Initial Environmental and Social Examination Report

PUBLIC

Project Number: 57191-001
Draft
November 2023

India: SAEL Gujarat Solar Power Project

PART 1: Main Report

Prepared by SAEL Industries Limited for the Asian Development Bank (ADB).

Initial Environmental and Social Examination of 800 MW Solar Power Plant, Gujarat

SAEL Industries Limited

November 2023

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Acronyms

Acronyms	Description
ADB	Asian Development Bank
AGEL	Adani Green Energy Limited
AoI	Area of Influence
ARF	Applicable Reference Framework
ASR	Adult sex ratio
AZE	Alliance for Zero Extinction
BMTPC	Building Materials & Technology Promotion Council
BSF	Border Security Force
CEA	Central Electricity Authority
CGWA	Central Ground Water Authority
CHA	Critical Habitat Assessment
CHWTSDF	Common Hazardous Waste Treatment, Storage and Disposal Facility
CLO	Community Liaison Officer
CLS	core labor standards
GPCB	Gujarat Pollution Control Board
CPCB	Central Pollution Control Board
CR	Critically Endangered
CRZ	Coastal Regulation Zone
CSO	civil society organizations
CSR	Child sex ratio
CTE	Consent to Establish
CTO	Consent to Operate
CTUIL	Central Transmission Utility of India Limited
DISH	Directorate Industrial Safety and Health Department
EAAAs	Ecologically Appropriate Areas of Assessment
EBRD	European Bank for Reconstruction and Development
EC	Electrical Conductivity
EHS	Environment, Health & Safety
ESC	Environmental and Social Consultant
ESMP	Environmental and Social Management, and Monitoring Plan
ESMS	Environmental and Social Management System
GCZMA	Gujarat Coastal Management Authority
GEDA	Gujarat Energy Development Agency
GERC	Gujarat Electricity Regulatory Commission

Acronyms	Description
GIPCL	Gujarat Industrial Power Company Limited
GRM	grievance redress mechanism
GSECL	Gujarat State Electricity Corporation Limited
GUVNL	Gujarat Urja Vikas Nigam Limited
GW	Gigawatt
IBA	Important Bird Area
IBAs	Important Bird and Biodiversity Areas
IBAT	Integrated Biodiversity Assessment Tool
ICESCR	International Covenant on Economic, Social and Cultural Rights
IESE	Initial Environmental and Social Examination
IFC	International Finance Corporation
ILO	International Labour Organization
IMD	India Meteorological Department
IPP	Indigenous peoples plan
ISA	Implementation & Support Agreement
IUCN	International Union for the Conservation of Nature
KBAs	Key Biodiversity Areas
KUMREPP	Khavada Ultra Mega Renewable Energy Power Park
LC	Least Concern
LoL	Letter of Intent
MoEFCC	Ministry of Environment Forests and Climate Change
NABL	National Accreditation Board for Testing and Calibration Laboratories
NFPA	National Fire Protection Authority
NGT	The National Green Tribunal
NHPC	National Hydroelectric Power
NOC	No Objection Certificate
NTPC	National Thermal Power Cooperation Limited
PAs	Protected areas
PGCIL	Power Grid Corporation of India Limited
PPE	Personal Protective Equipment
RE	Renewable Energy
RfS	Request for Selection
RoW	Right of Way
RPM	Respirable Particulate Matter
SC	Scheduled Caste
SCOD	date of the Project's Schedule Commercial Operation
SECI	Solar Energy Cooperation of India Limited

Acronyms	Description
SEP	Stakeholder Engagement Plan
SJVN	Satluj Jal Vidyut Nigam
SPCBs	state Pollution Control Boards
SPD	Solar Power Developers
SPPD	Solar Power Park Developer
SPS	Safeguard Policy Statement
SPV	Special Purpose Vehicle
SRL	Sarjan Realities Limited
SRRA	Solar Radiation Resource Assessment
SSP4PL	SAEL Solar P4 Private Limited
SSP5PL	SAEL Solar P5 Private Limited
ST	Scheduled Tribe
TDS	Total Dissolved Solid
WPA	Wildlife Protection Act
WPR	working population ratio

