all impacts to these resources/receptors, as the resource/receptor-specific considerations are factored into the assignment of magnitude and sensitivity/ vulnerability/ importance designations that enter into the matrix. ***Box 7.1*** provides a context of what the various impact significance ratings imply.

Box 7.1 Context of Impact Significance

An impact of **negligible** significance is one where a resource/ receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations.

An impact of **minor** significance is one where a resource/ receptor will experience a noticeable effect, but the impact magnitude is sufficiently small and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. In either case, the magnitude should be well within applicable standards/ guidelines.

An impact of **moderate** significance has an impact magnitude that is within applicable standards/guidelines, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.

An impact of **major** significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of IA is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual impact of a facility. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the Project.

It is important to note that impact prediction and evaluation takes into account any embedded controls (i.e., physical or procedural controls that are already planned as part of the Project design, regardless of the results of the IA Process).

A cumulative impact is one that arises from a result of an impact from the Project interacting with impact from other similar activities to create and additional impact. It was observed during site reconnaissance survey that the Project falls in Bhadla Park and has many plants within 5 kms radius and many are in planning stages. Cumulative impacts have also been discussed in the report.

Activity-Impact Interaction Matrix for Planning, Construction, Operation & Maintenance and Decommissioning Phases has been further used to assess the impact significance at activity levels on environmental, ecological and social resources.

Cumulative Impacts

A cumulative impact is one that arises from a result of an impact from the Project interacting with an impact from another activity to create an additional impact. Potential cumulative impacts are discussed in the relevant assessment chapters. How the impacts and effects are assessed is strongly influenced by the status of the other activities (e.g. already in existence, approved or proposed) and how much data is available to characterize the magnitude of their impacts.

The approach to assessing cumulative impacts in this ESIA is to screen potential interactions with other Projects on the basis of:

- Projects that are already in existence and are operating; and
- Projects that are approved but are not constructed or operating.

Identification of Mitigation and Enhancement Measures

Once the significance of an impact has been characterised, the next step was to evaluate what mitigation and enhancement measures are warranted. For the purposes of this IA, ERM adopted the following Mitigation Hierarchy:

- **Avoid at Source, Reduce at Source:** avoiding or reducing at source through the design of the Project.
- **Abate on Site:** add something to the design to abate the impact.
- **Abate at Receptor:** if an impact cannot be abated on-site then control measures can be implemented off-site.
- **Repair or Remedy:** some impacts involve unavoidable damage to a resource (e.g. agricultural land and forestry due to creating access, work camps or materials storage areas) and these impacts can be addressed through repair, restoration or reinstatement measures.
- **Compensate in Kind, Compensate Through Other Means:** where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate (e.g., planting to replace damaged vegetation, financial compensation for damaged crops or providing community facilities for loss of fisheries, access, recreation and amenity space).

The priority in mitigation was to first apply mitigation measures to the source of the impact (i.e., to avoid or reduce the magnitude of the impact from the associated Project activity), and then to address the resultant effect to the resource/receptor via abatement or compensatory measures or offsets (i.e., to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude).

Residual Impact Evaluation

Once mitigation and enhancement measures are declared, the next step in the ESIA Process is to assign residual impact significance. This is essentially a repeat of the impact assessment steps discussed above, considering the implementation of the proposed mitigation and enhancement measures.

Management and Monitoring

The final stage in the IA Process was the definition of the basic management and monitoring measures that are needed to identify whether: a) impacts or their associated Project components

remain in conformance with applicable standards/ guidelines; and b) mitigation measures are effectively addressing impacts and compensatory measures and offsets are reducing effects to the extent predicted. This is covered in ***Section 8*** under Environmental and Social Management Plan (ESMP).

7.3 Key Environmental Impacts

Interactions that are likely to lead to significant impacts as identified during the scoping exercise (refer to ***Section 4.2.1***) and baseline conditions (**Section *5.3***) are presented **Table 7.4**.

Table 7.4 Environmental Interactions identified that are likely to result in significant impacts

Resource/Receptor	Potentially Significant Impacts
Land Use	■ Perceived permanent changes in land use due to installation of PV Modules, SCADA system, Switching Yard, access roads. ■ Perceived temporary changes in land use due to temporary site office and material storage yard.
Topography and drainage	■ Change in the topography and micro drainage channel due to construction of Project site access roads (internal access roads).
Land and Soil Environment	■ Permanent change in land use at Solar farm site and ancillary facilities; ■ Erosion of loose soil especially during windy periods; ■ Generation of construction debris; ■ Impact on soil and land environment due to improper management of domestic solid waste generated; ■ Storage and handling of hazardous materials (e.g., fuel and lubricant) and waste generated from operation of construction equipment and machinery and their maintenance may lead to soil contamination due to leaks/ spillage; ■ Generation of hazardous waste during operation of solar farm.
Ambient Air Quality	■ Dust emissions due to movement of machinery and vehicles; ■ Fugitive dust emissions due to excavation and back filling activities etc.; ■ Air emissions due to operations of DG sets.
Ambient Noise Environment	■ Noise generation due to movement of vehicles and heavy earth moving machineries; ■ Generation of noise during operation of DG Set;
Water Environment	■ Requirement of water for domestic and construction purposes thereby will put a stress on water resources; ■ Surface and ground water contamination due to improper disposal of sewage at site; and ■ Surface and ground water contamination due to spillage of oil, lubricant and hazardous waste.

Resource/Receptor	Potentially Significant Impacts
Occupational Health and Safety	■ Occupational health hazards due to dust and noise pollution; ■ Exposure of workers to electromagnetic field (EMF) while working in proximity to charged electric power lines during operation and maintenance.
Visual Impacts	■ The visual landscape of the area will be altered due to the Solar farms and supporting facilities.

7.3.1 Change in Land Use

For the purpose of assessment of impacts on land use of the area, following Project activities leading to an alteration in land use of the area during construction phase were considered:

- Construction/ upgradation of access roads (internal);
- Establishment and operation of temporary structures such as temporary site office (portable cabin) and store yard;
- Vehicular movement;
- Erection of PV modules and associated transformer yard; and
- Construction of Central Monitoring Station, Switching Yard.

Criteria

For the assessment of land use, the sensitivity and magnitude criteria outline in **Table 7.5** and **Table 7.6** have been used respectively.

Table 7.5 Sensitivity Assessment Criteria for Land Use

Land Use Sensitivity	Criteria
Low	■ Land use not of relevant use by Community ■ Negligible visual change.
Medium	■ Land use of local use by communities e.g. grazing, agriculture, but no major dependence ■ Visual Change but common feature
High	■ Land use of regional importance. Change would impact Land use classification of the area. ■ Land use of major dependence of local people for agriculture, livestock grazing, settlement etc. ■ Visual Change aesthetically affecting locals.

Table 7.6 Criteria for Impact Magnitude for Assessment of Impact to Land Use

Magnitude	Criteria
Negligible	An imperceptible, barely or rarely perceptible change in land use characteristics. The change may be short term.
Small	Subtle changes in land use character over a wide area of a more noticeable change either over a restricted area or infrequently perceived. The change may be short term to long term and is reversible.

Magnitude	Criteria
Medium	A noticeable change in land use character, frequently perceived or continuous and over a wide area; or a clearly evident change over a restricted area that may be infrequently perceived. The change may be medium to long term and may not be reversible.
Large	A clearly evident, frequently perceived and continuous change in land use characteristics affecting an extensive area. The change may be long term and would not be reversible.

Context and Receptor Sensitivity

The Project area consists primarily of scrub/fallow land. The solar farm site is located on plain terrain with slightly elevated terrain. The Project would result in change of the land use within the land parcels where the proposed solar power Project is being setup. Besides this, construction of internal roads would result in certain levelling in the vicinity and setting of labour camp, storage yards, site office would temporarily alter the land use. The actual area of land use impact would be limited to the footprint and immediate vicinity of the solar farms site. Receptor sensitivity is envisaged to be medium Project considering the land use will change to industrial, although there is no major dependence of local community on the land use.

Embedded/In-built Controls

Construction activities will be restricted to within the acquired land and immediate surroundings only. Post construction activities, any land taken for a temporary basis for storage of material would be restored to their extent possible original form to minimise impacts to land use. Reportedly access roads (within the plant) will be developed connecting the site to the internal approach road (7 m width) of solar plant. Existing roads will be used to the extent possible.

Impact Magnitude

The establishment of the solar plant will convert scrub land to industrial use for long term (approximately 25 years). Changes in land use are also envisaged for the development of the associated facilities such as storage yard, offices, switch yard etc. However, the impact on land use will only be within the Project boundary and will not affect any of the neighbouring areas. Furthermore, the changes to land use will be reversible. Thus, magnitude of the impact has been assessed to be **medium**.

Significance of Impact

The overall impact significance will therefore be moderate.

Additional Mitigation Measures

- Construction activities should be restricted to designated area;
- On completion of construction activities, land used for temporary facilities such as stockyard if any should be restored to the extent possible;
- Waste management should be practiced to minimize any disturbances to the surrounding areas;
- The land use in and around permanent Project facilities should not be disturbed; and
- The land should be restored back to the original state to the extent possible after completion of life cycle of the Project and in case there are plans not to continue further at the site.

Residual Impact Significance

The residual impact significance is envisaged to be **moderate** as changes in land use will be for long term for majority of the Project component (installation of PV modules, access roads, central monitoring station, and switching yard).

Impact	Changes in Land use during construction and operation				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to Project site and associated facilities				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **moderate.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **moderate**				

7.3.2 Impact on Topography and Drainage

For the purpose of assessment of impacts on topography and drainage of the area, sensitivity and magnitude criteria have been outlined in **Table 7.7** and **Table 7.8** respectively.

Table 7.7 Sensitivity Assessment Criteria for Topography

Topography and Drainage Sensitivity	Criteria
Low	Flat topography
Medium	Undulating topography
High	Hilly area

Table 7.8 Criteria for Impact Magnitude for Assessment of Impacts on Topography and Drainage

Magnitude	Criteria
Negligible	An imperceptible, barely or rarely perceptible change in topographical characteristics. The change may be short term.
Small	A subtle change in topography character over a wide area of a more noticeable change either over a restricted area or infrequently perceived. The change may be short term to long term and is reversible.

Magnitude	Criteria
Medium	A noticeable change in topographic character, frequently perceived or continuous and over a wide area; or a clearly evident change over a restricted area that may be infrequently perceived. The change may be medium to long term and may not be reversible.
Large	A clearly evident, frequently perceived and continuous change in topographic characteristics affecting an extensive area. The change may be long term and would not be reversible.

Receptor Sensitivity

The Project area exhibits undulating topography. The receptor sensitivity has thus been assessed to be **medium**.

Embedded/In-built Control

The EPC contractor will be instructed not to deviate from the Project plan and design w.r.t topography.

Impact Magnitude

It was reported that the access road to the site will be developed which will involve site filling and levelling leading to a noticeable change in the topographic character of the area. This will lead to a long term and non-reversible impact and hence the magnitude has been assessed as **medium**.

Significance of Impacts

Significance of impact is envisaged to be **moderate**.

Additional Mitigation Measures

- Disruption/alteration of micro-watershed drainage pattern should be minimized to the extent possible; and
- Appropriate number of cross drainage channels should be provided during access road construction to maintain flow in existing natural channels.

Significance of Residual Impact

The residual impact significance will be reduced to **minor** after implementing above mentioned mitigation measures.

Impact	Change in topography and drainage				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to Project site and access road				
Impact Magnitude	Positive	Negligible	Small	Medium	Large

Resource/ Receptor Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Moderate.**				
Residual Impact Significance					
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor**				

7.3.3 Impact on Soil Environment

Project Phases and Associated Activities

For impact assessment, the following phases of the Project cycles were considered for potential impacts on the soil environment. The phase wise Project activities that may impact the environment are described below:

Construction Phase

- Construction/strengthening of access roads;
- Vegetation clearance and top soil removal;
- Storage of oil and lubricants onsite;
- Storage of construction materials; and
- Disposal of different type of waste generated from the temporary Project site and labour camp

Operational Phase

- Storage of oil and lubricants onsite;
- Disposal of municipal solid waste and waste water from site office; and
- Storage of waste materials onsite.

Decommissioning Phase

- Removal of PV modules; and
- Removal of associated infrastructure.

For the assessment of soil quality, the sensitivity and magnitude criteria is outlined in

Table 7.9 and
Table 7.10 respectively.

Table 7.9 Sensitivity Assessment Criteria for Soil Quality

Sensitivity Criteria	Contributing Criteria	
	Environment	**Social**
Soil Quality related criteria as compaction, erosion and contamination and Land use change	The extent to which the soil and its quality plays an ecosystem role in terms of supporting biodiversity. This includes its role as in supporting a lifecycle stage	The extent to which the soil and its quality provides a use (agricultural use) to the local communities and businesses, or is important in terms of national resource protection objectives, targets and legislation
Low	The soil quality does not support diverse habitat or populations and/or supports habitat or population of low quality	The soil quality has little or no role in provisioning of services as agricultural uses for the local community.
Medium	The soil quality supports diverse habitat or population of flora and fauna and supports habitats commonly available in the study area	The soil has local importance in terms of provisioning services as agricultural services but there is ample capacity and / or adequate opportunity for alternative sources of comparable quality i.e. ready availability across the study area.
High	The soil quality supports economically important or biologically unique species or provides essential habitat for such species.	The soil is wholly relied upon locally, with no suitable technically or economically feasible alternatives, or is important at a regional level for provisioning services.

Table 7.10 Criteria for Impact Magnitude for Assessment of Impact to Soil

Magnitude Criteria	Negligible	Small	Medium	Large
Soil compaction and erosion	■ Qualitative-No perceptible or readily measurable change from baseline conditions ■ Scale-Localized area as Particular activity areas ■ Time-Short duration (few days) or one time as temporary	■ Perceptible change from baseline conditions but likely to easily revert back to earlier stage with mitigation ■ Scale- - Project site, activity areas and immediate vicinity not impacting any sensitive receptor ■ Short term- Only during particular activities or phase of the Project lifecycle as civil works or construction phase (few months)	■ Clearly evident (e.g. perceptible and readily measurable) change from baseline conditions and/or likely take time to revert back to earlier stage with mitigation ■ Scale- Project site, activity areas and immediate vicinity impacting sensitive receptor/s ■ Long term- Spread across several phases of the Project lifecycle (few years) ■	■ Major (e.g. order of magnitude) change in comparison to baseline conditions and/or likely difficult or may not to revert back to earlier stage with mitigation ■ Scale- Regional or international; ■ Permanent change
Soil contamination	Well within Dutch standard[1]	Well within Dutch standard[2]	Exceeds Target Value but well within Interventional Value	Exceeds Interventional Value and needs intervention.

Receptor Sensitivity

The receptor sensitivity has been assessed as ***low*** because the soil quality has little or no role in provisioning of services as agricultural uses for the local community in the area.

[1] Dutch Target and Intervention Values (Soil remediation Circular 2009-2012 Revision), https://zoek.officielebekendmakingen.nl/stcrt-2012-6563.pdf.

The assessment of potential impacts to soil and sediment has been considered as per the Dutch Standard as Bangladesh does not have any local standards for soil or sediment quality.

[2] Dutch Target and Intervention Values (Soil remediation Circular 2009-2012 Revision), https://zoek.officielebekendmakingen.nl/stcrt-2012-6563.pdf.

The assessment of potential impacts to soil and sediment has been considered as per the Dutch Standard as Bangladesh does not have any local standards for soil or sediment quality.

7.3.3.1 Soil Compaction and Erosion

Soil compaction and erosion has been considered for the construction and decommissioning phases only. In the operation phase, soil compaction and erosion may occur due to heavy vehicle movement, which only happens during the occasional maintenance activities. Soil compaction for the operation phase has therefore been considered to be infrequent and negligible.

Impact Magnitude

The site clearance, excavation for foundation and access road construction will largely affect the top layers of the soil. Further, site clearance will be restricted only in the Project site. Land close to the Project site will not be disturbed.

Vehicles will be encouraged to utilize the existing roads with minor strengthening. The usage of existing roads by vehicles and minimal access road construction will reduce the impact from soil compaction in the area.

The Impact Magnitude has been assessed to be **small.**

Embedded/In-built Controls

- Vehicles will utilize existing roads to access the site. Existing roads will be widened to have the width and turning radius to accommodate the necessary vehicles for the Project.

Significance of Impacts

The overall impact significance on soil erosion and compaction has been assessed as **minor**.

Additional Mitigation Measures

- Site clearance, piling, excavation and access road construction will not be carried out during the monsoon season to minimize erosion and run-off.

Significance of Residual Impacts

The significance of residual impacts has been reduced to **negligible** taking into account the recommended mitigation measures.

Impact	Soil Erosion and Compaction (Construction and Decommissioning)				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to Project areas				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Minor.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large

Residual Impact Significance	Negligible	Minor	Moderate	Major
	Significance of impact is considered **Negligible.**			

7.3.3.2 Waste Generation and Soil Contamination

Waste is generated in all phases of the Project:

Construction

- Construction waste including concrete, steel cuttings etc.;
- Municipal solid waste produced by the labour camp including food, plastic, glass, aluminium cans and waste paper; and
- Hazardous material and waste including oil, used oil, oil containing rags, etc.

Operation

- Solid waste generated by the O&M team including disposal of food, plastic, aluminium cans, glass, etc.;
- Sewage generated from the site office; and
- Hazardous waste (used transformer oil).

Decommissioning

- Demolition waste generated from removal of site components;
- Hazardous waste including unused oil, fluids, lubricants and grease; and
- Municipal solid waste generated by any labour camp(s).

Context

General construction waste generated onsite will comprise of concrete, steel cuttings/filings, packaging paper or plastic etc. Municipal solid wastes consisting of food waste, plastic, glass and waste paper will also be generated by the construction workforce at canteen facility/ labour camp. A small proportion of the waste generated during construction phase will be hazardous and will include waste fuel, grease and waste oil containing rags. Used transformer oil which is also categorised as hazardous waste will be generated from the plant. If improperly managed, solid waste could create impacts on soil quality.

Impact Magnitude

Ritis Meera (EPC Contractor) has managed several solar farm Projects in the past and have effective management systems for waste and hazardous substances being generated or utilized during the Project life cycle. The impact magnitude has therefore been assessed as **small**.

Embedded/In-built Control

Hazardous material and waste should be properly labelled, stored onsite at a location provided with impervious surface and in a secondary containment system.

Significance of Impact

The impact significance for waste generation and soil contamination has been assessed as **minor.**

Additional Mitigation Measures

- EPC Contractor should ensure that no unauthorized dumping of used oil and other hazardous waste is undertaken at the site;
- Designated areas should be provided for Solid Municipal Waste and daily collection and period disposal should be ensured;
- Construction and Demolition Waste should be stored separately and be periodically collected by an authorized treatment and storage facility;
- All waste should be stored in a shed that is protected from the elements (wind, rain, storms, etc.) and away from natural drainage channels;
- A log book should be maintained for quantity and type of hazardous waste generated; and
- In case of accidental/unintended spillage, the contaminated soil should be immediately collected and stored as hazardous waste.

Significance of Residual Impacts

The significance of impacts due to waste generation in the construction and decommissioning phases after implementation of mitigation measures has been considered as **negligible.**

Impact	Impact on soil environment due to waste generation (hazardous and non-hazardous)				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to Project area				
Frequency	Occasionally				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Major
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				

7.3.4 Impact on Water Environment

The impacts of Project on the water environment are assessed due to consumption of water during Project activities and contamination of water from accidental spillage of fuel, lubricant and hazardous waste.

Criteria

For the assessment of water quality, the sensitivity and magnitude criteria are outlined in ***Table 7.11*** and ***Table 7.12*** respectively have been used.

Table 7.11 Sensitivity Assessment Criteria for Water Resources

Sensitivity Criteria	Contributing Criteria	
	Environment	**Social**
Water Resources - Surface water and ground water (quality/quantity related criteria)	The extent to which the water resource plays an ecosystem or amenity role in terms of supporting biodiversity either directly or indirectly, particularly with respect to dependent ecosystems.	The extent to which the water resource provides or could provide a use (drinking water, agricultural uses, washing and other domestic or industrial, use as waterways) to the local communities and businesses, or is important in terms of national resource protection objectives, targets and legislation.
Low	The water resource does not support diverse aquatic habitat or populations, or supports aquatic habitat or population that is of low quality.	The water resource has little or no role in terms of provisioning services as agricultural water source, other domestic uses as washing, bathing, industrial use and waterways for the local community. The groundwater resource is not currently abstracted and used in the vicinity of the Project, but is of sufficient quality and yield to be used for that purpose in the future (and there is a reasonable potential for future use).
Medium	The water resource supports diverse populations of flora and / or fauna but available in the surface water bodies in the region.	The surface water resources have local importance in terms of provisioning services but there is ample capacity and / or adequate opportunity for alternative sources of comparable quality. The groundwater resource is an important water supply, and is currently used, but there is capacity and / or adequate opportunity for alternative sources of comparable quality.
High	The water resource supports economically important or biologically unique aquatic species or provides essential habitat for such species.	The surface water resources are wholly relied upon locally, with no suitable technically or economically feasible alternatives, it is important at a regional or transboundary watershed level for provisioning services. The groundwater resource is wholly relied upon locally, with no suitable technically or economically feasible alternatives. The development stage of groundwater is critical or over exploited.

Table 7.12 Criteria for Impact Magnitude for Assessment of Impact to Water Resources

Magnitude Criteria	Negligible	Small	Medium	Large
General Criteria	No perceptible or readily measurable change from baseline conditions.	Perceptible change from baseline conditions but likely to be within applicable norms and standards for mode of use.	Clearly evident (e.g. perceptible and readily measurable) change from baseline conditions and / or likely to approach and even occasionally exceed applicable norms and standards for mode of use.	Major changes in comparison to baseline conditions and / or likely to regularly or continually exceed applicable norms and standards for mode of use.
Water	There is likely to be negligible or no consumption of surface water by the Project at any time	The Project will consume surface water, but the amounts abstracted are likely to be relatively small in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation)	The Project will consume surface water, and the amounts abstracted are likely to be significant in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation)	The Project will consume surface water, and the amounts abstracted are likely to be very significant in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation)

Context

According to the Report on Aquifer Mapping and Groundwater Management, Jodhpur District, Rajasthan released by Central Ground Water Board, Phalodi tehsil falls under the category of over exploited area.

Also, from community consultation, it was understood that ground water is scared in this area. Indira canal is the only source of water in the area. Tanker water from authorised sources will be used during construction phase. It is proposed to use dry robotic cleaning of modules which will reduce the water demand during operation phase. The receptor sensitivity has been assessed as low for environmental criteria but high for social criteria as per ***Table 7.11***.

Embedded/In-built control

- The embedded control measure is provision for impervious storage area, especially for fuel & lubricant, hazardous waste, etc.
- Dry robotic cleaning of module will be undertaken during operation phase. If required, tanker water from authorised sources will be used.
- Ground water abstraction will not be undertaken.

Impact Magnitude

During construction phase, water is sourced through authorised tankers. It is estimated that approximately 60 KLD of water would be required for civil works during construction stage. The Domestic water requirement is estimated to 36 KLD. Dry robotic cleaning of modules will be undertaken during operation phase, however domestic water requirement will be sourced from Indira Canal. Use of dry robotic cleaning system will reduce the water demand to a considerable extent.

The fuels, lubricant and hazardous waste generated during construction and operation phase of the Project will be stored at a designated area which will be paved with provision of secondary containment. The quality of water bodies could also be affected due to surface runoff from contaminated soil (soil contamination due to oil/ fuel spillage and leakages), particularly during monsoon season. The surface runoff carrying the loose top soil will lead to increased sedimentation in the receiving water bodies. Also the constriction activity is short term, (i.e. 6 months). Project site does not have water bodies in near vicinity.

The magnitude of impact for water quality is assessed to be **minor**. However, impact on water resource mainly during operation phase of the Project is assessed as **medium** in view of use of dry robotic cleaning system for solar modules during operation.

Significance of Impact

The overall impact significance will therefore be **moderate.**

Additional Mitigation Measures

- Hazardous material should be kept on impervious layer with secondary containment;
- In case of accidental/unintended spillage, the contaminated soil should be immediately collected and stored as hazardous waste;
- Maintain logbook for water consumption; and
- Prepare and implement water conservation scheme e.g., rainwater harvesting at the Project site.

Significance of Residual Impact

Residual impact significance has to be retained as **minor**.

Impact	Water quality due to spillage of oil, hazardous waste (waste oil) and water resource due requirement of water for construction and operational phase of the Project				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to Project areas				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **moderate.**				

Residual Impact Magnitude	Positive	Negligible	Small	Medium	Major
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor.**				

7.3.5 Impact on Air Quality

The assessment with respect to air quality of the study area has been done for the following Project activities:

- Fugitive emissions from site clearing, excavation work, material handling etc.;
- Fugitive emission from traffic movement;
- Exhaust emission from operation of machineries like pile drivers, vehicles; and
- Point source emission from diesel generator.

Criteria

The sensitivity criteria and impact magnitude criteria has been provided in ***Table 7.13*** and ***Table 7.14*** respectively.

Table 7.13 Sensitivity criteria for Air Quality

Sensitivity Criteria	Contributing Criteria	
	Human Receptors	***Ecological Receptors***
Low	Locations where human exposure is transient.[11]	No
Medium	Few Receptors (settlements) within 500 m of the Project site	Nationally designated sites.
High	Densely populated receptors(settlements) within 500 m of Project site	Internationally designated sites.

Table 7.14 Criteria for Impact Magnitude for assessment of impact to Air Quality

Magnitude Criteria	Negligible	Small	Medium	Large
Air Quality	Soil type with large grain size (e.g. sand); and/or No emissions/dust generation due to Project across all phases	Soil type with large grain size (e.g. sand); and/or Limited emissions/dust generations for short duration	Moderately dusty soil type (e.g. silt); and/or Dust generation and emissions from Projects for long duration	Potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size); and Significant process emissions from Project for the entire Project cycle.

[1] As per the NAAQS and World Bank/IFC guidelines, there are no standards that apply to short –term exposure, e.g., one or two hours, but there is still a risk of health impacts, albeit less certain.

Receptor Sensitivity

The receptor sensitivity has been assessed as medium for human receptors and low for ecological receptors. The receptor sensitivity is therefore **medium** based on the criteria provided in above.

Construction Phase

Air quality impacts in the construction phase will be largely due to the following sources:

- Fugitive dust emissions from site clearance, piling work, handling of construction materials, emission due to movement of vehicles on unpaved roads, plying of heavy construction machinery, etc.
- Vehicular emissions due to increased traffic movement on site and on the approach roads;
- Particulate emission from operation of batching plant;
- Exhaust emissions from construction machinery and other heavy equipment such as pile drivers; and
- Emissions from diesel generators required to be run for construction power purposes.

Impact Magnitude

The biggest source of emissions in the construction phase is the fugitive dust emissions from construction activities. The construction activities are also going to occur for a small period of time (~6 months). The impact magnitude has been categorized as **small**.

Embedded/In-built Controls

- Diesel generator use should be restricted to emergencies and power back-up only to minimize air emissions; and
- Vehicle engines need to be properly maintained and should have a valid Pollution Under Control (PUC) to ensure minimization in vehicular emissions.

Significance of Impact

The impact significance for air quality in the construction phase is assessed as **minor**. There will be some impacts due to plying of vehicles on the access roads which runs across settlement area. The impacts however, are not anticipated to be significant considering short duration of the construction phase of the Project.

Additional Mitigation Measures

- Speed of vehicles on site should be limited to 10-15 km/hr; and
- Prevent idling of vehicles and equipment.

Significance of Residual Impact

The significance of residual impact will be **negligible** after implementing mitigation measures.

Impact	Ambient Air quality – Construction phase

Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Project area and vicinity				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Major
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				

Decommissioning Phase

Air quality impacts in the decommissioning phase will be largely due to the following sources:

- Fugitive dust emissions from demolition, handling of demolition materials and transportation of materials;
- Vehicular emissions due to increased traffic movement on site and on the approach roads;
- Exhaust emissions from demolition machinery and other heavy equipment such as bulldozers, excavators and compactors; and
- Emissions from diesel generators required to be run for demolition purposes.

Impact Magnitude

The biggest source of emissions in the decommissioning phase is the fugitive dust emissions from demolition activities. The demolition activities are likely to occur for a very small period of time (~6 months) and therefore the impact magnitude has been assessed as **small** as per ***Table 7.14.***

Embedded/In-built Controls

- Diesel generator use should be restricted to emergencies and power back-up only to minimize air emissions; and
- Vehicle engines need to be properly maintained and should have a valid Pollution Under Control (PUC) to ensure minimization in vehicular emissions.

Significance of Impact

The impact significance for air quality in the decommissioning phase is assessed as **minor**. As discussed above, there will be some impacts due to plying of vehicles on the access roads which runs across settlement area. The impacts however, are not anticipated to be significant considering short duration of decommissioning phase of the Project.

Mitigation Measures

- Speed of vehicles on site should be limited to 10-15 km/hr;
- DG sets should be placed within enclosures and have an adequate stack height; and
- Prevent idling of vehicles and equipment.

Significance of Residual Impacts

The significance of residual impact will be **negligible** after implementing mitigation measures because of the fugitive dust emissions anticipated during demolition activities.

Impact	Air quality – Decommissioning Phase				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Project area and vicinity				
Frequency	Regular during decommissioning				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Major
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				

7.3.6 Impact on Noise Levels

The assessment with respect to ambient noise quality of the study area has been done for the following Project activities:

- Construction activities including site preparation, piling work, construction of ancillary facilities;
- Transportation of construction materials, machinery and personnel;
- Operation of D.G. sets; and
- Demolition activities during decommissioning phase.

Criteria

The ambient noise levels have been assessed with respect to Noise Pollution (Regulation and Control) Rules, 2000 and WHO Guidelines as shown in ***Table 7.15*** and ***Table 7.16*** respectively.

Table 7.15 Ambient Noise Quality Standards

Area Code	Category of Area	Limits dB(A)	
		Day Time	Night Time
(A)	Industrial Area	75	70
(B)	Commercial Area	65	55
(C)	Residential Area	55	45
(D)	Silence Zone	50	40

Note:

1. Day time shall mean from 6.00 a.m. and 10.00 p.m.
2. Night time shall mean from 10.00 p.m. and 6.00 a.m.
3. Silence zone is an area comprising not less than 100 metres around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority.
4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

* dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing. A “decibel” is a unit in which noise is measured. “A”, in dB(A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear. Leq: It is energy mean of the noise level over a specified period.

Table 7.16 Noise Emission Criteria

Location	Noise Level Limit (dB(A))	
	Day Time	**Night Time**
Industrial; commercial	70	70
Residential; institutional; educational	55	45

Source: Guidelines values are for noise levels measured out of doors. Source: Guidelines for Community Noise, World Health Organisation (WHO), 1999.

The above standards have been utilized to create a sensitivity criteria for ambient noise (***Table 7.17***) and criteria for impact magnitude for assessment of impact to ambient noise (table 7.19)

Table 7.17 Sensitivity criteria for ambient noise

Sensitivity Criteria	Contributing Criteria	
	Human Receptors	***Ecological Receptors***
Low	Industrial Use	Locally designated sites; and/or areas of specific ecological interest, not subject to statutory protection (for example, as defined by the Project ecology team).
Medium	Residential and Recreational place	Nationally designated sites.
High	Educational/ Religious/ Medical Facilities	Internationally designated sites.

Table 7.18 Criteria for impact magnitude for assessment of impact to ambient noise

Magnitude Criteria	Negligible	Small	Medium	Large
Noise Quality	Predicted noise levels are at or less than 3 dB (A) above the relevant limits / thresholds. Short term exposure (Few hours in a day and not continuous)	Predicted noise levels are 3 to less than 5 dB (A) above the relevant limits / thresholds.	Predicted noise levels are between 5 and 10 dB (A) above the relevant limits / thresholds. Medium Term Exposure (1 to 6 months)	Predicted noise levels are more than 10 dB (A) above the relevant limits / thresholds. Long term exposure (> 6 months)

The receptor sensitivity has been assessed as **medium** as per the criteria set in ***Table 7.17.***

Construction and Decommissioning Phase

The sources of noise in the construction phase include construction activities, operation of DG sets and movement of vehicles. There will also be increased noise levels because of increased anthropogenic movement in the area.

Similar to construction phase, during decommissioning phase of the Project, noise will generate from movement of vehicles carrying dismantled structure and equipment.

Context

Few dhanis (houses) are present close to the Project site and internal access roads. The receptor sensitivity is therefore considered as **medium.**

Embedded/In-built control

Normal working hours of the contractor to be defined (preferable 8 am to 6pm). If work needs to be undertaken outside these hours, it should be limited to activities which do not generate noise.

Impact Magnitude

Impact magnitude is considered to be **small** considering the construction period of the Project to last for approximately 6 months**.**

Significance of Impact

The impact significance has therefore been assessed as **minor.**

Mitigation Measures

- Only well-maintained equipment should be operated on-site;
- If it is noticed that any particular equipment is generating too much noise then lubricating moving parts, tightening loose parts and replacing worn out components should be carried out to bring down the noise and placing such machinery far away from the households as possible;

- Machinery and construction equipment that may be in intermittent use should be shut down or throttled down during non-work periods; and
- Minimal use of vehicle horns and heavy engine breaking in the area needs to be encouraged.

Significance of Residual Impacts

Significance of residual impact is assessed to be **negligible** considering above mentioned mitigation measures.

Impact	Ambient Noise Levels – Construction & Decommissioning Phase				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Project area and vicinity				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered to be **minor**.				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Major
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				

7.3.7 Occupational Health & Safety

Construction of support structure for PV module would require operation of pile drivers. The installation of solar module will involve operation of cranes and other mechanical lifting equipment. Laying of interconnecting cable with require digging. The commissioning of the inverter rooms and transmission line will also involve live power lines. Working on live wires carrying power has dangers of electric shock and electrocution.

The Project site also needs to implement proper measures for fire safety, structural safety and any for emergency situations.

The occupational health and safety concerns mentioned above would be consistent across the Project life cycle and therefore the impacts would be similar in nature.

Embedded/In-built Controls

- All construction activities should be carried out during daytime hours and vigilance should be maintained for any potential accidents;
- Personal Protective Equipment (PPEs) including safety shoes, helmet, goggles, ear muffs and face masks;
- Cranes and other lifting equipment are operated by trained and authorised persons;
- Training of the workers on climbing techniques, and rescue of fall-arrested workers;

- Excavated areas should be temporarily fenced to avoid access to outsiders and wildlife;
- An up-to-date first aid box should be provided at all construction sites and a trained person should be appointed to manage it; and
- Electrical and maintenance work should not be carried out during poor weather and during lightning strikes.

Significance of Impact

The impact on occupational health and safety during the construction phase is evaluated to be of **minor** significance, as the installation of solar module and electrical work will be done through experienced and trained workers.

Mitigation Measures

- All workers (regular and contracted) should be provided with training on HFE's Health and Safety policy with appropriate refresher courses throughout the life cycle of the Project;
- Obtain and check safety method statements from contractors;
- Monitor health and safety performance and have an operating audit system;
- Permitting system should be implemented to ensure that cranes and lifting equipment is operated by trained and authorized persons only;
- Appropriate safety harnesses and lowering/raising tools should be used for working at heights;
- All equipment should be turned off and checked when not in use; and
- A safety or emergency management plan should be in place to account for natural disasters, accidents and any emergency situations.

Significance of Residual Impacts

Significance of residual impact is assessed to be **negligible** considering above mentioned mitigation measures.

Impact	Occupational health and safety during construction, operation & maintenance and decommissioning.			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	The construction work involves construction of solar power station along with construction of transmission lines			
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Vulnerability of Receptors	Low	Medium	High	
	The construction of solar power plant and erection of transmission line will be done through experienced and trained workers. However, construction of other components will involve local workers who may not have earlier experience. Hence, there will be greater vulnerability for accidents.			
Impact Significance	Negligible	Minor	Moderate	Major

	Considering the overall impact magnitude and vulnerability of social receptors, the impact significance is assessed as **minor**.

7.3.8 Visual impact and landscape

Since there are other Projects operational and upcoming near the Project site, land use in the area is converting from open scrub land to industrial land along with development of various access roads in the area affecting its topography and land use as well. Since the Projects are environmentally friendly in nature the impacts due to industrial activities on the surrounding land will be minor, especially during the O&M phase. But if environmental conditions are not regularly monitored and the Project facilities are not properly maintained, these Projects can have a negative impact on the land environment of the area.

As for visual impact, the area is flat in terrain with minor undulations and the open nature of the terrain is common all across Rajasthan. However, with some Projects being developed in the area, along with some in the pipeline, the visual aesthetics of the area will be affected and the glare arising from all the solar Projects in the area, especially during peak summers, can have a negative impact on the local community.

7.4 Key ecological impacts

7.4.1 Assessment Criteria

ERM Impact Assessment Standards define sensitivity of ecological receptors by determining the significance of effects on species and habitats separately. The significance tables for species and habitats are given in **Table 7.19** and **Table 7.20** respectively.

Table 7.19 Habitat-Impact Assessment Criteria

Habitat Sensitivity/ Value		Magnitude of Effect on Baseline Habitats			
		Negligible	Small	Medium	Large
		Effect is within the normal range of variation	Affects only a small area of habitat, such that there is no loss of viability/ function of the habitat	Affects part of the habitat but does not threaten the long-term viability/ function of the habitat	Affects the entire habitat, or a significant portion of it, and the long-term viability/ function of the habitat is threatened.
Negligible	Habitats with negligible interest for biodiversity.	**Negligible**	**Negligible**	**Negligible**	**Negligible**
Low	Habitats with no, or only a local designation / recognition, habitats of significance for species listed as of Least Concern (LC) on IUCN Red List of Threatened Species, habitats which are common and widespread within the region, or with low conservation interest based on expert opinion.	**Negligible**	**Negligible**	**Minor**	**Moderate**
Medium	Habitats within nationally designated or recognised areas, habitats of significant importance to globally Vulnerable (VU) Near Threatened (NT), or Data Deficient (DD) species, habitats of significant importance for nationally restricted range species, habitats supporting nationally significant concentrations of migratory species and / or congregatory species, and low value habitats used by species of medium value.	**Negligible**	**Minor**	**Moderate**	**Major**
High	Habitats within internationally designated or recognised areas; habitats of significant importance to globally Critically Endangered (CR) or Endangered (EN) species, habitats of significant importance to endemic and/or globally restricted-range species, habitats supporting globally significant concentrations of migratory species and / or congregatory species, highly threatened and/or unique ecosystems, areas associated with key evolutionary species, and low or medium value habitats used by high value species.	**Negligible**	**Moderate**	**Major**	**Critical**

Table 7.20 Species-Impact Assessment Criteria

Baseline Species Sensitivity/ Value		Magnitude of Effect on Baseline Habitats			
		Negligible	Small	Medium	Large
		Effect is within the normal range of variation for the population of the species	Effect does not cause a substantial change in the population of the species or other species dependent on it	Effect causes a substantial change in abundance and/or reduction in distribution of a population over one, or more generations, but does not threatened the long term viability/ function of that population dependent on it.	Affects entire population, or a significant part of it causing a substantial decline in abundance and/or change in and recovery of the population (or another dependent on it) is not possible either at all, or within several generations due to natural recruitment (reproduction, immigration from unaffected areas).
Negligible	Species with no specific value or importance attached to them.	**Negligible**	**Negligible**	**Negligible**	**Negligible**
Low	Species and sub-species of LC on the IUCN Red List, or not meeting criteria for medium or high value.	**Negligible**	**Negligible**	**Minor**	**Moderate**
Medium	Species on IUCN Red List as VU, NT, or DD, species protected under national legislation, nationally restricted range species, nationally important numbers of migratory, or congregatory species, species not meeting criteria for high value, and species vital to the survival of a medium value species.	**Negligible**	**Minor**	**Moderate**	**Major**
High	Species on IUCN Red List as CR, or EN. Species having a globally restricted range (i.e. plants endemic to a site, or found globally at fewer than 10 sites, fauna having a distribution range (or globally breeding range for bird species) less than 50,000 km^2), internationally important numbers of migratory, or congregatory species, key evolutionary species, and species vital to the survival of a high value species.	**Negligible**	**Moderate**	**Major**	**Critical**

7.4.2 Project Impact during Construction Phase

Context

Construction activity had already stated and the land had been cleared of vegetation during the ESIA site visit. This section focuses on increased anthropogenic movement (men and transport) in the study area and risk of hunting and trapping by migrant labours. Anthropogenic movement will result in an increased stress on the avifauna in the area that will have to remain alert for an extended period and may prevent proper breeding, nesting, mating, socializing and foraging. Noise from anthropogenic movement (men and transport) along with the construction activities may further disturb mammalian and reptilian fauna in the nearby areas.

In addition there is risk of hunting and trapping of local wildlife by migrant labours for “bushmeat” and other body parts. Moreover disposal of kitchen waste like uneaten food, vegetable waste may attract wild animals in search of food and may alter food habit of such animals and may result in human wildlife conflict in the long run.

Embedded/ In-built Control

Site and labour camp is fenced which will minimize the chance encounter with wildlife.

Impact Magnitude

Anthropogenic movement will create increased stress on faunal species. Mammals, birds and reptiles in the Project study area are particularly susceptible to this movement. Mammal species are also susceptible to higher noise levels from anthropogenic movement and construction due to their better auditory perception. Noise can affect mating and breeding behaviour in all species that utilize sound to communicate with one another and find suitable mates. Though some Schedule I species like chinkara, desert fox etc. but classified as Least Concern as per the IUCN Red List (Online Version 2019-1) and has a large distribution range. So the impact magnitude was assessed to be “Negligible”.

Mitigation Measures

- Anti-poaching, trapping and hunting policy among employees and contractors should be strictly enforced;
- General awareness regarding presence of Scheduled fauna in the area their habits should be enhanced through trainings, posters, etc. among the staff and labourers;
- Number of routes should be minimized for construction and transportation;
- Speed limit of vehicles plying on these routes should be kept to 10-15 km/hr to avoid road kill; and
- Unnecessary disturbance of neighbouring areas due to off-road vehicular movement, needless expansion of labour camp and destruction of floral resources should be prohibited.
- Good housekeeping should be followed for kitchen and labour camp. Kitchen waste should be disposed off through registered waste handlers and disposal on open ground or open pit should be avoided at all cost.
- Proper sanitation facilities should be provided at the labour camps;
- Regular checking of fencing to prevent any gaps for entry of mammalian fauna;

Residual Impact Significance

After implementation of mitigation measures, the significance of residual impacts will be **Negligible**. We retain this significance, as while the mitigation measures are likely to reduce mortality, we do not expect complete cessation of mortality.

Table 7.21 Impact significance of Construction Phase

Impact	**Change in Ecological Environment – Construction**				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to electrical components of the solar farm, transmission lines (internal and external) and transmission poles.				
Frequency	Operation phase				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity (Species)	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is **Negligible** for species.				
Residual Impact Significance					
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Negligible.**				

7.4.3 Impacts during Operation Phase

7.5 Collision and Electrical hazards from Transmission Infrastructure

Context

Several species of birds identified during the ecological study were found perched on wires and poles in the area. These transmission lines and poles can potentially constitute an electrocution and collision hazard to birds. Some birds also utilize the transmission towers for nesting.
The impact of the solar plant operation on fauna includes reflections from the solar arrays and bird mortality through collision and electrocution. The 'lake effect' which refers to birds mistaking the panels as a water surface could also result in mortality (1).

(1) Kagan, R.A., Viner, T.C., Trail, P.W., & Espinoza, E.O. 2014. Avian mortality at solar energy facilities in southern California: a preliminary analysis. National Fish and Wildlife Forensics Laboratory, 19.

Embedded/ In-built Control

There are no embedded controls to prevent birds from roosting/nesting on transmission poles and colliding with transmission wires.

Impact Magnitude

Transmission line from the Pooling Substation to the Grid Substation is passing through a corridor surrounded by solar power Projects, occasionally passing through scrublands, so risk of mature tree cutting is almost nil. Also there are no water bodies along the 1 km transmission line route. Furthermore baseline has already established that the study area only provides habitat for only Least Concerned Species. So the impact magnitude on habitat, based on "Habitat-Impact Assessment Criteria" is considered to be "Negligible".

During the site visit some species were observed on existing transmission lines or solar park associated electrical facilities like electrical pole, lighting pole, lightning arrestors etc. These species includes Variable Wheatear (*Oenanthe picata),* Green Bee-eater (*Merops orientalis),* White-throated Kingfisher (*Halycon smyrnensis*), Long-legged buzzard (*Buteo rufinus)* etc. All the species listed are Least Concerned species. Though Long-legged buzzard, which is protected (schedule 1) as per the Wildlife Protection Act, 1972 of India, but classified as Least Concern as per the IUCN Red List (Online Version 2019-1) and has a large distribution range. So based on "Species-Impact Assessment Criteria" (as per **Table 7.20**) the impact magnitude on species was also found to be "Negligible".

Mitigation Measures

The following mitigation measures will further reduce the impact significance on avifaunal species:

- The transmission poles should be raised with suspended insulators in order to reduce the electrocution of bird species;
- Bird-safe strain poles require insulating chains at least 60 cm in length (determined based on the average wing span of common avifauna) should be used; and
- Marking overhead cables using diffractors and avoiding use in areas of high bird concentrations of species vulnerable to collision.
- Collision of birds with solar panel due to "lake Effect" is still not a clearly understood phenomenon and till date no well accepted mitigation measures exists in practice. So during regular maintenance process or during regular security check staff or security guard should be vigilant about any bird carcass and damaged solar PV cells and record should be maintained. If bird mortality due to collision with PV cell is recorded, then long term structured monitoring is recommended.

Residual Impact Significance

After implementation of mitigation measures, the significance of residual impacts will be **Negligible**. We retain this significance, as while the mitigation measures are likely to reduce mortality, we do not expect complete cessation of mortality.

Table 7.22 Impact significance of electrical hazards on avifaunal species

Impact	Electrocution hazards		
Impact Nature	Negative	Positive	Neutral
Impact Type	Direct	Indirect	Induced

Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to electrical components of the solar farm, transmission lines (internal and external) and transmission poles.				
Frequency	Operation phase				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity (Species)	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is **Negligible** for species.				
Residual Impact Significance					
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Negligible.**				

7.6 Key Social Risks

7.6.1 Criteria

For the assessment of social impacts, the sensitivity and magnitude criteria outlined in below table ***r***espectively have been used. The social impacts associated with the pre-construction, construction, operations and decommissioning stages have been assessed qualitatively and in some cases quantitatively (subject to availability of data), using professional judgment based on past experience from similar Projects.

Table 7.23 Impact Magnitude for Local Communities

	Extent / Duration / Scale / Frequency
Large	Change dominates over baseline conditions. Affects the majority of the area or population in the area of influence and/or persists over many years. The impact may be experienced over a regional or national area.
Medium	Clearly evident difference from baseline conditions. Tendency is that impact affects a substantial area or number of people and/or is of medium duration. Frequency may be occasional and impact may potentially be regional in scale.
Small	Perceptible difference from baseline conditions. Tendency is that impact is local, rare and affects a small proportion of receptors and is of a short duration.
Negligible	Change remains within the range commonly experienced within the household or community.

Table 7.24 Receptor Sensitivity for Local Communities

Category	Definition
High	Profound or multiple levels of vulnerability that undermine the ability to adapt to changes brought by the Project.
Medium	Some but few areas of vulnerability; but still retaining an ability to at least in part adapt to change brought by the Project.
Low	Minimal vulnerability; consequently with a high ability to adapt to changes brought by the Project and opportunities associated with it.

Table 7.25 Impact Significance Matrix

Receptor Sensitivity	Impact Magnitude			
	Negligible	Small	Medium	Large
Low	Negligible	Negligible	Minor	Moderate
Medium	Negligible	Minor	Moderate	Major
High	Negligible	Moderate	Major	Critical

7.6.2 Pre-construction phase

No major social impacts during the pre-construction phase have been envisaged.

7.6.3 Construction Phase

7.6.4 Impact on Significance on Economic Opportunities

Context and receptor

The receptors for impacts on economic opportunities include the local community within the Study area. The construction phase activities of the Project including construction of access road, civil works, site clearance and security will involve semi-skilled and unskilled workers, who are likely to be recruited from the local community. Additionally there are opportunities for petty contractors in the area for provision of vehicles for transport, increased economic activity due to influx of contractors and migrant workers during construction phase. It is evident from the occupational patterns in the Study area and ***Table 5.22*** that even with a WPR of 53%, the main working population is quite low (7.15%), which means the population with steady source of livelihoods is quite less. This suggests that the population in the area engages in short term work/ contracts. This is also explained through understanding aimed during consultations that there are many solar power plants in the study area which have provided employment opportunities to locals during construction phase and to a lesser number of locals during operations phase.

Community consultations and observations made during the site visit suggest that the existing scenario of agriculture in the study area is not favorable enough to meet requirements of the people who are solely dependent on it; especially with the growing population, consequent fragmentation of the limited land holdings and growing uncertainty of monsoons. Thus, overall the solar power Project in the area boosts the livelihood situation but the nature of work is same is temporary.

Embedded/ In-Built Control

It was reported during discussions with staff of CSP Bhadla Pvt Ltd., that it will provide employment opportunities in the form of housekeeping staff, security guards etc. at the Project site to the local youth during the operations phase of the Project as well, however with reduced number, due to the intrinsic nature of the Project requirements.

Significance of Impact

The nature of the impact is Positive and based on the above analysis, the impact is assessed to be **minor**.

Mitigation/Management Measures

As gathered from consultations with the site representative of CSP Bhadla Pvt ltd a significant segment of labor requirement during the construction phase will be sourced locally. During construction phase of the Project, employment opportunities will be significant for local people whereas during the operation phase, it could be restricted to the requirement of few security

personnel, module cleaners and few housekeeping staff at site office. The following additional measures may be recommended to enhance this impact:

- The sourcing of local labor wherever possible should be made obligatory for the sub-contractors and in all major procurement activities. The Project proponent will establish a mechanism to audit subcontractors and suppliers with respect to compliance of utilizing local labor and resources;
- Information on local employment should be communicated to the GPs and information on availability of employment opportunities should be displayed at GP office premises in consultation with the Sarpanch.
- Skills training programs for promoting agriculture-allied activities so as to create self-employment opportunities should be promoted

Table 7.26 Impact on Economic Opportunities

Impact	Impact on local employment opportunities during the Project life cycle			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Locals will mostly have short term employment opportunities during construction phase of the Project. However, there will be requirement for manpower for house-keeping jobs module cleaners, and security guards and other related work in the operational phase. Moreover the opportunities for skilled workforce will escalate and will benefit the people in the surrounding areas due to spike in the economic activities due to influx of population from outside.			
Frequency	Construction and operation phases of the Project.			
Resource/Receptors Sensitivity	Low	Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major

7.6.5 Impact of Labour Influx/Migrant Workforce

Context

The Project will employ skilled, semi-skilled and un-skilled workers, across the Project lifecycle in different numbers, which will include staff of CSP Bhadla, local workers and migrant workers. The regular skilled workers are likely to be comprised of migrant workers, from different districts and states in the country, depending upon the need for technical expertise. However the details of the number of employees required through the lifecycle of the Project is approximately 1000 which include skilled, unskilled and semi-skilled labours.

Due to lack of the required skills among the local youth, especially in undertaking the steel work for solar PV panels, migrant labourers might be engaged for the purpose during the construction phase. The labour requirements in the unskilled category are envisaged to be met locally. Moreover the locals were understood to be keener in opportunities like vendors, sub-contractors etc. also there were sections of people who were keen to be part of Project as skilled/unskilled labour both in construction and operational stage of Project. Thus there would be increased influx of population from outside during the construction phase, albeit for a short term duration, leading to sharing of resources, possibilities of spreading of communicable diseases, etc. and a spike in economic activities, on the upside.

Embedded/ In Built Control

At the time of the ERM site visit no Project-related construction activities has started at site; therefore, no mobilisation of labour/ migrant workers had taken place. The detailed plans of labour camps or other accommodation arrangements for the migrant will be done through hired contractors. However, consultations with the CSP Bhadla Pvt Ltd site team and prior experience of reviewing the amenities provided by EPC contractors to migrant workers in labour camps, suggest that the following embedded/ in built control measures will be implemented:

- Providing adequate ventilation, lighting, bathing facilities and bedding suitable to the climatic condition in the labour camps;
- Providing proper sanitation and drinking water facilities for migrant labours;
- Providing recreational and entertainment facilities to labourers in holidays or on their off-days; and
- Importantly, access to healthcare services and medical care in case of sickness.

Significance of Impact

Based on the above analysis, the impact after implementing the above envisaged embedded controls is assessed to be **moderate.**

Mitigation/Management Measures

The recommended mitigation/management measures to address the impacts related to migrant Labours should include:

- Provisioning adequate ventilation, lighting, bathing facilities and bedding suitable to the extreme climatic condition in the labour camps
- An ensure that most of the labor requirements are sourced from the neighboring villages;
- Ensuring health check-ups of all laborers employed at the Project site to screen pre-existing communicable diseases; and
- Extending provisions for hygiene in Labor Camps as well as Work Site, in terms of proper sanitation, proper drinking water facilities and monitoring of drinking water quality, proper disposal of waste, etc.
- Access to healthcare services and medical care in case of sickness
- Providing recreational and entertainment facilities to laborers on holidays or on their off-days to further limit their interface with the locals.
- Preference to local employment than hiring migrant workers, as it will help locals to earn the source of livelihood.

Residual Impact significance

After the implementation of these mitigation measures, the residual impact significance is expected to be **negligible**.

Table 7.27 Impact of Labour Influx/Migrant Workforce

Impact	Labour migration issues			
Impact Nature	Negative			Neutral
Impact Type	Direct		Indirect	Induced
Impact Duration	Temporary	Short-term	Long-term	Permanent

Impact Extent	Local	Regional	International		
Impact Scale	The required skill-set being not available at the local level, majority of the total workers to be engaged, especially in the skilled and highly skilled categories are envisaged to be migrant workers. The workers will be employed during the construction phase of the Project over a period of around 2 to 4 months. Presently, no Project-related construction activities have started. It is expected that during the peak construction phase, the number of migrant workers will increase.				
Frequency	Construction phase				
Impact Magnitude	Positive	*Negligible*	*Small*	*Medium*	Large
Resource/ Receptor Sensitivity	Low	*Medium*	*High*		
	The receptor vulnerability can be identified as medium. This is because, the local community is mostly engaged in agriculture and allied activities and only a fraction of the local youth is engaged in "Other works" including the solar power plants that are located near the study area. Consequently, most of the local youth do not possess the requisite skills for participating in construction activities, especially in the skilled and highly skilled categories. However, abrupt influx of outside population to take advantage of employment opportunities cropping up in their region might create resentment among the local communities.				
Resource/Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered to be **Moderate.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of residual impact is considered **Minor.**				

7.6.6 Impact on Community Health and Safety

Context and receptor

The construction phase activities such as installation of solar PV panels, construction of transmission cables and substations and movement of material and personnel may result in impacts on the health and safety of the community. These activities will involve the use of heavy machinery and live transmission power cables (at some places). Furthermore, the movement of material and personnel via the access roads may result in damage to human life or livestock due to accidents.

The major community health and safety risks include structural safety of Project infrastructure, life and fire safety, public accessibility and management of emergency situations. The receptors for impacts on community health and safety include the local community within the study area who may be present in the vicinity of the Project activities, for grazing purposes or while commuting.

Embedded/ In Built Control

Consultations with the CSP Bhadla Pvt Ltd site representative indicated that the following embedded/ in built control measures will be put in place during the construction phase;

- The excavated areas will be properly fenced for safety and sign boards in local languages will be put up;
- The truck drivers carrying construction machinery and materials will be instructed to drive within speed limits with careful consideration for village traffic; and

- Movement of heavy equipment and construction materials will be regulated during peak hours (09:00 AM to 06:00 PM).
- Safety measures will be taken while unloading goods from vehicles during construction phase;
- Also adequate safety measures will be taken during construction phase on site.

Impact Significance

Based on the above analysis, the impact is assessed to be **minor**.

Mitigation/ Management Measures

The following risk mitigation measures are suggested to minimize the risks/ hazards of construction activities onsite;

- Developing an ESMS for the Project;
- Monitoring Contractor's EHS performance for its worker;
- Proper fencing around Project boundaries;
- Drivers should be instructed to follow speed limit and careful while driving to avoid accidents;
- Water sprinkling on roads leading to Project site to avoid dust related impacts on the community;
- Regulating movement of heavy equipment and construction materials during peak hours during the day to avoid community health and safety threats;
- As part of the stakeholder engagement and information disclosure process, providing an understanding to the community concerning the activities proposed to be undertaken and the precautions being adopted for safety.
- Communicating the local community about the accidental risks and safety features of the solar PV panels.
- Construct sanitation facilities for labourers inside the Project area boundaries along with septic tanks to avoid contagion in the adjacent land,
- Involving the district disaster management cell and the nearest fire service station while preparing for emergency situations; and Obtain an adequate third party insurance cover to meet the financial loss to any third party due to such emergencies.

Residual Impact Significance

After the implementation of the above mitigation measures, the residual impact significance is anticipated to remain **negligible**.

Table 7.28 Impact on Community Health and Safety

Impact	Community health and safety				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term		Long-term	Permanent
Impact Extent	Local		Regional		International
Impact Scale	Limited to Project footprint				
Frequency	Project lifecycle				
Impact Magnitude	Positive	Negligible	Small	Medium	Large

Resource Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor		Moderate	Major
	Significance of impact is considered **Minor**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor		Moderate	Major
	Significance of impact is considered **negligible.**				

Operation phase

No major social impacts during the operations phase are envisaged.

7.7 Cumulative Impacts

There are other solar energy Projects located within the same solar park. Considering the availability of land and good solar potential in the region, establishment of some other solar power Project in near future cannot be ruled out. Settlements are located at a distance from the solar plants, hence no issues regarding the same is envisaged there.

One of the cumulative effects is solar reflections known as ***Glint and Glare***. Solar panels are designed to absorb sunlight and produce electricity. However, they can also reflect it and cause solar reflections affecting drivers, residents, aviators and other receptors. With a continuous increase in both numbers and sizes of such PV developments cumulative concerns are likely to increase soon.

The area is ***water scare***; the only source of water in the area is Indira Canal. More Projects coming in the area will have cumulative impact on water resource. A total of 58 cusec water is reserved by the Indira Gandhi Nahar Board for solar power plants. 300 MW out of the 500 MW currently installed are using dry cleaning system for module cleaning thus reducing water requirement for the Project. CSP (Bhadla) is also proposing dry cleaning method. To keep a check on cumulative impact on water resources in the region due to water utilization for solar park, developers will implement water conservation and harvesting programs. Tapping of rain water can augment the ground water resource in the region.

There will also be ***increase in traffic volumes*** on the access roads during construction period. However increase traffic volume will be for shorter duration. Operation phase of the Project has limited traffic.

As for **visual impact**, the area is flat in terrain with minor undulations terrain which is common all across Rajasthan. However, with some operational projects in the area, along with many more in planning stage, the visual aesthetics of the area will be impacted causing glare effect arising from all the solar projects in the area, especially during peak summers.

No historic structures or significant scenic resources exist on the proposed project sites. Hence, no significant cumulative impact would result from addition of the proposed project on the scenic view or damage to scenic resources.

The proposed Project's useful life is approximately 27 years. Cumulative impacts associated with decommissioning of the proposed Project would include the removal of all Project components, including generator tie line structures and wiring, as well as all wiring, PV panels, and inverter structures. After removal of Project components, the Project sites would return to original form. Therefore, decommissioning would temporarily impact the proposed Project's contribution to local and regional cumulative impacts on visual resources.

8. ENVIRONMENT AND SOCIAL MANAGEMENT PLAN

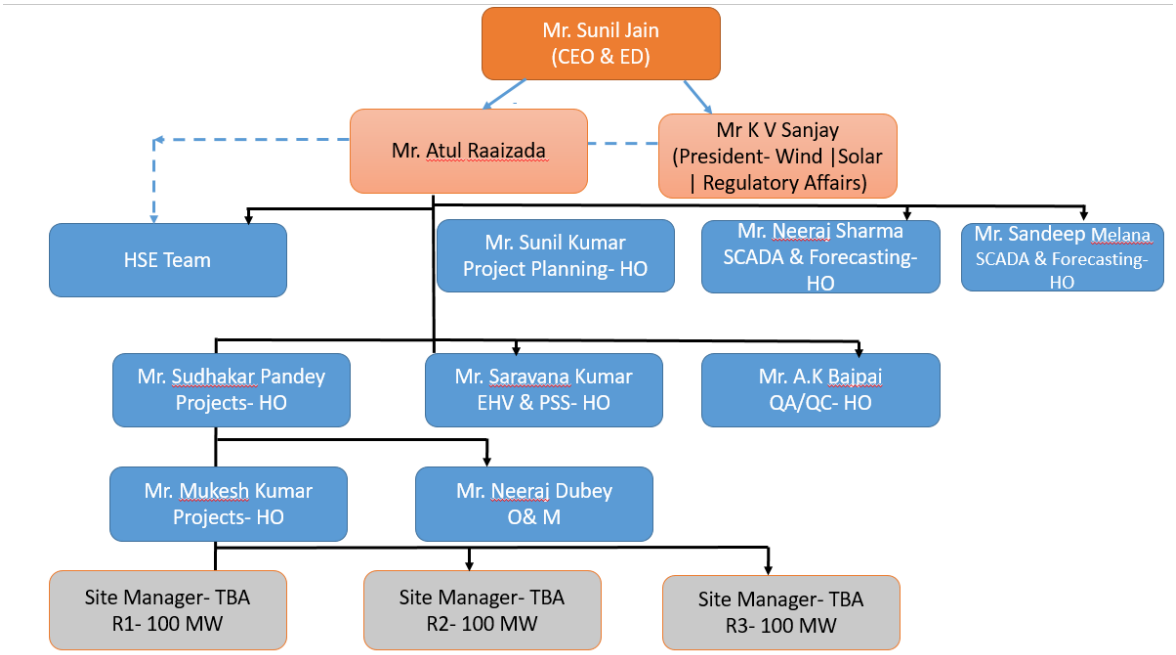
8.1 Introduction

This *section* presents the Environmental and Social Management Plan (ESMP) for the 100 MW Project. The purpose of this ESMP is to specify the standards and controls required to manage and monitor environmental and social impacts during different phase of Project life cycle, i.e. construction, operation and decommissioning phases. 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, natural and social environment. This is in accordance to IFC Performance Standards 1 which emphasizes the importance of managing social and environmental performance through the lifecycle of the Project.

8.2 HFE's Organizational Structure

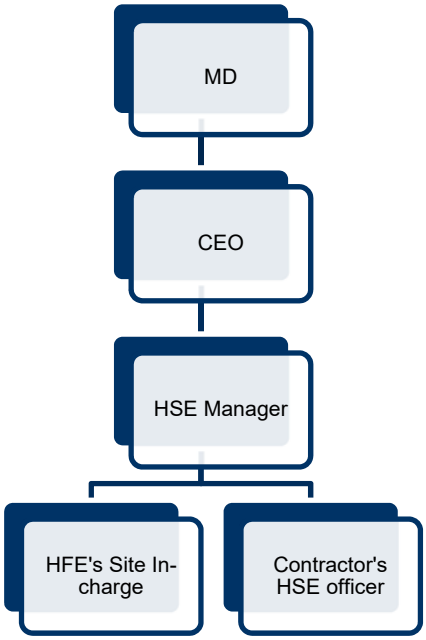
To ensure the efficacy of environmental and social management plan, certain institutional mechanisms with well-defined roles and responsibilities is essential for effective implementation of identified mitigation measures. HFE has a HSE manager at corporate level reporting to HOD – Projects and O&M who in turns report to CEO &ED. Corporate level organogram at HFE is as presented below.

Figure 8.1 Organisation Chart (Projects and O&M)



At site level, site in-charge from HFE and contractor's HSE office will report to HSE Manager of HFE. Site level organogram is presented below.

Figure 8.2 Site level organogram



8.3 EPC Contractor – Ritis Meera

8.3.1 Ritis Meera's Management

The EPC contractor, i.e. Ritis Meera will have a dedicated HSE department for the Project. The HSE department take the overall responsibility for co-ordination of the actions required for environment and social management and mitigation and for monitoring the progress of the proposed ESMP for the Project. However, ultimate responsibility for implementing the provisions of the ESMP will lie with CSP (Bhadla).

Environmental, Health and Safety Department (EHS Department) of Ritis Meera

In general, the EHS department shall perform the following activities:

- Preparation of required documents on environmental and social management;
- Ensuring availability of resources and appropriate institutional arrangements for implementation of ESMP;
- Implementation of the health and safety measures;
- Collection of the statistics of health of workers;
- Providing support during routine medical check-ups of workers;
- Awareness and implementing safety programmes;
- Providing job specific induction training;
- Compliance of regulatory requirements;
- Carrying out environmental audits;
- Identify unsafe acts and conditions and suggest remedies;
- Develop safety culture and comply with company's EHS policy and standard requirements;

- Encourage and enforce the use of PPE's;
- Educate all employees for the use of PPE's and safe practices;
- Direct, coordinate and orient the safety activities;
- Promulgate the spread of policy, objectives, rules and/or regulations;
- Perform a thorough investigation of all accidents and review the recommendations to avoid any repetition;
- Monitoring the progress of implementation of ESMP; and
- Reviewing and updating the ESMP as and when required for its effective implementation.

8.4 Inspection, Monitoring and Audit

Inspection and monitoring of the environmental impacts of the Project activities will increase the effectiveness of ESMP. Through the process of inspection and auditing, CSP (Bhadla) will ensure that the conditions stipulated in various permits are complied. The inspections and audits will be done by EPC contractor (during construction phase), trained team of HFE's EHS department and by external agencies/experts. The entire process of inspections and audits should be documented. The inspection and audit findings are to be implemented by the site in-charge in their respective areas.

8.5 Reporting and Documentation

CSP (Bhadla) will develop and implement a programme of regular reporting through the stages of the Project lifecycle. The personnel delegated EHS roles shall be required to fully comply with the monitoring programme in terms of timely submissions of reports as per acceptable level of detail. Reporting will be done in form of environmental check list, incident record register, training records, and environmental and social performance reports (weekly, monthly, quarterly, half yearly, yearly etc.).

8.5.1 External Reporting and Communication

EHS head is responsible for ensuring that communication with regulatory agencies and stakeholders are maintained as per the requirement. All complaints and enquiries are to be appropriately dealt with and records should be maintained in a Complaint/Enquiry Register by the delegated staff of EHS.

8.5.2 Internal Reporting and Communication

Internally, the personnel delegated EHS roles will share inspection and audit findings with their suggested measures regularly to the senior management for their consideration. The same are also to be communicated within the staff working on the Project. To maintain an open communication between the staff and management on EHS and social issues the followings are being used:

- Team Briefings,
- On-site work group meetings;
- Work Specific Instructions; and
- Meeting with stakeholders.

8.5.3 Documentation

Documentation is an important step in the implementation of the ESMP, CSP (Bhadla) will establish a documentation and record keeping system in keeping with their ESMS, to ensure recording and updating of documents as discussed in the ESMP. Responsibilities have to be assigned to relevant

personnel for ensuring that the ESMP documentation system is maintained and that document control is ensured through access by and distribution to, identified personnel in form of the following:

- Master Environment Management System document;
- Legal Register;
- Operation control procedures;
- Work instructions;
- Incident reports;
- Emergency preparedness and response procedures;
- Training records;
- Monitoring reports;
- Auditing reports; and
- Complaints register and issues attended/closed.

8.5.4 ESMP Review and Amendments

The ESMP acts as an environment and social management tool which needs to be periodically reviewed to address changes in the organization, process or regulatory requirements.

Following a review, Site in charge in coordination with personnel delegated EHS will be responsible for making the amendments in the ESMP and seeking approval from the Regional and Corporate heads. The amended ESMP will be communicated to all the staff on the Project.

8.6 Training Programme and Capacity Building

Training is needed for effective implementation of ESMP. The training programme will ensure that all concerned members of the team understand the following aspects:

- Purpose of management plan for the Project activities;
- Requirements of the management plan and specific action plans;
- Understanding the sensitive environmental and social features within and surrounding the Project areas; and
- Aware of the potential risks from the Project activities.

EHS head of Ritis Meera and HFE will ensure that environmental health and safety induction training and job specific trainings are identified and given to the concerned personnel for construction activities and operation of the solar plant.

Also general environmental awareness will be increased among the Project's team to encourage the implementation of environmentally sound practices and compliance requirements of the Project activities. This will help in minimising adverse environmental impacts, compliance with the applicable regulations and standards, and achieving performance beyond compliance. The same level of awareness and commitment will be imparted to the contractors and sub-contractors prior to the commencement of the Project.

8.7 Environmental and Social Management Plan

This section outlines the potential adverse impacts, mitigation measures, monitoring and management responsibilities during construction and operation phases of the Project.

The purpose of ESMP is to:

- Provide an institutional mechanism with well-defined roles and responsibilities for ensuring that measures identified in ESIA designated to mitigation potentially adverse impacts are implemented;
- List all suggested mitigation measures and control technologies, safeguards identified through the ESIA process;
- Provide Project monitoring program for effective implementation of the mitigation measures and ascertain efficacy of the environmental management and risk control systems in place; and
- Assist in ensuring compliance with all relevant legislations at local, state and national level for the Project.

Table 8.1 Environmental and Social Management Plan, CSP Bhadla

Project Activities	Impact/Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
Land use									
■ Construction and strengthening of access road; ■ Installation of PV modules ■ Construction of Central Monitoring Station, Switching Yard; and ■ Establishment and operation of temporary structures such as temporary site office and store yard.	Permanent and temporary changes in land use	Construction	On completion of construction activities, land used for temporary facilities such as store yard should be restored to the extent possible	EPC Contractor	Site inspection	Upon completion of task	Site HSE Officer of EPC Contractor	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor to site HSE In-charge of CSP Bhadla
			The land use in and around permanent Project facilities should not be disturbed.	EPC Contractor	Site inspection	Monthly Monitoring	Site HSE Officer of EPC Contractor	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor to site HSE In-charge of CSP Bhadla
			Construction activities should be restricted to designated area.	EPC Contractor	Site inspection	Monthly Monitoring	Site HSE Officer of EPC Contractor	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor to site HSE In-charge of CSP Bhadla
Topography and Drainage									
■ Construction and strengthening	Changes in Topography and Drainage	Construction	Disruption/alteration of micro-watershed drainage pattern should be	EPC Contractor	Site inspection	Monthly Monitoring	Site HSE Officer of EPC Contractor	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor to

Project Activities	Impact/Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
of access roads; and ■ Site clearance.			minimized to the extent possible; and						site HSE In-charge of CSP Bhadla
			Appropriate number of cross drainage channels should be provided during access road construction to maintain flow in existing natural channels	EPC Contractor	Site inspection	Monthly Monitoring	Site HSE Officer of EPC Contractor	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor to site HSE In-charge of CSP Bhadla
Soil									
■ Construction/ strengthening of access roads; ■ Vehicular movement; and ■ Piling and excavation work.	Soil compaction and soil erosion	Construction and Decommissioning	Vehicles will utilize existing roads to access the site.	EPC Contractor/O&M Team	Site inspection	Monthly Monitoring	Site HSE Officer of EPC Contractor	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor to site HSE In-charge of CSP Bhadla
			Piling and excavation work will not be carried out during the monsoon season to minimize erosion and run-off.	EPC Contractor/O&M Team	Site inspection	Monthly Monitoring	Site HSE Officer of EPC Contractor	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor to site HSE In-charge of CSP Bhadla
■ Storage and transport of	Soil contamination	Construction, Operation,	No unauthorized dumping of used oil and other	EPC Contractor/O&M Team	Site inspection	Monthly Monitoring	Site HSE Officer of EPC Contractor/ site	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC

Project Activities	Impact/Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
construction materials; ■ Storage of oil and lubricants onsite; ■ Storage of hazardous waste onsite; ■ Storage of waste (MSW and construction/demolition) onsite from Project site; and Sewage generated from the site office.		Decommissioning	hazardous waste should be undertaken at site.				HSE In-charge of O&M Team		Contractor/ O&M contractor to site HSE In-charge of CSP Bhadla
			Construction and Demolition Waste should be stored separately and be periodically collected by an authorized treatment and storage facility	EPC Contractor/O&M Team	Site inspection	Monthly Monitoring	Site HSE Officer of EPC Contractor/ site HSE In-charge of O&M Team	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Bhadla
			Hazardous waste should be properly labelled, stored onsite at a location provided with impervious surface and in a secondary containment system	EPC Contractor/O&M Team	Site inspection	Monthly Monitoring	Site HSE Officer of EPC Contractor/ site HSE In-charge of O&M Team	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Bhadla
			In case of accidental/unintended spillage on small area, the contaminated soil should	EPC Contractor/O&M Team	Site inspection	Monthly Monitoring	Site HSE Officer of EPC Contractor/ site	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor/

Project Activities	Impact/Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
			be immediately collected and stored as hazardous waste.				HSE In-charge of O&M Team		O&M contractor to site HSE In-charge of CSP Bhadla
			Designated areas should be provided for Solid Municipal Waste and daily collection and period disposal should be ensured	EPC Contractor/O&M Team	Site inspection	Monthly Monitoring	Site HSE Officer of EPC Contractor/ site HSE In-charge of O&M Team	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Bhadla
			All waste should be stored in a shed that is protected from the elements (wind, rain, storms, etc.) and away from natural drainage channels	EPC Contractor/O&M Team	Site inspection	Monthly Monitoring	Site HSE Officer of EPC Contractor/ site HSE In-charge of O&M Team	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Bhadla
Air Quality									
■ Fugitive emissions from site clearing, excavation	Fugitive and point source emission	Construction, Operation, Decommissioning	Speed of vehicles should be limited to 10-15 km/hr	EPC Contractor/O&M Team	Site inspection	Monthly Monitoring	Site HSE Officer of EPC Contractor/ site	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor/

Project Activities	Impact/Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
work, material handling etc.; ■ Fugitive emission from traffic movement; ■ Exhaust emission from operation of machineries like pile drivers, vehicles; ■ Point source emission from diesel generator.							HSE In-charge of O&M Team		O&M contractor to site HSE In-charge of CSP Bhadla
			DG sets should be placed within enclosures and have an adequate stack height;	EPC Contractor/O&M Team	Site inspection	Monthly Monitoring	Site HSE Officer of EPC Contractor/ site HSE In-charge of O&M Team	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Bhadla
			Prevent idling of vehicles and equipment	EPC Contractor/O&M Team	Site inspection	Monthly Monitoring	Site HSE Officer of EPC Contractor/ site HSE In-charge of O&M Team	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Bhadla
			Vehicle engines need to be properly maintained and should have a valid Pollution Under Control (PUC) to ensure	EPC Contractor/O&M Team	Review of PUC documents of vehicles	Monthly Monitoring	Site HSE Officer of EPC Contractor/ site HSE In-charge of O&M Team	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor/ O&M

Project Activities	Impact/Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
			minimization in vehicular emissions						contractor to site HSE In-charge of CSP Bhadla
Water Environment									
Water required for construction phase and operation phase of the Project	Depletion of water resource	Construction, Operation	Permission will be obtained from Rajasthan State Level/Central Groundwater Authority for abstraction of ground water.	EPC Contractor/O&M Team	Permission letter	Monthly Monitoring	Site HSE Officer of EPC Contractor/ site HSE In-charge of O&M Team	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Bhadla
			Maintain logbook for water consumption; and	EPC Contractor/O&M Team	Water consumption log book	Monthly Monitoring	Site HSE Officer of EPC Contractor/ site HSE In-charge of O&M Team	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Bhadla
			Prepare and implement water conservation scheme e.g., rainwater harvesting	EPC Contractor/O&M Team	Site inspection	Monthly Monitoring	Site HSE Officer of EPC Contractor/ site HSE In-charge of O&M Team	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor/ O&M

Project Activities	Impact/Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
									contractor to site HSE In-charge of CSP Bhadla
■ Storage of hazardous substances onsite; and ■ Storage of hazardous waste onsite.	Water Contamination	Construction, Operation, Decommissioning	Prevent & mitigate spill of fuel within the construction site	EPC Contractor/O&M Team	Site inspection	Monthly Monitoring	Site HSE Officer of EPC Contractor/ site HSE In-charge of O&M Team	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Bhadla
			Regularly monitored the surface and ground water quality	EPC Contractor/O&M Team	Site inspection	Monthly Monitoring	Site HSE Officer of EPC Contractor/ site HSE In-charge of O&M Team	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Bhadla
Noise quality									
■ Construction and demolition activities; ■ Operation of DG sets; and	Increase in noise level	Construction and Decommissioning	Normal working hours of the contractor to be defined (preferable 8 am to 6pm). If work needs to be undertaken outside these	EPC Contractor/O&M Team	Site inspection	Monthly Monitoring	Site HSE Officer of EPC Contractor/ site HSE In-charge of O&M Team	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor/ O&M

Project Activities	Impact/Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
▪ Vehicular movement			hours, it should be limited to activities which do not generate noise;						contractor to site HSE In-charge of CSP Bhadla
			Only well-maintained equipment should be operated on-site.	EPC Contractor/O&M Team	Site inspection	Monthly Monitoring	Site HSE Officer of EPC Contractor/ site HSE In-charge of O&M Team	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Bhadla
Operational Health and Safety									
▪ Working at heights; ▪ Working with live electrical components; and ▪ Operation of cranes and other mechanical lifting equipment	Injury, near-misses and fatalities for labour contracted on site.	Construction, Operation, Decommissioning	All workers (regular and contracted) should be provided with training on Health and Safety policies in place with appropriate refresher courses throughout the life cycle of the Project	EPC Contractor/O&M Team	Training report	Monthly Monitoring	Site HSE Officer of EPC Contractor/ site HSE In-charge of O&M Team	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Bhadla
			Obtain and check safety method statements from contractors	EPC Contractor/O&M Team	Site inspection	Monthly Monitoring	Site HSE Officer of EPC Contractor/ site HSE In-charge of O&M Team	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor/ O&M

Project Activities	Impact/Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
									contractor to site HSE In-charge of CSP Bhadla
			Permitting system should be implemented to ensure that cranes and lifting equipment is operated by trained and authorized persons only	EPC Contractor/O&M Team	Permitting document	Monthly Monitoring	Site HSE Officer of EPC Contractor/ site HSE In-charge of O&M Team	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Bhadla
			Appropriate safety harnesses and lowering/raising tools should be used for working at heights	EPC Contractor/O&M Team	Site inspection	Monthly Monitoring	Site HSE Officer of EPC Contractor/ site HSE In-charge of O&M Team	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Bhadla
			A safety or emergency management plan should be in place to account for natural disasters, accidents and any emergency situations	EPC Contractor/O&M Team	Site specific Emergency Management Plan	Monthly Monitoring	Site HSE Officer of EPC Contractor/ site HSE In-charge of O&M Team	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor/ O&M contractor to

Project Activities	Impact/Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
									site HSE In-charge of CSP Bhadla
			A safety or emergency management plan should be in place to account for natural disasters, accidents and any emergency situations. The nearest hospital, ambulance, fire station and police station should be identified in the implemented emergency management plan.	EPC Contractor/O&M Team	Site inspection	Monthly Monitoring	Site HSE Officer of EPC Contractor/ site HSE In-charge of O&M Team	HSE In-charge of CSP Bhadla	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Bhadla
Community Health and Safety									
Impact on Community Health and Safety	Safety risks through public accessibility, Emergency situations, and Exposure to unhygienic conditions	Construction	Developing an ESMS for the Project.	CSP Bhadla Pvt Ltd ,HSE team	Discussion with EPC, Visual inspection	Every month	EHS Manager and EPC EHS Team	EHS team of CSP Bhadla	Reports from different contractors to the EHS Manager of CSP Bhadla Pvt Ltd
			Monitoring Contractor's EHS performance for its workers						
			Proper fencing around Project boundaries						
			Drivers are instructed to follow speed limit and careful while driving to avoid accidents						

Project Activities	Impact/Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
			Water sprinkling on roads leading to Project site						
			Regulating movement of heavy equipment and construction materials during peak hours						
			Communicating the local community about the accidental risks and safety features of the solar PV panels.						
			Construct sanitation facilities for labourers inside the Project area boundaries along with septic tanks to avoid contagion in the adjacent land,						
			Involving the district disaster management cell and the nearest fire service station while preparing for emergency situations; and						
			Obtain an adequate third party insurance cover to meet the financial loss to any third party due to such emergencies.						

Project Activities	Impact/Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
Local employment									
Generation of local employment in the study area	Positive impact	More during Construction phase and extended to Operation phase	Some of the enhancement measures are as follows: Sourcing more local laborers, contractors, and vendors for Project work Communicate to the Gram Panchayat about the opportunities of employment in the Project Skills training programs for promoting agriculture-allied activities so as to create self-employment opportunities should be promoted.	CSP Bhadla Pvt Ltd ,EPC team.	Discussion with EPC, Visual inspection	Weekly monitoring	EHS Manager and EPC EHS Team	EHS team	Reports from different contractors to the EHS Manager of CSP Bhadla Pvt Ltd .
Labour influx									
Influx of migrant workforce into the study area	Limiting the opportunity of local employment and, Spread of communicable diseases if the migrant workers are	Construction	Provisioning adequate ventilation, lighting, bathing facilities and bedding suitable to the extreme climatic condition in the labour camps Ensuring health check-ups of all labourers employed at the Project site to screen pre-existing communicable diseases	CSP Bhadla Pvt Ltd, EPC team	Discussion with EPC, Visual inspection	Weekly during construction period	EHS Manager and EPC EHS Team	EHS team	Reports from different contractors to the EHS Manager of CSP Bhadla Pvt Ltd .

Project Activities	Impact/Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
	suffering through any.		Access to healthcare services and medical care in case of sickness						
			Extending provisions for hygiene in Labour Camps as well as Work Site						
			Providing recreational and entertainment facilities to labourers on holidays or on their off-days to further limit their interface with the locals						
			Preference to local employment than hiring migrant workers.						
Ecology									
Influx of migrant workforce into the study area	■ Hunting & Trapping ■ Change in food habit of local wildlife from scavenging on kitchen waste, leading	Construction	■ Strict no hunting, poaching, trapping or injuring of wildlife policies and discussions should be initiated by the EPC contractor to ensure that no protected or threatened species are harmed or killed by contractors/ labourers.	CSP Bhadla Pvt Ltd ,EPC team.	Discussion with EPC, Visual inspection	Weekly monitoring	EHS Manager and EPC EHS Team	EHS team	Reports from different contractors to the EHS Manager of CSP Bhadla Pvt Ltd.

Project Activities	Impact/Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
	to potential human wildlife conflict.		■ Kitchen waste (un eaten food, vegetable material) should be disposed off through authorised agency.						
Increased traffic and other anthropogenic movement in the Project area	Disturbance to fauna in the nearby areas May prevent proper breeding, nesting, mating, and foraging. Injury/death to mammalian fauna	Construction	■ Number of routes should be minimized for construction and transportation; ■ Speed limit of vehicles plying on these routes should be kept to 10-15 km/hr to avoid road kill; and ■ Unnecessary disturbance of neighbouring areas due to off-road vehicular movement, needless expansion of labour camp and destruction of floral resources should be prohibited. ■ Construction and transportation activities should be avoided at night	CSP Bhadla Pvt Ltd ,EPC team.	Discussion with EPC, Visual inspection	Weekly monitoring	EHS Manager and EPC EHS Team	EHS team	Reports from different contractors to the EHS Manager of CSP Bhadla Pvt Ltd.

Project Activities	Impact/Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
			(6:00 pm to 6:00 am); ■ Efforts should be made to minimize construction noise and the use of noise barriers should be considered for high noise levels;						
Power Generation and Evacuation	Collision and Electrical hazards from Transmission Infrastructure	Construction and Operation Phase	■ The transmission poles should be raised with suspended insulators in order to reduce the electrocution of bird species; ■ Bird-safe strain poles require insulating chains at least 60 cm in length (determined based on the average wing span of common avifauna) should be used; and ■ Marking overhead cables using diffractors and avoiding use in areas	CSP Bhadla Pvt Ltd ,EPC team & O&M Team	Discussion with EPC & O&M Team, Visual inspection	Weekly monitoring & During Operation depending on schedule of maintenance and security check	EHS Manager and EPC EHS Team and O&M's EHS Team	EHS team	Reports from different contractors to the EHS Manager of CSP Bhadla Pvt Ltd.

Project Activities	Impact/Issue	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of Verification that mitigation has been met	Timelines /frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
			of high bird concentrations of species vulnerable to collision. ■ During regular maintenance process or during regular security check staff or security guard should be vigilant about any bird carcass and damaged solar PV cells and record should be maintained. If bird mortality due to collision with PV cell is recorded, then long term structured monitoring is recommended						

9. IMPACT SUMMARY AND CONCLUSION

This Environmental and Social impact assessment has been conducted to evaluate the impacts associated with the proposed solar power Project of 100 MW capacity. The impact assessment has been conducted in compliance with the Administrative Framework identified herein, including relevant national legislative requirements, international conventions and HFE's corporate requirements.

9.1 Impacts Requiring Detailed Assessment

Following a Scoping exercise, this ESIA was focused on interactions between the Project activities and various resources/receptors that could result in significant impacts. The table below presents the outcomes of the comprehensive assessment of identified impacts as a result of the various phases of the Project.

Figure 9.1 Impact Assessment Summary

Impact Description	Impact nature	Significance of Impact	
		Before Mitigation	With Mitigation
Construction Phase			
Change in land use	Negative	Moderate	Moderate
Change in Topography and Drainage	Negative	Moderate	Minor
Soil erosion and compaction	Negative	Minor	Negligible
Soil contamination from waste generation and spills/leaks	Negative	Minor	Negligible
Depletion of water resource	Negative	Moderate	Minor
Impact on ambient air quality	Negative	Minor	Negligible
Impact on noise quality	Negative	Minor	Negligible
Occupational Health and Safety	Negative	Minor	Negligible
Community Health and Safety	Negative	Minor	Negligible
Ecological impacts due to Vegetation Clearance	Negative	Negligible	Negligible
Ecological impacts due to Construction Activities	Negative	Negligible	Negligible
Access restriction to Agricultural land and Common Property Resource	Negative	Minor	Negligible
Impact on Local Employment	Positive		
Impact of labour influx/migrant workforce	Negative	Moderate	Minor
Operation Phase			
Soil contamination due to waste generation, spillage and leakage	Negative	Minor	Negligible
Depletion of water resources	Negative	Moderate	Negligible
Impact on noise quality	Negative	Negligible	Negligible
Occupational Health and Safety	Negative	Minor	Negligible
Impact on fauna	Negative	Minor	Minor
Impact on Local Employment	Positive		
Decommissioning Phase			
Impact on soil environment	Negative	Minor	Negligible
Impact on ambient air quality	Negative	Minor	Negligible
Occupational Health and Safety	Negative	Minor	Negligible

9.2 Conclusion

The Project is a green energy Project proposing to generate 100 MW power through solar energy. The Project and its key components such as site office building, external transmission lines, etc. are likely to have had environmental impacts on baseline parameters, such as on land use (conversion from agricultural to industrial land), ambient air quality and noise quality, especially during the construction phase. The social impacts from the Project are assessed to be beneficial in terms of local employment and overall local area development.

The Environmental and Social Management Plan (ESMP) describes mitigation measures for impacts specific to Project activities and also discuss implementation mechanism. Project specific management plans are also provided for certain Project activities such as waste management, bird/ bat management, stakeholder consultation etc. To conclude, the implementation of ESMP/ Management plans will help CSP (Bhadla) in complying with its internal requirements as well as national/state regulatory framework in addition to meeting IFC requirements.

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