Deloitte.

Environmental and Social Impact Assessment for Solar Power Project in Bikaner Tehsil and District, Rajasthan

Project Location: Bikaner Tehsil and District, Rajasthan

Draft Report

April 2023

Prerak Greentech Private Limited

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1. Introduction

Prerak Greentech Private Limited (hereinafter referred to as "PGPL" or "Client"), a 100% subsidiary of Brookfield Renewable India Private Limited (hereinafter referred to as "BRIPL") is in the process of developing a 400 MW solar power project in Kawani and Gol Pratapsingh villages of Bikaner tehsil and district in the state of Rajasthan, India. PGPL has engaged Deloitte Touche Tohmatsu India LLP (hereinafter referred to as "DTTILLP") to undertake Environmental and Social Impact Assessment (ESIA) for the proposed 400 MW Solar Power Project.

This ESIA report identify and assist client in assessment of any potentially significant adverse environmental and social impacts associated with the proposed Project and provide recommendation to the client for their consideration to prevent, minimize, mitigate, and compensate adverse impacts in compliance with the Applicable Reference Framework

1.1 Objective

The primary objective of the ESIA includes the following

- Analyse the existing status of environment and social conditions in the project area including – a) within Project site boundary, b) area within 5 km around Project, c) identify community directly affected by Project activities, d) access road;
- Carry out environmental and social analysis of Project area in relation to activities under the Project;
- Conduct discussions with the Client and other select stakeholders which might be influenced by the Project to ascertain if all key stakeholders are aware of the objectives and potential impacts of the proposed Project;
- Review the socio-economic status of the project affected community based on data collated through secondary as well as primary information;
- Analyze biodiversity (flora and fauna) affected due to project activities;
- Undertake an analysis of alternatives: Analyze the alternatives to the proposed project site, make of solar module, route of transmission line as identified by Client in terms of their potential environmental and social impacts, the feasibility of mitigating these impacts, etc.;
- Assess the indicative impacts keeping in mind environmental and social impacts;
- Suggest best practices for Client's consideration to minimize the identified impacts associated with the pre-construction, construction, operation and decommissioning phases of the Project;
- Based on the defined reference framework (Section 1.2 below) and IFC's existing guidance on Environmental and Social Categorization for projects, indicate towards the project E&S category for client's consideration, decision and finalisation.

1.2 Applicable Reference Framework

Applicable reference framework for this assignment includes the following:

- Applicable local, national and state level (E&S) laws, regulations and standards
- IFC Performance Standards Framework, 2012
- IFC/WB Group General EHS Guidelines, April 2007
- IFC/World Bank EHS Guidelines for Electric Power Transmission and Distribution (2007)

1.3 Scope of Work

The scope of work for the ESIA study includes

- **Reconnaissance Survey:** Conduct reconnaissance site survey of the proposed Project location to understand site settings, environmental and social baseline and identify potential Project specific impacts
- **Defining the study area/ Project description:** Provide a Project description with focus on understanding the environmental and social setting and sensitivities for the proposed solar PV power Project. This would also include any related facilities that may be required (e.g., access roads within the Project area, water supply arrangements, transmission lines etc.).
- **Review of Project Information:** This includes review of all relevant Projects documentation and study of various activities during the construction and operational phase of the solar PV Project, including Project cost and implementation schedule, to identify the impacts on various environmental components as well as the areas/activities that lead to such impacts.
- **Laying down Policy, legal, and administrative framework**: Describe the policy, legal and administrative framework within which the assessment is carried out, national and state specific regulations (including permits and licenses). Review the Social & Environmental compliance requirement with respect to the above; present an overview of Government of India's and State

Government's social policies, legislations, regulatory and administrative frameworks in conjunction with the IFC Performance Standards.

- **Establishment of Baseline:** Review the data on various environmental and social components collected from authorized agencies/authorities (as required) and published secondary sources, to establish the baseline of the Project influence area from the Project location. This also include primary environmental, ecological and social surveys at Project locations, supplemented by secondary information. Land use mapping to include environmental sensitivity and land-use pattern along the route of transmission line based on desk-based GIS review.
- **Stakeholder Consultation and Analysis**: Conduct consultation and information dissemination session with Project affected persons (in case of private land) and other relevant stakeholders and government departments as well as with local community in general to inform stakeholders about the objectives and potential impacts of proposed Project at the site and suggested additional measures around stakeholder engagement and grievance mechanisms for the Project.
- **Impact Assessment and Mitigation Measures**: Assess the Social and Environmental impacts (both positive and negative), with potential assessment. Assist to provide mitigation measures and assessment of any residual negative impacts that cannot be mitigated. Also evaluate impacts and risks from associated facilities and other third-party activities.
- **Preparation of ESMP**: Provide recommendations in line with established Good Internatiinal Industry Practices for client's consideration to integrate into the project's E&S management plans developed specially for the project.
- **Reporting:** ESIA report based on the defined reference framework and IFC's existing guidance on Environmental and Social Categorization for projects in discussion with the client for their consideration.

1.4 Approach & Methodology

The approach and methodology for the ESIA has been provided in subsequent sections

1.4.1 Project Kick Off

DTTILLP organized a kick-off discussion with the Client to obtain an overview of the status of the project, and their expectations. Kick off meeting also included discussion on timelines for the site assessment and the deliverables. After project kick off, indicative list of details/ documents required to be reviewed were shared.

1.4.2 Documentation Review

The kick-off was followed by a desk-based review of information shared with DTTILLP. Documents reviewed as part of this assignment included project boundary, tentative transmission line route in KMZ, PGPL's HSSE Policy etc. Detailed list of documents reviewed is attached as **Appendix 1.**

1.4.3 Site Reconnaissance

Team comprising of EHS expert and Social expert conducted site visit to the proposed project between 10-11 March 2023 and a biodiversity expert conducted site visit between 13-15 March 2023 to screen the project features and identify environmental, social and ecological sensitive resources and receptors in and around the project site and transmission line route. Based on the sensitive resources and receptors identified, risks and impacts on such sensitivities due to the project activities has been assessed

1.4.4 Environmental and Social Impact Assessment Reporting

This ESIA report has been prepared by DTTILLP based on the site assessment, documents made available till 10.04.2023 by the client, consultation with representatives from PGPL and nearby communities and information available on public domain. The structure for the ESIA study report has been presented below:

- **Introduction** *(This Section)*- An overview of the ESIA objective, scope of work, approach and methodology adopted for the assignment and limitations.
- **Project Description-** An overview of the proposed project, resource requirement etc. are presented based on the data provided by client and information collected as part of the ESIA study.
- **Applicable Legislative Regulatory & Administrative Regime-** A summary on the understanding the Client's adherence to Applicable Reference Framework covering applicable national regulations and standards, applicable permits, approvals and licenses pertaining to environment, health, safety and social aspects.

- **Baseline Condition**- A detailed baseline condition of the project area presented is based on primary and secondary data available for the study area.
- **Stakeholder Consultation and Analysis:** Details on profile of the stakeholder groups identified as part of the study, their key interests and concerns and the way they may be involved in the project lifecycle have been provided.
- **Impact Assessment:** Based on the project details, outcomes of scoping exercises and baseline information collected, an assessment of impacts on the Environmental, Ecological and Social components has been undertaken which typically include:
    - Predicting and assessing the project's likely positive and negative impacts and assigning significance to each type of impact.
    - Identifying mitigation measures and any residual negative impacts that cannot be mitigated.
    - Evaluation of risks and impacts associated with the proposed project.
- **Environmental and Social Management Plan:** Provide recommendations to the client team to allow them to update their existing E&S management plans for the project to minimize any impact on environment and social receptors throughout the project life cycle.
- **Impact Summary:** Review the impact categorization based on IFC's existing guidance on Environmental and Social Categorization for projects for each environmental, social and ecological parameter.
- **Appendix 1:** List of documents reviewed
- **Appendix 2:** Photo Documentation
- **Appendix 3:** Contractor HSSE obligations for EPC Contractors

1.5 Limitations

This report has been developed based on the Project level information provided by Client and professional judgment to certain facts with resultant subjective interpretation. This ESIA report has following limitations:

- 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 local community and PGPL site representative.
- Details on resource requirement is currently unavailable with Client and will be finalised prior to mobilization of EPC contractor onsite. The resource requirement details provided in the report are based on DTTILLP's past experience on similar capacity of projects in Rajasthan.
- Ecological survey was conducted during the daylight hours and thus the avifaunal and faunal activities recorded were restricted to diurnal hours only. No night surveys were carried out.
- The project report is not intended to meet any national, state, or local statutory requirements and for any regulatory submission (as part of any permitting process or otherwise)
- This is a non-assurance work with no audit/loan staffing services to be provided and there are no other client-side / other-side parties involved in this engagement.
- Reportedly most of the landowners live outside the project area therefore consultations were carried with the available persons living close to the project.
- Reportedly most the land parcels were under possession of the project therefore, during the site visit, the pre-project status of land and its use could not be analysed.
- The land which is leased for the project was not in use (fellow land) since long time therefore dependence if any on the land for livelihood of the affected families could not be objectively ascertained.

2. Project Description

This section provides an overview of proposed project, in terms of location, associated facilities, site settings, resource requirement, land details and status of the project.

2.1 Project Overview

The 400 MW Solar Photovoltaic Power Project (hereinafter referred to as 'Project') is an open access group captive power project located in Bikaner Tehsil and District in the state of Rajasthan. The project is being developed by BRIPL under their special purpose vehicle (SPV) i.e. Prerak Greentech Private Limited (PGPL). The project is spread across a land admeasuring 1700 acres in Kawani and Gol Pratapsingh villages of Bikaner tehsil and district in the State of Rajasthan as presented in ***Figure 2-1.*** The project is proposed to be developed in two phases, where Phase I (226 MW) will be commissioned by November 2023 and Phase II (174 MW) will be commissioned by May 2024. PGPL has finalised "Jackson Green Private Limited" as the EPC contractor for the project who is yet to mobilise at the project location for initiating the construction work.

Commented [DTTILLP1]: Rishabh to note and update as relevant

The salient features of the proposed solar power project has been presented in ***Table 2-1.***

Table 2-1: Salient Features of the Proposed Project

Sr. No.	Components	Description
General Details		
1	SPV Name	Prerak Greentech Private Limited
2	Project Capacity	400 MW
3	Site Coordinates	28° 8'4.40"N, 73° 6'32.44"E
4	Site Location	Kawani and Gol Pratapsingh Villages of Bikaner tehsil and district, Rajasthan, India
5	Nearest Highway	National Highway 11 (Jaisalmer Bypass) located ~ 8.5 km (aerial distance) from site towards southeast direction
6	Nearest Railway Station	Bikaner railway station located ~ 25 km from site towards southeast direction
7	Nearest Airport	Bikaner Airport located ~ 13 km from site towards southeast direction
8	Current Project status	Pre-construction stage During DTTILLP site visit in March 2023, approximately 15% of the Project boundary wall was observed to be constructed. As reported by the Project team, construction of boundary wall for the Project is under the purview of land aggregator. However, the civil work for the Project will be initiated in the month of May 2023, after mobilization of EPC contractor.
9	EPC Contractor	Jackson Green Private Limited
10	Contractor for Transmission Line	Avengers Rays Private Limited
11	Commercial Operation Date	Phase I (226 MW): November 2023 Phase II (174 MA): May 2024
Project Components		
12	Total PV Modules	~10,00,000 no.s
13	Module Supplier	JA Solar Technology Company Limited
14	Mounting Type	Ground Mounting
15	Module Cleaning Type	Dry Robotic Module Cleaning
16	Total Inverters	121 no.s of 220 kW

Sr. No.	Components	Description
17	Inverter Make	Yet to be finalized
Power Transmission Details		
18	Transmission Line Length	220 kV single circuit transmission line of length 10.5 km connecting the Project to the 765/400 kV Bikaner II substation
19	Transmission Towers	50 towers
20	Pooling Substation	33kV pooling substation will be constructed within Project boundary. Tentative coordinates of Pooling substation is 28° 8'15.39"N, 73° 6'17.63"E.
21	Grid Substation	765/400 kV Power Grid Corporation of India (PGCIL) Bikaner II Grid Substation in Jaimalsar (28° 9'4.54"N, 73° 0'22.28"E) The Grid Substation is currently under construction and it will be operational from September 2023.
22	Power Purchase Agreement (PPA)	Yet to be Executed As informed by PGPL, separate PPA will be executed between PGPL and customers for selling power through the proposed open access 400 MW solar power plant.
Additional Project Infrastructure		
23	Additional Project Infrastructure	Project is expected to set up store room, site office and scrap yard within the project boundary
Project Land Details		
24	Land Requirement for the Project	1700 acres for the Solar power plant
E&S Sensitivities		
25	Surface water within 5 km	One natural and multiple manmade perennial water ponds were observed within 100m of the Project boundary towards south west direction. Water to the manmade water ponds is supplied from Kanwar Sen main lift line which is a branch of Indira Gandhi Nahar Pariyojana (IGNP) canal located 8 km (aerial distance) from the project boundary towards south direction. A sub branch of IGNP canal and three manmade ponds were observed to be located within the project boundary towards the north direction. The branch of IGNP canal and water ponds were observed to be dry during site visit. Based on discussion with onsite project team, it is understood that the sub branch of IGNP canal and the three manmade ponds are currently not connected to the main IGNP branch for water supply. Therefore, these water resources were observed to be dry.
26	Groundwater status	According to Dynamic Groundwater Resources of India by Central Groundwater Board (CGWB), 2022, Bikaner Rural block, where the proposed project is located is categorized as "Overexploited" in terms of groundwater availability.
27	Presence of Indigenous People (ownership of procured land or usage on procured land)	The land for the project is being leased for 29 years and the process of land procurement is not based on compulsory land expropriation laws and hence issues pertaining to involuntary land acquisition and resettlement is not getting triggered. The land transaction was carried out on willing seller and willing buyer basis. As informed, there are no land parcels belonging to Indigenous Community. However, the full list of potential land lessor was not available for review.

Sr. No.	Components	Description
28	Is project located in or near a Provincial or National Park, Protected Area, or ecologically sensitive sites	No National Park / Wildlife Sanctuary is present within 10 km radius from the proposed project. The nearest protected area as well as Important Bird Area (IBA), Jor Beed Conservation Reserve, Bikaner is situated about 28 km away from the proposed project site in Southeast direction[1]. The GIB (Great Indian Bustard) Potential Area is about 5 km from the project site in Southwest direction.
29	Project' Area of Influence considered as part of the ESIA	• **Ecological Parameters:** o ***Core Area:*** Boundary of the proposed project, and o ***Buffer Area:*** 5 km radius from the project boundary. • **Environmental Parameters:** The area of up to 5 km radius from the Project boundary has been demarcated as study area or Area of Influence for the Project by considering the extent of project impact in terms of air quality, noise, water resources, human settlement, location of the access roads besides considering the actual land area which will be used for the facilities. For the purpose of environmental baseline assessment, o ***core (0 - 500m from project site) and*** o ***buffer zones (beyond 500m – 5km of project site).*** • **Social and Cultural:** The study area for the social assessment comprises of the area identified for the Project as well as villages which might be impacted directly or indirectly by the Project. The key terms used for sub-categorisation of the study area are: o ***Core: Project village:*** Villages falling under the 2 km radius from the Project boundary o ***Buffer: Project's Area of Influence (AoI):*** Villages falling under the 5 km radius from the Project boundary except the project village o ***Project's study area:*** Study area including the Project villages and the village falling under the Project's AoI
30	Other Renewable Power Projects within 10 km	• Based on google earth imagery dated 10.09.2022 and discussion with PGPL team onsite, it is understood that currently there is no operational renewable power projects within 10 km of the proposed project. Additionally, currently no information on upcoming solar power projects by other developers in the project vicinity was available with PGPL onsite team and on public domain.

Source: DTTILLP Site Visit

2.2 Site Setting

The 400 MW proposed solar power project is located in Kawani and Gol Pratapsingh villages of Bikaner tehsil and district in the state of Rajasthan. It is proposed to be developed on flat to undulating land comprising of agricultural as well as scrub lands. The elevation of the project site ranges between 200 m to 220 m above mean sea level. The proposed area for the project is primarily covered with Acacia (babool) trees, Prosopis Cineraria (Khejri trees)[2] and vegetation consisting of shrubs and bushes. The site is polygonal in shape with land parcel admeasuring 1700 acres.

The nearest village to the site is Kawani village located at an aerial distance of 600 m from site towards north west direction. As observed during DTTILLP site visit, the proposed project is located along both the sides of Gram Panchayat road which is connecting Kawani village to NH-11 (Jaisalmer Bypass) at an aerial distance of 8.5 km towards south east direction. No separate approach road is proposed to be developed by PGPL and the existing village road will be used during both construction and operation phases.

During site visit, one natural and multiple manmade perennial water ponds were observed within 100m of the Project boundary towards south west direction (refer **Row 25** of ***Table 2-1).*** A sub branch of IGNP canal and three manmade ponds were observed to be located within the project boundary towards the north direction. As reported by onsite team, PGPL has verbally intimated IGNP department for development of the solar power plant around the sub branch of IGNP canal and three manmade ponds. As

[1] Rahmani, A.R., Islam, M.Z. and Kasambe, R.M. (2016) Important Bird and Biodiversity Areas in India: Priority Sites for Conservation (Revised and updated). Bombay Natural History Society, Indian Bird Conservation Network, Royal Society for the Protection of Birds and BirdLife International (U.K.). Pp. 1992 + xii

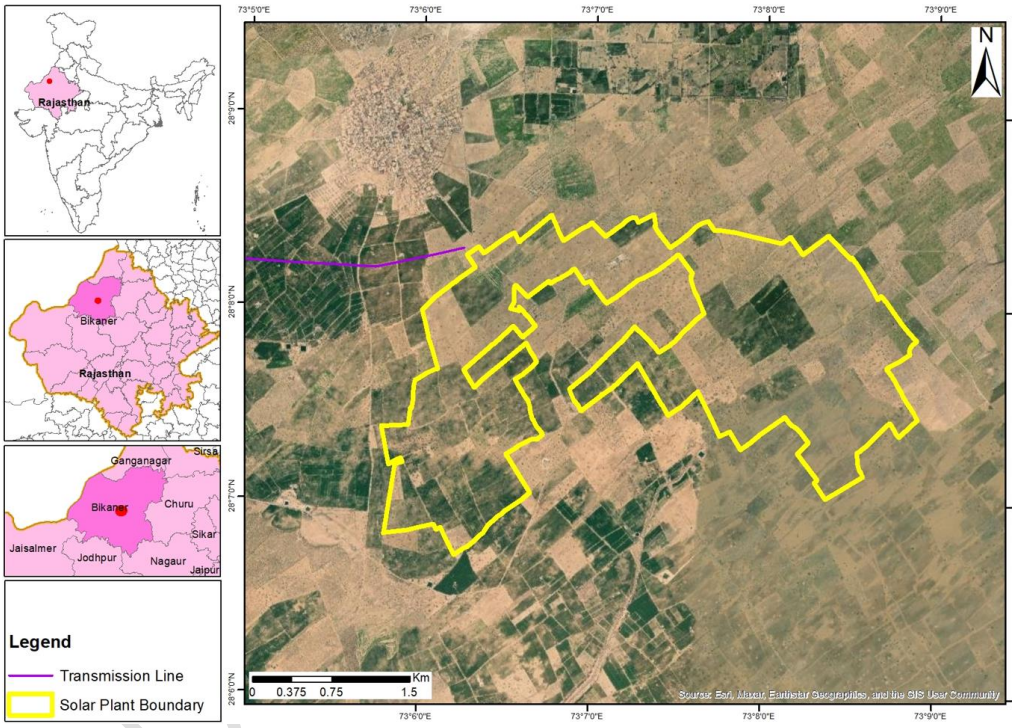
[2] Refer ***Section 4.4.3.3***

reported by PGPL team, the canal and the manmade ponds will be left untouched during the project lifecycle and access will be provided to IGNP authority (as and when required) for maintenance of the canal. However, PGPL is yet to receive a written no objection certificate (NOC) from IGNP Department.

A 400 kV multi-circuit transmission line is located along the Project boundary towards the north direction, where nearest tower of the transmission line is located at an aerial distance of 45 m from the proposed project boundary. The 400 kV transmission line is connecting 765/400 kV Bikaner II substation to Khetri Substation in Rajasthan.

The site location map for the project has been presented in ***Figure 2-1.***

Figure 2-1: Project location Map



Source: DTTILLP ArcGIS Mapping

2.3 Land Requirement and Procurement

As informed the total land requirement is nearly 1700 acres for the solar plant and details regarding the land required for transmission line and tower footing area were not available as on submission of this report. The land for the project was taken on a long term lease of 29 years. The land transaction was based on willing lesser and willing lessee agreements. The process for land procurement was started in June 2022 and is likely to be completed by June 2023. Nearly 1375 acres of land is in possession of the project and remaining 325 acres is in final stages of negotiations. The land for the project was procured through land aggregator which was subsequently transferred/ mutated in the name of the project. As the project does not involves compulsory expropriation of land hence the potential impacts associated with compulsory land acquisition and loss of livelihood of the affected families is not foreseen.

2.4 Resource Requirement

The resource requirement during construction and operation phase of the Project has been summarised in ***Table 2-2.***

Table 2-2: Resource Requirement

Sr. No.	Resource	Approximate Quantity	Source
1.	Manpower	The project will employ ~1200 skilled, semi-skilled and unskilled workers, during the construction phase. Further, during the operation the project will employee ~50 employees (on-roll and contractual).	Contractor
2.	Water	**Construction Phase** Water during construction phase will be required for civil work, domestic purpose and drinking purpose. As reported by PGPL, the water requirement for civil work will be estimated by the EPC contractor prior to mobilization at the Project site. However, based on DTTILLP's past experience in similar project, it is estimated that approximately 6000 KL of water will be required for the entire civil work which will be undertaken in two phases[3] for 6 months each. Furthermore, for domestic and drinking purpose, approximately 216 KLD water (considering 180 litres/person/day[4] for 1200 workers) will be required during construction phase. **Operation Phase** During operation phase of solar power project, typically water is required for module cleaning, domestic and drinking purposes. Since PGPL has plans to install 100% dry robotic module cleaning technology, therefore no water will be required for module cleaning except during one cycle of wet cleaning which will be undertaken once or twice a year. Considering, 10,00,000 modules and 1.5 litre water used per module, it is estimated that approximately 1500 KL water will be required in one cycle of wet module cleaning. Furthermore, for domestic and drinking purposes, approximately, 9 KLD water (considering 180 litres/person/day for 50 workers), will be required during operation phase.	**Construction and Operation Phases** PGPL has identified third party water tankers as the primary source of water during both construction and operation phases. Based on discussion with site team, it is understood that source of water for the tankers will be from IGNP. For drinking purpose, water campers will be procured from local vendor.
3.	Construction Material	As per PGPL, the estimated construction material for civil work will be calculated by EPC contractor prior to their mobilization at the Project site. However, based on DTTILLP's past experience in similar capacity of solar power projects, the following estimations on construction materials have been provided. **Cement** Approximately 1,837 tonnes/ month of cement is expected to be used during construction phase **Stone** Approximately 5,342 tonnes/month of stones is expected to be used during construction phase **Steel** Approximately 2,160 tonnes/month of steel is expected to be procured during construction phase **Sand** Approximately 3,125 tonnes/month of sand is expected to be procured during construction phase During operation phase, above mentioned construction materials will not be required.	**Cement** Cement will be procured from local suppliers which will be transported via road in cement bulkers and cement bags **Stone, Sand and Steel** Stones, sand and steel will be procured from local suppliers in Kolayat, Bikaner or Jodhpur which will be transported via road through trucks .
4.	Power	**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 15-25 kVA each will be used during construction phase. The exact number of DG sets to be used, as	

[3] Construction for Phase I (226 MW) will be completed by November 2023 and Phase II will be completed by May 2024.
[4] IFC Worker's accommodation Guideline

Sr. No.	Resource	Approximate Quantity	Source
		well as the quantity of fuel, could not be ascertained at this stage. As per PGPL, the same will be estimated by EPC contractor prior to mobilization at the Project site. **Operation Phase** It is anticipated that during operation phase, auxiliary power supply requirement may be catered from the power evacuation supply source, consequently the auxiliary energy consumption shall be deducted from the energy generated from the plant. The source of power for SCADA system and all related hardware shall be from auxiliary power supply. Additionally, Uninterrupted Power Supply (UPS) may be installed at the site office for power back up.	
5.	Fire safety and Security	**Construction Phase** Based on discussion with PGPL site team, it is understood that adequate firefighting system including fire extinguishers (ABC type), sand buckets, etc., will be installed at dedicated locations in compliance to National Fire Protection Authority (NFPA) fire safety standards and local fire authority requirements. **Operation Phase** During operation phase, firefighting system including portable fire extinguishers, fire buckets and automatic fire detection system are expected to be installed at the PV array, inverter stations, main control room and switchyard in compliance to National Fire Protection Authority (NFPA) fire safety standards and local fire authority requirements. In case of electrical utilities like transformers etc. the firefighting system is expected be in compliance to 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 Waste Management Practice for the Project

The following types of wastes are anticipated from the construction and operation of the proposed project and its associated management practices has been mentioned provided in the ***Table 2-3.***

Table 2-3: Waste Management at Project

Waste Type	Project Phase	Proposed Management Practice as per Good International Industry Practices (GIIP) and IFC E&S guidelines
Domestic solid waste including food waste from site office during construction phase and site office, SCADA building during operation phase	Construction and Operation Phase	Domestic solid waste including food wastes will be disposed through local municipal garbage collector
Construction and demolition wastes including debris, concrete etc.	Construction Phase	The project will generate construction wastes such as debris, cement etc from civil work. Construction debris generated on site will be used for backfilling and levelling and remaining wastes which cannot be reused will be disposed through municipal corporation in line with Construction and Demolition Waste Management Rules, 2016.
Hazardous waste such as waste oil, lubricants, oil contaminated rags, empty containers of paints etc	Construction and Operation Phase	Hazardous waste will be stored in designated store room with secondary containment. The storage containers will be clearly marked and identified for their hazards. Before completion of 90 days, hazardous waste materials will be sent to Rajasthan State Pollution Control Board (RSPCB)/Central Pollution Control Board (CPCB) authorized vendor for disposal at the Common Hazardous Waste Treatment, Storage and Disposal Facility (CHWTSDF). Hazardous waste authorized vendor is yet to be identified by PGPL.
Dry type or wet type batteries	Operation Phase	The batteries reaching end of life will be disposed of through authorised vendors as per the applicable regulations.

Waste Type	Project Phase	Proposed Management Practice as per Good International Industry Practices (GIIP) and IFC E&S guidelines
Sewage from site office and SCADA building	Construction Phase and Operation Phase	Sewage from site office and other areas will disposed through septic tank and soak tank as per specifications given in IS 2470: 1995 (Part I and II)
Biomedical wastes from first aid kits	Construction and Operation Phases	Biomedical wastes generated from site such as blood contaminated bandages, (if any) will be disposed through nearby hospital tie up. Expired medicines and ointments will be disposed through local authority in line Biomedical Waste Management Rules, 2016
E-waste	Construction and Operation Phases	E-waste generated at site will be in the form of defected or broken solar modules, laptops, monitors, Control Processing Unit (CPU) etc., will be disposed as per applicable e-waste rules.
Scrap waste such as wires, scrap steel etc	Construction and Operation Phase	Scrap material generated onsite will be disposed through identified vendor.

2.6 Analysis of Alternatives

This section analyses alternatives in connection to the Project, particularly related to the Project conception and planning phase.

2.6.1 No Project Scenario

Access to energy is a critical enabler of any region's economic development and prosperity. According to a survey conducted by the World Energy Council, as the population grows and the rate of electrification increases, India's total primary energy demand is expected to increase by nearly 150% by 2035.

2.6.1.1 Effect of COVID-19 Pandemic on Power Supply Position

As per the load generation balance report 2022-23 of the Central Electricity Authority, as a measure to contain the spread of COVID-19 pandemic in India, Government of India had announced complete lockdown in the country for 21 days from 25th March to 14th April 2020. Thereafter, the lockdown was extended in phases and gradual relaxations were affected from mid of May, 2020. This had impacted the economic activity in the country with consequent effect on demand for electricity as well. With the commencement of financial year 2021-22, the country had witnessed a rapid increase in cases of COVID-19 as a severe Second Wave, which again led to a lockdown scenario. However, this time the decision of imposing complete lockdown and relaxing the lockdown norms was with the respective States/ UTs and there was no nation-wide lockdown. The month-wise details of Actual Power Supply Position in the country in terms of Energy in the year 2020 and 2021 has been provided below:

Table 2-4: Actual Power supply Position in India in 2020 and 2021

Month	2021			2020		
	Energy Requirement (MU)	Energy Supplied (MU)	Energy Deficit (%)	Energy Requirement (MU)	Energy Supplied (MU)	Energy Deficit (%)
January	110,329	109,767	0.5	105,548	105,158	0.4
February	103,772	103,252	0.5	104,375	103,815	0.5
March	121,205	120,635	0.5	99,382	98,952	0.4

Month	2021			2020		
	Energy Requirement (MU)	Energy Supplied (MU)	Energy Deficit (%)	Energy Requirement (MU)	Energy Supplied (MU)	Energy Deficit (%)
April	117,496	117,080	0.4	85,030	84,550	0.6
May	109,085	108,809	0.3	102,651	102,089	0.5
June	114,837	114,483	0.3	105,556	105,086	0.4
July	124,167	123,720	0.4	112,341	112,147	0.2
August	128,519	127,881	0.5	109,474	109,217	0.2
September	112,898	112,435	0.4	112,407	112,407	0.1
October	114,028	112,797	1.1	109,300	109,174	0.1
November	99,557	99,324	0.2	97,374	96,883	0.5
December	109,541	109,177	0.3	106,093	105,623	0.4
Mean value for January to December	**1,365,434**	**1,359,360**	**0.4**	**1,249,532**	**1,244,934**	**0.4**

Source: Load generation balance report 2022-23 of the Central Electricity Authority

As observed from the above statistics, the complete lockdown in the country from 25th March, 2020, onwards has led to sharp increase in the Energy Requirement during the corresponding months of 2021, with the highest impact of 38.2% increase in the month of April, 2021 as compared to April, 2020. From September, 2021 onwards, there has been normal growth in energy requirement as compared to same month of last year due to normalcy being restored after the initial lockdown of 2020. On an overall basis, the Energy Requirement of 1,365,434 Million Units (MUs) in the country during the calendar year 2021 was 9.3% more than the Energy Requirement of 1,249,532 MUs during the previous calendar year of 2020.

2.6.1.2 Power Requirement in Rajasthan

As per the load generation balance report 2023-24 of the Central Electricity Authority, the current power supply scenario is deficient in the state of Rajasthan and the entire northern region. The actual power scenario in Rajasthan and Northern Region of India for FY 2022-23 has been presented in ***Table 2-5.***

Table 2-5: Power Supply Scenario of Rajasthan in FY 2022-23

State/Region	Requirement (MU)	Availability (MU)	Deficit (MU)	Deficit (%)
Rajasthan	103,260	101,271	-1988	-1.9
Northern Region	467,114	462,322	-4792	-1.0

Source: Load generation balance report 2023-24 of the Central Electricity Authority

To close the demand-supply gap, renewable/non-conventional energy sources will be needed to supplement conventional sources. The project, as a renewable source of power generation, will help to bridge the demand-supply gap. The project provides an opportunity to capitalize on solar power generation potential. The issue of power shortage will not be addressed by a "No Project Scenario." A non-project alternative is undesirable because it would worsen the power supply-demand scenario, which would be a constraint on economic growth.

2.7 Alternate Source for Power Generation

India has a large and rapidly growing economy, and the country's primary energy consumption is expected to increase four to five times by 2031-32. Despite the fact that India's energy box contains a diverse range of resources such as coal, lignite, oil, natural gas, LNG, nuclear, hydro, and wind power, however, coal holds a commanding 50% share in India's total power generation.

Solar energy is an eco-friendly process that is infinite and has a small environmental impact. The plant does not require any fuel to operate. Solar energy outperforms other forms of energy generation due to its low gestation time; a short lead time is required to design, install, and start-up a solar farm (up to a maximum of 2 months after micro siting, approvals, and land purchase). As per the estimations of International Atomic Energy Agency (IAEA) the grams of carbon-equivalent (including CO2, CH4, N2O, etc.) per kilowatt-hour of electricity (gCeq/kWh) for solar energy project are low and scores better when compared with forms of conventional sources of energy. ***Table 2-6*** highlights GHG emissions that each technology possesses

Table 2-6: Green House Emissions from Different Electricity Production Chains

Technology	Mean tonnes (CO2e/GWh)	Low tonnes (CO2e/GWh)	High tonnes (CO2e/GWh)
Lignite	1054	790	1372
Coal	888	756	1310
Oil	733	547	935
Natural Gas	499	362	891
Solar PV	**85**	**13**	**731**
Biomass	45	10	101
Nuclear	29	2	130
Hydroelectric	26	2	237
Wind	26	6	124

Source: World Nuclear Association (WNA)

Given various factors such as solar irradiation potential in the Project district; favourable environmental and social settings; low GHG emissions during the Project life cycle; land availability, governmental assistance, and local community acceptance of solar energy projects in the region over the last decade, solar energy-based power generation is the most appropriate alternative in Rajasthan.

2.8 Suitability of Project Site

Solar power projects are less polluting energy generation projects which are site specific and dependent on the availability of solar irradiance. 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 for solar is not available to a project developer.

The proposed project site has the following location advantages:

- Site with high solar irradiation;

- No reserve or protected forest within 5 km radius of the project site and tentative transmission line route
- No cultural property of archaeological importance within 5 km radius of the project site and transmission line route
- No settlements are falling within the project boundary

Therefore, based on the above, it is reasonable to conclude that the proposed project will contribute towards minimal greenhouse gas emissions, and it will enable the state of Rajasthan to be self-sufficient in power generation and supply.

During DTTILLP site visit, it was observed that a sub branch of IGNP canal and three manmade ponds were observed to be located within the project boundary towards the south direction. As reported by PGPL team, the canal and the manmade ponds will be left untouched during the project lifecycle and access will be provided to IGNP authority (as and when required) for maintenance of the canal.

3. Applicable Legislative, Regulatory and Administrative Regime

The following reference framework is applicable to the Project:

- Applicable environmental and social regulations and policies in India and the State of Rajasthan
- IFC Performance Standards on Environmental and Social Sustainability (2012)
- IFC/World Bank General EHS Guidelines (2007)
- IFC/World Bank EHS Guidelines for Electric Power Transmission and Distribution (2007)

3.1 National Administrative Requirements

In India, the national level laws are formulated by Ministry of Environment Forests and Climate Change (MoEFCC) and state governments are required to consider these regulations as base level for implementation. The State Pollution Control Boards (SPCBs) are responsible for securing compliance under the Environmental Protection Act, 1986, the umbrella legislation regulating environmental issues in the country. A brief description of the relevant enforcement agencies both at central level and state level with respect to the institutional framework is described in ***Table 3-1*** below.

Table 3-1: Relevant Enforcement Agencies

Sr. No	Agency	Function
Central Level		
1	Ministry of Environment Forests and Climate Change (MoEFCC)	The Ministry of Environment and Forests (MoEFCC), Government of India is responsible for the environment management at Union of India level. The specific functions of MoEFCC are as follows: • Environmental policy planning; • Effective implementation of legislation; • Issuing guidelines under EP Act for environment protection; • Monitoring and control of pollution through Central Pollution Control Board and State Pollution Control Boards; • Environmental clearance for industrial and development projects covered under EIA Notification; • Monitoring of compliance conditions stipulated in Environmental clearance through its regional offices; • Promotion of environmental education, training and awareness; • Forest conservation, development, and wildlife protection; and • Protection of Coastal areas. MoEFCC is responsible for the implementation and enforcement of the Environment Protection Act, 1986, and Rules issued under the Act, including the EIA notification. Under sections 3 and 5 of the EP Act, 1986, it retains enormous powers to issue directions in the interests of environment protection.
2	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.
3	Central Electricity Authority (CEA)	The Central Electricity Authority (CEA) is a statutory organization constituted under Section 3 of the repealed Electricity (Supply) Act, 1948, here in after replaced by the Electricity Act, 2003. Some of the functions performed by CEA include the following: • Advise the Central Government on the matters relating to the national electricity policy, formulate short-term and perspective plans for development of the electricity system and coordinate activities of the planning agencies for the optimal utilization of resources to sub-

Sr. No	Agency	Function
		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.
4	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.
5	The National Green Tribunal (NGT)	National Green tribunal was constituted in 2010 for effective and expeditious disposal of cases relating to environmental protection and conservation of forests and other natural resources including enforcement of any legal right relating to environment and giving relief and compensation for damages to persons and property and for matters connected therewith or incidental thereto. It is a specialized body equipped with the necessary expertise to handle environmental disputes involving multi-disciplinary issues. The tribunal will have jurisdiction over all civil cases relating to implementation of the following regulations: • The Water Act, 1974; • The Water Cess Act, 1977; • The Forest Conservation Act, 1980; • The Air Act, 1981; • The Environment Protection Act, 1986; • The Public Liability Insurance Act, 1991; and • The Biological Diversity Act, 2002.
6	Ministry of Power	The Ministry of Power is an Indian Government Ministry. The Ministry if charged with overseeing electricity production and infrastructure development, including generation, transmission, and delivery, as well as maintenance projects. Further, the ministry has issued the guidelines for payment of compensation towards damages in regard to Right of Way (RoW) of transmission line. The guideline has proposed compensation to be paid for the base area in between the transmission tower (between four legs) and towards diminution of land value in the width of the RoW corridor due to laying of transmission line @85% and 15%, respectively o the land value as determined by the District Collector, or any authority based on circle rate/guideline value/stamp value/stamp act.
State Level		
7	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

Sr. No	Agency	Function
		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 energy sources5 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.
8	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, 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 coordinated by this department.
9	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.
10	Board of Revenue, Rajasthan	The Revenue Board of Rajasthan was established on 12.08.49 by the ordinance number 22 of the Rajpramukh in 1949 as the apex court of revenue matters and the principal regulator and controller for revenue administration. In 1956, the Rajasthan Land Revenue Act, 1956 was implemented in place of the said ordinance. Under this Act, the Board of Revenue is acting as the administrative controller of the Apex Court and subordinate courts of appeal, monitoring and reference in revenue matters. It is also the apex court for judicial matters relating to land management. Being the apex body of revenue matters, the powers conferred on the State Government in various Acts were also transferred to the Revenue Board. Along with being the apex court in revenue matters, the Board of Revenue plays an active role on behalf of the administrative department in the implementation of the powers conferred under various Acts and represents the State Government. The work of supervising the maintenance of land records is also being done by the Revenue Board, which is not a judicial but an administrative work.
11	Gram Panchayats	The local Panchayats are empowered with management of local resources like forests, groundwater, common land and infrastructure like roads, buildings etc.
12	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 state's sphere.
13	Private Security Agency, Rajasthan	It is a state government body, with the aim to establish providing licenses to the private security agencies under the Private Security Agencies (Regulations) Act, 2015. Per the Act, no person shall carry on or commence the business of private security agency, unless he/she holds a license under the Act.
14	Directorate Industrial Safety and Health Department (DISH) and Labour Department	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, 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

[5] Renewable Energy Sources" means and includes non-conventional renewable generating sources such as mini hydel, wind, solar including its integration with combined cycle, biomass, biofuel cogeneration, urban/municipal waste and other such sources as approved by the Ministry of Non-conventional Energy Sources, Government of India, excluding the nuclear power stations and hydel power stations of capacity above 25 MW

Sr. No	Agency	Function
		• 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.
15	State Forest Department	The State Forest Department is the apex body in the States for implementation of the Wildlife Protection Act, 1972 and Forest (Conservation) Act, 1980. The main mandate of the Department is to protect and conserve the wildlife as well as forest in the state.

3.2 Rajasthan Solar Energy Policy, 2019

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, 2019[6]. 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 center of excellence that would work towards applied research and commercialization of nascent technologies to accelerate the march to grid parity.

According to this policy, Rajasthan Renewable Energy Corporation (RREC) shall act as nodal agency for clearance of the projects and shall be 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 Power Purchase Agreement (PPA)/ Wheeling and Banking Agreement (WBA) with Discoms of Rajasthan/ Rajasthan Rajya Vidyut Prasaran Nigam Limited (RVPN)/ NTPC Vidyut Vyapar Nigam Ltd (NVVN) (as may be applicable);
- Accreditation and recommending the solar power project for registration with Central Agency under REC mechanism for REC Certificate.

[6] https://energy.rajasthan.gov.in/content/dam/raj/energy/rrecl/pdf/Home%20Page/Rajasthan%20Solar%20Energy%20Policy2019.pdf

3.3 Applicable National Environmental and Social Acts and Rules

Table 3-2 below 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 that 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 E&S regulations in the different phases of Project lifecycle

Sr. No.	Applicable Regulation/Permit	Pre-Construction	Construction	Operation	Responsible Authority	Applicability to the Project/ Status
General Applicability – Transmission Line						
1.	Approval of the Power & Telecommunication Co-ordination Committee (PTCC)	✓	×	×	PTCC	• A copy of the map of the final line route is prepared in which the points where earth resistivity has been measured are indicated along with the values of the earth resistivity at such points • The questionnaire and other documents required for preparing the PTCC case are filled in and sent to the Executive Engineer (PTCC) in the office of the Chief Engineer (T&C), RVPN, Jaipur through the Circle Superintending Engineer. • The line shall not be charged until the PTCC clearance is obtained
2.	Approval of the Aviation Authorities	✓	×	×	Indian Airforce or Aviation Authorities	• This approval should be obtained in writing as per requirement of Rule 84 of the Indian Electricity Rules, 1956 • It is mandatory to obtain clearance from aerodromes / airports authorities to install overhead lines in the vicinity of aerodromes. • Since Bikaner airport is located 13 km from the Project site, approval from airport authority will be obtained by the Project.
3.	Approval of Electrical Inspector under The Electricity Act & Rules, 2003	✓	×	×	Electrical Inspector	• The approval of the Chief Electrical Inspector of the State Government is required to be obtained as per Rule 63 of the Indian Electricity Rules, 1956 before energizing the line. • The application is made in the prescribed questionnaire and submitted along with required drawings and information • The inspection fee, as prescribed from time to time, is to be deposited
Environment Protection						
4.	Environmental Clearance under EIA Notification 2006 and Environment Protection Act, 1986	×	×	×	MoEFCC	As per the EIA Notification (2006) and its amendments, the Solar Power project does not require prior environmental clearance (EC) from the Ministry of Environment Forest and Climate Change (MoEFCC) or the State Environmental Impact Assessment Authority (SEIAA).
5.	Consent to Establish (CTE) and Consent to Operate (CTO) under the Air (Prevention And Control Of Pollution) Act, 1981 and The Water (Prevention And Control Of Pollution) Act 1974	×	✓	×	RSPCB CPCB	As per latest notification from the Central Pollution Control Board (CPCB), dated 07/03/2016 [Ref No: B-29012/ ESS (CPA)/2015-2016], and dated 18/01/2017 [Ref No: B-29012/ESS(CPA)/2016-17] "Solar power generation through solar photovoltaic cell, wind power and mini hydel power (less than 25 MW)" has been classified to "white category" from "green category" and therefore "there shall be no necessity in obtaining 'Consent to Establish and Operate" for white category of industries except for an intimation to the concerned SPCB and PCC office. PGPL is yet to share Intimation letter to RSPCB for setting up of 400 MW solar power project at Kawani and Gol Pratapsingh villages of Bikaner tehsil and district, Rajasthan. However, as reported by PGPL onsite team, the requirement for batching plant at the project site will be determined by the EPC contractor prior to mobilization at the site. Therefore, in case a batching plant is set up by the EPC contractor during construction phase, CTO for operation of batching plant at site will be obtained by the contractor as ready mix cement concrete plants are categorised as orange category industry by RSPCB[7] which require consent management for its operation.
6.	Hazardous Waste Authorization under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 as amended till date	×	✓	✓	RSPCB CPCB	According to Hazardous and Other Wastes (Management and Transboundary Movement) Amendment Rules, 2019, an occupier shall not be required to obtain Hazardous Waste Authorization from SPCB in case Consent to Establish (CTE) or Consent to Operate (CTO) is not required under The Air (Prevention and Control of Pollution) Act, 1981 and The Water (Prevention and Control of Pollution) Act, 1974. Provided that the hazardous and other wastes generated by the occupier shall be given to the actual user, waste collector or operator of the disposal facility in accordance with CPCB guidelines. Since the Project does not require CTE and CTO, hence Project is exempted from obtaining hazardous waste authorization. However, the project will store and dispose hazardous wastes such as used oil from DG sets and transformers, contaminated cotton rags, empty drums of paint container to RSPCB authorised hazardous waste vendor. The maintenance of waste records indicated in the Hazardous and Other Wastes Rules, 2016 also needs to be complied.

[7] https://environment.rajasthan.gov.in/content/dam/environment/RPCB/Office%20Order/Categirization%20of%20industries.PDF

Sr. No.	Applicable Regulation/Permit	Pre-Construction	Construction	Operation	Responsible Authority	Applicability to the Project/ Status
7.	Environment Protection Act, 1986 and as amended till date	✓	✓	✓	MoEFCC CPCB RSPCB	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
8.	The Noise (Regulation & Control) Rules, 2000 and as amended up to 2010 Ambient Noise Standards	×	✓	✓	RSPCB CPCB	As 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, PGPL and their contractors will need to abide by the limits prescribed for residential zones.
9.	Solid Waste Management Rules 2016 as amended	×	✓	✓	RSPCB/ local municipal body	All bio-degradable, non-biodegradable and hazardous wastes generated from the project will be managed by PGPL and its contractors (the waste generator) in accordance with the relevant provision of this Rule.
10.	Construction and Demolition Waste Management Rules 2016	×	✓	×	Local authority	Construction waste generated at site will be handled as per the provisions of Construction and Demolition Waste Management Rules, 2016.
11.	Manufacture, Storage and Import of Hazardous Chemicals (MSIHC) Rules, 1989 and as amended	×	✓	✓	RSPCB	Rules will be applicable during construction and operation phases if chemicals stored at site satisfy the criteria laid down in the Rules
12.	Battery Waste Management Rules, 2022	×	✓	✓	RSPCB	Rules will be applicable during construction and operation phases as the project will use Batteries for power back up.
13.	E-waste (Management) Rules 2022	×	✓	✓	RSPCB	Rules will be applicable as Consumer Electrical and Electronics and Photovoltaic Panels as listed in the Schedule I of the aforesaid rules will be used and will require replacement within the lifecycle of the project
14.	Bio-Medical Waste Management Rules, 2016	×	✓	✓	RSPCB	Bio-medical waste generated at site will attract provisions of Bio-Medical Waste Management Rules, 2016. Biomedical waste generated to be disposed of through authorised agency.
15.	Ground water extraction permission will be required if the project plans to abstract groundwater for fulfilling water demand.	×	×	×	RSPCB	According to Dynamic Groundwater Resources of India by Central Groundwater Board (CGWB), 2022, Bikaner Rural block, where the proposed project is located is categorized as "***Overexploited***" in terms of groundwater availability. According to Central Groundwater Authority (CGWA) notification dated 24 September 2020, in Over-exploited assessment units, No Objection Certificate shall not be granted for ground water abstraction to any new industry except those falling in the category of Micro, Small and Medium Enterprises (MSME). Since the project is located in over exploited zone, groundwater abstraction shall not be permitted for the project development.
16.	Abstraction of water from IGNP canal	×	✓	✓	Rajasthan Renewable Energy Corporation Limited	PGPL will obtain permission from RREC, in case water for module cleaning and other project activities is abstracted from branch of IGNP canal.
Social						
17.	Rajasthan Tenancy Act 1995 and Rajasthan Land Revenue Act 1956	✓	×	×	District Collector Revenue Department	*Khatedar* (landowner) shall be permitted to set-up Solar Power plant on his holding or to sub-let his/her holding for setting up of such project without the requirement of land conversion in accordance with Rajasthan Government notification vide notification no. F.6(28) Rev-6/2014 dated 08.10.2014 and its amendment dated 06.12.2021
18.	Rajasthan Land Revenue (Conversion of agricultural land for non-agricultural purposes in rural areas) (Fourth Amendment) Rules, 2021	✓	×	×	District Collector Revenue Department	*Khatedar* shall be permitted to set-up Solar power Project on his holding or to sub-let his/her holding for setting up of such project without the requirement of land conversion in accordance with Rajasthan Government notification vide notification no. F.6(28)Rev-6/2014 dated 08.10.2014 and its amendment dated 06.12.2021
19.	Rajasthan Land Revenue (Control and Management of Forest Growth) Rule 1960	✓	✓	×	District Collector	• Removal of Khejri trees requires a prior permission to be obtained from the District Collector. Per the site visit observation, there are *Khejri* trees grwoing on the proposed project land – inside the proposed boundary of the solar power plant • The District Collector has the authority to define the use of the timber from the clearing of Khejri trees and restrict movement outside the administrative limits of the district
20.	The Electricity Act & Rules, 2003 and Guideline for payment of compensation towards damages in regard to Right of Way for Transmission Line issued by Ministry of Power	✓	×	×	Central Electricity Authority through C.E. (P&D) Bikaner	• As per the Electricity Act, the Project requires full compensation to be paid for any damage, detriment or inconvenience caused by the Project or by anyone employed by the Project during the construction activities • The Electricity Act requires reasonable compensation to be paid to the owner, in case of any existing trees/structures/ objects which have to be removed from the RoW. • The Electricity Act defines the compensation payable for damages to crops/ trees and structures. • The rules also provide a detailed understanding of vertical and horizontal clearances to maintained for different lines according to voltage • Per the "Guideline for payment of compensation towards damages in regard to Right of Way for Transmission Line" issued by the Ministry of Electricity: ▪ Compensation @ 85% of land value as determined by District Collector, or any other authority based on Circle rate/Guideline value/Stamp Act rates for tower base area (between four legs) impacted severely due to installation of tower/pylon structure ▪ Compensation towards diminution of land value in the width of Right of Way (RoW) corridor due to laying of transmission line and imposing certain restriction would be decided by the States as per categorization/type of land in different place of States, subject to a maximum of 15% of land value as determined based on Circle rate/guideline value/stamp rates.

Sr. No.	Applicable Regulation/Permit	Pre-Construction	Construction	Operation	Responsible Authority	Applicability to the Project/ Status
21.	The Indian Telegraph Act, 1885	✓	×	×	Department of Telegraphic – Communication, Government of Rajasthan	The Electricity Act and Telegraph Act define the compensation payable for damages to crops/trees and structures along the transmission line route
Labour						
22.	Contract Labour (Regulation & Abolition) Central Act 1970 and Rules, 1971	×	✓	✓	Labour Department	The Act applies to: • To every establishment in which twenty or more workmen are employed or were employed on any day of the preceding twelve months as contract labour • To every contractor who employees or who employed on any day of the preceding twelve months twenty or more workmen The Act details out conditions of licensing of contractors[8] and ensure basic welfare measures to be made available to the contract workers by the employer, which includes: • Canteens • Restrooms • First aid facilities • Liability of principal employer • Responsibility for payment of wages • Penalties and procedure Registers and other records to be maintained[9]
23.	Minimum Wages Act 1948	×	✓	✓	Labour Department	The act ensures minimum wages for each category of workers. Per the provision of the Act, the employer shall pay to every employee engaged in a schedule employment under them, wages at a rate not less than the minimum wages fixed by such notification of by the state government for that class of employees in that employment without any deductions except as may be authorised within such time and subject to such conditions as may be prescribed. Further, the Act also detailed out provisions on key aspects, such as: • fix the working hours for a normal working day • overtime payment • wages of worker who works for less than normal working days • Minimum time rate wages for piecework • Maintenance of registers and records • Penalties on offences to the Act • General provision for punishment of offences • Payment of undisbursed amounts due to employees **Overtime Payment** The employer shall pay to every employee engaged in a scheduled employment under him wages at a rate not less than the minimum rate of wages fixed by the appropriate Government Authority for that class of employees in that employment without any deductions except as may be authorized within such time and subject to such conditions as may be prescribed
24.	Equal Remuneration Act 1976	×	✓	✓	Labour Department	Puts in place rules and regulations governing the remuneration payable to workers and employees
25.	The Payment of Wages Act, 1936, amended in 2005 and 2017	×	✓	✓	Labour Department	• This Act was passed with the aim of regulating the payment of wages but excluding bonus/pension/PF/gratuity etc. to persons employed in any factory, either directly or indirectly through a sub-contractor. • The Act holds the employer solely responsible for the payment of wages to the employees. • The Act also specifies the need for a timeline for the wage payment, and the provisions for fines and deductions amongst other details pertaining to wages • No wage period shall exceed one month
26.	Maternity Benefit Act, 1961 & The Maternity Benefit (Amendment) Act, 2017	×	✓	✓	Labour Department	• Every woman shall be entitled to, and her employer shall be liable for, the payment of maternity benefit at the rate of the average daily wage for the period of her actual absence the period immediately preceding the day of her delivery, the actual day of her delivery and any period immediately following that day. • Increases the duration of the maternity leave from 12 to 26 weeks which can be availed prior to 8 weeks from the date of expected delivery (earlier it was 6 weeks prior). • From third child onwards, maternity leave to be for 12 weeks which can be availed 6 weeks prior.

[8] No contractor to whom this Act applies, shall undertake or execute any work through contract labour except under and in accordance with a license issued in that behalf by the licensing officer
[9] Every principal employer and every contractor shall maintain such registers and records giving such particulars of contract labour employed, the nature of work performed by the contract labour, the rates of wages paid to the contract labour and such other particulars in such form as may be prescribed

Sr. No.	Applicable Regulation/Permit	Pre-Construction	Construction	Operation	Responsible Authority	Applicability to the Project/ Status
						• Employer to permit a woman to work from home, if the nature of work permits her to do so and the same can be availed after the completion of her maternity leave for a duration mutually decided. Woman to be informed at the time of appointment, of the maternity benefits available, either in writing or electronically.
27.	The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013	×	✓	✓	Labour Department	• No woman shall be subjected to sexual harassment at any workplace • The following circumstances, among other circumstances, if it occurs or is present in relation to or connected with any act or behaviour of sexual harassment may amount to sexual harassment:- o Implied or explicit promise of preferential treatment in her employment: or o Implied or explicit threat of detrimental treatment in her employment; or o Implied or explicit threat about her present or future employment status: or o Interference with her work or creating an intimidating or offensive or hostile work environment for her; or • Humiliating treatment likely to affect her health or safety.
28.	The E.P.F. and Miscellaneous Provisions act, 1952	×	✓	✓	Labour Department	• This Act is applicable to every factory or establishment employing 20 or more persons. • This Act requires the employer to provide for provident fund as under the scheme to the general public • The contribution which shall be paid by the employer to the Fund shall be ten percent. Of the basic wages, dearness allowance and retaining allowance, if any, for the time being payable to each of the employees whether employed by him directly or by or through a contractor, and the employee's contribution shall be equal to the contribution payable by the employer in respect of him and may, if any employee so desires, be an amount exceeding ten percent of his basic wages, dearness allowance and retaining allowance if any,
29.	Payment of Bonus Act, 1965 and rules and subsequent amendment	×	✓	✓	Labour Department	Every employee shall be entitled to be paid by his employer in an accounting year, bonus, in accordance with the provisions of this Act, provided he has worked in the establishment for not less than thirty working days in that year. Further, every employer shall be bound to pay to every employee in respect of the accounting year commencing on any day in the year 1979 and in respect of every subsequent accounting year, a minimum bonus which shall be 8.33 per cent. of the salary or wage earned by the employee during the accounting year or one hundred rupees, whichever is higher, whether the employer has any allocable surplus in the accounting year. An employee shall be disqualified from receiving bonus under this Act, if he is dismissed from service for • fraud; or • riotous or violent behaviour while on the premises of the establishment; or • theft, misappropriation, or sabotage of any property of the establishment
30.	Payment of Gratuity Act, 1972	×	✓	✓	Labour Department	Gratuity shall be payable to an employee on the termination of his employment after he has rendered continuous service for not less than five years, • on employee's superannuation, or • on his retirement or resignation, • on his death or disablement due to accident or disease Provided that the completion of continuous service of five years shall not be necessary where the termination of the employment of any employee is due to death or disablement. The gratuity amount will be calculated as follows: • Employees are entitled to get the salary of 15 days for every completed year as gratuity. • Only the basic pay and DA (if any) are considered while accounting for the salary. It means any bonus, special allowance and HRA are not taken for the gratuity calculation. **Note** Gratuity calculation: Gratuity = (Salary / 26) x 15 x Number of years in service Where; Salary is "Last drawn basic pay + DA" 26 is the average working days in a month (As per Gratuity rules – 26 days not 30 days calculated) 15 is the actual days considered for gratuity in a year
31.	ESI Act, 1948 (Employees State Insurance Act, 1948)	×	✓	✓	Labour Department	• It applies to all non-seasonal factories • To provide benefits in case of sickness, maternity, and employment injury' and to make provision for certain other matters in relation thereto. • all employees in factories or establishments to which this Act applies shall be insured in the manner provided by this Act. • The contribution payable under this Act in respect of an employee shall comprise contribution payable by the employer (hereinafter referred to as the employer's contribution) and contribution payable by the employee (hereinafter referred to as the employee's contribution) and shall be paid to the Corporation.

Sr. No.	Applicable Regulation/Permit	Pre-Construction	Construction	Operation	Responsible Authority	Applicability to the Project/ Status
32.	Workmen's Compensation Act, 1923	×	✓	✓	Labour Department	• Payment of compensation amount as applicable at the time of the accident resulting in a temporary or a permanent disablement such that it reduces the earning potential of workman in any employment. Or contracts an occupational disease peculiar to that employment
33.	Child Labour (Prohibition and Regulation) Act, 1986 and subsequent amendments	×	✓	✓	Labour Department	The Act intends to: • Ban the employment of children, i.e., those who have not completed their fourteenth year, in specified occupations and processes • Lay down a procedure to decide modifications to the schedule of banned occupations or processes • Regulate the conditions of work of children in employments where they are not prohibited from working • Lay down enhanced penalties for employment of children in violation of the provisions of this Act and other Acts which forbid the employment of children
34.	The Bonded Labour System (Abolition) Act 1976;	×	✓	✓	Labour Department	• Abolition of Bonded Labour System: (i) The bonded labour system is abolished and every bonded labourer stands free and is discharged from any obligation to render any bonded labour; (ii) (a) No person is to make any advance of bonded labour, (b) No person is to compel any person to render any bonded labour or other form of forced labour.
35.	The Protection of Civil Rights Act, 1955	×	✓	✓	Labour Department	A person shall be deemed to boycott another person who - (a) refuses to let to such other person or refuses to permit such other person, to use or occupy any house or land or refuses to deal with, work for hire for, or do business with, such other person or to render to him or receive from him any customary service, or refuses to do any of the said things on the terms on which such things would be commonly done in the ordinary course of business; or (b) abstains from such social, professional or business relations as he would ordinarily maintain with such other person.
36.	Inter-state Migrant Workmen Act 1979.	×	✓	✓	Labour Department	The Key provisions of the Act, include: • Responsibility of payment of wages: 1) A contractor shall be responsible for payment of wages to each inter-state migrant workman employed by him and such wages shall be paid before expiry of such period as may be prescribed; 2) Every principal employer shall nominate a representative duly authorised by him to be present at the time of disbursement of wages by the contractor and it shall be the duty of such representative to certify the amounts paid as wages in such manner and may be prescribed; 3) It shall be the duty of the contractor to ensure the disbursement of wages in the presence of the authorize representative of the principal employer; 4) In case the contractor fails to make payment within the prescribed period or make short payment, then the principal employer shall be liable to make payment of the wages in full or the unpaid balance due, as the case maybe, to the inter-State migrant workman employed by the contractor and recover the amount so paid from the contractor either by deduction from any amount payable to the contractor under any contract or as a debt payable by the contractor • The wage rate of an interstate migrant worker shall in no case be paid less than the wages fixed under the Minimum Wages Act, 1948, 2. Wages payable to an interstate migrant workman shall be paid in cash • There shall be paid by the contractor to every interstate migrant worker at the time of recruitment, a displacement allowance equal to fifty per cent of the monthly wages payable to him or seventy-five rupees whichever is higher • The amount paid to a worker as displacement allowance shall not be refundable and shall be in addition to the wages or other amount payable to him
37.	The building and other Construction Workers Act, 1996	×	✓	✓	Labour Department	Ensure safety measures at construction work site and other welfare measures such as canteens, first-aid facilities, ambulance, housing accommodation for Workers near the Workplace etc. **Overtime Payment** Wages for overtime work: 1) Where any building worker is required to work on any day more than the number of hours constituting a normal working day, he shall be entitled to wages at the rate of twice his ordinary rate of wages; 2) The ordinary rate of wages means the basic wages plus such allowances as the worker is for the time being entitled to but does not include any bonus. **Workers' Accommodation** (1) The employer shall provide, free of charges and within the work site or as near to it as may be possible, temporary living accommodation to all building workers employed by him for such period as the building or other construction work is in progress. (2) The temporary accommodation provided under sub-section (1) shall have separate cooking place, bathing, washing and lavatory facilities. (3) As soon as may be, after the building or other construction work is over, the employer shall, at his own cost, cause removal or demolition of the temporary structures erected by him for the purpose of providing living accommodation, cooking place or other facilities to the building workers as required under sub-section (1) and restore the ground in good level and clean condition. **Creches** (1) In every place wherein, more than fifty female building workers are ordinarily employed, there shall be provided and maintained a suitable room or rooms for the use of children under the age of six years of such female workers. (2) Such rooms shall— (a) provide adequate accommodation; (b) be adequately lighted and ventilated; (c) be maintained in a clean and sanitary condition; (d) be under the charge of women trained in the care of children and infants.
38.	The Industries Disputes (Amendment) Act, 2010	×	✓	✓	Labour Department	• Every industrial establishment employing twenty or more workmen shall have one or more Grievance Redressal Committee for the resolution of disputes arising out of individual grievances. • The Grievance Redressal Committee shall consist of equal number of members from the employer and the workmen.

Sr. No.	Applicable Regulation/Permit	Pre-Construction	Construction	Operation	Responsible Authority	Applicability to the Project/ Status
						• The chairperson of the Grievance Redressal Committee shall be selected from the employer and from among the workmen alternatively on rotation basis every year. • The total number of members of the Grievance Redressal Committee shall not exceed more than six: Provided that there shall be, as far as practicable, one-woman member if the Grievance Redressal Committee has two members and in case the number of members are more than two, the number of women members may be increased proportionately. • Notwithstanding anything contained in this section, the setting up of Grievance Redressal Committee shall not affect the right of the workman to raise industrial dispute on the same matter under the provisions of this Act. • The Grievance Redressal Committee may complete its proceedings within forty-five days on receipt of a written application by or on behalf of the aggrieved party. • The workman who is aggrieved of the decision of the Grievance Redressal Committee may prefer an appeal to the employer against the decision of Grievance Redressal Committee and the employer shall, within one month from the date of receipt of such appeal, dispose of the same and send a copy of his decision to the workman concerned. Nothing contained in this section shall apply to the workmen for whom there is an established Grievance Redressal Mechanism in the establishment concerned.
39.	Trade Union Act, 1926	×	✓	✓	Labour Department	Any seven or more members of a Trade Union may, by subscribing their names to the rules of the Trade Union and by otherwise complying with the provisions of this Act with respect to registration, apply for registration of the Trade Union under this Act. The admission of ordinary members who shall be persons actually engaged or employed in an industry with which the Trade Union is connected, and the admission of the number of honorary or temporary members to form the executive of the Trade Union
40.	Persons with Disabilities Act, 1995 and Persons with Disability Rules 1996	×	✓	✓	Labour Department	• Give effect to the proclamation on the full participation and equality (equal opportunities) of people with disabilities and protection of rights • The employer in every establishment shall furnish such information or return as may be prescribed in relation to vacancies appointed for person, with disability that have occurred or are about to occur in that establishment to such Special Employment Exchange as may be prescribed and the establishment shall thereupon comply with such requisition. • Every employer shall maintain such record in relation to the person. With disability employed in his establishment in such form and in such manner as may be prescribed by the appropriate Government • Every appropriate Government shall appoint in every establishment such percentage of vacancies not less than three per cent. for persons or class of persons with disability of which one per cent. Each shall be reserved for persons suffering from- o Blindness or low vision; o Bearing impairment; o Loco motor disability or cerebral palsy, in the posts identified for each disability: • Provided that the appropriate Government may, having regard to the type of work carried on in any department or establishment, by notification subject to such conditions, if any, as may be specified in such notification, exempt any establishment from the provisions of this section.
41.	Ancient Monuments and Archaeological Sites and Remains Act 1958	×	✓	×	Labour Department	• This Act places restrictions on the destruction, alteration, defacement, or removal of monuments and on construction on or near the site of any protected monument. • No person, including the owner or occupier of a protected area, shall construct any building within the protected area or carry on any mining, quarrying, excavating, blasting or any operation of a like nature in such area, or utilise such area or any part thereof in any other manner without the permission of the Central Government
42.	Private Security Agencies (Regulation) Act, 2005	×	✓	✓	Private Security Agency, Rajasthan	• An Act to provide for regulations of private security agencies and for matters connected therewith or incidental thereto. Per the provision of the Act – No person shall carry on or commence the business of private security agency , unless he/she holds a license issued under this Act
43.	Factories Act, 1948 and Rajasthan Factory Rules, 1951	×	×	✓	Factories Inspector from Labour Department	• This applies to any premises wherein 10 or more persons with the aid of power or wherein 20 or more workers without aid of power are/were working on any day in the preceding 12 months, wherein manufacturing process is being carried on. The project to comply with the provisions as laid in Rajasthan Factory Rules, 1951 pertaining to health measures and safety provisions, disposal of waste and effluents, safe working conditions, cleanliness etc. • The main objective of the Act is to regulate the working conditions in a factory, to regulate health, safety welfare and annual leave, and enact special provisions in respect of young persons, women and children who work in a factory
Ecology						
44.	Wildlife (Protection) Act, 1972	✓	✓	✓	Wildlife Warden, State Forest Department	If any protected/ endangered flora or fauna (as listed in Schedules of Wildlife Protection Act, 1972) are found in the project area, the proponent should implement conservation measures for their protection.

3.4 Applicability of IFC Performance Standards

Table 3-3: Applicability of IFC Performance Standards to the Project

Sr. No.	IFC Performance Standards	Applicability/ Compliance/Details
1	PS 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 PGPL 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. This ESIA is being conducted as part of the "identification of risks and impacts" requirement under the IFC PS 1. The recommendations prescribed in this ESIA report to PGPL to allow them to update their existing E&S management plans for the project; will support them to mitigate identified E&S impacts associated with the project. The developer, at the corporate level, has also established Standard Operating Procedures (SOP), that will be implemented in conjunction with the recommendations presented in this report.
2	PS 2: Labour and Working Conditions	**Applicable** This PS is guided by several international conventions and instruments on labour and workers' rights. It recognizes that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of fundamental rights of workers. This 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 assess the status of the employees and workers at the project and any contractors. The project activities will involve hiring of approximately 1200 skilled, semi-skilled and unskilled labor during the construction phase and during operation phase the number of employees will be ~50 including both on-roll and contractual. The project will have to ensure compliance with this PS.
3	Performance Standard 3	**Applicable** 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. This PS will assess how PGPL 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 desertic soil and limited vegetation. The project activities will also lead to increase in ambient noise level during the construction phase which may impact the villages or sensitive receptors in the study area. Furthermore, Project will use water during construction phase for civil work and annual solar module cleaning during operation phase which may pose potential stress on existing common water resources such as IGNP canal. Therefore, PS 3 is applicable to the Project.
4	PS 4: Community Health, Safety & Security	**Applicable** PS-4 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 may impact the health and safety of the communities adjacent to its boundary during construction phase. The Project will involve construction activities that 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. Furthermore, the Project may pose

Sr. No.	IFC Performance Standards	Applicability/ Compliance/Details
		stress on common water resources such as IGNP canal due to use of water during construction and operation phase. Therefore PS 4 is applicable to the project.
5	Performance Standard 5	**Not getting Triggered** The land for the project is leased and the land rate is based on mutual agreements and negotiations are based on the willing lessor and willing lessee basis. Also the land procurement process does not involves compulsory land acquisition therefore any direct land based impacts in terms of impacts on livelihood or landlessness on the affected lessor are not foreseen therefore the provisions of PS 5 is not getting triggered.
6	Performance Standard 6	**Applicable** Specific requirements of PS 6 include (i) protection and conservation of biodiversity (modified, natural, critical habitat, legally protected and internationally recognized areas, invasive alien species); (ii) management of ecosystem services; (iii) sustainable management of natural resources; and (iv) supply chain The private land acquired for the project is used for agricultural purposes i.e. Modified habitat. In the operation phase, the transmission line will also contribute towards a risk of collision and electrocution with avifauna.
7	Performance Standard 7	**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 endeavor 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, interview with land lessors, no indigenous people is affected by the project activities and no ST land has been leased out. Further, the privately owned agricultural land has been leased out for the solar power plant and the land leasing process has not impacted any common property resource – owned or use by Indigenous People. Therefore, PS 7 is not applicable to the Project.
8	Performance Standard 8	**Not Applicable** For PS-8, cultural heritage refers to (i) tangible forms of cultural heritage; (ii) unique natural features or tangible objects that embody cultural value; and (iii) certain instances of intangible forms of culture that are proposed to be used for commercial purpose. The requirements of PS-8 apply to cultural heritage regardless of whether it has been legally protected or previously disturbed. As confirmed during the site visit and consultation with local community, no cultural heritage is impacted by the Project or its any activity. Therefore, PS 8 is not applicable on the Project.

3.4.1 Other Relevant International Guidelines and Standards

- **World Bank Group Environmental, Health and Safety (EHS Guidelines):** These General EHS Guidelines are designed to be used together with the relevant Industry Sector EHS Guidelines which provide guidance to users on EHS issues in specific industry sectors. The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs. Application of the EHS Guidelines to existing facilities may involve the establishment of site-specific targets, with an appropriate timetable for achieving them. The applicability of the EHS Guidelines should be tailored to the hazards and risks established for each project on the basis of the results of an environmental assessment in which site-specific variables, such as host country context, assimilative capacity of the environment, and other project factors, are taken into account.

- **IFC/World Bank EHS Guidelines for Electric Power Transmission and Distribution (2007):** The EHS Guidelines for Electric Power Transmission and Distribution include information relevant to power transmission between a generation facility and a

substation located within an electricity grid, in addition to power distribution from a substation to consumers located in residential, commercial, and industrial areas. The guidelines covers the following aspects:

- Industry specific environmental, occupational health and safety, community health and safety impacts and management
- EHS Performance Indicators
- General Description of Power Transmission and Distribution Industry

4. Environmental and Social Baseline Conditions

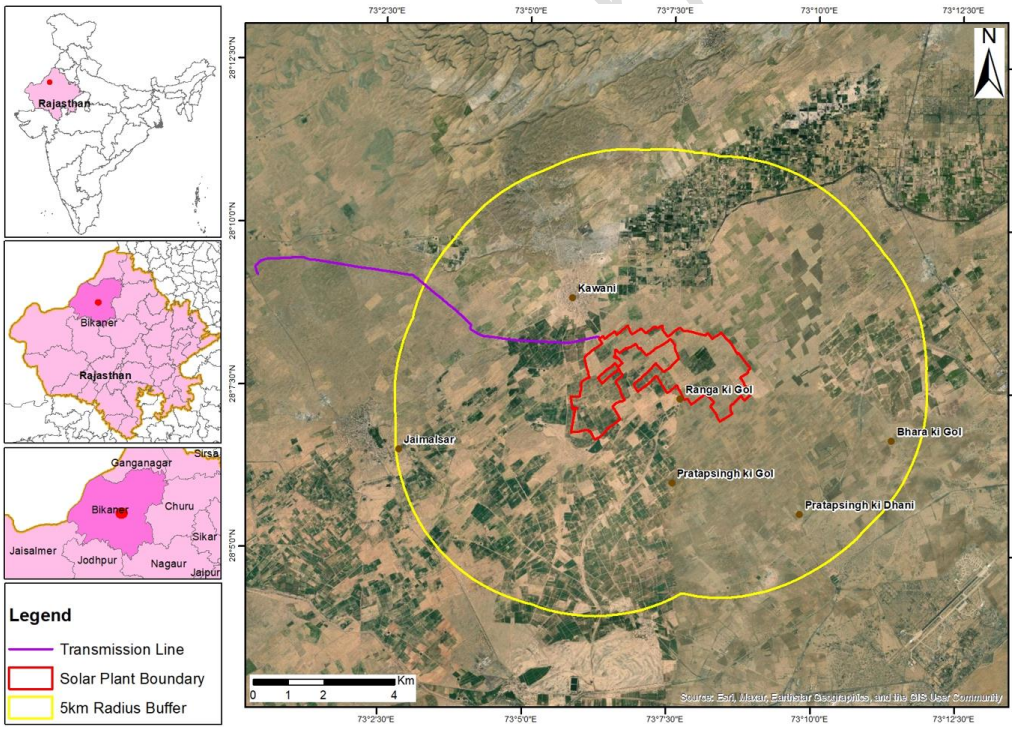
This section describes the existing environmental and social sensitivities and baseline conditions of the study area (as described below). The sensitivities include the relevant components of the physical, biological and socio-economic environment. The purpose of describing the environmental and social sensitivities of the study area is to:

- To describe the environmental characteristics of the Project site and surrounding areas to identify key resources and receptors that will be affected by the Project;
- To determine if any nearby communities or structures will be affected by the Project establishment; and
- To understand the significance of the different habitats within the study area and its importance for sustaining species of conservation importance, in terms of providing habitat contiguity to the surrounding region and dependency of surrounding communities.

4.1 Study Area

The area of up to 5 km radius from the Project boundary of proposed project has been demarcated as study area (as presented in ***Figure 4-1***) for the Project by considering the extent of Project impact in terms of air quality, noise, water resources, human settlement, cultural heritage sites, location of the access roads besides considering the actual land area which has been procured for the Project.

Figure 4-1: Identified Study area for the Project



Source: DTTILLP ArcGIS Mapping

4.1.1 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 the Project include land used for transmission line, and substation, access road (if any). The footprint area also includes the RoW of the transmission line.

4.1.2 Project area of influence (AoI)

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, including:

- Nature of the activity
- Specific resource or receptor
- Sensitivity of that resource or receptor
- Whether the impact is direct or indirect (e.g., secondary effect)

The Project's AoI refers to the Project footprint area as well as to a larger area in its immediate vicinity. This includes the footprint of the associated project components, such as access road as well as the immediate surroundings that will see increase movement of vehicles, personnel, and land-use change. Most of the impacts will occur within the project footprint area as identified above. However, certain impacts can be further reaching in terms of expected impacts.

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

- Ecological Parameters: Based on identified sensitivity during desk-based review and previous experiences, the study area for ecological assessment of solar plant was demarcated as,
    - ***Core Area:*** Boundary of the proposed project, and
    - ***Buffer Area:*** 5 km radius from the project boundary.

  While the core and buffer areas for transmission line (TL) was demarcated as,

    - ***Core Area:*** The transmission line route, the tower locations as well as the Right of Way, and
    - ***Buffer Area:*** 500 m radius area from the transmission tower locations and the transmission route.

- Environmental Parameters: The area of up to 5 km radius from the Project boundary has been demarcated as study area or Area of Influence for the Project by considering the extent of project impact in terms of air quality, noise, water resources, human settlement, location of the access roads besides considering the actual land area which will be used for the project. For the purpose of environmental baseline assessment,
    - ***core (0 - 500m from project site) and***
    - ***buffer zones (beyond 500m – 5km of project site).***
- Social and Cultural: The study area for the social assessment comprises of the area identified for the Project as well as villages which might be impacted directly or indirectly by the Project. The key terms used for sub-categorisation of the study area are:
    - ***Core: Project village:*** Villages falling under the 2 km radius from the Project boundary
    - ***Buffer: Project's Area of Influence (AoI):*** Villages falling under the 5 km radius from the Project boundary except the project village
    - ***Project's study area:*** Study area including the Project villages and the village falling under the Project's AoI

4.2 Physical Environmental Sensitivities and Baseline Conditions

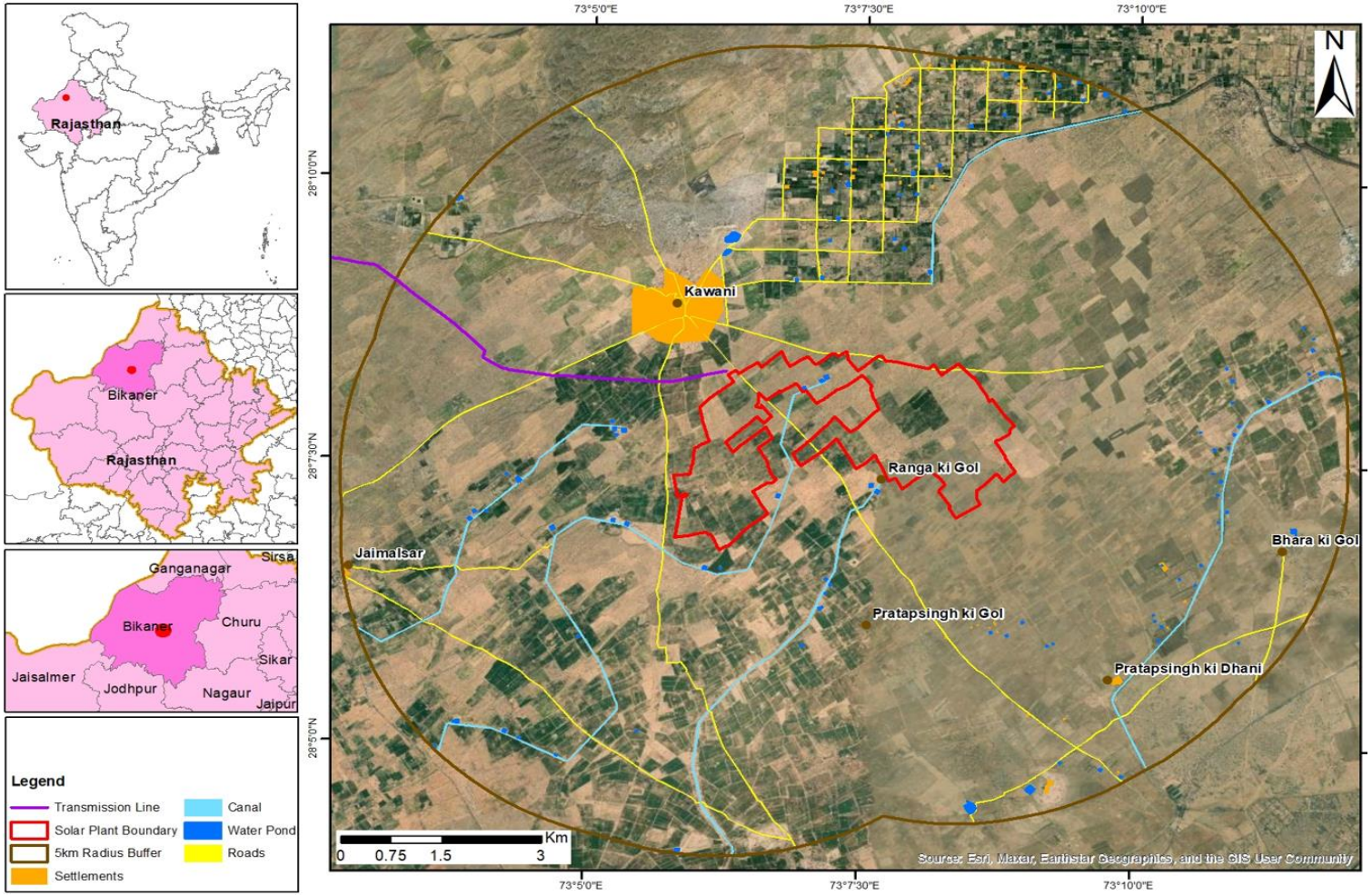
4.2.1 Physical Features

The physical features map of the study area is showcased in ***Table 4-7***. The map displays the following features that are located within 5 km radius from the Project site:

- The location of the proposed Project site and transmission line route

- Settlements within 5 km radius of the Project
- Road network around the site
- Water ponds within 5 km radius of the Project
- Canals within 5 km radius of the Project

Figure 4-2: Physical Feature Map



Source: DTTILLP ArcGIS Mapping

4.2.2 Climate

According to Ground Water Year Book-2021-2022 Rajasthan prepared by Central Groundwater Board (CGWB), the climate in Rajasthan can be divided into three major conventional seasons as follows:

- The Hot- Weather Season (March to end of June)
- Monsoon Season (End of June to September)
- The Cold- Weather Season (October to February)

The India Meteorological Department has further sub-divided the cold season into two divisions, i.e. the season of retreating monsoon (October to December) & the cold season (January to February). These seasonal variations have been broadly based on temperature and rainfall conditions in different months.

According to Central Groundwater Board (CGWB) report on "Aquifer Mapping and Management of Ground Water Resources" for Bikaner district, 2017-18, the climate of Bikaner district is dry in the east and west. As the district lies in the desert area, it is characterized by extremes of heat in summer and cold in winters. Both day and night temperatures increase gradually and reach their maximum values in April, May and June. The temperature varies from 48 ^{0}C in summer to 1 ^{0}C in winter. Atmosphere is generally dry except during the monsoon period. The winter season generally starts by mid-November when temperature begins to drop rapidly. January is the coldest month of the year with mean daily maximum and minimum temperature being about 22.5 ^{0}C and 5 ^{0}C respectively. In association with passing of western disturbances, the district gets affected with the severe cold wave conditions and on such occasion minimum temperature may go down to freezing point of water. The temperature starts rising rapidly from March to June. June is the hottest months of the year. When the area experiences daily mean maximum and minimum temperature of 41.7 ^{0}C and 29.3 ^{0}C respectively. The variation in maximum temperature from January to June is about 20.2 ^{0}C. In the month of April, hot westerly dust laden winds locally known as 'Luh' begin to blow and the weather becomes very hot under heat wave conditions. In May and June maximum temperature may go up to 48^{0}C. However, occasional dust storms and thunder storms causes drop in temperature. With the onset of the south-west monsoon currents in the district at the end of June, there is appreciable decline in the day temperature whereas nights temperature remain as high as in summer. The increased moisture content in the air causes the weather sultry and unpleasant. After the withdrawal of monsoon by mid-September, there is decrease in the day temperature but night temperature drops down steeply from 27^{0}C to 5 ^{0}C.

4.2.3 Rainfall

According to Central Groundwater Board (CGWB) report on "Aquifer Mapping and Management of Ground Water Resources" for Bikaner district, 2017-18, the annual average rainfall for a period of 48 years i.e., 1971 to 2018 was recorded to be 303 mm. The highest rainfall of 607.4 mm was recorded in 1997 which was 99% more than the average, whereas the lowest rainfall of about 66 mm was experienced in 2002 which was 78% less than the average. As per the CGWB rainfall study in the district for 48 years, 37% of the years i.e.1971, 1972, 1973, 1974, 1979, 1980, 1984, 1985, 1986, 1987, 1988, 1991, 1993, 2002, 2004, 2006, 2009, and2017 experienced drought conditions. The probability of mild and severe drought in the district is 27 % and 10% respectively.

As per the report by CGWB, almost 90% 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.

The annual rainfall data (1971-2018)[10] for Bikaner tehsil, where the proposed project is located has been presented in ***Table 4-1*** and a graph showing rainfall trend for the period 1971-2018 has been presented in ***Figure 4-3.***

Table 4-1: Annual Rainfall Analysis for Bikaner Tehsil (1971-2018)

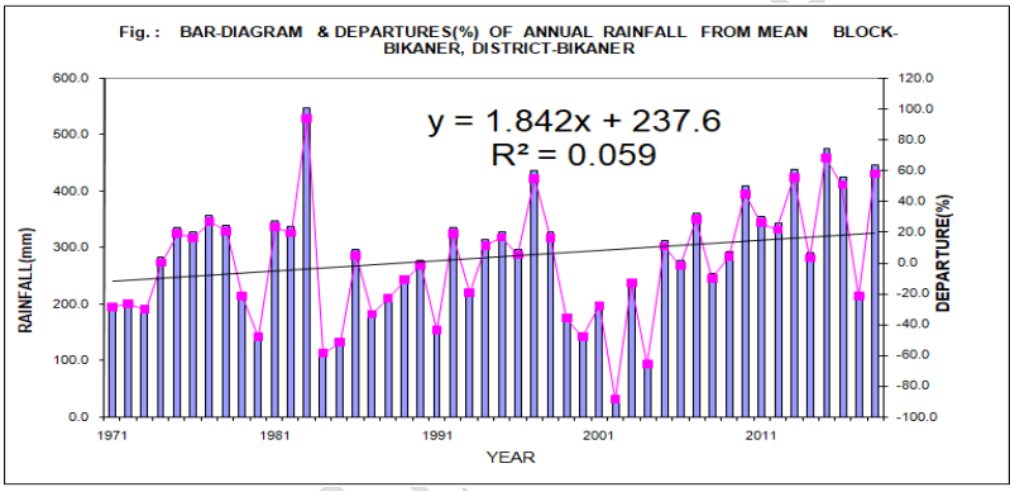
S.No.	Rainfall Data (1971-2018)	Bikaner Tehsil
1.	Normal Rainfall (mm)	275.15 mm
2.	Mean Annual rainfall (mm)	282.82 mm
3.	Highest annual rainfall with year (mm)	547.8 mm in the year 1983

[10] As per CGWB Aquifer Mapping and Management of Ground Water Resources report 2017-2018

S.No.	Rainfall Data (1971-2018)	Bikaner Tehsil
4.	Lowest annual rainfall (mm) with year	32 mm in the year 2002
5.	Standard deviation (mm)	104.68 mm
6.	Coefficient of Variation (%)	37.01 %

Source: Aquifer Mapping and Management of Ground Water Resources for Bikaner district, 2017-18 by CGWB

Figure 4-3: Annual Rainfall Trend in Bikaner Tehsil (1971-2018)



Source: Aquifer Mapping and Management of Ground Water Resources for Bikaner district, 2017-18 by CGWB

Based on the above data and figure, it was observed that the coefficient of variation in rainfall data for the period 1971-2018 was 37% which indicated that similar to the district, the rainfall in the project tehsil rainfall is also highly variable. The probability of normal rainfall in the tehsil is 17%. Bikaner tehsil experienced 1 most severe drought, 3 severe droughts, 8 normal and 9 mild droughts in the period of 1971-2018.

4.2.4 Humidity

According to Central Groundwater Board (CGWB) report on "Aquifer Mapping and Management of Ground Water Resources" for Bikaner district, 2017-18, the air is generally dry over Bikaner district during greater part of the year. During the southwest monsoon the humidity is high ranging between 67% to 48%. Humidity generally decreases in the post monsoon season. May and April are the driest months of the year when relative humidity is 31% or less in the afternoon.

4.2.5 Cloud

According to Central Groundwater Board (CGWB) report on "Aquifer Mapping and Management of Ground Water Resources" for Bikaner district, 2017-18, during the south west monsoon the skies are heavily clouded or overcast particularly in July and August. Rest of the year sky is mostly clear or lightly clouded except for a brief spells of one or two days in association with the passage of western disturbances during winter season.

4.2.6 Wind

According to Central Groundwater Board (CGWB) report on "Aquifer Mapping and Management of Ground Water Resources" for Bikaner district, 2017-18, winds are generally light in the district with some strengthening of speed during summer and early part

of the south west monsoon season. The maximum wind speed of 13.3 km./hr. is recorded in June. While minimum wind speed of about 3.5km./hr. is experienced in the month of November to January. In southwest monsoon season, wind direction is mostly southern or southwestern. Rest of the year winds are predominantly eastern or northeastern or calm.

4.2.7 Land Use

According to CGWB report on "Aquifer Mapping and Management of Ground Water Resources" for Bikaner district, 2017-18, the socio-cultural and economic factors have significantly influenced over land use both in rural and urban areas in the district. Land forms, slope, soils and natural resources are some of the important factors which control the land use pattern of the district. The land use pattern of district has been presented in ***Table 4-2.***

Table 4-2: Land Utilization Pattern in Bikaner District

Land Classification	Area (in Hectares)	%
Forest	92,850	3.05
Uncultivable land	2,97,920	9.80
Land not cultivated including pasture land; barren land; trees, grooves & orchards	8,77,571	28.86
Fallow and current fallow land	4,98,927	16.41
Net sown area (subtracting double)	12,73,208	41.88
Gross sown area	14,34,212	47.17
Area sown more than once	1,61,004	5.32

Source: Report on Aquifer Mapping And Ground Water Management Plan Bikaner District, Rajasthan

As observed during DTTILLP site visit and land use mapping, the site and Project area is majorly composed of agricultural land (87.77%) followed by sandy/fallow land (16.95%) that will be converted to non-agricultural land for industrial use.
A snapshot of the land use pattern of the project study area has been presented in ***Table 4-3.*** Map showing the land use pattern of the Project study area has been presented in

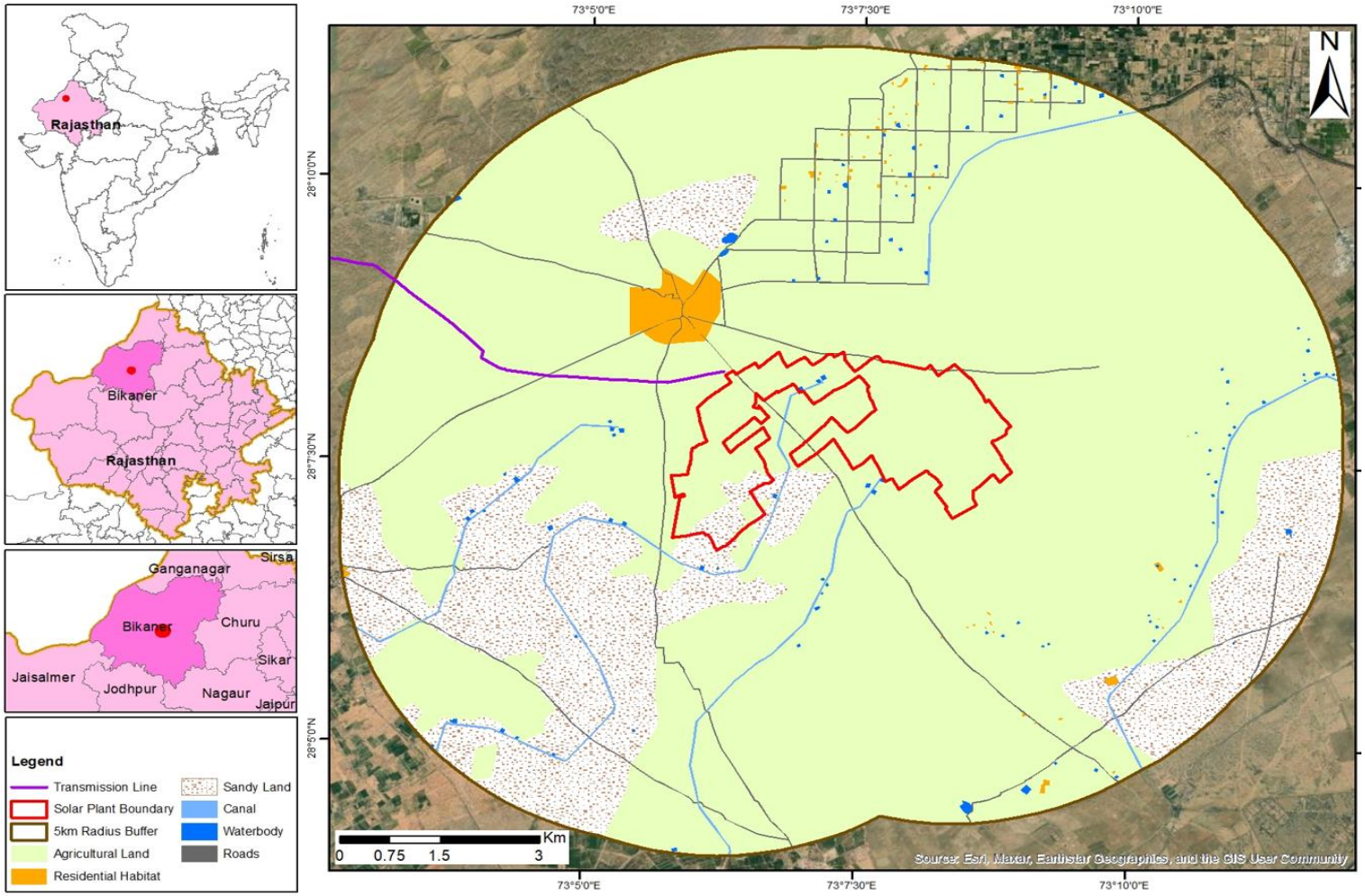
Figure 4-4.

Table 4-3: LandUse Pattern of Project Study Area

S.No	Land use Category	Area (Sq Km)	%
1.	Agriculture Land	129.91	80.77
2.	Sandy/Fallow Land	27.26	16.95
3.	Settlements	1.44	0.90
4.	Canal	0.79	0.49
5.	Water Pond	0.25	0.16
6.	Roads	1.18	0.73
Total Area (Sq Km)		**160.84**	**100**

Source: ArcGIS imagery processing

Figure 4-4: Land Use Pattern of Study Area



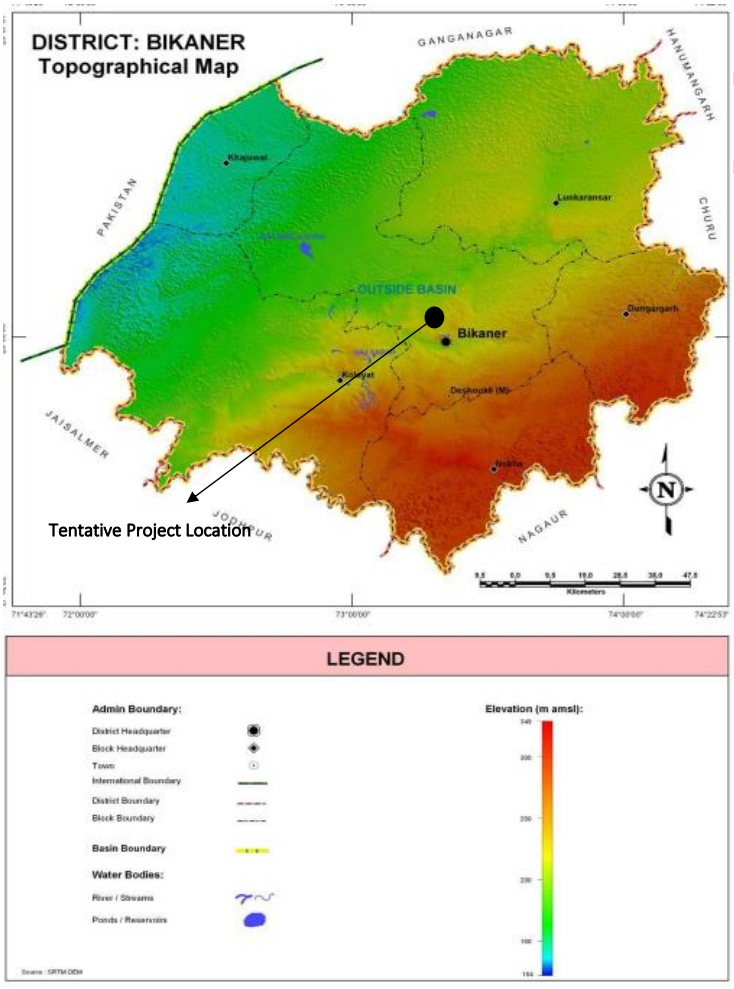
Source: ArcGIS imagery processing

4.2.8 Topography

According to Central Groundwater Board (CGWB) report on "Ground Water Yearbook Rajasthan 2021-22", most part of Rajasthan state comes under the Great Indian Desert. Rajasthan has a fairly mature topography developed during the long period of denudation and erosion. The present physiography and landforms are greatly determined by geological formations and structures and is the product of the past fluvial cycle of erosion and the recent & continuing desert cycle of erosion.

According to Aquifer Mapping and Management of Ground Water Resources by CGWB for Bikaner district, 2017-2018, Bikaner district is conspicuous of vast sandy areas and lack of hills. The topography is undulating interspersed with dunes of eolian origin. The general topographic elevation in the district ranges between 123.2 m to 298.6 m above mean sea level. General slope of the terrain is from southeast to northwest. Map showing topography of Barmer district has been presented in ***Figure 4-5.***

Figure 4-5: Topographical Map of Bikaner District

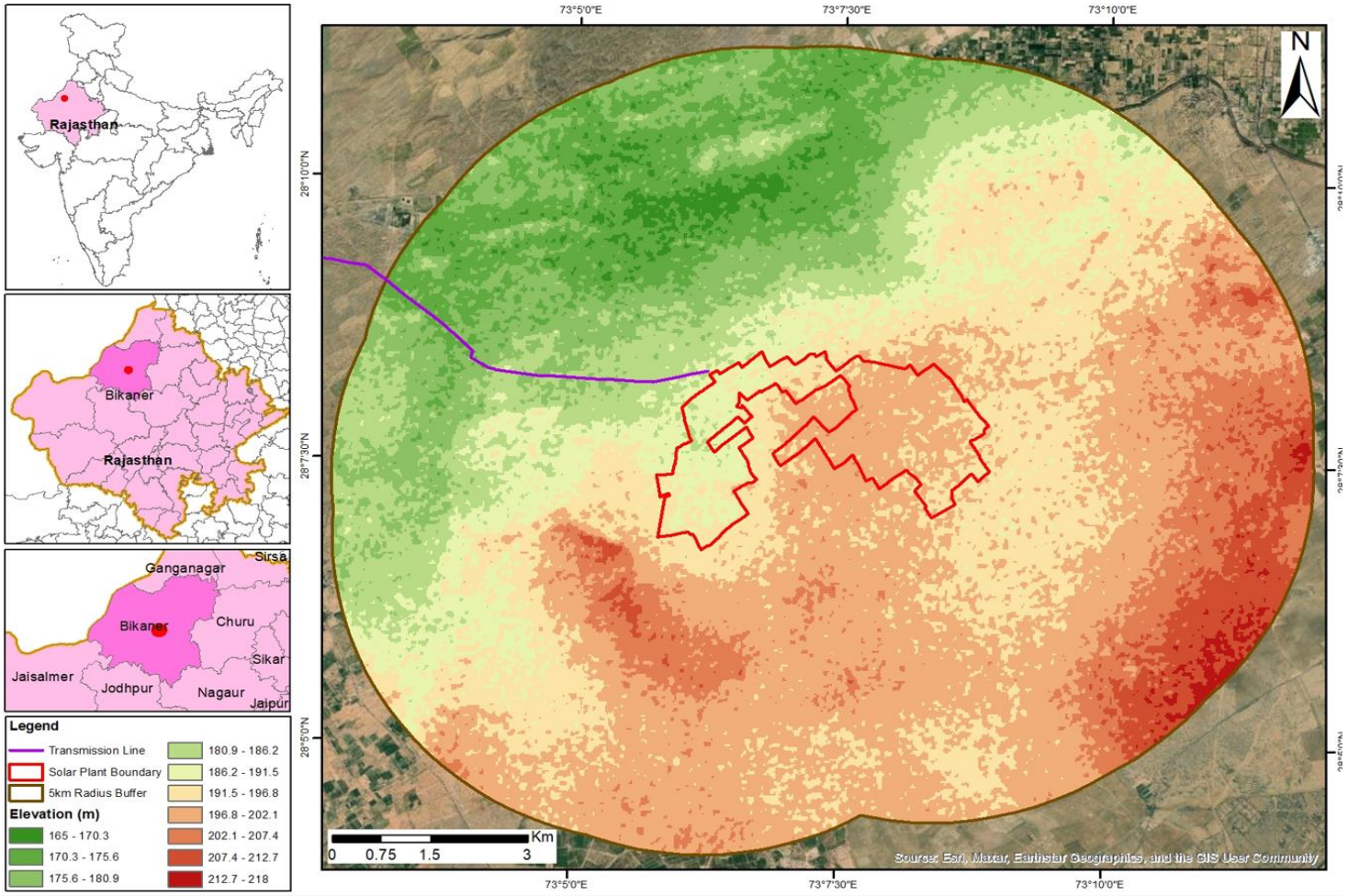


Source: Hydrogeological Atlas of Bikaner District by CGWB, 2013

Based on satellite imagery dated 10.09.2022 and site visit, it was observed that the project is proposed to be located at an elevation of 200 m to 220 m above mean sea level with elevation increasing from northwest to southeast direction. Analysis of digital elevation map presented in

Figure 4-6 for Project shows a trend in elevations ranging from 180-207 metres above mean sea level which is indicative of flat to undulating land in Project AoI.

Figure 4-6: Topographical Map of Study Area



Source: DTTILLP ArcGIS Mapping

4.2.9 Geology and Geomorphology

4.2.9.1 Geology

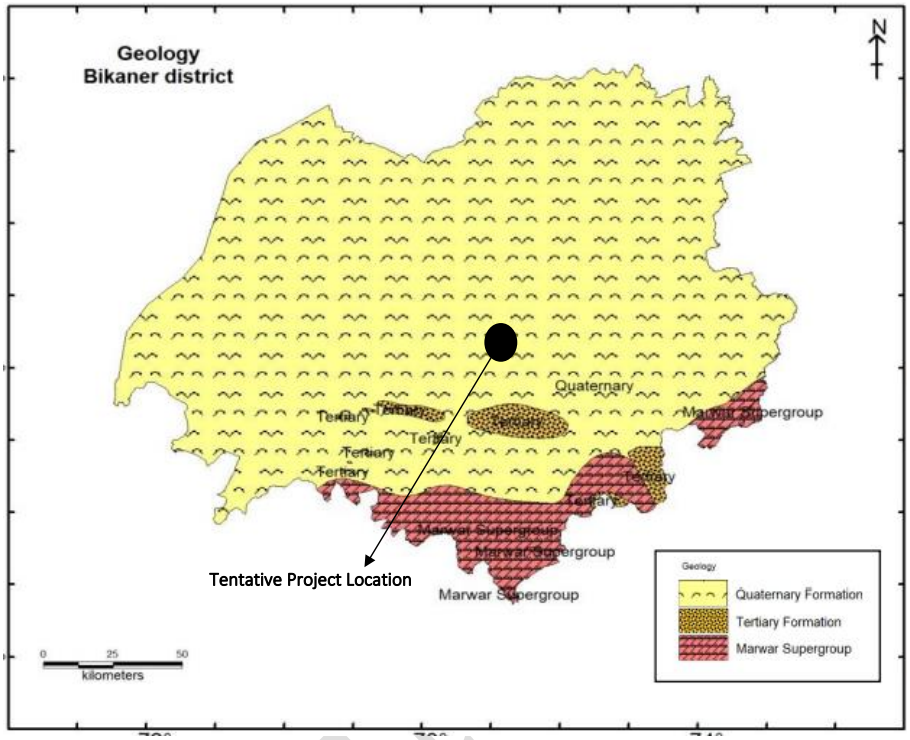
According to Aquifer Mapping and Management of Ground Water Resources by CGWB for Bikaner district, 2017-2018, the surface geology in the greater part of the district is concealed under a thick cover of windblown sand. However, rocks belonging to Palana Series of Eocene age are exposed around Kolayat, Mar and Bikaner. Sporadic outcrops of sandstone belonging to Lathi (Jurassic) and Badhaura Series (Permo-carboniferous) occur in southwestern corner of the district. Palanas or the Quaternaries are directly underlain by rocks belonging to Marwar Super Group. Jodhpur sandstones and shales are encountered at very shallow depth just below the top quaternaries in an elliptical area with its longer axis in east-west and shorter axis in north south direction along Bamanwali-Dhirera and Dulmera line. Thickness of Quaternaries is less around Mahajan in the northern part of the district but increases both in the north towards Arjunsar and in south towards Lunkaransar. Bikaner tehsil, where the proposed project is located is underlain by eolian/alluvium sand of Pleistocene to recent age. The project site is located in an area characterized by quaternary formation. The geological succession of Bikaner district has been presented in ***Table 4-4*** and map showing geology of Bikaner district has been presented in ***Figure 4-7.***

Table 4-4: Geological Succession of Bikaner District

Group	Series/Super Group	Geological Unit	Formation
Quaternary	Recent	Wind-blown Sand	Very fine, buff to grey sand, well rounded to sorted by wind action
	Pleistocene	Alluvium	Unconsolidated to loosely consolidated sand, fine to medium, silty clays and kankar with occasional horizons of gravel and coarse sand.
Tertiary	Eocene	Sandstone	Coarse and gritty sandstone usually consolidated, porous, within intercalated clays and gravel, fuller's earth (Bentonite) and lignite also occur in thin sequences
Palaeozoic	Marwar Super Group	Nagaur Sandstone	Hard compactly consolidated, reddish sandstone Interbedded with red shales.
		Bilara Limestone	Limestone, hard, massive grey to blackish in colour with occasional cavities.

Source: Aquifer Mapping and Management of Ground Water Resources for Bikaner district, 2017-18 by CGWB

Figure 4-7: Geology Map of Bikaner District



Source: Aquifer Mapping and Management of Ground Water Resources for Bikaner district, 2017-18 by CGWB

4.2.9.2 Geomorphology

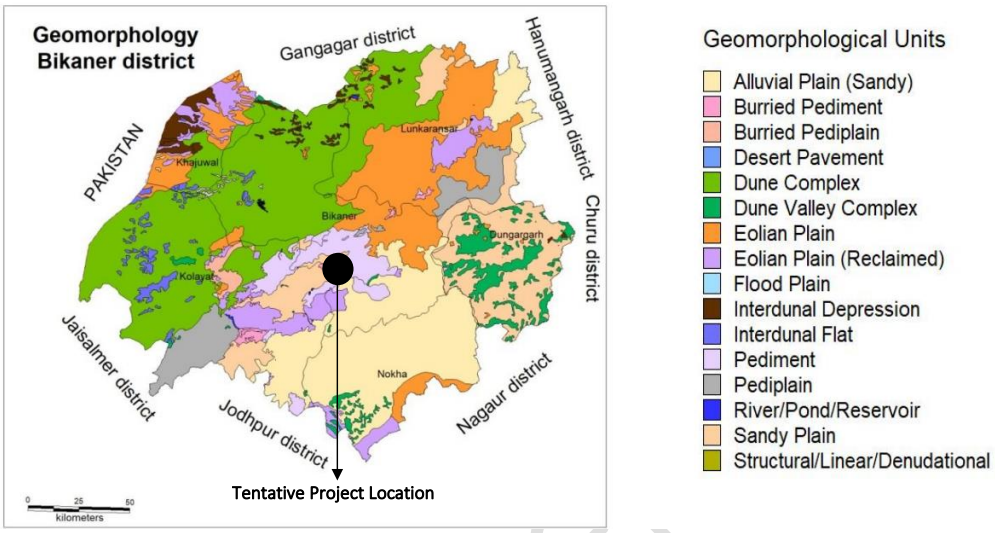
According to the Aquifer Mapping and Management of Ground Water Resources by CGWB for Bikaner district, 2017-2018, the district can broadly be divided into ten units viz. (1) flat graded older alluvial plains, (2) sandy undulating aggraded alluvial plains, (3) flat interdunal plains, (4) sandy undulating interdunal plains, (5) flood plains and Aeolian complex, (6) stabilized sand dunes, (7) active sand dunes, (8) gravelly aggraded alluvial plains, (9) eroded rocky surface and (10) saline depressions. The western, south-western, northern and north eastern parts of the district are largely covered with dunes of different types and magnitudes with flat to undulating interdunal plains. The central eastern and southern parts of the district constitute largely flat and undulating aggraded alluvial plains. The general trend of the regional slope in the area is from SSE (275 mamsl) to NNW (152 mamsl). There are only a few small hill outcrops of about 1-2 m height near Kolayat in the district. The district has no major river system except for a few short intermittent and ephemeral channels near Kolayat. A few natural lakes or depressions are observed near Gajner, Kolayat, Nal and Lunkaransar. The description of the geomorphological origin and landforms of Bikaner district has been presented in ***Table 4-5.*** The geomorphological map of Bikaner district has been presented in ***Figure 4-8.***

Table 4-5: Description of geomorphological origin and landforms in Bikaner District

Geomorphological Origin	Landform Unit	Description
Aeolian	Dune Complex	An undulating plain composed of number of sand dunes of crescent shape.
	Dune Valley Complex	Cluster of dunes and interdunal spaces with undulating topography formed due to wind-blown activity, comprising of unconsolidated sand and silt.
	Eolian Plain	Formed by aeolian activity, with sand dunes of varying height, size, slope. Long stretches of sand sheet. Gently sloping flat to undulating plain, comprised of fine to medium grained sand and silt.
	Eolian Plain (Reclaimed)	Gently sloping with sheet of sand or sand dunes, scattered xerophytic vegetation
	Interdunal Depression	Slightly depressed area in between the dunal complex showing moisture and fine sediments
	Interdunal Flat	Flat, narrow land between dunes.
	Sandy Plain	Formed of aeolian activity, wind-blown sand with gentle sloping to undulating plain, comprising of coarse sand, fine sand, silt and clay.
Denudational	Buried Pediment	Pediment covers essentially with relatively thicker alluvial, colluvial or weathered materials
	Pediment	Broad gentle sloping rock flooring, erosional surface of low relief between hill and plain, comprised of varied lithology, criss-crossed by fractures and faults
	Pediplain	Coalescence and extensive occurrence of pediment.
Fluvial	Alluvial Plain (Sandy)	Flat to gentle undulating plain formed due to fluvial activity, mainly consists of gravels, sand, silt and clay with unconsolidated material of varying lithology, predominantly sand along river.
Hills	Structural Hill	Linear to arcuate hills showing definite trend-lines with varying lithology associated with folding, faulting etc.

Source: Aquifer Mapping and Management of Ground Water Resources for Bikaner district, 2017-18 by CGWB

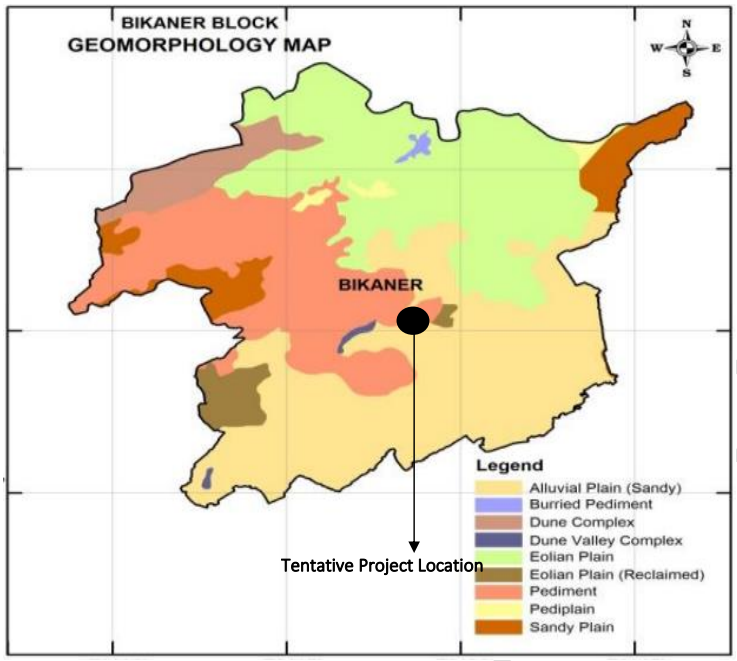
Figure 4-8: Geomorphological Map of Bikaner District



Source: Aquifer Mapping and Management of Ground Water Resources for Bikaner district, 2017-18 by CGWB

According to Aquifer Mapping and Management of Ground Water Resources for Bikaner district, 2017-18 by CGWB, the geomorphological landform of Bikaner tehsil where the proposed project is located comprise of older alluvial plains, sandy undulating aggraded alluvial plains, flat interdunal plains, sandy undulating interdunal plains, aeolian complex, stabilized sand dunes, active sand dunes, eroded rocky surface and sandy plain. Geomorphological map of Bikaner tehsil has been presented in ***Figure 4-9.***

Figure 4-9: Geomorphological Map of Bikaner Tehsil



Source: Aquifer Mapping and Management of Ground Water Resources for Bikaner district, 2017-18 by CGWB

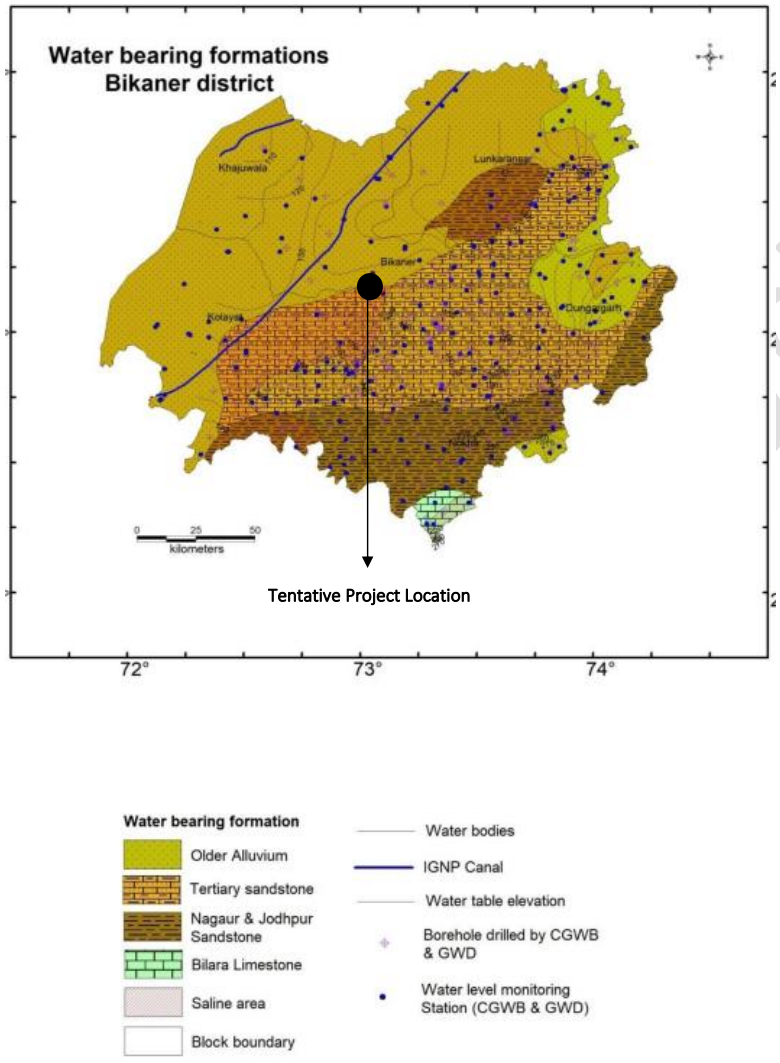
4.2.10 Water Resources

4.2.10.1 Hydrogeology and Drainage

According to Aquifer Mapping and Management of Ground Water Resources for Bikaner district, 2017-18 by CGWB, the Palana sandstone member of the Palana series is the main aquifer in the district. Other aquifer formations are sandstone and limestone of Nagaur group of rocks. Jodhpur sandstone and Quaternary alluvium also form aquifer whenever they extend in the zone of saturation.

As mentioned earlier in this report, the district has no major river system except for a few short intermittent and ephemeral channels near Kolayat. A few natural lakes or depressions are observed near Gajner, Kolayat, Nal and Lunkaransar. The main Rajasthan Canal enters the district somewhere north of village Bhansar and leaves in the southern boundary near village Gogliala. The main canal has a number of branches and distributaries such as Naushera Branch, Dathar Branch, Birsipur Branch, and Charanwala branch. Besides the main Rajasthan canal command area, there are other command areas of lift canals. The Indira Gandhi Nahar Pariyojana (IGNP) receives water from barrage at HariKaPattan in Amritsar district of Punjab through 204 km. The IGNP canal command area is 5,91,000 hectares in the district. The hydrogeological map of Bikaner district has been presented in ***Figure 4-10.***

Figure 4-10: Hydrogeological Map of Bikaner District



Source: Aquifer Mapping and Management of Ground Water Resources for Bikaner district, 2017-18 by CGWB

According to Aquifer Mapping and Management of Ground Water Resources for Bikaner district, 2017-18 by CGWB, there are no major drainage in Bikaner tehsil where the proposed project is located except few ephemerals streamlets. However, there are 6

canals located in the tehsil. As observed during site visit, one natural and multiple manmade perennial water ponds were observed within 500 m of the Project boundary in all the directions. Water to the manmade water ponds are supplied from Kanwar Sen main lift line which is a branch of IGNP canal located 8 km (aerial distance) from the project boundary towards north direction. A sub branch of IGNP canal and three manmade ponds were observed to be located within the project boundary towards the south direction (refer ***Figure 4-2***). The branch of IGNP canal and water ponds were observed to be dry during site visit. Based on discussion with onsite project team, it is understood that the sub branch of IGNP canal and the three manmade ponds are currently not connected to the main IGNP branch for water supply. There are dendritic to sub dendritic drainage channels passing through Project site and the study area. Map showing drainage pattern of the study area has been presented in

Figure 4-11**.**

4.2.10.2 Indira Gandhi Nahar Pariyojana

Indira Gandhi Nahar Pariyojana (IGNP) Canal is the only surface water source for irrigation in the district. According to Indira Gandhi Nahar Department, Government of Rajasthan, the IGNP aims to irrigate the desert land of Western Rajasthan with Himalaya's water and provide drinking water to crores of inhabitants of this area. The canal originates from Harike barrage situated in Punjab. From Harike, 204 km long Indira Gandhi Feeder starts, which has 170 km length in Punjab and Haryana and balance 34 km in Rajasthan. This canal enters in Rajasthan at Hanumangarh. From tail of Indira Gandhi Feeder 445 km long Indira Gandhi Main Canal starts which passes through Sri Ganganagar and Bikaner districts and ends at Mohangarh in Jaisalmer. The main objectives of the IGNP are as follows:

- To provide irrigation facilities in desert area to meet the increasing demand of agricultural products.
- To provide water for drinking and industrial uses.
- Drought proofing of the area and improving living conditions.
- To meet the needs of drinking water, fodder etc. for the animal wealth in the region.
- To provide opportunities for employment and overall development of the area.

According to Indira Gandhi Nahar Department, Government of Rajasthan, proposed beneficiary districts from IGNP canal in Rajasthan are Sriganganagar, Hanumangarh, Bikaner, Jaisalmer, Jodhpur, Churu, Jhunjhunu, Sikar, Nagore and Barmer[11].

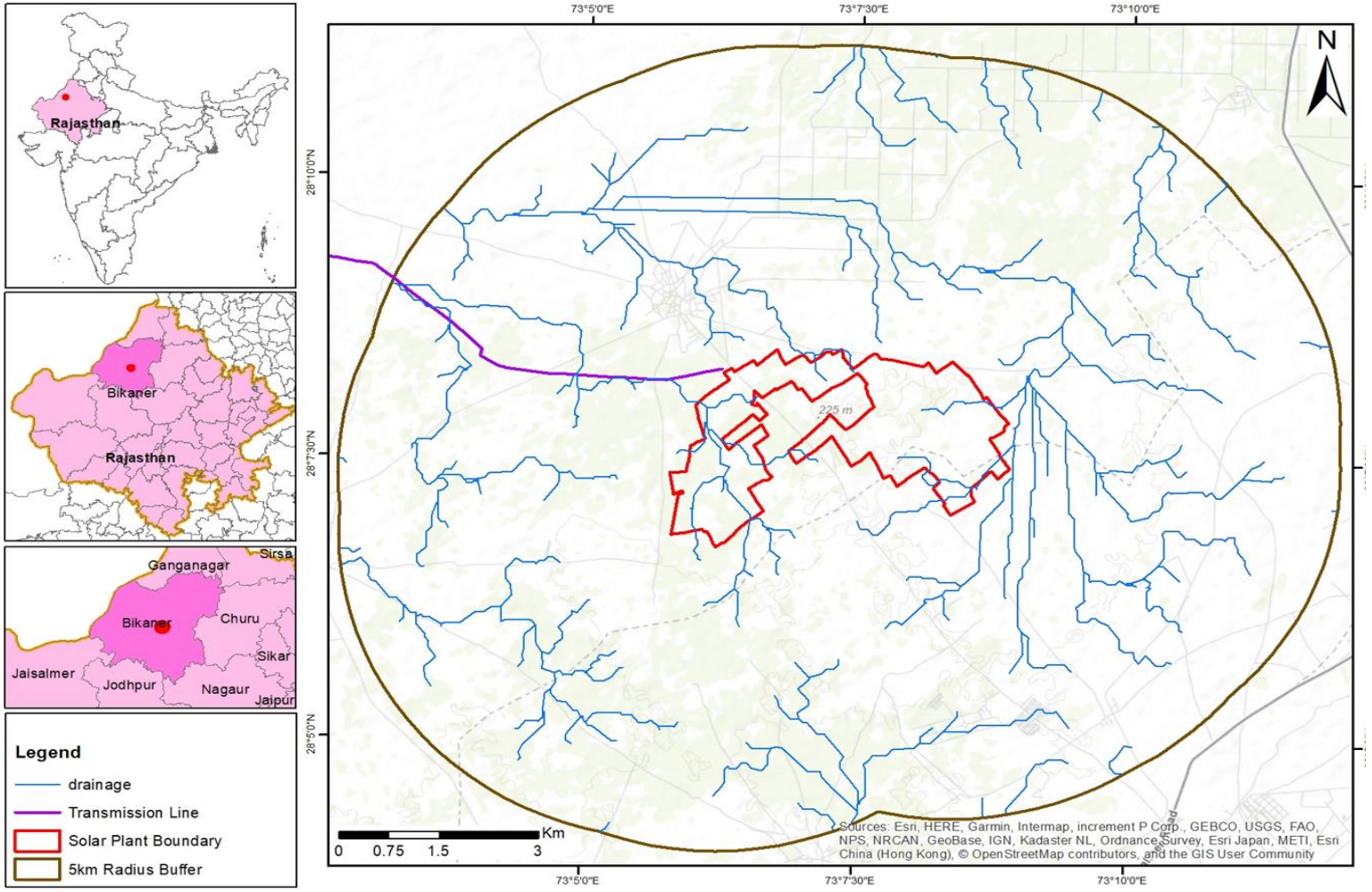
The uses of the canal in districts of Rajasthan are in the following ways:

- Irrigation is being done every year in districts where water is being sourced from IGNP, where earlier it was very difficult to arrange even drinking water;
- Drinking water from this canal is being supplied to various villages, towns & cities of Bikaner, Jodhpur, Sri Ganganagar, Hanumangarh, Jaisalmer, Jodhpur, Churu, Nagaur and Barmer;
- Water for Power generation is being supplied to various power projects of Suratgarh, Barsingsar, Guda, Ramgarh, Giral, Rajwest etc. and various Industries.

As per Rajasthan Solar Energy Policy, 2019, one of the incentives that the Govt. of Rajasthan is offering to renewable energy developers is access to water for project related activities which also includes cleaning of modules. As per secondary research it is understood that the Indira Gandhi Nahar Department has reserved 0.87 MAF (1200 cusec) of water for drinking, energy projects, and other industries[12]. It is understood that Water Resources Department will allocate required quantity of water from IGNP canal/ the nearest available source for cleaning of solar panels and auxiliary consumption for Solar PV Power Plants subject to the availability of water. Power Producer is expected to intimate estimated water requirement to Rajasthan Renewable Energy Corporation Limited (RREC) along with source of water to obtain approval for abstraction of water from IGNP.

[11] Jhunjhunu, Sikar, Nagore and Barmer districts can abstract water from IGNP canal only for drinking purpose.
[12] http://www.water.rajasthan.gov.in/content/water/en/ignd/dataroom/salientfeaturesofIGNP.html#

Figure 4-11: Drainage Map of Project Study Area



Source: ArcGIS Mapping

4.2.10.3 Primary Surface Water Quality Assessment

As part of the ESIA, surface water quality assessment was conducted by a National Accreditation Board for Testing and Calibration Laboratories (NABL) accredited lab in March 2023 to understand the surface water quality in the study area. One sample of surface water was collected from manmade water pond near Deepa Ram ji ki Dhani village within 5 km radius of the project under the supervision of DTTILLP and the sample was analyzed against IS 10500:2012 standard. The location of primary surface water sample has been presented in ***Table 4-6*** and the results of the assessment has been presented in ***Table 4-7.*** Map showing monitoring locations has been presented in ***Figure 4-18.***

Table 4-6: Locations of primary surface water sample

Location Code	Name of the Location	Coordinates	Location Criteria
SW 1	Canal Water Near Deepa Ram Ji Ki Dhani	28°06'33.48"N / 73°06'05.40"E	Collected from nearby manmade water pond to assess the surface water quality in the study area, against IS 10500:2012

Table 4-7: Results of Primary Surface Water Quality

Sr. No.	Parameters	Unit	SW 1	Desirable Limit	Permissible Limit
			Physical Parameters		
1.	Colour	Hazen	<5.0	5	5
2.	Odor	None	Agreeable	Agreeable	Agreeable
3.	pH	None	7.77 at 25 deg C	6.5-8.5	No Relaxation
4.	Turbidity	NTU	3.5	1	5
5.	Total Dissolved Solid (TDS)	mg/l	202.0	500	2000
			General Parameters		
6.	Aluminum (Al)	mg/l	<0.01	0.03	0.2
7.	Ammonia (N)	mg/l	<0.1	0.5	No Relaxation
8.	Anionic Detergent	mg/l	<0.02	0.2	0.01
9.	Boron (B)	mg/l	<0.5	0.5	1.0
10.	Barium (Ba)	mg/l	<0.05	0.7	No Relaxation
11.	Calcium (Ca)	mg/l	35.0	75	200
12.	Chloramines (Cl2)	mg/l	<0.3	4	No Relaxation
13.	Chloride (Cl)	mg/l	29.0	250	1000
14.	Copper (Cu)	mg/l	<0.02	0.05	1.5
15.	Fluoride (F)	mg/l	0.76	1	1.5
16.	Free Residual Chlorine	mg/l	<0.1	0.2	0.1
17.	Iron (Fe)	mg/l	0.15	0.3	No Relaxation
18.	Magnesium (Mg)	mg/l	10.0	30	100
19.	Manganese (Mn)	mg/l	<0.02	0.1	0.3
20.	Mineral Oil	mg/l	<0.01	0.5	No Relaxation
21.	Nitrate (NO_3)	mg/l	<0.5	45	No Relaxation
22.	Phenolic Compounds (C_6H_5OH)	mg/l	<0.001	0.001	0.002
23.	Selenium (Se)	mg/l	<0.005	0.01	No Relaxation

Sr. No.	Parameters	Unit	SW 1	Desirable Limit	Permissible Limit
24.	Silver (Ag)	mg/l	<0.005	0.1	No Relaxation
25.	Sulphate ($SO_{4)}$	mg/l	18.0	200	400
26.	Hydrogen Sulphide (H_2S)	mg/l	<0.01	0.05	No Relaxation
27.	Total Alkalinity	mg/l	93.0	200	600
28.	Total Hardness	mg/l	129.0	200	600
29.	Zinc (Zn)	mg/l	<0.02	5	15
30.	Cobalt (Co)	mg/l	<0.05	---	---
	Toxic Substances				
31.	Cadmium (Cd)	mg/l	<0.001	0.003	No Relaxation
32.	Cyanide (CN)	mg/l	<0.02	0.05	No Relaxation
33.	Lead (Pb)	mg/l	<0.005	0.01	No Relaxation
34.	Mercury (Hg)	mg/l	<0.001	0.001	No Relaxation
35.	Molybdenum (Mo)	mg/l	<0.05	0.07	No Relaxation
36.	Nickel (Ni)	mg/l	<0.02	0.02	No Relaxation
37.	Arsenic (As)	mg/l	<0.005	0.01	0.05
38.	Chromium (Cr)	mg/l	<0.01	0.05	No Relaxation
39.	Polychlorinated Biphenyl (PCB)	mg/l	<0.0005	0.0005	No Relaxation
40.	Polynuclear Aromatic Hydrocarbons (PAH)	mg/l	<0.0001	0.0001	No Relaxation
	Trihalomethanes				
41.	Bromoform	mg/l	<0.05	0.1	No Relaxation
42.	Dibromochloromethane	mg/l	<0.05	0.1	No Relaxation
43.	Bromodichloromethane	mg/l	<0.05	0.06	No Relaxation
44.	Chloroform	mg/l	<0.05	0.2	No Relaxation
	Pesticides Residues				
45.	Alachlor	µg/l	<0.02	20	20
46.	Atrazine	µg/l	<0.02	2	2
47.	Aldrin	µg/l	<0.01	0.03	0.03
48.	Dieldrin	µg/l	<0.01	0.03	0.03
49.	Alpha-HCH	µg/l	<0.01	0.01	0.01
50.	Beta-HCH	µg/l	<0.01	0.04	0.04
51.	Butachlor	µg/l	<0.02	125	125
52.	Chlorpyrifos	µg/l	<0.02	30	30
53.	Delta-HCH	µg/l	<0.01	0.04	0.04
54.	2,4-Dichlorophenoxyacetic acid	µg/l	<0.01	30	30
55.	o,p-DDT	µg/l	<0.01	1	1
56.	p,p-DDT	µg/l	<0.01	1	1

Sr. No.	Parameters	Unit	SW 1	Desirable Limit	Permissible Limit
57.	o,p-DDE	µg/l	<0.01	1	1
58.	p,p-DDE	µg/l	<0.01	1	1
59.	o,p-DDD	µg/l	<0.01	1	1
60.	p,p-DDD	µg/l	<0.01	1	1
61.	Beta-Endosulfan	µg/l	<0.01	0.4	0.4
62.	Ethion	µg/l	<0.02	3	3
63.	Gama-HCH(Lindane)	µg/l	<0.01	2	2
64.	Isoproturon	µg/l	<0.02	9	9
65.	Malathion	µg/l	<0.02	190	190
66.	Methyl parathion	µg/l	<0.02	0.3	0.3
67.	Monostrophes	µg/l	<0.02	1	1
68.	Phorate	µg/l	<0.02	2	2
69.	Endosulfan sulfate	µg/l	<0.01	0.4	0.4
70.	Alpha -endosulfan	µg/l	<0.01	0.4	0.4
	Bacteriological Parameters				
71.	Total coliform bacteria	/100ml	Detected	Not Detectable	Absent
72.	E.coli	/100ml	Not Detected	Not Detectable	Absent

Source: Laboratory analysis carried out by NABL Accredited Lab

Analysis of Surface Water Quality Results

Based on the results above, it was observed that majority of the parameters of the surface water sample were within CPCB desirable as well as permissible limit. However, total coliform bacteria was observed to be detected in the sample. This can be attributed to mixing of agricultural or animal waste in the water indicating disease-causing organisms (water borne-pathogens) within the water sample.

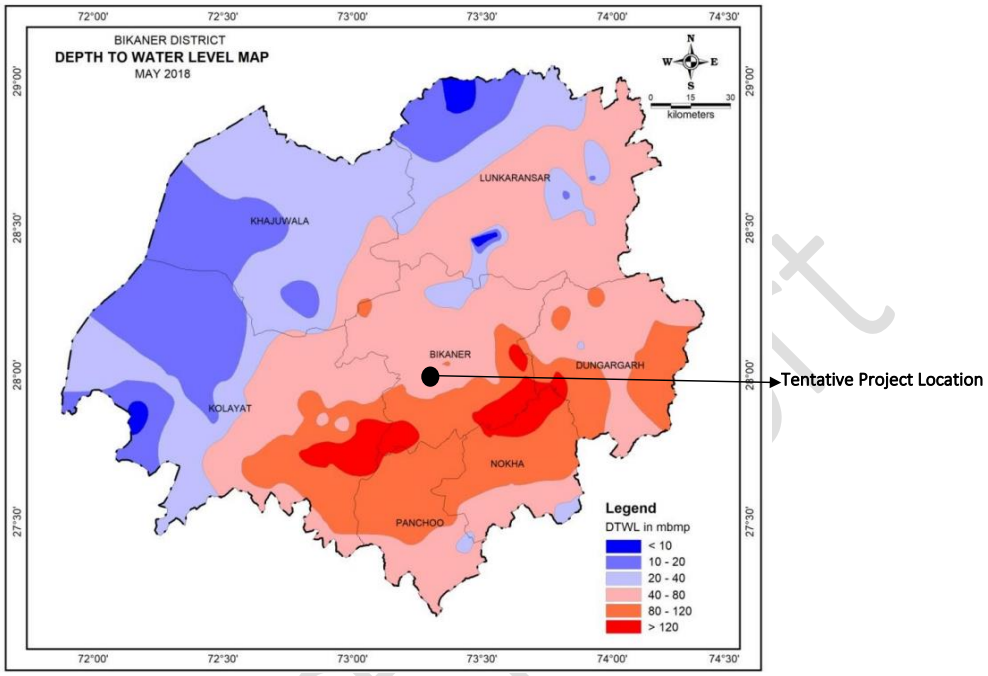
4.2.10.4 Groundwater Resources

According to Dynamic Groundwater Resources of India by Central Groundwater Board (CGWB), 2022, Bikaner Rural block, where the proposed project is located is categorized as **"Overexploited**" in terms of groundwater availability.

According to Aquifer Mapping and Management of Ground Water Resources for Bikaner district, 2017-18 by CGWB, the occurrence and movement of water in the subsurface of the district is broadly governed by geological frameworks i.e., nature of rock formations including their porosity (primary and secondary) and permeability. The principal aquifers in the district are alluvium, sedimentary formations viz. tertiary sandstone, limestone and shales. Occurrence and movement of ground water in alluvial aquifer is directly proportional to the granular zones i.e., the ground water accumulation will be higher in coarser formation and the formation clear of clayey admixture or intercalation.

According to the study undertaken by CGWB for Bikaner district in 2018, depth to water level varied from 7.29 m to 148 m below ground level (bgl) during pre-monsoon (May) 2018. The depth to water level in Bikaner tehsil where the proposed project is located ranged between 40 m - 80 m below ground level (bgl) during pre- monsoon. Map showing depth to water level during pre-monsoon 2018 in Bikaner district has been in ***Figure 4-12.***

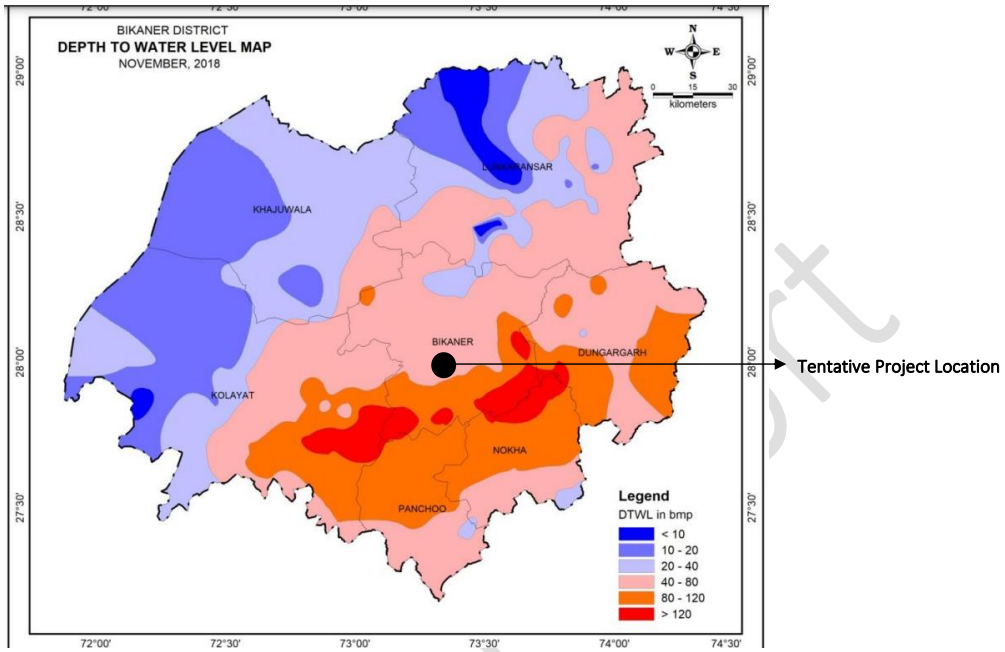
Figure 4-12: Depth to Water Level during Pre-monsoon (May), 2018



Source: Aquifer Mapping and Management of Ground Water Resources for Bikaner district, 2017-18 by CGWB

The depth to water level ranged between 7.46 m to 149 m during the Post monsoon (November), 2018. The depth to water level in Bikaner tehsil where the proposed project is located, ranged between 40m to 80 m during post- monsoon (November) in 2018 which is similar to the water level during pre- monsoon, 2018. Map showing depth to water level during post monsoon 2018 in Bikaner district has been in ***Figure 4-13.***

Figure 4-13: Depth to Water Level during Post Monsoon (November), 2018



Source: Aquifer Mapping and Management of Ground Water Resources for Bikaner district, 2017-18 by CGWB

4.2.10.5 Primary Groundwater Quality Assessment in Project Area

As part of the ESIA, groundwater quality assessment was conducted by a NABL accredited lab to understand the groundwater quality in the study area. One sample of groundwater was collected within 5 km radius of the project by the lab under the supervision of DTTILLP and the sample was analyzed against IS 10500:2012 drinking water standards adopted by Bureau of Indian Standards (BIS). The location of primary groundwater sample has been presented in ***Table 4-8*** and the results of the assessment has been presented in ***Table 4-9.*** Map showing monitoring locations has been presented in ***Figure 4-18.***

Table 4-8: Locations of primary groundwater samples

Location Code	Name of the Location	Coordinates	Location Criteria
GW1	Borewell at Village Kawani, Bikaner	28°08'54.60"N / 73°05'51.72"E	Collected from borewell to assess the ground water quality in the study area

Figure 4-14: Groundwater monitoring conducted in Study Area

GW 1 Location

Table 4-9: Results of Primary Groundwater Quality

Sr. No.	Parameters	Unit	GW 1	Desirable Limit	Permissible Limit
		Physical Parameters			
1.	Colour	Hazen	<5.0	5	5
2.	Odor	None	Agreeable	Agreeable	Agreeable
3.	pH	None	7.98 at 25 deg C	6.5-8.5	No Relaxation
4.	Turbidity	NTU	<1.0	1	5
5.	Total Dissolved Solid (TDS)	mg/l	4290.0	500	2000
		General Parameters			
6.	Aluminum (Al)	mg/l	<0.01	0.03	0.2
7.	Ammonia (N)	mg/l	<0.1	0.5	No Relaxation
8.	Anionic Detergent	mg/l	<0.02	0.2	0.01
9.	Boron (B)	mg/l	<0.5	0.5	1.0
10.	Barium (Ba)	mg/l	<0.05	0.7	No Relaxation
11.	Calcium (Ca)	mg/l	275.0	75	200
12.	Chloramines (Cl2)	mg/l	<0.3	4	No Relaxation
13.	Chloride (Cl)	mg/l	2376.0	250	1000
14.	Copper (Cu)	mg/l	<0.02	0.05	1.5
15.	Fluoride (F)	mg/l	1.8	1	1.5
16.	Free Residual Chlorine	mg/l	<0.1	0.2	0.1
17.	Iron (Fe)	mg/l	<0.05	0.3	No Relaxation
18.	Magnesium (Mg)	mg/l	161.0	30	100
19.	Manganese (Mn)	mg/l	<0.02	0.1	0.3
20.	Mineral Oil	mg/l	<0.01	0.5	No Relaxation

Sr. No.	Parameters	Unit	GW 1	Desirable Limit	Permissible Limit
21.	Nitrate (NO_3)	mg/l	95.0	45	No Relaxation
22.	Phenolic Compounds (C_6H_5OH)	mg/l	<0.001	0.001	0.002
23.	Selenium (Se)	mg/l	<0.005	0.01	No Relaxation
24.	Silver (Ag)	mg/l	<0.005	0.1	No Relaxation
25.	Sulphate ($SO_{4)}$	mg/l	488.0	200	400
26.	Hydrogen Sulphide (H_2S)	mg/l	<0.01	0.05	No Relaxation
27.	Total Alkalinity	mg/l	343.0	200	600
28.	Total Hardness	mg/l	1360.0	200	600
29.	Zinc (Zn)	mg/l	<0.02	5	15
30.	Cobalt (Co)	mg/l	<0.05	---	---
	Toxic Substances				
31.	Cadmium (Cd)	mg/l	<0.001	0.003	No Relaxation
32.	Cyanide (CN)	mg/l	<0.02	0.05	No Relaxation
33.	Lead (Pb)	mg/l	<0.005	0.01	No Relaxation
34.	Mercury (Hg)	mg/l	<0.001	0.001	No Relaxation
35.	Molybdenum (Mo)	mg/l	<0.05	0.07	No Relaxation
36.	Nickel (Ni)	mg/l	<0.02	0.02	No Relaxation
37.	Arsenic (As)	mg/l	<0.005	0.01	0.05
38.	Chromium (Cr)	mg/l	<0.01	0.05	No Relaxation
39.	Polychlorinated Biphenyl (PCB)	mg/l	<0.0005	0.0005	No Relaxation
40.	Polynuclear Aromatic Hydrocarbons (PAH)	mg/l	<0.0001	0.0001	No Relaxation
	Trihalomethanes				
41.	Bromoform	mg/l	<0.05	0.1	No Relaxation
42.	Dibromochloromethane	mg/l	<0.05	0.1	No Relaxation
43.	Bromodichloromethane	mg/l	<0.05	0.06	No Relaxation
44.	Chloroform	mg/l	<0.05	0.2	No Relaxation
	Pesticides Residues				
45.	Alachlor	µg/l	<0.02	20	20
46.	Atrazine	µg/l	<0.02	2	2
47.	Aldrin	µg/l	<0.01	0.03	0.03
48.	Dieldrin	µg/l	<0.01	0.03	0.03
49.	Alpha-HCH	µg/l	<0.01	0.01	0.01
50.	Beta-HCH	µg/l	<0.01	0.04	0.04
51.	Butachlor	µg/l	<0.02	125	125
52.	Chlorpyrifos	µg/l	<0.02	30	30
53.	Delta-HCH	µg/l	<0.01	0.04	0.04

Sr. No.	Parameters	Unit	GW 1	Desirable Limit	Permissible Limit
54.	2,4-Dichlorophenoxyacetic acid	µg/l	<0.01	30	30
55.	o,p-DDT	µg/l	<0.01	1	1
56.	p,p-DDT	µg/l	<0.01	1	1
57.	o,p-DDE	µg/l	<0.01	1	1
58.	p,p-DDE	µg/l	<0.01	1	1
59.	o,p-DDD	µg/l	<0.01	1	1
60.	p,p-DDD	µg/l	<0.01	1	1
61.	Beta-Endosulfan	µg/l	<0.01	0.4	0.4
62.	Ethion	µg/l	<0.02	3	3
63.	Gama-HCH(Lindane)	µg/l	<0.01	2	2
64.	Isoproturon	µg/l	<0.02	9	9
65.	Malathion	µg/l	<0.02	190	190
66.	Methyl parathion	µg/l	<0.02	0.3	0.3
67.	Monostrophes	µg/l	<0.02	1	1
68.	Phorate	µg/l	<0.02	2	2
69.	Endosulfan sulfate	µg/l	<0.01	0.4	0.4
70.	Alpha -endosulfan	µg/l	<0.01	0.4	0.4
	Bacteriological Parameters				
71.	Total coliform bacteria	/100ml	Detected	Not Detectable	Absent
72.	E.coli	/100ml	Detected	Not Detectable	Absent

Source: NABL Accredited Lab

Analysis of Groundwater Quality Results

Based on the results presented in ***Table 4-9,*** it is observed that most of the parameters (as per IS 10500:2012) for the groundwater sample are within the desirable and permissible limit except for the following.

- **Total Dissolved Solid (TDS):** The TDS in the groundwater sample was observed to be exceeding the desirable and permissible limit of 500 mg/l and 2000 mg/l respectively. This may be attributed to the fact that the groundwater sample was collected from an area near animal resting shed, therefore, mixing of soil contaminants (such as Iron, magnesium) and animal waste with groundwater through leaching can lead to high TDS. According to Central Groundwater Board (CGWB) report on "Aquifer Mapping and Management of Ground Water Resources" for Bikaner district, 2017-18, the concentration of total dissolved solids in ground water samples in the district has been found to vary generally between 117 mg/l to 11520 mg/l. TDS of 91% of analyzed water samples falls in the category of fresh water, while 7% samples have TDS in the range of 3000 - 10,000 mg/l and fall in brackish water category. TDS in excess of the maximum permissible limit of 2000 mg/l (IS-10500:2012) has been reported from parts of Lunkaransar, Bikaner (*where the proposed project is located*), Kolayat, Panchoo and Dungargarh and Nokha Blocks of the district.
- **Calcium:** Calcium content was found to be above desirable limit and permissible limit of 75 mg/l and 200 mg/l respectively. Hardness in most groundwater is naturally occurring from weathering of calcium bearing minerals. As can be observed in the previous paragraph, TDS in the groundwater sample was observed to be high. Therefore, high amount of calcium can be expected to occur in the groundwater.
- **Chloride:** The concentration of chloride was observed to be exceeding the desirable and permissible limit of 250 mg/l and 1000 mg/l respectively. Since TDS in the groundwater sample was observed to be high, therefore, high concentration of chloride is bound to occur in the groundwater. Additionally, high chloride content can be attributed to the presence of naturally occurring minerals in the district. According to Central Groundwater Board (CGWB) report on "Aquifer Mapping and

Management of Ground Water Resources" for Bikaner district, 2017-18, chloride concentration in groundwater within Bikaner tehsil ranged between 250 mg/l to >3000 mg/l which may affect the taste, corrosion and palatability of drinking water in the tehsil.

- **Fluoride:** The concentration of fluoride in GW 1 was observed to be 1.8 mg/l which is exceeding the desirable limit of 1mg/ l and the permissible limit of 1.5 mg/l. This may be attributed to the weathering and leaching of fluoride bearing minerals from rocks and minerals deep into the ground causing high content of fluoride in groundwater. According to CGWB report for Bikaner district, 2013, the fluoride concentration in groundwater of Bikaner district ranged between <1 mg/l to >1.5 mg/l.
- **Magnesium:** The level of magnesium in the sample was observed to be 161 mg/l which exceeded the desirable limit of 30 mg/l and the permissible limit of 100 mg/l. The exceedance of the desirable limit may be attributed to the high content of TDS in groundwater.
- **Sulphate:** Sulphate content was found to be exceeding the desirable and permissible limit in the sample (288 mg/l). As can be observed, TDS in the groundwater samples was observed to be high. Therefore, high amount of sulphate can be expected to occur in the groundwater
- **Total Alkalinity:** The total alkalinity in GW 1 was observed to be 343 mg/l which exceeded the desirable limit of 200 mg/l, however, it was within permissible limit of 600 mg/l.
- **Total Hardness:** The total hardness in GW 1 was observed to be 1360 mg/l which exceeded the desirable limit of 200 mg/l and permissible limit of 600 mg/l. Total hardness of water is correlated to the presence of bivalent metallic ions viz. calcium and magnesium. Since the sample has higher concentration of calcium and magnesium, therefore, there is high concentration of total hardness in the sample. According to Central Groundwater Board (CGWB) report on "Aquifer Mapping and Management of Ground Water Resources" for Bikaner district, 2017-18, Total Hardness has been found to vary between 60 mg/l and 2060 mg/l, indicating soft to very hard type of ground water. Long term consumption of extremely hard water might lead to an increased incidence of urolithiasis, anencephaly and cardio-vascular disorders
- **Total Coliform Bacteria and E.coli:** The sample was observed to be detected with total coliform bacteria and E.coli indicating disease-causing organisms (water borne-pathogens) within the water.

4.2.11 Soil Type

According to Aquifer Mapping and Management of Ground Water Resources for Bikaner district, 2017-18 by CGWB, the soils of Bikaner district are predominantly light textured, weak – structured, sand to sandy loam with the clay content. Arid climate with low rainfall, high temperature and high evaporation losses resulted in physical and mechanical disintegration of the parent material giving rise to predominance of coarse fraction in the soil. Very little chemical weathering has taken place and the development of soil is mostly indistinct. Soils are generally of desertic type with poor fertility status and very low water retention capacity.

4.2.11.1 Soil Quality Assessment

Soil characteristics within the study area, especially the physical quality and fertility of the soil have been characterized by analyzing soil samples collected from three locations under the supervision of DTTILLP through a NABL accredited Lab in March 2023. Soil sampling locations are shown in ***Table 4-10***. Soil analysis and results have been presented in ***Table 4-11.*** Map showing monitoring locations has been presented in ***Figure 4-18.***

Table 4-10: Soil Sampling Locations

Sampling ID	Location	Longitude	Latitude
S1	Within Project site at Kawani village,	73° 6'3.22"E	28° 7'55.93"N
S2	Within Project site at Gol Pratap Singh village	73° 7'5.39"E	28° 7'37.33"N
S3	Near Plant boundary located at village Gol Pratap Singh	73° 8'25.03"E	28° 7'9.28"N

Source: Monitoring conducted by NABL accredited Lab in March 2023

Figure 4-15: Soil test and monitoring conducted in Study Area

S 1 Location

S 2 Location

S 3 Location

Table 4-11: Results of Soil Sampling in Study Area

S.No	Parameter	Units	S1	S2	S3	Method
1.	pH Value (1:2.5) at 25℃	None	8.72	8.74	8.81	IS 2720 (Part 26) -1987, Rffm : 2011
2.	Texture	None	Sand	Sand	Sand	TPM/MSK/P&E/1/36A
3.	Electrical Conductivity (1:2.5) at 25℃	µs/cm	102.0	118.0	126.0	IS 14767:2000, RA2016
4.	Permeability	Cm/hr	4.9	5.6	4.8	IS 2720 (Part 17) -1986, Rffm : 2011
5.	Phosphate (as PO4)	mg/kg	11.0	10.0	9.7	TPM/MSK/P&E/1/12
6.	Sand	%	93.0	94.0	96.0	TPM/MSK/P&E/1/36A
7.	Silt	%	4.0	3.0	2.0	TPM/MSK/P&E/1/36A
8.	Clay	%	3.0	3.0	2.0	TPM/MSK/P&E/1/36A
9.	Porosity	%	44.0	46.0	43.0	TPM/MSK/P&E/1/30
10.	Nitrites (as NO2)	mg/kg	<0.5	<0.5	<0.5	TPM/MSK/P&E/1/20
11.	Nitrates (as NO3)	mg/kg	<4.0	<4.0	<4.0	TPM/MSK/P&E/1/19
12.	Total Petroleum Hydrocarbon as TPH	mg/kg	<1.0	<1.0	<1.0	IS 3025 (Part 39)-1991, Rffm : 2014
13.	Iron (as Fe)	mg/kg	<5.0	<5.0	<5.0	EPA 6010D
14.	Lead (as Pb)	mg/kg	<2.0	<2.0	<2.0	EPA 6010D
15.	Manganese (as Mn)	mg/kg	93.0	81.0	79.0	EPA 6010D
16.	Nickel (as Ni)	mg/kg	9.7	7.8	7.7	EPA 6010D
17.	Barium (as Ba)	mg/kg	17.0	12.0	13.0	EPA 6010D
18.	Zinc (as Zn)	mg/kg	13.0	10.0	12.0	EPA 6010D
19.	Copper (as Cu)	mg/kg	5.8	5.5	5.4	EPA 6010D
20.	Cadmium (as Cd)	mg/kg	<2.0	3.8	<2.0	EPA 6010D
21.	Total Chromium (as Cr)	mg/kg	10.0	8.3	9.4	EPA 6010D
22.	Arsenic (as As)	mg/kg	<0.25	<0.25	<0.25	EPA 6010D

S.No	Parameter	Units	S1	S2	S3	Method
23.	Mercury (as Hg)	mg/kg	<0.1	<0.1	<0.1	USEPA 245.5
24.	Total Hydrocarbon	mg/kg	<1.0	<1.0	<1.0	IS 3025 (Part 39)-1991, Rffm : 2014
25.	Cation Exchange Capacity	Meq/10	5.9	3.0	2.1	IS 2720 (Part 24)-1976, Rffm : 2015
26.	Organic Matter	%	0.21	0.19	0.18	IS 2720 (Part 22)-1972, Rffm : 2015
27.	Trace Metals	mg/kg	146.0	120.0	126.0	EPA 6010D

Source: Monitoring conducted by NABL accredited lab in March 2023

Table 4-12: Soil Classification Standards

S.No.	Soil Test Parameters	Classification
1	pH	<4.5 Extremely acidic 4.51-5.00 Very strongly acidic 5.00-5.50 slightly acidic 5.51-6.0 moderately acidic 6.01-6.50 slightly acidic 6.51-7.30 Neutral 7.31-7.80 slightly alkaline 7.81-8.50 moderately alkaline 8.51-9.0 strongly alkaline 9.01 very strongly alkaline
2	Salinity Electrical Conductivity (mmhos/cm) (1 ppm = 640 mhos/cm)	Up to 1.00 Average 1.01-2.00 harmful to germination 2.01-3.00 harmful to crops (sensitive to salts)
3	Organic Carbon	Up to 0.2: very less 0.21-0.4: less 0.41-0.5 medium, 0.51-0.8: on an average sufficient 0.81-1.00: sufficient >1.0 more than sufficient
4	Nitrogen (kg/ha)	Up to 50 very less 51-100 less 101-150 good 151-300 Better >300 sufficient
5	Phosphorus (kg/ha)	Up to 15 very less 16-30 less 31-50 medium, 51-65 on an average sufficient 66-80 sufficient >80 more than sufficient
6	Potash (kg/ha)	0-120 very less 120-180 less 181-240 medium 241-300 average 301-360 better

	>360 more than sufficient

Source: Handbook of agriculture, Indian Council of Agricultural Research, New Delhi, India

Analysis of Soil Quality Monitoring

The analysis of the soil quality assessment has been provided below.

1 ***pH*:** The pH value of the three soil samples were found to be 8.72 (S1) and 8.74 (S2) and 8.81 (S3). As per the standard soil classification, S1 and S2 and S3 are strongly alkaline in nature.
2 ***Texture:*** The texture of all the soil samples were found to be sandy in nature with low concentrations of clay and silt having low water retention capacity and poor fertility.
3 ***Electrical Conductivity (EC):*** EC is used to estimate the concentration of nutrients in soil. The electrical conductivity of S1, S2 and S3 was found to be 102 µs/cm, 118 µs/cm and 126 µs/cm respectively. This indicates low concentration of nutrients in the soil.
4 ***Metals:*** Iron, copper and zinc are important soil micronutrients considered essential for the normal growth of plants. Deficiencies of micronutrient drastically affect plant growth and metabolism. The level of iron in the soil samples were found <5.0 for all the soil samples S1, S2 and S3. The concentration of copper in the soil samples were found to be 5.8 mg/kg and 5.5 mg/kg and 5.4 mg/kg for samples S1, S2 and S3 respectively. The level of zinc in the soil samples were found to be 13 mg/kg (S1) and 10 mg/kg (S2) and 12 mg/kg (S3) which indicated low level of micronutrients in soil.

4.2.12 Ambient Air Quality Assessment

Existing ambient air quality of the study area was monitored at two (02) locations for 24 hours. Air quality samples were collected by NABL accredited lab by installation of air quality monitoring device under the supervision of DTTILLP. The monitoring parameters, including Respirable Particulate Matter (RPM) i.e. PM_{10} (particulate matter of particle size less than 10 micrometres) and $PM_{2.5}$ (particulate matter of particle size less than 2.5 micrometres), Sulphur Dioxide (SO_2), Oxides of Nitrogen (NO_x) and Carbon Monoxide (CO). PM_{10}, $PM_{2.5}$, SO_2 and NO_x, were monitored on 24 hourly basis, while CO was monitored on 8 hourly basis for 24 hours in the study area.

The locations of the ambient air quality monitoring has been presented in ***Table 4-13*** and results of the air quality monitoring has been presented in ***Table 4-13.*** Map showing monitoring locations has been presented in ***Figure 4-18.***

Table 4-13: Air Quality Monitoring Locations

Sampling ID	Location	Monitoring Frequency	Longitude	Latitude	Distance and Direction from Project
AAQ1	Village Kawani, Bikaner	24 hours for one week	73°05'46.32"E	28°08'50.64"E	750 m (aerial distance) from site towards north west direction
AAQ2	Near Kawani Road	24 hours for one week	73° 6'58.51"E	28° 7'47.05"N	200 m (aerial distance) from site towards north direction

Note*: Down wind at the project site is towards eastern or northeastern direction, however, since no settlements were located towards east or north east direction, the air samples were collected from above locations.*

Figure 4-16: Ambient Air Quality Monitoring conducted in Study Area

AAQ 1 Location

AAQ 2 Location

Table 4-14: Results of Ambient Air Quality Monitoring in Study Area

Parameter	Units	AAQ1	AAQ2	National Ambient Air Quality Standards (NAAQS) Permissible Limits (µg/m³)
Particulate matter (PM 10)	µg/m³	57.0	61.0	100
Particulate matter(PM 2.5) in µg/m3	µg/m³	33.0	40.0	60
Sulphur dioxide(SO2	µg/m³	7.2	8.6	80
Nitrogen dioxide (NO2)	µg/m³	24.0	28.0	80
Carbon monoxide(CO)	mg/m³	0.49	0.52	2

Source: Survey conducted by NABL accredited lab in March 2023

Analysis of Ambient Air Quality Monitoring

As per the above results, all the parameters were found to be within NAAQS CPCB permissible limit.

4.2.13 Noise Quality Assessment

Noise levels were recorded at four 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 Leqday and Leqnight 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 has been presented in ***Table 4-15*** and the results of the ambient noise monitoring has been presented in ***Table 4-16.*** Map showing monitoring locations has been presented in ***Figure 4-18.***

Table 4-15: Noise Quality Monitoring Locations

Sampling ID	Location	Longitude	Latitude	Distance and Direction from Transmission Line
N1	Village Kawani, Bikaner	73°05'47.04''E	28°08'48.48''N	750 m (aerial distance) from site towards north west direction

Sampling ID	Location	Longitude	Latitude	Distance and Direction from Transmission Line
N2	Near Plant Area, Bikaner	73°06'56.16''E	28°08'10.32''N	200 m (aerial distance) from site towards north direction
N3	Deepa Ramji ki Dhani, Gol Pratapsingh, Bikaner	73°06'12.96''E	28°06'29.88''N	350 m (aerial distance) from site towards south direction
N4	Kawani Road, Nalbari, Bikaner	73°08'03.12''E	28°06'03.24''N	800 m (aerial distance) from site towards south east direction

Figure 4-17: Noise Level monitoring conducted in Study Area

N 1 Location

N 2 Location

N 3 Location

N 4 Location

Table 4-16: Ambient Noise Quality Monitoring in Study Area

S.No.	Sampling ID	Results Leq dB(A)		CPCB Limits for rural area dB(A)	
		Leq Day	Leq Night	Leq Day	Leq Night
1.	N1	57.6	39.3	55	45
2.	N2	55.6	38.9	55	45
3.	N3	56.5	37.4	55	45
4.	N4	54.1	36.6	55	45

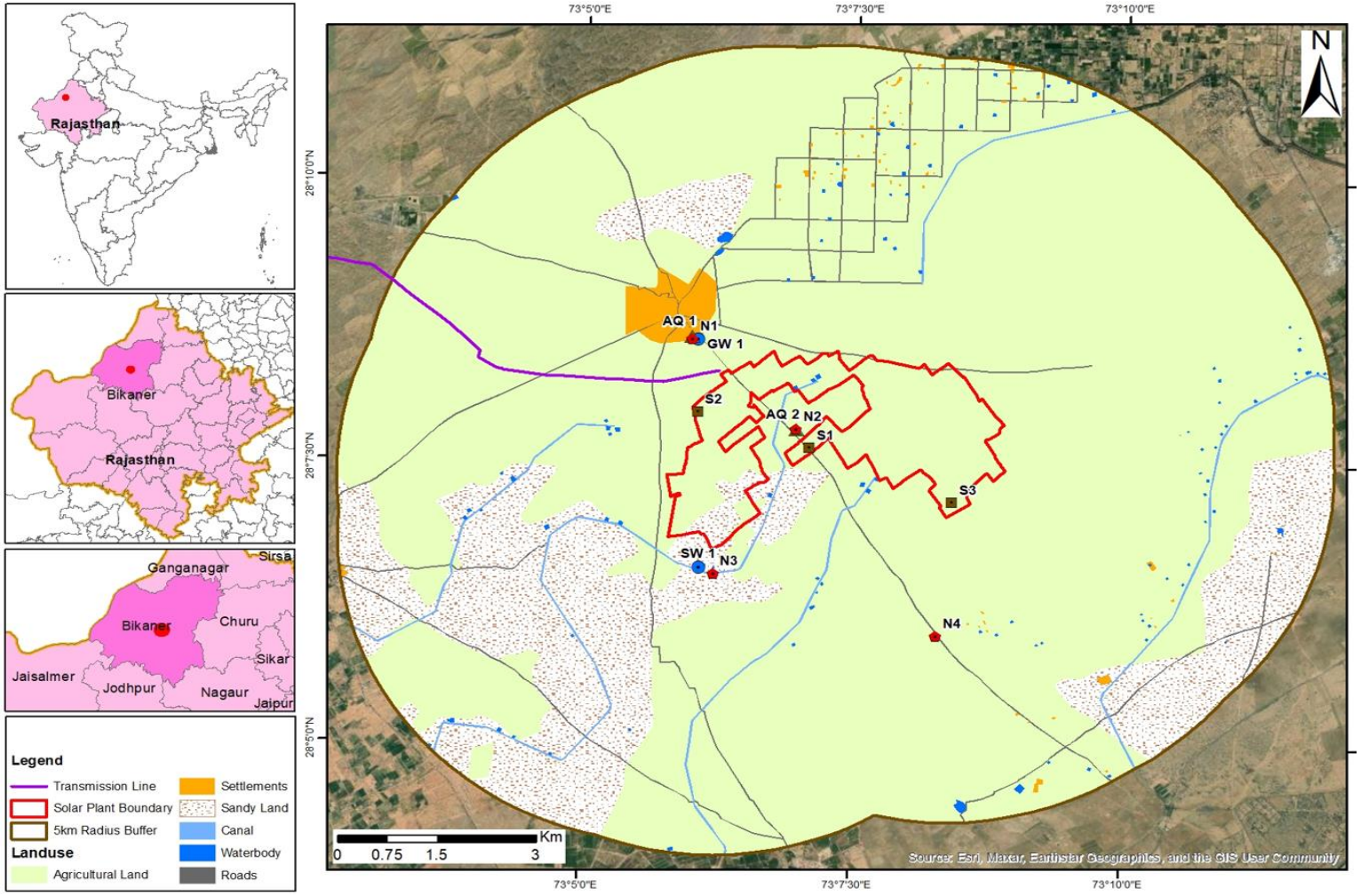
Source: Monitoring conducted by NABL accredited lab in March 2023

Analysis of Noise Quality Monitoring

The proposed project is in residential area, therefore, as per the above results, the Leq Night values of N1, N2,N3 and N4 was found to be within CPCB limits of 45 dB(A) for residential area. The Leq day level of N1, N2 and N3 was found to be 57.6 dB (A), 55.6 dB (A) and 56.5 respectively which slightly exceeded the CPCB limit of 55 dB(A). The exceedance of noise level in the daytime

can be attributed to high wind speed in the location as well as anthropogenic activities near the monitoring locations. The Leq day for N4 was found to be within the CPCB limit.

Figure 4-18: Map showing Monitoring Locations within Project Study Area



Source: DTTILLP ArcGIS mapping

4.2.14 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. According to the District Disaster Management Plan, drought, high wind and earthquake are the main natural hazards that can cause damage to life and property in Bikaner district, where the Project site falls[13]. The Project level details with respect to natural hazards have been presented in below.

- **Drought:** As per the district disaster management plan, low rainfall coupled with erratic behavior of the monsoon in the district makes Bikaner and its tehsils the most vulnerable to drought. Droughts are very common in the district, and it has occurred once in every 4 years in the past. The frequency of droughts causes very heavy loss to crops and livestock. The district had faced 3 very hard, 9 hard, 20 normal and 8 light droughts during last 75 years. The below map (***Figure 4-19)*** shows the drought frequency of the project area.

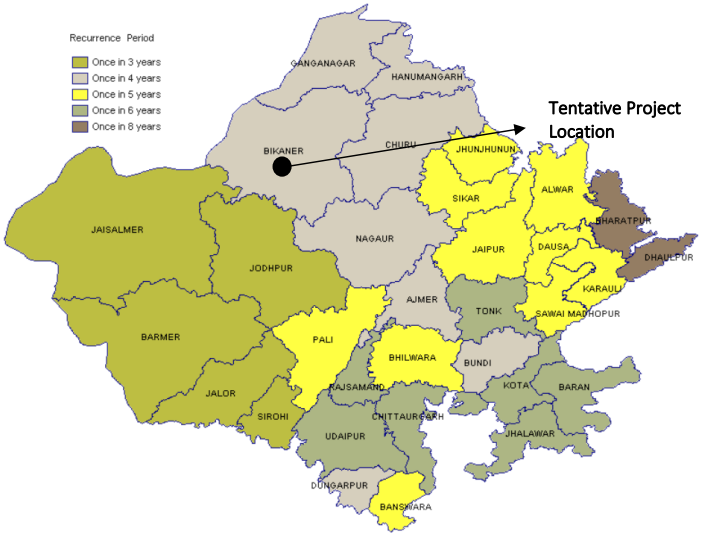
- As per the data released by Disaster Management, Relief & Civil Defence Department of Government of Rajasthan, the Project site is located in an area where drought frequency is once in 4 years.

- **Wind/Cyclone:** The Project site is located in an area vulnerable to high wind velocities Vb= 47 m/s and the zone is classified as high damage risk zone. The below ***Figure 4-20*** presents the wind hazard map which indicates the project area lies in the high damage risk zone.

- **Floods:** As per the data released by Disaster Management, Relief & Civil Defence Department of Government of Rajasthan the Project site falls in an area which is not prone to flooding incidents. The below ***Figure 4-21*** presents the flood prone map, showing the project area does not fall in the flood prone zone.

- **Earthquake:** The Project is located in an area that is designated as Zone III that corresponds to MSK VII. This is classified as a moderate damage risk zone in terms of earthquake occurrence. The earthquake map is shown in ***Figure 4-22.***

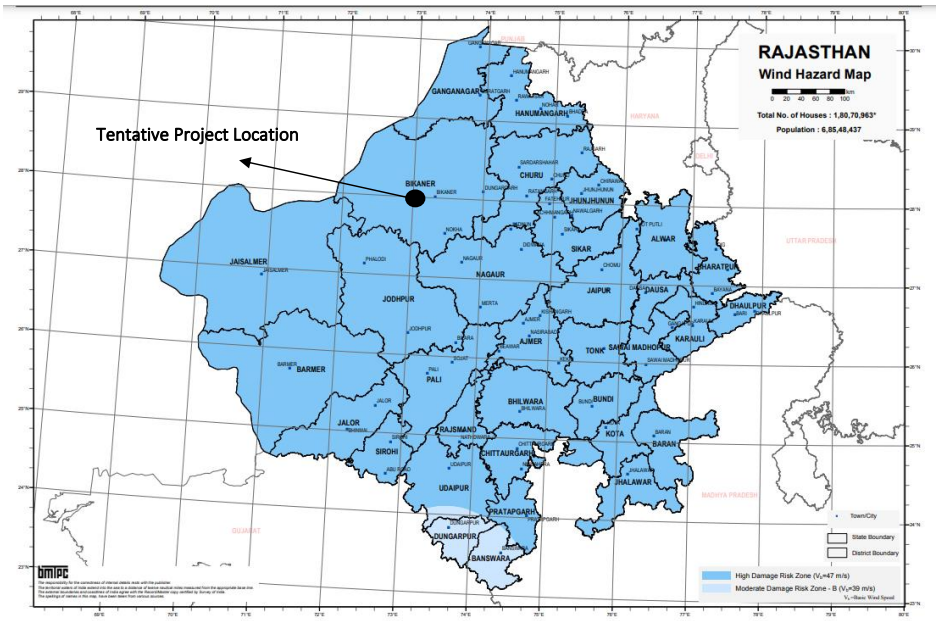
Figure 4-19: Map showing Drought Frequency in the Project district



Source: BMTPC

[13] http://www.dmrelief.rajasthan.gov.in/documents/ddmplan/bikaner_2017.pdf

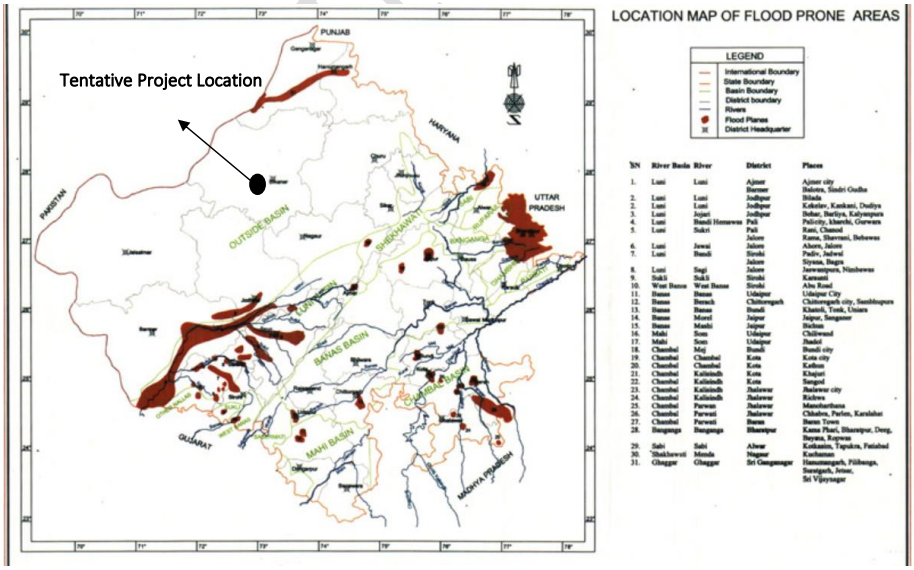
Figure 4-20: Map showing Wind Hazard in the Project District



Source: BMTPC

Source: BMTPC

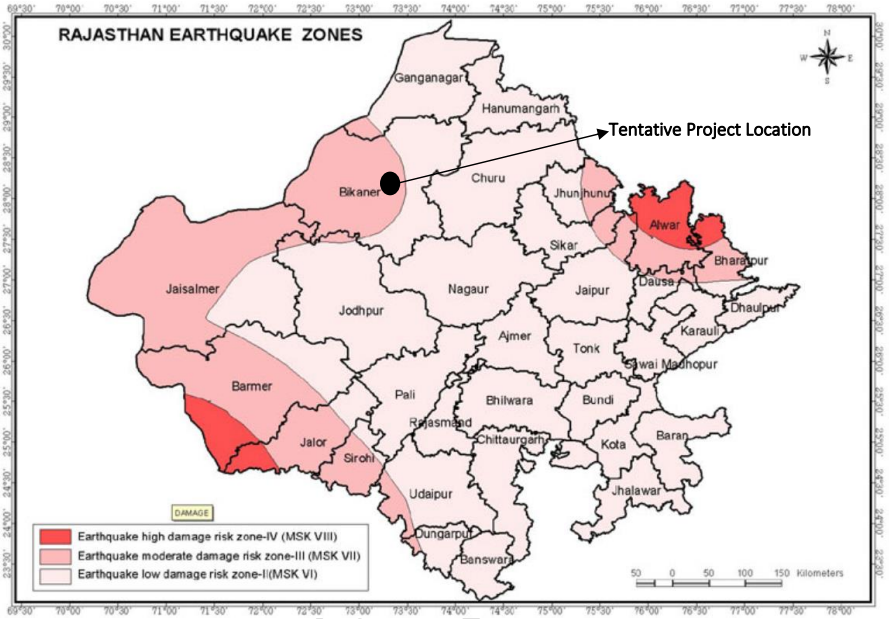
Figure 4-21: Map showing Flood Hazard in the Project District



Source: BMTPC

Source: BMTPC

Figure 4-22: Map showing Earthquake Hazard in the Project District



Source: BMTPC

4.3 Socio-economic Baseline

4.3.1 Approach

For the purpose of establishing the social baseline for the project and undertaking the social impact assessment of the project, a participatory approach has been adopted. Through this approach an attempt was made to integrate the local understanding and perspective into the impact assessment process and identification of the mitigation measures. The purpose of such an approach was to allow for:

- The triangulation of the information available from secondary sources through the information made available by the local community, both qualitative and quantitative
- Formulation of the socio-economic baseline on the basis of a combination of primary and secondary qualitative and quantitative data
- An understanding to be developed of the local community's perception of the project and its activities and the possible impacts from the same and the desirable mitigation measures

4.3.2 Primary data/information collection/site consultations

As part of the social baseline data collection process, consultations were undertaken with the local stakeholders identified for the Project. The ***Table 4-17:*** provides a list of consultation undertaken as part of the site visit.

Table 4-17: Consultation Undertaken during the site visit

Sr. No.	Stakeholder Details	Objective of the consultation	Remarks
1.	Discussion with the Project site team	Key Discussion points: • Companies' policy towards land procurement & land Identification process. • Status and process of the land procurement • Avoidance measures adopted by the project at the time of land procurement to avoid negative impacts on the community and land lesser • Timeline of the project • Key issues (if any) faced during the land procurement • General perception of the local community about the project • Stakeholder engagement/ Grievance management	At this planning phase of the project, the project team has identified following key stakeholders for the Project: • Land Lessers • Revenue department[14] • Nearby local community • Village council/ Panchayat
2.	Project affected person	• To understand the process of land leasing and status of payment of compensation • Understand the project impact • To assess the socio-economic conditions	

[14] It's a state government department in the local revenue authority who maintains the ownership record for specific area as well as to undertake the collection of land taxes

Sr. No.	Stakeholder Details	Objective of the consultation	Remarks
		• To assess the community needs and perception about the project	
3.	Consultation with community	Consultation on: • Socio economic status of the village • Major occupation in the villages • Demographic Profile • Social stratification • Land use pattern • Literacy profile • Livelihood profile • Social and physical infrastructure • Social Issues • Feedback related to the proposed project	

Source: Primary Survey 10 March 2023

As a part of these consultation an attempt has been made to develop an understanding of the stakeholder groups' key concerns and expectations from the Project, the stakeholder groups' perception of the project and to triangulate the secondary information available on the area.

4.3.3 Review of Secondary Information

For establishing the social baseline for the study area, a review of the secondary information available in the public domain was undertaken. The list of secondary sources of information used is as follows:

- District Statistical Handbook (Bikaner)
- Primary Census Abstract Data of India, 2011
- Village Directory Census Data of India, 2011

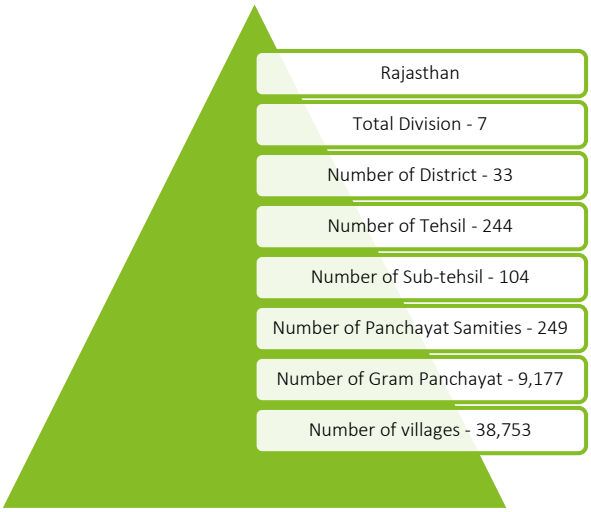
The proposed project falls under Bikaner district. The snapshot of the State and project district is given in the subsequent sections below.

4.3.4 State Profile: Rajasthan

Rajasthan covers an area of 342,239 square kilometers (132,139 sq. mile) or 10.4 per cent of the total geographical area of India. The state is the largest Indian state by area and the seventh largest by population. Rajasthan shares it border with the Pakistan's provinces of Punjab to the northwest and Sindh to the west, along the Sutlej-Indus River valley. Elsewhere it is bordered by five (5) other India 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 seven (7) divisions, 33 district, 244 tehsil, 104 sub-tehsil, 249 panchayat samities, and 38,753 villages.

Figure 4-23 Administrative Structure of Rajasthan



Source: Primary Census Abstract data of India, 2011

The state comprises of a population of 6,85,48,437 individuals, which is pre-dominantly living in rural area, 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.

The literacy rate of Rajasthan is nearly 66.10 per cent which is lower than that of the country, at 74.04 per cent. The male literacy rate is relatively higher in the state, at 79.19 per cent and female literacy rate is 52.112 per cent are also lower than the national literacy rate of 82.14 % and 65.46%, respectively.

Table 4-18 Demographic Profile of Rajasthan

Attributes	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	24.87	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: Primary Census Abstract data of India, 2011

4.3.5 District Profile: Bikaner

As per the census 2011, the population of Bikaner is 23,63,937 of which male and female were 12,40,801 and 11,23,136 respectively. Where as in year 2001 census, Bikaner had a population of 16,74,271 of which males were 8,86,075 and remaining 7,88,196 were females. Bikaner district population constituted 3.45 per cent of total Rajasthan population. In 2011 census, this figure for the district was 2.96 per cent of the state.

There was a change of 41.19 per cent in the total population compared to population as per 2001. In the previous census of India 2011, Bikaner district recorded increase of 29.62 percent to its population compared to 1991.

Table 4-19 District Profile

Variables	Bikaner District
Area (sq. km)	30,239
Total Population	23,63,937
Males	12,40,801
Female	11,23,136
Population Growth (percentage)[15]	41.19%
Sex Ratio[16]	905
Child Sex Ratio (0-6 age)	908
Population density[17] (sq. km)	78
Total Child Population (0-6 Age)	4,00,554
Male Population (0-6 Age)	2,09,952
Female Population (0-6 Age)	1,90,602
Total Literacy Rate[18] (percent)	65.13
Male Literacy Rate (percentage)	75.90
Female Literacy Rate (percentage)	53.23

Bikaner District Density

Per the census 2011, the density of the district for 2011 is 78 people per sq. km. In 2001, the district density was at 59 people per sq. km.

Bikaner Literacy Rate

Average literacy rate of the district in 2011 were 65.13 compared to 57.36 of 2001. The male and female literacy were 75.90 and 53.23, respectively. For 2001 census, the literacy rate stood at 70.65 and 42.45 in the district. Total literate in the district were 12,78,801 of which male and female were 7,82,399 and 4,96,402 respectively.

Bikaner Sex Ratio

[15] Population Growth from year 2001 to 2011
[16] It is the number of females per 1000 males.
[17] Population Density is a measurement of population per square kilometer
[18] It denotes ability to write a letter in any language. Literacy status assessment made for population 7 years and over.

With regards to sex ratio in Bikaner, it stood at 905 per 1000 male compared to 2001 census figure of 890. The average national sex ratio in India is 940 as per the census 2011 directorate. In 2011 census, sex ratio is 908 girls per 1000 boys compared to figure of 916 girls per 1000 boys in 2001.

Bikaner Child Population

In census enumeration, data regarding child under 0-6 age were also collected for all districts including Bikaner. There were total 4,00,554 children under age of 0-6 against 3,26,680 of 2001 census. Of total 4,00,554 male and female were 2,09,952 and 1,90,602, respectively. Child sex ratio as per census 2011 was compared to 916 of census 2011. In 2011, children under 0-6 formed 16.94 per cent of the district compared to 19.51 per cent of 2001. There was a net change of -2.57 per cent in this compared to previous census of India.

Bikaner district urban/rural

Out of the total Bikaner population for 2011 census, 33.86 per cent lives in urban regions of the district. In total 8,00,384 people lives in urban areas of which males are 4,109367 and female are 3,81,017. Sex ratio in urban region of the district is 909 as per 2011 census data. Similarly, child sex ratio in Bikaner district was 906 in 2011 census. Child population (0-6) in urban region was 1,08,422 of which males and females were 56,896 and 51,526. This child population figure of the district is 13.57% of total population. Average literacy rate in the district as per census 2011 is 77.98% of which males and female are 85.66% and 69.54% literates respectively. In actual number 5,39,597 people are literate in urban region of which males and females are 3,10,481 and 2,29,116 respectively.

A per 2011 census, 66.14% of population of the district lives in rural areas of villages. The total Bikaner district population living in the rural areas is 15,63,553 of which males and females are 8,21,43 and 7,42,119 respectively. In rural areas of the district, sex ratio is 903 females per 1000 males, If child sex ratio data of Bikaner district is considered, figure of 909 girls per 1000 boys. Child population in the age 0-6 is 2,92,132 in rural areas of which males were 1,53,056 and females were 1,39,076. The child population comprises 18.63% of total rural population of Bikaner district. Literacy rate in rural areas of the district is 58.14% as per census data 2011. Gender wise, male, and female literacy stood at 70.61 and 44.32 per cent respectively. In total, 7,39,204 people were literate of which males and females were 4,71,918 and 2,67,286, respectively.

4.3.6 Tehsil Profile: Bikaner

Bikaner tehsil of the Bikaner district has total population of 9,19,706 as per the Census 2011. Out of which 4,83,175 are males while 4,36,531 are females. In 2011 there were total 1,58,036 families residing in the Tehsil. The average sex ratio of the tehsil is 903.

The population of children of age 0-6 years in the tehsil is 1,33,591 which is 14.52% of the total population. There were 70,125 male children and 63,466 female children between the age of 0-6 years. Thus, as per the Census 2011, the child sex ratio of the tehsil is 905 which is greater than average sex ratio (903) of the tehsil.

The total literacy rate of the tehsil is 63.36%. The male literacy rate is 70.71% and the female literacy rate is 55.22% in the tehsil.

Table 4-20 Tehsil Profile

Variables	Bikaner Tehsil
Total Population	9,19,706
Males	4,83,175
Female	4,36,531

Variables	Bikaner Tehsil
Sex Ratio[19]	903
Total Literacy Rate[20] (percent)	63.36%
Male Literacy Rate (percentage)	70.71%
Female Literacy Rate (percentage)	55.22%

Working Population – Bikaner Tehsil

In the tehsil out of the total population, 3,17,558 were engaged in work activities. 84.40% of workers describe their work as main work (employment of earning more than 6 months) while 15.60% were involved in marginal activity providing livelihood for less than 6 months. Of 2,68,045 workers engaged in main work, 42,408 were cultivators (owner or co-owner) while 11,474 were agricultural labourer.

Table 4-21 Bikaner tehsil – working profile

	Total	Male	Female
Main Workers	2,68,045	2,26,348	41,697
Cultivators	6,448	5,290	1,158
Agriculture Labourer	3,815	3,200	615
Household Industries	11,237	9,154	2,083
Other Workers	2,05,384	1,82,019	23,365
Marginal Workers	27,269	16,696	10,573
Non-Working	6,02,148	2,33,623	3,68,525

4.3.7 Profile of the Study Area

The area of up to five (5) km radius from the Project boundary has been demarcated as the study area. The study area is demarcated based on the potential direct and indirect impact of the project on the local community.

The key terms used for sub-categorization of the Study Area are:

- *Project footprint* - The Project footprint comprises the area within the proposed boundary of the project which includes the following villages
- *Project Villages / Core Zone* - There are two villages (Kawani and Gol Pratap Singh) from the Bikaner tehsil from where the land for the project has been procured. These will be referred to as "Project Villages". The core zone for the baseline studies is considered within 2 km radius from the project area, where most of the impacts are anticipated. Since there are only two project villages in our core zone, the terms can be used interchangeably. The details of the villages in core area is given in **Table 4-22**.
- *Buffer Zone* - The buffer zone refers to the area between the 2km and 5 km radius from the project area. Details of village in buffer area is given in Table 4-23.

[19] It is the number of females per 1000 males.
[20] It denotes ability to write a letter in any language. Literacy status assessment made for population 7 years and over.

It must be noted that village Gol Pratap Singh is uninhabited.

Note: the study area = project village/core zone + buffer zone

Table 4-22 Core Zone Villages

S. No.	Name of Village	Tehsil
1	Kawani	Bikaner
2	Gol Pratap Singh	Bikaner

Table 4-23 Buffer Zone Villages

S.No.	Name of Village	Tehsil
1	Nal	Bikaner
2	Nalbari	Bikaner
3	Daiya	Bikaner
4	Sharah Brahmanan	Bikaner
5	Sharah Ratnani Vyas	Bikaner
6	Sharah Suthran Makran	Bikaner
7	Sharah Sutharan Gopala	Bikaner
8	Sharah Borla	Bikaner
9	Sharah Gheroolal	Bikaner
10	Badrasar	Bikaner
11	Bharu	Bikaner
12	Sharah Jatan	Bikaner
13	Shobhasar	Bikaner

4.3.7.1 Demographic Profile of Study Area

This section looks at demographic key indicators of the households to understand existing population dynamics, and how they may be influenced by the project as well as availability in numbers and quality of human resources.

Table 4-24 Demographic Profile of the Study Area

Villages	No. of HH	Population	Average HH Size	Sex Ratio	% SC	% ST	% Lit	% F Lit
Project Village / Core Zone								
Kawani	536	3,403	6.34	900	27.38	0.38	45.10	36.29
Gol Pratap Singh	3	9	3	800	0	0	33.33	0
Core Zone Total	**539**	**3,412**	**4.67**	**850**	**27.38**	**0.38**	**39.21**	**36.29**
Buffer Zone								
Nal Chhoti	220	1265	5.75	896.55	20.31	0.23	39.28	29.09
Nalbari	1709	8572	5.01	775.84	27.07	0.39	59.53	49.34
Daiya	150	881	5.87	870.48	41.54	0.11	52.21	39.26
Sharah Brahmanan	NA	NA	NA	NA	NA	NA	NA	NA
Sharah Ratnani Vyas	NA	NA	NA	NA	NA	NA	NA	NA
Sharah Suthran Makran	NA	NA	NA	NA	NA	NA	NA	NA
Sharah Sutharan Gopala	NA	NA	NA	NA	NA	NA	NA	NA
Sharah Borla	NA	NA	NA	NA	NA	NA	NA	NA
Sharah Gheroolal	NA	NA	NA	NA	NA	NA	NA	NA
Badrasar	289	1,973	6.28	891	41.56	0.10	50.02	37.63
Bharu	NA	NA	NA	NA	NA	NA	NA	NA
Sharah Jatan	NA	NA	NA	NA	NA	NA	NA	NA
Shobhasar	239	1,555	6.50	903.30	38.77	0.06	40.51	29.67
Buffer Total	**2,607**	**14,246**	**5.88**	**867.43**	**33.85**	**0.17**	**48.31**	**36.99**
Study Area Total	**3,146**	**17,658**	**5.27**	**858.71**	**30.61**	**0.27**	**43.76**	**36.64**

Source: Census of India 2011 data

(*Note: The data for village Sharah Brahmanan, Sharah Ratnani Vyas, Sharah Suthran Makran, Sharah Sutharan Gopala, Sharah Borla, Sharah Gheroolal, Bharu and Sharah Jatan could not be found in the Census 2011, and thus has not been considered for calculation purposes.)*

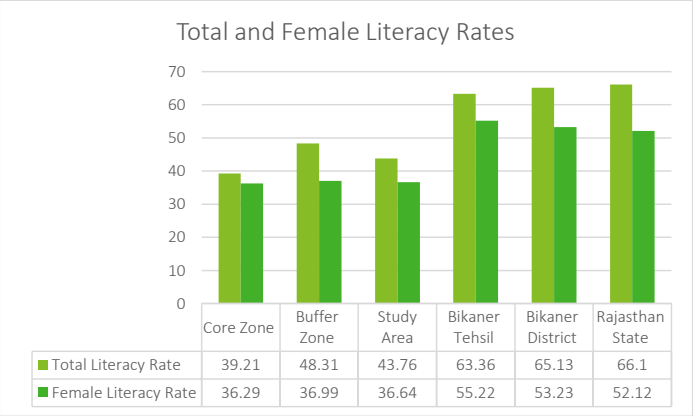
The core zone of the Study area comprises 2 villages while the buffer zone has 13 villages, as listed in Table 4-23. The core zone has 539 households with population of 3,412 individuals. The average size of the households varies from 3 to 6.50 across the core and buffer zone.

Shobhasar, one of the buffer zone villages has the highest sex ratio, at 903.30, followed by a project village (Kawani) at 900 females per 1000 males. On the other hand, Nalbari has the lowest sex ration, at 775.84. As can be noted, the SC population is always higher than the ST population in all villages falling in the Study Area. The average SC population in Study Area is 30.61% of total population, while for ST it is 0.27% of total population.

4.3.7.2 Literacy and Education

The total literacy rate and female literacy rate in the project villages is lower as compared to the tehsil, district and state figures. The female literacy rate in the study area is relatively lower as compared to the tehsil percentage.

Figure 4-24 Comparative overview of the Literacy rate across Core Zone, Buffer Zone, Study Area, Tehsil, District and State



	Core Zone	Buffer Zone	Study Area	Bikaner Tehsil	Bikaner District	Rajasthan State
Total Literacy Rate	39.21	48.31	43.76	63.36	65.13	66.1
Female Literacy Rate	36.29	36.99	36.64	55.22	53.23	52.12

Source: Primary Census Abstract data of India, 2011

4.3.8 Physical Infrastructure

4.3.8.1 Water Supply and Sanitation

As per the consultations with the local community it was understood that the piped drinking water is supplied in the study area by the PHED department (Public Health Engineering) and panchayat. The main source of drinking water supply is Indira Gandhi Canal. Additionally, rainwater harvesting was also carried out at household level. However, in summers when demand for water is high there is a less supply of water therefore to meet the demand community had to purchase water from the private tankers. As informed, most of the ground water is saline which is not suitable for drinking and irrigation therefore agriculture is the study area is mostly rainfed.

Reportedly most of the houses is the study area is having household toilet however, but due to the water scarcity and other social taboos the use toilet is still not prevalent.

4.3.9 Social Infrastructure

4.3.9.1 Education Infrastructure

As per the census 2011 there is no government primary school within the core zone and there is only one private pre-nursery school in Kawni. Other education institutions including different types of colleges are not in a 10 km radius of the study area. The study area has pre-primary, primary and middle schools inside the villages or in less than 5 kms of the villages.

4.3.9.2 Health Facilities and Health Seeking Behaviour

The health facility in the study area follows a three-tier health infrastructure system, as also applies to the state of Rajasthan. The health facilities available at the village level comprise of Primary Health Sub-centres and Public Health Centres (PHC). While the sub centers 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 (outpatient department) and basic IPD (Indoor Patient Department) cases, sub centres usually have a delivery room and two resident nurses (one male and one female). Each PHC has 5-6 sub-centers under them. In turn, a cluster of 6-10 PHCs comes under a CHC (Community Health Centre), which caters to a population exceeding 1 lakh, and provides emergency services. The CHCs in turn report to the public hospitals at the district level.

4.3.9.3 Energy Use

The population in the Study area is understood to use both LPG (Liquified Petroleum Gas) as well as dung cakes (as fuel source) to meet their daily domestic energy requirements. While LPG adoption and availability across the villages has improved over the past few years because of *Pradhan Mantri Ujjwala Yojana*, firewood and burning dung cakes as fuel

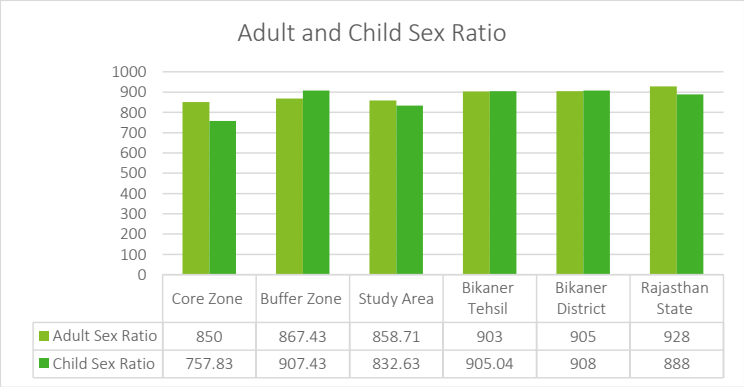
continues to be the main domestic fuel for cooking requirements. The usage/dependence also goes up to form the overall economics of livestock rearing in the area.

4.3.9.4 Gender: Role in Society

The sex ratio of the Bikaner district (905) is lower than the state sex ratio (928). The Project villages exhibit even lower sex ratio of 900 females per 1000 males and 800 females per 1000 males in Kawani and Gol Pratap Singh respectively.

The adult sex ratio is the highest in Rajasthan state (928 females per 1000 males), and lowest in Core zone (850 females per 1000 males) comprising of the project villages. However, the highest child sex ratio is in Bikaner district (908 girl child per 1000 male child) and lowest in Core Zone (757.83 girl child per 1000 male child).

Figure 4-25 Comparison of Adult and Child Sex ratios across Core Zone, Buffer Zone, Study area, Tehsil, District and State



	Core Zone	Buffer Zone	Study Area	Bikaner Tehsil	Bikaner District	Rajasthan State
Adult Sex Ratio	850	867.43	858.71	903	905	928
Child Sex Ratio	757.83	907.43	832.63	905.04	908	888

Source: Primary Census Abstract data of India, 2011

4.4 Ecological Baseline

To understand the ecological sensitivity and to establish an ecological baseline (flora and fauna) of the study area, an ecological survey was conducted between 13th – 15th March 2023. The main objective of this exercise was to identify the potential impacts on the species and habitats (present in the vicinity) due to the project-related activities, so as to identify suitable impact mitigation and management strategy.

4.4.1 Objectives

The survey was conducted with the following objectives,

- Identification of internationally and/or nationally recognized areas of high biodiversity value e.g., Protected Areas (PAs), Key Biodiversity Areas (KBAs) / Important Bird and Biodiversity Areas (IBAs), Alliance for Zero Extinction (AZE) sites, etc.
- Identification of different habitats (natural, modified, and critical) falling within core and buffer zones.
- Documentation of floral and faunal [specifically herpetofauna (reptiles + amphibians), birds, and mammals] species based on direct sightings, calls, pugmarks (if any), etc.
- Trace out of any endangered or protected or restricted range floral species. Identification of any threatened (as per IUCN Red List), scheduled (as per Wildlife (Protection) Act, 1972), Endemic or restricted-range and migratory or congregatory faunal species (as defined in IFC PS 6) from the study area.
- Identification of wildlife migratory corridors, avian migratory routes, and other important areas for ecological reasons such as breeding, nesting, foraging, resting, etc.

4.4.2 Ecological Baseline – Data Collection Methods

To understand the existing ecological conditions in the study area, an ecological baseline was prepared. This base line was prepared with the help of information gathered under, i. Literature Review and ii. Field Data Collection.

4.4.2.1 Literature Review

A literature review was performed to screen out the presence of internationally and/or nationally recognized areas of high biodiversity value e.g., Protected Areas (PAs), Alliance for Zero Extinction (AZE) sites, etc.; and habitat of IUCN Threatened and Restricted-range species; and Key Biodiversity Areas (KBAs), which include Important Bird and Biodiversity Areas (IBAs) in and around the proposed project location. A list of floral and faunal species was also prepared along with their conservation status (as per IUCN) and their status in the list of scheduled species [as per Wildlife (Protection) Act, 1972] utilizing collected secondary data during literature review. The dominant habitats in and around the project location was also identified with the help of google earth imagery and other available secondary data. The recognized (internationally and/or nationally) wildlife migratory corridors, and avian migratory routes were also identified with the available information.

4.4.2.2 Field Data Collection

A field survey was conducted to determine the existing ecological conditions (habitats, flora and fauna) within the study area. This baseline facilitates an adequate assessment of the project's impacts upon ecology as well as it helps the development of appropriate mitigation measures. Habitats, which may support good biodiversity i.e., forest patches, scrubs, water bodies, etc. will be focused during the survey.

Habitat Survey

Different habitats (natural and modified) available within the study area identified by the desktop review were verified through site visit. Data regarding the type and quality of habitat with reference to flora and fauna supported were collected.

Floral Survey

The floral diversity of the study area was recorded by visual observation during the site visit and identified using published manuals. The information (Scientific publications) dealing with the floristic diversity of the related area available in the public domain were also considered in the survey.

Faunal Survey

I. Faunal species (specifically reptiles, birds, and mammals) from the study areas were recorded based on direct sightings, indirect evidence such as dung, droppings, scats, pugmarks, scratch signs, burrows, nests, etc.;
II. Consultations were carried out by displaying photographs of species anticipated in the area to confirm whether there have been any recent sightings. The photographs of the species was typically obtained from the authentic sources[21,22];
III. Identification and classification of any species recognized as Threatened (in accordance with International Union for the Conservation of Nature [IUCN] Red List Online Version 2022-1) and according to the schedules of the Wildlife (Protection) Act, 1972; and
IV. Identification of areas which are important or sensitive for ecological reasons including their breeding, nesting, foraging, resting, overwintering areas including wildlife migratory corridors/avian migratory routes.

4.4.3 Ecological Baseline - Results

4.4.3.1 Literature Review - eBird Database

The historical data regarding the presence of birds in the region was extracted from the eBird Database[23]. The major objective to extract this information was to see the incidence of migratory birds, vultures, and raptors in the region. As per the eBird Database, at least 144 migratory birds including one Critically Endangered [Sociable Lapwing (*Vanellus gregarious*)]; two Endangered [Saker Falcon (*Falco cherrug*), Steppe Eagle (*Aquila nipalensis*)]; six Vulnerable [Asian Houbara (*Chlamydotis macqueenii*), Common Pochard (*Aythya farina*), Eastern Imperial Eagle (*Aquila heliacal*), Greater Spotted Eagle (*Clanga clanga*), White-browed Bushchat (*Saxicola macrorhynchus*), Yellow-eyed Pigeon (*Columba eversmanni*)]; and 15 Schedule I [Booted Eagle, Crested Serpent-Eagle, Eastern Imperial Eagle, Eurasian Buzzard, Eurasian Sparrowhawk, Greater Spotted Eagle, Hen Harrier, Long-legged Buzzard, Montagu's Harrier, Osprey, Pallid Harrier, Red-necked Falcon, Saker Falcon, Steppe Eagle, Western Marsh-Harrier, & White-tailed Eagle] species were reported from the region (***Table 4-25***). This secondary information also reports seven vultures (***Table 4-26***) and forty raptor species from the region (***Table 4-27***).

[21] Grewal, B., Sen, S., Singh, S., Devasar, N. & Bhatia G. (2016) A Pictorial Field Guide to Birds of India, Pakistan, Nepal, Bhutan, Sri Lanka and Bangladesh. Om Books International, Noida, Uttar Pradesh, India.

[22] Menon, V. (2014) Indian Mammals: A Field Guide. Hachette, India

[23] https://ebird.org/barchart?byr=2001&eyr=2023&bmo=1&emo=12&r=IN-RJ-BI

Among the Critically Endangered bird species, the presence of Sociable Lapwing (*Vanellus gregarious*)] in the study area is unexpected, because the species has not been reported from the 50 km buffer from the project area[24, 25]. As per the available secondary information and consultations, it may be anticipated that the Asian Houbara (*Chlamydotis macqueenii*) - Vulnerable has been recorded only from the Jorbeed Conservation Reserve up to 2018[26]. Thus, the presence of this vulnerable species (Asian Houbara) is also unexpected in and around the study area.

As per the available secondary data[27], Demoiselle Crane, Common Coot, Green-winged Teal, Ruff, Northern Shoveler, Common Crane, Tufted Duck, Common Pochard, Northern Pintail, & Gadwall are the key congregatory species from the region.

Table 4-25: Migratory birds reported from the region

S.N.	Common English Name	Binomial Scientific Name	IUCN Red List - Categories	Wildlife (Protection) Act - Schedules
1	Asian Desert Warbler	*Sylvia nana*	Least Concern	Schedule IV
2	Ashy Drongo	*Dicrurus leucophaeus*	Least Concern	Schedule IV
3	Asian Houbara (Macqueen's Bustard)	*Chlamydotis macqueenii*	Vulnerable	Not Listed
4	Baillon's Crake	*Zapornia pusilla*	Least Concern	Schedule IV
5	Bar-headed Goose	*Anser indicus*	Least Concern	Schedule IV
6	Barn Swallow	*Hirundo rustica*	Least Concern	Not Listed
7	Bimaculated Lark	*Melanocorypha bimaculate*	Least Concern	Schedule IV
8	Black Redstart	*Phoenicurus ochruros*	Least Concern	Schedule IV
9	Black Stork	*Ciconia nigra*	Least Concern	Schedule IV
10	Black-bellied Sandgouse	*Pterocles orientalis*	Least Concern	Schedule IV
11	Black-headed Bunting	*Emberiza melanocephala*	Least Concern	Schedule IV
12	Black-headed Gull	*Chroicocephalus ridibundus*	Least Concern	Schedule IV
13	Black-necked grebe	*Podiceps nigricollis*	Least Concern	Schedule IV
14	Black-tailed Godwit	*Limosa limosa*	Near Threatened	Schedule IV
15	Black-throated Thrush	*Turdus atrogularis*	Least Concern	Schedule IV
16	Blue Rock-Thrush	*Monticola solitarius*	Least Concern	Schedule IV
17	Bluethroat	*Cyanecula svecica*	Least Concern	Schedule IV
18	Blyth's Reed Warbler	*Acrocephalus dumetorum*	Least Concern	Schedule IV
19	Booted Eagle	*Hieraaetus pennatus*	Least Concern	Schedule I
20	Booted Warbler	*Iduna caligata*	Least Concern	Schedule IV
21	Brooks's Leaf Warbler	*Phylloscopus subviridis*	Least Concern	Schedule IV
22	Brown-headed Gull	*Larus brunnicephalus*	Least Concern	Schedule IV
23	Buff-bellied Pipit	*Anthus rubescens*	Least Concern	Schedule IV

[24] https://ebird.org/map/soclap1?bmo=1&emo=12&byr=2001&eyr=2023&env.minX=71.871&env.minY=27.183&env.maxX=74.358&env.maxY=29.05&gp=true

[25] https://www.inaturalist.org/observations?place_id=any&subview=map&taxon_id=4858

[26] https://ebird.org/map/macbus1?bmo=1&emo=12&byr=2001&eyr=2023&env.minX=71.871&env.minY=27.183&env.maxX=74.358&env.maxY=29.05&gp=true

[27] eBird Database [https://ebird.org/hotspot/L10773075, https://ebird.org/hotspot/L6188945, https://ebird.org/hotspot/L4194991, https://ebird.org/hotspot/L4968777, https://ebird.org/hotspot/L6068369, https://ebird.org/barchart?byr=2000&eyr=2022&bmo=1&emo=12&r=L6159884, https://ebird.org/barchart?byr=2000&eyr=2022&bmo=1&emo=12&r=L5185988, https://ebird.org/barchart?byr=2000&eyr=2022&bmo=1&emo=12&r=L5512527]

S.N.	Common English Name	Binomial Scientific Name	IUCN Red List - Categories	Wildlife (Protection) Act - Schedules
24	Chestnut-tailed Starling	*Sturnia malabarica*	Least Concern	Schedule IV
25	Cinereous Vulture	*Aegypius monachus*	Near Threatened	Schedule IV
26	Citrine Wagtail	*Motacilla citreola*	Least Concern	Schedule IV
27	Collared Sand Martin	*Riparia riparia*	Least Concern	Not Listed
28	Common Chiffchaff	*Phylloscopus collybita*	Least Concern	Schedule IV
29	Common Coot	*Fulica atra*	Least Concern	Schedule IV
30	Common Crane	*Grus grus*	Least Concern	Schedule IV
31	Common Greenshank	*Tringa nebularia*	Least Concern	Schedule IV
32	Common Gull-billed Tern	*Gelochelidon nilotica*	Least Concern	Schedule IV
33	Common Kestrel	*Falco tinnunculus*	Least Concern	Schedule IV
34	Common Pochard	*Aythya ferina*	Vulnerable	Schedule IV
35	Common Redshank	*Tringa tetanus*	Least Concern	Schedule IV
36	Common Rosefinch	*Carpodacus erythrinus*	Least Concern	Schedule IV
37	Common Sandpiper	*Actitis hypoleucos*	Least Concern	Schedule IV
38	Common Shelduck	*Tadorna tadorna*	Least Concern	Schedule IV
39	Common Snipe	*Gallinago gallinago*	Least Concern	Schedule IV
40	Common Starling	*Sturnus vulgaris*	Least Concern	Schedule IV
41	Common Teal	*Anas crecca*	Least Concern	Schedule IV
42	Cream-colored Courser	*Cursorius cursor*	Least Concern	Not Listed
43	Crested Serpent-Eagle	*Spilornis cheela*	Least Concern	Schedule I
44	Curlew Sandpiper	*Calidris ferruginea*	Near Threatened	Schedule IV
45	Dalmatian Pelican	*Pelecanus crispus*	Near Threatened	Schedule IV
46	Demoiselle Crane	*Grus virgo*	Least Concern	Schedule IV
47	Desert Wheatear	*Oenanthe deserti*	Least Concern	Schedule IV
48	Dunlin	*Calidris alpina*	Least Concern	Schedule IV
49	Eastern Imperial Eagle	*Aquila heliacal*	Vulnerable	Schedule I
50	Eastern Orphean Warbler	*Sylvia crassirostris*	Least Concern	Schedule IV
51	Eurasian Buzzard	*Buteo buteo*	Least Concern	Schedule I
52	Eurasian Curlew	*Numenius arquata*	Near Threatened	Schedule IV
53	Eurasian Hobby	*Falco Subbuteo*	Least Concern	Schedule IV
54	Eurasian Sparrowhawk	*Accipiter nisus*	Least Concern	Schedule I
55	Eurasian Wigeon	*Mareca Penelope*	Least Concern	Schedule IV
56	Eurasian Wryneck	*Jynx torquilla*	Least Concern	Schedule IV
57	European Roller	*Coracias garrulus*	Least Concern	Schedule IV
58	Ferruginous Duck	*Aythya nyroca*	Near Threatened	Schedule IV
59	Finsch's Wheatear	*Oenanthe finschii*	Least Concern	Not Listed
60	Gadwall	*Mareca strepera*	Least Concern	Schedule IV
61	Garganey	*Spatula querquedula*	Least Concern	Schedule IV

S.N.	Common English Name	Binomial Scientific Name	IUCN Red List - Categories	Wildlife (Protection) Act - Schedules
62	Glossy Ibis	*Plegadis falceinellus*	Least Concern	Schedule IV
63	Greater Flamingo	*Phoenicopterus roseus*	Least Concern	Schedule IV
64	Greater Scaup	*Aythya marila*	Least Concern	Schedule IV
65	Greater Short-toed Lark	*Calandrella brachydactyla*	Least Concern	Schedule IV
66	Greater Spotted Eagle	*Clanga clanga*	Vulnerable	Schedule I
67	Greater White-fronted Goose	*Anser albifrons*	Least Concern	Schedule IV
68	Green Sandpiper	*Tringa ochropus*	Least Concern	Schedule IV
69	Greenish Warbler	*Phylloscopus trochiloides*	Least Concern	Schedule IV
70	Grey Wagtail	*Motacilla cinerea*	Least Concern	Schedule IV
71	Grey-headed Canary-flycatcher	*Culicicapa ceylonensis*	Least Concern	Schedule IV
72	Greylag Goose	*Anser answer*	Least Concern	Schedule IV
73	Grey-necked Bunting	*Emberiza buchanani*	Least Concern	Schedule IV
74	Griffon Vulture	*Gyps fulvus*	Least Concern	Schedule IV
75	Hen Harrier	*Circus cyaneus*	Least Concern	Schedule I
76	Himalayan Griffon	*Gyps himalayensis*	Near Threatened	Schedule IV
77	Hume's Leaf-warbler	*Phylloscopus humei*	Least Concern	Schedule IV
78	Isabelline Shrike	*Lanius isabellinus*	Least Concern	Not Listed
79	Isabelline Wheatear	*Oenanthe isabelline*	Least Concern	Schedule IV
80	Kentish Plover	*Charadrius alexandrines*	Least Concern	Schedule IV
81	Lesser Black-backed Gull	*Larus fuscus*	Least Concern	Schedule IV
82	Lesser Kestrel	*Falco naumanni*	Least Concern	Schedule IV
83	Lesser Sand-Plover	*Charadrius mongolus*	Least Concern	Schedule IV
84	Lesser Whitethroat	*Sylvia curruca*	Least Concern	Schedule IV
85	Little Stint	*Calidris minuta*	Least Concern	Schedule IV
86	Long-billed Pipit	*Anthus similis*	Least Concern	Schedule IV
87	Long-legged Buzzard	*Buteo rufinus*	Least Concern	Schedule I
88	Mallard	*Anas platyrhynchos*	Least Concern	Schedule IV
89	Marsh Sandpiper	*Tringa stagnatilis*	Least Concern	Schedule IV
90	Montagu's Harrier	*Circus pygargus*	Least Concern	Schedule I
91	Northern Lapwing	*Vanellus vanellus*	Near Threatened	Schedule IV
92	Northern Pintail	*Anas acuta*	Least Concern	Schedule IV
93	Northern Shoveler	*Spatula clypeata*	Least Concern	Schedule IV
94	Olive-backed Pipit	*Anthus hodgsoni*	Least Concern	Schedule IV
95	Oriental Turtle-Dove	*Streptopelia orientalis*	Least Concern	Schedule IV
96	Osprey	*Pandion haliaetus*	Least Concern	Schedule I
97	Pacific Golden-Plover	*Pluvialis fulva*	Least Concern	Schedule IV
98	Paddyfield Warbler	*Acrocephalus Agricola*	Least Concern	Schedule IV
99	Pale Sand Martin	*Riparia diluta*	Least Concern	Not Listed

S.N.	Common English Name	Binomial Scientific Name	IUCN Red List - Categories	Wildlife (Protection) Act - Schedules
100	Pallas's Gull	*Larus ichthyaetus*	Least Concern	Schedule IV
101	Pallid Harrier	*Circus macrourus*	Near Threatened	Schedule I
102	Pallid Scops-Owl	*Otus brucei*	Least Concern	Schedule IV
103	Pied Avocet	*Recurvirostra avosetta*	Least Concern	Schedule IV
104	Plain Leaf Warbler	*Phylloscopus neglectus*	Least Concern	Schedule IV
105	Red-breasted Flycatcher	*Ficedula parva*	Least Concern	Schedule IV
106	Red-crested Pochard	*Netta rufina*	Least Concern	Schedule IV
107	Red-headed Bunting	*Emberiza bruniceps*	Least Concern	Schedule IV
108	Red-necked Falcon	*Falco ruficollis*	Least Concern	Schedule I
109	Red-necked Phalarope	*Phalaropus lobatus*	Least Concern	Not Listed
110	Red-tailed Shrike	*Lanius phoenicuroides*	Least Concern	Not Listed
111	Red-tailed Wheatear	*Oenanthe chrysopygia*	Least Concern	Not Listed
112	Red-throated Flycatcher	*Ficedula albicilla*	Least Concern	Schedule IV
113	Rosy Starling	*Pastor roseus*	Least Concern	Schedule IV
114	Ruddy Shelduck	*Tadorna ferruginea*	Least Concern	Schedule IV
115	Ruff	*Calidris pugnax*	Least Concern	Schedule IV
116	Saker Falcon	*Falco cherrug*	Endangered	Schedule I
117	Short-eared Owl	*Asio flammeus*	Least Concern	Schedule IV
118	Siberian Stonechat	*Saxicola maurus*	Not Listed	Schedule IV
119	Sociable Lapwing	*Vanellus gregarious*	Critically Endangered	Schedule IV
120	Spanish Sparrow	*Passer hispaniolensis*	Least Concern	Schedule IV
121	Spotted Flycatcher	*Muscicapa striata*	Least Concern	Schedule IV
122	Spotted Redshank	*Tringa erythropus*	Least Concern	Schedule IV
123	Spotted Sandgrouse	*Pterocles senegallus*	Least Concern	Schedule IV
124	Steppe Eagle	*Aquila nipalensis*	Endangered	Schedule I
125	Striated Heron	*Butorides striata*	Least Concern	Schedule IV
126	Sulphur-bellied Warbler	*Phylloscopus griseolus*	Least Concern	Not Listed
127	Sykes's Warbler	*Iduna rama*	Least Concern	Not Listed
128	Tawny Pipit	*Anthus campestris*	Least Concern	Schedule IV
129	Temminck's Stint	*Calidris temminckii*	Least Concern	Schedule IV
130	Terek Sandpiper	*Xenus cinereus*	Least Concern	Schedule IV
131	Tree Pipit	*Anthus trivialis*	Least Concern	Schedule IV
132	Tufted Duck	*Aythya fuligula*	Least Concern	Schedule IV
133	Variable Wheatear	*Oenanthe picata*	Least Concern	Schedule IV
134	Water Pipit	*Anthus spinoletta*	Least Concern	Schedule IV
135	Western Marsh-Harrier	*Circus aeruginosus*	Least Concern	Schedule I
136	Western Yellow Wagtail	*Motacilla flava*	Least Concern	Schedule IV
137	Whiskered Tern	*Chlidonias hybrida*	Least Concern	Schedule IV

S.N.	Common English Name	Binomial Scientific Name	IUCN Red List - Categories	Wildlife (Protection) Act - Schedules
138	White Wagtail	*Motacilla alba*	Least Concern	Schedule IV
139	White-browed Bushchat	*Saxicola macrorhynchus*	Vulnerable	Schedule IV
140	White-capped Bunting	*Emberiza stewartia*	Least Concern	Schedule IV
141	White-tailed Eagle	*Haliaeetus albicilla*	Least Concern	Schedule I
142	White-tailed Lapwing	*Vanellus leucurus*	Least Concern	Schedule IV
143	Wood Sandpiper	*Tringa glareola*	Least Concern	Schedule IV
144	Yellow-eyed Pigeon	*Columba eversmanni*	Vulnerable	Schedule IV

Table 4-26: Vulture reported from the region

S.N.	Common English Name	Binomial Scientific Name	Migrent (M) / Resident (R)	IUCN Red List - Categories	Wildlife (Protection) Act - Schedules
1	Cinereous Vulture	*Aegypius monachus*	M	Near Threatened	Schedule IV
2	Egyptian Vulture	*Neophron percnopterus*	R	Endangered	Schedule IV
3	Griffon Vulture	*Gyps fulvus*	M	Least Concern	Schedule IV
4	Himalayan Griffon	*Gyps himalayensis*	M	Near Threatened	Schedule IV
5	Indian Vulture	*Gyps indicus*	R	Critically Endangered	Schedule IV
6	Red-headed Vulture	*Sarcogyps calvus*	R	Critically Endangered	Schedule IV
7	White-rumped Vulture	*Gyps bengalensis*	R	Critically Endangered	Schedule IV

Table 4-27: Raptors reported from the region

S.N.	Common English Name	Binomial Scientific Name	Migrent (M) / Resident (R)	IUCN Red List - Categories	Wildlife (Protection) Act - Schedules
1	Barn Owl	*Tyto alba*	R	Least Concern	Schedule IV
2	Black Kite	*Milvus migrans*	R	Least Concern	Schedule I
3	Black-winged Kite	*Elanus caeruleus*	R	Least Concern	Schedule I
4	Bonelli's Eagle	*Aquila fasciata*	R	Least Concern	Schedule I
5	Booted Eagle	*Hieraaetus pennatus*	M	Least Concern	Schedule I
6	Brahminy Kite	*Haliastur indus*	R	Least Concern	Schedule I
7	Brown Fish-Owl	*Ketupa zeylonensis*	R	Least Concern	Schedule IV
8	Changeable Hawk-Eagle	*Nisaetus cirrhatus*	R	Least Concern	Schedule I
9	Common Kestrel	*Falco tinnunculus*	M	Least Concern	Schedule IV
10	Crested Serpent-Eagle	*Spilornis cheela*	M	Least Concern	Schedule I
11	Eastern Imperial Eagle	*Aquila heliacal*	M	Vulnerable	Schedule I
12	Eurasian Buzzard	*Buteo buteo*	M	Least Concern	Schedule I
13	Eurasian Hobby	*Falco Subbuteo*	M	Least Concern	Schedule IV
14	Eurasian Sparrowhawk	*Accipiter nisus*	M	Least Concern	Schedule I
15	Greater Spotted Eagle	*Clanga clanga*	M	Vulnerable	Schedule I
16	Hen Harrier	*Circus cyaneus*	M	Least Concern	Schedule I

S.N.	Common English Name	Binomial Scientific Name	Migrent (M) / Resident (R)	IUCN Red List - Categories	Wildlife (Protection) Act - Schedules
17	Indian Scops-owl	*Otus bakkamoena*	R	Least Concern	Schedule IV
18	Indian Spotted Eagle	*Clanga hastata*	R	Vulnerable	Not Listed
19	Laggar Falcon	*Falco jugger*	R	Near Threatened	Schedule I
20	Lesser Kestrel	*Falco naumanni*	M	Least Concern	Schedule IV
21	Long-legged Buzzard	*Buteo rufinus*	M	Least Concern	Schedule I
22	Montagu's Harrier	*Circus pygargus*	M	Least Concern	Schedule I
23	Oriental Honey-buzzard	*Pernis ptilorhynchus*	R	Least Concern	Schedule I
24	Osprey	*Pandion haliaetus*	M	Least Concern	Schedule I
25	Pallas's Fish-eagle	*Haliaeetus leucoryphus*	R	Endangered	Schedule I
26	Pallid Harrier	*Circus macrourus*	M	Near Threatened	Schedule I
27	Pallid Scops-Owl	*Otus brucei*	M	Least Concern	Schedule IV
28	Peregrine Falcon	*Falco peregrinus*	R	Least Concern	Schedule I
29	Red-necked Falcon	*Falco ruficollis*	M	Least Concern	Schedule I
30	Rock Eagle-owl	*Bubo bengalensis*	R	Least Concern	Schedule IV
31	Saker Falcon	*Falco cherrug*	M	Endangered	Schedule I
32	Shikra	*Accipiter badius*	R	Least Concern	Schedule I
33	Short-eared Owl	*Asio flammeus*	M	Least Concern	Schedule IV
34	Short-toed Snake-Eagle	*Circaetus gallicus*	R	Least Concern	Schedule I
35	Spotted Owlet	*Athene brama*	R	Least Concern	Schedule IV
36	Steppe Eagle	*Aquila nipalensis*	M	Endangered	Schedule I
37	Tawny Eagle	*Aquila rapax*	R	Vulnerable	Schedule I
38	Western Marsh-Harrier	*Circus aeruginosus*	M	Least Concern	Schedule I
39	White-eyed Buzzard	*Butastur teesa*	R	Least Concern	Schedule I
40	White-tailed Eagle	*Haliaeetus albicilla*	M	Least Concern	Schedule I

4.4.3.2 Habitat Survey

In the literature review, different habitats within the study area, were identified with the help of google earth satellite imagery. These habitats were verified during the reconnaissance survey in site visit. The study area consists of natural habitats (open scrub, water bodies), and modified habitats (agricultural lands, plantation). The distribution of identified habitats within the study area can be seen in ***Figure 4-26***. Photographs of these habitats have been presented in ***Figure 4-27***.

Figure 4-26: Distribution of habitats in the study area

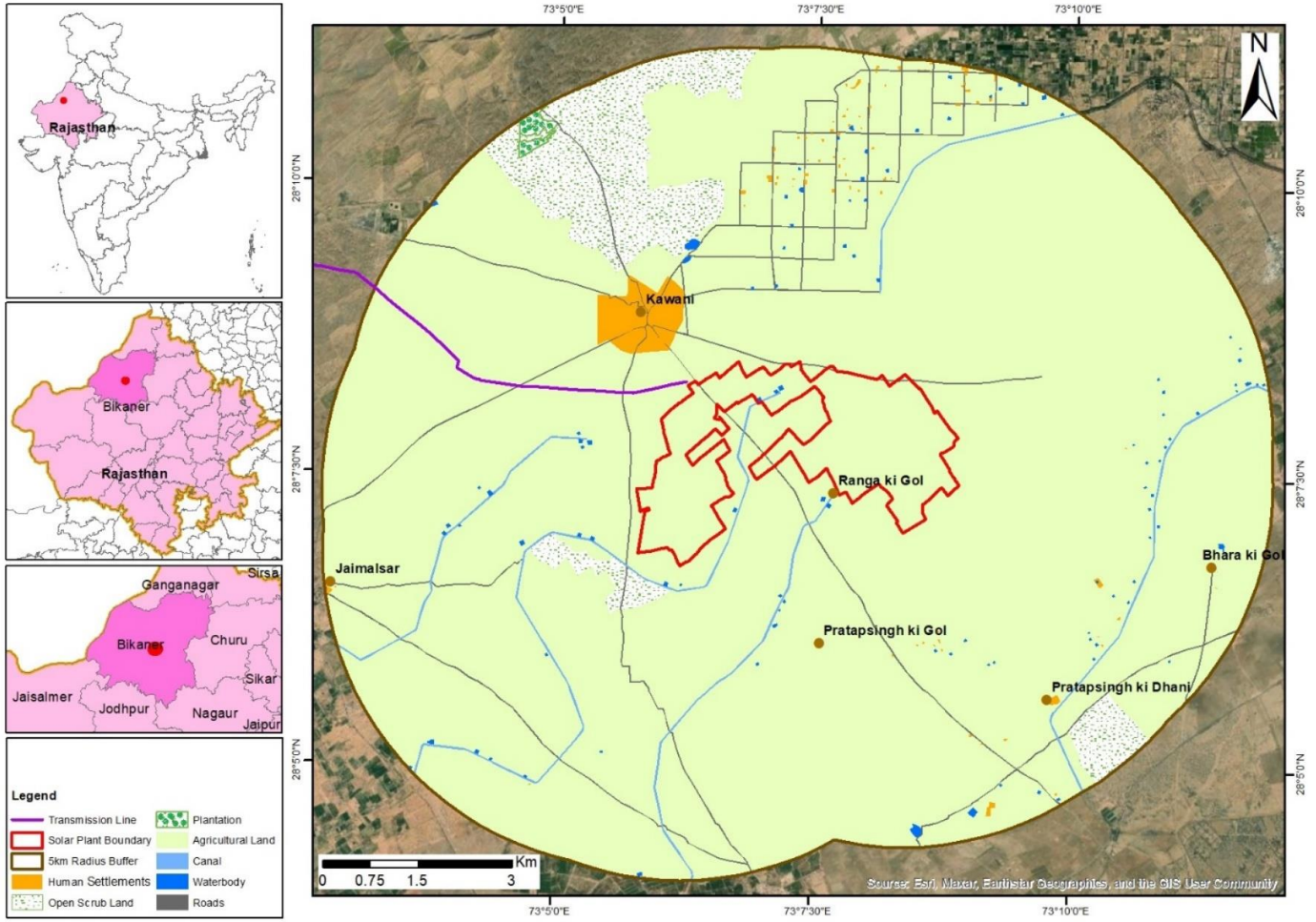


Figure 4-27: Habitats in the study area


Open Scrub


Water Body


Agricultural Land


Plantation

4.4.3.3 Floral Survey

Vegetation Profile

As per the available information, the proposed project is coming on the Desert - Thar (3A) Biogeographical Province of India[28]; Western plains and Kutch Peninsula (Hot, Arid eco-region with desert saline soils) Agro-ecological Region[29] and Western dry region (XIV) Agro-Climatic Region[30]. The vegetation of the region may be defined as Desert thorn forest (6B-C1) according to forest classification of Champion and Seth (1968)[31].

Floral Diversity

The floral diversity present within the project boundary and 5 km buffer areas was assessed during the site survey. A total of fourty-one (41) floral species belonging to twenty-one (21) families were observed from the 5 km radius of the project area. Fabaceae was the most dominating family in the area with 11 species. None of the species identified in the region is threatened and/or restricted range species. A list of encountered floral species with their families and life forms has been given in ***Table 4-28***.

[28] http://wiienvis.nic.in/database/htmlpages/bioprovincemap.htm

[29] Mandal D.K., Mandal C. and Singh S.K. (2015) Delineating Agro-Ecological Regions. ICAR-NBSSLUP technology, p. 8.

[30] http://apps.iasri.res.in/agridata/19data/chapter1/db2019tb1_2.pdf

[31] Champion H.G. and Seth S.K. (1968) A Revised Survey of Forest Types of India. Govt. of India Press, New Delhi, p. 404.

Table 4-28: Floral diversity of the study area

S.N.	Binomial Scientific Name	Family	Life form
1	*Acacia jacquemontii* Benth.	Fabaceae	Shrub
2	*Acacia nilotica* (L.) Delile	Fabaceae	Tree
3	*Acacia senegal* (L.) Willd.	Fabaceae	Tree
4	*Acacia tortilis* (Forssk.) Hayne	Fabaceae	Tree
5	*Aerva javanica* (Burm.f.) Juss. ex Schult.	Amaranthaceae	Herb
6	*Ailanthus excelsa* Roxb.	Simaroubaceae	Tree
7	*Argemone mexicana* L.	Papaveraceae	Herb
8	*Azadirachta indica* A.Juss.	Meliaceae	Tree
9	*Boerhavia diffusa* L.	Nyctaginaceae	Herb
10	*Brachiaria ramosa* (L.) Stapf	Poaceae	Grass
11	*Calligonum polygonoides* L.	Polygonaceae	Shrub
12	*Calotropis procera* (Aiton) Dryand.	Apocynaceae	Shrub
13	*Capparis decidua* (Forssk.) Edgew.	Capparaceae	Shrub
14	*Cenchrus biflorus* Roxb.	Poaceae	Grass
15	*Citrullus colocynthis* (L.) Schrad.	Cucurbitaceae	Climber
16	*Crotalaria burhia* Buch.-Ham.	Fabaceae	Herb
17	*Cynodon dactylon* (L.) Pers.	Poaceae	Grass
18	*Dactyloctenium aegyptium* (L.) Willd.	Poaceae	Grass
19	*Dactyloctenium sindicum* Boiss.	Poaceae	Grass
20	*Dalbergia sissoo* DC.	Fabaceae	Tree
21	*Datura metel* L.	Solanaceae	Herb
22	*Dipterygium glaucum* Decne.	Capparaceae	Herb
23	*Eucalyptus* sp.	Myrtaceae	Tree
24	*Euphorbia hirta* L.	Euphorbiaceae	Herb
25	*Fagonia paulayana* J.Wagner & Vierh.	Zygophyllaceae	Herb
26	*Ficus religiosa* L.	Moraceae	Tree
27	*Heliotropium indicum* L.	Boraginaceae	Herb
28	*Leptadenia pyrotechnica* (Forssk.) Decne.	Apocynaceae	Shrub
29	*Leucaena leucocephala* (Lam.) de Wit	Fabaceae	Tree
30	*Prosopis cineraria* (L.) Druce (*Khejri)*	Fabaceae	Tree
31	*Prosopis juliflora* (Sw.) DC.	Fabaceae	Tree
32	*Ricinus communis* L.	Euphorbiaceae	Small Tree
33	*Salvadora oleoides* Decne.	Salvadoraceae	Tree
34	*Senna italica* Mill.	Fabaceae	Herb
35	*Senna obtusifolia* (L.) H.S.Irwin & Barneby	Fabaceae	Herb
36	*Solanum virginianum* L.	Solanaceae	Herb

S.N.	Binomial Scientific Name	Family	Life form
37	*Tecomella undulata* (Sm.) Seem.	Bignoniaceae	Tree
38	*Tribulus terrestris* L.	Zygophyllaceae	Herb
39	*Verbesina encelioides* (Cav.) Benth. &Hook.f. ex A.Gray	Asteraceae	Herb
40	*Ziziphus mauritiana* Lamk.	Rhamnaceae	Tree
41	*Ziziphus nummularia* (Burm. f.) Wight & Arn.	Rhamnaceae	Shrub

4.4.3.4 Faunal Survey

Herpetofauna

As per the literature review[32], local consultation and field survey, ten (10) herpetofauna (reptiles + amphibians) species were reported / observed from the study area. One species, Red Sand Boa (*Eryx johnii*) was categorized under Near Threatened category of the IUCN Red List (Online Version 2022-2); and two species [Bengal Monitor Lizard (*Varanus bengalensis*), & Desert Monitor Lizard (*Varanus griseus*)] were listed under the Schedule I category as per the Wildlife (Protection) Act, 1972 (***Table 4-29***).

Table 4-29: Herpetofauna diversity from the study area

S.N.	Common English Name	Binomial Scientific Name	IUCN Red List - Categories	Wildlife (Protection) Act - Schedules	Reported / Observed
1	Bengal Monitor Lizard	*Varanus bengalensis*	Least Concern	Schedule I	Reported
2	Common Skittering Frog	*Euphlyctis cyanophlyctis*	Least Concern	Schedule IV	Observed
3	Desert Monitor Lizard	*Varanus griseus*	Least Concern	Schedule I	Reported
4	Indian Bullfrog	*Hoplobatrachus tigerinus*	Least Concern	Schedule IV	Reported
5	Indian Cobra	*Naja naja*	Least Concern	Schedule II	Reported
6	Indian Fringe-fingered Lizard	*Acanthodactylus cantoris*	Not assessed	Not listed	Observed
7	Indian spiny-tailed lizard	*Saara hardwickii*	Not assessed	Schedule II	Observed
8	Oriental Garden Lizard	*Calotes versicolor*	Not assessed	Not listed	Observed
9	Red Sand Boa	*Eryx johnii*	Near Threatened	Schedule IV	Reported
10	Saw-scaled Vipers	*Echis carinatus*	Least Concern	Not listed	Reported

Avifauna (Birds)

During the field survey, 51 avifaunal species were observed from the study area, which include one Endangered [Egyptian Vulture (*Neophron percnopterus*)]; and two Near Threatened [Laggar Falcon (*Falco jugger*), & Painted Stork (*Mycteria leucocephala*)] as per IUCN Red List (Online Version 2022-2). Seven (07) Schedule I species - Black Kite, Black-winged Kite, Indian Peafowl, Laggar Falcon, Shikra, Short-toed Snake-Eagle, & White-eyed Buzzard were also observed from the area as per the Wildlife (Protection) Act, 1972. Only three (03) Migratory [Demoiselle Crane (*Grus virgo*), Variable Wheatear (*Oenanthe picata*), & Common Kestrel (*Falco tinnunculus*)], one Vulture [Egyptian Vulture (*Neophron percnopterus*)] and 07 Raptors [Black Kite (*Milvus migrans*), Black-winged Kite (*Elanus caeruleus*), Common Kestrel (*Falco tinnunculus*), Shikra (*Accipiter badius*), Short-toed Snake-Eagle (*Circaetus gallicus*), Spotted Owlet (*Athene brama*), White-eyed Buzzard (*Butastur teesa*)] species were also observed in the study area (***Table 4-30***). The survey was conducted in mid of March 2023, which is not a good time to record the movement of migratory birds. Thus, based on this primary observation, it may not be concluded that the area has not been supporting migratory bird species in the winter.

[32] Forest Working Plans: Bikaner Division and IGNP-II

Table 4-30: Avifaunal diversity observed from the study area

S.N.	Common English Name	Binomial Scientific Name	Migrant (M) / Resident (R)	IUCN Red List - Categories	Wildlife (Protection) Act - Schedules
1	Ashy Prinia	*Prinia socialis*	R	Least Concern	Schedule IV
2	Ashy-crowned Sparrow-lark	*Eremopterix griseus*	R	Least Concern	Schedule IV
3	Asian Green Bee-eater	*Merops orientalis*	R	Least Concern	Schedule IV
4	Black Drongo	*Dicrurus macrocercus*	R	Least Concern	Schedule IV
5	Black Kite	*Milvus migrans*	R	Least Concern	Schedule I
6	Black-rumped Flameback	*Dinopium benghalense*	R	Least Concern	Schedule IV
7	Black-winged Kite	*Elanus caeruleus*	R	Least Concern	Schedule I
8	Black-winged Stilt	*Himantopus himantopus*	R	Least Concern	Schedule IV
9	Brown Rockchat	*Oenanthe fusca*	R	Least Concern	Schedule IV
10	Cattle Egret	*Bubulcus ibis*	R	Least Concern	Schedule IV
11	Chestnut-bellied Sandgrouse	*Pterocles exustus*	R	Least Concern	Schedule IV
12	Common Babbler	*Argya caudata*	R	Least Concern	Schedule IV
13	Common Hoopoe	*Upupa epops*	R	Least Concern	Not Listed
14	Common Kestrel	*Falco tinnunculus*	M	Least Concern	Schedule IV
15	Common Kingfisher	*Alcedo atthis*	R	Least Concern	Schedule IV
16	Common Tailorbird	*Orthotomus sutorius*	R	Least Concern	Schedule IV
17	Crested Lark	*Galerida cristata*	R	Least Concern	Schedule IV
18	Demoiselle Crane	*Grus virgo*	M	Least Concern	Schedule IV
19	Desert Lark	*Ammomanes deserti*	R	Least Concern	Schedule IV
20	Egyptian Vulture	*Neophron percnopterus*	R	Endangered	Schedule IV
21	Eurasian Collared-Dove	*Streptopelia decaocto*	R	Least Concern	Schedule IV
22	Great Grey Shrike	*Lanius excubitor*	R	Least Concern	Not Listed
23	Grey Francolin	*Francolinus pondicerianus*	R	Least Concern	Schedule IV
24	House Crow	*Corvus splendens*	R	Least Concern	Schedule V
25	House Sparrow	*Passer domesticus*	R	Least Concern	Schedule IV
26	Indian Cormorant	*Phalacrocorax fuscicollis*	R	Least Concern	Schedule IV
27	Indian Peafowl	*Pavo cristatus*	R	Least Concern	Schedule I
28	Indian Robin	*Saxicoloides fulicata*	R	Least Concern	Schedule IV
29	Indian Roller	*Coracias benghalensis*	R	Least Concern	Schedule IV
30	Indian Silverbill	*Euodice malabarica*	R	Least Concern	Schedule IV
31	Jungle Babbler	*Turdoides striatus*	R	Least Concern	Schedule IV
32	Laggar Falcon	*Falco jugger*	R	Near Threatened	Schedule I
33	Laughing Dove	*Streptopelia senegalensis*	R	Least Concern	Schedule IV
34	Little Grebe	*Tachybaptus ruficollis*	R	Least Concern	Schedule IV
35	Oriental Magpie-Robin	*Copsychus saularis*	R	Least Concern	Schedule IV
36	Painted Stork	*Mycteria leucocephala*	R	Near Threatened	Schedule IV

S.N.	Common English Name	Binomial Scientific Name	Migrant (M) / Resident (R)	IUCN Red List - Categories	Wildlife (Protection) Act - Schedules
37	Purple Sunbird	*Nectarinia asiatica*	R	Least Concern	Schedule IV
38	Red-naped Ibis	*Pseudibis papillosa*	R	Least Concern	Schedule IV
39	Red-vented Bulbul	*Pycnonotus cafer*	R	Least Concern	Schedule IV
40	Red-wattled Lapwing	*Vanellus indicus*	R	Least Concern	Schedule IV
41	Rock Dove	*Columba livia*	R	Least Concern	Schedule IV
42	Rose-ringed Parakeet	*Psittacula krameri*	R	Least Concern	Schedule IV
43	Rufous Treepie	*Dendrocitta vagabunda*	R	Least Concern	Schedule IV
44	Shikra	*Accipiter badius*	R	Least Concern	Schedule I
45	Short-toed Snake-Eagle	*Circaetus gallicus*	R	Least Concern	Schedule I
46	Spotted Owlet	*Athene brama*	R	Least Concern	Schedule IV
47	Variable Wheatear	*Oenanthe picata*	M	Least Concern	Schedule IV
48	White-breasted Kingfisher	*Halcyon smyrnensis*	R	Least Concern	Schedule IV
49	White-browed Wagtail	*Motacilla maderaspatensis*	R	Least Concern	Schedule IV
50	White-eared Bulbul	*Pycnonotus leucotis*	R	Least Concern	Schedule IV
51	White-eyed Buzzard	*Butastur teesa*	R	Least Concern	Schedule I

Mammals

As per the literature review[33], local consultation and field survey, ten (10) mammals were recorded (reported and observed) from the study area. None of the species was categorized under any threatened category of the IUCN Red List (Online Version 2022-2); but, one species, Chinkara (Gazella bennetti) were listed under the Schedule I category as per the Wildlife (Protection) Act, 1972 (***Table 4-31***).

Table 4-31: Mammals from the study area

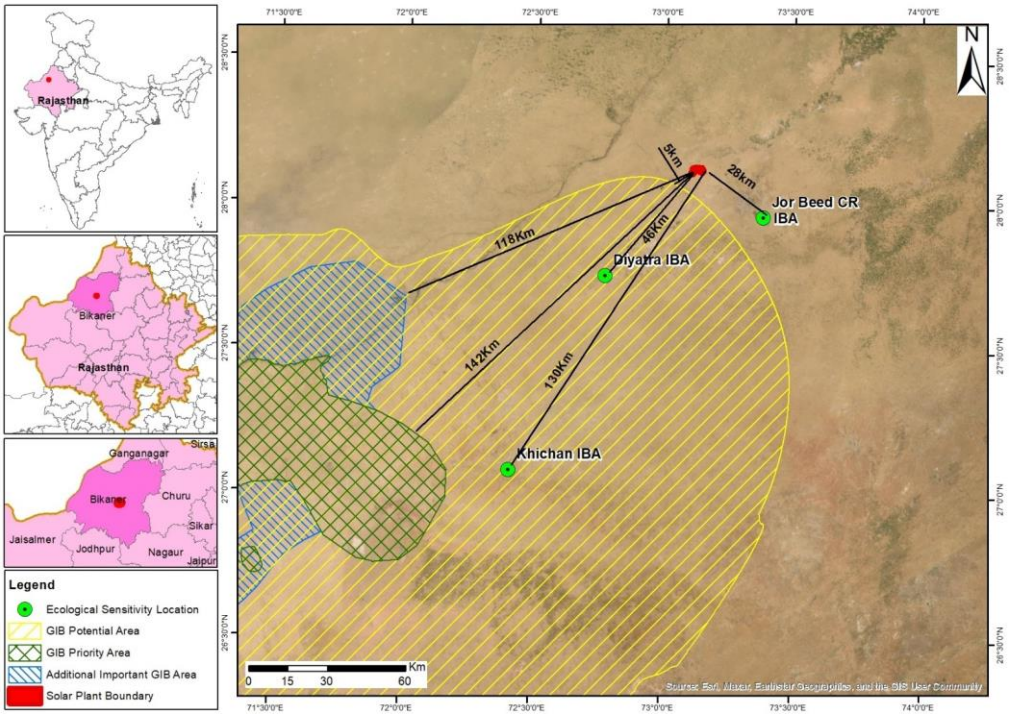
S.N.	Common English Name	Binomial Scientific Name	IUCN Red List - Categories	Wildlife (Protection) Act. 1972 - Schedules	Reported / Observed
1	Chinkara	*Gazella bennetti*	Least Concern	Schedule I	Reported
2	Five-striped Palm Squirrel	*Funambulus pennantii*	Least Concern	Schedule IV	Observed
3	Indian Desert Jird	*Meriones hurrianae*	Least Concern	Not listed	Observed
4	Indian Grey Mongoose	*Herpestes edwardsii*	Least Concern	Schedule II	Observed
5	Indian Hare	*Lepus nigricollis*	Least Concern	Schedule IV	Observed
6	Indian Porcupine	*Hystrix indica*	Least Concern	Schedule IV	Reported
7	Jungle Cat	*Felis chaus*	Least Concern	Schedule II	Reported
8	Nilgai	*Boselaphus tragocamelus*	Least Concern	Schedule III	Observed
9	White-footed Fox	*Vulpes vulpes pusilla*	Least Concern	Schedule II	Reported
10	Wild Boar	*Sus scrofa*	Least Concern	Schedule III	Reported

[33] Forest Working Plans: Bikaner Division and IGNP-II

4.4.3.5 Protected and Key Biodiversity Areas

The nearest protected area as well as Important Bird and Biodiversity Area (IBA) - Jor Beed Conservation Reserve is about 28 km away from the project boundary in Southeast direction[34, 35]. Another IBA, Diyatra is situated about 46 km from the project location in Southwest direction. Khichan famous site for the congregation of Cranes, is about 130 km from the project site in Southwest direction. The project is proposed about 5 km away from the GIB (Great Indian Bustard) Potential Area, 118 km from Additional Important Area, and 142 km from the GIB Priority Area[36] (***Figure 4-28***).

Figure 4-28: Ecological Sensitivity around the proposed site



Jor Beed Conservation Reserve (Jodbeed Gadhwala Bikaner Conservation Reserve)

The Jor Beer region is spread over an area of 56.4662 km^2 on the carcass dumping ground of Bikaner and surrounding areas. It attracts thousands of vultures and other raptors, besides crows, ravens, and dogs. It is about 28 km away from the proposed project location in a Southeast direction[37]. This area is mainly famous for large congregation of migratory and resident vultures, as about 20-35 carcasses are dumped per day by the municipal board in the conservation reserve[38]. Seven species of vultures reported from the area are, Cinereous Vulture (*Aegypius monachus*) - Near Threatened, Egyptian Vulture (*Neophron percnopterus*) - Endangered, Griffon Vulture (*Gyps fulvus*) - Least Concern, Himalayan Griffon (*Gyps himalayensis*) - Near Threatened, Indian Vulture (*Gyps indicus*) - Critically Endangered, Red-headed Vulture (*Sarcogyps calvus*) - Critically Endangered, & White-rumped

[34] http://wiienvis.nic.in/Database/Maps_PAs_1267.aspx
[35] Rahmani A.R., Islam M.Z. and Kasambe R.M. (2016) Important Bird and Biodiversity Areas in India: Priority Sites for Conservation (Revised and updated). Bombay Natural History Society, Indian Bird Conservation Network, Royal Society for the Protection of Birds and BirdLife International (U.K.), p. 1992 + xii.
[36] https://wii.gov.in/images//images/documents/species_recovery_programme/Conserving_GIB_Landscapes_technical_report_2020.pdf
[37] http://wiienvis.nic.in/Database/Maps_PAs_1267.aspx
[38] Khatri P.C. (2013) Status of Migratory Vultures at Jorbeer, Bikaner (Rajasthan). *Life Sciences Leaflets*, 35: 6-13.

Vulture (*Gyps bengalensis*) - Critically Endangered. Out of these, three are migratory - Griffon Vulture, Himalayan Griffon, and Cinereous vulture. Beside vultures, four Vulnerable species (Pallas's Fish-eagle, Greater Spotted Eagle, Eastern Imperial Eagle & Yellow-eyed Pigeon) have also been reported from this conservation reserve[39].

Great Indian Bustard (GIB) Sensitivity

The Great Indian Bustard (GIB) is a Critically Endangered (as per IUCN, Online Version 2022-2) bird with less than 150 individuals left in India/World and in urgent need of conservation actions. These numbers are based on surveys conducted by the Wildlife Institute of India (WII) research team in Rajasthan in 2017-18[40]. The species is also listed as Schedule I that accords it the highest level of legal protection under Wildlife (Protection) Act, 1972 in India.

The project is proposed about 5 km away from the GIB (Great Indian Bustard) Potential Area, 118 km from Additional Important Area, and 142 km from the GIB Priority Area[41]. Thus, the presence of Great Indian Bustard in the study area is unexpected.

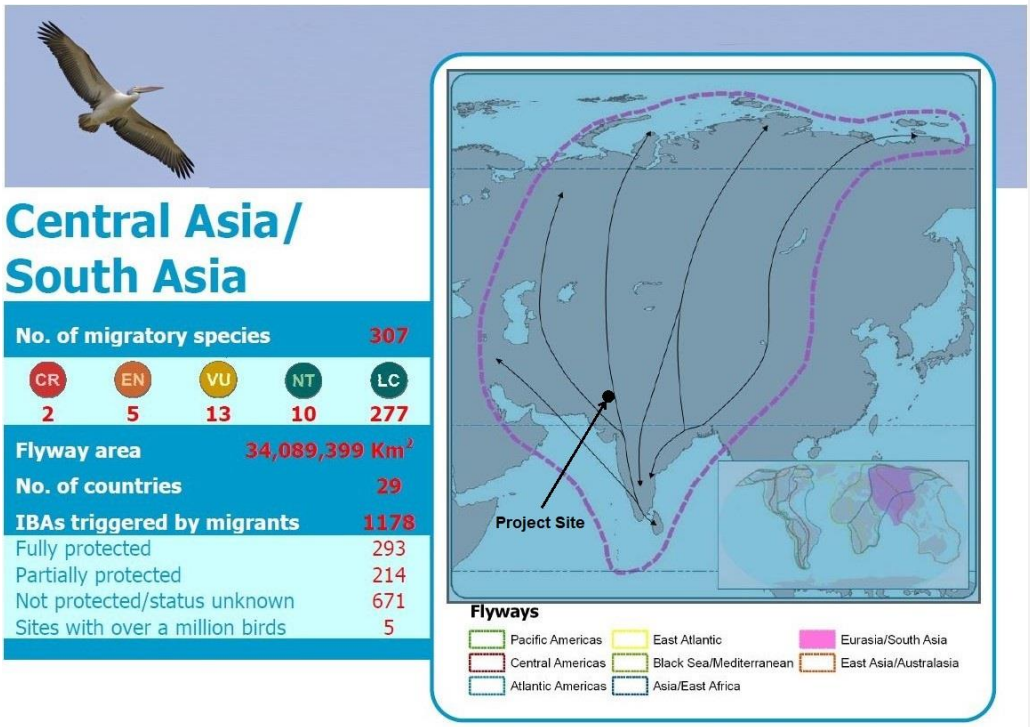
4.4.3.6 Bird Migration Flyways

India majorly lies in the Central Asian Flyway[42] (***Figure 4-29***). More than 300 species travel along the Central Asian Flyway, including a significant movement of the family Anatidae (Ducks, Geese and Swan), Gruidae (Cranes), etc. that travel from Europe/North Asia to the Indian subcontinent and occupy medium to large water bodies. As per the eBird Database[43], at least 144 migratory birds including one Critically Endangered [Sociable Lapwing (*Vanellus gregarious*)]; two Endangered [Saker Falcon (*Falco cherrug*), & Steppe Eagle (*Aquila nipalensis*)]; six Vulnerable [Asian Houbara (*Chlamydotis macqueenii*), Common Pochard (*Aythya farina*), Eastern Imperial Eagle (*Aquila heliacal*), Greater Spotted Eagle (*Clanga clanga*), White-browed Bushchat (*Saxicola macrorhynchus*), Yellow-eyed Pigeon (*Columba eversmanni*)]; and 15 Schedule I [Booted Eagle, Crested Serpent-Eagle, Eastern Imperial Eagle, Eurasian Buzzard, Eurasian Sparrowhawk, Greater Spotted Eagle, Hen Harrier, Long-legged Buzzard, Montagu's Harrier, Osprey, Pallid Harrier, Red-necked Falcon, Saker Falcon, Steppe Eagle, Western Marsh-Harrier, & White-tailed Eagle] species were reported from the region (***Table 4-25***). This secondary information also reports three migratory vultures - Cinereous Vulture, Griffon Vulture, & Himalayan Griffon (***Table 4-26***) and 21 raptors - Booted Eagle, Common Kestrel, Crested Serpent-Eagle, Eastern Imperial Eagle, Eurasian Buzzard, Eurasian Hobby, Eurasian Sparrowhawk, Greater Spotted Eagle, Hen Harrier, Lesser Kestrel, Long-legged Buzzard, Montagu's Harrier, Osprey, Pallid Harrier, Pallid Scops-Owl, Red-necked Falcon, Saker Falcon, Short-eared Owl, Steppe Eagle, Western Marsh-Harrier, & White-tailed Eagle from the region (***Table 4-27***). Although, Sociable Lapwing (*Vanellus gregarious*) - Critically Endangered migratory bird species has been reported from the region; but the presence of Sociable Lapwing in the study area is unexpected, as the species has not been reported from the 50 km buffer from the project area[44, 45].

As number of seasonal and few perennial water bodies are present within the study area, the congregation of migratory water birds especificaly, Demoiselle Crane, Common Coot, Green-winged Teal, Ruff, Northern Shoveler, Common Crane, Tufted Duck, Common Pochard, Northern Pintail, & Gadwall can not be overlooked. However, during the survey no significant congregation of these above-mentioned birds were recorded through local consultation in the study area. But the presence of migratory birds in the region can not be overlooked. To reduce the risk of collision and electrocution of this bird, some mitigation measures have been suggested under section, ***Impacts on Biological Environment***

[39] Rahmani A.R., Islam M.Z. and Kasambe R.M. (2016) Important Bird and Biodiversity Areas in India: Priority Sites for Conservation (Revised and updated). Bombay Natural History Society, Indian Bird Conservation Network, Royal Society for the Protection of Birds and BirdLife International (U.K.), p. 1992 + xii.
[40] https://greentribunal.gov.in/sites/default/files/all_documents/Report%20byNo.385-2019..pdf
[41] https://wii.gov.in/images//images/documents/species_recovery_programme/Conserving_GIB_Landscapes_technical_report_2020.pdf
[42] http://datazone.birdlife.org/userfiles/file/sowb/flyways/7_Central_Asia_Factsheet.pdf
[43] https://ebird.org/barchart?byr=2001&eyr=2023&bmo=1&emo=12&r=IN-RJ-BI
[44] https://ebird.org/map/soclap1?bmo=1&emo=12&byr=2001&eyr=2023&env.minX=71.871&env.minY=27.183&env.maxX=74.358&env.maxY=29.05&gp=true
[45] https://www.inaturalist.org/observations?place_id=any&subview=map&taxon_id=4858

Figure 4-29: Location of Project Site in the Central Asian Flyway



5. Stakeholder Identification and Engagement

This section provides the stakeholder identification and mapping for the project based on the current stage. The identification is based on present status and understanding of land procurement. The analysis of the identified stakeholders is based on stakeholders' profiling and the significance of impact/influence each stakeholder in relation to the Project.

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/company's actions, objectives, and policies". Stakeholder 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. Considering the nature of the Project and its setting, the stakeholders have been identified and listed in the table given below:

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
- 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 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 to make it comprehensive for any given period.

The following table provides a brief profile of the stakeholder groups identified, their key interests and concerns and the way they may be involved in the project lifecycle.

Table 5-1: Profile of stakeholder identified, their key interests and concerns and the way they may be involved in the project lifecycle

Relevant Stakeholders	Profile	Concerns and Expectations from the project	Influence of Stakeholder on Project	Influence of Project on Stakeholder	Influence Rating
Primary Stakeholders					
Land Lessors/ Project affected Persons	The landowners who leased their private land for the project and PAPs whose land is used for ROW and tower. Group mostly consist of people who are mostly engaged in agriculture and allied activities.	• The major concern of the stakeholder group till now is related to availability of employment opportunities that the project will generate. • Timely payment of land lease amount for land and crop and damages if any	• The stakeholder groups' influence on the project pertains to the smooth functioning of the project and the timely completion of the project activities. As most of the land for the plant is already procured therefore the influence is limited however construction is yet to be completed, they can influence the process especially those who are sharing the boundaries with the proposed solar plant • The social consultation indicates that generally, fallow agricultural land is being leased for plant. As informed due to lack of water most of the agriculture is rainfed and it is done for subsistence. • Nearly 75 Landowners who leased their land mainly due to less irrigation facilities and less productivity of land and they can use money for investing in other productive assets, paying	• It was understood that the project has potential to impact both negatively and positively to large group of people including landowners and PAPs • Community consultations indicates that people have expectations in terms of employment and other benefits from the project. • Project can potentially cause damage to the future value of land (under ROW and tower footing) and pose restriction of land use. • There are high chances of potential conflicts during the entire life cycle of the project because TL may require routine maintenance which can potentially lead to unrest among PAPs if they are not	• Influence of Stakeholder: **HIGH** • Influence of Project: **HIGH**

Relevant Stakeholders	Profile	Concerns and Expectations from the project	Influence of Stakeholder on Project	Influence of Project on Stakeholder	Influence Rating
			off debts or meeting other expenses • As informed approximately 11 Km TL will be required for the project. However, the Route survey is yet to be completed therefore the number of affected persons due to TL is not available. The land procurement for ROW for TL and tower erection will be done through electricity and telegraph act. . The compensation of land and damages will be paid as per the provisions of Telegraph Act 1885.	properly informed /consulted or compensated for their damages	
Local Community	The community has a livestock-agriculture-commons economy where cultivators, animal rearing and agricultural labours form a major proportion, followed by casual workers.	• The expectations and concern of this group from the project: – Receiving benefits from the project in terms of employment and development of infrastructure and the community – Employment opportunity from the proposed solar power plant – Project will undertake Corporate Social Responsibility (CSR) activities in and around	• As the project involves large land parcel and TL therefore the involvement of community at large will also be there however as the project spread over large area therefore there might be fringe elements who can potentially negatively influence the project • The stakeholder group may have a significant role to play in the public opinion formation towards the project.	• The project can prove to be potential employer of the people in the area; and • The need-driven CSR activities can play the critical role in the development of the community through economic opportunities and CSR projects.	• Influence of Stakeholder: **HIGH / MEDIUM** • Influence of Project: • **HIGH / MEDIUM**

Relevant Stakeholders	Profile	Concerns and Expectations from the project	Influence of Stakeholder on Project	Influence of Project on Stakeholder	Influence Rating
		villages where solar plant is proposed to be developed.			
Vulnerable Groups	This group comprises of those groups/households considered to be vulnerable due to their social, political, or economic status in society. This group in the study area is primarily comprised of ST population, women population, and the families below the poverty line.	• The key expectation and concerns of the group from the project include: – Receiving benefits from the project in terms of economic opportunities and development programmes – Access to the economic opportunities and development programmes because of their status in the society – Minimal disturbance to the community in regard to access issues, pollution, and influx of migrant workers	This group's influence on the project from the group being part of a local community	The project may play a critical role in the development of these groups, by identifying specific opportunities and programmes for the groups	• Influence of Stakeholder: **LOW** • Influence of Project **HIGH/ MEDIUM**
Opinion Holder and Community Leaders	This stakeholder group is comprised of those individuals of the local community who hold traditional and rational power. These stakeholder group members include the elders, community and political leaders in the village and play a critical role in the decision making in the local community	• The expectations and concerns of this group from the project includes: – Receiving benefits from the project in terms of employment and development of infrastructure and the community – Regular updates on the project activities and	• This group, though powerful enough to affect the functioning of the Project in their vicinity • This stakeholder group may play an important role in the public opinion formation, implementation of the CSR activities planned by the project	• These groups due to their social status, may already have access to several economic benefits from the other Projects, and thus may not be completely dependent upon the Project for access to	• Influence of Stakeholder: **MEDIUM** • Influence of Project: **MEDIUM**

Relevant Stakeholders	Profile	Concerns and Expectations from the project	Influence of Stakeholder on Project	Influence of Project on Stakeholder	Influence Rating
		the opportunities from the same – Minimal disturbance to the community in regard to access issues, and influx of migrant workers		development opportunities	
Local Gram Panchayats	This stakeholder group is comprised of the lowest level of local governance. The gram panchayats consist of one or more revenue villages and are the lowest level of decision-making bodies for development activities in the villages	• The expectations and concerns of this group from the project: – Receiving benefits from the project in terms of employment and development of infrastructure – Implementation of community development programmes in consultation with the Gram Panchayat and the local 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 project	• This stakeholder group is crucial in the smooth functioning of the project. The panchayat members can influence the decision-making process of the landowners and the entire community, at large; and • This stakeholder may also play an important role in the implementation CSR activities planned and the execution of other plans such as stakeholder engagement and grievance management. • Payment of compensation for damages	• The project can play an important role in the development of the villages by undertaking CSR activities in collaboration with the Gram Panchayat, especially in areas where there is a paucity of government funds	• Influence of Stakeholder: **HIGH** • Influence of Project: **MEDIUM**

Relevant Stakeholders	Profile	Concerns and Expectations from the project	Influence of Stakeholder on Project	Influence of Project on Stakeholder	Influence Rating
Regulatory Authorities	This stakeholder group is comprised of the central, state and district level regulatory authorities. These authorities influence the project in terms of establishing policy, granting permits and approvals for the project, monitoring, and enforcing compliance with the applicable rules and regulations	The key expectations and concerns of the group from the project include: • Project's compliance to the regulatory requirements; and • Timely disclosure of information and provisioning of updated through the life of the project.	• The failure of the project to comply with the various rules and regulations applicable can affect the timely implementation of the project • This stakeholder group is also critical for various permits/clearances required for the commissioning of the project	• The influence of the project on the stakeholders pertains to the role the project will play in the development of the Project in the area	• Influence of Stakeholder: **HIGH** • Influence of Project: **LOW**
District Administration	This stakeholder group is comprised of the government bodies at the district level. These bodies are vested with funds and decision-making authority through the decentralization process. Accordingly, the bureaucracy, the Block Development Officers, Block Health Officers, Tehsildar, Patwari, and Revenue Officer have become extremely influential.	The key expectations and concerns of the group from the project include: • Project's compliance to the regulatory requirements • Timely disclosure of information and provisioning of updates throughout the life of the project	• This stakeholder group is critical for the obtaining of the various permits/clearances required for the commissioning of the project and its smooth functioning thereafter • This group serves as important points of contact between the state level authorities and the local community	The influence of the project on the stakeholders pertains to the role the project will play in the development of the Project in the area	• Influence of Stakeholder: **HIGH** • Influence of Project: **LOW**
Staff & Contractors and Sub-Contractors	This stakeholder group is comprised of the technical & non-technical staff of Prayrak and staff and workers of sub-contractors.	The primary concerns and expectations of the group from the project include: • Timely completion of the project • The role of the project in continued economic opportunity and work generation	• This stakeholder group is critical for the smooth functioning and timely implementation of the project • This group may also play an important role in the formation of public opinion towards the project	The influence of the project on the group pertains to the role of the project in business opportunities and the process of contract closure	• Influence of Stakeholder: **HIGH** • Influence of Project: **HIGH**

Relevant Stakeholders	Profile	Concerns and Expectations from the project	Influence of Stakeholder on Project	Influence of Project on Stakeholder	Influence Rating
		• Avoidance of any reputational risks associated with the project due to any future community unrest or project activities • Clarity in terms of scope of work, expectations, key performance indicators and timelines • Timely and adequate disclosure of information to allow the project activities to be carried out • Fair business opportunities and contract closure; and • Business continuity. • Payment of wages and other concerns related to Labor welfare s			
Contractual workers	This group is comprised of skilled and semi-skilled workers, involved in the project on a contractual basis. This group is most likely to be comprised of the semi-skilled workers involved in the construction work of the project. As reported by the project the first preference of the project is to involve local people, from the neighbouring villages with the remaining workers being migrants,	The primary concerns and expectations of the stakeholder group pertaining to the project is as follows: • The role of the project in continued economic opportunity, work generation and a source of income • Timely settlement of dues and payments in keeping with the legal requirements	• This stakeholder group is critical for the smooth functioning and timely implementation of the project • This group may also play an important role in the formation of public opinion towards the project	The influence of the project on the group pertains to the roles of the project in the continuance of economic opportunities, timely payment of wages and ensuring the health and safety of the workers	• Influence of Stakeholder: **MEDIUM** • Influence of Project: **HIGH**

Relevant Stakeholders	Profile	Concerns and Expectations from the project	Influence of Stakeholder on Project	Influence of Project on Stakeholder	Influence Rating
	depending upon skill requirement	• Continued work opportunities • Safety at work.			
Secondary Stakeholders					
Village Institutions	This stakeholder group is comprised of health and education institutions at the village level. The institutions in the immediate vicinity of the project are the primary schools in the villages	The main concerns and expectations of the group from the project pertain to: • Adequacy of community development activities in the area • Contribution of the project towards the overall development of the area • Involvement in the formulation and implementation of the community development activities; and • Timely and adequate disclosure of information pertaining to the project.	The influence of the group on the project pertains to the role of the played by these institutions in the opinion formation and implementation of community development programmes and CSR activities	The influence of the project on the group pertains to the role of the project in the development of these institutions	• Influence of Stakeholder: **LOW** • Influence of Project: **LOW**
Political Parties	This stakeholder group is comprised of political parties, which are active in the area. This group plays a critical role in the sensitization of the population and the creation of the public opinion	The key expectations and concerns of the group from the project include: • the role of the project in the overall development of the area • the impact of the project on the local community • adequate community development activities throughout the life of the project; and	The influence of this stakeholder group on the project pertains to the role of the political parties in the formulation of public opinion towards the project.	The influence of the project on the group is expected to be extremely limited, pertaining to the role of the project in the development of the area	• Influence of Stakeholder: **MEDIUM** • Influence of Project: **LOW**

Relevant Stakeholders	Profile	Concerns and Expectations from the project	Influence of Stakeholder on Project	Influence of Project on Stakeholder	Influence Rating
		• Timely disclosure of information pertaining to the project activities.			
State Administration	The state administration is comprised of the state level agencies of the various departments/authorities such as industries department, revenue department, labour department and land department etc.	The main expectations and concerns of the stakeholder group from the project include: • Compliance to the regulatory requirements for the project • Project's role in the development of the area • Timely disclosure of information pertaining to the project activities	This stakeholder group is also critical for the obtaining of the various permits/clearances required for the commissioning of the project	The influence of the project on the stakeholders pertains to the role the project will play in the development of solar energy in the state	• Influence of Stakeholder: **MEDIUM** • Influence of Project: **LOW**
Media	The media, comprising of both print and visual media, has a presence in the district. They are known to have played an extremely important role in generating awareness amongst the community.	The main expectations and concerns of the stakeholder from the project include: • Compliance to the regulatory requirements for the project • Project's role in the development of the area • Maintenance of positive relationship with the local community and other stakeholders • Timely disclosure of information in regard to the project activities	The influence of the stakeholder group on the project is likely to pertain to the opinion formation amongst other stakeholders towards the project	The influence of the project on the stakeholder is likely to be extremely limited due to the nature of the project activities	• Influence of Stakeholder: **LOW** • Influence of Project: **LOW**

4.1 Engagement undertaken – Pre-impact assessment

According to the discussions undertaken with the local community and the project team, it is understood that the engagement by the project proponent with the local community was restricted to landowners and local regulatory authority which includes district administration & police. The community consultations are generally carried out with the land lessors family related to information of land procurement for plant, ROW and compensation. As part of ESIA process, consultations with land lessors was carried and it was understood that community is aware about the project and process of disbursement of compensation.

Engagement as part of the Impact assessment – this assignment

As part of EISA process the community consultations were carried with the land lessors near kawni , NAl and Bikaner and around the project area to assess the potential impacts of the project and broad socio-economic profile of land lessors and the community living close to the project. The subsequent section provides an understanding of the engagement activities undertaken as part of the ESIA process.

4.1.1 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 project:**
    - It was informed during the consultation that most of the affected community is dependent on agriculture, and it constitutes the important aspect for livelihood. The region is mostly dependant of monsoon for irrigation therefore due to lack of irrigation most of the farmers only cultivate monsoon crops. The community expects to receive benefits from the project in terms of employment and development of infrastructure and the overall community development. In addition, the community has also demanded preference to the local community in contracting workers and employment opportunities from the project.
- **Key feedback received from landowners/lessors / PAPs:**
    - It was informed that the landowners are willing to lease out their land to the project due to the low productivity of the land, dependency on monsoons and lack of irrigation facilities and the rates are mutually accepted and land transection is based on willing seller and willing buyer.
- **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 area for development activities identified include advancements of irrigation technology, education, medical infrastructure, water infrastructure and technical trainings for youth within the villages

6. Impact Assessment & Mitigation Measures

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 construction, operation and decommissioning phases of the project life cycle to understand the risks and impacts associated with each phase.

6.1 Project Activities

An overview of the typical project activities during different phases of a solar power project has been summarised below:

Table 6-1: Project Activities

Sr. No.	Project Phase	Activities
1.	Pre-Construction Phase	• Site Survey; • Land Identification and Land lease; • Project approvals and licenses; • Finalization of contractor.
2.	Construction Phase	• Contractor mobilization; • Site Preparation including fencing, clearing of trees, bushes, pit filling, levelling and grading; • Transportation of construction material; • 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 Phase	• Daily dry robotic cleaning of PV modules[46]; • 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.

6.2 Scoping

As part of ESIA study, scoping exercise has been carried out 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 significance. This stage is intended to ensure that the impact assessment focuses on the issues that are most important for decision-making and stakeholder interest.

The impact interaction matrix highlighting the potential interaction between project activities and resources/receptors has been presented in ***Table 6-2.***

[46] Wet Cleaning to be undertaken once or twice a year

6.2.1 Potential Impacts

The potential interaction matrix for project activities and likely impacted resources/receptors is presented in the below table

Table 6-2: Impact Interaction Matrix

Potential Impact Interaction Matrix		Resources													
		Topography and Drainage	Land Use	Soil Environment	Groundwater Resources	Surface Water Resources	Air Environment	Noise Environment	Terrestrial Ecology	Aquatic Ecology	Land Based Livelihood	Economic Environment / Employment	Social and Cultural Environment	Occupational Health and Safety	Community Health & Safety
Activities	**Pre-Construction Phase**														
	Site Survey														
	Land Identification and Land Lease												√		
	Project Approvals and Licenses														
	Finalization of Contractors														
	Construction Phase														
	Contractor mobilization	√		√			√	√				√	√	√	√
	Site Preparation including fencing, clearing of trees, bushes, pit filling, levelling and grading	√	√	√	√		√	√	√			√	√	√	√
	Transportation of construction material			√			√	√	√			√		√	√
	Construction of site office, pooling substation SCADA room and internal roads		√	√		√	√	√	√			√		√	
	Construction of temporary storage facilities		√	√		√	√	√	√			√		√	
	Foundation laying for ground mounted structures		√	√	√	√	√	√				√		√	
	Storage of PV modules delivery and their installation		√	√	√	√	√	√				√		√	
	Hazardous and non-hazardous waste generated from construction activities			√	√	√			√	√				√	√
	Laying of internal electrical connections		√	√			√	√				√		√	
	Installation of inverter and transformers		√	√	√	√	√	√				√		√	
	Excavation foundation and erection of transmission line towers						√	√	√		√	√		√	
	Stringing of transmission line			√				√	√		√	√		√	√
	Operation and Maintenance Phase														
	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.							√						√	
	Dry module cleaning and wet module cleaning (once or twice a year)					√								√	
	Operation and maintenance of ancillary facilities such as power substation			√	√		√	√	√					√	
	Inspection and maintenance of transmission lines							√	√		√			√	√
	Inspection and maintenance of internal pathways and access roads			√	√		√	√						√	√
	Power evacuation through transmission line								√*						

* Avifaunal ecology

6.3 Scoped Out Interactions

Based on interactions defined in *Table above* the impacts on the following resources have been scoped out.

Table 6-3 Scoped Out-Potential Interactions

S.no.	Impact	Rationale for Scoping Out
1.	Ambient Air Quality Impacts during Operation Phase	During operation phase, no significant impact on air quality is envisaged since solar power projects are less polluting power source, and power generation from solar plant will not lead to increase in air emissions. However, there will be deployment of vehicles on site for project team commuting purpose and operation and maintenance work. Since the O&M work will be undertaken once or twice a year and there will be one or two vehicles used for commuting purpose, the air emissions during operation phase are envisaged to be negligible. Hence the project activity and receptor interaction has been scoped out.
2.	Impact on Cultural Heritage	Since there are no cultural heritage located in and around the project site which has archaeological, cultural or historical importance, therefore, the impact on cultural heritage due to the project has been scoped out.

6.4 Impact Assessment Methodology

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 construction, operation and decommissioning phases of the project life cycle to understand the risks and impacts associated with each phase

6.4.1 Impact Estimation and Assessment

Criteria	Sub-Classification	Defining Limit
Spread: refers to area of direct influence from the impact of a project activity	Insignificant / Local spread	impact is restricted within the foot prints of the Project boundary or within 500m of the boundary
	Medium Spread	impact is spread beyond 500m up to 2 km of the Project boundary
	High spread	impact is spread beyond 2 km to 5 km from footprint boundary of the Project
Duration: based on duration of impact and the time taken by an environmental component to recover back to its best possible pre-project state	Insignificant / Short Duration	when impact is likely to be restricted for duration of less than 12 months;
	Long Duration	when impact is likely to be extended up to 10 years
	Permanent	when impact is likely to be extended beyond 10 years
Intensity: defines the magnitude of Impact	Insignificant intensity	when resulting in changes in the environmental baseline conditions is up to 10%

Criteria	Sub-Classification	Defining Limit
	Low intensity	when resulting in changes in the baseline conditions up to 20%
	Moderate intensity	when resulting in changes in the baseline conditions for up to 30%
	High intensity	when change resulting in the baseline conditions beyond 30%
Nature: refers to whether the effect is considered positive or negative	Positive	When impact will result in positive or beneficial change in the project area
	Negative	When impact will result in negative or adverse change in the project area
Frequency: refers to extent of occurrence of any activity/ task	Intermittent	Activities which may be undertaken intermittently but may not be continuous or have impact only when undertaken beyond certain intensity
	Routine	Activities which will be undertaken on regular and daily basis as part of construction or operation of the project

Based on the above, an impact significance matrix to assess the various impacts as presented in the table below. The potential impacts from Pre-construction, Construction, and Operation phases of the project are discussed in the subsequent sections.

6.4.2 Impact Significance Criteria

Spread	Duration	Intensity	Magnitude
Local	Short	Low	Negligible
Local	Short	Moderate	Small
	Long	Low	
	Long	Moderate	
	Permanent	Low	
Medium	Short	Low	
Local	Short	High	Substantial
	Long	High	
	Permanent	Moderate	
Medium	Short	Moderate	

Spread	Duration	Intensity	Magnitude
	Long	Low	
	Long	Moderate	
	Permanent	Low	
	Permanent	Moderate	
High	Short	Low	
	Short	Moderate	
	Long	Low	
	Long	Moderate	
	Permanent	Low	
Local	Permanent	High	Major
Medium	Short	High	
	Long	High	
	Permanent	High	
High	Short	High	
	Long	High	
	Permanent	Moderate	

In case of social and ecological impacts due to the project activities, vulnerability of the impacted receptor shall also be assessed in addition to characterising the magnitude of impact. Multiple factors have been considered while defining the vulnerability of the resource/receptor, which may be biological, cultural or human as presented in table below. Other factors have been also considered while characterising vulnerability, such as legal protection, government policy, stakeholder views and economic value.

The ***vulnerability characterization*** used herein for social and ecological receptors are

- Low
- Medium
- High.

Furthermore, for health and safety impacts due to the project activities, probability of incidence occurrence has been considered. The probability of an incidence occurrence has been established via qualitative scale as presented in ***Table 6-4.***

The ***probability*** used herein for health and safety incidence are:

- Unexpected
- Possible
- Expected

Table 6-4: Criteria for Receptor Vulnerability

Receptors	Sub criteria	Low	Medium	High
Impact on Local Community	The impact on local community of their socio-economic condition would be raised due to: • Potential loss of land-based livelihood • Potential Loss of Livelihood • Labour Influx • Employment Opportunities	• Minimum vulnerability consequently with a high ability to adapt to changes brought by the Project and opportunities associated with it	• Some but few areas of vulnerability; but still retaining an ability to at least in part adapt to change brought by the Project	• Profound or multiple levels of vulnerability that undermine the ability to adapt to changes brought by the Project
Habitat Sensitivity	Not Applicable	• Habitats with negligible interest for biodiversity. • 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	• Habitats within nationally designated or recognized 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 congregator species • Low value habitats used by species of medium value	• Habitats within internationally designated or recognized 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 congregator species • Highly threatened and/or unique ecosystems, areas associated with key evolutionary species • Low or medium value habitats used by high value species
Species Sensitivity	Not Applicable	• Species with no specific value or importance attached to them • Species and sub-species of Least Concern (LC) on the IUCN Red List of Threatened Species • Not meeting criteria for medium or high value	• Species on IUCN Red List as Vulnerable (VU) Near Threatened (NT), or Data Deficient (DD) • Species protected under national legislation • Nationally restricted range species, nationally important numbers of migratory, or congregator species • Species not meeting criteria for high value, and species vital to the survival of a medium value species	• Species on IUCN Red List as Critically Endangered (CR) or Endangered (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 km2) • Internationally important numbers of migratory, or congregator species • Key evolutionary species, and species vital to the survival of a high value species

Table 6-5: Probability of Incidence Occurrence

Probability	Defining Limit
Unexpected	The incident is unexpected but may happen at any time during routine operations (probability less than 20%)
Possible	The incident is expected to happen at any time during routine operations (probability greater than 20% and less than 50%)
Expected	The incident will occur during normal routine operations (probability greater than 50%)

6.5 Impacts on Physical Environment

The proposed Project site is located in a rural setup with no major industrial/ anthropogenic activities. This section outlines the potential impacts on the physical environment due to project activities planned during different phases of the Project lifecycle.

6.5.1 Impacts during Construction Phase

6.5.1.1 Land Use

Based on review of the land use in the Project AoI, it was observed that majority of land use in the study area was agricultural land (80.77%) followed by sandy/fallow land (16.95 %). The land use pattern of the Project AoI has been presented in ***Figure 4-4.***

As observed during DTTILLP site visit and discussion with site team, solar power plant will be predominantly located on private agricultural land and fallow land. A sub branch of IGNP canal and three manmade water ponds were observed to be located within the project boundary towards the north direction (refer ***Figure 4-2***). Based on discussion with onsite project team, it is understood that the sub branch of IGNP canal and the three manmade ponds are currently not connected to the main IGNP branch for water supply. It was further informed that PGPL has verbally intimated IGNP regarding development of the solar power plant around the sub branch of IGNP canal and three manmade ponds, however, a written no objection certificate from IGNP department is yet to be obtained. As reported by PGPL team, the canal and the manmade ponds will be left untouched during the project lifecycle and access will be provided to IGNP authority (as and when required) for maintenance of the canal.

The ~10.5 km transmission line connecting the pooling substation to Jaimalsar grid substation will pass through private agricultural land and patches of sandy fallow land. Furthermore, it is understood that pooling substation, storage yard and site office will be developed on private agricultural land within the project boundary and no separate land will be leased out for the same. The project activities such as installation of solar modules and proposed transmission towers are expected to alter the land use of the study area throughout the project life cycle.

Structures, albeit of temporary nature, which will support project activities during the construction stage such as storage yards, etc. will have an impact on the immediate vicinity of the construction area. The construction phase is expected to last approximately 6 months, following which the temporary structures will be dismantled from their respective locations with the returning of land to its acceptable pre-construction state. However, internal roads, transmission lines and permanent structures such as solar modules, site office and the pooling substation will remain until the end of the Project life cycle (i.e. 25 years).

Impact Magnitude

Since the change in land use will be limited to the project site and transmission route, therefore the spread is medium. However, the duration of the change will be permanent i.e., till the project lifecycle and the intensity is classified as low as the resulting change in the baseline will be limited to project site and surrounding area. Therefore, as per Impact Significance criteria, the impact magnitude on land use resource due to the project has been classified as **Substantial.**

Mitigation Measures proposed for the Project

- Construction activity should be restricted to designated area;
- Minimum land should be cleared for access to the transmission towers;
- No Objection Certificate from IGNP department should be obtained for development of the project around the sub branch of IGNP canal
- On completion of the construction activities, land used for temporary facilities will be restored to the extent possible;
- The land use around the permanent project facilities should not be disturbed.

	Nature of Impact	Spread of Impact	Duration	Intensity	Frequency	Significance of Impact
Without Mitigation Measures	Negative	Medium	Permanent	Low	**Intermittent**	Substantial

	Nature of Impact	Spread of Impact	Duration	Intensity	Frequency	Significance of Impact
With Mitigation Measures	Negative	Local	Permanent	Low	**Intermittent**	**Small**

6.5.1.2 Topography and Drainage

The project site exhibit flat to undulating topography. The elevation at the project site ranges between 180 m-207 m (refer ***Figure 4-6***). As observed during site visit, a dry sub branch of IGNP and three dry manmade water ponds were located within the project boundary. Additionally, there are dendritic drainage lines passing through the project site and in and around the study area (refer ***Figure 4-11***). Typically solar power projects do not undertake major levelling of topography. However, the topography may be altered slightly due to the development of internal roads within site, excavation work at transmission tower locations and PSS and SCADA. Clearing and minor levelling of land may be done prior to any civil work, although these changes are envisaged to be small and restricted to the immediate vicinity of the Project components. Since a dry sub branch of IGNP canal is passing through the project boundary, levelling and excavation work at site may choke the canal with sand.

Control Measures for the Project

The EPC contractor at site will be instructed to avoid any unnecessary changes in the topography including at the IGNP canal area. Appropriate number of cross drainage channels will be provided in and around the project site to maintain flow in existing natural drainage channels.

Impact Magnitude

Since the topography of the site may be altered slightly which will be restricted within the Project area, the spread is categorized as local. Furthermore, since the slight alteration to the topography will remain throughout the project lifecycle, the duration has been classified as permanent. The intensity and frequency has been classified as medium and intermittent respectively, there are dendritic drainage channels and sub branch of IGNP canal passing through the site and any alteration to the site may impact these channels. Therefore, based on Impact Significance criteria, the impact magnitude on topography and drainage has been classified as **Substantial**

Proposed Mitigation Measures

- EPC contractor should be instructed to carry out levelling and grading activities with as little disturbance to the existing contour as possible, in order to retain the general slope of the site.
- To the extent possible, disruption/alteration of sub branch of IGNP canal and micro-watershed drainage patterns should be avoided.

	Nature of Impact	Spread of Impact	Duration	Intensity	Frequency	Significance of Impact
Without Mitigation Measures	Negative	Local	Permanent	Moderate	**Intermittent**	**Substantial**
With Mitigation Measures	Negative	Local	Permanent	Low	**Intermittent**	**Small to Negligible**

6.5.1.3 Air Quality

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

- Fugitive dust emissions from site clearing, excavation work, cutting and levelling work at solar site, stacking of soils, handling of construction material, transportation of material, emission due to movement of vehicles and heavy construction machinery at solar site and transmission line route etc.
- Vehicular emissions due to traffic movement on site and on access roads
- Exhaust emissions from construction machineries, other heavy equipment like bull dozers, excavators, and compactors
- Dust emissions from the batching plant (in case installed)
- Exhaustive emission due to excavation work at transmission line route
- Emissions from diesel generators required during construction activity.

Based on ambient air quality monitoring conducted at two locations for 24 hours within study area, all the air quality parameters for all the locations were found to be within NAAQS permissible limit (refer ***Table 4-14***). The Project will be spread across an area of 1700 acre land and the air quality impacts would be confined to 500 m of the construction activity area, material storage area, transmission line route. Since the nearest settlement to the project site is Kawani village located at an aerial distance of ~ 600 m from project site towards northwest direction and the predominant wind direction in Bikaner district is eastern or northeastern except for southwest monsoon season, when it is mostly southern or southwestern, therefore, air quality impact on settlements due to construction activities is limited. The Project will not have any long term impact on the ambient air quality of the study area including transmission line route, since construction activities will last for 6 months each for Phase I and Phase II where peak construction work will be carried out for only 3-4 months However, the Project study area is characterized by presence of loose desertic 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. Kawani Gram panchayat road along with State Highways will be utilized for transportation of construction materials. Villages along the access roads in the Project AoI is anticipated to be impacted due to increased emissions.

Negligible impacts are envisaged during operational phase of the Project with respect to impact on air quality since the Project is a renewable energy Project which does not lead to air emissions. As for impacts due to vehicular emissions and fugitive dust emissions, they are assessed to be limited considering vehicles will use upgraded approach roads (thus nullifying the impacts arising from fugitive dust) and during maintenance activities which will be planned to occur only a few times a year.

Control Measures for the Project

- PGPL will include its EPC contractor health, safety, security and environmental (HSSE) obligations as part of its EPC HSSE agreement which provide obligations to the EPC on environment protection.
- PGPL mandate its EPC contractors to adhere to its Group level HSSE policy as part of the EPC HSSE clauses.
- Preventive measures such as storage of construction material in sheds, covering of construction materials during transportation will be undertaken, for reducing dust emissions
- Minimizing of stockpiling by coordinating excavations, spreading, re-grading and compaction activities
- Proper maintenance of engines and use of vehicles with Pollution under Control (PUC) Certificate.

Impact Magnitude

Impacts on ambient air quality during construction activities will be for limited period i.e. 6 months each for Phase I and Phase II, therefore, the impact duration has been assessed to be short. Furthermore, since there will be dust emissions due to construction activities at the project site and along the access routes, the spread has been assessed to be small. The intensity and frequency has been classified as moderate and routine respectively as the construction activities will be undertaken regularly for 6 months each during Phase I and Phase II within the project site and at transmission line route. Therefore, the impact magnitude based on the impact significance criteria has been classified as **Substantial to Small**

Proposed Mitigation Measures

- Speed of vehicles on site and transmission route will be limited to 10-15km/h which will help in minimizing fugitive dust emissions due to vehicular movement;
- Emissions from the D.G. set and other stationary machines will be controlled by ensuring that the engines are always properly tuned and maintained;

- Cease or phase down work if excess fugitive dust is observed. Investigate the source of dust and ensure proper suppression measures;
- Idling of vehicles and equipment must be prevented;
- Batching plant (if installed) should be set up away from the settlements;
- In case of community complain on dust emission from site, or transmission route, PGPL along with the contractors should reconsider the construction technique and conduct regular water sprinkling (as appropriate) to suppress dust emission;
- Burning of waste at the construction site should be strictly prohibited;
- All stockpile materials which are likely to generate airborne fugitive dust will be covered with canvas or plastic sheets during windy season;
- Water sprinkling at the dust emitting areas should be undertaken regularly;
- Construction materials and soil heaps should be covered and kept away from settlement area;
- Vehicles and machineries should be regularly inspected and maintained;
- Prefabricated materials should be used to the extent possible to minimize localized air pollution.

	Nature of Impact	Spread of Impact	Duration	Intensity	Frequency	Significance of Impact
Without Mitigation Measures	Negative	Local	Short	Moderate	**Routine**	**Substantial to Small**
With Mitigation Measures	Negative	Local	Short	Low	**Routine**	**Small to Negligible**

6.5.1.4 Ambient Noise

The project is located in rural setting and therefore prescribed to CPCB and WHO standards set for residential areas (day time Leq = 55). The sources of noise in the construction phase include civil work, operation of batching plant (if installed), operation of DG sets and construction machineries such as cranes, drillers, bull dozers etc. and movement of vehicles at project site and transmission line route. There will also be increased noise levels because of increased anthropogenic movement in the area.

Based on the ambient noise quality monitoring conducted at four locations within study area, the Leq day at N1, N2 and N3 locations were observed to be slightly exceeding the CPCB limit of 55 dB(A). Therefore, construction work at the project site including operation of construction machineries and DG sets are envisaged to increase the existing noise level at the project area. However, Since the nearest settlement to the project is located at an aerial distance of ~ 600 m towards northwest direction, impact on settlement due to increased noise levels is envisaged to be limited.

Control Measures for the Project

- Normal working hours of the contractor will be defined (preferable 8 am to 6pm). If work needs to be undertaken outside these hours, it will be limited to activities which do not generate noise.
- PGPL mandate its EPC contractors to adhere to its Group level HSSE policy as part of the EPC HSSE clauses

Impact Magnitude

Impacts on ambient noise quality during construction activities will be for limited period i.e. 6 months each for Phase I and Phase II, therefore, the impact duration has been assessed to be short. Furthermore, since there will be noise emissions due to construction activities at the project site and along the access routes due to movement of construction vehicles, the spread has been assessed to be small. The intensity and frequency has been classified as moderate and routine respectively as the construction activities will contribute towards increasing the noise levels at the project area. However, such activities will last for a short period of time i.e., 6 months each for Phase I and Phase II within the project site and at transmission line route. Therefore, the impact magnitude based on the impact significance criteria has been classified as **Small.**

Proposed Mitigation Measures

- Only well-maintained equipment should be operated on-site;

- Acoustic enclosures should be provided for all the noise emitting machineries to reduce noise levels at the nearby settlements;
- 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;
- Limit the number of heavy vehicles required for the Project to only those that are necessary;
- Machinery and construction equipment that may be in intermittent use should be shut down or throttled down during non-work periods;
- Batching plant (if installed) should be set up in the direction which is away from settlements;
- Minimal use of vehicle horns and heavy engine breaking in the area needs to be encouraged;
- Noise limits for construction equipment to be installed at the project area during peak construction such as front loaders concrete mixers, cranes (moveable), will not exceed 75 dB (A), measured at one meter from the edge of the equipment in free field, as specified in the Environment (Protection) Rules, 1986.

	Nature of Impact	Spread of Impact	Duration	Intensity	Frequency	Significance of Impact
Without Mitigation Measures	Negative	Local	Short	Moderate	**Routine**	**Small**
With Mitigation Measures	Negative	Local	Short	Low	**Routine**	**Negligible**

6.5.1.5 Soil Environment

Soil Erosion and Compaction

Soil compaction and erosion has been considered for construction phase only. In the operation phase, soil compaction and erosion will be negligible to limited due to vehicular movement, which only happens during the occasional maintenance activities and will be along the transmission line route and within land foot print leased already during the construction phase. Soil compaction and erosion for operation phase has therefore been assessed to be negligible

During the construction phase, the top soil will be susceptible to soil erosion to some extent due to site clearance activities. The region is characterised by desertic sandy soil which is loose in nature, and thus soil erosion can occur easily in the Project area. The removal of stabilised top soil would result in slope destabilisation and increase in soil erosion.

As for soil compaction, the strengthening of internal access roads and excavation and collection of soil may lead to soil compaction, thus increasing surface run-off and decreasing the percolation rate of the soil. However, since the soil in the project area is desertic having low water retention capacity and additionally, since the Project is being developed in a drought prone area soil compaction in the project area is envisaged to be minimal.

Control Measures for the Project

- Using existing roads to access the site to the extent possible
- Topography shall be restored to the extent possible and re-vegetated to prevent soil erosion to the extent possible.

Impact Magnitude

Since the construction phase will last for limited period of time i.e., 6 months each for Phase I and Phase II, the duration has been classified as short. Furthermore, since the soil erosion may occur due to movement of vehicles on unpaved roads, the spread has been classified as medium. The intensity has been classified as low to moderate and the frequency has been classified as routine. Therefore, based on impact significance criteria, the impact magnitude is assessed to be **Small.**

Proposed Mitigation Measures

- Stripping of topsoil shall not be conducted earlier than required (vegetation cover will be maintained for as long as possible) in order to prevent the erosion (wind and water) of soil;
- Top soil that has been stripped should be stored for landscaping of the site;
- The stock piles of the soil should be kept moist/covered to avoid wind erosion of the soil;
- Soil to be ploughed in compacted area after completion of the construction work;
- Revegetation of the construction boundaries using fast growing local vegetation;
- As a best practice, site clearance, piling, excavation and access road strengthening will not be carried out during the monsoon season to minimize erosion and run-off;
- Site to be restored at the end.

	Nature of Impact	Spread of Impact	Duration	Intensity	Frequency	Significance of Impact
Without Mitigation Measures	Negative	Medium	Short	Low	**Routine**	**Small**
With Mitigation Measures	Negative	Local	Short	Low	**Routine**	**Negligible**

Soil Contamination

General construction waste generated onsite will comprise of concrete, wooden pallets, steel cuttings/filings, packaging paper or plastic, wood, metals etc. Municipal domestic wastes consisting of food waste, plastic, glass, aluminum cans and waste paper will also be generated by the construction workforce at any canteen facility/ rest area. A small proportion of the waste generated during construction phase will be hazardous and may include used oil, hydraulic fluids, waste fuel, grease and waste oil containing rags. If improperly managed, solid and hazardous waste could create negative impacts on land. Additionally, soil contamination during the construction phase may result from leaks and spills of oil, lubricants, or fuel from heavy equipment, improper handling of chemical/fuel storage and wastewater. Such spills could have a long-term impact on soil quality.

Control Measures for the Project

- Hazardous material and waste will be properly labelled, stored onsite at a location provided with impervious surface and in a secondary containment system.
- PGPL will mandate its EPC contractor to adhere to their group level HSSE Policy which highlights commitment towards promoting waste recycling and reduce and eliminate waste generation.
- As part of contract agreement with EPC contractor, PGPL will include HSSE obligations such as drafting and implementing environmental plans including spill prevention and control.

Impact Magnitude

Any leaks and spills of oil from project activities may contaminate the soil in project site and nearby areas, therefore the spread has been classified as medium. Furthermore, contamination of soil may last for long period of time, thus the duration has been classified as long. The intensity has been classified as moderate as the soil contamination may have impact on the soil of project area and nearby areas. Therefore, the impact magnitude as per impact significance criteria has been assessed to be **Substantial.**

Proposed 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
- It is to be ensured that hazardous waste is not stored for more than 90 days. Hazardous waste should be disposed through RSPCB authorized hazardous waste vendor only.
- Use of spill control kits to contain and clean minor spills and leaks
- Unloading and loading protocols should be prepared for diesel, oil and used oil respectively and workers trained to prevent/contain spills and leaks, and
- In case of accidental/unintended spillage, the contaminated soil should be immediately collected and stored as hazardous waste.

	Nature of Impact	Spread of Impact	Duration	Intensity	Frequency	Significance of Impact
Without Mitigation Measures	Negative	Medium	Long	Moderate	**Routine**	**Substantial**
With Mitigation Measures	Negative	Local	Short	Low	**Routine**	**Negligible**

6.5.1.6 Water Resources

Water Availability

Water is a prime requirement for the execution of civil works, especially with regard to preparation of construction materials like concrete etc. for civil works associated with the Project (i.e. solar PV module foundation and installation, casting, construction of proposed site office, SCADA room).

The proposed project site falls in the over-exploited category as specified in the CGWB report, 2022. Based on discussion with onsite team and local community, it is understood that source of water in the area is Kanwar Sen main lift line which is a branch of IGNP canal located 8 km (aerial distance) from the project boundary towards south direction. As reported by site team, the source of water for the proposed project has been identified as water tankers which will be procured from local vendor. Furthermore, the source of water for the tankers will be branch of IGNP canal. Based on consultation with the local community, it is understood that people in Kawani village is dependent on IGNP canal for agriculture, drinking and domestic purposes.

It is estimated that approximately 6000 kl of water will be used for entire civil work (Phase I and Phase II) at the project site during construction phase i.e. 6 months each for Phase I and Phase II. Furthermore, approximately 216 KLD water will be required for domestic and drinking purposes at the project site during construction phase.

Control Measures for the Project

- PGPL will mandate its EPC contractor to adhere to their group level HSSE Policy which highlights commitment towards protecting the natural environment and minimising any impact by undertaking activities in a sustainable manner.
- As part of HSSE requirement, PGPL require its EPC contractor to record and share report on water consumption at site on weekly basis.

Impact Magnitude

Since the project has identified water tankers for meeting water requirement during construction phase, the spread has been classified as local. Furthermore, water requirement for construction phase will last for limited period i.e., 6 months each for Phase I and Phase II, the impact duration has been considered as short. Since branch of IGNP canal is currently the only source of water for agricultural, drinking and domestic purpose of local community and the same source will be used for supply of water at the project site through water tankers, the impact intensity has been classified as high. Therefore, based on impact significance criteria, the impact magnitude has been classified as **Substantial.**

Proposed Mitigation Measures

- Construction labour deputed onsite to be sensitized about water conservation and encouraged for optimal use of water;
- PGPL to identify alternate sources of water abstraction such as water tankers from different village ponds (if any) to minimize dependency on IGNP;
- Permission from RREC should be obtained by the Project, in case PGPL directly abstracts water from IGNP canal;
- In case, project hire third party vendor for supply of water through tankers at the project site, the project should conduct prior background check of the vendor to ensure that no illegal abstraction of water from IGNP or any other water resource is practiced to supply water to the project.
- Regular inspection for identification of water leakages and preventing wastage of water from water supply tankers is necessary for efficient utilization of water
- Blending of low quality water with fresh water for construction uses to ensure efficient use of natural resource
- Record daily water consumption at site
- Recycling/reusing to the extent possible
- Explore water conservation scheme e.g., rainwater harvesting at the project site.

	Nature of Impact	Spread of Impact	Duration	Intensity	Frequency	Significance of Impact
Without Mitigation Measures	Negative	Local	Short	High	**Routine**	**Substantial**
With Mitigation Measures	Negative	Local	Short	Moderate	**Routine**	**Small**

Water Quality

There is a potential for contamination of groundwater resources resulting from improper management of sewage at project site office or other accidental spills/leaks at the storage areas.

The soil type of the area is desertic 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.

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 each for Phase I and Phase II).

Control Measures for Project

- Provision of septic tank and soak pits 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 will be away from natural drainage channels.
- As part of contract agreement with EPC contractor, PGPL will include HSSE obligations such as drafting and implementing environmental plans including spill prevention and control, water pollution prevention and wastewater management

Impact Magnitude

Since, any spillage or leaks may contaminate the groundwater of the Project area, the spread has been classified as Medium. Furthermore, there will be long term impact on groundwater quality in case of leaks/spills, the duration has been classified as long. The intensity has been classified as moderate due to high percolation rate of sandy soil, which may seep the contaminant deep into ground water. Furthermore, groundwater in the project area has been classified as **over-exploited** as per CGWB report

(2022) in terms of ground water development. Therefore, based on impact significance criteria, the impact magnitude has been classified as **Substantial.**

Proposed Mitigation Measures

- Hire/engage licensed contractors for management and disposal of waste and sludge
- Provision for impervious storage area, especially for fuel & lubricant, hazardous waste, etc. should be made onsite
- Labourers should 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 should be strictly prohibited
- Spill/ leakage clearance plan to be adopted for immediate cleaning of spills and leakages
- 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.

	Nature of Impact	Spread of Impact	Duration	Intensity	Frequency	Significance of Impact
Without Mitigation Measures	Negative	Medium	Long	Moderate	**Routine**	**Substantial**
With Mitigation Measures	Negative	Local	Short to Long	Low	**Routine**	**Small to Negligible**

6.5.2 Impacts during Operation Phase

6.5.2.1 Ambient Noise

During operation phase, no significant noise impacts are envisaged from the project. There may be impact due to movement of vehicles for operation and maintenance work at the plant and along the route of transmission line , however, the same will be carried out once or twice a year. Furthermore, there will be movement of staffs on and off from site during working hours, however, noise from movement of workers are anticipated to be minimal

Impact Magnitude

Based on the above context**,** noise impact magnitude during operation phase has been assessed to be **Small to Negligible.**

Proposed Mitigation Measures

- Vehicle drivers should be instructed not to blow horns until necessary
- Anti-honking sign boards to be placed near village areas and at entry / exit points of the project
- Vehicles should be maintained regularly to avoid noise from engines etc.

	Nature of Impact	Spread of Impact	Duration	Intensity	Frequency	Significance of Impact
Without Mitigation Measures	Negative	Local	Long	Low	**Routine**	**Small to Negligible**
With Mitigation Measures	Negative	Local	Short	Low	**Routine**	**Negligible**

6.5.2.2 Soil Environment

Soil Contamination

During operation phase, the waste generated from Project will include domestic solid wastes at SCADA building, and site office and hazardous wastes like waste oil from DG sets and transformers, and oil containing jutes and rags. There are chances of spillage of oil during maintenance work such as lubricating oils from transformers etc. The accidental spillages of oil/lubricants and

hazardous waste generated during maintenance work may cause contamination of soil and ground water. There is a likelihood of spillage to occur at an area that is designated for storage of hazardous wastes.

During operation phase, the quantity of municipal waste and hazardous waste generated will be less and probability of the hazardous waste generation will be only during maintenance work and therefore occasional.

Control Measures for the Project

- The waste generated will be routed through proper collection and containment.
- The hazardous wastes will be stored onsite at separate designated covered area provided with impervious flooring and oil spill control kit will be used for cleaning small spills and leaks.
- As part of contract agreement with O&M contractor, PGPL will include HSSE obligations such as drafting and implementing spill prevention and control plan, wastewater management plan etc.

Impact Magnitude

Since there will be limited hazardous and non-hazardous waste, and the spillage may be restricted to project site therefore, the spread and duration has been classified as small and short respectively. The intensity has been classified as moderate due to the type of soil in the area that have high percolation rate, therefore, any leaks/spillage of hazardous oil may seep into the soil and further into groundwater. Therefore, the impact magnitude as per impact significance criteria has been assessed to be **Small.**

Proposed 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;
- Discarded or broken solar panels should be disposed in line with E-waste (Management) Rules, 2022;
- Ensure routinely disposal of hazardous waste through approved vendors and records are properly documented;
- Oil/ lubricants will be stored on impervious floor in the storage area having secondary containment;
- Use of spill control kits to contain and clean minor spills and leaks during O&M activities;
- The guidelines and procedures shall be prepared and followed for immediate clean-up actions following any spillages;
- The sewage generated onsite will be treated and disposed through septic tanks and soak pits;
- Transportation vehicles and equipment should undergo regular maintenance to avoid any oil leakage; and
- Unloading and loading protocol should be prepared for diesel, oil and used oil respectively and workers trained to prevent spills and leaks.

	Nature of Impact	Spread of Impact	Duration	Intensity	Frequency	Significance of Impact
Without Mitigation Measures	Negative	Local	Short	Moderate	**Intermittent**	**Small**
With Mitigation Measures	Negative	Local	Short	Low	**Intermittent**	**Negligible**

6.5.2.3 Water Resources

Water Availability

As mentioned earlier in the report, use of 100% dry robotic cleaning technologies is a method that will be adopted for module cleaning during operation phase. However, based on DTTILLP's past experience in solar power projects in Rajasthan, wet module cleaning is required once or twice a year due to high wind speed in the area and presence of loose sandy soil causing deposition of sand on the solar panels. Approximately, 1500 KL water will be required for one cycle of module cleaning (refer ***Table 2-2***). Additionally, 9 KLD water will be required for domestic requirements of O&M staff. The water during operation phase will be procured through water tankers. Since, as per CGWB report, 2022, Bikaner Rural block, where the project falls is categorised as **over-exploited**, in terms of water development and the TDS and total hardness in groundwater is high (refer ***Table 4-9)*** which is not suitable for module cleaning, therefore, no groundwater will be abstracted at the project area by PGPL. Hence, the source of water for the tankers will be IGNP canal or manmade water ponds, where supply water is through IGNP. As mentioned in ***Section 4.2.10.2***, as per Rajasthan Solar Energy Policy, 2019, Govt. of Rajasthan is offering access to water for project related activities to renewable energy developers which also includes cleaning of modules. Water Resources Department will allocate required quantity of water from IGNP canal/ the nearest available source for cleaning of solar panels and auxiliary consumption for Solar PV Power Plants subject to the availability of water. Therefore, PGPL is required to intimate estimated water requirement to RREC along with source of water to obtain approval for abstraction of water from IGNP.

For drinking purpose packaged water bottles will be supplied at the solar plant.

Control Measures for the Project

- PGPL will mandate its O&M contractor to adhere to their group level HSSE Policy
- As part of HSSE requirement, PGPL require its O&M contractor to record and share report on water consumption at site on weekly basis.

Impact Magnitude

During operation phase, since water will be majorly required for drinking and domestic purpose of 50 workers at site. Furthermore, since the project will implement 100% dry robotic cleaning technology and wet cleaning will be undertaken only once or twice a year, the spread and duration has been classified as local and short respectively. However, since a significant amount of water will be abstracted for wet cleaning (*to be undertaken once or twice a year*), from IGNP, this may put stress on water resources in case wet cleaning is undertaken during dry seasons. Therefore the intensity has been classified as moderate. Based on the impact significance criteria, the impact magnitude has been classified as ***Small.***

Proposed Mitigation Measures

- Records of daily water consumption to be maintained
- Regular inspection for identification of water leakages and preventing wastage of water
- Recycling/reusing to the extent possible
- Feasibility of constructing rain water harvesting system at site should be explored
- Approval for abstraction of water from IGNP should be obtained from RREC for water utilisation at the power plant.
- In case, project hire third party vendor for supply of water through tankers at the project site, the project should conduct prior background check of the vendor to ensure that no illegal abstraction of groundwater and/or surface water is practiced to supply water to the project.

	Nature of Impact	Spread of Impact	Duration	Intensity	Frequency	Significance of Impact
Without Mitigation Measures	Negative	Local	Short	Moderate	**Intermittent**	**Small**
With Mitigation Measures	Negative	Local	Short	Moderate	**Intermittent**	**Small**

Water Quality

During operation phase, wastewater generation is expected to be from solar wet module cleaning, which will be undertaken only once or twice a year. Additionally, sewage would be generated from substation, and SCADA building, these will be of almost negligible quantity.

Control Measures

As part of contract agreement with O&M contractor, PGPL will include HSSE obligations such as drafting and implementing water pollution prevention and wastewater management plan

Impact Magnitude

Since limited to negligible amount of waste water will be generated from the project, the spread, duration and intensity has been classified as local, short and low respectively. Therefore, the impact magnitude is assessed to be **Negligible.**

Proposed Mitigation Measures

- The provisions of septic tank and soak pits should be provided onsite for disposal of sewage, thereby minimizing the impacts of wastewater discharge.
- Adequate drainage line should be constructed in and around the site to avoid impact on natural drainage channels within site due to discharge of wastewater from solar module cleaning within site.
- Planning of toilets, soak pits and septic tanks, waste collection areas should be away from natural drainage

	Nature of Impact	Spread of Impact	Duration	Intensity	Frequency	Significance of Impact
Without Mitigation Measures	Negative	Local	Short	Low	**Intermittent**	**Negligible**
With Mitigation Measures	Negative	Local	Short	Low	**Intermittent**	**Negligible**

6.5.3 Impact during Decommissioning Phase

6.5.3.1 Air Quality

The decommissioning activities will have limited impact on the air quality of the area and will be mainly in the form of dust emissions due to demolition of office buildings. The increased vehicular movement for transportation of dismantled solar panels, demolition debris, and scrap materials will also generate fugitive dust emissions. In case DG sets are used for demolition activities, exhaustive emissions from DG stacks are also anticipated.

It is expected that the existing state highways will be utilized along with Kawani Gram Panchayat village road for transportation of demolished and dismantled materials. Villages along the access roads in the Project AoI is anticipated to be impacted due to increased emissions during decommissioning phase.

Impact Magnitude

Impacts on ambient air quality during decommissioning activities will be for limited period, therefore, the impact duration has been assessed to be short. Furthermore, since there will be dust emissions due to demolition and dismantling activities at the project site and along the access routes, the spread has been assessed to be local. The intensity and frequency has been classified as moderate and routine respectively as the demolition activities will be undertaken regularly within the project site and at transmission line route during the decommissioning phase. Therefore, the impact magnitude based on the impact significance criteria has been classified as **Small.**

Proposed Mitigation Measures

- Barricading the demolition areas;
- Cease or phase down work if excess fugitive dust is observed, investigate source and take suppression measures;
- Proper maintenance of engines and use of vehicles with Pollution Under Control (PUC) Certificate;
- Emissions from the emergency D.G. set and other stationary machines will be controlled by ensuring that the engines are always properly tuned and maintained;
- Speed of vehicles on site will be limited to 10-15km/h which will help in minimizing fugitive dust emissions due to vehicular movement.
- All stockpile materials which are likely to generate airborne fugitive dust will be covered with canvas or plastic sheets during windy season

	Nature of Impact	Spread of Impact	Duration	Intensity	Frequency	Significance of Impact
Without Mitigation Measures	Negative	Local	Short	Moderate	**Routine**	**Small**
With Mitigation Measures	Negative	Local	Short	Low	**Routine**	**Negligible**

6.5.3.2 Ambient Noise

During decommissioning phase of the project, noise will generate from demolition of SCADA buildings, office building, dismantling of transmission towers and solar panels, movement of vehicles carrying dismantled structure and equipment. However, the noise emission will be for limited period of time since the decommissioning phase will last for only a short duration.

Impact Magnitude

Impacts on ambient noise quality during demolition and dismantling activities will be for limited period, therefore, the impact duration has been assessed to be short. Furthermore, since noise emissions due to demolition and dismantling activities will be limited to the project site and immediate surrounding area, the spread has been assessed to be small. The intensity and frequency has been classified as moderate and routine respectively as the demolition activities will contribute towards increasing the noise levels within the project site and at transmission line route. However, such activities will last for a short period of time. Therefore, the impact magnitude based on the impact significance criteria has been classified as **Small.**

Proposed 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;
- Limit the number of heavy vehicles required for the Project to only those that are necessary;
- Machinery and equipment that may be in intermittent use should be shut down or throttled down during non-work periods;
- Minimal use of vehicle horns and heavy engine breaking in the area needs to be encouraged.

	Nature of Impact	Spread of Impact	Duration	Intensity	Frequency	Significance of Impact
Without Mitigation Measures	Negative	Local	Short	Moderate	**Routine**	**Small**
With Mitigation Measures	Negative	Local	Short	Low	**Routine**	**Negligible**

6.5.3.3 Soil Environment

The decommissioning activities will cause following impacts on soil:

- Soil compaction due to the increased vehicular and workforce movement, dismantling and storage of solar components on the adjacent land, removal of electric lines/ towers etc.
- Waste will be generated as end of life solar modules and demolition debris from solar foundations, storage yard and substation complex, SCADA building. Electric components such as transformers, insulators, wires will be generated.
- 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 oil/ lubricants.

Impact Magnitude

Since there will be limited hazardous and non-hazardous waste, and the spillage may be restricted to project site therefore, the spread and duration has been classified as local and short respectively. The intensity has been classified as moderate due to the type of soil in the area that have high percolation rate, therefore, any leaks/spillage of hazardous oil may seep into the soil and further into groundwater. Therefore, the impact magnitude as per impact significance criteria has been assessed to be **Small**

Proposed Mitigation Measures

- The vehicular movement during decommissioning activities should be restricted to the designated route path;
- The demolition/ dismantling waste (hazardous and nonhazardous waste) should not be left over in whole project area and to be collected and stored at designated area only for further segregation and disposal
- Soil to be ploughed in compacted area after completion of the decommissioning work
- Adequate guidelines and procedures shall be prepared and followed for immediate clean-up actions following any spillages
- The site should be restored to its original state by the project team

	Nature of Impact	Spread of Impact	Duration	Intensity	Frequency	Significance of Impact
Without Mitigation Measures	Negative	Local	Short	Moderate	**Intermittent**	**Small**
With Mitigation Measures	Negative	Local	Short	Low	**Intermittent**	**Negligible**

6.5.3.4 Water Resources

Water during the decommissioning phase will be consumed by workers and will be required in limited quantity for decommissioning work. The water demand is expected to be met through water tankers. However, the water requirement will be for a limited period since decommissioning phase will last for a short period of time. Also, there is a potential for contamination of groundwater resources resulting from improper management of sewage and accidental spills/leaks at the storage areas.

Impact Magnitude

Since the project is expected to source water tankers locally the spread has been classified as local. Furthermore, water requirement for decommissioning phase will be limited and it will last for short period of time, the impact duration has been considered as short. The impact intensity has been classified as moderate, since the Bikaner district and tehsil where the proposed project is located has suffered drought instances in the past (refer ***Section 4.2.3***), therefore, it is anticipated that there may be drought cases in future in the district and tehsil causing stress on water resources. Furthermore, there will be long term impact on water quality in case of leaks/spills, therefore, the duration for water contamination has been classified as long. Therefore, based on impact significance criteria, the impact magnitude has been classified **as Substantial to Small.**

Proposed Mitigation Measures

- Ensure proper cover and stacking of loose demolition material to prevent surface runoff and contamination of receiving water body

- Hire/engage licensed contractors for management and disposal of waste and sludge
- Workers should 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;
- Workers deputed onsite to be sensitized 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.
- Demolition and dismantled materials and other non-hazardous and hazardous waste should be stored away from water bodies prior to their disposal.
- Permission from appropriate authority should be obtained for abstraction of water
- Recycling/reusing to the extent possible.

	Nature of Impact	Spread of Impact	Duration	Intensity	Frequency	Significance of Impact
Without Mitigation Measures	Negative	Local	Long/short	Moderate/low	**Routine**	**Substantial to Small**
With Mitigation Measures	Negative	Local	Short	Low	**Routine**	**Small to Negligible**

6.6 Impacts on Biological Environment

The possible impacts on the biological environment in construction and operation phase have been assessed below,

6.6.1 Construction Phase: Impact Assessment

6.6.1.1 Habitat Modification and Loss due to Vegetation Clearance

The project is coming on the Modified habitat - Agricultural land, while the proposed 220 kV transmission line (TL) with a length of about 10.5 km is crossing the natural habitat - open scrubs and modified habitat - agricultural lands. Due to the establishment of the project, the land use of the 1700 Acres area will be changed. Similarly, the land use of the area going to be utilized for transmission towers (50 in number) will also be changed.

As per the baseline, the site is pre-dominated by *Acacia nilotica* (L.) Delile, *Aerva javanica* (Burm.f.) Shult., *Calotropis procera* (Aiton) Dryand., *Capparis decidua* (Forssk.) Edgew., *Citrullus colocynthis* (L.) Schrad., *Leptadenia pyrotechnica* (Forssk.) Decne., *Prosopis cineraria* (L.) Druce (=Khejri), and *Ziziphus nummularia* (Burm. f.) Wight & Arn. No floral species of conservation importance was identified in the study area.

One Endangered (IUCN Red List) [Egyptian Vulture (*Neophron percnopterus*)], two Near Threatened [Laggar Falcon (*Falco jugger*), & Painted Stork (*Mycteria leucocephala*)]; 7 Schedule I (Wildlife (Protection) Act, 1972) [Black Kite, Black-winged Kite, Indian Peafowl, Laggar Falcon, Shikra, Short-toed Snake-Eagle, & White-eyed Buzzard]. Three (03) Migratory**,** one Vulture - Egyptian Vulture (*Neophron percnopterus*) and 07 Raptors [Black Kite (*Milvus migrans*), Black-winged Kite (*Elanus caeruleus*), Common Kestrel (*Falco tinnunculus*), Shikra (*Accipiter badius*), Short-toed Snake-Eagle (*Circaetus gallicus*), Spotted Owlet (*Athene brama*), White-eyed Buzzard (*Butastur teesa*)] species were also observed in the study area (***Table 4-30***). The survey was conducted in mid of March 2023, which is not a good time to record the movement of migratory birds. Thus, based on this primary observation, it may not be concluded that the area has not been supporting migratory bird species in the winter. One Near Threatened (IUCN Red List) herpetofauna - Red Sand Boa (*Eryx johnii*); two Schedule I herpetofauna [Bengal Monitor Lizard (*Varanus bengalensis*), & Desert Monitor Lizard (*Varanus griseus*)]; and one Schedule I mammal [Chinkara (*Gazella bennetti*)] were also observed/reported from the study area, utilizing the existing vegetation for their food and shelter.

Control Measures planned for the Project

According to the discussion with the project officials, the clearance of vegetation will be limited to the project area and transmission towers.

Impact Magnitude

During the construction phase, the land use of 1700 Acres area will be changed for the project life, thus the **Duration** has been Permanent. As the vegetation clearance will be performed only in the project boundary and the area required for transmission towers, the **Spread** has been classified as local. The **Intensity** has been classified as moderate as the habitat of the reseptor species will be modified and loss due to vegetation clearance permanently. Thus, the impact magnitude has been classified as ***Small*** based on the impact significance criteria (***6.4.2***).

Proposed Mitigation Measures

The mitigations proposed to minimize the impact(s) on Habitat and Species have been given as,

- Vegetation clearance activities should be restricted within the project site and transmission towers
- Vegetation of the project surrounding area should be returned to the pre-construction state, after completion of construction activities
- The area for the storage yard and other supplementary facilities should be selected away from any water body, canal, etc.
- Unnecessary disturbance of neighboring vegetation due to off-road vehicular movement, fuel wood procurement, and destruction of floral resources should be prohibited
- There should be a ban on the use of woody plants as kitchen fuel, collected from the nearby areas

	Nature of Impact	Spread of Impact	Duration	Intensity	Receptor Vulnerability	Significance of Impact
Without Mitigation Measures	Negative	Local	Permanent	Moderate	Medium (Habitat) Medium (Species)	**Small**
With Mitigation Measures	Negative	Local	Permanent	Moderate	Medium (Habitat) Medium (Species)	**Small**

6.6.1.2 Impacts on the Habitat and Species due to Construction Activites

Construction of substations, labor camps and transmission towers; installation of solar panels and power lines; increases movement of people and goods; noise; and the potential for sedimentation/pollution of water resources due to excavation and filling operations in the study area. These activities are evaluated in terms of habitat and species disturbance. Excavation for construction activities directly impacts burrowing fauna, such as white-footed foxes, and indirectly impacts flora and fauna through changes in soil properties. There is a possibility, that the anthropogenic migration has resulted in increased stress on the fauna of the region, requiring them to remain vigilant for extended periods of time, preventing proper reproduction, nesting, mating, socialization, and foraging. Anthropogenic movements (transportation of people and goods) and noise from construction activities can also disturb the fauna of the surrounding area.

The site is pre-dominated by *Acacia nilotica* (L.) Delile, *Aerva javanica* (Burm.f.) Shult., *Calotropis procera* (Aiton) Dryand., *Capparis decidua* (Forssk.) Edgew., *Citrullus colocynthis* (L.) Schrad., *Leptadenia pyrotechnica* (Forssk.) Decne., *Prosopis cineraria* (L.) Druce (=Khejri), and *Ziziphus nummularia* (Burm. f.) Wight & Arn. No floral species of conservation importance was identified in the study area.

One Endangered (IUCN Red List) [Egyptian Vulture (*Neophron percnopterus*)], two Near Threatened [Laggar Falcon (*Falco jugger*), & Painted Stork (*Mycteria leucocephala*)]; 7 Schedule I (Wildlife (Protection) Act, 1972) [Black Kite, Black-winged Kite, Indian Peafowl, Laggar Falcon, Shikra, Short-toed Snake-Eagle, & White-eyed Buzzard]. Three (03) Migratory**,** one Vulture - Egyptian Vulture (*Neophron percnopterus*) and 07 Raptors [Black Kite (*Milvus migrans*), Black-winged Kite (*Elanus caeruleus*), Common Kestrel (*Falco tinnunculus*), Shikra (*Accipiter badius*), Short-toed Snake-Eagle (*Circaetus gallicus*), Spotted Owlet (*Athene brama*),

White-eyed Buzzard (*Butastur teesa*)] species were also observed in the study area (***Table 4-30***). The survey was conducted in mid of March 2023, which is not a good time to record the movement of migratory birds. Thus, based on this primary observation, it may not be concluded that the area has not been supporting migratory bird species in the winter. One Near Threatened (IUCN Red List) herpetofauna - Red Sand Boa (*Eryx johnii*); two Schedule I herpetofauna [Bengal Monitor Lizard (*Varanus bengalensis*), & Desert Monitor Lizard (*Varanus griseus*)]; and one Schedule I mammal [Chinkara (*Gazella bennetti*)] were also observed/reported from the study area, utilizing the existing vegetation for their food and shelter.

Control Measures planned for the Project

According to the discussion with the project officials, the workers and supervisors will receive internal and external training on wildlife encounter situations and the do's and don'ts of dealing with these situations. The labor camps, mixing plants and equipment storage sites (if located outside the project boundary) will be selected away from the water resources to avoid any deposition/contamination.

Impact Magnitude

During the construction phase, the above-mentioned activities will be performed for a limited period i.e. 6 months each for Phase I and Phase II, thus the **Duration** has been short. As the construction activities will be performed in the project boundary, labor camps, mixing plants and equipment storage sites, the **Spread** has been classified as medium. The **Intensity** has been classified as moderate as the numbers of species are inhabiting the area impacted by the construction activities. Thus, the impact magnitude has been classified as ***Substantial*** based on the impact significance criteria (***6.4.2***).

Proposed Mitigation Measures

The mitigations proposed to minimize the impact(s) on Habitat and Species have been given as,

- Night-time (6:00 pm to 6:00 am) construction and transportation activities should be avoided
- The areas of high animal activity, such as forests and water bodies the construction and transportation activities should be avoided during dawn (6:00 am to 7:30 am) and dusk (5:00 pm to 6:30 pm)
- Hazardous materials should be avoided to store near water bodies and drains
- Sites with existing burrows or roosts should be avoided where possible, and temporary fencing should be installed over excavated areas
- Efforts should be made to minimize construction noise and sound barriers should be considered if noise levels are high
- Construction activities must implement proper housekeeping, properly dispose of discarded packaging materials, and provide labor camps with adequate sanitary facilities
- Movement of workers between camps and construction sites should be restricted and they should not be allowed to visit in natural areas not included the planned construction activities

	Nature of Impact	Spread of Impact	Duration	Intensity	Receptor Vulnerability	Significance of Impact
Without Mitigation Measures	Negative	Medium	Short	Moderate	Medium (Habitat) Medium (Species)	**Substantial**
With Mitigation Measures	Negative	Local	Short	Moderate	Medium (Habitat) Medium (Species)	**Small**

6.6.2 Operation Phase: Impact Assessment

6.6.2.1 Collision and Electrocution Risk due to the Power Transmission, etc.

In any power generation project, collision and electrocution are the universally recognized risks due to the transmission infrastructures. Several species of birds tend to perch on wires and towers/poles in the area. It has been observed across power projects globally that avifaunal species utilize the transmission towers/poles for nesting, hunting prey or using the height of the manmade structure as a lookout for predators. These transmission lines and towers/poles can potentially constitute an electrocution and collision hazard to birds (specifically for the larger wingspan birds). During the ecological survey, several species

of birds were found perching on existing wires and poles in the study area. A 10.5 km long route of 220 kV transmission line (TL) with 50 transmission towers can possibly constitute electrocution and collision risks to birds.

The baseline suggests the presence of three[47] Critically Endangered (IUCN Red List) Indian Vulture (*Gyps indicus*), Red-headed Vulture (*Sarcogyps calvus*), & White-Rumped Vulture (*Gyps bengalensis*)]; four Endangered (IUCN Red List) [Egyptian Vulture *(Neophron percnopterus*), Pallas's Fish-eagle (*Haliaeetus leucoryphus*), Saker Falcon (*Falco cherrug*), & Steppe Eagle (*Aquila nipalensis*)]; eight[48] Vulnerable (IUCN Red List) [Common Pochard (*Aythya ferina*), Eastern Imperial Eagle (*Aquila heliacal*), Greater Spotted Eagle (*Clanga clanga*), Indian Spotted Eagle (*Clanga hastata*), River Tern (*Sterna aurantia*), Tawny Eagle (*Aquila rapax*), White-browed Bushchat (*Saxicola macrorhynchus*), & Yellow-eyed Pigeon (*Columba eversmanni*)]; and 31 Schedule I (Wildlife (Protection) Act, 1972) [Black Kite, Black-winged Kite, Bonelli's Eagle, Booted Eagle, Brahminy Kite, Changeable Hawk-Eagle, Crested Serpent-Eagle, Eastern Imperial Eagle, Eurasian Buzzard, Eurasian Sparrowhawk, Eurasian Spoonbill, Greater Spotted Eagle, Hen Harrier, Indian Peafowl, Laggar Falcon, Long-legged Buzzard, Montagu's Harrier, Oriental Honey-buzzard, Osprey, Pallas's Fish-eagle, Pallid Harrier, Peregrine Falcon, Red-necked Falcon, Saker Falcon, Shikra, Short-toed Snake-Eagle, Steppe Eagle, Tawny Eagle, Western Marsh-Harrier, White-eyed Buzzard, & White-tailed Eagle] species from the region. The secondary data also suggests the presence of at least 144 migratory birds, 07 vultures, and 40 raptors from the region.

Control Measures planned for the Project

No information available.

Impact Magnitude

During the operation phase, power evacuation will remain till the life of the project, thus the **Duration** has been permanent. As the length of the 220 kV transmission line is 10.5 km with 50 transmission towers, the **Spread** has been classified as medium. The **Intensity** has been classified as high as the numbers and ecological significance of species under the risk of collision and electrocution. Thus, the impact magnitude has been classified as ***Major*** based on the impact significance criteria (***6.4.2***).

Proposed Mitigation Measures

The mitigations proposed to minimize the impact(s) on bird species have been given as,

- Cross arms transmission tower, suspended insulators, and insulated jump connectors (at least 60 cm in length) should be utilized
- Bird diverters / diffractors, and perch rejecters should be applied[49]
- Frequent checking of the transmission towers to avoid bird nesting
- Disposal of corpses near project components (solar plants and power lines) should be restricted; and carcasses observed around project components should be immediately removed to avoid attracting vultures and raptors
- A Bird Survey, specifically in the migratory season may provide more site-specific information about the presence and movement of migratory and other sensitive avifaunal species

	Nature of Impact	Spread of Impact	Duration	Intensity	Receptor Vulnerability	Significance of Impact
Without Mitigation Measures	Negative	Medium	Permanent	High	High (Species)	**Major**
With Mitigation Measures	Negative	Medium	Permanent	Moderate	High (Species)	**Substantial**

[47] Among the Critically Endangered bird species, the presence of Sociable Lapwing (*Vanellus gregarious*)] in the study area is unexpected, because the species has not been reported from the 50 km buffer from the project area.

[48] As per the available secondary information and consultations, it may be anticipated that the Asian Houbara (Chlamydotis macqueenii) - Vulnerable has been recorded only from the Jorbeed Conservation Reserve up to 2018. Thus, the presence of this vulnerable species (Asian Houbara) is also unexpected in and around the study area.

[49] Galis, M. and Sevcik, M. (2019) Monitoring of effectiveness of bird flight diverters in preventing bird mortality from powerline collisions in Slovakia. *Raptor Journal* 13: 45–59.

6.6.2.2 Human-Wildlife Conflicts

The project is coming on the modified habitats, at the same time natural and modified habitats are present within the 5 km buffer from the project boundary. These habitats support several herpatofauna, avifauna, and mammals (as described in the ecological baseline). The species that can climb, jump or fly over the walls can also enter the compound. Solar modules or other obstacles can injure wildlife and may also cause human-wildlife conflicts.

As per the baseline, two Schedule I reptiles, Bengal Monitor Lizard (*Varanus bengalensis*) and Desert Monitor Lizard (*Varanus griseus*) (Wildlife (Protection) Act, 1972) and three mammals, Chinkara (*Gazella bennetti*), Indian Grey Mongoose (*Herpestes edwardsii*), Jungle Cat (*Felis chaus*), & White-footed Fox (*Vulpes vulpes pusilla*) are capable to climb/jump and thus can enter within the project compound.

The Lizards mentioned above can climb over the wall and can also enter the project compound through the holes in the wall. Chinkara, Jungle Cat and White-footed Fox can jump over the wall and enter the project compound. Access of these wildlife during operation phase may cause a risk of Human-Wildlife conflicts. Beside these species, Indian cobra (*Naja naja*), Red Sand Boa (*Eryx johnii*), & Saw-scaled Vipers (*Echis carinatus*) were also reported from the study area which can also access the project boundary.

Control Measures planned for the Project

No information available.

Impact Magnitude

As the project will be established for a long time, thus the **Duration** has been permanent. As the impact is restricted within the footprints of the Project boundary or within 500 m of the boundary wall, the **Spread** has been classified as local. The **Intensity** has been classified as moderate as the numbers and ecological significance of species under the risk. Thus, the impact magnitude has been classified as ***Small*** based on the impact significance criteria (***6.4.2***).

Proposed Mitigation Measures

The mitigations proposed to minimize the impact(s) on bird species have been given as,

- Regular checking of the boundary wall to avoid any space for wildlife entrance into compound
- Good housekeeping practices and regular removal of grass and ground vegetation in the project compound could help to reduce the faunal attraction
- Bird detractors such as scarecrows or moving clothes could be installed around the solar modules to prevent avifauna from venturing close

	Nature of Impact	Spread of Impact	Duration	Intensity	Receptor Vulnerability	Significance of Impact
Without Mitigation Measures	Negative	Local	Permanent	Moderate	Low (Species)	**Small**
With Mitigation Measures	Negative	Local	Permanent	Low	Low (Species)	**Small**

6.7 Impacts on Socio- Economics

The socio-economic assessment would be carried out in the given below criteria for all the phases of the Project including:

- Pre-construction (planning) phase
- Construction Phase
- Operation Phase

6.7.1 Impact during Planning Phase

6.7.1.1 Leasing out of Private Land

The private land identified for the solar power plant comprises of 1700 acre of leasing. Since the land belongs to the biogeographical province classified as Desert, the soil is mostly sandy desert type with poor productivity and therefore, agriculture if undertaken, is only for subsistence and irrigation is mostly rainfed. It is understood through the interaction with the landowners, the lease rent will provide the long term assured income and will be an additional cushion to the livelihood earning and will also help in paying out of debts if any. Thus, it is understood that land lease will have a positive impact on the landowners and land lease will not change the ownership on the land, even the land is taken by the project on lease, the land ownership still will remain with landowners.

Furthermore, the area surrounding the leased land for project would still be used for cultivation and local livelihood purposes (as it was there in the pre-project phase) in future and the project will not restrict access or make accessibility difficult for the local community, livestock, etc. especially during the construction phase.

The impact is related to the land related human rights of local community[50]. The human rights aspects of land affect issues including poverty reduction and development, right to earn a livelihood, rural planning, freedom of residence and settlement, to name but few.

Control Measure adopted

As per the consultation with landowner and project land team, the land lease rate was established based on consultation and fair negotiation with landowners.

Impact Magnitude

The impact magnitude of the land lease is evaluated to be of **substantial**.

Proposed Mitigation Measures

- Timely sharing of project related information with all relevant stakeholders
- Provision of Grievance Redressal Mechanism (GRM) to all impacted stakeholders to raise and register their grievances

	Nature of Impact	Spread of Impact	Duration	Intensity	Frequency	Receptors' Vulnerability	Magnitude of Impact
Without Mitigation Measures	Positive	Local	Permanent	**Moderate to High**	**Routine**	**Medium**	**Substantial**
With Mitigation Measures	Positive	Local	Permanent	**Moderate to High**	**Routine**	**Medium**	**Substantial**

6.7.2 Impact during Construction Phase

6.7.2.1 Impact on local community and agricultural field due to proposed transmission line

- The transmission line (11 Km approx.) will result in economic displacement[51] during the construction of transmission line's towers. As the construction of transmission line (especially tower) will obstruct the usage of the resource (agricultural land) to the project Impacted Households (PAHs) and will also result in loss of standing crops. The impact duration will be for short period of time and may remain for six (6) months (the one agriculture season takes 3 to 4 months).
- The Project Affected Households (PAHs) will suffer from the temporary loss of agriculture land under the footprint of transmission line's tower. As per rough estimates The average area of a tower digging is 8 m x 8 m = 64 m^2[52] per each tower –

[50] In the local context, the land is not a mere commodity, but an essential element for the realization of many human rights. Local communities considered land as linked to peoples' identities, and so is tied to social and cultural rights. For many people, land is a source of livelihood and is central to economic rights.
[51] Economic displacement – Loss of income streams or means of livelihood resulting from obstructed to resource (land) resulting from construction of transmission line.
[52] The area of tower will depend on the type of tower, the illustration is given for understanding purpose as the design is yet to be finalized therefore the actual requirement of land may differ.

total 50 towers will be installed along the transmission and the total land falling under the tower footprint is 3200 m^2 (0.32hectare).
- The stringing of transmission line will not result in obstruction of resource (agriculture land). However, the stringing will result in loss of standing crops
- The impact is related to the land related human rights of local community. The human rights aspects of land affect issues including poverty reduction and development, right to earn a livelihood, rural planning, freedom of residence and settlement, to name but few.

Control Measures Planned for the Project

Payment to landowners for obtaining the easement rights of transmission line, shall be made in compliance with the "Guidelines for payment of compensation towards damages in regard to the Right of Way for transmission lines"

Impact Magnitude

The impact magnitude of the land lease is evaluated to be of **small to negligible**, due to nature of the agricultural land and low crop yield in the area.

Proposed Mitigation Measures

The proposed mitigation measures to mitigate the impact, are provided below:

- Procure the land in accordance with the applicable reference framework of this report
- The project shall not adopt any lawful expropriation for procurement of land
- The purchase rate shall be decided in negotiation with landowners and shall be in accordance with the market rate of the similar type of land and in compliance with the Ministry of Power issued – "Guidelines for payment of compensation towards damages in regard to Right of Way for transmission line"
- If any of the land parcel belongs to women landowner, market-based compensation shall be paid to the actual women owner of the land, not to their male counterparts. Moreover, if any land parcel belongs to minor (under 18), compensation to the right person shall be paid as per India law in this regard to avoid discrimination of vulnerable groups
- Construction of transmission line during the non-crop cultivation person i.e., May and June – so that the construction will not result in loss of standing crops
- Timely sharing of project related information with all relevant stakeholders
- Provision of Grievance Redressal Mechanism (GRM) to all impacted stakeholders to raise and register their grievances

	Nature of Impact	Spread of Impact	Duration	Intensity	Frequency	Receptors' Vulnerability	Magnitude of Impact
Without Mitigation Measures	Negative	Local	Short	**Insignificant**	**Intermittent**	**Medium**	**Small**
With Mitigation Measures	Negative	Local	Short	**Insignificant**	**Intermittent**	**Low**	**Negligible**

6.7.2.2 Impact due to Migrant workers

The project will employee skilled, semi-skilled and unskilled workers which include contractual and regular employees as well as local and Migrant workers. The regular skilled workers comprise of migrant workers, from different districts and states in the country depending upon the need for technical expertise. Semi-skilled/unskilled laborer can be hired locally from the project village and the AoI villages. The details regarding the workforce of the Project site are estimated to ~1000 -1200 contractual workers, however, bifurcation of number in between skilled, semi-skilled and unskilled, and migrant and local is not known at this stage of pre-construction phase of the project.

The labour influx is likely to create the following issues:

- As informed most of the labour will be accommodated in the near by villages however if required, labour camps may be built during the construction phase for the migrant workers

- Labour influx in the village will add pressure to their resources, especially to already scarce water
- Labour influx may add health and safety risks for the villagers
- This may impact human rights related to violation of the right to non-discrimination in the local area in the process of employment. The employment process of the local community in the plant can violate the human rights of non-discrimination, corruption, accountability and transparency.

Control Measures Planned for the Project

The project as part of its sub-contractor agreement, will require EPC to have an EHS plan (including government mandated COVID-19 guidelines) in place, as well as procedures for monitoring the EHS performance of contractors shall be adopted by the project .

Impact Magnitude

The intensity of the impact is evaluated as **substantial to small**

Proposed Mitigation Measures

The intensity of labour influx and welfare is understood to be **low**, and hence the following measures should be put in place to ensure that the local community's safety and convenience, as well migrant labour welfare is maintained:

- The accommodation facility for regular employees should be constructed to meet the requirement of IFC worker camp recommendation guideline
- Regular monitoring and auditing mechanism should be in place for monitoring the sub-contractors and suppliers with respect to compliance to IFC PS 2 requirements, in terms of resource, migrant workers, child labour and forced labour, health and safety, payment of wages, etc.
- The Project shall provide training or induction program related to the gender sensitization and gender-based violence to all employees at the time of commencement of their job
- Provide training to all female and male workers (contracted or migrant) during their commencement of job on POSH policy and procedure of filling of complaint. Further, refresher training shall be given in every quarter to each female and male worker

	Nature of Impact	Spread of Impact	Duration	Intensity	Frequency	Receptors' Vulnerability	Magnitude of Impact
Without Mitigation Measures	Negative	Medium	Short	**Insignificant**	**Intermittent**	**High**	**Substantial**
With Mitigation Measures	Negative	Medium	Short	**Insignificant**	**Intermittent**	**Medium**	**Small**

6.7.2.3 Stress on Local Community

The community resources, water resources and roads will be the prime receptors for the impact caused by project activities. The project related construction activities are understood to span across eight (8) months and would require water for drinking, cooking and sanitary purposes. As reported by the project site team and local community, construction water requirement will be met through water tankers (fetch from the local pond). The water consumption during construction phase will put stress on water resources (specially on local pond) used for tanker water supply.

Impact Magnitude

The impact magnitude from the above activities is understood to be **substantial to small** – as the construction period is for short duration.

Proposed Mitigation Measures

- There shall be worker code of conduct defined by the Project that will prevent workers and contractors from using the local resources like water, fuel wood which will be shared with contractors and their workers
- An induction season will be organized for the migrant workers where they will be sensitized on the Do's and Don'ts during their stay near project location, which would include aspects on conservation of community's resources
- Project to identify alternate sources of water abstraction such as water tankers from different villages to minimize dependency on single village
- Periodic maintenance activities for roads used for transportation of goods for the project shall be undertaken by the Project, through its contractor (if any impact due to construction activity)
- Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievance on misuse of locally available resources

	Nature of Impact	Spread of Impact	Duration	Intensity	Frequency	Receptors' Vulnerability	Magnitude of Impact
Without Mitigation Measures	Negative	Medium	Short	**Low**	**Intermittent**	**Medium**	**Substantial**
With Mitigation Measures	Negative	Medium	Short	**Insignificant**	**Intermittent**	**Low**	**Small**

6.7.2.4 Impact on Economy and Employment

The higher presence casual laborer amongst local community was also established during consultations (due to consistent drought in the area and less productive agricultural land). In the absence of industrial area or any major industries or any industrial activity in the study area, people in several villages have no source of income to support their family or have to migrate to other places to find work. The construction phase will generate employment for unskilled and semi-skilled labour, giving local community an opportunity to be involved during this phase.

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

- Civil work during construction phase including, construction of boundary walls and other works
- Self-employment options for individuals possessing vocational or technical training skills like electricians, welders, filters etc.
- Contracting opportunities for locals possessing tractors, dumper trucks or their vehicles which would be needed to carry away excavated soil and other material. Creation of indirect employment for local community through establishing small shop like tea stalls, supply of intermediate raw materials, repair outlets, hardware stores etc. However, these are likely to be temporary
- Additionally, there would be some skilled labour required that would be brought in from other state (if not present in the local area) that would also lead to spike in economic activity in the area, during construction phase. This would lead to better business opportunities for smaller vendors in the area owning petty shops, petty contractors' firms, etc. for providing essential goods and services to the Project

Control Measure adopted

As gathered information from consultations with project team, a significant segment of labour requirement during the construction phase will be sourced locally.

Impact Magnitude

The magnitude of the impact is evaluated as **substantial**

Proposed Mitigation Measure proposed for the Project

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

- Preference should be provided to local labour. However, the preference shall be based on available skillset and knowledge
- Project shall provide equal access to both female and male local population in available employment opportunities and for greater employability of local residents, technical/vocational training may be arranged for female and male, if required
- The project proponent will establish a mechanism to audit sub-contractors and suppliers with respect to compliance of utilizing local labour and resources, especially from households whose livelihoods are impacted due to project related activities

	Nature of Impact	Spread of Impact	Duration	Intensity	Frequency	Receptors' Vulnerability	Magnitude of Impact
Without Mitigation Measures	Positive	Local	Permanent	**Moderate to High**	**Routine**	**Medium**	**Substantial**
With Mitigation Measures	Positive	Local	Permanent	**Moderate to High**	**Routine**	**Medium**	**Substantial**

6.7.2.5 Labour Rights and Welfare

The project will employ skilled, semi-skilled and unskilled workers, across the project lifecycle, which will include contractual and regular employees and local and migrant workers. The regular skilled workers are likely to be comprised of migrant workers, from different districts and states in the country, depending upon the need for technical expertise.

Impact Magnitude

The intensity of the impact is evaluated as **Major to Small**

Proposed Mitigation Measures

The following proposed mitigation measures are suggested in order to ensure compliance with labour laws/provisions as pr the industry best practices:

- The labour accommodation facility for contractual workers and as well as for regular employees should meet the requirements of the applicable reference framework in terms of space per worker, water and sanitation facilities, first aid, lighting and ventilation etc. and regular monitoring should be undertaken to ensure compliance through the project lifecycle
- Project should also ensure a monthly and regular auditing mechanism for monitoring the sub-contractors and suppliers with respect to compliance to the applicable reference framework, in terms of resources, migrant workers, child labour and forced labour, health and safety, payment of wages etc.
- Project shall also establish provisions related to non-employment and abolition of any form of child labour and forced labour in the contractual agreement with suppliers and as well as contractors
- Establish a grievance redressal mechanism in place, to allow for the employees and workers, and workers employed by supplier to report any concern or grievance related to work activities
- Further, to ensure the labour rights and welfare, the project shall implement ILO's fundamental instruments ratified by India:
    - Forced Labour Convention
    - Abolition of Forced Labour Convention
    - Minimum age convention
    - Worst Form of Child Labour Convention
    - Equal Remuneration Convention
    - Discrimination (Employment and Occupation) Convention
    - Occupational Safety and Health Convention

	Nature of Impact	Spread of Impact	Duration	Intensity	Frequency	Receptors' Vulnerability	Magnitude of Impact
Without Mitigation Measures	Negative	Local	Short	**High**	**Routine**	**High**	**Major**
With Mitigation Measures	Negative	Local	Short	**Moderate**	**Routine**	**Medium**	**Small**

6.7.2.6 Occupational Health and Safety

During construction phase, potential occupational health and safety risks are envisaged from the following activities:

- Fall from height during erection of transmission towers and establishment of transmission lines;
- Physical hazards during construction of support structure for PV module requiring operation of pile drivers;
- Risks while working in confined spaces at pooling substation or excavated areas;
- Fire hazards while handling oils and chemicals and due to operation of cranes and other mechanical lifting equipment;
- Respiratory problems due to dust emissions from construction site;
- Hearing problems due to high noise level at construction site and batching plant (if installed);
- Accidents due to hit by construction vehicles deployed at site;
- Exposure to extreme heat while working at site during summers;
- Electrocution while working with live electrical components – transmission towers, lines and internal electrical parts;
- Diseases due to unhygienic conditions at site including contaminated drinking water for workers.

Note: The occupational health and safety concerns mentioned above will be consistent during decommissioning phase and therefore the impacts would be similar in nature. Thus, no separate impact on occupational health and safety during decommissioning phase has been presented.

Control Measures for the Project

As part of HSSE agreement with EPC contractor, the EPC contractor will b be required to adhere to PGPL's Group level HSSE policy. Additionally, the contractor will be required to develop site specific HSSE plan in line with PGPL's HSSE Obligations for EPC contractor" document. The HSSE plan shall include (but not limited to) the following

- Pre-Job HSSE Planning Process
- Hazard Identification and Risk Assessment
- Personal Protective Equipment Program
- Permit to Work System
- EHS Training records
- Incident Reporting and Investigation
- Emergency Response Plan

Additionally, BRIPL has HSSE clauses for security contractors which will be applicable to the PGPL site.

Impact Magnitude

Since occupational health and safety risks will be confined to project site and along the transmission route, the spread has been categorized as local. Furthermore, since the construction phase will last for limited period of time, the occupational health and safety risks during construction phase will be also limited i.e., 6 months each for Phase I and Phase II, therefore, the impact duration has been classified as short. The intensity has been classified as high, as though PGPL has its own HSSE policies in place at the corporate level that will be implemented at the site along with contractor's HSSE plans, however any hazard, if occurred will lead to adverse impact on the workers. Therefore, the impact magnitude has been classified as **Substantial.**

According to ***Table 6-5*** the workers at construction site may be exposed to possible fire hazards, physical hazards, and chemical hazards, if adequate training, awareness and management measures are not communicated to the workers. Therefore, the probability of incidence occurrence has been categorized as ***unexpected to possible.***

Proposed Mitigation Measures

- 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
- A site specific training calendar should be developed and implemented onsite
- 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
- Safe drinking water supply should be provided for the workers
- An up-to-date first aid box should be provided at all construction sites and a trained person should be appointed to manage it
- All equipment should be turned off and checked when not in use
- A site specific safety or emergency management plan should be in place to account for natural disasters, accidents and any emergency situations. The nearest hospital, ambulance, fire station and police station should be identified in the implemented emergency management plan
- All construction activities (to the extent possible) should be carried out during daytime hours and vigilance should be maintained for any potential accidents
- Personal Protective Equipment (PPEs) including safety shoes, helmet, goggles, ear muffs and face masks should be provided to the workers. A PPE inventory should be maintained onsite
- Structural integrity should be checked before undertaking any work
- Electrical and maintenance work should not be carried out during poor weather
- Excavated areas should be temporarily fenced to avoid access to outsiders and wildlife.

	Nature of Impact	Spread of Impact	Duration	Intensity	Frequency	Probability of Incidence Occurrence	Significance of Impact
Without Mitigation Measures	Negative	Local	Short	High	Routine	**Unexpected to Possible**	**Substantial**
With Mitigation Measures	Negative	Local	Short	Moderate to Low	Routine	**Unexpected**	**Small to Negligible**

6.7.2.7 Community Health and Safety

The receptors for impacts on community health and safety include project settlements in the close proximity of the project site (within 500 m) and transmission line (within 100 m from the centerline), 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 such as exposure to fire hazards, accidents, communicable diseases etc. There are no settlements located within 500 m of the project site. The nearest settlement is Kawani village located ~ 600 m (aerial distance) from site towards north west direction. However, since the Project is located in both the sides of Kawani Gram Panchayat Road which is used by local community for commuting purpose, therefore, local community is anticipated to be impacted due to traffic movement, dust emissions, noise emissions, fire hazards etc. while commuting from Kawani Gram Panchayat road and during construction work along the transmission route.

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 community health and safety hazards during the construction, and operation of solar power projects are generally similar to those of most large infrastructure projects though the scale of activities are considerably less.

The community 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. Thus, community health and safety during operation and decommissioning phase has not been separately presented in this ESIA report.

Control Measures for the Project

As reported, PGPL at the corporate level has documented HSSE Policy which provides Project Company's commitment towards ensuring safety, security and environmental performance at project site along with building positive relationships with communities. The Policy will be applicable to the Project, contractors and sub-contractors. PGPL will also be involved in monitoring of the Project activities to ensure that the requirements of their health and safety standards are met.

Impact Magnitude

Since the community health and safety risks will be present throughout the project lifecycle, the duration has been assessed to be long. The community health and safety risks will be confined to settlements located within 500 m of the project site and along the transmission route and access road. However, since the nearest settlement is located 600 m from site, impact on settlement is assessed to be limited but the Kawani gram panchayat road will be used by the project team as well as local community for commuting and transportation purpose which may be exposed to health and safety risk during the project lifecycle. Therefore, the spread and intensity has been assessed to be local and moderate. Therefore, the impact magnitude has been categorized as **Small** and the receptor vulnerability has been classified as **Medium.**

Proposed Mitigation Measures

- Ensuring that the sub-contractor agreements require all contractors to possess an HSSE plan with provisions for monitoring of the EHS performance of contractors and their workers
- Safety Sign Boards in Local Language should be installed in and around the project site especially near the gram panchayat road.
- 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
- As part of stakeholder engagement, the project will also propagate health awareness amongst the community, including setting up of health camps
- The traffic movement for the project in the area will be regulated to ensure road and pedestrian (including livestock) safety
- A traffic management plan should be developed identifying routes for transportation of materials onsite, measures for safe driving etc.
- The workers (both regular and contractual) on the project will be provided with trainings on the Health and Safety policy in place, and their role in the same and refresher courses will be provided throughout the life of the project
- A site specific grievance redressal mechanism in line with Brookfield's grievance redressal mechanism should be developed to allow for the workers and community members to report any concern or grievance related to project activities
- Emergency Scenarios and Response Actions should be communicated to nearby communities.

	Nature of Impact	Spread of Impact	Duration	Intensity	Frequency	Receptors' Vulnerability	Significance of Impact
Without Mitigation Measures	Negative	Local	Long	Moderate	Routine	**Medium**	**Small**
With Mitigation Measures	Negative	Local	Long	Moderate	Routine	**Small**	**Small**

6.7.3 Impact during Operation Phase

6.7.3.1 Occupational Health and Safety

During operation phase, potential occupational health and safety risks are envisaged from the following activities:

- Accidents due to hit by O&M vehicles deployed at site
- Physical hazards during manual grass cutting activities
- Fire hazards at SCADA room, circuit box, solar PVs etc.
- Electrocution while working with live electrical components – transmission towers, lines and internal electrical parts
- Diseases due to unhygienic conditions at site including contaminated drinking water for workers
- Fall from height during maintenance or repairing of transmission towers

Control Measures for the Project

As part of HSSE agreement with O&M contractor, the contractor will b be required to adhere to PGPL's Group level HSSE policy. Additionally, the contractor will be required to develop site specific HSSE plan in line with PGPL's HSSE Obligations for contractor" document. The HSSE plan shall include (but not limited to) the following

- Pre-Job HSSE Planning Process
- Hazard Identification and Risk Assessment
- Personal Protective Equipment Program
- Permit to Work System
- EHS Training records
- Incident Reporting and Investigation
- Emergency Response Plan

Impact Magnitude

Since occupational health and safety risks will be confined to project site and along the transmission route, the spread has been categorized as local. Furthermore, since the operation phase will last for longer period of time i.e.25 years, the duration of occupational health and safety risks during operation has been classified as long and the intensity has been classified as moderate, Therefore, the impact magnitude has been classified as **Substantial**.

According to ***Table 6-4,*** the workers at construction site may be exposed to possible fire hazards, physical hazards, and chemical hazards, if adequate training, awareness and management measures are not communicated to the workers. Therefore, the probability of incidence occurrence has been categorized as ***unexpected to possible.***

Proposed Mitigation Measures

- 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
- A site specific training calendar should be developed and implemented onsite
- Appropriate safety harnesses and lowering/raising tools should be used for working at heights
- Adequate fire safety system including fire extinguishers, sand buckets should be provided on site
- Safe drinking water supply should be provided for the workers
- An up-to-date first aid box should be provided at site and a trained person should be appointed to manage it
- A site specific safety or emergency management plan should be in place to account for natural disasters, accidents and any emergency situations. The nearest hospital, ambulance, fire station and police station should be identified in the implemented emergency management plan
- Personal Protective Equipment (PPEs) including safety shoes, helmet, goggles, ear muffs and face masks should be provided to the workers. A PPE inventory should be maintained onsite
- Electrical and maintenance work should not be carried out during poor weather
- Annual health checkup of workers should be undertaken

	Nature of Impact	Spread of Impact	Duration	Intensity	Frequency	Probability of Incidence Occurrence	Significance of Impact
Without Mitigation Measures	Negative	Local	Long	Moderate	Routine	**Unexpected to Possible**	**Substantial**
With Mitigation Measures	Negative	Local	Short	Moderate to Low	Routine	**Unexpected**	**Small to Negligible**

6.7.4 Impact during Decommissioning Phase

6.7.4.1 Impact on Local Economy and Employment

As the project is having high potential for local employment and additional source of income for the landowners the decommissioning of the project will potentially have impacts on the following aspects:

- Loss of technical and not technical jobs including contractual jobs such as grass cutters, security guards and cleaners.
- Loss of local revenue from the project given in form of tax to local authorities
- Loss of local livelihood and rental income to the landowners etc.

Impact Magnitude

The magnitude of the impact is evaluated as **substantial**

Proposed Mitigation Measure proposed for the Project

- In case of decommissioning project should withdraw its operations in phase wise manner
- Employees including subcontracted staff should be informed about the decommissioning schedule
- Develop retrenchment policy for the staff and contracted workers
- Deploy the staff to other locations
- Advance notice to the landowners informing them the lease exit/ termination process and assist them to mutate the land in their land parcels.

	Nature of Impact	Spread of Impact	Duration	Intensity	Frequency	Receptors' Vulnerability	Magnitude of Impact
Without Mitigation Measures	Negative	Local	Permanent	**High**	**Once**	**Medium**	**Substantial**
With Mitigation Measures	Negative	Local	Permanent	**High**	**Once**	**Medium**	**Substantial**

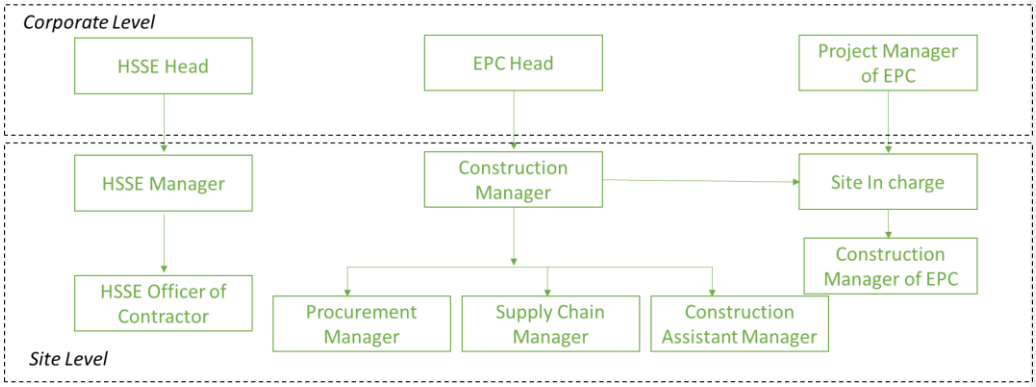
7. Environment & Social Management and Monitoring Plan

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 project lifecycle. 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 with the applicable reference standards which emphasizes the importance of managing social and environmental performance throughout the lifecycle of the Project.

7.1 Organizational Structure

The project specific organisation structure is yet to be developed by the PGPL Project team. However, based on discussion with onsite team of PGPL, a tentative organisation structure has been presented in ***Figure 7-1***.

Figure 7-1: Tentative Organizational Structure



Source: Discussion with onsite PGPL Team

7.1.1 Roles and Responsibilities

An outline for responsibilities of the proposed Project HSSE Manager is given below

- Preparation of required documents on environmental and social management.
- Ensuring availability of resources and appropriate institutional arrangements for implementation of ESMP.
- Implementation of 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 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

7.2 Existing Policies

7.2.1 Health, Safety, Security and Environment (HSSE) Policy

Brookfield Renewable India at the corporate level has a dedicated HSSE Policy which is duly signed by the Chief Executive Officer (CEO). The policy applies to Brookfield Renewable India's operations, employees and contractors working or engaged by Brookfield across all its locations including the proposed project. The key commitments of the HSSE Policy are as follows:

- Respect and protect natural environment and minimize any impact by undertaking activities in a sustainable manner
- Respect and value employees and contractors and work together as a team to forge a strong proactive safety culture
- Build positive relationships with communities in which it operates
- Protect our people, property, reputation and sensitive information
- Comply with applicable government regulations, adopt high quality international standards and relevant agreements in every area in which we operate
- Communicate and cooperate with customers, communities and other stakeholders to address HSSE issues in a customer oriented, responsible, consistent and transparent manner
- Promote and protect health and safety and wellbeing of employees, contractors and neighbours by having effective safety and health programs which manage risk and prevent injury and ill health.

PGPL will be responsible for implementation of the HSSE policy at the proposed project. As part of its agreements with EPC and O&M contractors, PGPL will mandate its contractors to implement and adhere to the HSSE policy at the project site along with contractor's HSE policies and procedures.

7.2.2 Social Policies

Human Resource Policy:

BROOKFIELD RENEWABLE is having detailed HR policy which is provided to each employee after recruitment and individuals joining the organization needs to acknowledge the HR policy. The HR Policy states that the Brookfield Renewable (Operating) India Private Limited is committed to a hiring process that is fair, objective, equitable, non-discriminatory and in compliance with all applicable legislations and good governance. Hiring is done on the principle of merit, and guided by values that support diversity, respect, integrity, and accountability. The hiring process is designed to:

- Hire the best qualified individual for the position.
- Ensure hiring is fair and based on merit and cultural fit within the organization in order to maximize the candidate's success in the organization.

In keeping with the Anti-Bribery and Anti-Corruption Policy of Brookfield Renewable (Operating) India Private Limited, it

- Prohibits offers of employment or internship as inducement to obtain/retain business; and
- Provides a protocol for making employment offers to a public official who currently works or previously worked with the government on matters directly impacting the company

The HR policy broadly covers the following aspects:

- Recruitment Selection and On-Boarding – Guiding Principles
- Policies related to work environment
    - Equal Opportunity Employment
    - Freedom of Association
    - General Policy Against Discrimination and Harassment
    - Policy on Prohibition of Child and Forced Labor
    - Policy Against Sexual Harassment
    - Open Door and Complaint procedure
    - Heath Safety and Environment
    - Violence Prevention
    - Visitors in Workplace
    - HSSE Policy
- Standers of Business Conduct
    - Code of Business Conduct

  - Confidential Information
  - Intellectual Property Rights
  - Conflict of Interest
  - Outside of Employment
  - Non Solicitation
  - Workplace Solicitation
  - Computer/ Email Electronic System usage policy
  - Employment of relative / Fraternization
  - Anti-Smoking Policy
  - Drug and Alcohol Policy
  - Brookfield Renewable (Operating) India Private Limited Sponsored Event

- Personnel Records and Payroll Practices
- Hours of Work and Attendance
- Employee Development and Corrective Action
- General Harassment and Grievances Redressal
- Compensation, Benefits, Time off and Leave of Absence
- Travel and Expense Management Policy
- Working Hours, Leave and Holiday
- Termination of Employment

The scope of the HR policy only covers the staff of Brookfield renewables India working at Mumbai office. And the provisions are not applicable for the subcontracted staff and other service providers.

Grievance Policy

In India, along with the Ethic Reporting/ Whistle Blowing Hotline company is having a comprehensive Grievance Mechanism comprising of Open Door Policy & Complaint Procedure, Policy against Sexual Harassment, Stakeholder Engagement practices, etc.

The below listed are the channels through which stakeholders can report their grievances.

Employees: Employees of the organisation can register their complaint via;

- Report to immediate supervisor / reporting authority.
- Report to Head of Department / Unit of the organisation.
- Contact Human Resources and register the grievance.
- Internal reporting is important to the Organization and hence it has laid down formal reporting channel;

Two-Stage Dialling:

Stage 1: India – 000-117, then 844-826-8141

Stage 2: Online (India) - https://secure.ethicspoint.com/domain/media/en/gui/49682/index.html (English) and https://secure.ethicspoint.com/domain/media/hi/gui/49682/index.html (Hindi)

The redressal procedure may be ascertained basis the nature of the grievance and / or stipulated statutory framework.

Community: The project community may use one of the following ways / mediums to share their concerns/feedback:

- Contact the Project Manager and report concerns via convenient written/ verbal communication channels. (i.e. telephone, post, community meeting etc)
- Contact number / address made available to the community members for any emergency – accidents, serious injury or loss of life which may need to be reported on priority

Contractors and the indirect resources: The grievance related to contractor's operation can be reported via, contacting the Site In-charge of the project site or responsible person monitoring the contractor's operations.

Other Stakeholders, including lenders: The grievances of the other stakeholder can be directly reported to the single point of contact of Brookfield Renewable India.

All our stakeholders are made aware of these channels to communicate with the Organization and convey / register their concerns.

7.3 Review and Reporting

The project will develop and implement a programme of regular reporting through the stages of the project lifecycle. The personnel delegated HSE 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 checklist, incident record register, training records, and environmental and social performance reports (weekly, monthly, quarterly, half-yearly, yearly etc.) for example environmental check list, incident record register, training records etc in line with Brookfield's Contractor HSSE obligation document (Refer ***Appendix 3)***

7.4 Environment and Social Management Plan

This section outlines the potential impacts, mitigation measures, monitoring and management responsibilities during Project lifecycle for client's consideration to integrate into the project's E&S management plans developed specially for the project. The purpose of ESMP is to:

- Provide recommendations for consideration of client's team to allow them to update their existing E&S management plans for the project to minimize any impact on environment and social receptors throughout the project life cycle.
- Advise on institutional mechanism with well-defined roles and responsibilities for ensuring that recommendations as agreed with client are implemented to mitigate potential impacts

Table 7-1: Environment and Social Management Plan for Construction Phase

Sr. No.	Environmental/Social Resources	Impact/Issues	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of verification that mitigation has been met	Timeline/Frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
Physical Environment										
1.	• Strengthening of access road; • Site clearance and preparation, solar plant, PSS and transmission line	Permanent and temporary changes in land use	Construction Phase	• Construction activity should be restricted to designated area; • Minimum land should be cleared for access to the transmission towers • On completion of the construction activities, land used for temporary facilities will be restored to the extent possible • The land use around the permanent project facilities should not be disturbed. • No Objection Certificate from IGNP department should be obtained for development of the project around the sub branch of IGNP canal	Contractor's HSSE Manager	Visual Observation and EHS Inspection	Monthly	PGPL HSSE Manager	Project management team	--
2.	• Clearing and levelling of land • Excavation work at solar site	Impact on topography and drainage	Construction Phase	• EPC contractor should be instructed to carry out levelling and grading activities with as little disturbance to the existing contour as possible, in order to retain the general slope of the site • To the extent possible, disruption/alteration of micro-watershed drainage patterns should be avoided.	Contractor's HSSE Manager	Visual Observation and EHS Inspection	Monthly	PGPL HSSE Manager	Project management team	--
3.	• Site preparation and excavation and piling work • Construction of ancillary facilities; • Operation of D.G. sets; • Vehicular movement	Exhaust, fugitive and vehicular emissions	Construction and Decommissioning Phase	• Speed of vehicles on site and transmission route will be limited to 10-15km/h which will help in minimizing fugitive dust emissions due to vehicular movement; • Emissions from the D.G. set and other stationary machines will be controlled by ensuring that the engines are always properly tuned and maintained; • Cease or phase down work if excess fugitive dust is observed. Investigate the source of dust and ensure proper suppression measures; • Idling of vehicles and equipment must be prevented • Batching plant (if installed) should be set up away from the settlements • In case of community complain on dust emission from site, or transmission route, PGPL along with the contractors should reconsider the construction technique and conduct regular water sprinkling (as appropriate) to suppress dust emission • Burning of waste at the construction site should be strictly prohibited • All stockpile materials which are likely to generate airborne fugitive dust will be covered with canvas or plastic sheets during windy season • Water sprinkling at the dust emitting areas should be undertaken regularly. • Construction materials and soil heaps should be covered and kept away from settlement area • Vehicles and machineries should be regularly inspected and maintained	Contractor's HSSE Manager	Visual Observation and EHS Inspection	Monthly	PGPL HSSE Manager	Project management team	Report from onsite HSSE team to PGPL corporate HSSE team

Sr. No.	Environmental/Social Resources	Impact/Issues	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of verification that mitigation has been met	Timeline/Frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
				• Prefabricated materials should be used to the extent possible to minimize localized air pollution						
4.	Civil work Vehicular movement Operation of DG set and construction machinery	Impact on noise Quality	Construction and Decommissioning Phase	• Only well-maintained equipment should be operated on-site; • Acoustic enclosures should be provided for all the noise emitting machineries to reduce noise levels at the nearby settlements • 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; • Limit the number of heavy vehicles required for the Project to only those that are necessary; • Machinery and construction equipment that may be in intermittent use should be shut down or throttled down during non-work periods; • Batching plant (if installed) should be set up in the direction which is away from settlements; • Minimal use of vehicle horns and heavy engine breaking in the area needs to be encouraged. • Noise limits for construction equipment to be installed at the project area during peak construction such as front loaders concrete mixers, cranes (moveable), will not exceed 75 dB (A), measured at one meter from the edge of the equipment in free field, as specified in the Environment (Protection) Rules, 1986.	Contractor's HSSE Manager	Visual Observation and EHS Inspection	Monthly	PGPL HSSE Manager	Project management team	Report from onsite HSSE team to PGPL corporate HSSE team
5.	Soil Environment	Soil Erosion and Compaction	Construction and Decommissioning Phase	• Stripping of topsoil shall not be conducted earlier than required; (vegetation cover will be maintained for as long as possible) in order to prevent the erosion (wind and water) of soil; • Top soil that has been stripped should be stored for landscaping of the site; • The stock piles of the soil should be kept moist/covered to avoid wind erosion of the soil; • Soil to be ploughed in compacted area after completion of the construction work; • Revegetation of the construction boundaries using fast growing local vegetation; • As a best practice, site clearance, piling, excavation and access road strengthening will not be carried out during the monsoon season to minimize erosion and run-off. • Site to be restored at the end	Contractor's HSSE Manager	Visual Observation and EHS Inspection	Monthly	PGPL HSSE Manager	Project management team	Report from onsite HSSE team to PGPL corporate HSSE team
6.	Soil Environment	Soil Contamination	Construction and Decommissioning Phase	• 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	Contractor's HSSE Manager	Visual Observation and EHS Inspection	Monthly	PGPL HSSE Manager	Project management team	Report from onsite HSSE team to PGPL corporate HSSE team

Sr. No.	Environmental/Social Resources	Impact/Issues	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of verification that mitigation has been met	Timeline/Frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
				• 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 • It is to be ensured that hazardous waste is not stored for more than 90 days. Hazardous waste should be disposed through RSPCB authorized hazardous waste vendor only. • Use of spill control kits to contain and clean minor spills and leaks • Unloading and loading protocols should be prepared for diesel, oil and used oil respectively and workers trained to prevent/contain spills and leaks, and • In case of accidental/unintended spillage, the contaminated soil should be immediately collected and stored as hazardous waste.						
7.	Water Environment	Water Availability	Construction and Decommissioning Phase	• Construction labour deputed onsite to be sensitized about water conservation and encouraged for optimal use of water; • PGPL to identify alternate sources of water abstraction such as water tankers from different village ponds (if any) to minimize dependency on IGNP • Permission from RREC should be obtained by the Project, in case PGPL directly abstracts water from IGNP canal • In case, project hire third party vendor for supply of water through tankers at the project site, the project should conduct prior background check of the vendor to ensure that no illegal abstraction of water from IGNP or any other water resource is practiced to supply water to the project. • Regular inspection for identification of water leakages and preventing wastage of water from water supply tankers is necessary for efficient utilization of water • Blending of low quality water with fresh water for construction uses to ensure efficient use of natural resource • Record daily water consumption at site • Recycling/reusing to the extent possible • Explore water conservation scheme e.g., rainwater harvesting at the project site.	Contractor's HSSE Manager	EHS Inspection	Monthly	PGPL HSSE Manager	Project management team	Report from onsite HSSE team to PGPL corporate HSSE team
	Water Quality		Construction and Decommissioning Phase	• Hire/engage licensed contractors for management and disposal of waste and sludge • Provision for impervious storage area, especially for fuel & lubricant, hazardous waste, etc. should be made onsite • Labourers should 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 should be strictly prohibited • Spill/ leakage clearance plan to be adopted for immediate cleaning of spills and leakages • Hazardous material should be kept on impervious layer with secondary containment	Contractor's HSSE Manager	EHS Inspection	Monthly	PGPL HSSE Manager	Project management team	Report from onsite HSSE team to PGPL corporate HSSE team

Sr. No.	Environmental/Social Resources	Impact/Issues	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of verification that mitigation has been met	Timeline/Frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
				• In case of accidental/unintended spillage, the contaminated soil should be immediately collected and stored as hazardous waste						
Socioeconomics										
8.	Impact on local community and agricultural field due to proposed transmission line	Economic Displacement	Construction stage	• Procure the land in accordance with the applicable reference framework . • The project shall not adopt any lawful expropriation for procurement of land f • The purchase rate shall be decided in negotiation with landowners and shall be in accordance with the market rate of the similar type of land and in compliance with the Ministry of Power issued – "Guidelines for payment of compensation towards damages in regard to Right of Way for transmission line" • If any of the land parcel belongs to women landowner, market-based compensation shall be paid to the actual women owner of the land, not to their male counterparts. Moreover, if any land parcel belongs to minor (under 18), compensation to the right person shall be paid as per India law in this regard to avoid discrimination of vulnerable groups • Construction of transmission line during the non-crop cultivation person i.e., May and June – so that the construction will not result in loss of standing crops • Timely sharing of project related information with all relevant stakeholders • **Provision of Grievance Redressal Mechanism (GRM) to all impacted stakeholders to raise and register their grievances**	Land team Social / HSSE team	Payment details Bank statement Grievance Records	Weekly	Land team	Project In charge	Project in charge should appraise the HSSE team on fortnightly basis
9.	Impact due to Migrant workers	Working conditions	Construction Phase	• The accommodation facility for regular employees should be constructed to meet the requirement of IFC worker camp recommendation guideline • Regular Monitoring and auditing mechanism should be in place for monitoring the sub-contractors and suppliers with respect to compliance to IFC PS 2 requirements, in terms of resource, migrant workers, child labour and forced labour, health and safety, payment of wages, etc. • The Project shall provide training or induction program related to the gender sensitization and gender-based violence to all employees at the time of commencement of their job • **Provide training to all female and male workers (contracted or migrant) during their commencement of job on POSH policy and procedure of filling of complaint. Further, refresher training shall be given in every quarter to each female and male worker**	HR/ Project Incharge	Guidelines for workers accommodations Inspection report of camps Copy of labour records Copy of training records ,photographs and training material	Fortnightly	HR Team	Project In charge	Project in charge should appraise the Corporate HR on monthly basis
10.	**Stress on Local Community**	Local resources	Construction Phase	• There shall be worker code of conduct defined by the Project that will prevent workers and contractors from using the local resources like water, fuel wood which will be shared with contractors and their workers	HR/ Project in charge	Code of conduct Training Records Records of maintenance, Photographs, and records of grievances if any	Fortnightly	HR Team	Project In charge	Project in charge should appraise the Corporate HR on monthly basis

Sr. No.	Environmental/Social Resources	Impact/Issues	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of verification that mitigation has been met	Timeline/Frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
				• An induction season will be organized for the migrant workers where they will be sensitized on the Do's and Don'ts during their stay near project location, which would include aspects on conservation of community's resources • Project to identify alternate sources of water abstraction such as water tankers from different villages to minimize dependency on single village • Periodic maintenance activities for roads used for transportation of goods for the project shall be undertaken by the Project, through its contractor (if any impact due to construction activity) • Provision of Grievance Redressal Mechanism to all the key stakeholders to raise and register their grievance on misuse of locally available resources						
11.	**Labour Rights and Welfare**		Construction Phase	• The labour accommodation facility for contractual workers and as well as for regular employees should meet the requirements of the applicable reference framework in terms of space per worker, water and sanitation facilities, first aid, lighting and ventilation etc. and regular monitoring should be undertaken to ensure compliance through the project lifecycle • Project should also ensure a monthly and regular auditing mechanism for monitoring the sub-contractors and suppliers with respect to compliance to the applicable reference framework, in terms of resources, migrant workers, child labour and forced labour, health and safety, payment of wages etc. • Project shall also establish provisions related to non-employment and abolition of any form of child labour and forced labour in the contractual agreement with suppliers and as well as contractors • Establish a grievance redressal mechanism in place, to allow for the employees and workers, and workers employed by supplier to report any concern or grievance related to work activities • Further, to ensure the labour rights and welfare, the project shall implement ILO's fundamental instruments ratified by India: o Forced Labour Convention o Abolition of Forced Labour Convention o Minimum age convention o Worst Form of Child Labour Convention o Equal Remuneration Convention o Discrimination (Employment and Occupation) Convention o Occupational Safety and Health Convention	HR/ Project in charge	Guidelines for workers accommodation and checklist Labour audit report Notice against child labour Copy of GRM at site	Fortnightly	HR Team	Project In charge	Project in charge should appraise the Corporate HR on monthly basis
12.	Occupational Health and Safety	Physical, and Chemical hazards due to project activities	Construction and Decommissioning Phase	• 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	Contractor's HSSE Manager	EHS Inspection	Monthly	PGPL HSSE Manager	Project management team	Report from onsite HSSE team to PGPL's corporate HSSE team

Sr. No.	Environmental/Social Resources	Impact/Issues	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of verification that mitigation has been met	Timeline/Frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
				• A site specific training calendar should be developed and implemented onsite • 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 • Safe drinking water supply should be provided for the workers • An up-to-date first aid box should be provided at all construction sites and a trained person should be appointed to manage it • All equipment should be turned off and checked when not in use • A site specific safety or emergency management plan should be in place to account for natural disasters, accidents and any emergency situations. The nearest hospital, ambulance, fire station and police station should be identified in the implemented emergency management plan • All construction activities (to the extent possible) should be carried out during daytime hours and vigilance should be maintained for any potential accidents • Personal Protective Equipment (PPEs) including safety shoes, helmet, goggles, ear muffs and face masks should be provided to the workers. A PPE inventory should be maintained onsite • Structural integrity should be checked before undertaking any work • Electrical and maintenance work should not be carried out during poor weather • Excavated areas should be temporarily fenced to avoid access to outsiders and wildlife.						
13.	Community health and safety	Physical and Chemical Hazards	Construction and Decommissioning Phase	• Ensuring that the contractor agreements require all contractors to possess an EHS plan with provisions for monitoring of the EHS performance of contractors and their workers • 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 • As part of stakeholder engagement, the project will also propagate health awareness amongst the community, including setting up of health camps • The traffic movement for the project in the area will be regulated to ensure road and pedestrian (including livestock) safety • A traffic management plan should be developed identifying routes for transportation of materials onsite, measures for safe driving etc. • The workers (both regular and contractual) on the project will be provided with trainings on the Health and Safety policy in place, and their role in the same and refresher courses will be provided throughout the life of the project	Contractor's HSSE Manager	EHS Inspection	Monthly	PGPL HSSE Manager	Project management team	Report from onsite HSSE team to PGPL's corporate HSSE team

Sr. No.	Environmental/Social Resources	Impact/Issues	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of verification that mitigation has been met	Timeline/Frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
				• A site specific grievance redressal mechanism in line with Brookfield's grievance redressal mechanism should be developed to allow for the workers and community members to report any concern or grievance related to project activities • Emergency Scenarios and Response Actions should be communicated to nearby communities. • Safety Sign Boards in Local Language should be installed in and around the project site especially near the settlement area.						
14.	Impact on Local Economy and Employment	Local Economy	Decommissioning Phase	• In case of decommissioning project should withdraw its operations in phase wise manner • Employees including subcontracted staff should be informed about the decommissioning schedule • Develop retrenchment policy for the staff and contracted workers • Deploy the staff to other locations and develop retrenchment policy • Advance notice to the landowners informing them the lease exit/ termination process and assist them to mutation the land in their land parcels. •	HR/ Project in charge	Project decommissioning schedule Copy of Notification Copy of transfer letter Copy of Retrenchment Policy Copy of Lease termination And Land records update	Quarterly	HR Team	Project In charge	Project in charge should appraise the Corporate HR other department
Biological Environment										
15.	Vegetation Clearance	Habitat Modification and Loss	Construction	• Vegetation clearance activities should be restricted within the project site and transmission towers • Vegetation of the project surrounding area should be returned to the pre-construction state, after completion of construction activities • The area for the storage yard, and other supplementary facilities should be selected away from any water body, canal, etc. • Unnecessary disturbance of neighboring vegetation due to off-road vehicular movement, fuel wood procurement, and destruction of floral resources should be prohibited • There should be a ban on the use of woody plants as kitchen fuel, collected from the nearby areas	Contractor's HSSE Manager	EHS Inspection	Monthly	Project HSSE Manager	Brookfield HSSE	Monthly observation report by Project HSSE
16.	Excavation, anthropogenic movement, etc.	Impacts of enhanced anthropogenic activities on the Habitat and Species	Construction Phase	• Night-time (6:00 pm to 6:00 am) construction and transportation activities should be avoided • The areas of high animal activity, such as forests and water bodies the construction and transportation activities should be avoided during dawn (6:00 am to 7:30 am) and dusk (5:00 pm to 6:30 pm) • Hazardous materials should be avoided to store near water bodies and drains • Sites with existing burrows or roosts should be avoided where possible, and temporary fencing should be installed over excavated areas • Efforts should be made to minimize construction noise and sound barriers should be considered if noise levels are high • Construction activities must implement proper housekeeping, properly dispose of discarded packaging materials, and provide labor camps with adequate sanitary facilities	Contractor's HSSE Manager	EHS Inspection	Monthly	Project HSSE Manager	Brookfield HSSE	Monthly observation report by Project HSSE

Sr. No.	Environmental/Social Resources	Impact/Issues	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of verification that mitigation has been met	Timeline/Frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
				• Movement of workers between camps and construction sites should be restricted and they should not be allowed to visit in natural areas not included the planned construction activities						

Table 7-2: Environment and Social Management Plan for Operation Phase

Sr. No.	Environmental/Social Resources	Impact/Issues	Applicable Project Phase	Mitigation Measures	Responsibility for ensuring implementation of the suggested mitigation	Means of verification that mitigation has been met	Timeline/Frequency of Monitoring	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
Physical Environment										
1.	Movement of staff on and off from site	Impact on Noise Quality	Operation Phase	• Vehicle drivers should be instructed not to blow horns until necessary • Anti-honking sign boards to be placed near village areas and at entry / exit points of the project • Vehicles should be maintained regularly to avoid noise from engines etc.	Contractor's HSSE Manager	Visual Observation and EHS Inspection	Monthly	PGPL HSSE Manager	Project management team	Report from onsite HSSE team to HSSE corporate team
2.	Soil Environment	Soil Contamination	Operation Phase	• 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; • Discarded or broken solar panels should be disposed in line with E-waste (Management) Rules, 2022; • Ensure routinely disposal of hazardous waste through approved vendors and records are properly documented; • Oil/ lubricants will be stored on impervious floor in the storage area having secondary containment; • Use of spill control kits to contain and clean minor 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; • The sewage generated onsite will be treated and disposed through septic tanks and soak pits; • Transportation vehicles and equipment should undergo regular maintenance to avoid any oil leakage; and • Unloading and loading protocol should be prepared for diesel, oil and used oil respectively and workers trained to prevent spills and leaks.	Contractor's HSSE Manager	EHS Inspection	Monthly	PGPL HSSE Manager	Project management team	Report from onsite HSSE team to HSSE corporate team
3.	Water Environment	Water Availability	Operation Phase	• Records of daily water consumption to be maintained • Regular inspection for identification of water leakages and preventing wastage of water • Recycling/reusing to the extent possible	Contractor's HSSE Manager	EHS Inspection	Monthly	PGPL HSSE Manager	Project management team	Report from onsite HSSE team to HSSE corporate team

				• Feasibility of constructing rain water harvesting system at site should be explored • Approval for abstraction of water from IGNP should be obtained from RREC for water utilisation at the power plant. • In case, project hire third party vendor for supply of water through tankers at the project site, the project should conduct prior background check of the vendor to ensure that no illegal abstraction of groundwater and/or surface water is practiced to supply water to the project.						
		Water Quality	Operation Phase	• The provisions of septic tank and soak pits should be provided onsite for disposal of sewage, thereby minimizing the impacts of wastewater discharge. • Adequate drainage line should be constructed in and around the site to avoid impact on natural drainage channels within site due to discharge of wastewater from solar module cleaning within site. • Planning of toilets, soak pits and septic tanks, waste collection areas should be away from natural drainage	Contractor's HSSE Manager	EHS Inspection	Monthly	PGPL HSSE Manager	Project management team	Report from onsite HSSE team to HSSE corporate team
Socioeconomics										
4.	Occupational Health and Safety	Physical, and Chemical hazards due to project activities	Operation Phase	• 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 • A site specific training calendar should be developed and implemented onsite • Appropriate safety harnesses and lowering/raising tools should be used for working at heights • Adequate fire safety system including fire extinguishers, sand buckets should be provided on site • Safe drinking water supply should be provided for the workers • An up-to-date first aid box should be provided at site and a trained person should be appointed to manage it • A site specific safety or emergency management plan should be in place to account for natural disasters, accidents and any emergency situations. The nearest hospital, ambulance, fire station and police station should be identified in the implemented emergency management plan • Personal Protective Equipment (PPEs) including safety shoes, helmet, goggles, ear muffs and face masks should be provided to the workers. A PPE inventory should be maintained onsite • Electrical and maintenance work should not be carried out during poor weather • Annual health check-up of workers should be undertaken	Contractor's HSSE Manager	EHS Inspection	Monthly	PGPL HSSE Manager	Project management team	Report from onsite HSSE team to HSSE corporate team
5.	Community Health and Safety	Physical and Chemical Hazards	Operation Phase	• Ensuring that the sub-contractor agreements require all contractors to possess an EHS plan with provisions for monitoring of the EHS performance of contractors and their workers • As part of the stakeholder engagement and information disclosure process, providing an understanding to the community concerning the	Contractor's HSSE Manager	EHS Inspection	Monthly	PGPL HSSE Manager	Project management team	Report from onsite HSSE team to HSSE corporate team

				activities proposed to be undertaken and the precautions being adopted for safety • As part of stakeholder engagement, the project will also propagate health awareness amongst the community, including setting up of health camps • The traffic movement for the project in the area will be regulated to ensure road and pedestrian (including livestock) safety • A traffic management plan should be developed identifying routes for transportation of materials onsite, measures for safe driving etc. • The workers (both regular and contractual) on the project will be provided with trainings on the Health and Safety policy in place, and their role in the same and refresher courses will be provided throughout the life of the project • Put in place a grievance mechanism to allow for the workers and community members to report any concern or grievance related to project activities • Emergency Scenarios and Response Actions should be communicated to nearby communities. • Safety Sign Boards in Local Language should be installed in and around the project site especially near the settlement area.						
Biological Environment										
6.	Power Transmission	Collision and Electrocution	Operation Phase	• Cross arms transmission tower, suspended insulators, and insulated jump connectors (at least 60 cm in length) should be utilized • Bird diverters / diffractors, and perch rejecters should be applied[53] • Frequent checking of the transmission towers to avoid bird nesting • Disposal of corpses near project components (solar plants and power lines) should be restricted; and carcasses observed around project components should be immediately removed to avoid attracting vultures and raptors • A Bird Survey, specifically in the migratory season may provide more site-specific information about the presence and movement of migratory and other sensitive avifaunal species	Contractor's HSSE Manager	Visual Inspection and Record Keeping	Trimonthly	O&M Team of Brookfield Power	Brookfield HSSE	Report from site HSSE to Corporate HSSE
7.	Access of wildlife in the project compound	Human-Wildlife Conflicts	Operation Phase	• Regular checking of the boundary wall to avoid any space for wildlife entrance into compound • Good housekeeping practices and regular removal of grass and ground vegetation in the project compound could help to reduce the faunal attraction • Bird detractors such as scarecrows or moving clothes could be installed around the solar modules to prevent avifauna from venturing close	Contractor's HSSE Manager	Visual Inspection and Record Keeping	Trimonthly	O&M Team of Brookfield Power	Brookfield HSSE	Report from site HSSE to Corporate HSSE

[53] Galis, M. and Sevcik, M. (2019) Monitoring of effectiveness of bird flight diverters in preventing bird mortality from powerline collisions in Slovakia. *Raptor Journal* 13: 45–59.

8. Impact Summary and Conclusion

8.1 Introduction

This Environmental and Social Impact Assessment (ESIA) has been conducted to assess the impacts associated with the proposed solar power project. The impact assessment has been conducted in compliance with the requirement of applicable reference framework (refer to ***Section 1.2***).

8.2 Significance of Impacts

The ESIA focussed on interaction between the Project activities and various resources/receptors that could result in significant impacts. The table below presents the outcome of the comprehensive assessment of identified impacts due to various project activities.

Table 8-1 Impact Assessment Summary

Impact Description	Intensity	Nature of Impact	Phase of the Project	Magnitude of Impact	
				Without Mitigation	With Mitigation
Environment					
Land Use	Low	Negative	Construction Phase	Substantial	Small
Topography and Drainage	Moderate	Negative	Construction Phase	Substantial	Small to Negligible
Ambient Air	Moderate	Negative	Construction Phase	Substantial to Small	Small
	Moderate	Negative	Decommissioning Phase	Small	Negligible
Ambient Noise	Moderate	Negative	Construction Phase	Small	Negligible
	Low	Negative	Operation Phase	Small to Negligible	Negligible
	Moderate	Negative	Decommissioning Phase	Small	Negligible
Soil Erosion and Compaction	Low	Negative	Construction Phase	Small	Negligible
Soil Contamination	Moderate	Negative	Construction Phase	Substantial	Negligible
	Moderate	Negative	Operation Phase	Small	Negligible
	Moderate	Negative	Decommissioning Phase	Small	Negligible
Water Availability	High	Negative	Construction Phase	Substantial	Small
	Moderate	Negative	Operation Phase	Small	Small
	Moderate	Negative	Decommissioning Phase	Substantial	Small
Water Quality	Moderate	Negative	Construction Phase	Substantial	Small to Negligible
	Low	Negative	Operation Phase	Negligible	Negligible
	Low	Negative	Decommissioning Phase	Small	Negligible
Social					
Occupational Health and Safety	High	Negative	Construction and decommissioning Phase	Substantial	Small
	Moderate	Negative	Operation Phase	Substantial	Small
Community Health and Safety	Moderate	Negative	Construction, Operation and Decommissioning Phases	Small	Small
Economic Displacement	Medium	Negative	Construction Phase	Small	Negligible
Impact due to Migrant workers	Low	Negative	Construction Phase	Substantial	Small

Impact Description	Intensity	Nature of Impact	Phase of the Project	Magnitude of Impact	
				Without Mitigation	With Mitigation
Stress on Local Community	Low	Negative	Construction Phase	Substantial	Small
Labour Rights and Welfare	High	Negative	Construction Phase	Major	Small
Impact on Local Economy and Employment	High	Negative	Construction Phase	Substantial	Substantial
Ecology					
Habitat Modification and Loss due to Vegetation Clearance	Moderate	Negative	Construction Phase	Small	Small
Impacts on the Habitat and Species due to Construction Activities	Moderate	Negative	Construction Phase	Substantial	Small
Collision and Electrocution Risk due to the Power Transmission, etc.	High to Moderate	Negative	Operation Phase	Major	Substantial
Human-Wildlife Conflicts	Moderate to Low	Negative	Operation Phase	Small	Small

8.3 Project Categorization

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

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

Based on the defined reference framework (refer ***Section 1.2***) and IFC's existing guidance on Environmental and Social Categorization for projects, the project can be categorized as ***Category B*** as per the IFC guidelines. The rationale for indication towards the project categorization has been provided below:

- Construction and operation phase activities on site may have low to medium scale impacts which include land use change, air emissions, noise emissions, water availability, waste including hazardous waste generation etc. Activities during project lifecycle will also have impacts on occupational health and safety and community health & safety. The impacts will be limited, site specific, largely reversible and can be readily addressed through recommendations in the ESMP.
- The project has plans to abstract water from IGNP and source it at site through water tankers during construction phase which may put stress on water resources for limited period i.e., 6 months for Phase I and other 6 months for Phase II. However, the project has planned to implement dry robotic module cleaning technology during operation phase with only one or two cycle of wet cleaning annually which will reduce the impact on nearby water resources during operation phase.
- The identified impacts on the ecology and biodiversity are site specific, irreversible and could be addressed through suggested mitigation measures. Thus, the Category should be "B".
- The private land identified for the solar power plant comprises of 1700-acres of leasing. Since the land belongs to the biogeographical province classified as Desert, the soil is mostly sandy desert type with poor productivity and therefore,

agriculture, if undertaken, is only for subsistence purposes when there is rainfall. It is understood through the interaction with the landowners, the lease rent will provide the cushion to the livelihood earning and will also help in paying out of debts undertaken by landowners. Further, lease rent will provide a source of continuous earning. Thus, it is understood that land lease will have a positive impact on the landowners and land lease will not change the ownership on the land, even the land is taken by the project on lease, the land ownership still will remain with landowners

- The project is not impacting any Indigenous People, common property resources and cultural heritage
- The project has committed to:
    - Promote the fair treatment, non-discrimination, and equal opportunity of workers
    - Establish, maintain, and improve the worker-management relationship
    - Promote compliance with national employment and labour laws
    - Protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties
    - Promote safe and healthy working condition and health of workers
    - Avoid the use of forced labour

APPENDIX 1: DOCUMENTS REVIEWED

- Project Location in KMZ
- Route of Transmission Line in KMZ
- BRIPL HSSE Policy
- BRIPL's Contractor HSSE obligations for EPC Contractors
- HSSE Clauses for contractor
- Security Clauses
- HR Policy
- Grievance Policy

APPENDIX 2: PHOTOLOG

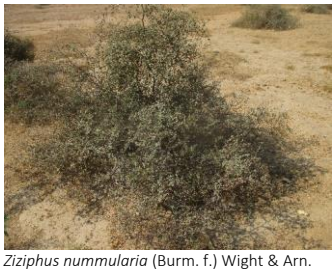
Some representatives of the floral diversity

Prosopis cineraria (L.) Druce / Khejri

Capparis decidua (Forssk.) Edgew.

Prosopis juliflora (Sw.) DC.

Ziziphus mauritiana Lamk.



Ziziphus nummularia (Burm. f.) Wight & Arn.

Calotropis procera (Aiton) Dryand.

Leptadenia pyrotechnica (Forssk.) Decne.

Aerva javanica (Burm.f.) Shult.

Crotalaria burhia Buch.-Ham.

Zygophyllum indicum (Burm.f.) Christenh. & Byng

Solanum virginianum L.

Convolvulus prostratus Forssk.

Some representatives of the faunal diversity


Indian spiny-tailed lizard


Indian Fringe-fingered Lizard


Chestnut-bellied Sandgrouse


Indian Cormorant


Black-winged Stilt

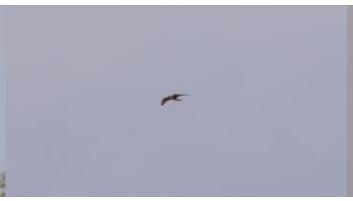

Little Grebe


Red-wattled Lapwing


White-breasted Kingfisher


Black Drongo


Common Kestrel


Laggar Falcon


Egyptian Vulture


Demoiselle Crane

APPENDIX 3: CONTRACTOR HSSE OBLIGATIONS FOR EPC CONTRACTORS