1 Introduction

SAEL Industries Limited (hereafter referred to as 'SAEL' or the 'Client), is currently engaged in the development of a 800 MW solar power project (hereinafter referred to as 'the Project'). This project is an integral part of the larger 30 Gigawatt (GW) hybrid renewable energy park (denoted as the '30 GW RE Park'), situated in the state of Gujarat, India. It is important to note that this project falls under the oversight of the Gujarat State Electricity Corporation Limited (GSECL), which is one of the six designated park developers authorized by the Gujarat Power Corporation Limited, the governing authority responsible for overseeing the development of the 30 GW RE Park.

SAEL has established two (2) 100% owned Special Purpose Vehicles (SPVs) – (i) SAEL Solar P4 Private Limited (hereinafter referred to as 'SSP4PL'), tasked with developing of 400 MW solar power plant as part of the Project; and (ii) SAEL Solar P5 Private Limited (hereinafter referred to as 'SSP5PL'), responsible for developing another 400 MW solar power plant. For the purpose of this report, both SPVs will collectively be referred to as 'Project SPVs'.

In the context of evaluating the environmental and social considerations associated with the project, SAEL has engaged Deloitte Touche Tohmatsu India LLP (hereinafter referred to as "DTTILLP" or "E&S Consultant") to undertake Initial Environmental and Social Examination (IESE) of the Project against the objectives, principles and requirements of ADB's Safeguard Policy Statement and other applicable environmental and social requirements as per Applicable Reference Framework (ARF) as mentioned in *section 1.2*.

This IESE report identify and assess any potentially significant adverse environmental and social impacts associated with the Project's development and operation, and determine the measures needed to prevent, minimize, mitigate and compensate adverse impacts. The IESE also identifies potential environmental and social opportunities, including those that would improve the environmental and social sustainability of the Project, in compliance with ARF.

1.1 Objective

The primary objective of the Initial Environmental and Social Examination (IESE) includes:

- Assess the potential environmental and social impacts of the Project, including those related to the environment, health, safety, involuntary resettlement, and indigenous peoples
- Undertake critical habitat screening and, if required, the critical habitat assessment (CHA), of the solar power project and its area of influence and drafting of terms of reference for other supplementary studies that may be required as a result of the CHA
- Identify potential risks and vulnerabilities arising from Project activities including but not limited to key components of the Project, i.e., solar power plant, transmission line stretch, etc.
- Develop feasible and effective mitigation measures to address identified impacts and risks, with a special emphasis on safeguarding the environment, biodiversity, addressing involuntary resettlement, grievance redressal of stakeholders and respecting the rights of indigenous peoples
- Ensure full compliance with the Asian Development Bank's (ADB) Safeguard Policy Statement, World Bank EHS Guidelines (general and sector-specific), national environmental and social regulations, and international best practices
- Plan and execute stakeholder engagement and consultation, including affected communities, indigenous peoples, CSOs/NGOs (if any), and relevant government authorities, to incorporate their concerns and feedback into the project design and implementation

1.2 Applicable Reference Framework

Applicable reference framework for IESE includes:

- ADB Safeguard Policy Statement, 2009
- ADB's Social Protection Strategy, 2001
- ADB Access to Information Policy, 2019
- ADB's Gender and Development Policy, 1998
- The Applicable Work Bank EHS guidelines:
  - General Environment, Health & Safety (EHS) guidelines, 2007
  - Guidelines for electric power transmission and distribution, 2007
- International Finance Corporation (IFC) and European bank for Reconstruction and Development (EBRD) Guidance Note on Workers' Accommodation: Processes and Standards, 2019
- International Covenant on Economic, Cultural and Social Rights and relevant ILO Core Labour Standards Conventions
- Other relevant good industry practice guidelines and related documents

- Applicable local and national laws and regulations of India relating to concessions, land acquisitions and resettlement, labour and working conditions, public and occupational health and safety, ethnic minorities/Indigenous Peoples, and environmental protection
- Relevant International conventions and protocols relating to environmental and social issues, as transposed into national legislation.

1.3 Scope of Work

The scope of work for the IESE includes:

- Introduction: Prepare comprehensive details of project background, justification for the solar power project as per development requirement, extent of the study, limitations of the study, structure of the report methodology and approach of data collection and literature review in the entire study.
- Legislative, Regulation and Policy Consideration: Outline the pertinent regulations and standards governing environmental quality, safety and health, social issues, including those that relate to land acquisition and involuntary resettlement, Indigenous People, protection of sensitive areas, protection of endangered species, siting, and land use control at the local and state levels. The national policies, acts, regulations, and guidelines as well as development partner's/project financier's policies, has also been reviewed.
- Description of the Project: Provide details of planned activities, support and associated facilities, construction plan, project layout, project components, site location maps, nearest sensitive receptors etc. with respect to the Project. Further, DTTILLP to review relative E&S plans and provide its comments in line with ARF.
- Description of the Environment: Collect baseline data of the existing environmental conditions within project area and area of influence, which is expected to be used to describe the physical, biological, socio-economic, and/or physical, cultural resources in the project's area of influence. This data to be relevant to project location, design, construction, operation, or mitigation measures. Based on information available from literature, government and special studies or other sources, the IESE to provide information on the environmental setting for the different types of physical, biological, and social-economic-cultural environments for the current situation, important trends, and predicted situation in the absence of the Project.
- Project's Area of Influence (AoI): The Project's AoI (based on the definition in IFC PS1) in the IESE to be included:
    - Project activities and facilities that are directly owned, operated, or managed (including by contractors) by the Project Proponent and that are a component of the Project
    - Impact from unplanned but predictable developments caused by the Project that may occur later or at a different location
    - Indirect Project impacts on biodiversity or on ecosystem services upon which 'Affected Communities' livelihoods are dependent
    - Associated facilities which are facilities that are not funded as part of the Project and that would not have been expanded if the Project did not exist and without which the Project would not be viable
    - Cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the Project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted
- Baseline generation: Baseline data collection to be collected to include:
    - Baseline data on the environmental characteristics of the study area, construction, resettlement sites (if any), inundation, floodplain, and biological features (habitat, vegetation, fisheries, birds, terrestrial fauna)
    - Physical environment: geology, topology, soils, climate, surface and ground water hydrology, water availability, ambient air quality; noise; vehicular traffic, erosion and sediment loading, existing/projected pollution discharges and receiving water quality; water quality, availability, and adequacy vis-à-vis the requirements during different phases of the project life cycle; instances of flooding, siltation/erosion, natural hazards etc
    - Biological environment: ecology: flora and fauna, including rare or endangered species; sensitive natural habitats, including sanctuaries and reserves; and habitat types
    - Physical or cultural resources (if any)
    - Socio-economic environment: demographics, land use in the Project area, main sources of income, gender gaps, poverty levels, culture, religion, skills and education levels, social service provision, business environment, ethnic profile and existing vulnerabilities of project affected communities (gender disaggregated if possible)
    - Land: access requirements, land use, involuntary resettlement and / or negotiated land acquisition, details on land acquisition/ transfer (loss of lands, houses, livelihood, etc.), and resultant involuntary resettlement extent; review of the land take/lease process to assess any legacy or current/existing issues (like informal settlers, livelihood dependence, other usage etc.) on the allotted land with regard to compliance with ADB SPS SR2 and ADB's requirements regarding Negotiated Land Acquisition (i.e. willing buyer/seller)
- Desktop Critical Habitat Screening: Conduct a desk based Critical Habitat Screening to understand the presence of ecologically sensitive species in and around the proposed project location which may trigger for a Critical Habitat. DTTILLP has undertaken following steps to achieve the goal:

  - Screen the site using Integrated Biodiversity Assessment Tool (IBAT) data
  - Identify the candidate critical habitat-qualifying species
  - Define one or more Ecologically Appropriate Areas of Assessment (EAAAs)
  - Assess the importance of EAAAs for potential CH-qualifying species and for threatened ecosystems
  - Assess whether the Project area is likely to have any features which would make the area particularly evolutionarily important
  - Assess the presence of protected areas and internally recognised areas within the Project Area of Influence
  - Provide a desktop assessment of Natural Habitat
  - Identify biodiversity field survey priorities
- Analysis of Alternatives: Alternative approaches to meeting the purpose and need for the proposed project site include alternative siting, alternative configuration on the site, designing, constructing, operating the project firstly to avoid and prevent, or secondly to reduce or minimize adverse or improve beneficial environmental or socioeconomic impacts. The IESE to assess, as appropriate the impacts of a range of representative reasonable and technically feasible alternatives as well as the proposed project. The alternatives to the project have included a "No Action" alternative, indicating what would happen in the absence of the proposed project as well as consideration of best practices that may not otherwise have been incorporated in the proposed project. Other alternatives should be developed as needed to address significant issues with the study. All project key alternatives that are reasonable and feasible and meet the purpose and need for the proposed project to be identified in this section and evaluated in the IESE as appropriate
- Impact and Risk Assessment: Identify and analyse potential impacts and risks resulting from project's construction, operation, and decommissioning phases. Assess likely significant environmental and social effects of the development, which should cover the direct effects and any indirect, induced, cumulative short, medium, and long-term permanent and temporary, positive, and negative effects of the development.
- Mitigation and Management Measures and Monitoring: Develop Environmental and Social Management and Monitoring Plan to prevent, mitigate and monitor each impact identified in the IESE. Mitigation measures to be proposed for avoiding, as far as possible, any adverse impacts due to proposed development. Shall include quantification (wherever required) of mitigation methods.
- Risk Assessment and Emergency Response: Analysis of the likelihood of exceeding the economic, social, and environmental consequences at the project site. Indicate vulnerability of the exposed elements and the risk may be caused by man or nature. An occupational/community health safety management plan along with emergency response plan against emergency events during construction and operation phase of the project to be prepared as part of the IESE.
- Stakeholder Consultation & Information Disclosure: IESE to describe the consultation and participation mechanisms adopted and consolidate the regulatory and lender compliance requirements into a consultation and information disclosure plan, including the activities undertaken to disseminate project information and engage stakeholders. This section, in addition to the Plan, shall include a summary of the results of consultations with affected persons, the host communities, and other stakeholders, and the project's response to satisfactorily address the concerns raised will be reported. Special attention to be given to the needs and concerns of vulnerable groups, including women, the poor, ethnic minorities, and Indigenous Peoples in the project area. ESC to include in the Plan, information disclosure measures (including type of information to be disseminated and the methods for dissemination) and the process for carrying out consultation with and the participation of affected people during project implementation and operations. ESC is expected to undertake consultation with affected parties once the IESE is ready to ensure stakeholders are aware of, understand and have opportunity to provide input to the impact assessment findings and proposed mitigation plans.
- Grievance Redress Mechanism: Provide description of the grievance redress framework/mechanisms (both informal and formal channels), setting out the time frame and mechanisms for i) resolving complaints about environmental and social performance; and ii) worker/contractor related grievance.
- Climate-risk vulnerability assessment: IESE to identify the existing operational facility and the facility that has been undertaken under the use of proceeds are at potential risk and if SAEL has systems in place to address that risk. IESE (i) shall set out the climate vulnerability for SAEL's business model or stakeholders of influence, including the existing project; (ii) determine if SAEL conducts adaptation activities and be able to provide improvements or recommendations to these adaptation activities; and (iii) assess the institutional capacity and/or commitment of the Company to strengthen capacity, to report on related adaptation activities.

1.4 Approach and Methodology

The approach and methodology utilized for the IESE study has been described in the relevant sections, and summarised below:

1.4.1 Project Kick off

DTTILLP undertook a kick-off meeting with SAEL, project implementation team, and ADB, prior to site reconnaissance visit. Discussion was held with regard to the expectations from this assessment in terms of scope of work, deliverables timeline and the methodology to be followed for the same.

1.4.2 Desk Based Documents Review

DTTILLP undertook a desk-based review of the Project to identify any environmental, social, and ecological sensitivities around the Project Site. The desk based review includes:

- Review of the available secondary information on 30 GW RE solar park
- Applicable national and state level regulation on the Project
- Gujarat Waste Land Policy for renewable energy power projects
- Google imagery based review of the Project location and availability of E&S sensitivities
- The Integrated Biodiversity Assessment Tool (IBAT) serves the purpose of evaluating the ecological sensitivity of a prospective location and generates a list of species found within a 50-kilometer radius. Additionally, it identifies potential critical habitat concerns by assessing proximity to migration routes, legally protected zones, and key biodiversity areas.
- ebird.org database offers a geographically referenced catalog of identified bird species within a specific geographical region. The ebird.org database was employed to verify the presence or absence of bird species within the EAAA, which encompasses parts of the Kachchh Desert Wildlife Sanctuary, portions of the Banni Grasslands and Chari Dham Important Bird Area (IBA), and the Flamingo City IBA..
- The inaturalist.org database is an online platform dedicated to citizen science and nature enthusiasts. It allows users to upload, share, and identify observations of plants, animals, and other organisms from around the world. The database was used to trace the presence/absence of all the ecologically sensitive species reported from the EAAA.
- The IUCN Red List (online Version) assesses species' conservation status by categorizing them based on a range from Critically Endangered (CR) to Least Concern (LC). This classification relies on an analysis of factors such as their worldwide distribution, population size, population decline trends, and external pressures on the species. As part of this categorization, this screening also includes information about the global distribution and habitat preferences of the species.
- Bird Life Data Zone: Bird Life International curates a database of Important Bird Areas (IBAs) which offers a comprehensive record of species located within these specified regions. It assesses the habitat sensitivity and highlights migratory, congregatory, and endangered species within these areas. Furthermore, the presence of an IBA in proximity to a project is considered a significant indicator of critical habitats.

1.4.3 Site Assessment & Consultations

DTTILLP team comprising of environment, biodiversity and social experts undertook a site visit during 5-12 September 2023 to understand the site setting, environmental and social sensitivities and to identify the relevel stakeholders.

The activities undertaken during the site visit has been summarized below:

- Site Reconnaissance and Identification of key social and environmental risks/receptors in the study area
- Consultation with representative from Gujarat State Electricity Corporation Limited (GSECL) to understand the Project and related facilities
- Understanding of prevailing community engagement processes
- Understanding aspects of community health and safety, if any, linked to the proposed Project
- Understanding land-based impacts, livelihood impacts, issues of vulnerable groups, cultural heritage issues
- Understanding significance of impacts on biodiversity and natural resource management
- Consultation with the local communities and focused group discussions in the vicinity to understand their view and concerns of the Project
- Environmental baseline data was collected through primary environmental monitoring and surveys within the study area through a National Accreditation Board for Testing and Calibration Laboratories (NABL) Accredited Lab

1.4.4 Initial Environmental and Social Examination Reporting

The IESE report has been prepared by DTTILLP based on the site assessment, documents made available till 15.09.2023 by the client, consultation with representatives of GSECL and nearby communities and information available on public domain. The structure of the IESE has been presented below:

- Project Description: An overview of the project location and its associated facilities, and resource requirement are presented based on the data provided by the client and information collected as part of the IESE study
- Applicable Reference Framework: An overview of the applicable reference framework including the national and state level regulations, and applicable international standards, principles, and guidelines are presented as part of the IESE study
- Baseline Condition: A detailed baseline condition of the project area presented has been based on secondary data available for the study area supplemented by the primary data collected and consultation during the consultation with stakeholders
- Stakeholder Consultation and Analysis: Details on profile of the stakeholder groups identified as part of the IESE, 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 exercise and baseline information collected, an assessment of impacts on the Environmental, