Environmental and Social Impact Assessment (ESIA) of a 250 MW (DC) Solar PV Project in Noore Ki Bhoorj, Rajasthan

Clean Solar Power (Jodhpur) Private Limited

Final Report

25 October 2019

Project No.: 0501073

The business of sustainability

ERM

Document details	The details entered below are automatically shown on the cover and the main page footer. PLEASE NOTE: This table must NOT be removed from this document.
Document title	Environmental and Social Impact Assessment (ESIA) of a 250 MW (DC) Solar PV Project in Noore Ki Bhoorj, Rajasthan
Document subtitle	Final Report
Project No.	0501073
Date	25 October 2019
Version	2.0
Author	Karishma Sharma, Saumabha Bhattacharya, Karan Masand Rai
Client Name	Clean Solar Power (Jodhpur) Private Limited

Document history

				ERM approval to issue		
Version	Revision	Author	Reviewed by	Name	Date	Comments
Draft	00	Karishma Sharma, Saumabha Bhattacharya, Karan Masand Rai	Reela Mishra Ajay Pillai	Neena Singh	22.04.2019	-
Draft	01	Karishma Sharma, Saumabha Bhattacharya, Karan Masand Rai	Reela Mishra Ajay Pillai	Neena Singh	24.04.2019	-
Final	00	Karishma Sharma, Saumabha Bhattacharya, Karan Masand Rai	Reela Mishra Ajay Pillai	Neena Singh	05.07.2019	-
Final	01	Karishma Sharma, Karan Masand Rai	Reela Mishra Ajay Pillai	Neena Singh	14.10.2019	Added desk-based information based on discussions held with HFE and AIIB.
Final	02	Karishma Sharma, Karan Masand Rai	Reela Mishra Ajay Pillai	Neena Singh	25.10.2019	Added information on transmission line route, gender component and HFE audit checklist.

Signature Page

25 October 2019

Environmental and Social Impact Assessment (ESIA) of a 250 MW (DC) Solar PV Project in Noore Ki Bhoorj, Rajasthan

Final Report

Prepared by: Karishma Sharma
Job title: Assistant Consultant

Prepared by: Saumabha Bhattacharya
Job title: Consultant

Prepared by: Karan Masand Rai
Job title: Assistant Consultant

Reviewed by: Reela Mishra
Job title: Senior Consultant

Reviewed by: Ajay Pillai
Job title: Partner

Approved by: Neena Singh
Job title: Managing Partner

ERM India Private Limited

Building 10A

4th Floor, DLF Cyber City

Gurgaon, NCR – 122002

www.erm.com

CONTENTS

List of Tables

List of Figures

Acronyms and Abbreviations

Name	Description
AIIB	Asian Infrastructure Investment Bank
AL	Agricultural Labourers
Amsl	Above mean sea level
AoI	Area of Influence
BMTPC	Building Materials and Technology Promotion Council of India
CDGR	Community Disclosure and Grievance Redressal
CEA	Central Electricity Authority
CGWA	Central Groundwater Authority
CGWB	Central Ground Water Brochure
CL	Cultivators
CMS	Convention of Migratory Species
CO2	Carbon dioxide
CPCB	Central Pollution Control Board

CPR	Common Property Resources
CSR	Corporate Social Responsibility
CTE	Consent to Establish
CTO	Consent to Operate
DEM	Digital Elevation Map
DG	Diesel Generator
DISH	Directorate Industrial Safety and Health Department
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
EPA	Environment Protection Act
ERM	Environmental Resources Management India Private Limited
ESF	Environmental and Social Framework
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
FPIC	Free, Prior and Informed Consent
GoR	Government of Rajasthan
GSI	Geological Survey of India
GSS	Grid Substation
HH	Household
HWA	Hazardous Waste Authorization
IA	Impact Assessment
IFC	International Finance Corporation
IGNP	Indira Gandhi Nahar Pariyojna
ILO	International Labour Organization
IMD	India Meteorological Department
IREDA	Indian Renewable Energy Development Agency Limited
kV	Kilowatt
kWh	Kilowatt per hour
LNG	Liquefied Natural Gas
Mbgl	Meters below ground level
MNRE	Ministry of New and Renewable Energy
MNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MoEFCC	Ministry of Environment, Forest and Climate Change
Mtoe	Million tons of oil equivalent
MW	Mega Watt
NAAQ	National Ambient Air Quality
NFPA	National Fire Protection Authority
NISE	National Institute of Solar Energy
NOC	No Objection Certificate

O&M	Operation and Maintenance
OBC	Other Backward Caste
PPE	Personal Protective Equipment
Ppm	Parts per million
PPM	Project-affected People's Mechanism
PS	Performance Standards
PUC	Pollution under Control
PV	Photovoltaic
RRECL	Rajasthan Renewable Energy Corporation Limited
RSPCB	Rajasthan State Pollution Control Board
SC/ST	Schedule Caste/Schedule Tribe
SECI	Solar Energy Corporation of India
SPV	Special Purpose Vehicle
TL	Transmission Line
VD	Village Directory
WB	World Bank
WHO	World Health Organization

EXECUTIVE SUMMARY

E.1 Project Background

Hero Future Energies (HFE) is developing a 250 MW Solar Power Project in Jodhpur, Rajasthan via its special purpose vehicle (SPV) M/s. Clean Solar Power (Jodhpur) Private Limited (CSP Jodhpur). The site is located in Bap and Phalodi tehsil in Jodhpur district of Rajasthan. The solar power project is spread across three (3) villages, namely Dedasari, Khakori and Durjani and is located approximately 10 km south of the Bhadla Solar Park.

ERM India Private Limited (ERM) was engaged by HFE to undertake an Environmental and Social Impact Assessment (ESIA) study of the solar power project in accordance with International Finance Corporation (IFC) Performance Standards, Asian Infrastructure Investment Bank (AIIB) Environmental and Social Framework (ESF) and national environmental laws and regulations.

The site visit for the ESIA study was carried out on 12th and 13th February 2019 to obtain data on the environmental conditions for the various identified parameters along with the social-economic survey of the site. Ecological survey of the site was conducted on the same dates, wherein an analysis was undertaken of any ecological sensitivities in the vicinity of the site. As part of additional scope of work, another site visit was undertaken from 16th to 18th October 2019. Consultation were held with vulnerable communities such as women headed households, BPL and landless households.

E.2 Project Overview

The proposed 250 MW Project is located over private agricultural land measuring approximately 1,350 acres across Dedasari (approximately 3.6 km south), Khakori (approximately 4 km southeast) and Durjani (approximately 5 km south) villages in Bap and Phalodi tehsil. At the time of ERM site visit the Project was at the planning/pre-construction stage.

The proposed project site is approachable through national highway (NH-11) connecting to a paved village road which connects Dedasari village to Bap and Phalodi. Beyond the Dedasari village, the project site is accessible through an unpaved village road connecting the southern part of the project site to the village. The unpaved road itself runs along the eastern part of the project site.

The EPC contractor for the Project, responsible for installation of the Project components and development/procurement of Project related common infrastructure, is yet to be finalised and hired. Power from the project will be evacuated through a 220 kV transmission line to 765 kV Power Grid Corporation of Indian Limited (PGCIL) grid substation (GSS) located in Noore Ki Bhoorj village, approximately 6-7 km east of the proposed project site.

A 3 km long high-tension (HT) line, developed by M/s. Tata Power, will act as a common point (external transmission line) and will connect with the 5 km long transmission lines to be developed by HFE (internal transmission line). The external transmission line is a double circuit line consisting of 13 poles. Specifications of the 5 km long TL to be installed by HFE have not been shared with ERM.

At the time of ERM site visit, out of the 1306 acres of proposed project land, 844.39 acres had already been procured with 28 sale deeds for 844.39 acres of land already signed. The land is being procured through a local land aggregator from an estimated number of 150 land owners in total from Dedasari and Baroo[1] villages. All private land parcels for the project have been procured through a land aggregator. The land team informed ERM that only private land is being preferred for the Project and the remaining land to be procured is also private land.

1 Note: The habitation of Baroo village is present beyond the buffer zone, at approx. 8 km from project site and therefore not included in the environment and socio-economic baselines.

At the time of ERM site visit it was observed that the procured land parcels consist of agricultural land (fallow and current fallow with single season cropping)[2]. Small patches of open scrubland were also observed in nearby areas when accessing the site via the village road. The proposed site is located over a mix terrain (flat land and slightly undulated land). Furthermore, the procured land parcels consist of seasonally used *Kuccha* structures which are used for agricultural purposes. The structures house the family of the farmer (landowner) owning that particular patch of land during farming season and are also used for storage. The residents of these *kuccha* structures belong to Noore Ki Bhoorj and Dedasari villages.

E.3 Applicable Reference Framework

The following reference framework is applicable to the Project:

- 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 including:
  - IFC Performance Standards (2012);
  - IFC/World Bank General EHS Guidelines (2007);
  - IFC/World Bank EHS Guidelines for Electric Power Transmission and Distribution (2007);
  - Asian Infrastructure Investment Bank (AIIB) Environmental and Social Framework (ESF); and
  - AIIB Project-affected People Mechanism (PPM).

E.3.1 Applicability to IFC Performance Standards

The following IFC Performance Standards are applicable to the Project:

IFC PS No.	Description	Objectives and Applicability to Project
1.	Assessment and Management of Environmental and Social Risks and Impacts	**Applicable** This PS aims to assesses the existing social and environmental management systems of CSP Jodhpur and to identify the gaps with respect to their functioning, existence and implementation of an environmental and social management plan (ESMP), a defined EHS Policy, organization chart with defined roles and responsibilities, risk identification and management procedures as well as processes like stakeholder engagement and grievance management..
2.	Labour and Working Conditions	**Applicable** The project activities will involve hiring of approximately 400 skilled, semi-skilled and unskilled labourers during the construction phase and solar plant staff during the operation phase. The project will have to develop a human resource policy and ensure non-discrimination and equal opportunity, protection of the workforce and occupational health and safety. Therefore, PS 2 is applicable to the Project.

2 This is the land which is left without cultivation for one or less than one agricultural year. Fallowing is a cultural practice adopted for giving the land rest. The land recoups the lost fertility through natural processes.

3.	Resource Efficiency and Pollution Prevention	**Applicable** The Project construction activities will lead to increased fugitive dust emissions, especially in the area it is being developed due to the presence of loose sandy soil and limited vegetation. The project activities will also lead to increase in ambient noise level during the construction phase, which may impact the nearest villages of Dedasari, Durjani and Khakori. Furthermore, the project activities will involve generation of waste and may involve abstraction of groundwater. Therefore, PS 3 is applicable to the Project.
4.	Community Health, Safety and Security	**Applicable** The Project activities will involve upgradation/widening of one of the 3 access routes identified and construction activities will lead to stress on the Project access road and on the area in general. Transportation of equipment and increased traffic in the area may lead to accidents and other threats on community health and safety, therefore PS 4 is applicable to the project.
6.	Biodiversity conservation and sustainable management of natural living resources	**Applicable** Though actual geo coordinates were not available for this particular project, based on onsite visit, the project seemed to be located in a mosaic of “Natural Habitat” (Sand dunes & Scrublands) as well as “Modified Habitat” (Agricultural Fields). Though no Threatened species (IUCN version 2019-1), was recorded or reported from the study area and the proposed project is not expected to cause any significant habitat loss (as such habitats are present in abundance in the landscape), PS 6 is applicable due to the presence of significance biodiversity value representing Flora and Fauna of “Thar Desert”.

E.3.2 Project Categorisation and Justification

The IFC and AIIB categories are similar in nature and based on the assessment of said categories the Project has been categorised as **Category B** based on the following reasoning:

- Environmental and social impacts of the project 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;
- The site location of the project does not involve any anticipated settlements and physical displacement;
- 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;
- 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.

E.4 Baseline Conditions

E.4.1 Environmental Baseline

During the ERM site visit it was observed that the project area consists primarily of private agricultural land with seasonally used structures/ sheds, along with structures used for collection of water, were

present. Land use of the procured land parcels consists of agricultural land (fallow and current fallow with single season cropping)[3]. Small patches of open scrubland were also observed in nearby areas when accessing the site via the village road.

The topography of the site is flat with slight undulation with elevation ranging from 195 m to 210 m above mean sea level. The proposed site is characterised by presence of sand dunes and the elevation gradually decreases from south going towards north.

There is no surface water body within the AoI of the project. The nearest surface water body to the site is the Indira Sagar Canal, located at a distance of 8 km towards the east of the project site, which receives water from the Indira Gandhi Nahar Pariyojna (IGNP) canal.

The stage of ground water development of Bap tehsil, where the study area falls is reported to be 38.66 % and marked as **Safe.**

It is to be noted that as per consultations conducted by ERM in the project area, groundwater in the area is reported to be scarce and available at approx. 600-800 feet below ground level, however, with reportedly high concentrations of fluoride, iron, nitrates and high electrical conductivity.

The Project study area 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.

As for natural hazards, the Project lies in the low damage risk zone in terms of earthquake occurrence, high damage risk zone for cyclones, the drought frequency in the area is once in three years and the Project area is not prone to flooding.

E.4.2 Social Baseline

The study area has a total population of 3558 with approximately 7.5 % and 3.03 % of SC and ST population respectively. . For the overall study area, the population of STs varies from nil in Khakori and Durjani villages to 4 % in Dedasari.

The average sex ratio in the study area is observed to be 938 which is significantly lower than the state sex ratio of 973. One of the reasons cited for the lower sex ratio is the preference for the male child amongst the community as a whole. The average literacy rate in the study villages is 50 %. There are two Government-run primary schools. There is 1-government run middle schools. There are no senior secondary schools or colleges in the study area. The nearest senior secondary school is in Bap. The major reason behind the low literacy rate reported was high dropout rates due to lack of education infrastructure. The dropout rate amongst the girls were higher than boys.

The Study Area is characterised by a mixed population in terms of religion and caste, with a dominance of the Muslim religion and few Hindu households in Dedasari village (according to the information made available during the consultations). The major sub castes of ST population inhabiting the area are Meghwal and Bhil.

The settlement pattern in the area is rural, with the settlements being scattered over a large area in small clusters (also known as ‘Dhani’). The houses in the villages in the Study Area are of three types, Pukka, Semi-Pukka and Kutcha Houses.

3 This is the land which is left without cultivation for one or less than one agricultural year. Fallowing is a cultural practice adopted for giving the land rest. The land recoups the lost fertility through natural processes.

The primary land use in the area is agricultural land use. There is no forest cover in the project area. Similarly, area under non-agricultural uses and barren and un-cultivable land account for 1.5% and 10.9 % of the total study area respectively. Total fallow land i.e. fallows land other than current fallows and current fallows account for 32.41% of the total land in the study area.

The average Work Participation Ratio (WPR) in the study villages is 55 %. With the study villages, Dedasari accounts for the highest WPR (58) and accounts for the lowest WPR (35.96). Casual labourers are in a higher proportion than other workers and agriculture labour in all villages. The higher presence of casual labourers in most villages was also established during consultations. The labourers are mostly engaged in the construction of houses, roads etc.

The water supply in the area is restricted to supply of water from the Indira Gandhi canal through tankers. The villages in the Study Area don't have access to piped water supply or hand pumps and dug wells. The water stored is sufficient for 10-15 days, dependent upon the size of the household; the procured water is stored in Tank for further usage. All the villages in the study area have access to household electricity supply. The health facilities in the Study Area are characterised by a three tier health infrastructure. The health facilities available at the village level comprise of sub centres and Public Health Centres (PHC). The common health problems in the area include Mal, Jaundice, Pneumonia, Diarrhoea, Headaches, and Common fever.

E.4.3 Ecology baseline

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.

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. In major part of the study area agriculture is highly dependent on rain.

No waterbody and amphibian species were recorded from the study area during the course of ecological survey. Two (2) reptile species observed during the ecological survey were Leith's sand snake (*Psammophis leithii*) and Keeled rock gecko (*Cyrtopodion scabrum*).

A total of 24 bird species were recorded in the study area. Four species, the Short toed Snake Eagle (*Circaetus gallicus),* Long-legged buzzard (*Buteo rufinus),* Common Kestrel (*Falco tinnunculus)* and Indian peafowl (*Pavo cristatus)* 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

Total eight mammals can be found in the study area. Out of eight species four were directly recorded during primary survey. No Threatened species (IUCN version 2019-1), was recorded or reported from the study area.

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.

E.5 Stakeholder Engagement

During the ESIA, ERM identified/profiled the various stakeholders of the project, such as the affected families, vulnerable groups such as women headed households, BPL card holders and landless households, the village-level key informants, the line departments (revenue, land, agriculture and forest), state/district administration and civil society organisations as well as developed an understanding of their stakes, interests and influences on the project as per the IFC and AIIB's

standards. 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.

The key concerns and expectations that were raised during the stakeholder consultation process have been summarised below:

- **Key feedback received from local community of Dedasari, Noore ki Bhoorj and Baroo village regarding solar plants in Bap tehsil :** It was informed during the consultation with the community that there is a drastic shift from agriculture based economy to non-agriculture based economy due to lack of irrigation facilities and decline in crop yield. There was a positive outlook towards the solar projects in the area. Although Bap tehsil has witnessed development of various solar projects in the past 5-10 years, the community desired more such projects in the vicinity. They expect to receive benefits from the project in terms of employment and development of infrastructure and the overall community. In addition they also demanded preference to the local community in contractor and employment opportunities from the project.
- **Key feedback received from 5 land sellers who were consulted during the ERM site visit:** It was informed that the sellers are willing to sell their land due to the low productivity of the agricultural land, dependency on monsoons and lack of irrigation facilities. The compensation received after selling their land was reinvested into purchase of fertile land in other nearby villages at a lower price (Baroo village, bap tehsil). Remaining money is also considered as an option of liquidating their assets. The major concern of the stakeholder group till now is related to availability of employment opportunities that the project will generate.
- **Community Development activities**: The local communities were of the opinion that apart from the economic opportunities, the local community should also benefit from the project in terms of community development activities. Some of the key areas for development activities identified included medical infrastructure, access to middle and higher schools, separate schools for girls and trainings for youth and women within the village. This can be done by collaborating with local NGOs working on these areas.
- This can be done by collaborating with local NGOs working on these areas such as Foundation for Education and Development (FED) (Doosra Dashak project), Gram Vikas Seva Sansthan. The organisations are working with women groups by forming micro finance groups and working on life skill training.

E.6 HFE Grievance Redressal Mechanism (GRM) Procedure

HFE has developed a formal Grievance Redressal Mechanism (GRM) for external and internal stakeholders. The procedure is applicable to the entire life cycle of the project i.e. post site selection till the decommissioning phase (including mobilization, construction and operations phase). Consultations, communication and disclosure are mandated by framework specified for the projects.

The GRM outlines the process for lodging grievances, steps to be taken for subsequent action and the time limit within which the issue would be resolved to the satisfaction of the complainant. All complaints shall be recorded and addressed in a uniform and consistent manner.

E.7 Key Identified Impacts

E.7.1 Construction phase

Site clearance and loss of top soil: The site clearance, excavation for foundation and access road construction will largely affect the top layers of the soil. Loss of top soil quality would have an impact on the agricultural productivity of the land but the effects can be reversed over time. Further, site clearance will be restricted only in the project site.

Waste generation: 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. A small proportion of the waste generated during construction phase will be hazardous and will include waste fuel, grease and waste oil containing rags.

Water requirement: It is estimated that approximately 60 KLD of water would be required for civil works during construction stage and considering peak worker requirement of 400 workers, daily water requirement is estimated as 18 KLD. The water will be obtained from nearby borewells (study area falls in region marked as Safe in terms of groundwater availability) and/or the IGNP canal (the only source of surface water).

Air quality: Air quality in the study area will be impacted in the form of fugitive dust emissions from construction/installation activities, vehicular emissions and exhaust emissions from DG sets.

Ambient noise: Settlements of Dedasari, Khakori and Durjani villages will most likely be affected by increasing noise levels because of proximity to the project site and construction of the proposed access road.

Occupational and community health and safety: The construction phase activities such as installation of solar PV panels, construction of transmission lines and substations and movement of material and personnel may result in impacts on the health and safety of the workers and the community. These activities will involve the use of heavy machinery and live transmission power lines.

Labour and employment: As gathered from consultations CSP's site team, a significant segment of labour requirement during the construction phase will be sourced locally.

Local biodiversity: Based on habitat sensitivity value, open scrub and sand dune habitat was found to sustain only Least Concern species, and such habitat is widespread in the study area and beyond study area, so the loss of such habitat for project activity affects only a small portion of such habitat.

E.7.2 Operational phase

Soil environment: In the operation phase, soil compaction and erosion may occur due to vehicle movement, which only happens during the occasional maintenance activities.

Waste generation: The waste generated from project includes domestic solid waste at SCADA building and substation and hazardous waste like waste oil and lubricants and oil containing jutes and rags will be generated during maintenance activities.

Dry robotic cleaning: Use of dry cleaning technologies is a proposed method that will be adopted to undertake module cleaning. Therefore, water requirement for module cleaning purpose will be very minuscule.

Employment: During the operations phase, the requirement for unskilled and semi-skilled labour is expected to reduce to 20 and 15 respectively. The locally procured services will include maintenance work of the facility, 24 hour security, bush and undergrowth cleaning and housekeeping activities.

Ecology: 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.

E.7.3 Decommissioning phase

Soil environment: Soil in the study area will be affected due to soil compaction due to the increased vehicular and workforce movement, dismantling and storage of plant components on the adjacent land, removal of internal electric lines/ poles etc. and waste generated in form of dismantled plant components and demolition debris from plant foundations, storage yard and substation complex.

Air quality: Air quality in the study area will be impacted in the form of fugitive dust emissions from construction/installation activities, vehicular emissions and exhaust emissions from emergency DG sets.

Ambient noise: During decommissioning phase of the project, noise will generate from movement of vehicles carrying dismantled structure and equipment.

Economy and employment: The major social impacts associated with the decommissioning phase are linked to the loss of jobs and associated income.

E.7.4 Key cumulative impacts

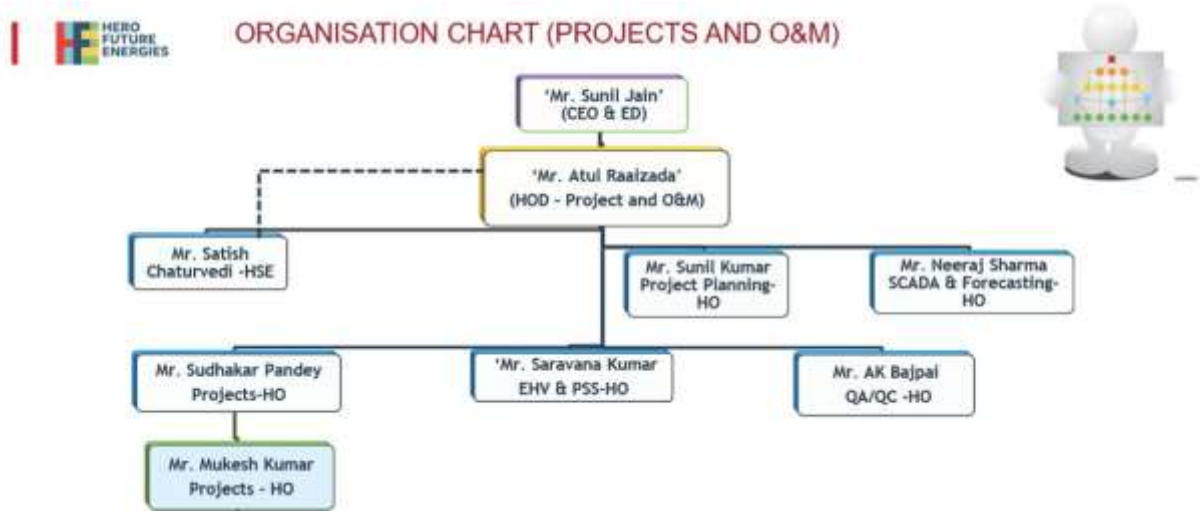
All of the above highlighted impacts may have a heightened effect in the study area as the study area is characterised by the presence of other solar power Projects, namely:

- 23 MW Solar Power Plant owned by Waaree Energies Limited (WEL) and Maharashtra Seamless Limited (MSL);
- 20 MW Solar Power Plant owned by Northern Solaire Prakash Private Limited (NSPPL);
- 10 MW Solar Power Plant owned by Sauryauday Solaire Prakash Private Limited (SSPPL); and
- Bhadla Solar Park.

E.8 Mitigation Measures and ESMP

For the purpose of providing site specific mitigation measures to mitigate key identified impacts from the Project, an ESMP has been developed. The ESMP specifies the standards and controls required to manage and monitor environmental and social impacts during construction and operation 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 throughout the lifecycle of the Project.

E.8.1 HFE's Organisational Structure



Source: Hero Future Energies

Since the project is at initial stages of planning, details related to site level organogram of CSP Jodhpur and their EPC Contractors are not presently known.

E.8.2 Roles and Responsibilities

CSP Jodhpur will majorly play a role of supervisor to oversee the project performance pertaining to environment, health, safety and social issues. It is recommended to strength the EHS organizational structure by creating a dedicated EHS department at the corporate level. Identify unsafe acts and conditions and suggest remedies.

E.8.3 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 Jodhpur will ensure that the conditions stipulated under various permits are followed. The inspections and audits will be done by EPC contractor (during construction phase), 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.

E.8.4 Reporting and Documentation

CSP Jodhpur 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.).

E.8.5 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.

E.8.5.1 Internal Reporting and Communication

There are following reports required for the construction and operations period, as per HFE ESMS:

- **Monthly Compliance Report**: Once the construction of the project starts, a monthly compliance report needs to be submitted by the Contractor. The compliance will be verified against applicable laws, ESMP and other conditions as required by the contract.
- **Quarterly Audit Report**: Regular supervisory missions to be carried out by the environmental Manager and a brief summary report shall be prepared with corrective actions, which will be shared with the contractors during construction till commissioning.
- **Monthly Compliance Report**: Once the operation of the project has started, a monthly compliance report will be submitted by Contractor. The compliance will be verified against applicable laws, ESMP and other conditions as required by the contract.
- **Six-monthly Audit Report**: Regular supervisory missions will be carried out by the Environmental Manager and a brief summary report shall be prepared with corrective actions, which will be shared with the contractors

E.8.5.2 Documentation

Documentation is an important step in the implementation of the ESMP, CSP Jodhpur 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.

E.8.5.3 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.

E.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.

E.8.7 Purpose of the ESMP

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.

E.8.8 Mitigation measures

The relevant mitigation measures to all the impacts identified during the impact assessment study have been presented in **Section 6** (Impact Assessment) and **Table 8.1** (Environmental and Social Management Plan) of the ESIA report for the Project. Key mitigation measures for construction and operational phases have been summarized below. As for decommissioning phase, ensure mitigation measures for construction phase are reviewed and appropriately followed.

- Construction phase:
  - Proper water sprinkling of road should be undertaken to reduce the fugitive emissions during transportation.
  - HFE Grievance Redressal mechanism should be followed by CSPPL and its sub-contractors. It should be ensured that a complaint register is maintained onsite so that any complaints from the locals or labours can be registered, investigated and timely resolved.
  - Proper PPE's viz. gloves, glasses, helmet and shoes should be worn by workers/labours while handling solar panels as well as during other activity during construction phase.
  - Camp and kitchen waste shall be collected in a manner that it does not attract wild animals.
  - Temporary barriers/fencing shall be installed on excavated areas.
  - The speed limit of the heavy vehicles should be maintained.
  - All the vehicle should have valid PUC certificate.
  - Hazardous materials such waste oil, used oil should be stored at designated locations in enclosed structures over impermeable surface.
  - Hazardous Waste authorization as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 should be obtained.
- Operational phase:
  - Implement the recommended complaint resolution procedure (Grievance Redress Mechanism) to assure that any complaints regarding noise or any other issue related to project activity is not left unnoticed. The complaints should be registered, investigated and timely resolved.
  - To minimize effect of "Lake effect", visual frightening techniques like "Scare crow" may be considered to frighten any bird trying to land on panels and prevent birds from landing.
  - Ensure dry robotic cleaning is undertaken at the operational plant so as to decrease the stress on local water resources, especially groundwater resources.
  - Hazardous waste viz. waste oil used oil, used grease, wastes or residues containing oil, empty barrels/ containers/ liners waste or residues containing oil etc. will be collected and stored in paved and enclosed area with secondary containment and subsequently sold to authorized recyclers/ Transfer storage disposal facility (TSDF) in compliance with RSPCB norms.

E.9 Conclusion

The Project is a green energy project proposing to generate 250 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.

कार्यकारी सारांश

ई.1 परियोजना की पृष्ठभूमि

हीरो फ़्यूचर एनर्जीज़ (एचएफ़ई) अपने विशेष प्रयोजन वाहन (एसपीवी) सर्वश्री क्लीन सोलर पॉवर (जोधपुर) प्राइवेट लिमिटेड (सीएसपी जोधपुर) के माध्यम से जोधपुर में एक 250 मेगावॉट की सौर विद्युत परियोजना विकसित कर रही है। परियोजना स्थल राजस्थान के जोधपुर जिले के बाप और फलोडी तहसील में स्थित है। सौर विद्युत परियोजना तीन (3) गांवों, नामतः डेडासरी, खकोरी और दुर्जनी में फैली है और भदला सोलर पार्क के दक्षिण में लगभग 10 किमी की दूरी पर स्थित है।

एचएफ़ई ने अंतरराष्ट्रीय वित्त निगम (आईएफ़सी) के प्रदर्शन मानकों, एशियाई अवसंरचना निवेश बैंक (एआईआईबी) के पर्यावरणीय एवं सामाजिक ढांचे (ईएसएफ़) और राष्ट्रीय पर्यावरणीय कानूनों तथा विनियमों के अनुसरण में सौर विद्युत परियोजना के पर्यावरणीय एवं सामाजिक प्रभाव आकलन (ईएसआईए) अध्ययन के लिए ईआरएम इंडिया प्राइवेट लिमिटेड (ईआरएम) को संलग्न किया था।

पहचाने गए विभिन्न प्राचलों के लिए पर्यावरणीय स्थितियों के आंकड़े जुटाने और परियोजना स्थल का सामाजिक–आर्थिक सर्वेक्षण करने के उद्देश्य से ईएसआईए अध्ययन हेतु 12 और 13 फ़रवरी, 2019 को परियोजना स्थल का दौरा किया गया था। इन्हीं दिनांकों पर परियोजना स्थल का पारिस्थितिकीय सर्वेक्षण भी किया गया था जिसमें, परियोजना स्थल के आस–पास जो भी पारिस्थितिकीय संवेदनशीलताएं थीं उनका विश्लेषण किया गया। कार्य के अतिरिक्त दायरे के भाग के रूप में, 16 से 18 अक्तूबर, 2019 तक परियोजना स्थल का एक और दौरा किया गया था। असुरक्षित समुदायों जैसे महिला मुखिया वाले घरों, बीपीएल और भूमिहीन घरों से परामर्श किया गया।

ई.3.2 परियोजना का श्रेणीकरण और औचित्य–सिद्धीकरण

आईएफ़सी और एआईआईबी की श्रेणियां मिलती–जुलती प्रकृति हैं और उक्त श्रेणियों के आकलन के आधार पर परियोजना को **श्रेणी बी** में श्रेणीबद्ध किया गया है जिसका तर्काधार निम्नवत है:

- निर्माण चरण के दौरान परियोजना से पर्यावरण और समाज पर प्रभाव पड़ना प्रत्याशित है जिसमें भू–उपयोग में परिवर्तन, शोर के स्तर में वृद्धि, वायु गुणवत्ता में परिवर्तन, जल के उपयोग और उसकी गुणवत्ता में परिवर्तन, थलीय पारिस्थितिकी, व्यवसायगत स्वास्थ्य व सुरक्षा आदि पर प्रभाव शामिल हैं;
- परियोजना स्थल की अवस्थिति में कोई प्रत्याशित बसावट एवं भौतिक विस्थापन शामिल नहीं है;
- पिछले दशक में सौर विद्युत परियोजनाओं का विकास बड़ी संख्या में हो रहा है और इसलिए संपूर्ण भारत में ऐसी बहुत सी परियोजनाएं स्थित हैं। अतः सौर विद्युत परियोजना को कोई अभूतपूर्व गतिविधि नहीं माना जा सकता है;
- सूर्य आधारित ऊर्जा का विकास, ऊर्जा का एक प्रदूषणहीन स्रोत है और इसलिए इससे प्रचालन चरण के दौरान आधार–रेखा पर्यावरण पर कोई प्रतिकूल प्रभाव पड़ने की संभावना नहीं है।

ई.7 पहचाने गए मुख्य प्रभाव

ई.7.1 निर्माण चरण

परियोजना स्थल की सफ़ाई और मिट्टी की ऊपरी पर्त की हानिः परियोजना स्थल की सफ़ाई, तथा नींव व पहुंच मार्ग के निर्माण के लिए उत्खनन से मुख्यतः मिट्टी की ऊपरी पर्तें प्रभावित होंगी। मिट्टी की ऊपरी पर्त की गुणवत्ता की हानि से भूमि की कृषि उत्पादकता पर प्रभाव पड़ेगा पर समय के साथ ये प्रभाव समाप्त किए जा सकते हैं। इसके अतिरिक्त, स्थल की सफ़ाई का कार्य केवल परियोजना स्थल तक ही सीमित होगा।

कचरा उत्पन्न होनाः परियोजना स्थल पर उत्पन्न होने वाले सामान्य निर्माण कचरे में कंक्रीट, स्टील की कतरन/छीलन, पैकेजिंग पेपर या प्लास्टिक आदि होंगे। निर्माण कार्यबल द्वारा कैंटीन में नगरीय ठोस कचरा भी उत्पन्न होगा जिसमें बचे–खुचे खाद्य पदार्थ, प्लास्टिक, कांच और रद्दी कागज शामिल हैं।
निर्माण चरण के दौरान बहुत छोटी मात्रा में ख़तरनाक कचरा भी उत्पन्न होगा जिसमें अवशिष्ट ईंधन, ग्रीज़ एवं अवशिष्ट तेल में लथपथ चिथड़े शामिल हैं।

जल की आवश्यकताः यह अनुमानित है कि निर्माण चरण के दौरान निर्माण कार्यों के लिए लगभग 60 केएलडी जल की आवश्यकता होगी और 400 कर्मियों की शीर्ष जल आवश्यकता को देखते हुए, दैनिक जल आवश्यकता का 18 केएलडी होना अनुमानित है। जल निकटवर्ती बोरवैलों (अध्ययन क्षेत्र भूजल उपलब्धता की दृष्टि से सुरक्षित की श्रेणी में रखे गए क्षेत्र में आता है) और/या आईजीएनपी नहर (सतही जल का एकमात्र स्रोत) से प्राप्त किया जाएगा।

वायु गुणवत्ताः निर्माण/संस्थापना गतिविधियों से निकलने वाले पलायक धूल उत्सर्जनों, वाहनों से निकलने वाले उत्सर्जनों और डीजी सेट के एक्ज़ॉस्ट उत्सर्जनों से अध्ययन क्षेत्र में वायु की गुणवत्ता प्रभावित होगी।

परिवेशी शोरः शोर के स्तर में वृद्धि से डेडासरी, खकोरी और दुर्जनी गांवों की बस्तियों के प्रभावित होने की संभावना सर्वाधिक है क्योंकि उक्त बस्तियां परियोजना स्थल और प्रस्तावित पहुंच मार्ग के निर्माण के समीप हैं।

व्यवसायगत एवं सामुदायिक स्वास्थ्य तथा सुरक्षाः निर्माण चरण की गतिविधियां जैसे सोलर पीवी पैनलों की संस्थापना, पारेषण लाइनों और सबस्टेशनों के निर्माण, और सामग्री व कार्मिकों के आवागमन से कर्मियों और समुदाय के स्वास्थ्य व सुरक्षा पर प्रभाव पड़ सकते हैं। इन गतिविधियों में भारी मशीनों और लाइव (विद्युत–युक्त) पारेषण विद्युत लाइनों का उपयोग शामिल होगा।

श्रम एवं रोज़गारः जैसा कि सीएसपी के स्थल दल द्वारा किए गए परामर्शों से पता चला है, निर्माण चरण के दौरान श्रमिकों की आवश्यकता का एक बड़ा भाग स्थानीय श्रमिकों को नियुक्त करके पूरा किया जाएगा।

स्थानीय जैव–विविधताः प्राकृतिक वास–स्थान संवेदनशीलता मान के आधार पर यह पाया गया है कि खुली झाड़ी और रेत टीला प्राकृतिक वास–स्थान में केवल न्यूनतम चिंता वाली प्रजातियां पनपती हैं, और उक्त प्राकृतिक वास–स्थान अध्ययन क्षेत्र और उससे बाहर भी व्यापक रूप से फैला हुआ है, अतः परियोजना गतिविधि के कारण होने वाली उक्त प्राकृतिक वास–स्थान की हानि, उक्त प्राकृतिक वास–स्थान के एक छोटे से अंश मात्र को प्रभावित करती है।

ई.7.2 प्रचालन चरण

मृदा परिवेशः प्रचालन चरण में वाहनों के आवागमन के कारण मिट्टी का संहनन और अपरदन हो सकता है, जो केवल कभी–कभार की जाने वाली रखरखाव गतिविधियों के दौरान होता है।

कचरा उत्पन्न होनाः परियोजना से निकलने वाले कचरे में एससीएडीए भवन और सबस्टेशन से निकलने वाला घरेलू ठोस कचरा शामिल है और रखरखाव गतिविधियों के दौरान ख़तरनाक कचरा जैसे अवशिष्ट तेल और स्नेहक एवं तेल में लथपथ जूट और चिथड़े आदि निकलेंगे।

शुष्क रोबोटिक सफ़ाईः शुष्क सफ़ाई प्रौद्योगिकी का उपयोग वह प्रस्तावित विधि है जिसे मॉड्यूलों की सफ़ाई के लिए अपनाया जाएगा। अतः मॉड्यूलों की सफ़ाई के प्रयोजन से जल की आवश्यकता अत्यंत अल्प होगी।

रोज़गारः प्रचालन चरण के दौरान अकुशल और अर्द्धकुशल श्रमिकों की आवश्यकता घटकर क्रमशः 20 व 15 रह जाने की अपेक्षा है। स्थानीय स्तर पर जुटाई जाने वाली सेवाओं में इकाई का रखरखाव कार्य, 24 घंटे सुरक्षा, झाड़–झंखाड़ की सफ़ाई और हाउसकीपिंग गतिविधियां शामिल होंगी।

पारिस्थितिकीः पारिस्थितिकीय अध्ययन के दौरान क्षेत्र में पक्षियों की कई प्रजातियां तारों और खंभों पर बैठी पहचानी गईं। इन पारेषण लाइनों और खंभों से पक्षियों के लिए विद्युत–आघात और टकराने के संभावित ख़तरे उत्पन्न हो सकते हैं। कुछ पक्षी घोंसले बनाने के लिए भी पारेषण टॉवरों का उपयोग करते हैं।

ई.7.3 विप्रवर्तन चरण

मृदा परिवेशः वाहनों और कार्यबल के आवागमन में वृद्धि, संयंत्र के घटकों को खोलकर अलग करने और अगल–बगल की भूमि पर भंडारित करने, अंदरूनी विद्युत लाइनों/खंभों को निकालने आदि के कारण मिट्टी का संहनन होने से और, खोलकर अलग किए गए संयंत्र घटकों के रूप में तथा संयंत्र की नींव, भंडारण यार्ड और सबस्टेशन भवन–समूह से निकले मलबे के रूप में निकले कचरे से अध्ययन क्षेत्र की मिट्टी प्रभावित होगी।

वायु गुणवत्ताः निर्माण/संस्थापना गतिविधियों से निकलने वाले पलायक धूल उत्सर्जनों, वाहनों से निकलने वाले उत्सर्जनों और आपातकालीन डीजी सेट के एक्ज़ॉस्ट उत्सर्जनों से अध्ययन क्षेत्र में वायु की गुणवत्ता प्रभावित होगी।

परिवेशी शोरः परियोजना के विप्रवर्तन चरण के दौरान, खोलकर अलग किए गए ढांचों व उपकरणों को ले जाने वाले वाहनों के आवागमन से शोर उत्पन्न होगा।

आर्थिकी और रोज़गारः विप्रवर्तन चरण से जुड़े प्रमुख सामाजिक प्रभाव नौकरियों और संबंधित आय की हानि से संबंध रखते हैं।

ई.8.8 न्यूनीकरण के उपाय

प्रभाव आकलन अध्ययन के दौरान पहचाने गए सभी प्रभावों के संबंधित न्यूनीकरण उपाय, परियोजना की ईएसआईए रिपोर्ट के **अनुभाग 6** (प्रभाव आकलन) और **तालिका 8.1** (पर्यावरणीय एवं सामाजिक प्रबंधन योजना) में प्रस्तुत किए गए हैं। निर्माण और प्रचालन चरण के मुख्य न्यूनीकरण उपाय नीचे सारांश रूप में दिए गए हैं। जहां तक विप्रवर्तन चरण की बात है, सुनिश्चित करें कि निर्माण चरण के न्यूनीकरण उपायों की समीक्षा की जाए और उनका उपयुक्त पालन किया जाए।

- निर्माण चरणः

– परिवहन के दौरान पलायक उत्सर्जन घटाने के लिए सड़क पर ठीक से जल का छिड़काव किया जाना चाहिए।

– सीएसपीपीएल और उसके उप–ठेकेदारों द्वारा एचएफ़ई के व्यथा निवारण तंत्र का पालन किया जाना चाहिए। यह सुनिश्चित किया जाना चाहिए कि स्थल पर एक शिकायत रजिस्टर बनाकर रखा जाए ताकि स्थानीय लोगों या श्रमिकों की जो भी शिकायतें हों उन्हें पंजीकृत किया जाए, उनकी पड़ताल की जाए और उन्हें समय से हल किया जाए।

– सोलर पैनलों की हैंडलिंग के दौरान और निर्माण चरण में अन्य गतिविधियों के दौरान कर्मियों/श्रमिकों द्वारा उचित पीपीई जैसे दस्ताने, चश्मे, हेलमेट और जूते पहने जाने चाहिए।

– शिविर और रसोई से कचरा इस प्रकार एकत्र किया जाएगा जिससे वन्य जीव आकर्षित न हों।

– उत्खनित क्षेत्रों पर अस्थायी बैरियर/बाड़ लगाए जाएंगे।

– भारी वाहनों की गति सीमा बनाई रखी जानी चाहिए।

– सभी वाहनों के पास मान्य पीयूसी प्रमाणपत्र होना चाहिए।

– ख़तरनाक सामग्री जैसे अवशिष्ट तेल, प्रयुक्त तेल आदि को निर्धारित स्थानों पर, अपारगम्य सतह के ऊपर, परिबद्ध संरचनाओं के अंदर भंडारित किया जाना चाहिए।

– ख़तरनाक एवं अन्य अवशिष्ट (प्रबंधन एवं पारसीमा संचलन) नियमों, 2016 के अनुसार ख़तरनाक कचरे का प्राधिकरण प्राप्त किया जाना चाहिए।

- प्रचालन चरणः

– परियोजना गतिविधि से संबंधित शोर या किसी भी अन्य समस्या से जुड़ी कोई भी शिकायत अनसुनी न रह जाए यह आश्वस्ति देने के लिए अनुशंसित शिकायत निवारण कार्यविधि (व्यथा निवारण तंत्र) लागू करें। शिकायतें पंजीकृत की जानी चाहिए, उनकी पड़ताल की जानी चाहिए और उन्हें समय से हल किया जाना चाहिए।

– "झील प्रभाव" को न्यूनतम करने के लिए, दृश्यात्मक भयकारी तकनीकों, जैसे "बिजूका", के उपयोग पर विचार किया जा सकता है ताकि पैनलों पर उतरने की कोशिश करने वाले पक्षियों को डराया जा सके और उन्हें पैनलों पर उतरने से रोका जा सके।

– सुनिश्चित करें कि प्रचालन संयंत्र में शुष्क रोबोटिक सफाई का उपयोग किया जाए ताकि स्थानीय जल संसाधनों, विशेष रूप से भूजल संसाधनों पर पड़ने वाले तनाव को कम किया जा सके।

– ख़तरनाक कचरे, जैसे अवशिष्ट तेल, प्रयुक्त तेल, प्रयुक्त ग्रीज़, तेल युक्त कचरे या अवशेष, खाली पीपे/ पात्र/ लाइनर आदि को पक्के फ़र्श और द्वितीयक संरोधन वाले परिरुद्ध क्षेत्र में एकत्र व भंडारित किया जाएगा और तत्पश्चात उसे आरएसपीसीबी मानदंडों के अनुपालन में अधिकृत पुनर्चक्रकों/ स्थानांतरण भंडारण निपटान इकाई (टीएसडीएफ़) को बेच दिया जाएगा।

ई.9 निष्कर्ष

यह परियोजना एक हरित ऊर्जा परियोजना है जो सौर ऊर्जा के माध्यम से 250 मेगावॉट विद्युत उत्पादन का प्रस्ताव रखती है। परियोजना और उसके मुख्य घटकों जैसे स्थल कार्यालय भवन, बाहरी पारेषण लाइनों आदि से आधार–रेखा प्राचलों, जैसे भू–उपयोग (कृषि से औद्योगिक भूमि में परिवर्तन), परिवेशी वायु गुणवत्ता और शोर गुणवत्ता पर, विशेष रूप से निर्माण चरण के दौरान, पर्यावरणीय प्रभाव पड़ने की संभावना है। आकलन के अनुसार, परियोजना से पड़ने वाले सामाजिक प्रभाव स्थानीय रोज़गार और स्थानीय क्षेत्र के समग्र विकास की दृष्टि से लाभकारी हैं।

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 [(4)]. As of 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 also implemented a 43 MW Project in Madhya Pradesh under state policy and is implementing another 40 MW project in Telangana under the state policy as well. Additionally, M/s. Clean Solar Power (Bhadla) Private Limited, a SPV (Special Purpose Vehicle) of HFE, is in the process of implementing a 300 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.

HFE has now proposed to set up a new 250 MW solar power project in Noore Ki Bhoorj, Jodhpur (Rajasthan). The Project SPV (Special Purpose Vehicle), M/s. Clean Solar Power (Jodhpur) Private Limited (hereinafter referred to as 'CSP Jodhpur') is planning to implement a 250 MW grid connected solar photovoltaic power plant at Noore Ki Bhoorj. The Project site is located in Bap tehsil of Jodhpur district, Rajasthan.

CSP Jodhpur intends to undertake an Environmental and Social Impact Assessment (ESIA) for the project, in accordance with International Finance Corporation (IFC) Performance Standards 2012. The aim of the study is to understand the environmental and social sensitivities associated with the solar power project as well as assess the ability of the project to comply with the requirements of the above mentioned guidelines and implement mitigation measures during the Project's lifecycle. For this purpose, ERM India Private Limited (ERM) has been appointed to carry out the ESIA study.

ERM undertook a site reconnaissance visit for the project on 12th and 13th February 2019 to obtain data on the environmental conditions for the various identified parameters along with the social survey of the site. Ecological survey of the site was conducted on the same dates, wherein an analysis was undertaken of any ecological sensitivities in the vicinity of the site.

1.1 Project Overview

Error! Reference source not found.**Table 1.1** provides a snapshot of the proposed project.

Table 1.1 250 MW Solar Power Plant, Noore Ki Bhoorj - Snapshot

Particulars	Description
Location	■ The 250 MW solar power plant is located in Noore Ki Bhoorj Village, Bap tehsil, Jodhpur district of Rajasthan; ■ The elevation at the project site ranges from 195 m to 210 m above mean sea level; ■ The project is located over private agricultural land in an open terrain along with very limited vegetation consisting of shrubs and bushes.
PV Modules	■ Manufacturer-Telesun/ Jinko/ Trina/ Yingli/ Canadian/ equivalent (the manufacturer will be finalised based on preparation of Detailed Project Report which is currently under progress).
Power Evacuation	■ Power from the project will be evacuated to a 765 kV PGCIL Bhadla grid substation (GSS) located in Noore Ki Bhoorj village, approximately 6-7 km east of the proposed project site; ■ A 3 km long high-tension (HT) line, developed by M/s. Tata Power, will act as a common point (external transmission line) and will connect with the 5 km long transmission lines to be developed by HFE (internal transmission line).

4. https://www.herofutureenergies.com/projects/ Accessed on 18 February 2019

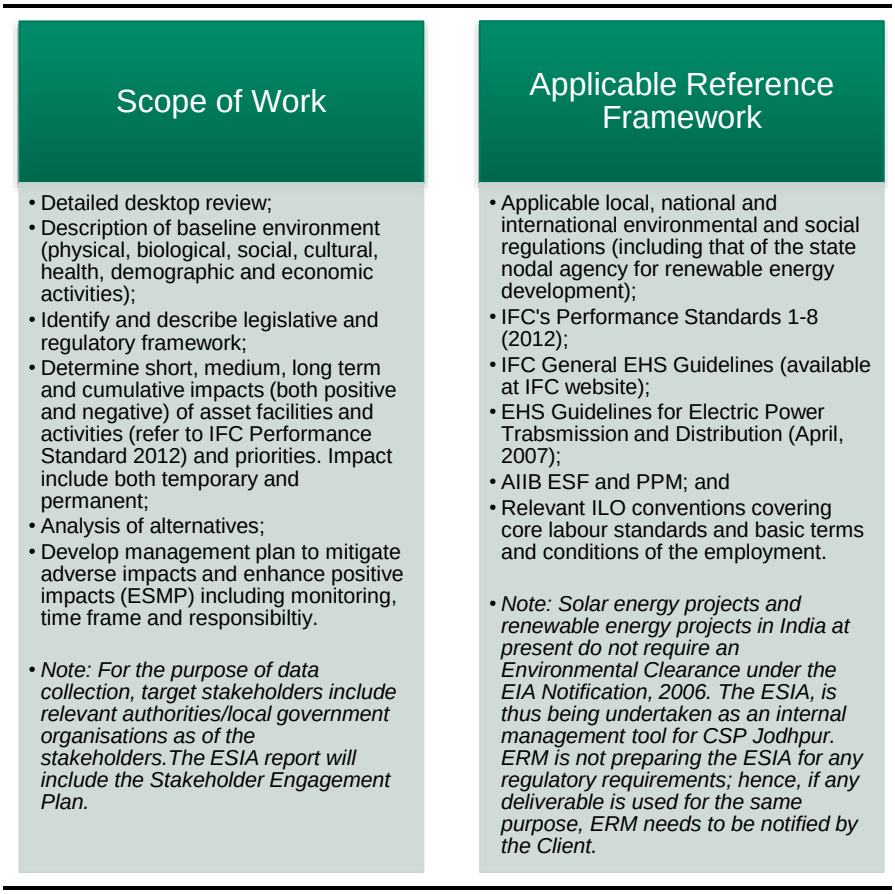
Particulars	Description
Land Requirement	■ The project will be developed over approximately 1,350 acres of private agricultural land. The facility will include site office, inverter control rooms, SCADA control room, switchyard, storage area, scrap yard, transformers etc.; ■ Out of 1306 acres, 844.39 acres has been procured through land aggregator and procurement of remaining 461.61 acres is under process.
Project Status during ERM Site Visit	■ Planning stage with partial land procurement under process; ■ Detailed Project Report is under preparation by HFE; ■ Route survey for power evacuation is yet to be undertaken; and ■ Boundary for the project site is yet to be identified and constructed.
Contractors (construction and O&M phase)	■ Information regarding contractors and workforce required for the project is presently unavailable as the project is at the planning stage.
Commissioning date	■ The date of commissioning of the power plant is presently unavailable as the project is at the planning stage.

Note: ERM would like to mention that this report describes the environment and social impacts associated with the specific solar power plant as defined for the Project. Any further addition to the current project which comprises of a 250 MW solar power plant will require additional impact assessment.

1.2 Purpose and Scope of Work

ERM understands that International Finance Corporation (IFC) has invested in the proposed 250 MW solar power plant in Jodhpur, Rajasthan. In this context, the project requires evaluating the environmental and social risks associated with the project and to implement mitigation measures to avoid adverse impacts for the remainder of the project's lifecycle. The project has to comply with international standards, which have been presented in the applicable reference framework below, along with applicable national, state and local regulations. This report discusses the environmental and social baseline within which the proposed solar power project is commissioned and assesses the potential adverse and beneficial impacts that the project could have, along with suitable mitigation measures and an Environmental and Social Management Plan (ESMP) for the project. The following figure provides an understanding of the scope of work and the applicable reference framework for the project.

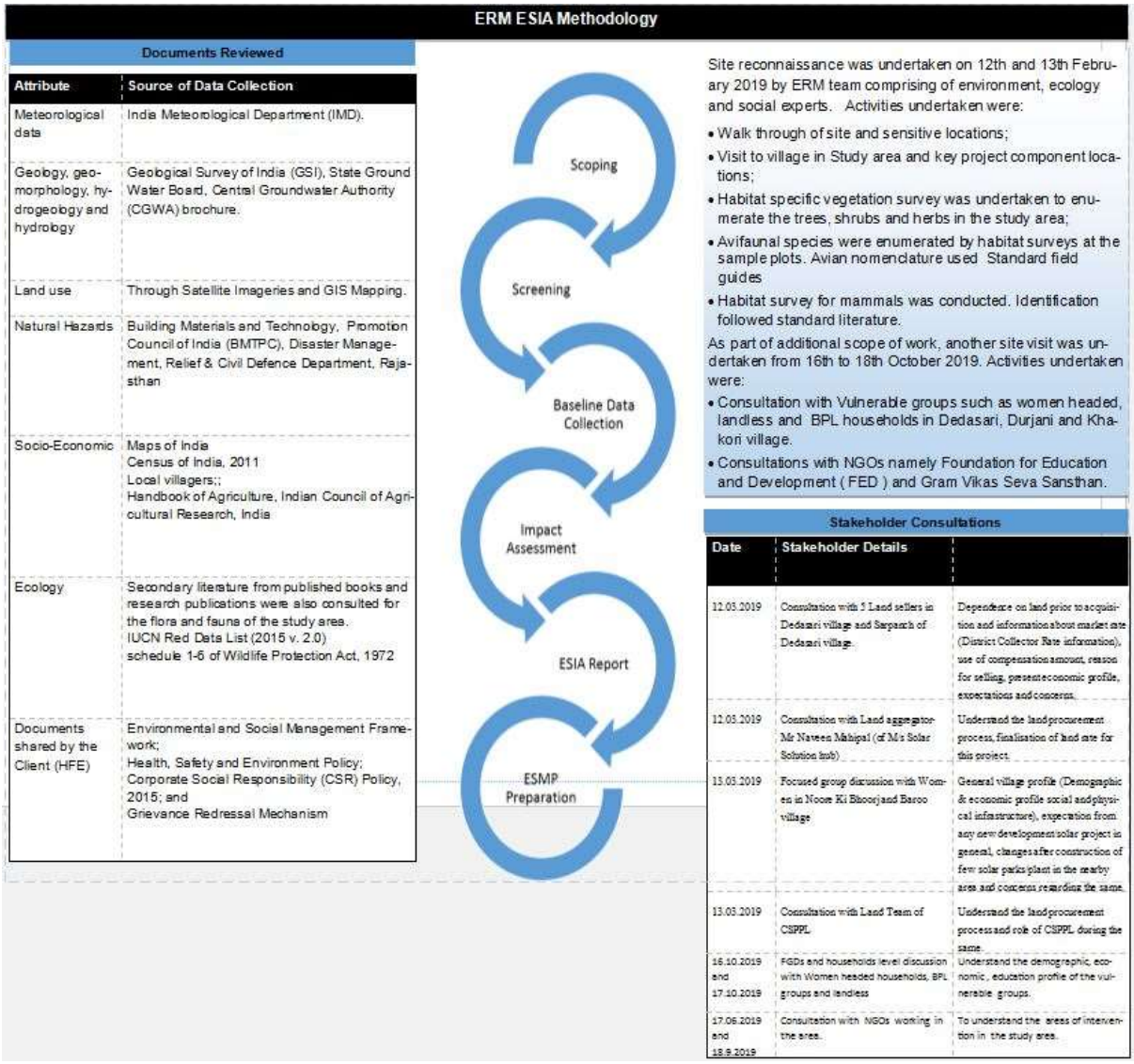
Figure 1.1 Scope of Work and Applicable Reference Framework



1.3 ESIA Methodology

The ESIA methodology follows the overall ESIA approach illustrated in **Figure 1.2**Error! Reference source not found.. 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 1.2 Approach Adopted by ERM for the 250 MW Project



1.3.1 Screening and Scoping

1.3.1.1 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.

1.3.1.2 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.

1.3.1.3 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.

1.3.1.4 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.

1.3.1.5 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 1.2***Error! Reference source not found.*.

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). Those interactions that are grey are 'scoped out', but the 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 1.3** 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 1.4**.

1.3.1.6 Cumulative Impacts

A cumulative impact is one that arises from a result of an impact from the Project interacting with an impact from other similar activities to create an additional impact. It was observed during the site reconnaissance survey that the project falls in an area characterised by presence of other solar power projects and has some solar plants within a 5-10 km radius, with some still in the pipeline. Therefore, cumulative impacts have been assessed and discussed in this report.

Table 1.2 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															
Development/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, transformers, etc.															
Electrical cable laying and installation of PV module															
Operation and Maintenance Phase															
Washing of solar modules															
Grass cutting															
Regular Inspection and Maintenance of equipment															
Cumulative Impacts arising from solar projects in the area															
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 1.3 Identified interactions with potential significant impacts

S. No.	Interaction (between project activity and Resource/Receptor	Justification for Expectation of Potentially Significant Impacts
1.	Changes in Land Use	■ Construction of temporary structures during the construction phase, such as stockyard, labour camp etc., would lead to changes in the land use albeit for a short period; ■ Setting up the project would require 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; ■ However, dry cleaning methods for module cleaning would decrease impact on local water environment.
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, such as that of Dedasari, Khakori and Noore Ki Bhoorj villages, may be disturbed due to higher than anticipated noise.
7.	Ecology	■ Impact on habitats and species may result from vegetation clearance, construction of site and access roads. Impact to avifauna may also occur due to electrocution with the transmission lines.
9.	Local Economy and Employment	■ Local community might chose to work during the construction of access roads and other project components and as security guards for the plant. There is also a likelihood of reduced dependence on agriculture for income. ■ If the project hires migrant labourers, contractors and subcontractors they might stay in local villages and could provide an influx of money into local businesses. ■ However, inadequate accommodation facilities provided to the migrant workers in the vicinity of local inhabitation can also result into unsafe and unhygienic conditions in the local areas. Such as an incident of fire in kitchen area of labour colony can cause damage to property and people in the neighbourhood, and likewise impacts
10.	Land-based Livelihoods	■ Land based livelihoods (agriculture, animal husbandry) are expected to be impacted as the project will procure multiple

		parcels of private land (mostly contiguous in nature) for development. The key stakeholders to get impacted due to this impact are landowner who will lose their agricultural land who were dependent on these farms for primary income generation.
11.	Community Health & Safety	■ Community health and safety hazards include noise pollution, increased traffic, dust pollution and any effects due to structural damage. In the case of spills/leaks, there is a potential for fire hazards and soil/water contamination. ■ In addition, if migrant labourers are hired the level of interface that locals have with the migrant workers of the project may determine spread of communicable diseases.
12.	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. ■ Impacts on female workers and migrant workers may be a focused area of assessment.
14.	Cumulative Impact	■ Due to presence of other solar projects within a 5-10 km radius, there are chances of decline in water level in the area due to water requirement during module cleaning and domestic purpose. Based on the consultation with the site team, it is understood that the supply water to all the projects is done through tankers in the area and the water is sourced from Indira Sagar canal; ■ Land rates in the area will increase due to multiple solar projects being developed in the area. Also there will be further loss of agricultural land. ■ Also, construction phase of current and upcoming projects in the area may cause increased air emissions and noise levels.

Table 1.4 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.	Demography (Influx and Displacement)	■ The projects will not result in any physical displacement of the local community. Also, since 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 Jodhpur and its contractors
4.	Impact on cultural resources and heritage structures	■ No structures bearing cultural, historical, religious or spiritual significance are located within the vicinity of the project; ■ Community consultations and discussions with the site team of CSP Jodhpur also confirmed that the project would not impact any such structure.
5.	Natural/Common Property Resources	■ Common property resources either due to traditional use or recognizable rights (legal) include animal grazing land, pathways of commute, meeting/gathering areas etc. Such areas may be belonging to a private owner or government but used by the community at large; ■ Based on the consultation with local community, it was understood that villagers have their animal grazing land, community hall etc

		within the village and no such common property has been procured by the project.

1.3.2 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 Jodhpur. The project description in detail is as provided in **Section 2** of this report.

1.3.3 Baseline Conditions

Primary data collection was not undertaken for this project. Secondary information was collected through literature surveys and consultation with stakeholders was undertaken for the study area. The detailed baseline characterisation for the project is provided in **Section 4** of his ESIA report.

1.3.4 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 affected families, the village-level key informants, the line departments (revenue, land, agriculture and forest), state/district administration and civil society organisations as well as developed an understanding of their stakes, interests and influences on the project.

Details of the Stakeholder Engagement activities undertaken for these projects to date are presented in **Section 5** of this report.

1.3.5 Impact Assessment (IA)/Predictions

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 impact assessment for the project is as given in **Section 6.**

1.3.6 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 7** of this ESIA report.

1.4 Limitations

This report has been developed based on the project level information provided by CSP Jodhpur 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.

The site specific limitations are as given below.

- As the project is in early stages of planning and land procurement is underway, information related to technical details including specifications of modules and other plant components is presently unavailable;
- Information related to project logistics, organisational structure and resource requirement is also presently unavailable and will be shared by CSP Jodhpur upon preparation of Detailed Project Report. A request for information (RFI) document for the same has been shared with CSP Jodhpur;
- Tentative route of the 5 km internal transmission line has been shared with ERM and information regarding the same has been showcased in the ESIA report. However, specification with respect to the internal transmission line, such as information on circuit type and number of transmission poles, have not been shared with ERM. Furthermore, details on land owners and compensation for right of way (RoW) for internal transmission lines are not available at this stage as the process has not yet been initiated by CSP Jodhpur;
- The secondary data utilized for the purpose of baseline assessment is limited to that available in the public domain or made available during the consultations with the CSP Jodhpur Project team. ERM's past experience of conducting similar projects in the study area has been utilized to collate supplemental baseline information;
- Primary baseline monitoring/ sampling for air quality and noise quality was not undertaken in the project area since the area is largely rural and there are no settlements in the immediate vicinity of the project site. Ambient air and noise related impacts will be largely limited to the construction phase and therefore short term. Groundwater quality was assessed for the HFE's 300 MW solar power project in Bhadla, about 10km from the project site and results of the same have been used to assess potential impacts on groundwater quality for this project;
- Due to the fact that the Bap Tehsil was formed in the year 2012, the Census data for the same is not available, and for this reason, the Phalodi Tehsil has been used as the reference point for the Census of India data as part of the socio-economic baseline assessment.

1.4.1 Use 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 is as given in **Table 1.5**.

Table 1.5 Structure of the Report

Section	Title	Description
Section 1	Introduction	Introduction to the 250 MW Project as well as the ESIA methodology
Section 2	Project Description	Technical description of the 250 MW Project & related infrastructure and activities
Section 3	Administrative Framework	Discussion of the applicable environmental and social regulatory framework and its relevance for the 250 MW Project.
Section 4	Environmental, Ecological and Social Baseline	An outline of the Environmental, Ecological and Social Baseline status in the area of the 250 MW Project.
Section 5	Stakeholder Identification and Engagement	An outline of the engagement with the stakeholder groups undertaken as part of the assessment process and the key issues identified from the same.
Section 6	Impact Assessment	Details of identified environmental impacts and associated risks due to project activities of the Project, assessment of significance of impacts and mitigation measures for minimizing and /or offsetting adverse impacts identified.
Section 7	Grievance Redressal Mechanism	An outline of the grievance redressal mechanism developed by HFE.
Section 8	Environmental and Social Management Plan	Outline of the Environmental and Social Management Plan (ESMP) taking into account identified impacts and planned mitigation measures and monitoring requirements.
Section 9	Impact Summary and Conclusion	Summary of impacts identified for the 250 MW Project.

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 an identification of the potential impacts on resources and receptors that could result from Project activities during the planning, construction, operation and decommissioning stages.

2.2 Project Location

The 250 MW solar power plant is proposed to be developed on 1306 acres of open private agricultural land in Noore Ki Bhoorj village in Bap tehsil of Jodhpur district. Nearest villages are Durjani, Khakori and Dedasari at an approximate distance of 5 km south, 4 km southeast and 3.6 km south from the project site respectively. Phalodi is the nearest town at a distance of ~ 40 km from the Project Site also nearest railway station is at Phalodi at a distance of ~ 42 km.

The proposed project site is approachable through national highway (NH-11) connecting to a paved village road which connects Dedasari village to Bap and Phalodi. Beyond the Dedasari village, the project site is accessible through an unpaved village road connecting the southern part of the project site to the village. The unpaved road itself runs along the eastern part of the project site.

The project site location and tentative plant layout are as showcased in **Figure 2.1** and **Figure 2.2,** respectively.

2.2.1 Project site setting

The boundary for the project has not yet been defined by CSP Jodhpur. During ERM site visit, project site reconnaissance was undertaken along the patches of land procured by CSP Jodhpur, coordinates for which are *205085.29 m E, 3035013.90 m N* and *20461.614.57 m E, 3033001.20 m N*. Land procurement has been completed for 844.39 acres of private land. Land use of the procured land parcels consists of agricultural land (fallow and current fallow with single season cropping)[5]. Small patches of open scrubland were also observed in nearby areas when accessing the site via the village road. The proposed site is located over a mix terrain (flat land and slightly undulated land). Elevation at project site ranges from 195 m to 210 m above mean sea level.

The procured land parcels at the project site are characterised by presence of seasonally used *Kuccha* structures which are used for agricultural purposes. The structures house the family of the farmer (landowner) owning that particular patch of land during farming season and are also used for storage. The residents of these *kuccha* structures belong to Noore Ki Bhoorj and Dedasari villages. (See **Figure 2.4**)

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.

5 This is the land which is left without cultivation for one or less than one agricultural year. Fallowing is a cultural practice adopted for giving the land rest. The land recoups the lost fertility through natural processes.

Figure 2.1 Project Site Location

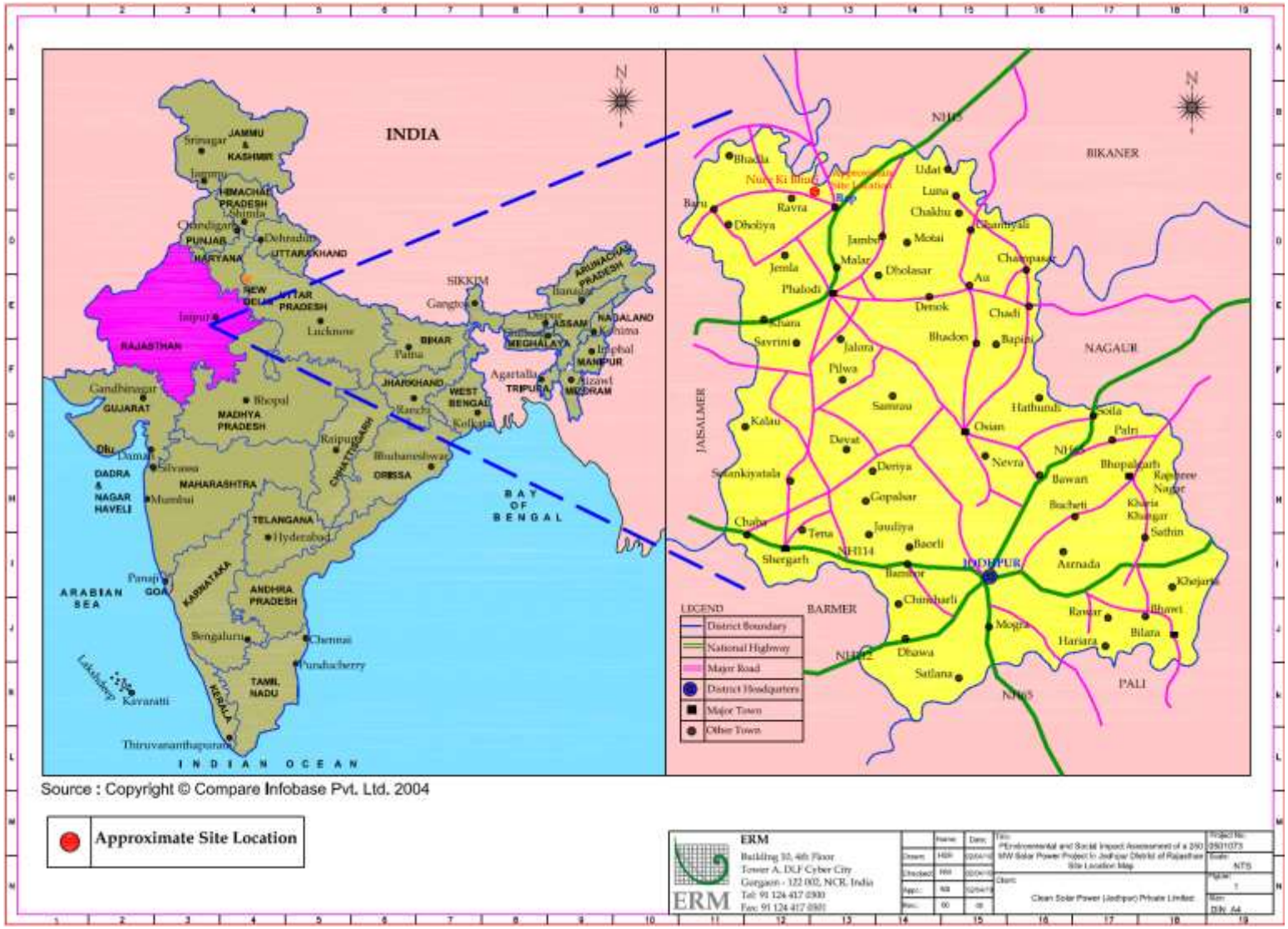
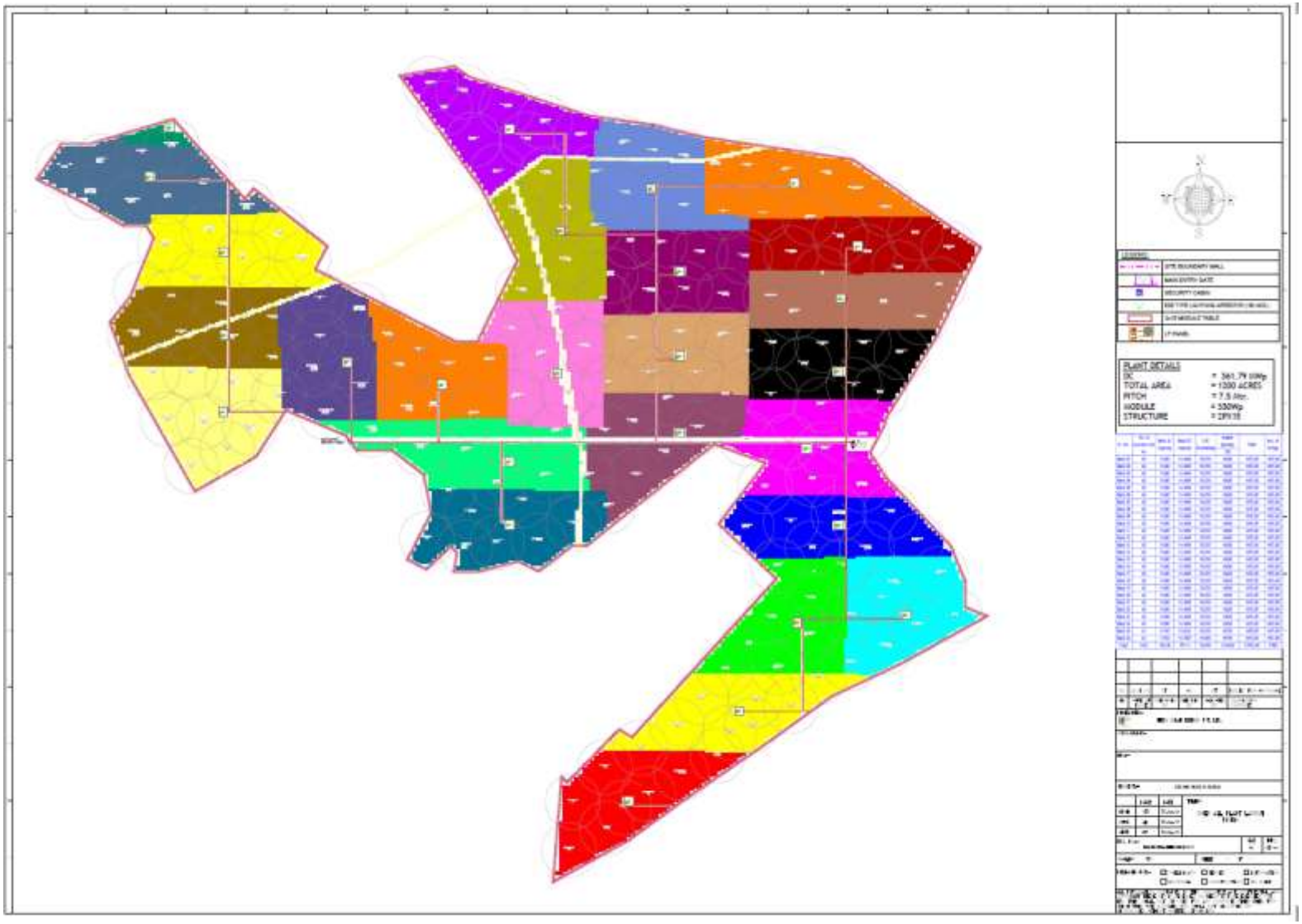


Figure 2.2 Project Tentative Plant Layout



Source: HFE

Figure 2.3 Project Land and Access Road

Source: ERM Site Visit.

1. Access route from Dedasari Village to the Site;
2. Project site towards Northern direction;
3. Project site towards Eastern direction and access route that will be developed for logistical support;
4. Project site towards Southern Direction;
5. Project site towards Western direction;
6. Irrigation field towards North of the project site.

Figure 2.4 Structures within the proposed project site

Source: ERM Site Visit.

2.2.2 Other solar plants near the project site

The areas surrounding the project site are characterised by upcoming, under construction as well as operational solar plants. Three operational solar plants were observed along the paved approach road to Dedasari village as well. The details of the solar plants observed within 5-10 km from the site along, with their distance from the proposed project site, are as follows:

- 23 MW Solar Power Plant owned by Waaree Energies Limited (WEL) and Maharashtra Seamless Limited (MSL) (Approximately 4 km South);
- 20 MW Solar Power Plant owned by Northern Solaire Prakash Private Limited (NSPPL) (Approximately 7 km South);
- 10 MW Solar Power Plant owned by Sauryauday Solaire Prakash Private Limited (SSPPL) (Approximately 4 km Southwest)
- Bhadla Solar Park (Approximately 5-10 km North);
    - 680 MW Solar Power Plant Owned by Rajasthan Solar Park Development Company (RRECL Subsidiary) (Approximately 8-10 km North);
    - 1000 MW Solar Power Plant owned by Saurya Urja Company of Rajasthan (JV of GoR and IL&FS Energy) (Approximately 5-8 km North). This section of the Bhadla Solar Park consists of the 300 MW grid connected solar PV power plant being developed by HFE via its SPV CSP (Bhadla).
- During consultation in Dedasari village, it was informally reported by few locals that land adjacent to the project site, towards the east, have been leased to Azure Power for another solar project. However details on capacity of the project, quantity of land leased, project status etc., were not available.

The location of the above mentioned solar power projects with respect to the proposed 250 MW project is as given in **Figure 2.5**.

Figure 2.5 Project Site Setting

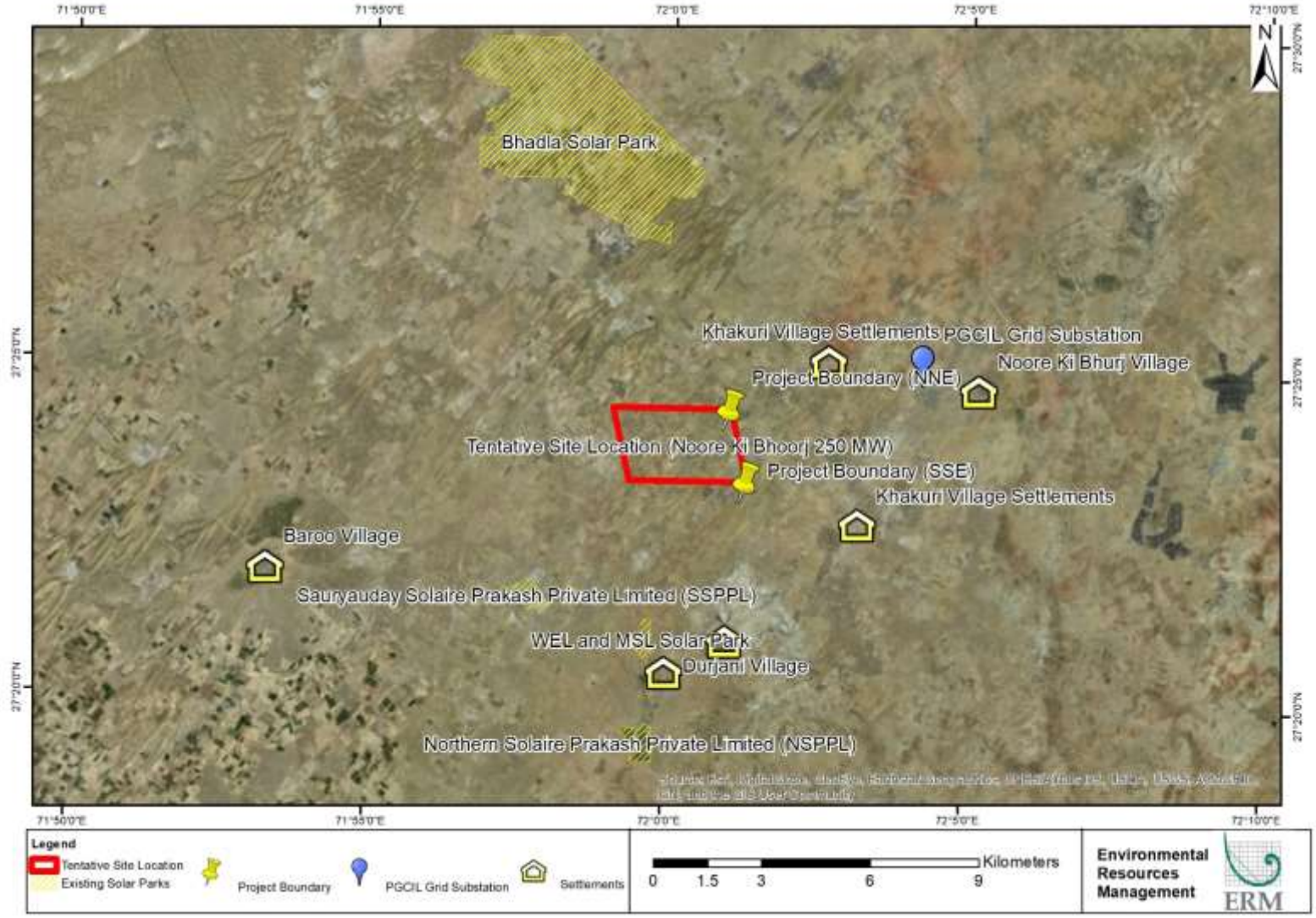
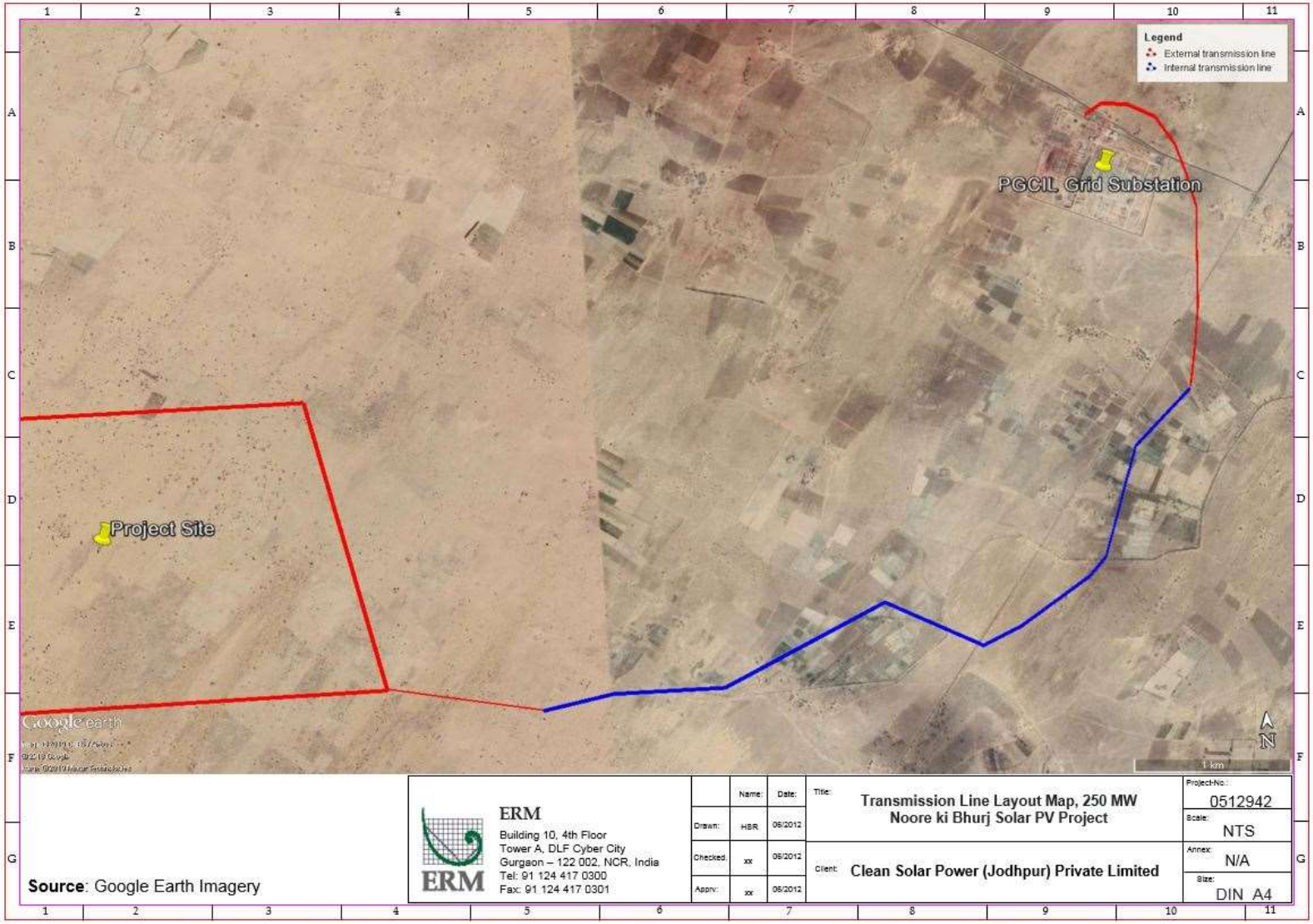


Figure 2.6 Transmission line route (tentative)



Source: CSP (Jodhpur)

2.3 Description of Project Facilities, Components and Activities

The proposed 250 MW solar power project will be based on multi crystalline Solar Photo Voltaic technology. It is to be noted that the description of the layout plan for the project is presently unavailable as the project is in planning stage. The proposed solar plant will include the following:

- Project Components:
  - Solar panels;
  - Switchyard;
  - Inverters;
  - Transformers;
  - Main Control Room;
- Associated Facilities:
  - External and internal transmission lines and towers;
  - Access roads; and
- Additional project infrastructure such as scrap yard, storage area, etc.

2.3.1 Project Components

Key components envisaged for this project are

- Solar PV Modules
- Power Conditioning Unit (PCU) or Inverter
- Cables
- Transformers
- Switchyard
- Earthing and Lighting protection
- Site office/Main Control Room
  - The site office will be present within the project site;
  - The site office will consist of emergency contact details, fire extinguishers, first aid kit, PPE room and the lock out/tag out station, etc.;
  - The SCADA control room will also be present within the project site;
  - The project site will also consist of sleeping quarters for the site personnel during the operational stage.

The project is in planning phase and technical details pertaining to project components (including make, model and number) of the PV modules, inverters, transformers are not available at this stage.

Figure 2.7 PGCIL 765 kV Grid Substation

Source: ERM Site Visit

2.3.2 Associated Facilities and Other Plant Infrastructure

Details of the associated facilities and other plant infrastructure are as given in **Table 2.1**.

Table 2.1 Associated facilities and other plant infrastructure

S.No	Associated Components	Details
1.	Access Road	■ Primary approach to the site is through NH-11 which connects to a paved village road leading to the nearest village to the project site (Dedasari) from Bap. The site can then be accessed through unpaved village roads via Noore Ki Bhoorj and Dedasari villages; ■ The project has identified 3 routes for access to the proposed project site. These are all kuccha roads. Once a route is finalized out of the three identified, the said access road will be upgraded/widened. No new access road will be constructed; ■ Further details such as length of road etc. are not available at this stage.
2.	Transmission Line for Power Evacuation	■ Power from the 250 MW solar power plant will be evacuated to a 765/400/220 kV Bhadla grid substation (GSS) owned by M/s Power Grid Corporation of India Limited (PGCIL), located approximately 6-7 km east of the proposed project site. ■ An existing 3 km long high-tension (HT) line, constructed by M/s. Tata Power, will act as a common point (external transmission line) and will connect with the 5 km long transmission lines to be developed by HFE (internal transmission line). The external transmission line is a double circuit line consisting of 13 poles. Specifications of the 5 km long TL to be installed by HFE have not been shared with ERM (see **Figure 2.6**). The route of internal transmission line currently depicted in the Figure is tentative, and exact route is yet to be finalized.
3.	Scrap yard	■ The scrap yard will also be present within the site; ■ The scrap yard will consist of discarded panels and other hardware components such as wood/steel, oil barrels, wires/cables and domestic components.

Source: Discussion with CSP Jodhpur project team.

*Note: Audit checklist for 3 km long constructed external transmission line, mentioned in **Table 2.1** above, has been presented in **Appendix A** of this report. The audit checklist has been prepared by M/s. Hero Future Energies (HFE).*

2.3.3 Project Phases and Activities

The proposed project plant is currently at initial stages of planning. The activities for the project can be divided into the following phases/stages.

- Planning phase;
- Construction phase;
- Operation and maintenance phase; and
- Decommissioning phase.

The key activities for the above are as showcased in **Table 2.2**.

Table 2.2 Project Phase and Key activities

S. No	Project phase	Key activities
1.	**Planning** **(Current phase of the Project)**	■ 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.
2.	Construction	■ 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 erection of transmission line towers; and ■ Stringing of transmission lines.
3.	Operation and Maintenance	■ 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.
4.	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, or disposed as per the then applicable legislation; ■ 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.

Identification and procurement 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) procurement of land. During the time of the ERM site visit, partial land procurement was completed

while remaining land was being procured from owners residing in Dedasari and Baroo villages, details for the same are as given in **Section 2.4.1**.

2.4 Resource Requirement

The resource requirement for construction and operation phases of the proposed project have been made based on professional judgement since the project is in the initial stages of planning. The resources required have been assessed based on assumptions and discussions made with the CSP Jodhpur project team. The resource requirements are as elaborated below.

2.4.1 Land Requirement and Procurement Process

The total land requirement for the 250 MW solar power project is estimated to be approximately 1306 acres. Break down of land requirement for each component (Installation of solar modules, Site office, Inverter room, Temporary labour camp, Stock yard and Transmission line) and village wise details are not available with CSP Jodhpur at this stage. The project involves only private agricultural land procured and there is no diversion of forest or revenue land. Details on land owners and compensation for right of way (RoW) for internal transmission lines are not available at this stage as the process has not yet been initiated by CSP Jodhpur.

Approximately, out of the 1306 acres of proposed project land, 844.39 acres has already been procured and 28 sale deeds for 844.39 acres of land has already been signed. The land is being procured through a local land aggregator, from an estimated number of 150 land owners in total from Dedasari and Baroo villages. On the basis of the visual observations during the site visit and consultations with the land aggregator, representatives of CSP Jodhpur, five (5) land sellers and community consultations held in Noore ki Bhoorj, Dedasari and Baroo villages, it is understood that the land parcels procured till now for the project were primarily utilized for one season agriculture. Also, the procured land parcels did not have any encroachers or informal users such as sharecroppers or agricultural labour.

Details on the land parcels that are currently under procurement are not available at this stage. Hence their land use and presence of encroachers or informal users cannot be confirmed in this report.

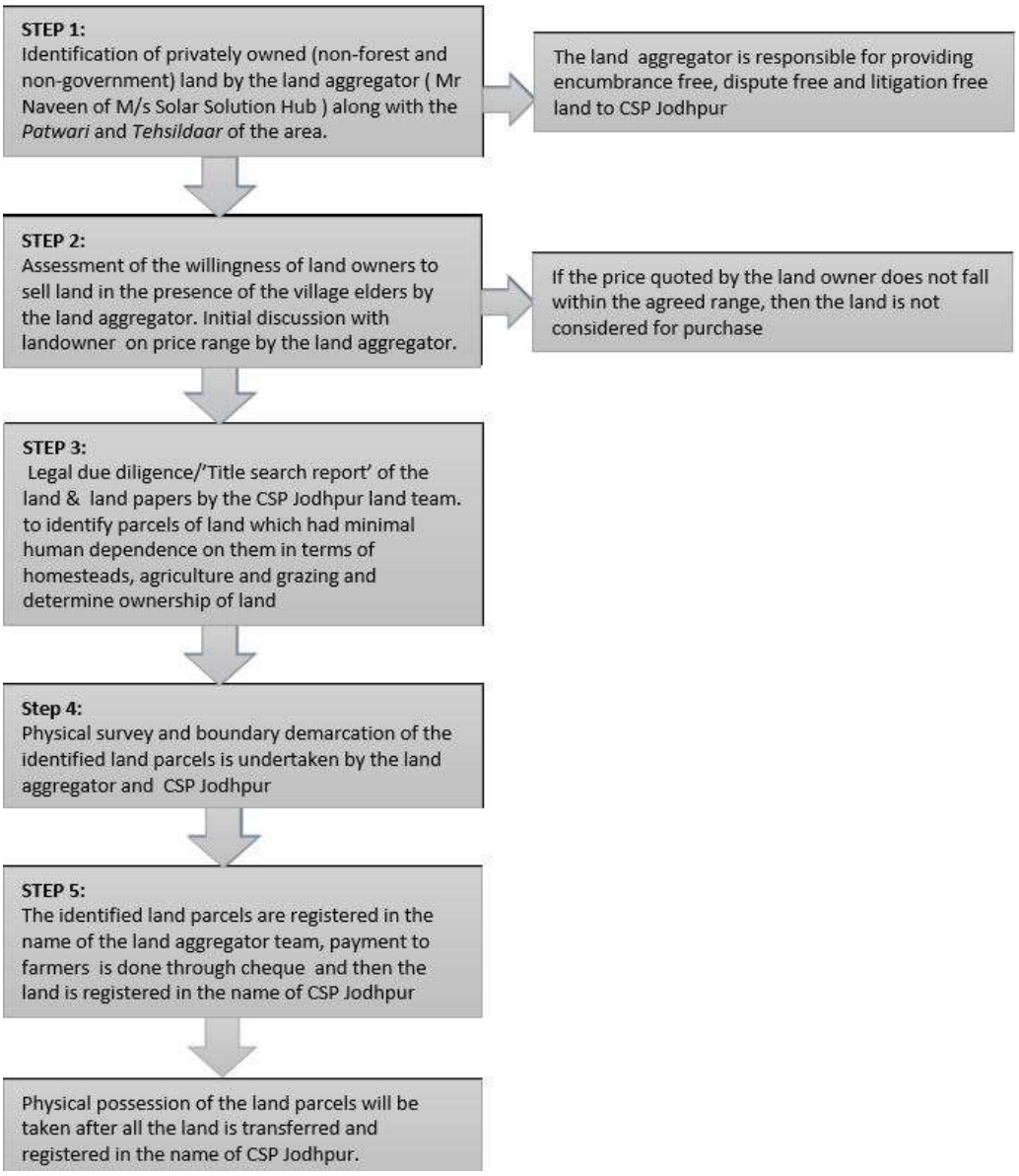
The details of the land procurement process followed by CSP Jodhpur are discussed below.

2.4.1.1 Details of Land Procurement Process

At the time of ERM site visit, procurement of about 461.61 acres of land was in progress and 844.39 acres of private land had already been procured. All private land parcels for the project have been procured through a land aggregator. The land team informed that only private land is preferred for the project and the remaining land to be procured is also private land.

Consultations were also held with local communities to understand the general community perception and concerns regarding the project and the dependence of local communities on the land parcels proposed to be procured for the project. The land procurement process for the project has been highlighted in **Box 1.**

Box 1 Land procurement process undertaken for this project



Rajasthan Renewable Energy Policy, 2014 - Land Procurement/Allotment Process

As per the Rajasthan Renewable Energy Policy, 2014, the State will promote setting up of Solar Power Plant / Solar Farm on private land. Khatedar shall be permitted to set-up Solar Power Project on his holding or to sub-let his holding for setting up of such projects without the requirement of land conversion in accordance with the provisions of Rajasthan Tenancy Act 1955 and Rajasthan Land Revenue Act 1956. Solar Power Producers shall also be allowed to purchase private land from Khatedar for setting up of Solar Power Plant in excess of ceiling limit in accordance with the provisions of Ceiling Act, 1973.

Market Rate

As discussed earlier, 1306 acres of land will be procured from estimated 150 land owners from Dedasari and Baroo villages. Out of which, 844.39 acres has already been procured and sale deeds have been finalised. The land is procured in the name of the land aggregator and then transferred in the name of CSP Jodhpur.

It was informed by the land team of CSP Jodhpur that the compensation paid to the land sellers was more than INR 4,00,000 per acre. The same was confirmed during the consultations with the 5 land sellers and review of copy of MoU signed between land aggregator and CSP Jodhpur. It was also informed that this rate was finalised after negotiation with prospective land sellers. It was informed by the land aggregator and land sellers during consultations that disbursement of payment for land and other assets have been made at price more than the market rate.

As reported the prevailing market rate of the area is approximately INR 1, 50,000- INR 2, 50,000 per acre. According to the latest notification of government circle rate (for the month of April), the DLC rate is in the range of INR 82,800 to INR 98,325 per acre in Baroo village and INR 54,337.5 to INR 64,687.5 in Dedasari village.

ERM team consulted 5 landowners from Dedasari village, Bap tehsil who have already sold land for the project in order to understand the process that was adopted by the land aggregator, and their concerns, if any. These landowners were selected and made available for consultation by HFE. The details are highlighted in the table below.

Table 2.3 Brief Profile of Consulted Land Sellers

S. No.	Stakeholder Profile	Total Land sold to CSP Jodhpur (in acres)	Reason for selling the land	General Occupation Profile of consulted land sellers
1.	5 number of land sellers who were consulted during the ERM site visit.	248 acres	It was informed that these sellers were willing to sell their land due to the low productivity of the agricultural land, dependency on monsoons and lack of irrigation facilities. The compensation received after selling their land was reinvested into procurement of fertile land in other nearby villages at a lower price. Remaining money was also considered as an option for liquidating their assets. .	■ Primary occupation of these land sellers is farming (Oil Seed (Mustard/ Soybean), Millet (*Ragi)* and Cumin seeds (*Jeera*). ■ One of the land sellers had a different parcel of land (information regarding total area not shared) in a nearby village with irrigation facility and was therefore involved in cultivation of wheat. He was supported by private business and some of the household members work in Dubai, who send money back on monthly basis. ■ All the land sellers are selling only a proportion of their land and not all of their land holding. ■ Family members also work as non-agriculture labourer in house construction and MGNREGA work.

2.4.1.2 Specific issues with the project land

Table 2.4 Key Sensitivities related to Land Procurement for Project

Sensitivity	Details
Tribal Land/Schedule V Area[6]	Jodhpur district and project area does not fall under Schedule V area as defined in the Indian constitution. It was confirmed by the representatives from the land department of CSP Jodhpur that no SC or ST land has been procured or is envisaged to be procured for the project.
Forest Land	The project does not involve any forest land. There are no forests located within 5 km of the project.
Encroachment	No encroachments on the project land procured till date were reported or were observed during the site visit by ERM team. Details on encroachers on land parcels currently under procurement cannot be confirmed at this stage.
Common Property Resources[7](CPR)	It was also reported by the community and CSP Jodhpur team that the required land does not have Common Property Resource such as grazing land etc.
Cultural Heritage	No structures bearing cultural, historical, religious or spiritual significance were reported to be located within the vicinity of the project or on the land parcels procured or identified for the Project. Community consultations and discussions with the site team of CSP Jodhpur also confirmed that the project would not impact any such structure.
NOC- Land use change	As per the guidelines by Rajasthan Renewable Energy Corporation Ltd. Solar Power Producers do not require conversion of private land for setting up of the solar power project. As per the guideline CSP Jodhpur is also not required to obtain NOC from Dedasari Gram Panchayat.

2.4.1.3 Grievance Redressal Process and Stakeholder Engagement

HFE has a formal grievance redressal process and stakeholder engagement mechanism in place for all its project. The same will be applied by CSP Jodhpur for this project.

2.4.2 Manpower Requirement

During the construction phase, it is estimated that the project will require approximately 400 skilled, semi-skilled and unskilled labourers. As reported they will be sourced from the local labour pool.

During the operation phase, approximately 10 - 12 employees/technicians of CSP Jodhpur / O&M contractor would be deployed at site. Apart from these, there will be 3-4 staff who will be engaged in housekeeping and approximately 25 are envisaged to be employed as security guards during O&M stage. These figures will be confirmed upon finalization of project components and other technical details by the project team of CSP Jodhpur.

(6) In the Constitution of India, the expression “Scheduled Areas” means such areas as the President may by order declare to be Scheduled Areas. The criteria followed for declaring an area as Scheduled Area are preponderance of tribal population; compactness and reasonable size of the area; under-developed nature of the area; and marked disparity in economic standard of the people. These criteria are not spelt out in the Constitution of India but have become well established. (Source: Official website of the Ministry of Tribal Affairs (MoTA), Government of India (GoI). URL: http://tribal.nic.in/Content/DefinitionofScheduledAreasProfiles.aspx. Accessed on 03.01.2018.

(7) Common Property Resources (environmental) are natural resources owned and managed collectively by a community or society rather than individuals.

2.4.3 Water Requirement and Source

Upon discussion with the CSP Jodhpur team during ERM site visit it was understood that sourcing of water from the Indira Sagar Canal (Indira Sagar Nahar Pariyojna) for Project construction phase will be explored by the company. Indira Sagar Canal is located at an approximate distance of 9-10 km from the project site and there are no other surface water bodies in the project area or its vicinity.

As per the Rajasthan Solar Energy Policy, 2014, water resource department of Rajasthan is authorized to allocate required quantity of water from Indira Gandhi Nahar Pariyojna (IGNP) canal's nearest available source for proposed Solar Power Plants, subject to the availability of water[8]. The project will have to intimate estimated water requirement to Rajasthan Renewable Energy Corporation Limited (hereinafter referred to as 'RREC') along with the source of water. After assessing the estimate, case of water requirement will be forwarded to the Water Resource Department. The modifications required, if any, in the existing canal system will be undertaken by the Water Resource Department at the cost of the Project. The project will thereafter hire water tankers from authorised contractors to procure water from the nearest IGNP canal source during construction phase. The nearest source of the IGNP canal system is located approximately 7-9 km away from the proposed project site towards the eastern direction.

However, in case of non-allocation of water from the IGNP canal and in the absence of other surface water bodies, CSP Jodhpur will procure water through authorised water tankers from nearby borewells in the project area during the construction phase. The borewell from where water will be sourced is yet to be identified as the project is at the planning stage. It is to be noted that as per consultations conducted by ERM in the project area, groundwater in the area is reported to be scarce and available at approx. 600-800 feet below ground level, however, with reportedly high concentrations of fluoride, iron, nitrates and high electrical conductivity.

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 and sourced from existing borewells in the area. Water will also be required for domestic use by workers at project site. Considering peak worker requirement of 400 workers, daily water requirement is estimated as 18 KLD. Domestic water requirement will also be met through tankers from authorised contractors, and packaged drinking water will be purchased.

Operation Phase

CSP Jodhpur has proposed use of 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. Water requirement for domestic use during operation phase considering 35-37 employees and workers will be ~ 3 KLD. Packaged water will be purchased for drinking purpose.

2.4.4 Raw Material Requirement

Construction Phase

As per the discussion held with CSP Jodhpur project team, 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.

(8) Section 13.2 of the Rajasthan Solar Energy Policy, 2014. Link: https://mnre.gov.in/file-manager/UserFiles/Grid-Connected-Solar-Rooftop-policy/Rajasthan-Solar-Energy-Policy-2014.pdf.

Operation Phase

There will not be major requirement of raw materials 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, could not be ascertained as the Project is in the planning stages.

Operation Phase

Based on initial assessment, 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 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

It is understood that 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 Construction 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 ERM's assessment, 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 will be operated at project site.

Operation Phase

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 Waste 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 settlements in the near vicinity of the construction site, the receptors of noise pollution will be the residents of the settlements and 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

Access to energy is a fundamental enabler for economic development and prosperity of any region. A survey conducted by the World Energy Council states that as the population increases and as the growing rate of electrification places huge requirements on energy supplies, the total primary energy demand of India is expected to increase by almost 150% by 2035.

As per the load generation balance report 2018-19 of the Central Electricity Authority, the current power supply scenario is deficient in the state of Rajasthan and the entire northern region. **Table 2.5** showcases the actual power scenario in Rajasthan and the northern region for the year 2017-18.

Table 2.5 Actual Power supply scenario (in terms of Energy Requirement) in 2017-18 for Rajasthan and Northern Region

State/Region	Requirement (MU)	Availability (MU)	Deficit (MU)	Deficit (%)
Rajasthan	71,193	70,602	-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 (http://www.cea.nic.in/reports/annual/lgbr/lgbr-2018.pdf)

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.

2.6.2 Alternate Source of 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 CO2 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.

Further to the above mentioned reasons, it would be significant to conclude that:

- The Project is environment friendly with minimal greenhouse gas emissions;
- It is the most feasible choice of power generation in the state; and
- It will contribute towards the state of Rajasthan attaining self-sufficiency in power supply.

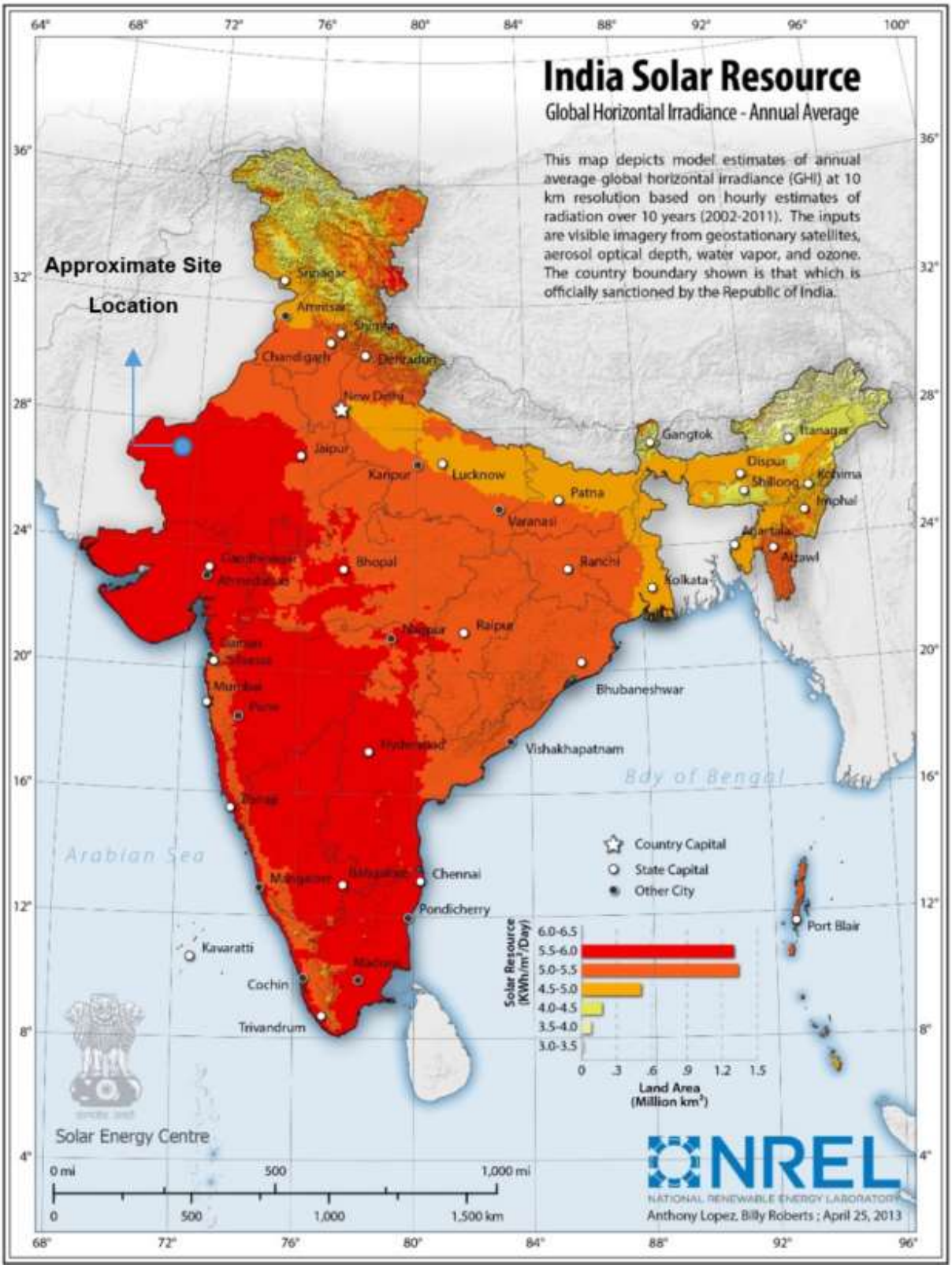
2.6.3 Alternate Location for Project Site

Solar projects are non-polluting energy generation projects which are site specific and dependent on the availability of solar irradiance resource. Solar irradiance mapping done by Solar Energy Corporation of India (SECI) through National Renewable Energy Laboratory (NREL), based on which potential areas are notified by SECI. The current site selected is a high solar power potential site with irradiation of 5.5-6.0 kWh/m^2/day and availability of 300 sunny days. The final selection of the project site depends upon availability of a contiguous patch of land that is willingly sold by land owners. Hence, the option of choosing an alternative area is not available to a project developer.

The proposed project site has the following location advantages:

- Site with high solar irradiation;
- No ecological sensitive receptor such as national Parks, Wildlife Sanctuary, within 10 km radius;
- No reserve or protected forest within 5 km radius;
- 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 near shading; and
- The substation is located at aerial distance of 6-7 km east of the project site.

Figure 2.8 Horizontal Solar Resource map of India



Source: Mapping done by SECI through National Renewable Energy Laboratory (NREL), Government of India

3. APPLICABLE LEGAL AND REGULATORY FRAMEWORK

3.1 Introduction

The following reference framework is applicable to the Project:

- 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 including:
  - IFC Performance Standards (2012);
  - IFC/World Bank General EHS Guidelines (2007);
  - IFC/World Bank EHS Guidelines for Electric Power Transmission and Distribution (2007);
  - Asian Infrastructure Investment Bank (AIIB) Environmental and Social Framework (ESF); and
  - AIIB Project-affected People Mechanism (PPM).

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)” have 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”.

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[9]. The policy aims to promote widespread usage of solar power and to meet the following objectives, such as:

- 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;
- 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.

[9] https://mnre.gov.in/file-manager/UserFiles/Grid-Connected-Solar-Rooftop-policy/Rajasthan-Solar-Energy-Policy-2014.pdf Accessed on 19 March 2019.

According to this policy, Rajasthan Renewable Energy Corporation (RREC) shall act as nodal agency for clearance of the projects. They are responsible for the following:

- 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 **Table 3.1**.

Table 3.1 Enforcement Agencies relevant to the Project

Agency	Functions
Central Level	
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

Agency	Functions
	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 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.
Central Ground Water Authority	The Central Ground Water Authority (CGWA) was constituted in 1997 to regulate, control and manage groundwater development in the country, under the EP Act 1986. One of the main functions of CGWA is to regulate indiscriminate boring and withdrawal of groundwater and to issue necessary regulatory directions with a view to preserve and protect the groundwater. CGWA has declared certain areas of India as “notified areas” from the point of over-development of resource, or from groundwater quality point of view, or for registration of groundwater abstraction structures. In these so "notified areas” further extraction is regulated in order to prevent the depletion of groundwater levels and deterioration of its quality.
State Level	
Rajasthan Renewable Energy Corporation Limited (RRECL)	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. The main objectives of the RRECL are ■ To generate electricity through renewable sources like wind and solar on decentralized manner; ■ To conserve energy in rural areas; ■ To import and adopt viable technology and machinery in the areas of Non-conventional energy sources and ensures post installation service; and To impart training and to promote research and development in the field of Non-conventional energy sources.
Department of Environment, Rajasthan	The Environment Department is the apex body in the States for implementation of all the environment related matters including Environment (Protection) Act, 1986,

Agency	Functions
	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.
Rajasthan State Pollution Control Board (RSPCB)	RSPCB is 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.
Labour Department, Government of Rajasthan	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.
Gram Panchayats	The local Panchayats are empowered with management of local resources like forests, groundwater, common land and infrastructure like roads, buildings etc.
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 to section **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	√	√	√	√	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	√	√	√	√	RSPCB	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 Jodhpur* and their contractors will need to abide by the limits prescribed for residential zones.
Ambient Noise Standards	X	√	√	X	RSPCB MoEFCC	

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-degradable, non-biodegradable and domestic hazardous wastes generated from the project will be managed by CSP Jodhpur (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 stored at site 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	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 Jodhpur* will need to comply with 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 Department, Government of Rajasthan	*CSP Jodhpur* will need to comply with the requirements of the 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 Department, Government of Rajasthan	*CSP Jodhpur* and their contractors will need to comply with the requirements of these regulations.
Companies Act, 2013	X	X	√	X	Ministry of Corporate Affairs	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.
International treaties and conventions						

Topic and Reference	Pre-construction	Construction	Operations	Decommissioning	Agency Responsible	Remarks
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	-
Basel Protocol on Liability and Compensation for Damage Resulting from Transboundary Movements of Hazardous Wastes and their Disposal Basel, 10 December 1999.	√	√	√	√	State pollution control board	--
International Standards and Guidelines						

Topic and Reference	Pre-construction	Construction	Operations	Decommissioning	Agency Responsible	Remarks
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	√	√	√		During the construction, operation and eventual decommissioning of the site, the following guidelines will need to be followed.
IFC EHS Guidelines for Power Transmission and Distribution, 2007	X	√	√	√		
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	√	√	√		
AIIB ESF and ESS 1, 2 and 3	√	√	√	√		
Asian Infrastructure Investment Bank (AIIB) Policy on the Project-affected People's Mechanism	√	√	√	√		

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 International Safeguard Requirements

3.7.1 IFC Requirements and Applicability

IFC applies the Performance Standards 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 IFC Performance Standards and their Applicability

IFC PS No.	Description	Objectives and Applicability to Project
1.	Assessment and Management of Environmental and Social Risks and Impacts	**Applicable** This PS aims to assesses the existing social and environmental management systems of CSP Jodhpur and to identify the gaps with respect to their functioning, existence and implementation of an environmental and social management plan (ESMP), a defined EHS Policy, organization chart with defined roles and responsibilities, risk identification and management procedures as well as processes like stakeholder engagement and grievance management..
2.	Labour and Working Conditions	**Applicable** This PS is guided by a number of international conventions and instruments on labour and workers' rights. It recognises that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of fundamental rights of workers. The PS covers following themes: human resource policy and management, workers' organization, non-discrimination and equal opportunity, retrenchment, protecting the workforce and occupational

		health and safety. This PS helps to assess the status of the employees and workers in CSP Jodhpur as well as any contractors. The project activities will involve hiring of approximately 400 skilled, semi-skilled and unskilled labourers during the construction phase and solar plant staff during the operation phase. The project will have to develop a human resource policy and ensure non-discrimination and equal opportunity, protection of the workforce and occupational health and safety. Therefore, PS 2 is applicable to the Project.
3.	Resource Efficiency and Pollution Prevention	**Applicable** PS-3 covers the use resources and materials as inputs and wastes that could affect human health. The objective of PS-3 are: 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. Key themes covered under PS-3 are: pollution prevention, resource conservation and energy efficiency, wastes, hazardous materials, emergency preparedness and response, greenhouse emissions, pesticide use and management. This PS will assess how CSP Jodhpur intends to minimize pollution related impacts, what management plans and systems are in place, and what measures it plans to take to conserve and use resources more efficiently. The Project construction activities will lead to increased fugitive dust emissions, especially in the area it is being developed due to the presence of loose sandy soil and limited vegetation. The project activities will also lead to increase in ambient noise level during the construction phase, which may impact the nearest villages of Dedasari, Durjani and Khakori. Furthermore, the project activities will involve generation of waste and may involve abstraction of groundwater. Therefore, PS 3 is applicable to the Project.
4.	Community Health, Safety and Security	**Applicable** This PS-4 requires due diligence 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. It also requires 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. Key areas of compliance screened under PS-4 includes: infrastructure/equipment safety, hazardous material safety, natural resource issues, exposure to disease, emergency preparedness and response, and security personnel requirements. The project would affect the health and safety of the communities adjacent to it during construction phase. The Project activities will involve upgradation/widening of one of the 3 access routes identified and construction activities will lead to stress on the Project access road and on the area in general. Transportation of equipment and increased traffic in the area may lead to accidents and other threats on community health and safety, therefore PS 4 is applicable to the project.

5.	Land Acquisition and Involuntary Resettlement	**Not Applicable** PS-5 requires project proponents to anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use. The key themes covered under this are: compensation and benefits for displaced persons, consultation and grievance mechanism, resettlement planning and implementation, physical displacement, economic displacement. The PS-5 also prescribes private sector responsibility to supplement government actions and bridge the gap between governments assigned entitlements and procedures and the requirements of PS-5. All the land parcels identified/procured are private land procured/ to be procured on willing buyer and willing seller basis. Furthermore, the project has not led to resettlement, physical displacement and economic displacement Therefore, PS 5 is not applicable to the project.
6.	Biodiversity Conservation and Sustainable Management of Living Natural Resources	**Applicable** The requirements of this Performance Standard are applied to projects (i) located in modified, natural, and critical habitats; (ii) that potentially impact on or are dependent on ecosystem services over which the client has direct management control or significant influence; or (iii) that include the production of living natural resources (e.g., agriculture, animal husbandry, fisheries, forestry). PS-6 screens relevant threats to biodiversity and ecosystem services, especially focusing on habitat loss, degradation and fragmentation, invasive alien species, overexploitation, hydrological changes, nutrient loading, and pollution. The key themes covered under PS-6 are: natural habitat, critical habitat, legally protected areas, international introduction of alien species, and living natural resources (natural and plantation forest, aquatic resources etc.) are sustainably managed. Though actual geo coordinates were not available for this particular project, based on onsite visit, the project seemed to be located in a mosaic of “Natural Habitat” (Sand dunes & Scrublands) as well as “Modified Habitat” (Agricultural Fields). Though no Threatened species (IUCN version 2019-1), was recorded or reported from the study area and the proposed project is not expected to cause any significant habitat loss (as such habitats are present in abundance in the landscape), PS 6 is applicable due to the presence of significance biodiversity value representing Flora and Fauna of “Thar Desert”.
7.	Indigenous Peoples	**Not Applicable** This Performance Standard applies to communities or groups of Indigenous Peoples who maintain a collective attachment, i.e., whose identity as a group or community is linked, to distinct habitats or ancestral territories and the natural resources therein. PS-7 endeavour to ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples. Key themes covered under PS-7 are: avoidance of adverse impacts, consultation and informed participation, impacts on traditional or customary lands under use, relocation of IPs from traditional or customary lands, and cultural resources. As confirmed during community consultations and consultation with the CSP Jodhpur team, no indigenous peoples will be affected by the project

		activities and no ST land will be purchased. Therefore, PS 7 is not applicable to the project.
8.	Cultural Heritage	**Not Applicable** For the purposes of PS-8, cultural heritage refers to (i) tangible forms of cultural heritage; (ii) unique natural features or tangible objects that embody cultural values; and (iii) certain instances of intangible forms of culture that are proposed to be used for commercial purposes. The requirements of PS-8 apply to cultural heritage regardless of whether or not it has been legally protected or previously disturbed. As confirmed during ERM site visit, no cultural heritage will be affected by the project activities. Therefore, PS 8 is not applicable to the project.

3.7.2 AIIB Environmental and Social Policy and Standards

AIIB environmental and social policy and standards are as described below.

3.7.2.1 Overarching Policy

The Bank recognizes that environmental and social sustainability is a fundamental aspect of achieving outcomes consistent with its mandate to support infrastructure development and enhance interconnectivity in Asia. The objective of this policy is to facilitate achievement of these development outcomes, through a system that integrates sound environmental and social management into Projects.

3.7.2.2 Environmental and Social Policy Including Environmental and Social Standards

This overarching policy comprises of:

- Environmental and Social Policy. An environmental and social policy (ESP), which sets forth mandatory environmental and social requirements for each Project;
- Environmental and Social Standards. The following three associated environmental and social standards (ESSs), which set out more detailed mandatory environmental and social requirements relating to the following:
  - ESS 1: Environmental and Social Assessment and Management (ESS 1);
  - ESS 2: Involuntary Resettlement (ESS 2); and
  - ESS 3: Indigenous Peoples (ESS 3).

3.7.2.3 An Approach for Environmental and Social Management

Together, the ESP and the ESSs comprise an environmental and social management approach designed to:

- Support decision-making by the Bank;
- Provide a robust structure for managing operational and reputational risks of the Bank and its shareholders in relation to environmental and social risks and impacts in Projects;
- Provide for environmental and social screening and categorization of Projects;
- Analyze potential environmental and social risks and impacts of Projects;
- Identify actions to avoid, minimize, mitigate, offset or compensate for environmental and social impacts of Projects;

- Support integration of environmental and social management measures into Projects;
- Specify environmental and social management provisions to be included in agreements governing Projects;
- Provide a mechanism for public consultation and disclosure of information on environmental and social risks and impacts of Projects;
- Provide for monitoring and supervision of environmental and social management measures under Projects;
- Facilitate development and dissemination of lessons learned from Projects to improve environmental and social management practices.

3.7.2.4 Support for Clients

The ESP (including the associated ESSs) sets out the requirements for Clients relating to identification and assessment of environmental and social risks and impacts associated with Projects supported by the Bank. The Bank believes that the application of the ESP and ESSs, by focusing on the identification and management of environmental and social risks and impacts, will support Clients in achieving good international practice relating to environmental and social sustainability; assist Clients in fulfilling their national and international obligations relating to environmental and social risks and impacts; enhance non-discrimination, transparency, participation, accountability and governance; and enhance sustainable development outcomes of Projects through ongoing stakeholder engagement.

4. BASELINE SETTINGS - ENVIRONMENT, ECOLOGY AND SOCIAL

This section presents environment, ecological and socio economic baseline of the study area for the proposed 250 MW solar power project of CSP Jodhpur in Jodhpur district of Rajasthan, India. The project study area covers three villages, namely Dedasari, Khakori and Durjani falling under Bap tehsil.

4.1 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 baseline 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 site and surrounding area to provide a context within which the impacts of the proposed solar power project are to be assessed.

4.2 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 identified and the reasons for the same.

4.2.1 Study Area

The area of up to 5 km radius from the project boundary (solar plant area) has been demarcated as study area for the project by considering the extent of project impact in terms of noise, water resources, human settlement, cultural heritage sites, location of labour sites, location of the access roads besides considering the actual land area which has been procured for the project and its utilities footprints. The study area includes three villages namely Khakori, Durjani and Dedasari located in Bap tehsil.

4.2.2 Project Footprint Area

The Project Footprint is the area that may reasonably be expected to be physically touched by Project activities, across all phases. 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.

4.2.3 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 500 m from a construction area and 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 wind farm; (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 and/or area identified beyond 5 km that is directly impacted by project activities.

4.2.4 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 project lifecycle) would be contained within a 1 km radius (core zone) from the Project Footprint in terms of spread and intensity, with the buffer zone (5 km radius) appearing to have limited interaction with the project.

The Buffer Zone is the area which does not have direct impact on land or environment, however it is demarcated in case the impact on core zone are sometimes/often extended to near-by areas. Usually the impact on buffer zone are more inclined towards, noise, air and water pollution. In cases it also has impact over labour, land ownership, migration and accessibility to any natural resources.

For the purpose of socio economic baseline assessment, core (1 km from project site) and buffer zones (beyond 1 km and within 5 km of project site).Three villages- Dedasari, Durjani and Khakori fall within the buffer zone and no villages are present within the core zone. The habitation of Baroo village is present beyond the buffer zone, at approx. 8 km from project site and therefore not included in the socio-economic baseline.

4.3 Environment Baseline

Environmental baseline data was collected through secondary sources by literature survey and discussions with the concerned stakeholders. The environmental baseline has been assessed covering an area of 5 Km zone (hereinafter referred to as the study area) from the Project boundary. Secondary baseline data collection involved identifying and collecting available published material and documents. Information on various environmental aspects like soil, geology, hydrology, drainage, ecology etc., were collected from different government department, institutions, literature etc. & stakeholder consultations held undertaken during the site visit.

A brief description of the existing physical environment within the project site is detailed in the sections below.

4.3.1 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. Based on the discussion with site representatives and observations from satellite images it is understood that the current land use of the project site is agricultural land that will be converted to non-agricultural land for industrial development.

The plant boundary is not yet defined at this stage, and the land procurement process is still underway. Details on land use will be incorporated after finalization of plant boundary by CSP project team.

During the ERM site visit it was observed that the project area consists primarily of private agricultural land with seasonally used structures/ sheds, along with structures used for collection of water, were present. Land use of the procured land parcels consists of agricultural land (fallow and current fallow with single season cropping)[10]. Small patches of open scrubland were also observed in nearby areas when accessing the site via the village road.

4.3.2 Topography

The topography of the site is flat with slight undulation with elevation ranging from 195 m to 210 m above mean sea level. The proposed site is characterised by presence of sand dunes and the elevation gradually decreases from south going towards north.

The plant boundary is not yet defined at this stage, and the land procurement process is still underway. Details on land use will be incorporated after finalization of plant boundary by CSP project team.

4.3.3 Geology

As per the Hydrogeological Atlas of Jodhpur district, 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 the regional geological set up 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 and 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 also traversed by major lineaments, such as Jaisalmer Barwani lineaments trending NW-SE and Luni-Sukri lineament trending North East-South West.

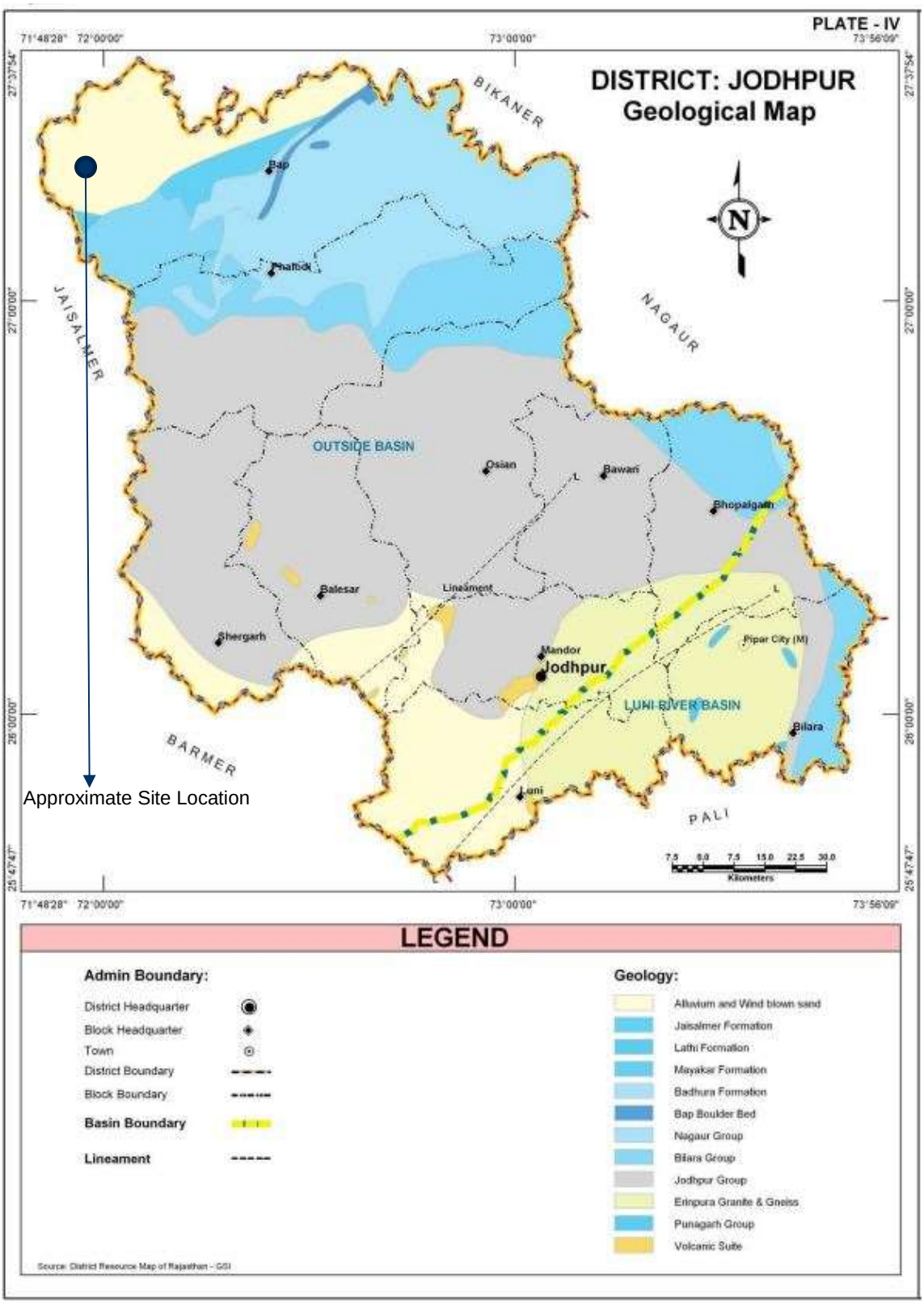
The major rock types in the district include, but are not limited to, the following types:

- Sandstone;
- Shale;
- Gypsum;
- Limestone;
- Siltstone;
- Granite; and
- Gneiss

The map presented below showcases the geology of the Jodhpur district.

10 This is the land which is left without cultivation for one or less than one agricultural year. Fallowing is a cultural practice adopted for giving the land rest. The land recoups the lost fertility through natural processes.

Figure 4.1 Geology of Jodhpur District



Source: Hydrogeological Atlas of Rajasthan Jodhpur District, Groundwater Department of Rajasthan

4.3.4 Water Quality and Source

4.3.4.1 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. There is no surface water body within the AoI of the project. The nearest surface water body to the site is the Indira Sagar Canal, located at a distance of 8 km towards the east of the project site, which receives water from the Indira Gandhi Nahar Pariyojna (IGNP) canal.

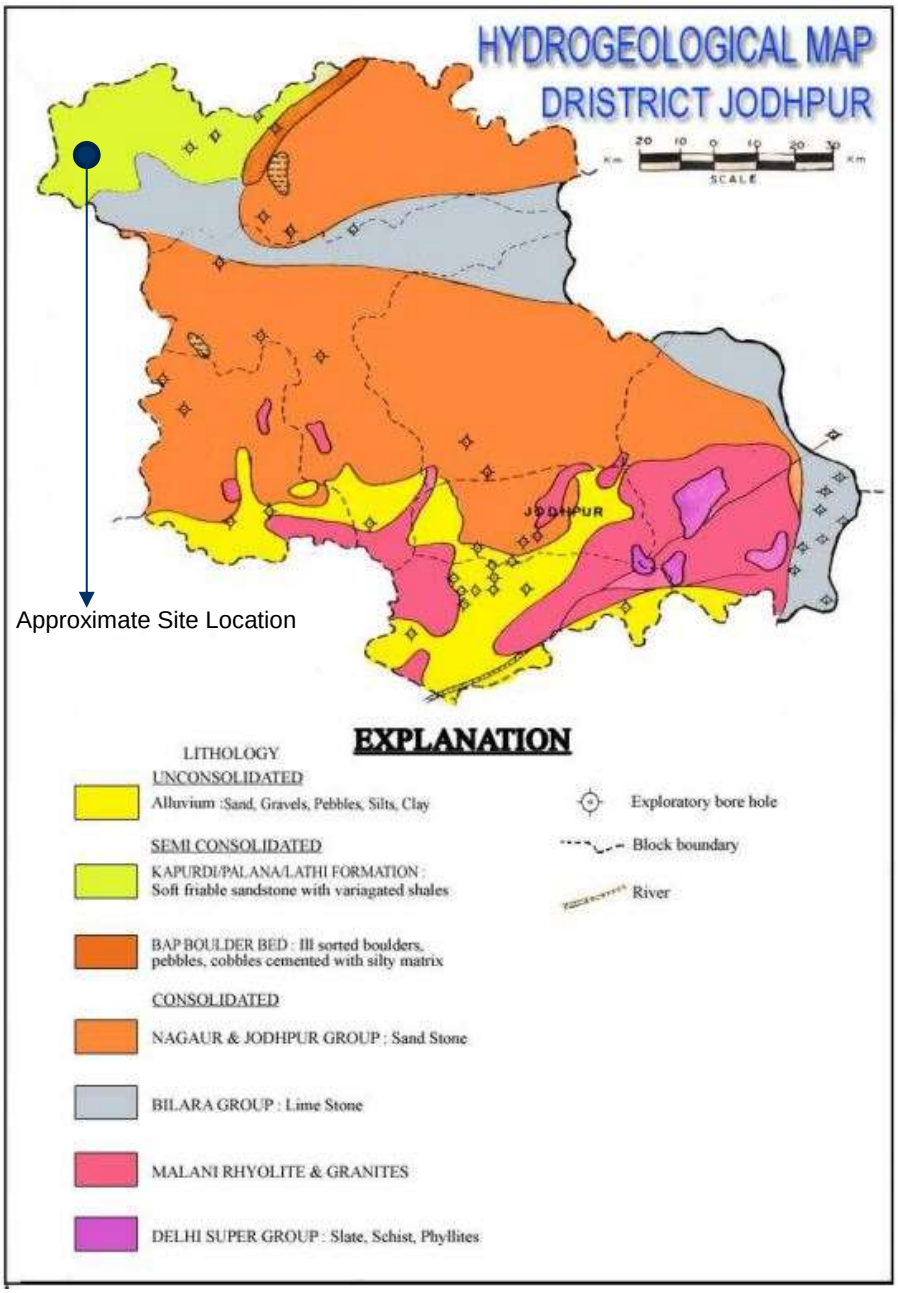
4.3.4.2 Hydrogeology

As per the Central Ground Water Board (CGWB) brochure of Jodhpur District (2013), ground water in the Jodhpur district 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 and a brief description of these rocks is as given below.

- **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.
- **Palaeocene and associated formation:** Semi-consolidated formations comprising of soft, friable sandstone, grit and conglomerate ranging from Permian to Palaeocene 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.

Confined condition is also observed sometimes at deeper levels in the north western part of the district. Bap boulder bed occurs in narrow stretches in northern part of the district consisting of NE-SW extension. The boulder bed consists of ill-sorted boulders, pebbles, cobbles embedded in silty matrix. Ground water in this bed occurs under unconfined condition. The hydrogeology map of Jodhpur district is shown below in **Figure 4.2**.

Figure 4.2 Hydrogeological Map of Jodhpur district



Source: Central Ground Water Brochure, Jodhpur District, 2013

4.3.4.3 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 Bap tehsil, where the study area falls is reported to be 38.66 % and marked as **Safe**.

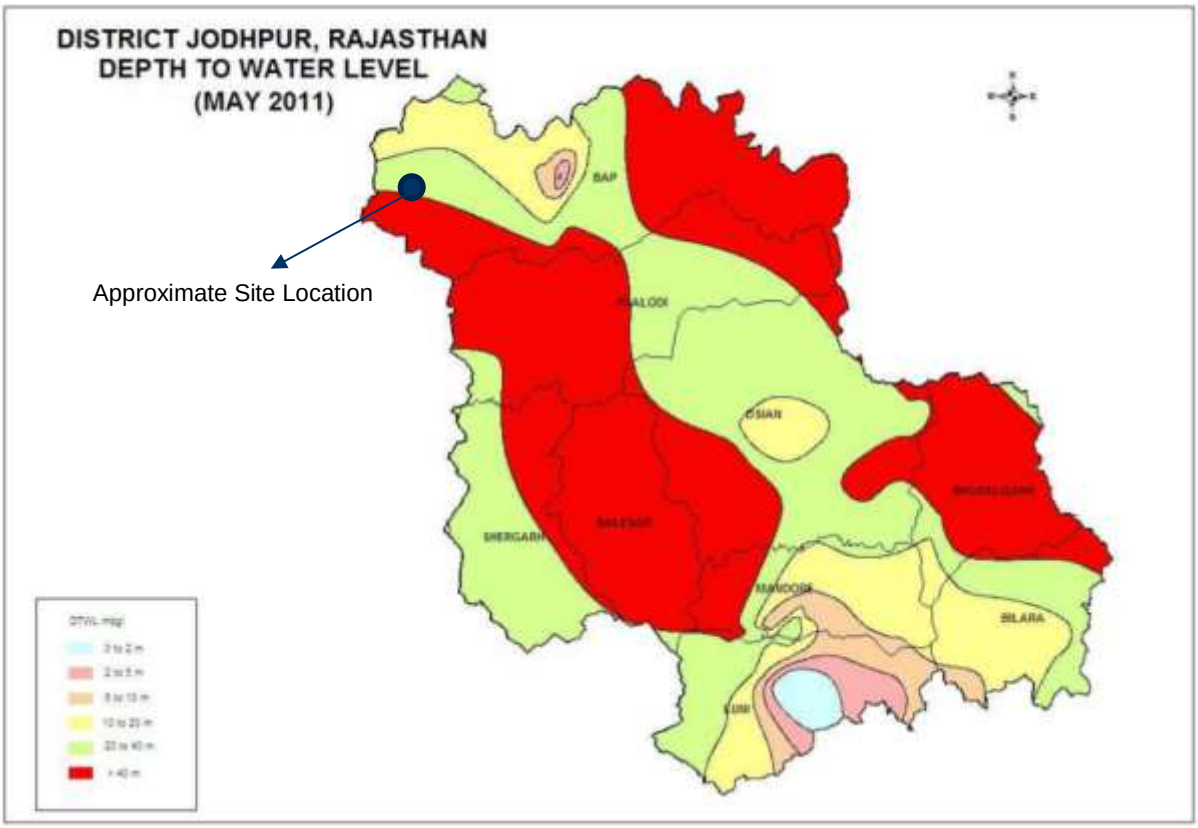
According to the study undertaken by CGWB for Jodhpur district in 2013, depth to water level in the district generally ranges from less than 1m to more than 100 m below ground level (mbgl). Furthermore, the depth to water level in the district ranges from 0.01 to 82.51 m bgl and 0.01 to 114.9 m bgl during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

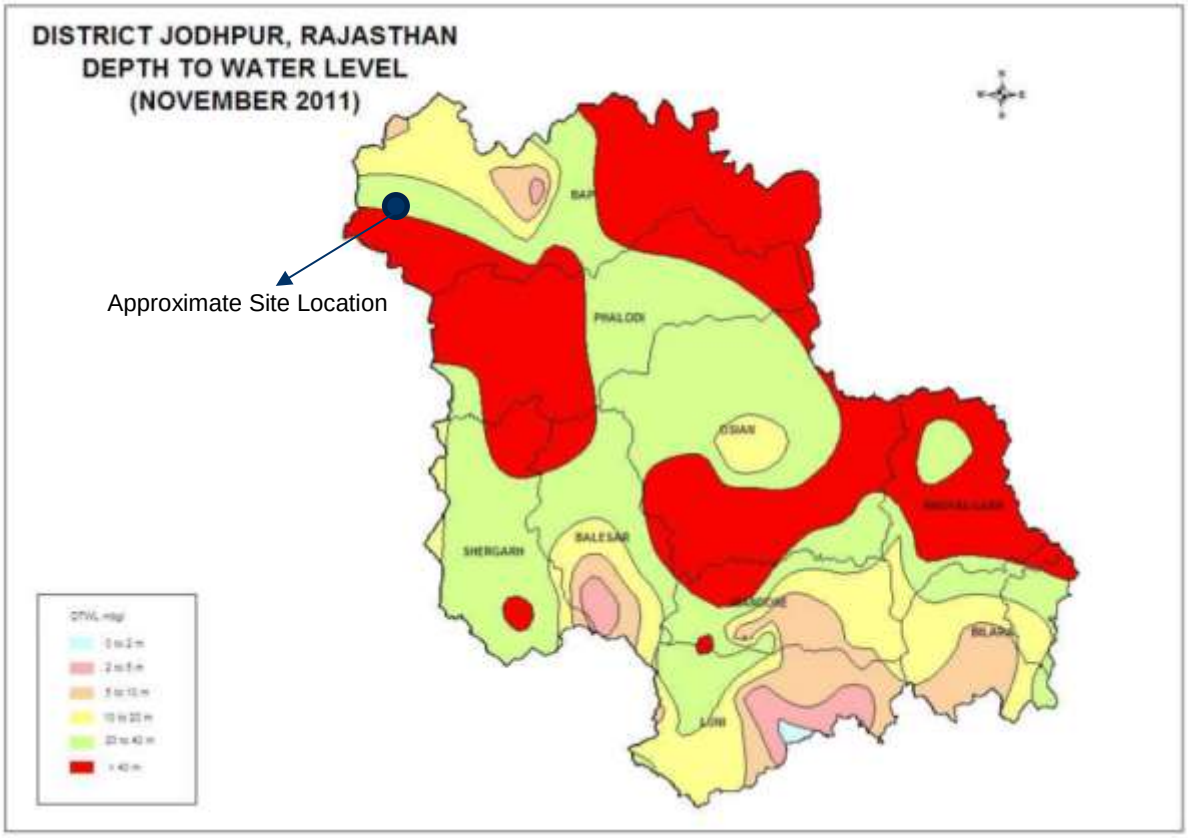
Depth to water level for Pre-monsoon and Post Monsoon in Jodhpur district is as presented in **Figure 4.3** and **Figure 4.4**.

Figure 4.3 Depth to Water Level in Jodhpur District in Pre Monsoon (May-2011)



Source: Central Ground Water Brochure, Jodhpur District, 2013

Figure 4.4 Depth to Water Level in Jodhpur District in Post Monsoon (Nov-2011)

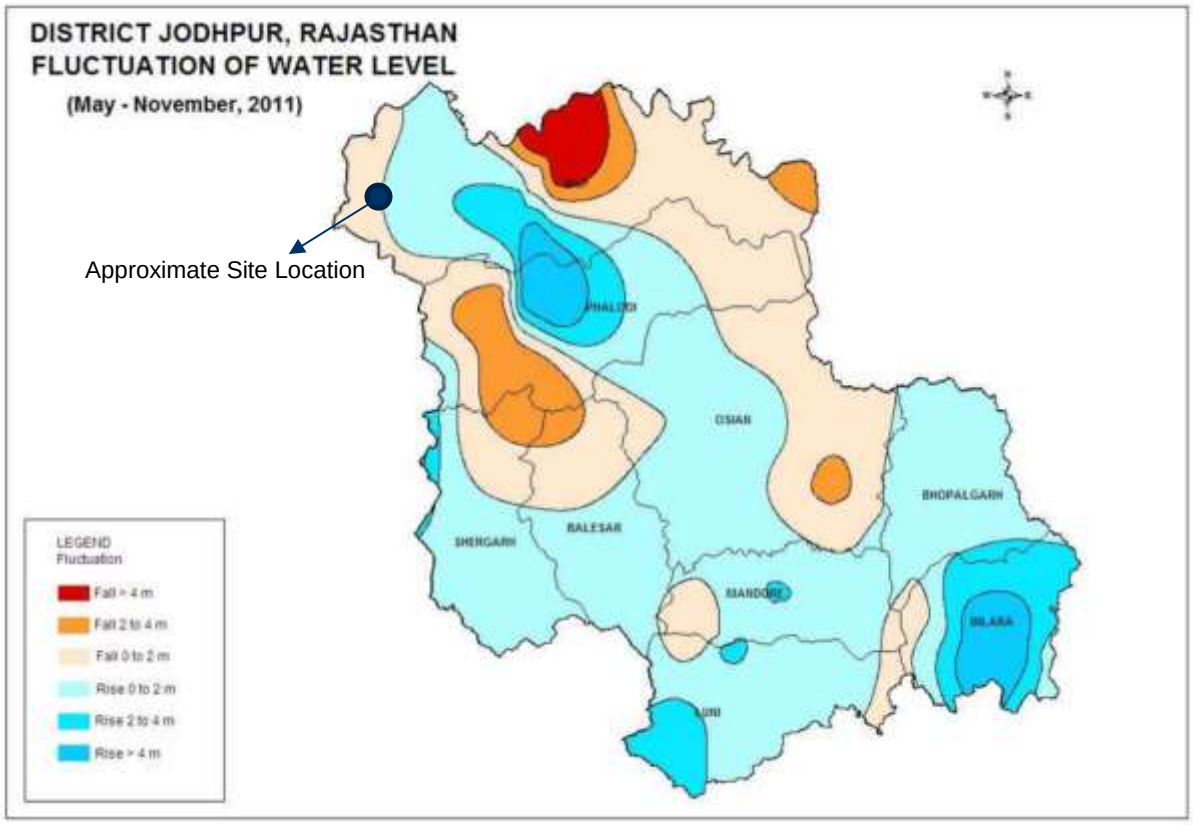


Source: Central Ground Water Brochure, Jodhpur District, 2013

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



Source: Central Ground Water Brochure, Jodhpur District, 2013

4.3.4.4 Groundwater Quality

According to the groundwater assessment undertaken by CGWB for Jodhpur district in 2013, northern and western parts of Bap have brackish ground water. The groundwater quality in the district of Jodhpur has as given below.

- **Fluoride concentration** in ground water varies between 0.124 mg/l at Rohila Kalan and Osian to 2.552 mg/l at Nandwan and Mandore. Fluoride content in excess maximum permissible limit of 1.5 mg/l has been observed in major parts of the district covering western halves of **Bap**, Balesar and **Phalodi** blocks as well as major parts of Shergarh block, eastern and southcentral parts of Osian block, south-western part of Mandore block, northwestern, south-western and south-eastern part of Luni block, northern part of Bhopalgarh and eastern and western part of Bilara block;
- **Nitrate concentration** in ground water varied from 8 mg/l at Balesar to 199 mg/l at Baori and Osian. Exceptionally high concentration of 536 mg/l was observed at Mandore. Nitrate in excess of maximum permissible limit of 45 mg/l has been reported from parts of Osian, Bhopalgarh, Mandore and Luni blocks;
- **Iron concentration** in ground water has been found to be mostly within the maximum permissible limit of 1 mg/l. Isolated pockets of excess iron have been noticed in western extremity of **Bap**, southern part of Shergarh, south-eastern part of Luni, eastern part of Osian, northern part of Bhopalgarh and southern, south-eastern and eastern parts of Bilara block; and
- As for **electrical conductivity**, chemical quality of deeper ground water indicates large variation having electrical conductance from 520 ms/cm at 250 C (Ranja Ki Dhani) to 31370 ms/cm at 250 C (Ghataur). High salinity of more than 10000 ms/cm at 250 C electrical conductance has been noticed at Sangaria Ki Dhani, Narnadi, Agolai, Lunawas Charnan, Sajjara and Jhanwar. Ground

water quality in deeper zones in the area north of **Phalodi** is better due to encountering of Bilara Limestone below Nagaur sandstone.

4.3.4.5 Water source and quality in the study area

The water supply in the study area is restricted to supply of water from the Indira Gandhi canal through tankers. The villages in the Study Area don't have access to piped water supply or hand pumps and dug wells. The water stored is sufficient for 10-15 days, dependent upon the size of the household; the procured water is stored in Tank for further usage.

As per consultations conducted by ERM in the project area, groundwater in the area is reported to be scarce and available at approximately 600-800 feet below ground level, however, with reportedly high concentrations of fluoride, iron, nitrates and high electrical conductivity.

Groundwater Quality Assessment (CSP Bhadla)

Results of groundwater quality assessment undertaken for Bhadla 300 MW Project are as given below.

Groundwater samples were collected from various points within the project area of influence and assessed against the CPCB water quality criteria[11]. The sampling locations for this study are discussed below.

Table 4.1 Primary Monitoring Location for Water Quality (CSP Bhadla)

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 4.2 Water Analysis in the Study Area (CSP Bhadla)

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)

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

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
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)
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.

4.3.5 Soil Type and Classification

As per the information provided by CGWB in the groundwater brochure for Jodhpur district (2013), soils of the district of Jodhpur have been classified below.

- **Red desertic soils**: This type of soils are predominant in central, eastern and southern parts of the district. These are pale brown to reddish brown soils, loose and well drained and texture varies from sandy loam to sandy clay loam;
- **Desert soils**: Desert soils occupy a considerable area covering northern and western parts of the district. These are mainly wind-blown sand and soils of interdunal depressions;
- **Sand dunes**: Sand dunes occupy a small part in northern and north-western margin of the district. These are sandy to loamy sand, loose, structure less and well drained; and
- **Lithosols and regosols of hills**: These types of soils are found in hills and hill slopes of central and western parts of the district. These are shallow, light textured, fairly drained and reddish brown to grayish brown in colour.

4.3.6 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 4.3 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 (^{o}C)	16.9	19.9	25.1	30.2	34.4	34.1	31.2	29.1	29.3	27.6	22.5	18.4

4.3.7 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 4.4. Hazard zonation maps of the state for earthquake, wind/cyclone, flood and drought are presented in **Figure 4.6**, **Figure 4.7**, **Figure 4.8** and **Figure 4.9**.

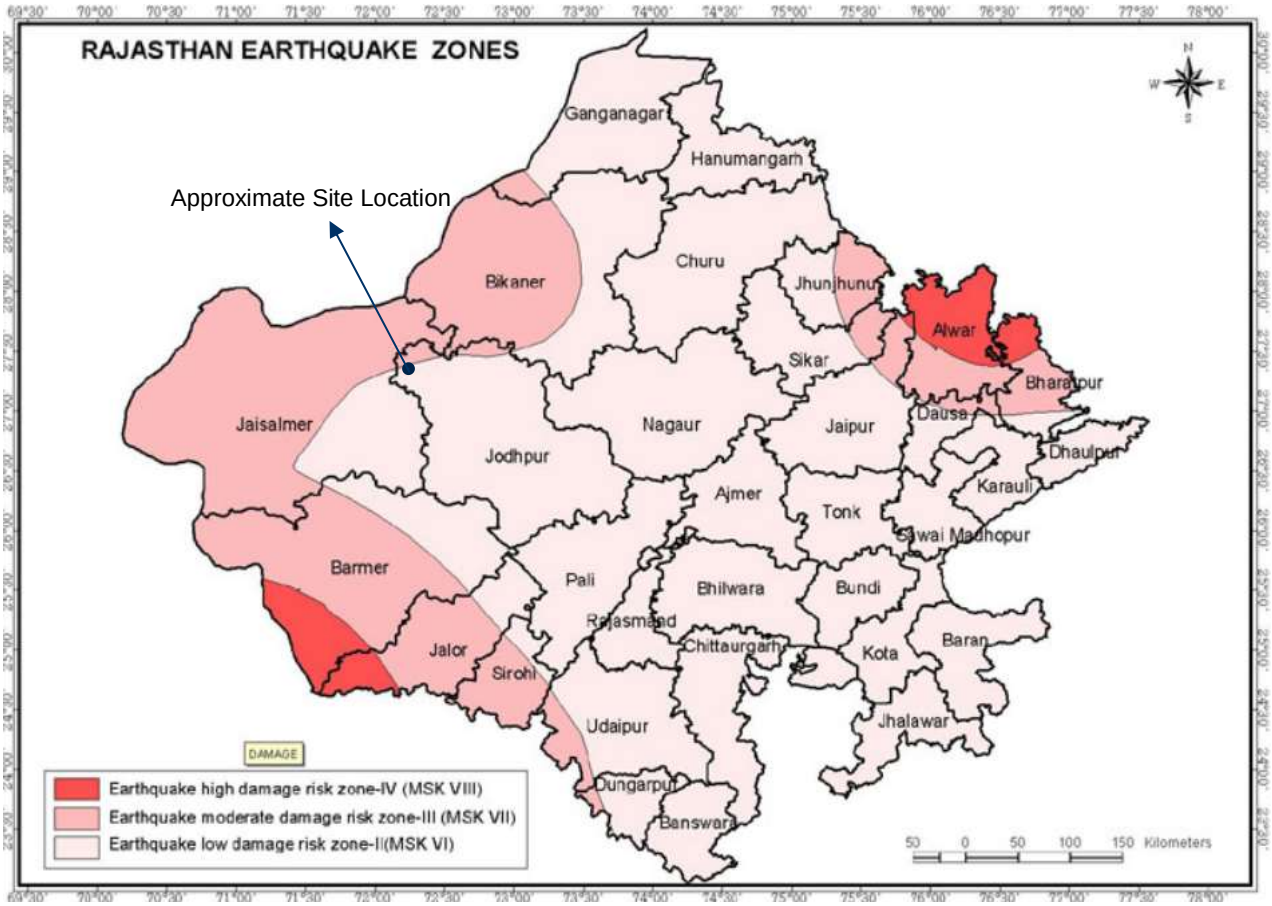
Table 4.4 Natural Hazard Details, Jodhpur

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[12], 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.
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.

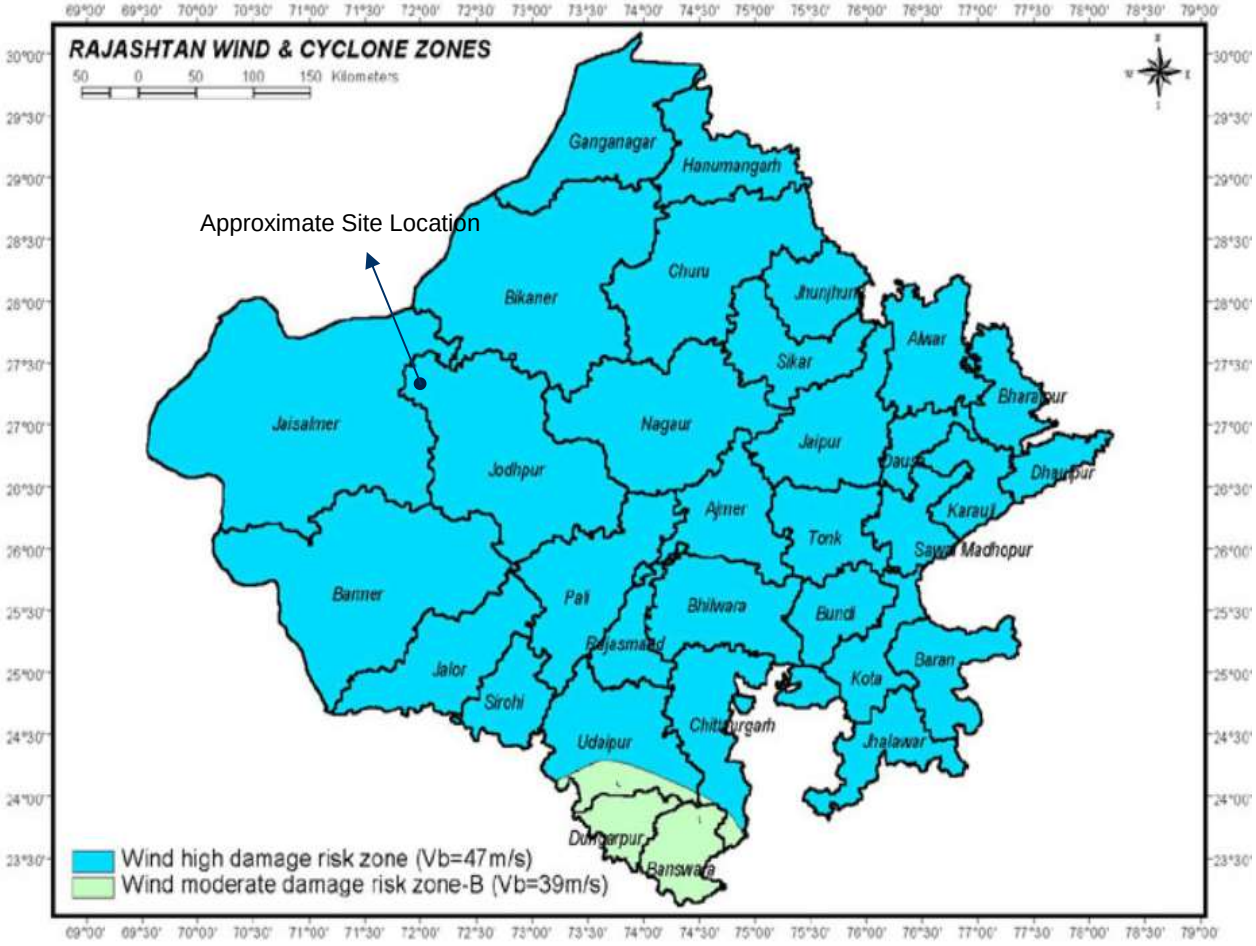
[12] Disaster Management, Relief & Civil Defence Department of Government of Rajasthan Link: http://www.dmrelief.rajasthan.gov.in/

Figure 4.6 Map Showing Earthquake Zones in Rajasthan



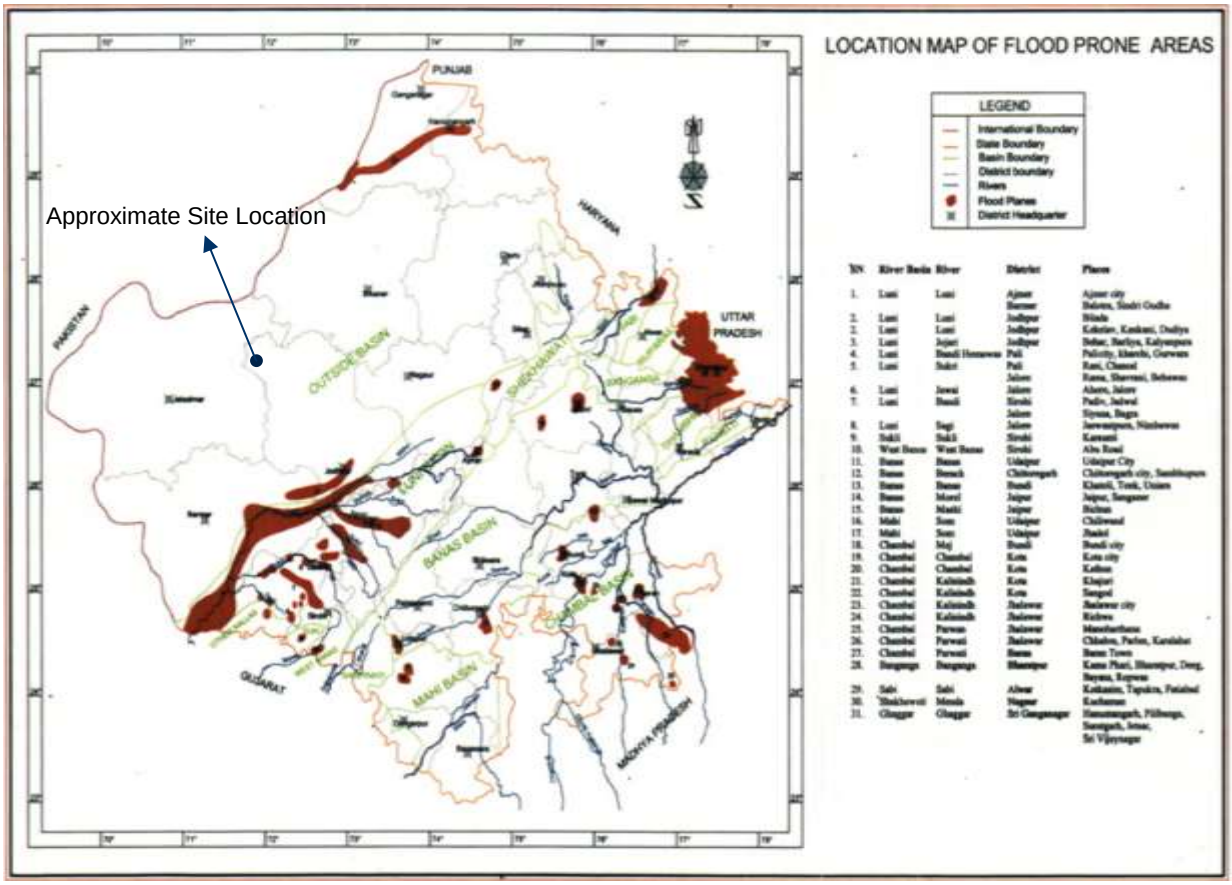
Source: Disaster Management, Relief & Civil Defence Department, Government of Rajasthan

Figure 4.7 Map Showing Wind and Cyclone Zones in Rajasthan



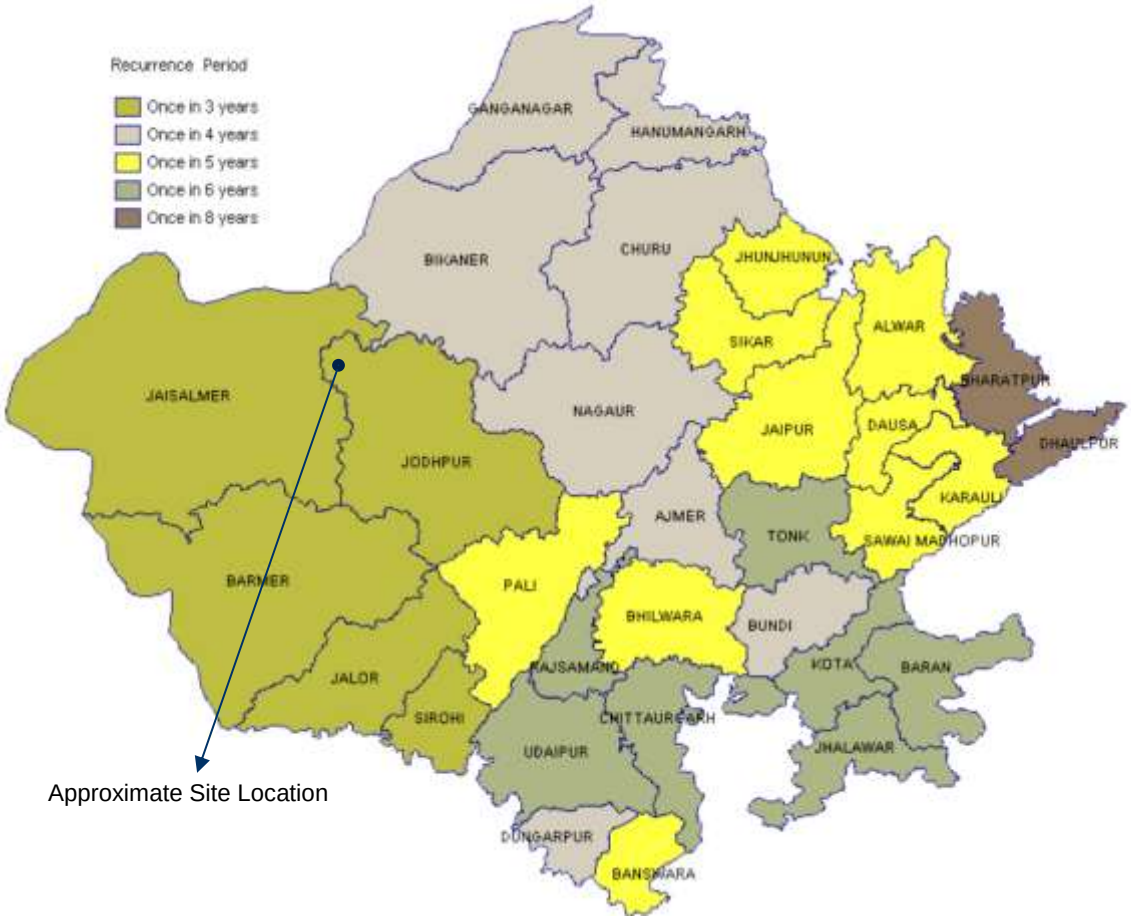
Source: Disaster Management, Relief & Civil Defence Department, Government of Rajasthan

Figure 4.8 Map showing Flood Prone Areas, Rajasthan



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

Figure 4.9 Map Showing Drought Frequency in Rajasthan



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

4.3.8 Ambient noise (CSP Bhadla)

Results of groundwater quality assessment undertaken for Bhadla 300 MW Project are as given below.

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 4.5**. The noise level in the study area is detailed in **Table 4.6**.

Table 4.5 Details of Noise Monitoring locations

Sr. No.	Location code	Location	Remarks
1	N1	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.

Table 4.6 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	75- Industrial Area	70- Industrial 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

4.3.8.1 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 and night for NL1 were observed to be within the industrial area limit of 75 dB (A) and 70 dB (A) at the Mather market, near the site office of Ritis Meera Infra Energy where sampling was carried out.
- 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.

4.3.9 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

Table 4.7 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 **Table 4.8** and **Table 4.9.**

Table 4.8 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

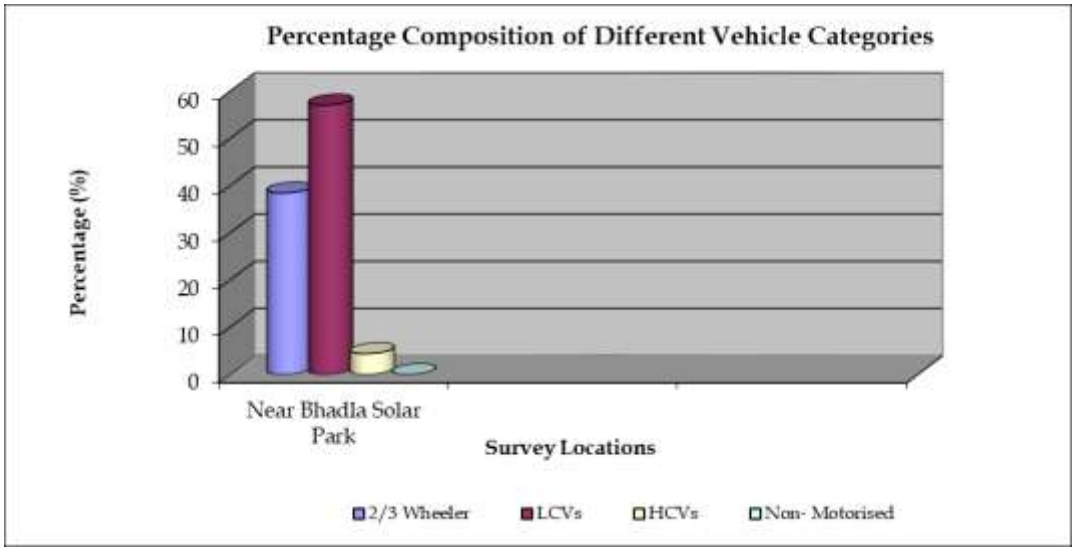
Table 4.9 Percentage Composition of Vehicles in Study Area

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 4.10**.

Figure 4.10 Percentage Composition of Different Vehicles Categories



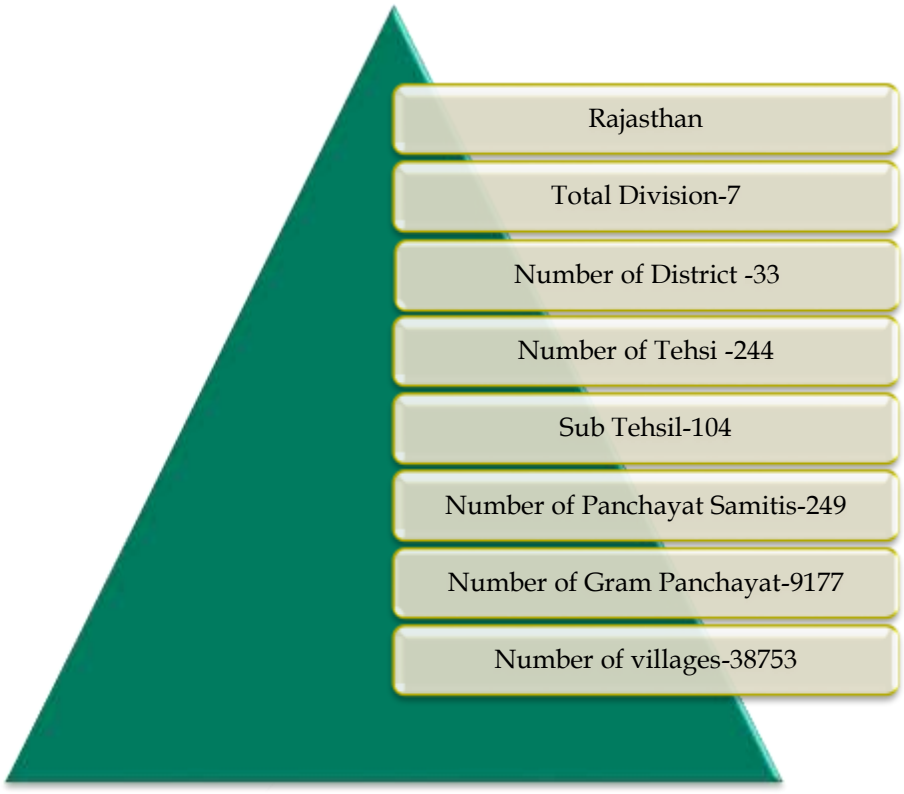
Light motor vehicles contribute to the maximum (more than 50%) of traffic on the roads followed by 2/3 wheelers vehicles and Heavy motor vehicles. No non-motorised vehicles were recorded on the access road.

4.4 Socio-economic Environment

4.4.1 State Profile: Rajasthan

Rajasthan covers an area of 342,239 square kilometres (132,139 sq. mi) or 10.4 percent of the total geographical area of India. It is the largest Indian state by area and the seventh largest by population. Rajasthan shares it border with the Pakistani provinces of Punjab to the northwest and Sindh to the west, along the Sutlej-Indus river valley. Elsewhere it is bordered by five other Indian states: Punjab to the north; Haryana and Uttar Pradesh to the northeast; Madhya Pradesh to the southeast; and Gujarat to the southwest.

Rajasthan has total divisions 7, number of district is 33, number of tehsil 244, number of sub tensil-104, number of panchayat samitis-249 and number of villages 38753.



Source: Census of India, 2011

The State comprises of a population of 3, 42,239 individuals, which is pre-dominantly rural, forming 75.13 % of the State's total population. The sex ratio in the State is 928, which is significantly lower than that of India which stands at 943 females per 1000 males as per census 2011 data.

The literacy rate of Rajasthan is nearly 66.10 % which is lower than that of the country, at 74.04%. The male literacy rate is relatively higher, at 79.19% while the female literacy rate is 52.12 % which is also lower than the national female literacy rate of 65.46 %.

Table 4.10 Demographic Profile of Rajasthan

Attribute	Number	% of India
Area (sq. km)	3,42,239	10.4
Total population	6,85,48,437	5.66

Males	3,55,50,997	5.77
Females	3,29,97,440	5.66
Sex ratio	928	NA
Percentage of rural Population	75.13	NA
Percentage of urban population	17,048,085	NA
Percentage of SC population	18.51	NA
Percentage of ST population	13.48	NA
Total literacy rate	66.10	NA
Male Literacy rate	79.19	NA
Female Literacy Rate	52.12	NA

Source: Census of India, 2011

4.4.2 Bap and Phalodi Tehsils

The Tehsil Bap, where the project is located, comes under the Jodhpur district and was formed from the Phalodi tehsil in the year 2012. Due to this, the secondary information for the tehsil in terms of demographic details and economic profile is primarily limited to the information available for the Phalodi tehsil.

Table 4.11 Demographic Profile of Rajasthan, Jodhpur and Phalodi tehsil

Region	Total population	Sex ratio	SC%	ST%	Literacy rate (%)	Female literacy rate (%)	Rural population (%)
Rajasthan	68,548,437	928	17.82	13.47	79.19	52.12	75.13
Jodhpur	36,87,165	916	16.49	3.23	65.9	51.83	65.70
Phalodi	3,10,543	906	17.18	4.16	45.76	32.53	99.95

Source: District Census Handbook, Jodhpur and Primary Census Abstract, Census of India 2011

The Phalodi tehsil, of which Bap was earlier a part of, is characterised of a population of 3,10,543 individuals with a population density of 24.71 individuals per sq. km. The sex ratio in the tehsil is 906, which is considerably lower than that of the state and nation, and is comparable to the district. This low sex ratio in the district and the tehsil is attributed primarily to the reported preference for a male child amongst the community. In terms of the population of Scheduled Caste and Scheduled Tribes, the tehsil has a proportion of 17.18 % and 4.16 %, respectively. This is in keeping with the trends visible at the district level as well.

4.4.2.1 Economic Profile of Phalodi Tehsil

The tehsil of Phalodi, and now Bap, are known for the solar power projects, with the Rajasthan Government aiming to make the tehsils and district into a hub for solar power projects within the Jawaharlal Nehru National Solar Mission (JNNURM). As part of the plans to create this power generation capacity in the district, solar power projects to the capacity of 1000 MW are planned, of which 484 MW; spread across 873 projects have been sanctioned. It is reported that a total of 899 companies have registered with the government, with a capacity of 18,476 MW.

4.4.3 Socio-economic status of Study Area

This sub section provides an understanding of the socio-economic profile of the Study Area. This understanding is based on the secondary information available on the area, primarily the Census of India data and the primary data collected during the baseline assessment in the form of consultations and visual observations. Such an understanding will in turn allow for the assessment of the potential impacts from the project as well as the formulation of specific mitigation plans.

The area of up to 5 km radius from the project boundary (solar plant area) has been demarcated as study area for the project by considering the extent of project impact in terms of noise, water resources, human settlement, cultural heritage sites, location of labour sites, location of the access roads besides considering the actual land area which has been procured for the project and its utilities footprints. The study area is further divided into core zone and buffer zone. The core zone for this study has been considered as 1 km from the project area, and the buffer zone stretches from 2 to 5 km from the site. The study area includes three villages namely Khakori, Durjani and Dedasari located in Bap tehsil. There are no villages or settlements within 1 Km radius of the project boundary, therefore, consultation were held in villages falling from 2-5 kms and 5-10 kms.

4.4.3.1 Demographic Profile

All 3 villages in the study area fall under the Phalodi Tehsil. Demographic profile of the villages that could be located in the Census data 2011 and Village Directory 2011 is captured in **table below.**

Name of the village	No. of households	Total population	Sex Ratio	SC %	ST %	Literacy rate (in %)	Female literacy rate (in %)
Buffer Zone							
Dedasari	362	2420	941	1	4	51	31
Khakori	83	498	851	0	0	35	26
Durjani	126	640	1000	37.65	0	59	37
Total	571	3558	938	7.5	3.03	50	25.12

Source: Census 2011

The study area has a total population of 3558. It could also be observed from the table that the SC population in the study area is about 7.5 %. The study area is observed to have 3.03 % of ST population and the same was confirmed during the consultations. For the overall study area, the population of STs varies from nil in Khakori and Durjani villages to 4 % in Dedasari.

Dedasari is the largest in terms of population and Khakori is the smallest. The average sex ratio in the study area is observed to be 938 which is significantly lower than the state sex ratio of 973. One of the reasons cited for the lower sex ratio is the preference for the male child amongst the community as a whole.

Educational Infrastructure

As can be seen from ***Table 4.12***, it can be observed that there is only 1 private pre-primary school (1) in the study area. Similarly, there are 2 Government-run primary schools. There is 1 government run middle schools. There are no senior secondary schools or colleges in the study area. The nearest senior secondary school is in Bap. Due to this the percentage of children dropping out of school is also high.

Table 4.12 Educational institutions (Schools) in the study area

Name of the village	Govt. Pre - Primary School (Nursery/LKG/UKG)	Private Pre - Primary School (Nursery/LKG/UKG)	Govt. Primary School	Private Primary School	Govt. Middle School	Private Middle School	Govt. Secondary School	Private Secondary School	Govt. Senior Secondary School	Private Senior Secondary School
Dedasari	0	1	1	0	1	0	1	0	0	0
Khakori	0	0	1	0	0	0	0	0	0	0
Durjani	0	0	0	0	0	0	0	0	0	0
Total	0	1	2	0	1	0	1	0	0	0

Source: Village Directory, 2011

Social stratification

The Study Area is characterised by a mixed population in terms of religion and caste, with a dominance of the Muslim religion and few Hindu households in Dedasari village (according to the information made available during the consultations). The study area has low proportions of ST and SC population in comparison with that of the State, district and tehsil levels. The major sub castes of ST population inhabiting the area are Meghwal and Bhil. Though no significant deviations in the livelihood pattern from the general community were observed, the STs were reported to be more dependent on agriculture and wage labour.

Settlement Patterns

The settlement pattern in the area is rural, with the settlements being scattered over a large area in small clusters (also known as ‘Dhani’). The houses in the villages in the Study Area are of three types, Pukka, Semi-Pukka and Kutcha Houses.

The semi- pukka houses are primarily those houses which are made with sandstone slabs held together with mud with a thatched roof or brick houses with thatched roofs.

The settlements were observed to be scattered in nature, with most of the families constructing kutcha houses on their fields, to allow easy access to their land for agriculture and grazing. During consultations, it was revealed that family members stay in these kutcha houses during agriculture season and return back after the end of agriculture season. While no clear demarcations were observed along the lines of caste or religion, informal clusters were reported to exist on the basis of caste and tribe.

4.4.3.2 Land Use and Ownership

This sub section provides an understanding of the land resources in the Study Area. Land resources, whether private or common are an extremely important asset for rural communities. At the village level it is the land resources which allow for the satisfaction of the needs/demands of fuel wood, and fodder for livestock and other everyday resources. At the household level, land holdings are arguably the most valuable asset for rural communities, which serve as an important means for livelihood and source of income. It also serves as an insurance to help tide over financially difficult situations. In the context of Rajasthan, land as a resource is extremely crucial, owing to the climatic conditions and the productivity in the region and dependency on cattle.

Table 4.13 Land Use Pattern in the Study Area

Name of the village	Total Geographical Area (in Hectares)	Forest Area (I %)	Area under Non-Agricultural Uses (%)	Barren & Un-cultivable Land Area (in Hectares)	Permanent Pastures and Other Grazing Land Area (in Hectares)	Land Under Miscellaneous Tree Crops etc. Area (in Hectares)	Culturable Waste Land Area (in Hectares)	Fallows Land other than Current Fallows Area (in	Current Fallows Area (in Hectares)	Net Area Sown (in Hectares)
Dedasari	3300	0	0.92	20.2	20.9	0	0	27.11	7.18	23.54
Khakori	2578	0	0.02	4.48	0.85	0	0	1.055	32.32	68.40
Durjani	3032	0	0.02	8.80	13.73	0	0	20.23	12.14	42.90
Total	8910	0	1.5	10.9	11.39	0	0	15.46	16.95	43.70

Source: Village Directory, 2011

As can be seen from **Table 4.13**, the primary land use in the area is agricultural land use. There is no forest cover in the project area. Similarly, area under non-agricultural uses and barren and un-cultivable land account for 1.5% and 10.9 % of the total study area respectively. Total fallow land i.e. fallows land other than current fallows and current fallows account for 32.41% of the total land in the study area.

Agriculture Land Use

Of the agricultural land in the area, a significant proportion is characterised as unirrigated land, neither of the villages have access to irrigation through Indira Gandhi Canal network.

The Study Area is characterised by an average land holding size of 15 acres per household. Though the land holdings are big; however access to water for irrigation, dependence on rain and soil type suitable for limited crops limit the productivity potential of these big land holdings.

Non Agricultural Land use

Apart from agricultural land use, the other major form of land use is under the category of 'Area not available for Cultivation' and 'Cultivable Waste'. This is primarily comprised of the land on which the village settlements are located, the grazing land, and the land that is unfit for cultivation.

Common Property Resources and Culturally Significant Areas

Common Property Resources (CPRs) in the Study Area are primarily of two types, the common grazing land of the villages, religious structures such as temples and mosques and cremation grounds. These CPRs, apart from having a cultural significance for the community are also critical as grazing lands for the community.

4.4.3.3 Livelihood Profile

As can be seen from **Table 4.14**, the average Work Participation Ratio (WPR) in the study villages is 55 %. With the study villages, Dedasari accounts for the highest WPR (58) and accounts for the lowest WPR (35.96). From the table below, it can also be observed that casual labourers are in a higher proportion than other workers and agriculture labour in all villages. The higher presence of casual labourers in most villages was also established during consultations. The labourers are mostly engaged in the construction of houses, roads etc.

Table 4.14 Workforce Participation Rate (WPR) in the study area

Name of the village	Total population	Worker Participation Rate (WPR) (%)	Main Workers %	Marginal Workers %	Non-Workers %	Casual Labourers %	Agricultural Labourers %	Household Industry %	Other Workers %
Dedasari	2420	58	66	33	42	88	4	0	8
Khakori	498	51	42	57	49	59	27	7	7
Durjani	640	44	52	47	52	91	0	2	7
Total	3558	55	61	46	45	54	1	1	6

Source: Primary Census Abstract, Census of India 2011

Farm-based livelihood

The primary crops in the region comprise of Plantago ovata (Isabgol), Oil Seed (Mustard/ Soybean) amongst Kharif crops and some of the farmers were also growing Castor. The agriculture in the Study Area is completely rain fed, with the land being characterised by single crop cultivation. The dependence on monsoons for agriculture is resultant from the lack of irrigation canals in the region and depth of ground water (600-800 feet).

Even though Indira Gandhi Canal Project (IGCP) provides assured availability of water for drinking and irrigation in some parts of Jodhpur district and other districts of Rajasthan. The canal has not reached the study area for irrigation purposes. Therefore, there is no systematic irrigation support extended to the region for which dependence on monsoons/ rain fed water for agriculture is extremely high. With the drying up of water bodies, the dependence on rain water further increases in the summer months of May and June.

It was also understood during the community consultations process that farmers owning less than 10 acres of land holdings in the project area cultivate their land and the agricultural produce were used for self-consumption purposes only. However, due to erratic monsoon farmers with marginal (10-15 acres) and large land holdings (more than 15 acres) were able to manage the output only for self-consumption purpose only. Most of the land parcels are barren in nature, lack of irrigation has left large swatches of land in the region untilled. Lack of irrigation has also declined overall crop yield of the limited land parcels in the region that are still under cultivation

The district comes under the Arid Zone of the Rajasthan State. The temperature varies from 49-1 degrees, with maximum rainy days being limited to 15 in a year and an average rainfall of 302 mm. The soil of the district is characterised as sandy and loamy.

It was revealed during the consultation that due to scarcity of water and lack of return, people now prefer non-farm based livelihood to farming. They are willingly selling their land to buy a land at a nearby water intensive area.

Livestock based livelihood

Apart from agriculture, livestock holdings play an important part in the livelihoods of the community, in terms of providing extra income in addition to meeting the nutritional intake of the household. While there are no reported household rearing livestock for commercial purposes, most of the household reported to be engaged in the sale of surplus milk and milk products (mostly ghee) to individuals as well as to dairies supplying in Bap. The main livestock holdings in the area comprise of Cattle, Buffaloes, Goats, Sheep, Camel and Poultry.

Community consultations revealed that the practice of livestock holding and cattle rearing was declining in the study area owing to growing availability of and inclination towards regular jobs, especially among the youth.

Non-Farm based livelihood

The non-farm based livelihoods in the area primarily comprise of casual labour in construction sites. The daily wage rate for men was reported to be INR 400 per day and INR 300 per day for women. Similarly, demand for casual labour in social infrastructure projects in the locality under the Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA) has also increased. This form of livelihood is restricted only to the younger men of the household. There is lack of economic opportunities in the area due to lack of development. The problem is majorly faced by landless households, where there is no other source of livelihood. In this situation, where adequate work isn't available in the vicinity of the villages, the individuals have started migrating to Dubai for work. In such scenarios, it is only the worker who migrates, with the family staying back in the village.

The setting up of the solar Power plant in the area is expected to provide employment opportunities, especially in the form of engagement of security personnel at the solar plant site. Community consultations indicated that the youth now prefer working on these plants over agriculture.

4.4.3.4 Social and Physical Infrastructure

Water Supply and Sanitation

The water supply in the area is restricted to supply of water from the Indira Gandhi canal through tankers. The villages in the Study Area don't have access to piped water supply or hand pumps and dug wells. The water stored is sufficient for 10-15 days, dependent upon the size of the household; the procured water is stored in Tank for further usage.

Sanitation is also observed to be very poor in mostly villages of the study area. Open defecation is very common. Percentage of households using toilet is very low. Many toilets constructed under Total Sanitation Campaign (TSC) fund for the BPL families are actually not functional due to lack of water availability.

Electricity Supply

All the villages in the study area have access to household electricity supply. However, it was reported during consultations that there is power outages of 2-4 hours daily, with increased power cuts in the summer months.

Health Facilities and Health Seeking Behaviour

The health facilities in the Study Area are characterised by a three tier health infrastructure. The health facilities available at the village level comprise of 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 6-10 PHCs come under a CHC (Community Health Centre), which caters to a population of 1 lakh plus, and also provides emergency services. The CHCs in turn report to the public hospitals at the district level.

There are no Community Health Centres (CHC) in the study area. There is only 1 Primary Health Centre (PHC) in Dedasari village. There are 3 Primary Health Sub Centres – one each in villages there are no Maternity and child Welfare centres or TB clinics in the study area.

It was reported during the discussion that except for provision of Ambulance in the village to facilitate commutation of women to Government hospital at the time of delivery, there is no ambulance for local community during an emergency. This is a major issue for economically weaker groups such as BPL and landless households. As the commute to the nearest government hospital is costly in the absence of public transportation.

The common health problems in the area include Mal, Jaundice, Pneumonia, Diarrhoea, Headaches, and Common fever.

4.4.4 Gender based vulnerability

The society in the project area is characterised by a patriarchal family structure. Women continue to be rooted in traditional norms of social behaviour which include *Purdaah* system, early marriages and child marriage, minimal participation in household or economic decision making, lesser economic freedom and limited opportunity to socialize with other females in the village. The market relations, trade or sale aspects are mostly managed by the male members of the family.

Table 4.15 Village-wise Female Literacy Rates

	Village Name	Female
	Literates (in %)	Illiterates (in %)
Dedasari	31	92
Khakori	26	96
Durjani	37	98
Total	25	93

Source: Primary Census Abstract, Census of India 2011

4.4.4.1 Literacy and economic condition of women

The average literacy rate in the study villages is 50%. As can be seen from table above, percentage of female literacy is even lower across all villages in study area. It was reported that there is high dropout rate amongst girls. One of the most common reason for the high dropout rate on the area is the low age of marriage in the community. These factors have also resulted in a difference between the female and male literacy levels.

Based on the FGD's held during the field visit, the division of work among genders follow the age-old tradition. In a typical household, the head of the household is the eldest male members, while the decision making authority is shared between him and adult sons. While men are mostly responsible for ensuring the financial security of the family, the women mostly undertake household activities such as cooking, cleaning, taking care of the children and elders etc.

As per the discussion held with surveyed households and groups, majority of the women are not engaged in economic activities. The productive roles of women however vary across caste and religious groups in the study area. The women of Rajput families are generally confined to their houses and carry out household chores like cooking, animal husbandry (does not include grazing) and working on their own agricultural fields, at the most. Out of the total who are working, the women belonging to the lower social strata take up jobs as construction and agricultural labourers in nearby areas, driven by their weak economic status. It was reported during community consultations, that women are paid lesser wages than their male counterparts for the same nature, amount and duration

of work. The common reason reported for the disparity was the perceived lesser efficiency of women by the contractors.

The Rajput are a part of the affluent group with larger land-holding, while the SC population is among the poor/backward groups with relatively low landholdings.

4.5 Ecology and Biodiversity Baseline

An ecological survey was undertaken during third week of February 2019 at the Solar Power Project Site of and surrounding areas located in Bap tehsil, Jodhpur district, Rajasthan. 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.

4.5.1 Objective

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.

4.5.2 Approach and Methodology

4.5.2.1 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 (Project site location, vital installations) was also considered during desktop review process.

4.5.2.2 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.

4.5.2.3 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

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 [(13)]. 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.

(13) Knutson et. al. 2004. Agricultural ponds support amphibian populations. Ecological Applications. 14 (3): 669-684

Reptiles

Reptile presence was determined through the use of Intensive Time Constrained Search Methods (14) (15). 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 clumps of higher vegetation during the hottest parts of the day. Binoculars and standard field guides (16) 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 (17) (18).

4.5.3 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 Jully 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

4.5.3.1 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.

(14) 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.

(15) 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.

(16) Grimmet, R. Inskipp, C. and Inskipp, T. 2013. Birds of the Indian Subcontinent - Second Edition. Published by Christopher Helm, 49-51 Bedford Square, London.

(17) Prater, S.H. 2005. The Book of Indian Animals. Bombay Natural History Society and Oxford University Press - 12th Edition. pp 316

(18) Menon, V. 2003. A field guide to Indian Mammals. Dorling Kindersley (India) Ltd. New Delhi, 201 p

4.5.3.2 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.

4.5.3.3 Aquatic Habitat

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

Figure 4.11 Pics of Project site and study area

Sand Dunes with Natural Vegetation at the project site

Agricultural field adjacent to the proposed project site

Source: ERM Site Visit

4.5.4 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

4.5.4.1 Amphibians

No Amphibian was recorded during the course of the survey.

4.5.4.2 Reptiles

Though only few reptilian species were recorded during the course of survey, tracks on loose sand provide evidence of high reptilian diversity in the study area. Reptiles recorded from the study area are provided below.

Table 4.16 Reptiles recorded from the study area

Sn	Common Name	Scientific name	Family	Source	WPA 1972 Schedule	IUCN Status
1..	Leith's Sand Snake	*Psammophis leithii*	Lamprophiidae	PS	-	-
2	Keeled rock gecko	*Cyrtopodion scabrum*	Gekkonidae	PS	-	LC

Figure 4.12 Reptiles Recorded from Study Area

Leith's Sand Snake (*Psammophis leithii)*

Keeled rock gecko (*Cyrtopodion scabrum)*

Source: Primary Data Survey

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

4.5.4.3 Avifauna

A total of 24 bird species were recorded in the study area. Four species, the Short toed Snake Eagle (*Circaetus gallicus),* Long-legged buzzard (*Buteo rufinus),* Common Kestrel (*Falco tinnunculus)* and Indian peafowl (*Pavo cristatus)* 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.

Six migratory species were recorded viz. Long-legged buzzard, Common Kestrel, Common stonechat (*Saxicola torquatus),* Variable Wheatear (*Oenanthe picata),* lesser whitethroat (*Sylvia curruca)* and Demoiselle crane (*Grus virgo).* 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 9 km North West of the proposed study area.

No vultures were recorded during the survey period. And consultation with local people revealed that Vultures (locally known as "Gidh") are very rare and hardly ever seen. During survey period few cow carcass were identified and monitored regularly, but vultures were never recorded.

In 2014 Forest Department of Rajasthan along with Wildlife Institute of India, conducted survey [19] 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 4.17 Avian Species observed from the study area

SN	Common Name	Scientific Name	Family	Migratory Status	Habitats	IUCN (Version 2019-1)	WPA, 1972

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

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
4	Common Kestrel	*Falco tinnunculus*	Accipitridae	M	T	LC	I
5	Red-naped ibis	*Pseudibis papillosa*	Threskiornithidae	R	A/T	LC	IV
6	Indian peafowl	*Pavo cristatus*	Phasianidae	R	T	LC	I
7	Demoiselle crane	*Grus virgo*	Gruidae	M	T/A	LC	IV
8	Eurasian Collared Dove	*Streptopelia decaocto*	Columbidae	R	T	LC	IV
9	Green Bee-eater	*Merops orientalis*	Meropidae	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
24	Grey Francolin	*Francolinus pondicerianus*	Phasianidae	R	T	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 4.13 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

4.5.4.4 Mammals

Total eight mammals can be found in the study area. Out of eight species four were directly recorded during primary survey.

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

Out of these eight species, three are Schedule I species, viz. Chinkara/ Indian gazelle (*Gazella bennettii),* Indian Wolf (*Canis lupus pallipes)* and Desert Fox (*Vulpes bengalensis).* Chinkara was recorded about 15km north from the study area but secondary information [(20)] as well as consultation with local people confirmed presence of these species in the study area. All these species prefer open desert and scrub habitat, such habitats are abundant within the study area as well as in adjacent area. Local people also informed that Chinkara as well as Nilgai (*Boselaphus tragocamelus)* occasionally raids agricultural fields.

Apart from these schedule species other species recorded from desert scrubs are Indian Desert Gerbil (*Meriones hurrianae*) and Grey Mongoose (*Herpestes edwardsii*). Northern Plain grey Langur (*Semnopithecus entellus*) was recorded sitting on a transmission line pole, locate about 3.5km North West of the project site.

Table 4.18 Mammals reported from the study area

S. No	Common Name	Scientific Name	Source	WPA Schedule	IUCN Status
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

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

Figure 4.14 Mammals Recorded

Chinkara/ Indian gazelle

Grey Mongoose

Indian Desert Gerbil

Northern plains gray langur

4.5.5 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.

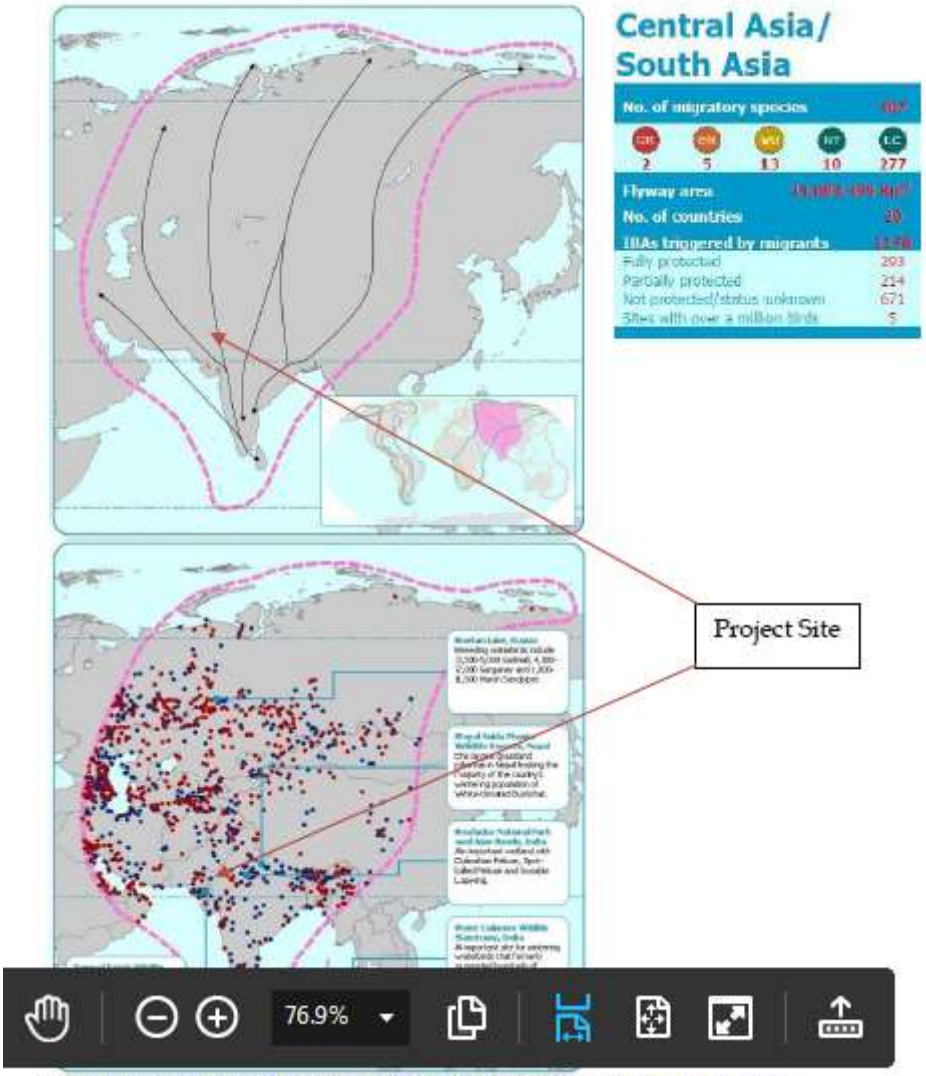
4.5.6 Migratory Route

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 six migratory species were recorded viz. Long-legged buzzard, Common Kestrel, Common stonechat (*Saxicola torquatus),* Variable Wheatear (*Oenanthe picata),* Lesser whitethroat (*Sylvia curruca)* and Demoiselle crane (*Grus virgo).*

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 9 km north west of the proposed study area

Figure 4.15 Project Area With respect to Migratory Flyway



http://datazone.birdlife.org/userfiles/file/sowb/flyways/7_Central_Asia_Factsheet.pdf

5. STAKEHOLDER ENGAGEMENT

This section provides the stakeholder identification and analysis as well as a brief understanding of the engagement process for the project.

Who is a Stakeholder?

"*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 Analysis" is understood as the process of identifying the individuals or groups that are likely to affect or be affected by a proposed project, and sorting them according to their impact on the project and the impact the project will have on them. This information is then used to assess the manner in which the interests of the stakeholders should be addressed in the project plan, policy, program, or other action.

The importance of such an analysis lies in the role played by this understanding in the assessment of the socio-political environment surrounding the project. It allows for the:

- Identification of key stakeholders, their primary groupings and sub groupings;
- Identification of the interests, concerns and potential risks surrounding the stakeholders, as well as conflicts of interests (if any);
- Identification of relations between stakeholders that may enable "coalitions" of project sponsorship, ownership and co-operation as well as the mechanisms which may have a role in influencing other stakeholders;
- Key groups/ individuals to be pin pointed who need to be informed about the project;
- Identifying stakeholders (those who are likely to have an adverse impact on the project) and taking appropriate measures to combat their influence;
- Identification of the impact and influence of the project on the stakeholders and of the stakeholders on the project;
- Generation of information essential to the planning, implementation and monitoring of the project; and;
- Development of a framework for participatory planning and implementation of various project activities.

5.1 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 5.1 Overview of Disclosure and stakeholder consultation requirement

Institution/ Regulatory Body	Reference Regulation/ Standard	Requirements

IFC	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. ■ 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.

5.2 Stakeholder Characterisation and Identification

A stakeholder is "a person, group, or organization that has a direct or indirect stake in a project/organization because it can affect or be affected by the Project/organization's actions, objectives, and policies". 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 the table given below.

Table 5.2 Stakeholder Group Categorisation

Stakeholder Groups	Primary Stakeholders	Secondary Stakeholders
Community	■ Land Sellers ■ Land aggregator, Developer and Contractors ■ Local Labourers	■ Local community ■ Vulnerable Communities ■
Institutional Stakeholders	■ Gram Panchayats	■ Civil Society/ Local NGOs
Government Bodies	■ Regulatory Authorities; ■ District /Tehsil Administration	■
Other Groups	■ Employees ■ Contractual Labourers	■ Other Projects in the area

Table below showcases the list of stakeholders consulted during ERM site visit.

Table 5.3 Stakeholder Consulted

Date	Stakeholder Details	Points discussed
12.03.2019	Consultation with 5 Land sellers in Dedasari village and Sarpanch of Dedasari village.	Dependence on land prior to acquisition and information about market rate (District Collector Rate information), use of compensation amount, reason for selling, present economic profile, expectations and concerns.
12.03.2019	Consultation with Land aggregator- Mr Naveen Mahipal (of M/s Solar Solution hub)	Understand the land procurement process, finalisation of land rate for this project.
13.03.2019	Focused group discussion with Women in Noore Ki Bhoorj	General village profile (Demographic & economic profile social and physical infrastructure), expectation from any new development/solar project in general, changes after construction of few solar parks/plant in the nearby area and concerns regarding the same.
13.03.2019	Focused group discussion in Baroo Village	Same as above
13.03.2019	Consultation with Land Team of CSPPL	Understand the land procurement process and role of CSPPL during the same.
16.10.2019 and 17.10.2019	FGDs and households level discussion with Women headed households, BPL groups and landless	Understand the demographic, economic, education profile of the vulnerable groups.
17.10.2019	Consultation with NGOs such as Foundation for Education and Development (FED) (Doosra Dashak project)	To understand the areas of intervention in the study area.

18.09.2019	Consultation with NGOs such as Gram Vikas Seva Sansthan.	To understand the areas of intervention in the study area.

Source: ERM Site Visit

5.2.1 Stakeholder Mapping

Stakeholder mapping" is a process of examining the relative influence that different individuals and groups have over a project as well as the influence of the project over them. The purpose of a stakeholder mapping is to:

- Identify each stakeholder group;
- Study their profile and the nature of the stakes;
- Understand each group's specific issues, concerns as well as expectations from the project
- Gauge their influence on the Project;

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 a 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 and proximity 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 in a scale of low, medium and high. The overall significance of the stakeholder group is assessed as per the matrix provided in Table below.

Table 5.4 Stakeholder Significance and Engagement Requirement

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

5.3 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 5.5 Stakeholder Analysis

Stakeholder Category	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 Stakeholder	Land sellers	■ Please refer to **section 2.4.1** for the land seller profile	■ Constituting the most critical stakeholder group, landowners who will sell land for the project were observed to be aware of land procurement process as few solar parks have been set up in the area for over 5-10 years. However, none of the land owners consulted have sold their land to other developers nearby. ■ The consultations with 5 land owners revealed that the land was sold for more than INR 400,000 per acre to the land aggregator. The details regarding the market price is discussed in **section 2.4.1.** ■ It was understood during consultations that the farmers are willing to sell	■ The stakeholder groups' influence on the project pertains to the smooth functioning of the project and the timely completion of the project activities.	■ The major concern of the stakeholder group till now is related to availability of employment opportunities that the project will generate.	High

			their land due to the low productivity of the agricultural land, dependency on monsoons and lack of irrigation facilities. The land sellers who were consulted informed that the compensation received after selling their land was reinvested into purchase of fertile land in other nearby villages. Selling land is therefore also considered as an option of liquidating their assets.			
	Land aggregator	■ CSP Jodhpur has engaged a land aggregator (Mr Naveen of M/s Solar Solution hub) for land procurement from local community. Please refer to **section 2.4.1** description of land procurement process by the land aggregator.	■ Hassle-free procurement of the identified plots of land for the project;	■ Non-compliance to the legal requirements; ■ Not meeting the community expectations; and ■ Leaving behind a legacy of conflict ridden relationship with local communities	■ The land aggregator will play the most important role at the current stage of the project and construction phase for timely commissioning of the project, fair and transparent procurement of the private land and within the stipulated budgetary provisions.	Medium

	Local Labourers	■ The area has adequate availability of unskilled workers, as considerable section of the working population of the study area (54%) is engaged in casual labourers working in house construction and repairing work. ■ As the project is in planning stage and local community was not consulted about this project. It is envisaged that the employment opportunities generated during the construction period will attract local workers.	■ As the project is in pre-construction phase, total number of unskilled, skilled workers required are not available. ■ However, once the information regarding the project reaches the local community, the local wage earners will have high expectations for employment in the project.	■ Any labour unrest and protests may cause delays in construction schedule and create a non-congenial social atmosphere; consequently, delay in construction activities will have financial implications on the project. ■ However, no such incidents have been reported by the community in the nearby area till now.	■ 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; and - Holidays and leaves as per labour laws applicable etc.	Medium
	Gram Panchayats (GPs)	■ Dedasari and Noore Ki Bhoorj Gram Panchayat is the lowest levels of local governance and consists of Dedasari and Baroo	■ The Gram panchayat might expect positive impact from the project in the following manner: - Generation of employment	■ Most of the rural development schemes and funds for central schemes are channelled through this body of	■ No consultations were held with Noore ki Bhoorj gram Panchayat. Consultation held with Sarpanch of Dedasari village expressed the	Medium

		village and Noore Ki Bhoorj respectively. This stakeholder group comprises of the Panchayat and its members which govern the villages in the study area	opportunities at the local level - Adequacy of the community development initiatives to be undertaken by the project - Timely and adequate disclosure of information throughout the life of the project	governance. Also, it is the Panchayats who are bestowed with the decision making authority for economic development and social justice. They also play a key role in the opinion formulation towards the project. Even though solar projects do not require legal NOC from gram panchayat. (As per the guidelines by Rajasthan Renewable Energy Corporation Ltd). However, in order for the smooth and proper functioning of the project, the consent of the Panchayat is imperative.	following expectations: - Preference in employment opportunities for locals - Involvement in the formulation of the community development activities (construction of toilets through CSR activity being one) and their implementation - Timely disclosure of information through the life of the project	
	Regulatory Authorities	■ This stakeholder group comprise of the central, state	■ The influence of the project on this stakeholder group	■ The failure of the project to comply with the various	The sole expectation of the Regulatory Authorities from the project Proponents will be abidance to all	Low

		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 primary regulator for renewable energy projects in Rajasthan are: - Rajasthan Renewable Energy Corporation Limited (RRECL) - IREDA at national level - Rajasthan State Pollution Control Board	pertains to the role the project will play in the development of solar energy in Rajasthan. ■ The project should comply with applicable regulatory framework comprising of the guidelines and policies of the State Government such as the Rajasthan Solar Energy Policy 2014.	rules and regulations applicable is instrumental for the timely implementation of the project	applicable guidelines, policies and laws.	

		- Rajasthan Rajya Vidyut Prasaran Nigam Limited				
	Employees	■ This stakeholder group comprises of the regular employees of CSP Jodhpur who are to be involved in the various stages of the project	■ The expectations of this stakeholder group in regards to the project pertain to the following: - Job security - Safe working conditions - Provision of rewards and recognitions for good performances and safe behaviour - Proper work-life balance - Ethical and professional conduct - Employee engagement within & after working hours - Regular updating of rules and regulations	■ The influence of these stakeholders pertains to the roles played by them in the overall smooth functioning of the project operations as well as the brand value. ■ They will also serve an extremely important role in the maintenance and improvement of services and facilities.	■ The primary concern of the stakeholder group will pertains to the role of the project in ensuring continued economic opportunities and work generation	High

			- Facilitation and maintenance of everyday convenience in regards to facilities such as transport, seating, food, accommodation etc			
	Contractual Labourers	■ This stakeholder group comprises of those workers who are to be engaged in the project on a contractual basis through the different phases of project life. ■ These labourers will be primarily semi-skilled and unskilled workers. As reported by CSP Jodhpur team will be sourced from the local community	■ These stakeholder group's influence on the project pertains to their role in the smooth functioning of the project and the opinion formation towards the project.	■ The primary concern of the stakeholder group pertaining to the project will be as following: - the role of the project in continued economic opportunity, work generation and a source of income	■ The main expectations from the project will be: - timely settlement of dues and payments in keeping with the legal requirements - continued work opportunities - safety at work	Medium
	District/Tehsil Administration	■ The project area is administered at three levels by different Government Bodies: at the	■ The primary concern of the stakeholder group can be: - project's compliance towards	■ These authorities not only serve as important points of contact for villagers or other party wanting to	■ The main expectations of the stakeholders from the project might be: - Compliance with the regulatory	Low

		district level, at the block/tehsil level and at the Panchayat level in each village/or cluster of villages; ■ In this context, local administration refers to the district level and block level administration comprising of the offices of the Tehsildaar, District Magistrate Collectors, and Revenue officer etc.; and ■ The sub-registrar of the revenue department is responsible for registration of sale of land, land mutation, updating of records of transfer of land.	the regulatory requirement - role played by the project in the development of the area	liaise with higher authorities but are also critical in obtaining permissions and support for the various project activities	requirements and legal provisions specific to the project - Timely disclosure of information pertaining to the project activities - Involvement in the formulation and implementation of the community development activities throughout the life of the project	
Secondary Stakeholders	Local Community	■ The stakeholder group comprising of local communities around a radius of 5 kms inhabit the	■ Though a number of other solar power projects already exist in the area, the project can play a critical role in the	■ Although, there were no reports regarding disruption of any projects due to the	■ The local community, where ERM had undertaken consultations (Noore Ki Bhoorj, Dedasari	Low

		villages of Khakori, Dedasari and Durjani. ■ The study area comprises of Marwari Hindus and Muslims and less than 5 % of ST population such as Bhil and Megwar. ■ The community in the study area is primarily dependent on wage labour such as construction work and farming.	development of the community through economic opportunities and CSR projects.	local community, the local community's support of the project and its activities is extremely crucial to ensure smooth functioning of the project and meeting of the timelines for the project. ■	and Baroo) are not aware of the present proposed project and were not informed about the same by CSP Jodhpur, as the project is still in planning stage. However, a general community consultations regarding the development projects (including upcoming and current solar projects in the area) revealed the following expectations: - 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 and if there is any influx of migrant workers (CSP Jodhpur team has informed that no temporary labour camps will be constructed and local unskilled and semi-skilled labourers will be hired)	
	Vulnerable Groups such as women headed households, BPL and Landless households	■ This stakeholder group includes women headed household, BPL household and landless. These subdivisions are on the basis of	■ In view of the poor social and economic conditions of the Vulnerable Communities, the project Proponent may have to provide engagement avenues for the group.	■ The influence of this stakeholder group in regards to the project pertains to the smooth functioning of the project and the opinion formation	■ The primary expectations of this stakeholder group from the project pertain to the following: - Appropriate community	Low

		the understanding of the possibility of differentiated impacts on the community on the basis of the economic and social status in the society.		of the same. While due to the position of this group in the community, the level of influence towards the project is limited, the project can disproportionately influence this group.	development activities in keeping with the needs of the community - Compensation for the land purchased due to the project at market rates (It was confirmed by the CSP Jodhpur team and land aggregator that no land is/will be purchased from ST. However, it cannot be ascertain if any land has been purchased from any women headed household and BPL families). - Involvement in the formulation of the community development activities and their implementation	

					- Timely disclosure of information through the life of the project	
	Civil Society/Local NGOs	■ Not only local NGOs but NGO's based out of Delhi act as a social watchdog in matters relating to securing the livelihoods of rural communities along with their related socio-cultural facets ; ■ However, the number of such NGOs active in the study area is highly limited. No report regarding NGO's filing complaints against projects have been reported.	■ With respect to contributing towards the cause of local development, the project proponent can either participate in the ongoing developmental activities of the Government or might take up interventions on its own or through partnerships with NGOs and CBOs after obtaining prior approval from competent authorities. ■	■ The opinion of the NGOs and Civil Society Groups towards a project is determined largely by whether the impacts of setting up of the development venture is being viewed/ perceived in positive light by the local population with special reference to the vulnerable communities or not. ■ The key concerns of this stakeholder group centres around justice and equal opportunities in matters of economic and social development being provided to	■ The NGOs and Civil Society Groups often play a critical role in bringing to the limelight the issues of vulnerable communities in the society; and ■ They can also play a major role in community mobilization, building trust and even participate in implementing CSR initiatives.	Low

				the Vulnerable Communities.		
	Other Projects in the area	■ The Tehsil Bap is characterised by a number of solar power projects, initiated as part of the Jawaharlal Nehru National Solar Mission Bhadla Solar Park (Approximately 5-10 km North); 23 MW Solar Power Plant owned by Waaree Energies Limited (WEL) and Maharashtra Seamless Limited (MSL) (Approximately 4 km South); 20 MW Solar Power Plant owned by Northern Solaire Prakash Private Limited (NSPPL) (Approximately 7 km South);10 MW Solar Power Plant owned by Sauryauday Solaire Prakash Private	■ The influence of the stakeholder group is likely to be extremely limited due to the nature of interaction likely to exist amongst the industries and the project		■ The main concerns of the stakeholders towards the project pertain to the influence of the project on the community's perception towards solar power projects in the area and their relations with the same.	Low

		Limited (SSPPL) (Approximately 4 km Southwest)			

***Note**: It is significant to note that the stakeholder analysis is based on the current situation. The stakeholder influence on the project is dynamic and may change during the project life. Consequently, the stakeholder analysis needs periodical reassessment and updating.*

5.3.1 Key feedback received during stakeholder consultation process

The key concerns and expectations that were raised during the stakeholder consultation process have been summarised below:

- **Key feedback received from local community of Dedasari, Noore ki Bhoorj and Baroo village regarding solar plants in Bap tehsil :** It was informed during the consultation with the community that there is a drastic shift from agriculture based economy to non-agriculture based economy due to lack of irrigation facilities and decline in crop yield. There was a positive outlook towards the solar projects in the area. Although Bap tehsil has witnessed development of various solar projects in the past 5-10 years, the community desired more such projects in the vicinity. They expect to receive benefits from the project in terms of employment and development of infrastructure and the overall community. In addition they also demanded preference to the local community in contractor and employment opportunities from the project.
- **Key feedback received from 5 land sellers who were consulted during the ERM site visit:** It was informed that the sellers are willing to sell their land due to the low productivity of the agricultural land, dependency on monsoons and lack of irrigation facilities. The compensation received after selling their land was reinvested into purchase of fertile land in other nearby villages at a lower price (Baroo village, bap tehsil). Remaining money is also considered as an option of liquidating their assets. The major concern of the stakeholder group till now is related to availability of employment opportunities that the project will generate.
- **Community Development activities**: The local communities were of the opinion that apart from the economic opportunities, the local community should also benefit from the project in terms of community development activities. Some of the key areas for development activities identified included medical infrastructure, access to middle and higher schools, separate schools for girls and trainings for youth and women within the village. This can be done by collaborating with local NGOs working on these areas.
- This can be done by collaborating with local NGOs working on these areas such as Foundation for Education and Development (FED) (Doosra Dashak project), Gram Vikas Seva Sansthan. The organisations are working with women groups by forming micro finance groups and working on life skill training.

The summary of overall stakeholder influence is presented below.

Table 5.6 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	Land Sellers	High	High	High
	Employees	High	High	High
	Developer and Contractors	Medium	Medium	Medium
	Contractual Labourers	Medium	Medium	Medium
	Local Labourers	Negligible	Medium	Medium
	Gram Panchayats	Medium	Negligible	Medium
	Regulatory Authorities	Negligible	Negligible	Low
	District/Tehsil Administration	Negligible	Negligible	Low
		Negligible	Negligible	Low
Secondary Stakeholders	Local Community	Negligible	Negligible	Low
	Vulnerable Communities	Negligible	Negligible	Low
	Civil Society/Local NGOs	Negligible	Negligible	Low
	Other Projects in the area	Negligible	Negligible	Low

6. IMPACT ASSESSMENT AND MITIGATION MEASURES

6.1 Introduction

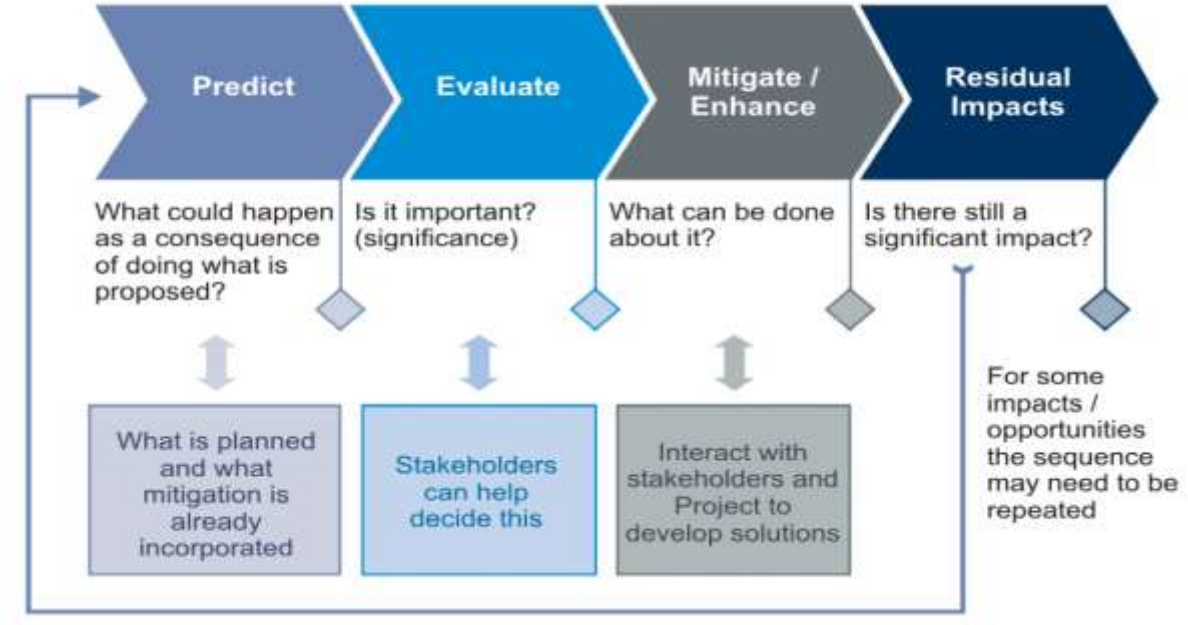
This section assesses the manner in which the Project will interact with elements of the physical, ecological or social environment to produce impacts to resources/ receptors. It has been organized as per the operational and decommissioning phases of the project life cycle to understand the risks and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

6.2 Impact 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 6.1** and comprises of the following:

- **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 6.1 Impact Assessment Process



Source: ERM India

6.2.1 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.

6.2.2 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 as shown in **Table 6.1**.

Table 6.1 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 6.2**. Definitions for the other designations are resource/receptor-specific.

Table 6.2 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 the table below.

Table 6.3 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 6.2** Impact Significance.

Figure 6.2 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 6.1** provides a context of what the various impact significance ratings imply.

Box 6.1 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).

An activity – impact interaction matrix for construction and operation phases of the Project is presented in Error! Reference source not found., which has been further used to assess the impact significance at activity levels on environmental, ecological and social resources.

6.2.3 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).

6.2.4 Management and Monitoring

The final stage in the IA Process is 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 7** under Environmental and Social Management Plan (ESMP).

6.3 Impact Assessment Criteria

For the purpose of this assessment the following sections define the criteria against which the impacts associated with the 250 MW proposed project have been assessed. The impact assessment criteria are general criteria and not specifically associated with the project. Interactions that are likely to lead to significant impacts, as identified during the scoping exercise and baseline conditions (**Section 4**) are presented in **Table 6.4**.

Table 6.4 Interactions identified that are likely to result in significant impacts

Resource/Receptor	Potentially Significant Impacts
Land Use	■ Permanent changes in land use due to installation of PV Modules, Central Monitoring Station, Switching Yard, access roads. ■ Temporary changes in land use due to temporary site office and material storage yard.
Topography and drainage	■ Alteration of topography and micro drainage channel due to construction of project site approach road.
Soil Environment	■ Decrease of soil quality due to loss of vegetation cover; ■ Soil erosion during monsoon season and windy periods;

	■ Sedimentation into nearby water bodies due to soil erosion and run-off; ■ 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; and ■ Impact on soil and land environment due to improper management of domestic solid waste generated.
Ambient Air Quality	■ Fugitive dust emissions due to movement of machinery and vehicles; ■ Fugitive emission due to operation of pile drivers; and ■ Air emissions due to operations of DG sets and machinery.
Water Environment	■ Usage of ground water for construction activities and cleaning of PV modules; ■ 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.
Ambient Noise Quality	■ Noise generation due to movement of vehicles and machineries; ■ Noise generation due to operation of pile drivers; and ■ Noise generation due to operation of DG set.
Occupational Health and Safety	■ Occupational health hazards due to dust and noise pollution; ■ Safety risk due to wrong handling of construction machinery, working at heights; and ■ Exposure of workers to electromagnetic field (EMF) while working in proximity to charged electric power lines during operation and maintenance.

6.3.1 Assessment Criteria for 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:

- Strengthening of access roads and construction of internal access roads;
- Strengthening of access roads and construction of internal access roads;
- Installation of PV modules;
- Construction of Central Monitoring Station, Switching Yard and
- Establishment and operation of temporary structures such as temporary site office (porta cabin) and store yard.

For the assessment of land use, the sensitivity and magnitude criteria outline in **Table 6.5** and **Table 6.6** have been used respectively.

Table 6.5 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 6.6 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.
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.

6.3.2 Assessment Criteria for 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 6.7** and **Table 6.8** respectively.

Table 6.7 Sensitivity Assessment Criteria for Topography

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

Table 6.8 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.
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.

6.3.3 Assessment Criteria for Impact on Soil Environment

6.3.3.1 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;
- Vegetarian 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.

Operation and Maintenance 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 as outlines in **Table 6.9** and **Table 6.10** respectively.

Table 6.9 Sensitivity Assessment Criteria for Soil Quality (compaction, erosion and contamination)

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 6.10 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 standards	Well within standards	Exceeds Target Value but well within Interventional Value	Exceeds Interventional Value and needs intervention.

6.3.4 Assessment Criteria for 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.

For the assessment of water quality, the sensitivity criteria and magnitude criteria are outlined in **Table 6.11** and **Table 6.12** respectively have been used.

Table 6.11 Sensitivity Assessment Criteria for Water Resources (Surface water and Ground water)

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	The surface water resources are wholly relied upon locally, with no suitable

	biologically unique aquatic species or provides essential habitat for such species.	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 6.12 Criteria for Impact Magnitude for Assessment of Impact to Surface and Groundwater 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)

	There is likely to be negligible or no abstraction, use of or discharge to the groundwater by the Project at any time.	The Project will consume groundwater or deliver discharge to groundwater, but the amounts abstracted / discharged 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 groundwater or discharge to groundwater, and the amounts abstracted / discharged 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 groundwater or discharge to groundwater, and the amounts abstracted / discharged are likely to be very significant in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation).

6.3.5 Assessment Criteria for 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.

The sensitivity criteria and impact magnitude criteria has been provided in **Table 6.13** and **Table 6.14** respectively.

Table 6.13 Sensitivity criteria for air quality

Sensitivity Criteria	Contributing Criteria	
	Human Receptors	***Ecological Receptors***
Low	Locations where human exposure is transient.[121]	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 6.14 Criteria for Impact Magnitude for Assessment of Impact to Air Quality

Magnitude Criteria	Negligible	Small	Medium	Large

[21] 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.

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.

6.3.6 Assessment Criteria for Impact on Ambient Noise

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, access road widening, construction of ancillary facilities;
- Transportation of construction materials, machinery and personnel;
- Operation of DG sets; and
- Demolition activities during decommissioning phase.

The ambient noise levels have been assessed with respect to Noise Pollution (Regulation and Control) Rules, 2000 and WHO Guidelines as shown in **Table 6.15** and **Table 6.16** respectively.

Table 6.15 Ambient noise quality standards

Area Code	Category of Area	Limits in dB(A) L_{eq}*	
		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 6.16 Noise emission criteria

Location	Noise Level Limit (dB(A)	
	Daytime (0700 – 2200 hrs)	Night-time (2200 – 0700 hrs)
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 and criteria for impact magnitude for assessment of impact to ambient noise.

Table 6.17 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 6.18 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)

6.3.7 Assessment Criteria for Socio-economic Impacts

For the assessment of social impacts, the sensitivity and magnitude criteria outlined in **Table 6.19** and **Table 6.20** respectively have been used.

The social impacts associated with the operations and decommissioning stages have been assessed qualitatively and in some cases quantitatively (subject to availability of data), using professional judgement and based on past experience from similar projects.

Table 6.19 Impact Magnitude for Local Communities

Category	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 6.20 Receptor Sensitivity for Local Communities

Category	Extent / Duration / Scale / Frequency
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.

On the basis of this understanding of magnitude and sensitivity, the significance of impacts will be assessed, as depicted in the table below.

Table 6.21 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

6.3.8 Assessment Criteria for Ecological Impacts

Interactions that are likely to lead to significant impacts on ecology and biodiversity in the study area are listed in the following table and will be focus of the impact assessment.

Table 6.22 Identified interactions that are likely to result in significant impacts

S. No	Potential Impacts	Causes for Impacts
1.	Clearance of vegetation for construction of access roads, ancillary facilities	• Loss of scrub habitat that may be used by species spilling over from the forest habitats located northeast and northwest of the site; and • Loss of foraging resources, shelter and shade for resident fauna.

S. No	Potential Impacts	Causes for Impacts
2.	Electrocution risk from increase transmission line laying in the region	• Roosting on solar panels places avifauna in close proximity to wiring and other electrical components of the solar module.
3.	Disturbance and displacement of species due to noise, light, anthropogenic movement and traffic	• Increased movement of people and vehicles can increase the stress levels of fauna that causes them to spend an increased amount of time in alert mode instead of foraging, nesting, socializing or mating; and • Noise, light and uncovered waste can attract or repel fauna to or from the solar site.
4.	Mortality as a result of worker influx and increased hunting, trapping and poaching of wildlife	• The Project site is located near sensitive ecological areas and therefore an influx of workers to the area can result in increased human-wildlife conflicts.
5.	Loss of resources and barrier to movement	• Project compound has to be fenced off and therefore fauna cannot access the resources that were formerly located in the Project site; • The fenced project site acts as a barrier for animals to move along the large expanse of scrub land present at the Project site; • Solar panels mimic the reflection of water bodies that may attract avifauna that could collide with the panels; • Heat related issues on roosting avifauna that could be impacted by the reflection of the panels onto their bodies; and • Steel components of solar modules can injure faunal species that have wandered into the Project compound.

6.3.9 Key Ecological Impacts

6.3.9.1 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 tables below.

Table 6.23 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**

Habitat Sensitivity/ Value		Magnitude of Effect on Baseline Habitats			
		Negligible	Small	Medium	Large
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 6.24 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**

6.4 Impact Assessment – Construction Phase

6.4.1 Change in Land Use

6.4.1.1 Impacts

The study area consists of private agricultural land with patches of open scrubland and stony waste. The external transmission line developed by M/s. Tata Power has been constructed and consists of 13 poles. The internal transmission lines will be developed by HFE. As per the tentative route shared by HFE, the internal transmission line is located on agricultural land and passes through a hamlet of Khakori village. The land procured for the project site was used for cultivation and comprises fallow and current fallow[22]. There is no major dependency for grazing on the land procured for the project. Thus, receptor sensitivity is assessed as **medium.**

During consultation, it was learnt that the cultivable land did not belong to marginal farmers. The establishment of the solar plant will convert cultivable land to industrial use for long term (25 years). Changes in land use are also envisaged for material store yard and temporary site office (porta cabin). However, those changes in land use will take place only during construction period (6 months). Further, the project will require to develop an existing road which will be used as the main access road to the project site. Thus, magnitude of the impact has been assessed to be **medium**.

6.4.1.2 Embedded/in-built controls

The actual area of land use impact would be limited to the footprint of 1306 acres of private agriculture land and immediate vicinity of the solar farm site. There will be additional land utilized for transmission line towers. After construction work, any land taken for a temporary basis for storage of material will be restored to their original form. Existing roads will be developed for access to the project site with the exception of a small connection from the main village road to the plant site.

6.4.1.3 Significance of Impact

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

6.4.1.4 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; and
- The land use in and around permanent project facilities should not be disturbed.

6.4.1.5 Residual Impact Significance

The residual impact significance will remain **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, switching yard).

Table 6.25 Changes in land use during construction and operation phases

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

22 This is the land which is left without cultivation for one or less than one agricultural year. Fallowing is a cultural practice adopted for giving the land rest. The land recoups the lost fertility through natural processes.

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**				

6.4.2 Impact on Topography and Drainage

6.4.2.1 Impacts

The project area exhibits flat topography with minor undulations. There are no water bodies that pass though the proposed project site. Typically solar power projects do not undertake levelling of topography and since the proposed project, along with the access road, is mostly on a flat terrain the receptor sensitivity has been assessed to be **low**.

Due to undulating topography, study area may exhibit presence of micro drainage channels. Though the solar power project does not require levelling of land, construction of access road for the project purpose could potentially alter topography but the chances of that are miniscule. Therefore, the impact magnitude has therefore been assessed as **small.**

6.4.2.2 Embedded/in-built control

The EPC contractor will be instructed to avoid any unnecessary changes in the topography.

6.4.2.3 Significance of Impact

Significance of impact is assessed to be **minor**.

6.4.2.4 Additional Mitigation Measures

No further mitigation measures are suggested as embedded/in-built control will be sufficient to reduce the impact on topography.

6.4.2.5 Residual Impact Significance

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

Table 6.26 Change in topography and drainage

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

6.4.3 Impact on Soil Environment

6.4.3.1 Soil Compaction and Erosion

Impacts

Soil compaction and erosion has been considered for the construction and decommissioning phases only. The receptor sensitivity has been assessed as **medium** because of the preponderance of agriculture as a source of livelihood in the area.

The site clearance, excavation for foundation and access road construction will largely affect the top layers of the soil. Loss of top soil quality would have an impact on the agricultural productivity of the land but the effects can be reversed over time. Further, site clearance will be restricted only in the project site. Agricultural land/scrub land close to the project site will not be disturbed.

Road quality in the region is moderate and therefore 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 therefore has been assessed to be **small.**

Embedded/in-built control

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. Furthermore, a new existing road will be constructed to facilitate with transport of project equipment and components.

Significance of Impact

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.

Residual Impact Significance

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

Table 6.27 Impact on Soil Environment (Compaction and Erosion)

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.**				

6.4.3.2 Waste Generation and Soil Contamination

Impacts

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. A small proportion of the waste generated during construction phase will be hazardous and will include waste fuel, grease and waste oil containing rags. Use 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. Therefore, the receptor sensitivity has been assessed as **medium.**

The impact magnitude has been assessed as **small** since the client has managed other solar power projects as well and has effective management systems for waste and hazardous substances being generated or utilized during the project life cycle as part of their Environmental and Social Management Framework.

Embedded/in-built control

Hazardous material and waste will 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.

Residual Impact Significance

The significance of impacts due to waste generation during the construction phase after implementation of mitigation measures has been considered as **negligible.**

Table 6.28 Impact on Soil Environment (Waste Generation and Soil Contamination)

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.**				

6.4.4 Impact on Water Environment

6.4.4.1 Impacts

The proposed project site falls in the safe category as specified in the CGWB report of Jodhpur district (2013). However, from community consultations it was understood that ground water in the region is present 600-800 feet below ground level and is difficult to abstract. Locals rely on ground water and canal water (Indira Sagar Canal) for agriculture and for their domestic/drinking needs. Upon consultation with the CSP Jodhpur Project team it was understood that water may be procured from the nearby borewells through water tanker suppliers during the construction phase, in case of non-allocation of water from the IGNP canal.

It is estimated that approximately 60 KLD of water would be required for civil works during construction stage and considering peak worker requirement of 400 workers, daily water requirement is estimated as 18 KLD.

The soil type of the area is red desertic soil and sandy soil. This type of soil usually has high percolation (measured in the range of 1 to 8 inches or more per hour) into the subsoil and subsequently the ground water. Therefore, the receptor sensitivity is assessed to be **medium**.

Furthermore, accidental spillage of chemical and fuel may easily contaminate the ground water. Therefore, the spillage of chemicals and fuel may cause measurable changes in the ground water quality during construction activities (i.e. 6 months).

Therefore the magnitude of impact on water quality and water quantity is assessed to be **medium**.

6.4.4.2 Embedded/in-built control

- Provision for impervious storage area, especially for fuel & lubricant, hazardous waste, etc. will be made onsite;

6.4.4.3 Significance of Impact

The overall impact significance is therefore assessed to be **moderate**.

6.4.4.4 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;
- Regularly monitor the ground water quality;
- Maintain logbook for water consumption;
- Adopt less water consuming module cleaning methods; and
- Prepare and implement water conservation scheme e.g., rainwater harvesting at the project site.

6.4.4.5 Residual Impact Significance

Residual impact significance has to be retained as **minor** upon application of additional mitigation measures.

Table 6.29 Impact on Water Environment

Impact	Water quality due to spillage of oil, hazardous waste (waste oil) and water resource due to requirement of water for construction phase from IGNP canal.				
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.**				

6.4.5 Impact on Air Quality

6.4.5.1 Impacts

Since the Project study area is characterised by presence of loose sandy soil and is prone to soil erosion, coupled with the fact that construction activities will involve increase in the number of vehicles entering the region, the receptor sensitivity is therefore **medium.**

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 vehicles, etc.
- Vehicular emissions due to increased traffic movement on site and on the approach roads;
- Exhaust emissions from construction machinery and other equipment such as pile drivers; and
- Emissions from diesel generators required to be run for construction power purposes.

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 **medium** because the soil type is largely sandy and the dust emissions will occur frequently.

6.4.5.2 Embedded/in-built control

- 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.

6.4.5.3 Significance of Impact

The impact significance for air quality in the construction phase is assessed as **moderate**. There will be some impacts due to plying of vehicles on the access roads which runs across settlement area.

6.4.5.4 Additional Mitigation Measures

- Speed of vehicles on site should be limited to 10-15 km/hr;
- Switch off machinery and equipment when not in use; and
- Prevent idling of vehicles and equipment.

6.4.5.5 Residual Impact Significance

The significance of residual impact will be **minor to moderate** after implementing mitigation measures.

Table 6.30 Impact on Air Quality (Construction Phase)

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

6.4.6 Impact on Ambient Noise

6.4.6.1 Impacts

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.

Settlements of Dedasari, Khakori and Durjani villages will most likely be affected by increasing noise levels because of proximity to the project site and construction of the proposed access road. The receptor sensitivity is therefore considered as **medium.**

Impact magnitude is considered to be **small to medium** considering the construction period of the project to last for approximately 6 months and proximity to the two villages**.**

6.4.6.2 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.

6.4.6.3 Significance of Impact

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

6.4.6.4 Additional 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.

6.4.6.5 Residual Impact Significance

Significance of residual impact is assessed to be **negligible to minor** taking into consideration above mentioned mitigation measures.

Table 6.31 Impact on Ambient Noise (Construction Phase)

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

6.4.7 Impact on Occupational Health and Safety

6.4.7.1 Impact

Working at height will be undertaken during erection of transmission line and stringing of wires. 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. The working at height has the risks of falling from the height and 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 (construction, operation and decommissioning stages) and therefore the impacts would be similar in nature.

6.4.7.2 Embedded/in-built control

- All construction activities will 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.

6.4.7.3 Significance of Impacts

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 erection of transmission line will be done through experienced and trained workers.

6.4.7.4 Additional mitigation measures

- All workers (regular and contracted) should be provided with training on Health and Safety management system of the EPC contractor during construction stage and company's EHS policies and procedures during the operation stage;
- Obtain and check safety method statements from contractors;
- Monitor health and safety performance and have an operating audit system; and
- 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.

6.4.7.5 Residual impact significance

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

Table 6.32 Impact on occupational health and safety (Construction Phase)

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
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.**				

6.4.8 Impact on Community Health and Safety

6.4.8.1 Impacts

The receptors for impacts on community health and safety include project site workers, settlements in the close proximity of the project site (within 1km and along the access road and transmission line (within 100 m from the centreline), which will be exposed to health impacts from the project activities.

The construction phase activities such as installation of solar PV panels, construction of transmission lines and substations and movement of material and personnel may result in impacts on the health and safety of the community. As mentioned earlier in the report, the internal transmission line will pass through a hamlet of Khakori village and will thus lead to significant impact on community health and safety during construction phase.

Construction activities will involve the use of heavy machinery and live transmission power lines. 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 failure of project infrastructure, life and fire safety, public accessibility and management of emergency situations. As per IFC EHS guidelines, the occupational and community health and safety hazards during the construction, operation, and decommissioning of solar power projects are generally similar to those of most large infrastructure projects.

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

6.4.8.2 Embedded/in-built control

Consultations with the CSP team and HFE HSE policy review 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;
- No hazardous waste or any waste be stored within the site for long periods of time and be in contact with the soil in order to prevent against ground water contamination
- The truck drivers carrying construction machinery and materials will be instructed to drive within speed limits with careful consideration for village traffic;
- Movement of heavy equipment and construction materials will be regulated during peak hours (09:00 AM to 06:00 PM).

6.4.8.3 Significance of Impact

The impact to community health and safety during the construction phase is evaluated to be of **minor to moderate significance** due to proximity of the internal TL line to a hamlet of Khakori village and project's proximity to Dedasari village. However, the significance of impact decreases because the Project site consists of low density of population and most of the unskilled labour will be engaged from the local habitation.

6.4.8.4 Additional Mitigation Measures

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

- Developing an onsite ESMS and EHS Policy by the developer;

- Ensuring that the sub-contractor agreements that the developer enters into require all contractors to possess an EHS plan with provisions for monitoring of the EHS performance of contractors and their workers; and
- 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.

6.4.8.5 Residual Impact Significance

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

Table 6.33 Impact on the 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	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 to Moderate**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Major
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Negligible to Minor**				

6.4.9 Landscape and Visual Impacts

6.4.9.1 Impacts

The project site is located on plain terrain with slight undulation. There will be a significant change to visual quality of the area resulting from development or change in land use that will alter the landscape. Changes in the visual landscape will range from construction phase to commissioning of the PV Modules and associated structures and further during operations. HFE solar power Project is not the first and only solar power Project in the vicinity of project area and the new development will have impact on the surrounding area.

The project area is primarily a rural area and with agriculture as a primary activity. Although the PV modules, inverter, Transformers and associated components would be manufactured off site and the construction phase would be relatively short-term in duration (less than 10 months), it would still require large number of equipment or infrastructure such as ground mounted structures, PV Modules, Transformers, Inverter, Transmission line towers the themselves when being erected as well as cranes, dumpers, transportation vehicles on site. Additionally, the presence of bare soil along the access roads would increase the potential visual impact. The significance of the visual impacts will reduce at increasing distance from the development.

Visual impacts will also arise due to the presence of project infrastructure such as labour camp, batching plant, construction material storage area, temporary site office and erection and commissioning of various Project components in the project footprints.

6.4.9.2 Significance of Impacts

The extent of the visual impacts will be localised. The overall impact significance change in visual landscape during construction phase is assessed as **moderate**.

6.4.9.3 Suggested mitigation measures

The following mitigation measures will have to be implemented to minimise potential visual impacts during the construction phase:

- The extent of the labour camp and storage area should be limited in area to only that which is essential;
- Minimize presence of ancillary structures on the site, avoid fencing, minimize roads disturbance; and
- After completion of construction work, areas utilized for labour camp, storage area to be restored to original form.

6.4.9.4 Residual impact significance

After implementation of mitigation measures, the significance of residual impacts will reduce to **minor**.

Table 6.34 Landscape and Visual Impacts (Construction Phase)

Impact	Landscape and Visual Impacts (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 **Moderate.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Major
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Minor.**				

6.4.10 Impact due to Land Holding and Agriculture Income

6.4.10.1 Impacts

The area identified for the project consists of 1306 acres of private agriculture land from Dedasari and Baroo villages, Bap Tehsil, Jodhpur District of Rajasthan. The land parcel is mostly surrounded by private agriculture land, with some patches of government land being located close to the southern boundary of the site. As reported by CSP Jodhpur land team and land aggregator, 1306 acres of

private land will be procured from estimated 150 land owners from Dedasari and Baroo villages. Out of this, 844.39 acres of land has already been procured. Consultations with 5 land owners revealed that the land was sold for more than INR 400,000 per acre to the land aggregator.

As reported by the consulted land sellers, land sold was only a fraction of their total land holdings. These farmers were willing to sell their land due to the low productivity of the agricultural land, dependency on monsoons and lack of irrigation facilities. The land sellers who were consulted informed that the compensation received after selling their land was reinvested into purchase of fertile land in other nearby villages. Selling land is therefore also considered as an option of liquidating their assets. However, the same cannot be ascertained for other land sellers and prospective sellers.

During the site visit it was observed that there are 3 kuccha structures (please refer **section 2.2.1 & 5.5.3.1** (settlement pattern)) on the procured and some of the identified land parcels. It was revealed during the consultation that out of the 3 structures, 2 belong to land sellers who were consulted by ERM and 1 prospective land seller, who has not yet sold his land. Land owners who have already sold their land for the project were also paid a lump sum amount for their structures.

Therefore, as per the discussion with CSP Jodhpur team and land sellers, the project does not involve physical displacement of titleholder. The sale of land is also not expected to have significant impact on the agricultural income of the land sellers as they are not solely dependent on the particular land parcel. Further, there were no encroachers or non-titleholders with recognizable usage rights on the procured land parcels, hence informal rights have not been impacted due to the project.

However it is to be noted that since process of procuring remaining 461.61 acres of land is still underway, presence of structures, details of informal users etc. is not available at this stage.

Dependence of local community on agriculture land

As reported during the consultation, due to lack of irrigation facilities and dependence on rainfall, considerable section of the working population, working as agricultural labourers in the study area has reduced. It was also reported that none of the land sellers consulted and the local community in the area practice sharecropping. Majority of the households are working as casual labourers. (See **section 5.5.3.3**). Therefore, sale of land, is not expected to have significant impact on the agriculture labourers.

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

6.4.10.2 Embedded/in-built control

- The developer is trying to ensure that it will not make the land sellers landless; and
- Additional employment opportunities may also be created for the local youth by the developer.

6.4.10.3 Significance of Impact

The overall impact significance of the land procured during the planning phase is assessed **as minor**.

6.4.10.4 Additional Mitigation Measures

Considering that the procurement of land will have only a minor implication on the economy of the sellers, the following additional measures may be recommended to minimise this impact:

- Providing skills-based training interventions, especially for self-employment to the young and unemployed in the families who will be selling land to project. This will enhance their employability and create potential for income generation through self-employment;
- Providing preference to members of the families who will be selling land to the project for livelihood opportunities in Construction phase;
- Procuring resources from the local sources so as to induce more employment in the supply chain.

6.4.10.5 Residual Impact Significance

After implementation of mitigation measures, the significance of residual impacts will be reduced to **negligible.**

Table 6.35 Land Holding and Agriculture Income

Impact	Land Holding and Agriculture Income				
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 habitation within the study area and land sellers.				
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.**				

6.4.11 Impact on Economy and Employment

6.4.11.1 Impacts

The average Work Participation Ratio (WPR) in the study villages is 55 %. The casual labourers are in a higher proportion than other workers and agriculture labour in the study area. The higher presence of casual labourers in most villages was also established during consultations. The labourers are mostly engaged in the construction of houses, roads etc. (See **section 4.4.3.3**). Though employment of unskilled and semi-skilled labour in the nearby solar parks have increased over the past couple of years, the scale of engagement being offered by the sector is limited to a few thousand local youth of the district. In absence of any major industrial activity in the study area, people in several villages have already resorted to entering into petty trades or have started migrating to other places in search of work.

The local community is likely to benefit from the economic opportunities to be created from the following:

- Civil works during construction phase including, construction of solar PV module mounting area, transformer yard, inverter room, internal roads, laydown areas, labour camp, transmission line,
- Self- employment options for individuals possessing vocational or technical training skills like electricians, welders, fitters etc;
- Contracting opportunities for locals possessing tractors, dumper trucks or other vehicles which would be needed to carry away excavated soil and other material. Creation of indirect employment for local community through establishing small shops like tea stalls, supply of intermediate raw materials, repair outlets, hardware stores etc. However, these are likely to be temporary

6.4.11.2 Embedded/in-built control

As gathered from consultations CSP's site team, a significant segment of labour requirement during the construction phase will be sourced locally.

6.4.11.3 Significance of Impact

The impacts have been assessed as **positive** due to employment opportunities for locals.

7.4.8.5 Additional Mitigation Measures

While, the significance of the impact on economy and employment opportunities during the construction phase is understood to be positive, the following measures should be put in place to ensure that the local community receives maximum benefit from the presence of the project:

- Preference should be provided to local labour, sub-contractors or suppliers to pass on maximum economic benefit locally;
- Preference should be provided to the vulnerable population in the Study Area;
- The project proponent will establish a mechanism to audit sub-contractors and suppliers with respect to compliance of utilizing local labour and resources.

6.4.11.4 Residual Impact Significance

The significance of the residual impacts will remain **positive**

Table 6.36 Impact on Economy and Employment

Impact	Impact on local employment opportunities during 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	Locals will mostly have short term employment opportunities during construction phase of the project. However, people in limited numbers, from the neighbouring districts of Jodhpur are likely to be engaged in the project, especially in the highly skilled category of manpower.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	The impact magnitude will be positive as people from the locality will definitely be employed, especially during the construction phase of the project. However, the exact figures of local people benefitting from the employment opportunities cannot be estimated.				

6.4.12 Ecological Impacts - Construction Phase

The impacts from the construction phase of the Project on the local ecology have been assessed with respect to the following activities:

- Vegetation Clearance and Other Construction Impacts; and
- Barrier Effect and Loss of Resources.

6.4.12.1 Impact due to Vegetation Clearance and Construction Activity

Impact

The Project site is located on open scrub and sand dune, ideal for dry climate specialists and considering the fact that the site is already in construction phase and vegetation clearance has already been done, displacement of species may have already happened.

Embedded/ In-built Controls

- The Project site has been planned on fallow land with no mature trees or dense vegetation.

Significance of Impacts

Based on habitat sensitivity value, open scrub and sand dune habitat was found to sustain only Least Concern species, and such habitat is widespread in the study area and beyond study area, so the loss of such habitat for project activity affects only a small portion of such habitat. So the impact magnitude on habitat, based on “Habitat-Impact Assessment Criteria” is considered to be “Negligible”.

Based on species sensitivity value, project construction activity is not going to cause a substantial change in the population of the species or other species dependent on it. So based on “Species-Impact Assessment Criteria” the impact magnitude on species was also found to be “Negligible”.

Mitigation Measures

Vegetation clearance should be kept restricted to project site only and should be avoided wherever possible. Moreover it is recommended that the selected EPC contractor should display and educate labourers not to collect fuel wood from adjacent scrublands and alternate arrangement for fuel, like LPG must be made available in the labour camps for cooking.

Table 6.37 Impact significance of vegetation clearance during the construction phase

Impact	Clearance of vegetation				
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 construction area and immediate surroundings				
Frequency	Construction phase				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity (Agricultural lands)	Low	Medium	High		
Resource Sensitivity (Species)	Low	Medium	High		
Impact Significance	Not Significant	Minor	Moderate	Major	
	Significance of impact is considered **Minor** for habitat and species**.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
	Not Significant	Minor	Moderate	Major	

Residual Impact Significance	Significance of impact is considered **Not Significant** for habitats and species**.**

6.4.12.2 Impact due to Influx of Migrant Labour and Labour Camps

Impacts

Local labours are not aware of the local biodiversity values and there is always risk of hunting and trapping of local wildlife (eg. Chinkara) by labours for “bushmeat” as well as for easy source of money by selling products like skin. Apart from impact like direct hunting or trapping, careless disposal of kitchen waste like discarded vegetable materials and excess food, may attract wildlife like herbivores like Chinkaran and Nilgai as well as scavengers like Indian fox and Desert fox, this unwanted interaction with wild animals may lead to human-wildlife conflict. Collection of fuel wood for cooking from outside project area, may result in additional habitat degradation.

Embedded/in-built control

The Labour Camp will be located within the Project site. So there will be no additional habitat loss.

Significance of Impacts

Based on habitat sensitivity value, open scrub and sand dune habitat was found to sustain only Least Concern species, and such habitat is widespread in the study area and beyond study area, so degradation of such habitat for project activity affects only a small portion of such habitat. So the impact magnitude on habitat, based on “Habitat-Impact Assessment Criteria” is considered to be “Negligible”.

Only species with “Low Sensitivity value” is found in the study area, and hunting trapping of animals like chinkara, foxes and grey mongoose may result in substantial change in abundance and/or reduction in distribution of a population locally, but does not threatened the long term viability. So based on “Species-Impact Assessment Criteria” the impact magnitude on species was also found to be “Minor”. Most of the mammals found in the study area are scheduled animals, including Schuduled I species like chinkara, Indian Wolf and desert fox. All Scheduled animals are protected under “Wildlife Protection Act, 1972” and its amendments, with highest degree of protection provided to Scheduled I species. So Hunting and trapping of such animals are criminal offence and punishable by law.

Mitigation Measures

The likelihood of threated and protected fauna venturing into the Project site is small but proper precautions should be taken to prevent any human-wildlife conflict. It is recommended that the selected EPC contractor should display and educate labourers and staff about the hunting, poaching, trapping, injuring or killing of wildlife in the region.

Table 6.38 Impact due to Influx of Migrant Labour and Labour Camps during the construction phase

Impact	Impact due to Influx of Migrant Labour and Labour Camps during the 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	Limited to construction area and immediate surroundings			

Frequency	Construction phase				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity (Agricultural lands)	Low	Medium	High		
Resource Sensitivity (Species)	Low	Medium	High		
Impact Significance	Not Significant	Minor	Moderate	Major	
	Significance of impact is considered **Minor** for habitat and species**.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Not Significant	Minor	Moderate	Major	
	Significance of impact is considered **Not Significant** for habitats and species**.**				

6.5 Impact Assessment – Operation and Maintenance Phase

6.5.1 Impact on Soil Environment

6.5.1.1 Soil Compaction and Erosion

Impacts

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

Since the chances of soil compaction and erosion during the O&M phase are less, the impact magnitude is assessed to be **small**.

Embedded/in-built control

Vehicles will utilise the existing access road to undertake maintenance activities at the solar plant.

Significance of Impact

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

Additional Mitigation Measures

No further mitigation measures are suggested as embedded/in-built control will be sufficient to reduce the impact on soil environment.

Residual Impact Significance

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

Table 6.39 Impacts due to Soil Erosion and Compaction (Operation Phase)

Impact	Soil Erosion and Compaction (Operations)		
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 **Negligible.**				

6.5.1.2 Waste Generation and Soil Contamination

Impacts

During operation phase, the waste generated from project includes domestic solid waste at SCADA building and substation and hazardous waste like waste oil and lubricants and oil containing jutes and rags will be generated during maintenance activities. The quantity of hazardous waste generated will be much lesser quantity than during the construction phase. Therefore, receptor sensitivity has been assessed as **low.**

The quantity of municipal and hazardous waste generated will be much lesser in quantity in operation phase than during the construction phase. Thus, the Impact magnitude has been assessed to **small.**

Embedded/in-built control

The waste generated will be disposed of through approved vendors in accordance with Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016. The hazardous wastes will be stored onsite at separate designated covered area provided with impervious flooring and sent for disposal to nearest TSDF in Jodhpur district of Rajasthan. During operation phase, the quantity of municipal waste and hazardous waste generated is less and probability of the hazardous waste generation is only during plant maintenance and therefore occasional. The waste generated would be routed through proper collection and containment.

Additional, following steps must be undertaken to avoid soil contamination:

- Ensure oil/ lubricants are stored on impervious floor in the storage area having secondary containment;
- Use of spill control kits to contain and clean small spills and leaks during O&M activities; and
- The guidelines and procedures shall be prepared and followed for immediate clean-up actions following any spillages.

Significance of Impact

The overall impact significance on land due to waste disposal during O&M phase has been assessed as **minor.**

Additional Mitigation Measures

- Municipal domestic waste generated at site to be segregated onsite;
- Ensure hazardous waste containers are properly labelled and stored onsite provided with impervious surface, shed and secondary containment system;
- Ensure routinely disposal of hazardous waste through approved vendors and records are properly documented; and

- Disposal of hazardous wastes shall be done strictly as per the conditions of authorisation granted by Rajasthan Pollution Control Board.
- Ensure hazardous waste is properly labelled, stored onsite at a location provided with impervious surface, shed and secondary containment system as per in accordance to Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

Residual Impact Significance

The significance of residual impacts will be **negligible** post implementation of recommended mitigation measures.

Table 6.40 Impacts due to waste generation and soil contamination (Operation Phase)

Impact	Waste Generation and Soil Contamination (Operations)				
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 Significance	Positive	Negligible	Small	Medium	Large
	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Negligible.**				

6.5.2 Impact on Water Environment

6.5.2.1 Impacts

As mentioned earlier in the report, use of dry cleaning technologies is a method that will be adopted to undertake module cleaning. Therefore, water requirement for module cleaning purpose will be very minuscule. Additionally, water is required during operation phase to meet domestic requirements of O&M staff and for use in the SCADA building. For that purpose, the water requirement will be met through water procured by authorised vendor via tankers, most likely sourced from existing bore wells in the nearby area, and through packaged water bottles. During operation phase, there will be no wastewater generation from the power generation process. Only sewage would be generated from SCADA building and this will also be of negligible quantity. Therefore, the receptor sensitivity is assessed to be **low to medium.**

As reported by the CGWB for the district, the status of ground water is considered to be Safe, but discussions with the villagers in the nearby village revealed that there has been decline in ground water availability in the region. But, since the project proposes to use dry cleaning technologies as their module cleaning mechanism, coupled with the fact that very less or negligible amount of wastewater would be generated from SCADA building during the O&M phase, the impact magnitude has been assessed to be **small.**

6.5.2.2 Embedded/in-built control

- The drainage and sewerage system will be provided for the collection and treatment of waste water at SCADA building.
- No wastewater discharge on open land will be practiced;
- The provisions of septic tank and soak pits will be provided onsite for treatment and disposal of sewage, thereby minimizing the impacts of wastewater discharge. Planning of toilets, soak pits and septic tanks, waste collection areas should be away from natural drainage channels;

6.5.2.3 Significance of Impact

The overall significance of impacts is assessed to be **minor**.

6.5.2.4 Additional Mitigation Measures

- Optimising water usage in the SCADA building by application of water conservation measures such as sensor based taps, low flush urinals etc.;
- Ensure proper cover and stacking of loose construction material to prevent surface runoff and contamination of receiving water body;
- Labourers will be given training towards proactive use of designated areas/bins for waste disposal and encouraged for use of toilets. Open defecation and random disposal of sewage shall be strictly restricted;
- Construction labour deputed onsite to be sensitised about water conservation and encouraged for optimal use of water;
- Regular inspection for identification of water leakages and preventing wastage of water from water supply tankers.
- Recycling/reusing to the extent possible.

6.5.2.5 Residual Impact Significance

The residual impact significance is envisaged to be **negligible** upon application of embedded controls and additional mitigation measures.

Table 6.41 Impact on Water Environment (Operation Phase)

Impact	Impact on water environment operation 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	Limited to project area				
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
	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Negligible.**				

6.5.3 Landscape and Visual Impacts

6.5.3.1 Impacts

The major project component of the PV Modules are spread over a horizontal forms with height of maximum of 2m above the ground level and the entire facility will be fenced with brick/stone wall with height of approximately above 2 meters, hence may not visible to the passers or moving traffic.

The current land use of site is barren /agriculture and is devoid of any permanent structures. The permanent change of current landscape to area spread with PV modules will have potential visual impact for nearest habitations and passers.

Site office and storage areas would be single-storey structures. The potential visual impact of these complexes would be relatively higher with single storey building.

6.5.3.2 Significance of Impacts

It is important to note that whether the visual impact is seen as positive or negative is highly subjective, and people's attitude towards and perception of the visual impacts associated with the any project including solar power project. The project and its surrounding area are new for such developmental project and will have visual impacts during initial period of Project and the same will disappear over a period of time.

Based on the above, significance of visual impact on landscape during operation phase of the project has been assessed as **moderate.**

6.5.3.3 Suggested mitigation measures

Following mitigation measures are proposed to reduce the visual impacts on the surroundings during operational phase:

- Signage related to the Solar Farm must be discrete and confined to entrance gates. No other corporate or advertising signage, particularly billboards to be displayed on site;
- The footprint of the operations and maintenance facilities, as well as parking and vehicular circulation, should be clearly defined, and not be allowed to spill over into other areas of the site;
- Construction of fencing or compound wall around the project boundary;
- Plantations near settlements which can buffer or screen the view to a certain extent; and
- Landscape development around the solar farm site with the participation of the local community.

6.5.3.4 Residual impact significance

After implementation of mitigation measures, the significance of residual impacts will reduce to **minor**.

Table 6.42 Landscape and Visual Impacts (Operational Phase)

Impact	Landscape and Visual Impacts (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 **Moderate.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Major
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Minor.**				

6.5.4 Impact on Economy and Employment

6.5.4.1 Impacts

Community consultations and observations made during the site visit suggest that the existing scenario of the agriculture in the study area is not capable enough to meet requirements of the people who are solely dependent upon it; especially due to water availability and growing population.

During the operations phase, the requirement for unskilled and semi-skilled labour is expected to reduce to 20 and 15 respectively. The locally procured services will include maintenance work of the facility, 24 hour security, bush and undergrowth cleaning and housekeeping activities.

6.5.4.2 Significance of Impact

The overall impact significance of the impact on economy and employment during the operations phase is assessed as **positive.**

7.4.8.5 Additional Mitigation Measures

While, the significance of the impact on economy and employment opportunities during the operations phase is understood to be positive, the following measures should be put in place to ensure that the local community receives maximum benefit from the presence of the project:

- Preference should be provided to local labour or suppliers to pass on maximum economic benefit locally;
- Preference should be provided to the vulnerable population in the Study Area;

6.5.4.3 Residual Impact Significance

The significance of the residual impacts will remain **positive**

Table 6.43 Impact on Economy and Employment

Impact	Impact on local employment opportunities during operations 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	Local population in the Study Area. The impact may also be experienced at the regional level.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	Significance of impact is considered positive				

6.5.5 Ecological Impacts - Operation Phase

6.5.5.1 Collision and Electrical hazards from Transmission Infrastructure

Impacts

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.

Embedded/ in-built Control

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

Significance of Impacts

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 2017-3) and has a large distribution range. So based on "Species-Impact Assessment Criteria" the impact magnitude on species was also found to be "Negligible".

Additional Mitigation Measures

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

- Design of transmission towers and transformers should be such so as to minimize the risks of electrocution of birds;
- The transmission poles should be raised with suspended insulators in order to reduce the electrocution of bird species; and
- Marking overhead cables using bird-flight deterrents and avoiding use in areas of high bird concentrations of species vulnerable to collision.

Residual Impact Significance

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

Table 6.44 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 **Minor** for species.				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Minor.**				

6.6 Impact Assessment – Decommissioning Phase

6.6.1 Impact on Soil Environment

6.6.1.1 Impacts

The decommissioning activities will cause following impacts on soil:

- Soil compaction due to the increased vehicular and workforce movement, dismantling and storage of plant components on the adjacent land, removal of internal electric lines/ poles etc.
- Waste will be generated in form of dismantled plant components and demolition debris from plant foundations, storage yard and substation complex. Electric components such as transformers, insulators, wires will be generated. The waste will be mainly of inert nature;

The possibility of soil contamination during decommissioning phase is very less though may occur due to leakage from machinery and transportation vehicles and during collection of remaining oil/ lubricants in the plant.

Receptor sensitivity, based upon the context presented above, is assessed to be **medium.**

Removal of grounded structures and demolition of during decommissioning phase may affect the top layers of the soil and loss of top soil quality but the effects can be reversed over time. Also, as the plant is spread over 1,350 acres, number of labours required during the decommissioning phase is assumed to be large. Hence, generation of domestic waste will be a lot, especially at the labour camps. Thus, the Impact magnitude has been assessed to be **medium.**

6.6.1.2 Embedded/in-built control

- The decommissioning of the solar plant will be carried out in a planned manner.
- During decommissioning phase, the quantity of waste generated will be high. The waste will be routed through proper collection, storage and disposal. The waste will be evaluated for its recycling/ reuse/ scrap value and disposed accordingly.

6.6.1.3 Significance of Impact

The overall impact significance is assessed to be **moderate**.

6.6.1.4 Additional Mitigation Measures

Following mitigation measures are proposed to reduce the impacts of solar plant decommissioning activities on soil environment:

- The vehicular movement during decommissioning activities should be restricted to the designated route path;
- The demolition/ dismantling waste should not be left over in the project area and to be collected and stored at designated area only for further segregation and disposal.

6.6.1.5 Residual Impact Significance

The significance of impacts due to waste generation and soil contamination after implementation of mitigation measures will be **minor.**

Table 6.45 Impact on Soil Environment (Decommissioning Phase)

Impact	Impact on soil environment during 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	Limited to project area				
Frequency	Occasionally (mainly during construction and operation phase)				
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
	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Minor.**				

6.6.2 Impact on Water Environment

6.6.2.1 Impacts

Water during the decommissioning phase will be consumed by labourers and will be required for civil work. The water demand will be met through procurement of water tankers sourcing water from bore wells or the IGNP canal. Also, there is a potential for contamination of groundwater and surface water resources resulting from improper management of sewage and accidental spills/leaks at the storage areas. Therefore, the receptor sensitivity is assessed to be **medium.**

6.6.2.2 Embedded/in-built control

- The provisions of septic tank and soak pits will be provided onsite for treatment and disposal of sewage, thereby minimizing the impacts of wastewater discharge. Planning of toilets, soak pits and septic tanks, waste collection areas should be away from natural drainage channels;
- Use of licensed contractors for management and disposal of waste and sludge;
- Spill/ leakage clearance plan to be adopted for immediate cleaning of spills and leakages;
- Water tankers with proper permissions will be utilized for water sourcing.

6.6.2.3 Significance of Impact

The overall impact significance is assessed to be **moderate.**

6.6.2.4 Additional Mitigation Measures

- Ensure proper cover and stacking of loose construction material to prevent surface runoff and contamination of receiving water body;
- Labourers will be given training towards proactive use of designated areas/bins for waste disposal and encouraged for use of toilets. Open defecation and random disposal of sewage shall be strictly restricted;
- Construction labour deputed onsite to be sensitised about water conservation and encouraged for optimal use of water;
- Regular inspection for identification of water leakages and preventing wastage of water from water supply tankers.
- Recycling/reusing to the extent possible.

6.6.2.5 Residual Impact Significance

The residual impact significance is envisaged to be **minor** upon application of embedded controls and additional mitigation measures.

Table 6.46 Impact on Water Environment during Decommissioning Phase

Impact	Impact on water environment during 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	Limited to project area				
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
	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor.**				

6.6.3 Impact on Air Quality

6.6.3.1 Impacts

Air quality will largely get impacted from the following sources during the decommissioning phase:

- Fugitive dust emissions from site clearing, excavation work, cutting and levelling work at site and access/ internal roads, stacking of soils, handling of construction material, transportation of material, emission due to movement of vehicles and heavy construction machinery etc.;
- Vehicular emissions due to traffic movement on site and on access roads;
- Particulate emissions from operation of batching plant;

- Exhaust emissions from construction machineries, other heavy equipment like bull dozers, excavators, and compactors;
- Emissions from emergency power diesel generator used during decommissioning activity.

Based on the above, the receptor sensitivity is assessed to be **medium.**

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 and therefore the impact magnitude has been assessed as **small.**

6.6.3.2 Embedded/in-built control

- Emissions from the emergency DG set and other stationary machines will be controlled by ensuring that the engines are always properly tuned and maintained.
- Minimize stockpiling by coordinating excavations, spreading, re-grading and compaction activities;
- Speed of vehicles on site will be limited to 10-15 km/hr which will help in minimizing fugitive dust emissions due to vehicular movement; and
- Idling of vehicles and equipment will be prevented.

6.6.3.3 Significance of Impact

The impact significance for air quality in the decommissioning phase is assessed as **minor.**

6.6.3.4 Additional Mitigation Measures

- Burning of any waste material shall be prevented;
- Labourers shall be provided with gas connection to prevent burning of fuel wood for cooking purposes;
- Work shall be ceased or phased down if excess fugitive dust is observed. Source of dust shall be investigated and proper suppression measures ensured;
- Proper maintenance of engines and use of vehicles with Pollution under Control (PUC) Certificate shall be ensured.

6.6.3.5 Residual Impact Significance

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

Table 6.47 Impact on Air Quality during Decommissioning Phase

Impact	Ambient 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.**				

6.6.4 Impact on Ambient Noise

6.6.4.1 Impacts

During decommissioning phase of the project, noise will generate from movement of vehicles carrying dismantled structure and equipment.

There are three other solar projects and a grid substation located within 5 km radius of the project site along with three village. The area is would then be an Industrial area and therefore the receptor sensitivity is assessed to be **low to medium.**

Impact magnitude is considered to be **small** considering the decommissioning period to last for small duration.

6.6.4.2 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.

6.6.4.3 Significance of Impact

The overall impact significance is envisaged to be **negligible to minor.**

6.6.4.4 Additional 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 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.

6.6.4.5 Residual Impact Significance

Significance of residual impact is assessed to be **negligible** upon incorporation of the above mentioned mitigation measures.

Table 6.48 Impact on Ambient Noise during Decommissioning Phase

Impact	Ambient Noise Levels –Decommissioning Phase				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term	Temporary	
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 to be **negligible to minor**.				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Major
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible.**				

6.6.5 Impact on Economy and Employment

6.6.5.1 Impacts

The major social impacts associated with the decommissioning phase are linked to the loss of jobs and associated income. This has implications for the households who are directly affected, including their families. However, the impacts are likely to be limited due to relatively small number of permanent employees (mainly security guards) who will be affected. Other associated impacts would be:

- Improper disposal of construction waste and debris from deconstruction of storage area, etc. will lead to contamination of soil and discontentment with the immediate villages in the local surrounding communities.

Impact magnitude is considered to be **small** considering the decommissioning period to last for small duration.

6.6.5.2 Significance of Impact

The overall impact significance is envisaged to be **Minor.**

6.6.5.3 Additional Mitigation Measures

The decommissioning phase will require removal of machinery, workers and other temporary structures. The mitigation measures for decommissioning shall include the following:

- CSP Jodhpur should ensure that retrenchment packages are provided for all staff who stand to lose their jobs when the plant is decommissioned;
- The contractor shall inform the workers and local community about the duration of work;
- Reduction of worker will be done phase wise and corresponding to completion of each activity; and
- All waste generated from demobilisation shall be collected and disposed of at the nearest municipal disposal site.

6.6.5.4 Residual Impact Significance

Significance of residual impact is assessed to be **negligible** upon incorporation of the above mentioned mitigation measures.

Table 6.49 Impact on Economy and Employment

Impact	Impact on Economy and Employment			
Impact Nature	Negative		Positive	Neutral
Impact Type	Direct		Direct	Direct
Impact Duration	Temporary	Temporary	Temporary	Temporary
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 to be **minor**.				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Major
Residual Impact Significance	Negligible	Minor		Moderate	Major
	Significance of impact is considered **negligible.**				

6.7 Cumulative Impact Assessment

As mentioned earlier in the report, it was observed during the site reconnaissance survey that the project falls in an area characterised by presence of many other solar power projects and has some solar plants within a 5 km radius with some still in the pipeline. They are as follows:

- 23 MW Solar Power Plant owned by Waaree Energies Limited (WEL) and Maharashtra Seamless Limited (MSL) (Approximately 4 km South);
- 20 MW Solar Power Plant owned by Northern Solaire Prakash Private Limited (NSPPL) (Approximately 7 km South);
- 10 MW Solar Power Plant owned by Sauryauday Solaire Prakash Private Limited (SSPPL) (Approximately 4 km Southwest)
- Bhadla Solar Park (Approximately 5-10 km North);
    - 680 MW Solar Power Plant Owned by Rajasthan Solar Park Development Company (RRECL Subsidiary) (Approximately 8-10 km North);
    - 1000 MW Solar Power Plant owned by Saurya Urja Company of Rajasthan (JV of GoR and IL&FS Energy) (Approximately 5-8 km North).

This section assesses the cumulative impacts the above mention projects will have on the local soil, water, land, air and ambient noise environment.

6.7.1 Change in Land Use and Visual Impacts

6.7.1.1 Impacts

Since there are other projects operational and upcoming near the project site, land use in the area is converting from agricultural and 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. Also, the agricultural land in the area could potentially decline further in the future and this can have an impact on the local community since agriculture is the primary source of occupation in 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.

Considering the above discussion, with only 2 operational projects and 2 upcoming projects in the area as of now, the resource sensitivity is assessed to be **medium**.

The impact magnitude is considered to be **medium** as well considering the area is characterised by presence of agricultural as well as grazing land which will convert to industrial land and the impacts have the potential to effect on a regional level as well.

6.7.1.2 Significance of Impact

The overall impact significance for has been assessed as **moderate.**

6.7.1.3 Mitigation Measures

It is recommended that the project follows the mitigation measures, as showcased in **section 6.4.1.4**, to minimize the cumulative impacts on land use.

Table 6.50 Cumulative Impact on Land Use and Visual Aesthetics

Impact	Cumulative Impact on Land Use and Visual Aesthetics				
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 **Moderate**.				

6.7.2 Impact on Soil Environment

6.7.2.1 Impacts

As mentioned earlier, the region is characterised by sandy soil which is loose in nature, and thus soil erosion is common in these parts. Since the projects require clearance of the limited vegetation in the area, the amount of soil being eroded can increase. Another major concern in terms of soil environment is soil compaction considering the projects will develop various access road to connect to the site as well as for logistical support. Furthermore, waste generated and stored on site during a particular project's life cycle can lead to increased contamination of the soil if not maintained and managed properly, considering the amount of projects that are operational or being developed in the area.

Therefore, the resource sensitivity in the area is assessed to be **medium** taking into consideration that the area consists of only 4 projects as of now.

The impact magnitude is assessed **medium** as well considering the access roads that will lead to soil compaction, increased soil erosion during windy days and the fact that the soil in the project area is sandy in nature with high soil permeability. Therefore, oils and lubricants can easily percolate inside the soil during accidental leakage.

6.7.2.2 Significance of Impact

The overall impact significance for soil contamination due to leaks/spills has been assessed as **moderate.**

6.7.2.3 Mitigation Measures

It is recommended that the project follows the additional mitigation measures, as showcased in **section 6.4.3.1** and **6.4.3.2**, to minimize the cumulative impacts on soil environment.

Table 6.51 Cumulative Impact on Soil Environment

Impact	Cumulative Impact on Soil Environment				
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 **Moderate**.				

6.7.3 Impact on Water Environment

6.7.3.1 Impacts

As mentioned earlier in the Central Groundwater Authority brochure of Jodhpur district, Bap tehsil falls under the **Safe** category based on stage of groundwater development. However the depth of groundwater in the area is very low (in the range of 600-700 feet) and is largely inaccessible. Therefore the community is dependent primarily on the Indira Gandhi Nahar Pariyojna (IGNP) canal for domestic water requirement as well as for irrigation. As per the Rajasthan Solar Energy Policy, 2014, water resource department of Rajasthan will allocate required quantity of water from Indira Gandhi Nahar Pariyojna (IGNP) canal's nearest available source from the proposed Solar Power Plants, subject to the availability of water.

Now, it is envisaged that development of multiple solar power plants in the area, along with community's dependence, can cumulatively lead to additional stress on the primary water source in the area i.e. the IGNP Canal, in the long term. Furthermore, if the proposed 250 MW project abstracts groundwater from the nearest identified borewell during the construction phase, stress on the groundwater resources in the region may increase.

The proposed 250 MW solar power project in Noore Ki Bhoorj will potentially use dry cleaning technologies for the purpose of module cleaning, which was also observed during ERM's site visit to Bhadla solar park where operational projects had adopted new dry cleaning methods. This technology results in significant reduction in water usage as compared to conventional methods of module cleaning.

With respect to impacts on water quality, the area consists of loose sandy soil with high soil permeability and in cases of leakages and improper waste management practices the groundwater in the area can be severely impacted. Considering all the solar power plants consist of a proper waste management mechanism and leakages being a rare phenomenon in solar power plants coupled with

the fact that dry cleaning technologies will be adopted for module cleaning as part of this project and is being undertaken at the Bhadla Solar Park, the receptor sensitivity is assessed to be **medium**.

The impact magnitude is assessed to be **small to medium** taking into consideration impacts, such as groundwater contamination, that can arise due to accidental leaks and spills since the percolation rate of the soil in the study area is high.

6.7.3.2 Significance of Impact

The overall impact significance for soil contamination due to leaks/spills has been assessed as **minor to moderate.**

6.7.3.3 Mitigation Measures

It is recommended that the project follows the mitigation measures, as showcased in **section 6.4.4.4**, to minimize the cumulative impacts on water environment.

Table 6.52 Cumulative Impact on Water Environment

Impact	Cumulative Impact on Water Environment				
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 to Moderate**.				

6.7.4 Impact on Air Quality

6.7.4.1 Impacts

Impact on air quality in the region will arise during the construction as well as decommissioning phases due to the following 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.

Since construction work for the proposed 250 MW project in Noore Ki Bhoorj along with that of the 300 MW Bhadla solar project is set to be undertaken this year, the impacts on air quality during this period will be high. The impact on decommissioning phase will be similar and the villages, namely Bhadla, Noore Ki Bhoorj, Durjani and Dedasari, along with their hamlets within the vicinity of these projects or along the access route will be impacted. Considering the construction/decommissioning period will last for approximately 6 months for a particular project, and the air quality will improve during the operation phase, the receptor sensitivity is assessed to be **low to medium**.

The impact magnitude is assessed to be **small to medium** considering that the construction period, which will last for approximately six months to one year, will lead to increased fugitive dust emissions in the area.

6.7.4.2 Significance of Impact

The overall impact significance for air quality has been assessed as **minor to moderate** as impacts arising during the construction phase will last for a short period of time and the ambient air quality will improve during the operation phase**.**

6.7.4.3 Mitigation Measures

It is recommended that the project follows the mitigation measures, as showcased in **section 6.4.5.4**, to minimize the cumulative impacts on air quality.

Table 6.53 Cumulative Impact on Air Quality

Impact	Cumulative Impact on Air Quality				
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 to Moderate**.				

6.7.5 Impact on Ambient Noise

6.7.5.1 Impacts

The impacts arising due to high noise levels are confined to the construction and decommissioning phases. Noise levels during the O&M phase are negligible and may only arise during the maintenance phase of the solar plant. Considering that the project area consists of 2 solar power plants of 300 MW and 250 MW being developed over approximately 2,900 to 3,000 acres, coupled with the fact that there are villages close to the Bhadla Solar Park and near to the proposed project site of 250 MW Solar Plant in Noore Ki Bhoorj as well, the receptor sensitivity is assessed to be **low to medium**.

The impact magnitude is assessed to be **small to medium** considering that the construction period, which will last for approximately six months to one year, will lead to increased noise levels due to the following activities:

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

6.7.5.2 Significance of Impact

The overall impact significance for ambient noise has been assessed as **minor to moderate** as impacts arising during the construction phase will last for a short period of time and the ambient noise quality will improve during the operation phase**.**

6.7.5.3 Mitigation Measures

It is recommended that the project follows the mitigation measures, as showcased in **section 6.4.6.4**, to minimize the cumulative impacts on ambient noise.

Table 6.54 Cumulative Impact on Ambient Noise

Impact	Cumulative Impact on Ambient Noise Environment				
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 to Moderate**.				

6.7.6 Impact on Land Holding and Agriculture Land

6.7.6.1 Impacts

The study area is in Bap tehsil, known for solar power projects, with the Rajasthan Government aiming to make the tehsils and district into a hub for solar power projects within the Jawaharlal Nehru National Solar Mission (JNNURM). As part of the plans to create this power generation capacity in the district, solar power projects to the capacity of 1000 MW are planned, of which 484 MW; spread across 873 projects have been sanctioned. It is reported that a total of 899 companies have registered with the government, with a capacity of 18,476 MW. Due to the above mentioned factor, the land-use pattern of the area will change from agricultural to industrial area thereby bringing a change in the livelihood patterns in the area.

Due to increase in land requirement for the solar plants, the land market price is also envisaged to increase.

The impact magnitude is assessed to be **Positive**.

6.7.6.2 Significance of Impact

The overall impact significance for land holding has been assessed as **Positive**

Table 6.55 Cumulative Impact on Land Holding and Agriculture Land

Impact	Cumulative Impact on Land Holding and Agriculture Land			
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 **Positive**.				

7. GRIEVANCE REDRESSAL MECHANISM

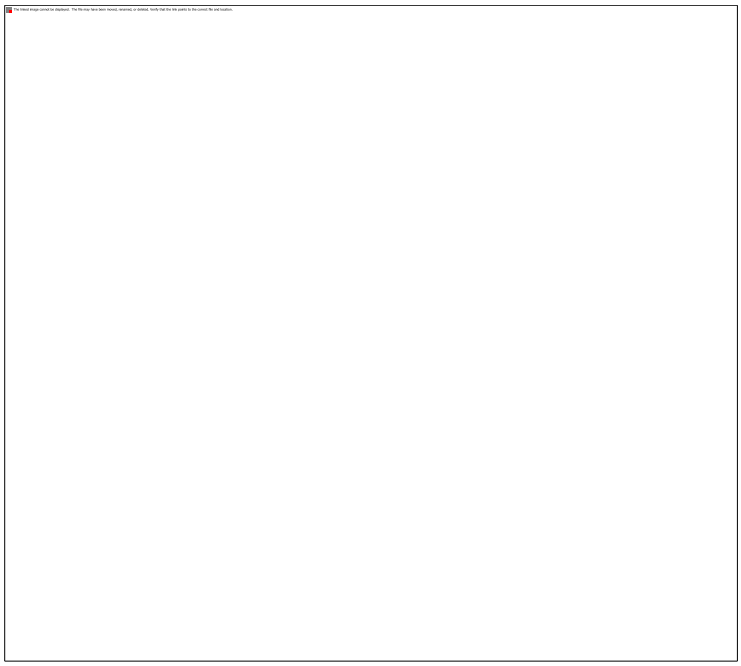
HFE has developed a formal Grievance Redressal Mechanism (GRM) for external and internal stakeholders. The procedure is applicable to the entire life cycle of the project i.e. post site selection till the decommissioning phase (including mobilization, construction and operations phase). Consultations, communication and disclosure are mandated by framework specified for the projects.

GRM, is detailed below outlines the process for lodging grievances, steps to be taken for subsequent action and the time limit within which the issue would be resolved to the satisfaction of the complainant. All complaints shall be recorded and addressed in a uniform and consistent manner.

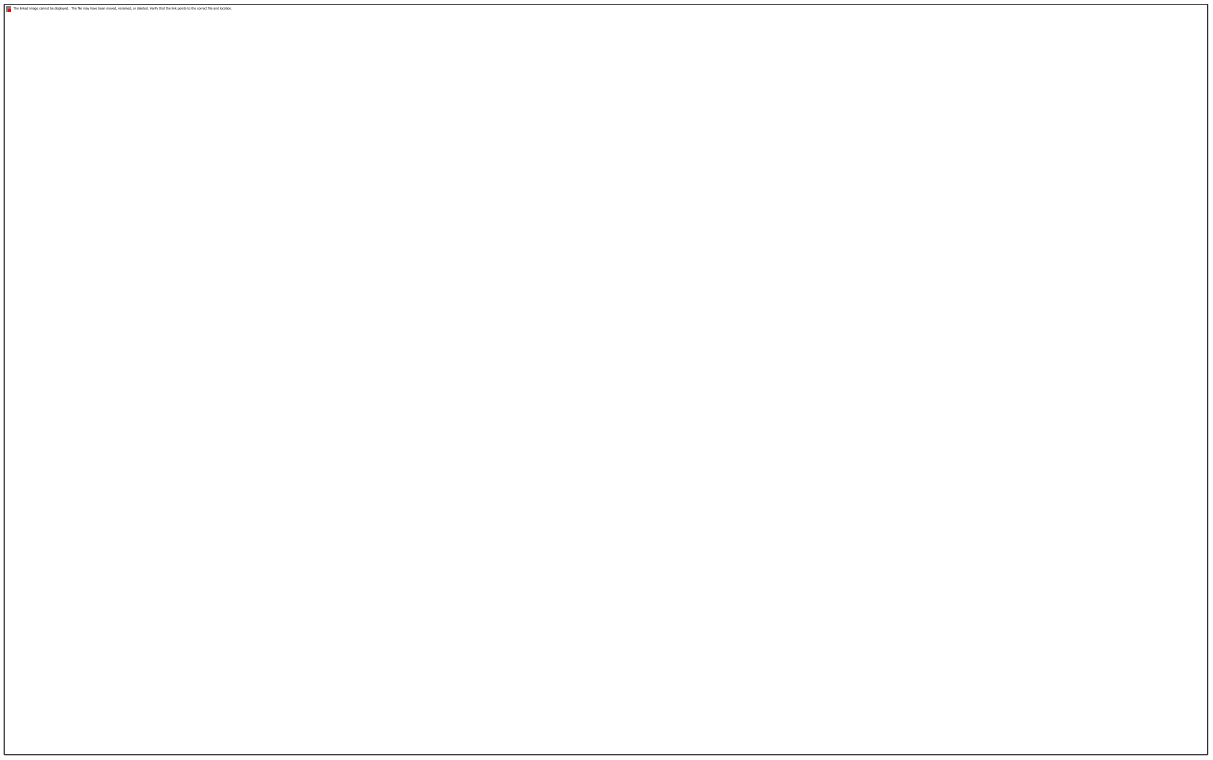
Formation of Committee

A site level Grievance Redressal Committee (GRC) consisting of representatives from the contractors and HFE officials shall be formed. The GRC will be designed at three levels – Levels I to III. The representatives proposed at different levels of the GRC are as below.

Figure 7.1 Composition of Grievance Redressal Committee



The Grievance Redressal Mechanism and Recording procedure are as below.



Source: HFE ESMS

The above mentioned Grievance Redressal Mechanism will be followed along with the AIIB's Project-affected People's Mechanism, which mentions the following;

"*Establish a suitable grievance redress mechanism to receive and facilitate resolution of the concerns of people who believe they have been adversely affected by the Project's environmental and social impacts and inform Project-affected people of its availability. Be aware of and respond to stakeholders' concerns related to the Project in a timely manner. Scale the grievance mechanism to the risks and impacts of the Project. The grievance mechanism may utilize existing formal or informal grievance mechanisms, provided that they are properly designed and implemented, and deemed by the Bank to be suitable for the Project; these may be supplemented, as needed, with Project specific arrangements. Design the mechanism to address Project-affected people's concerns and complaints promptly, using an understandable and transparent process that is gender sensitive, culturally appropriate and readily accessible to all Project-affected people. Include provisions to protect complainants from retaliation and to remain anonymous, if requested.*"

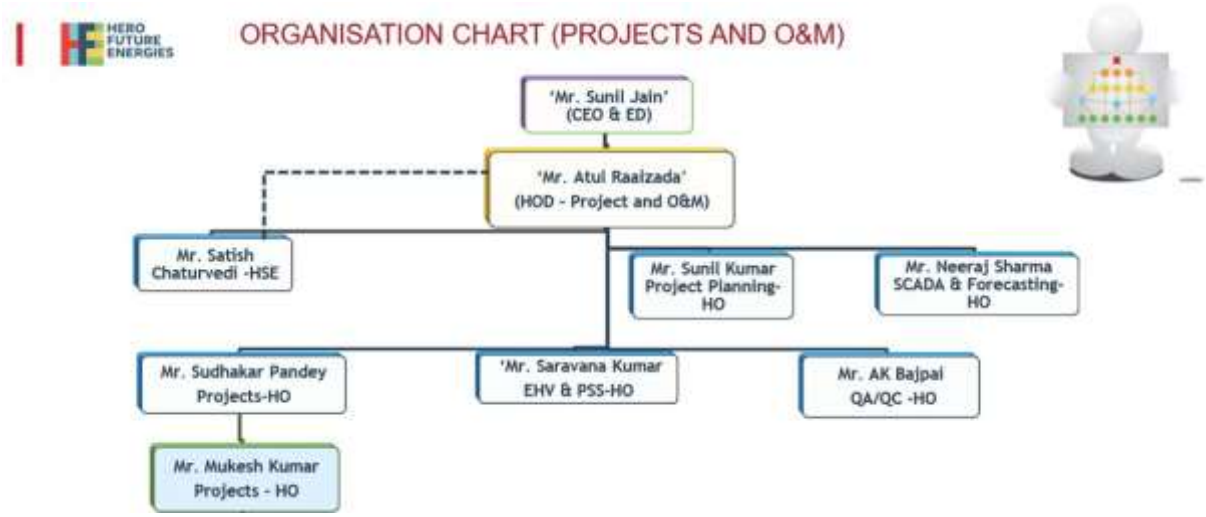
8. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

This section presents the Environmental and Social Management Plan (ESMP) for the Project. The purpose of this ESMP is to specify the standards and controls required to manage and monitor environmental and social impacts during construction and operation phase. To achieve this, the ESMP identifies potential adverse impacts from the planned activities and outlines mitigation measures required to reduce the likely negative effects on the physical, natural and social environment. This is in accordance to IFC Performance Standards 1 which emphasizes the importance of managing social and environmental performance throughout the lifecycle of the Project.

8.1 HFE's Organisational 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 Health, Safety and Environment manager at the corporate level reporting to the Head of Department – Projects and O&M, who in turns report to the CEO & ED. Corporate level organogram at HFE is as presented below.

Figure 8.1 Organisation Chart (Projects and O&M)



Source: Hero Future Energies

Since the project is at initial stages of planning, details related to site level organogram of CSP Jodhpur and their EPC Contractors are not presently known.

8.2 Roles and Responsibilities

CSP Jodhpur will majorly play a role of supervisor to oversee the project performance pertaining to environment, health, safety and social issues. It is recommended to strength the EHS organizational structure by creating a dedicated EHS department at the corporate level. An outline for responsibilities of the proposed EHS department is given below.

Environmental, Health and Safety Department (EHS Department)

Environment, Health and Safety department shall be responsible for monitoring the implementation of the various actions which are to be executed by the agencies specified in the ESMP.

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.

8.3 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 Jodhpur will ensure that the conditions stipulated under various permits are followed. The inspections and audits will be done by EPC contractor (during construction phase), 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.

8.3.1 Transmission line audit

As per AIIB requirements, an audit of the 3 km long constructed external transmission line was conducted by HFE. The audit was conducted as per the audit checklist prepared by HFE. The filled audit checklist of the 3 km long constructed external transmission line has been presented as ***Appendix A*** of this report.

8.4 Reporting and Documentation

CSP Jodhpur 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.).

8.4.1 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.

8.4.2 Internal Reporting and Communication

There are following reports required for the construction and operations period, as per HFE ESMS:

- Monthly Compliance Report: Once the construction of the project starts, a monthly compliance report needs to be submitted by the Contractor. The compliance will be verified against applicable laws, ESMP and other conditions as required by the contract.
- Quarterly Audit Report: Regular supervisory missions to be carried out by the environmental Manager and a brief summary report shall be prepared with corrective actions, which will be shared with the contractors during construction till commissioning.
- Monthly Compliance Report: Once the operation of the project has started, a monthly compliance report will be submitted by Contractor. The compliance will be verified against applicable laws, ESMP and other conditions as required by the contract.
- Six-monthly Audit Report: Regular supervisory missions will be carried out by the Environmental Manager and a brief summary report shall be prepared with corrective actions, which will be shared with the contractors.

8.4.3 Documentation

Documentation is an important step in the implementation of the ESMP, CSP Jodhpur 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.

8.4.4 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.

8.5 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 EPC Contractor 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.

8.6 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 Jodhpur

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 Jodhpur	Report from HSE officer of EPC Contractor to site HSE In-charge of CSP Jodhpur
			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 Jodhpur	Report from HSE officer of EPC Contractor to site HSE In-charge of CSP Jodhpur
			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 Jodhpur	Report from HSE officer of EPC Contractor to site HSE In-charge of CSP Jodhpur
Topography and Drainage									

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 and strengthening of access roads; and ▪ Site clearance.	Changes in Topography and Drainage	Construction	Disruption/alteration of micro-watershed drainage pattern should be minimized to the extent possible; and	EPC Contractor	Site inspection	Monthly Monitoring	Site HSE Officer of EPC Contractor	HSE In-charge of CSP Jodhpur	Report from HSE officer of EPC Contractor to site HSE In-charge of CSP Jodhpur
			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 Jodhpur	Report from HSE officer of EPC Contractor to site HSE In-charge of CSP Jodhpur
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 Jodhpur	Report from HSE officer of EPC Contractor to site HSE In-charge of CSP Jodhpur
			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 Jodhpur	Report from HSE officer of EPC Contractor to site HSE In-charge of CSP Jodhpur

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
▪ Storage and transport of 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.	Soil contamination	Construction, Operation, Decommissioning	No unauthorized dumping of used oil and other hazardous waste should be undertaken at 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 Jodhpur	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Jodhpur
			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 Jodhpur	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Jodhpur
			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 Jodhpur	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Jodhpur
			In case of accidental/unintended spillage on small area, the contaminated soil should be immediately	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 Jodhpur	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-

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
			collected and stored as hazardous waste.						charge of CSP Jodhpur
			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 Jodhpur	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Jodhpur
			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 Jodhpur	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Jodhpur
Air Quality									
▪ Fugitive emissions from site clearing, excavation work, material handling etc.;	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 O&M Team	HSE In-charge of CSP Jodhpur	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Jodhpur

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
▪ Fugitive emission from traffic movement; ▪ Exhaust emission from operation of machineries like pile drivers, vehicles; ▪ Point source emission from diesel generator.			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 Jodhpur	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Jodhpur
			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 Jodhpur	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Jodhpur
			Vehicle engines need to be properly maintained and should have a valid Pollution Under Control (PUC) to ensure minimization in vehicular emissions	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 Jodhpur	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Jodhpur
Water Environment									
Water required for construction phase and	Depletion of water resource	Construction, Operation Phase	Permission will be obtained from Rajasthan State Level/Central	EPC Contractor/O&M Team	Permission letter	Monthly Monitoring	Site HSE Officer of EPC Contractor/ site	HSE In-charge of CSP Jodhpur	Report from HSE officer of EPC Contractor/ O&M 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
operation phase of the project			Groundwater Authority for abstraction of ground water.				HSE In-charge of O&M Team		to site HSE In-charge of CSP Jodhpur
			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 Jodhpur	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Jodhpur
			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 Jodhpur	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Jodhpur
			Use of dry cleaning technologies or similar new technologies (PV module cleaning) during the operation phase to conserve water	O&M Team	Site inspection	Monthly Monitoring	Site HSE In-charge of O&M Team	HSE In-charge of CSP Jodhpur	Report from HSE O&M contractor to site HSE In-charge of CSP Jodhpur

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
▪ 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 Jodhpur	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Jodhpur
			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 Jodhpur	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Jodhpur
Noise quality									
▪ Construction and demolition activities; ▪ Operation of DG sets; and ▪ Vehicular movement	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 hours, it should be limited to activities which do not generate noise;	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 Jodhpur	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Jodhpur

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
			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 Jodhpur	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Jodhpur
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 Jodhpur	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Jodhpur
			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 Jodhpur	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Jodhpur
			Permitting system should be implemented to ensure that cranes	EPC Contractor/O&M Team	Permitting document	Monthly Monitoring	Site HSE Officer of EPC Contractor/ site	HSE In-charge of CSP Jodhpur	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
			and lifting equipment is operated by trained and authorized persons only				HSE In-charge of O&M Team		O&M contractor to site HSE In-charge of CSP Jodhpur
			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 Jodhpur	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Jodhpur
			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 Jodhpur	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Jodhpur
			A safety or emergency management plan should be in place to account for natural disasters, accidents and any emergency situations. The nearest hospital, ambulance,	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 Jodhpur	Report from HSE officer of EPC Contractor/ O&M contractor to site HSE In-charge of CSP Jodhpur

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
			fire station and police station should be identified in the implemented emergency management plan.						
Community, Health & Safety									
Community Health & Safety		Construction	■ For the access road: Identify community health hazards and safety risks especially during night time along the construction stretch. Formulate mitigation strategies and implement them effectively. Specific issues that will pose safety risks to local community could be restricted carriage way	CSP Jodhpur through EPC contactor, Electrical Contractor and any other contractors to be mobilised at site.	■ Site Inspection; ■ Training records; ■ Visual Assessment	Monthly	EHS- EPC and Electrical Contractors	EHS- CSP Jodhpur	Monthly Progress Report

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
			width; allowing heavy machineries/heavy load traffic through normal village roads, material loading/ unloading sites, boulder dumps etc.; night time visibility especially if material/ waste dumps are maintained along traffic allowed carriageway; hazardous road surface conditions that is dusty or wet or pot holed; poor SWD arrangements etc; ■ The project will communicate about the technical aspects of the construction						

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
			and operations along with their community safety and nuisance implications; ■ CSP Jodhpur shall ensure that the EPC and Electrical Contractors are committed to health and safety of workers as well as the community and their property and will community the precautions that will be taken; ■ Exposure visits of community representatives to construction sites to increase awareness on community H&S aspects;						

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
			■ Review the construction phase accident and incident records at least every month; ■ Training of contractors and their labourers on precautions to be taken to minimize nuisance for the local community; ■ Movement of heavy vehicles: The access road to the site location passes through some villages. Plying of heavy vehicles carrying equipment to the site particularly during day time could lead to unsafe situation						

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
			for the local community; ■ Other safety measure like provision for night time visibility at accident prone areas, repair hazardous road surface conditions etc. should devised based on consultation with community representatives.; ■ There should be control on movement of migrant workers in local community. Site authority should provide all the basic facilities to migrant workers at site only;						

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
			■ The project should communicate with community about the technical aspects of the construction and operations along with their community safety and nuisance implications; ■ CSP Jodhpur shall ensure that the EPC and Electrical contractors are committed to health and safety of workers as well as the community and their property ; ■ Provision for cattle safety should be provided as the area was observed with						

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
			many grazing animals; Installation of signage/boards indicating danger, safety practices and emergency contact details for the benefit of nearby community. ■ Training of contractors and their labourers on precautions to be taken to minimize nuisance for the local community such as safety of women						
■ Land based community impact ■ Procurement of private land for the project ■ Loss of any crop or	■ Loss of land ■ Economic impact due to loss of crop/ agricultural field	Construction & Operation	■ Land should be procured at the prevailing market rate; ■ Avoidance of any undue pressures on landowners to sell-off land	CSP Jodhpur	Record Keeping	Quarterly	Community Relations Manage- CSP Jodhpur	EHS- CSP Jodhpur	Internal Verification Report to EHS Manager

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
agricultural field during stringing or maintenance during erection of transmission lines			through land aggregator ; ■ During transmission line stringing process and tower erection process, compensation for crop loss, if any will be provided ■ Document the land procurement procedure that is being followed for the project to enable its review; ■ All assets and crops to be valued at replacement value during land negotiations – allow harvesting of standing crops. ■ Have provision to compensate adequately any						

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
			kind of damage to the assets/crops/other properties of the local incurred due to project activities. ■ As HFE already has a Stakeholder engagement and grievance redress plan in place, it should be disclosed with the community. Documentation of engagement activities and record of grievances received and action taken there upon. ■ CSP Jodhpur should form a Community Relations Team						

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
			for the project lifecycle; ■ Training of Community Relations Team of CSP Jodhpur as Community Liaison Officers to implement the stakeholder engagement & grievance redressal Plan;						
Impact on Community Use and Access of Land: Grazing; fuel wood collection; collection of endemic herbs etc.	Impact on local community	Construction	■ The project will engage with the affected community to understand the most commonly accessed regions/areas on the Solar farm site with respect to grazing, fodder collection,	CSP Jodhpur through EPC contactor, Electrical Contractor and any other contractors to be mobilised at site.	Record Keeping	Quarterly	Community relations Manager- CSP Jodhpur	EHS- CSP Jodhpur	Internal Verification Report to EHS Manager

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
			firewood collection etc; ■ Avoid impacting community lands of value to the community and if unavoidable, replace or compensate any community lands and use in consultation with the people;						
Long-term Employment Opportunities in unskilled and semi-skilled and housekeeping tasks	Impact on local community	Construction & Operation	■ CSP Jodhpur and their EPC/Electrical contractors should establish a procedure for employment scheme which sets reasonable targets and estimates of absorbing workforce from the	CSP Jodhpur	Record Keeping	Quarterly	Community relations Manager- EPC/Electrical Contractor and CSP Jodhpur	EHS- CSP Jodhpur	Internal Verification Report to EHS Manager

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 communities. Efforts should be made to made to employ women workforce ■ Criteria should be set, wherever reasonable and possible for preference of any vulnerable groups/households; land sellers who ever rendered marginal/landless; women etc; ■ Share employment or vendor opportunities with local panchayats and maintain record of such opportunities provided to local community						

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
			■ Provide training on EHS aspects to local employees; ■ Training provided should focus on local skill development.						
Large scale change in the current landscape due to construction of a solar farm site	Interference in original visual landscape	Construction & Operation	■ Signage related to the solar Farm must be discrete and confined to entrance gates. No other corporate or advertising signage, particularly billboards to be displayed on site ■ The footprint of the operations and maintenance facilities, as well as parking and vehicular circulation, should	CSP Jodhpur	Visual Inspection & Site Assessment	Once	EHS- EPC and Electrical Contractors	EHS- CSP Jodhpur	Internal Verification Report to EHS Manager

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 clearly defined, and not be allowed to spill over into other areas of the site						
Labour and Working Conditions									
Labour and working condition	Impact on Economy and Employment	Construction and operation phase	■ The accommodation facility for regular employees should be constructed to meet the requirements of IFC's Workers' Accommodation, Processes and Standards. ■ CSP Jodhpur should ensure that the accommodation facilities being used in the villages meet the requirements of	CSP Jodhpur	Internal Audit	On priority basis on monthly basis	EHS head and contractors	EHS- CSP Jodhpur	Internal Verification Report to EHS Manager

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
			the IFC Standards; ■ CSP Jodhpur, as part of its sub-contractor agreements, must include a clause that requires each contractor to have an EHS plan in place, as well as procedures for monitoring the EHS performance of contractors and their workers; ■ A monthly monitoring and regular auditing mechanism should be in place for monitoring the sub-contractors and suppliers with respect to compliance to the applicable						

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
			reference framework, in terms of resources, migrant workers, child labour and forced labour, health and safety (Workers safety system aspect and inclusion of PPEs and mitigation measures for electrical related work), payment of wages etc. ■ If women workers are engaged, all the applicable labour laws (Maternity Benefit (Amendment) Act, 2017, Sexual Harassment of Women at Workplace						

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
			(Prevention, Prohibition and Redressal) Act, 2013) etc. are required to be followed.						
Ecology									
Disturbance in Wildlife Movement	Impact on wildlife. The land clearance activities for the construction activities lead to removal of vegetation, habitat disturbance for resident birds and animals.	Construction	■ Project related activities should be avoided during the night time. ■ Removal of vegetation should be limited to the extent possible; ■ Damage to the natural topography and landscape should be minimized; ■ General awareness regarding wildlife should be enhanced through	CSP Jodhpur through EPC contactor, Electrical Contractor and any other contractors to be mobilised at site.	Site Inspection; Training records; Visual Assessment by experts	Once during the project phase	EHS- EPC and Electrical Contractors	EHS- CSP Jodhpur	Once during project phase

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
			trainings, posters etc. among the staff and labourers; ■ Strict prohibition should be implemented on trapping, hunting or injuring wildlife within the subcontractors and should bring a penalty clause under contractual agreements; ■ Camp and kitchen waste should be collected and disposed in a manner that it does not attract wild animals; ■ A minimum possible number of routes should be authorized for						

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
			use during construction by the labourers and staff, speed limited of the vehicles plying in these routes should be kept 15-20 km/hr to avoid road kill; ■ Where natural drainage crossing is envisaged at approach roads, culverts should be provided for crossing of herpetofauna species; ■ Strict prohibition on use of fuel wood and shrubs from nearby areas as kitchen fuel; ■ Temporary barriers should be						

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
			installed on excavated areas; ■ Stage-wise re-vegetation with local species should be undertaken immediately after completion of construction work; and ■ The footprint of the construction activities should be kept to the minimum to reduce disturbance to flora and fauna.						
Habitat Alteration at the Solar farm site	Impact on wildlife	Construction and Operation	■ Minimise vegetation removal or trimming to the extent possible at Solar Farm site,	CSP Jodhpur through EPC contactor, Electrical Contractor and any other	Site Inspection; Training records; Visual Assessment by experts	Once during the project phase	EHS- EPC and Electrical Contractors	EHS- CSP Jodhpur	Once during project phase

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
			EHV transmission line alignments, internal/ external access roads, substation area, yards, CMS facility and other ancillary facilities; ■ Strict prohibition should be implemented for cutting of trees, shrubs for kitchen fuel and trapping and hunting of animals and birds; ■ The soil removed during construction of roads and other related structures should be used to reclaim disturbed areas upon completion of	contractors to be mobilised at site.					

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 activities; ■ Construction noise should be minimized by usage of acoustic enclosures and lubrication of equipment's where feasible; ■ Design of the transmission towers and transformers should be such that there is minimum risk of electrocution to birds; ■ The transmission towers should be raised with suspended insulators in order to reduce the						

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
			electrocution of bird species; ■ Bird flight deterrents should be installed on transmission lines.						

1. If traffic traverses the community, then the traffic plan should be prepared prior to mobilization.
2. The Biodiversity Management Plan suggested by IFC should be added to reflect the mitigations for ecological impacts from solar and T-line prior to mobilizations.

9. IMPACT SUMMARY AND CONCLUSION

9.1 Introduction

This environmental and social impact assessment has been conducted to evaluate the impacts associated with the solar power project of 250 MW capacity. The impact assessment has been conducted in compliance with the administrative framework identified herein, including relevant national legislative requirements and international guidelines/conventions.

9.2 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.

Table 9.1 Impact Assessment Summary

Impact Description	Impact Nature	Significance of Impact	
		Without Mitigation	With Mitigation
Construction Phase			
Change in Land Use	Negative	Moderate	Moderate
Impact on Drainage and Topography	Negative	Minor	Negligible
Soil Compaction and Erosion	Negative	Minor	Negligible
Waste Generation and Soil Contamination	Negative	Minor	Negligible
Impact on Water Environment	Negative	Moderate	Minor
Impact on Air Quality	Negative	Moderate	Minor
Impact on Ambient Noise	Negative	Minor to Moderate	Negligible to Minor
Impact on Occupational Health and Safety	Negative	Minor	Negligible
Impact on Community Health and Safety	Negative	Minor	Negligible
Landscape and Visual Impacts	Negative	Moderate	Minor
Impact in Land Holding and Agriculture Land	Negative	Minor	Negligible
Impact on Economy and Employment	Positive		
Ecological Impacts - Impacts due to Vegetation Clearance and Construction Activities	Negative	Minor	Negligible
Ecological Impacts - Impacts due to Influx of Migrant Labour and Labour camps	Negative	Minor	Negligible
Operation and Maintenance Phase			
Soil Compaction and Erosion	Negative	Negligible	Negligible
Waste Generation and Soil Contamination	Negative	Minor	Negligible
Impact on Water Environment	Negative	Minor	Negligible
Landscape and Visual Impacts	Negative	Moderate	Minor
Impact on Economy and Employment	Positive		

Impact Description	Impact Nature	Significance of Impact	
		Without Mitigation	With Mitigation
Ecological Impacts - Impacts due to Collision and Electrical Hazards from Transmission Infrastructure	Negative	Minor	Minor
Decommissioning Phase			
Impact on Soil Environment	Negative	Moderate	Minor
Impact on Water Environment	Negative	Moderate	Minor
Impact on Air Quality	Negative	Minor	Negligible
Impact on Ambient Noise	Negative	Negligible to Minor	Negligible
Impact on Economy and Employment	Negative	Minor	Negligible
Cumulative Impact Assessment			
Change in Land use and Visual Impacts	Negative	Moderate	
Impact on Soil Environment	Negative	Moderate	
Impact on Water Environment	Negative	Minor to Moderate	
Impact on Air Quality	Negative	Minor to Moderate	
Impact on Ambient Noise	Negative	Minor to Moderate	
Impact in Land Holding and Agriculture Land	Positive		

9.3 Project Categorisation

9.3.1 IFC and AIIB Project Categorisation

IFC's Environmental and Social Review Procedure Manual [23] and AIIB Environmental and Social Framework have 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.

9.3.2 Category Justification

Selection of **Category B** is based on similar reasoning:

- **Potentially limited risks/impacts and reversible**: Environmental and social impacts of the project 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. Further, there is no physical displacement

(23) 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.

involved in this project. Thus, most of these impacts are limited to the project sites and their immediate vicinity and can be minimized through application of mitigation measures as proposed in the ESMP.

- **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. Furthermore, another 250 MW solar power project of CSP (Bhadla) is located within the 5 km radial zone of the project along with three other solar plants with 23 MW, 20 MW and 10 MW capacity.
- **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 terms of social impacts the land required is composed of private agricultural land. The site location of the project does not involve any anticipated settlements and physical displacement.

9.4 Conclusion

The Project is a green energy project proposing to generate 250 MW power through solar energy. The Project and its key components such as site office building, external transmission lines, internal transmission line, 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 Jodhpur in complying with its internal requirements as well as national/state regulatory framework in addition to meeting IFC requirements.

APPENDIX A EXTERNAL TRANSMISSION LINE AUDIT CHECKLIST

Items	Status	Remarks
Enforcement of the application of personal protective equipment whenever exposure levels of fumes, solvents and other materials exceed threshold limit	NA	PPEs are used for work at site. However, there is no significant exposure level of fumes, solvents or other material.
Maintenance of equipment	YES	The equipment are periodically inspected by third party (in scope of O&M contractor)
Use of protective gear when noise level exceeds 85 dB	YES	Ear plugs are used as the protective gear
Safe working area (absence of radiation, magnetic fields)	NA	
Monitor regularly for radiation and field levels and equipment integrity	NA	This shall be done after energizing TL, if required.
Strict procedure for de-energizing before working on electrical equipment	YES	Globally accepted procedure of Lock Out Tag Out is practiced for isolation and de-energizing before working on electrical equipment
Training of personnel for safety procedures	YES	This is mandatory requirement as per law of the land and all applicable job specific training provided.
Physical factors in the workplace signage	YES	workplace safety signages are placed at site
Lighting (including security lights)	YES	
Fire detection mechanism/equipment	NA	
Firefighting equipment	YES	Only Fire extinguishers will be used
First Aid Kit	YES	First aid kit provided with sufficient medicine.
Features that pose safety risks (missing or broken slabs, dogged holes, etc.)	YES	During construction there is procedure to identify unsafe condition through various methods such as safety walkdown, safety inspection etc. This ensure that reduction in risk level.
Safe and clean drinking water	YES	Water purchased from food safety approved supplier.
Noise	YES	Noise monitoring conducted during construction of transmission line.
Vibration	NA	
Illumination	NA	All work executed in day light only.
Temperature	yes	During Hot weather mid noon work restricted. Beside that glucose and cold water made available to maintain good hydration.
Hazardous materials	NA	No significant hazardous material used however, if any hazardous material generated then disposed as per law of the land.
Biological agents	YES	Only snake and scorpion can be find in working area. During construction sprinkling of carbolic acid done to avoid.
Ionization radiation	NA	
Training (Learning materials, equipment and tools)	YES	in scope of owner of transmission line as per their HSEMS (TATA)

Items	Status	Remarks
Training on operational hazardous and how to control the hazards	YES	Transmission line not in operational till now. Training shall be provided on controlling of hazard after operation starts.
Training on health risks, hygiene, and exposure prevention	YES	All relevant training provided during construction.
Training on accidents and accident prevention, protective equipment and clothing	YES	All relevant training provided during construction.
OHSMS organization policy	YES	OHSE policy is in place
Emergency prevention, preparedness and response	YES	Project specific emergency response plan was available and made aware each of associates.
Investigation of work related injuries, ill health, disease and accidents	YES	Accident/incident investigation system is available.
Safety inspection, testing and calibration	YES	inspection, testing & calibration is done by the third party
Storage	YES	Safe storage has been ensured.
Labelling	YES	All materials were clearly marked.
Handling	YES	MSDS and other relevant information provided for safe handling of materials.
Disposal	YES	Disposal of hazardous waste, e-waste & bio medical waste is disposed through the third party vendor. Tie - up with all the three vendor are in the scope of contractor
Compensation Compliance with GoI Legislation	YES	
Labour complaints	YES	There is a grievance mechanism to address the community & labour complaints
Public consultation	YES	Public consultations are conducted during the land acquisition and is a part of ESIA process & report
Community complaints		There is a grievance mechanism to address the community & labour complaints

Note: Audit checklist prepared and filled by HFE based on AIIB requirements

ERM has over 160 offices across the following countries and territories worldwide

Argentina
Australia
Belgium
Brazil
Canada
China
Colombia
France
Germany
Hong Kong
Hungary
India
Indonesia
Ireland
Italy
Japan
Kazakhstan
Kenya
Malaysia
Mexico
The Netherlands
New Zealand
Panama
Peru
Poland
Portugal
Puerto Rico
Romania
Russia
Singapore
South Africa
South Korea
Spain
Sweden
Taiwan
Thailand
UAE
UK
US
Vietnam

ERM India Private Limited
Building 10A, 4th Floor
DLF Cyber City
Gurgaon – 122002
NCR

T: +91 124 4170300
F: +91 124 4170301

www.erm.com

The business of sustainability

ERM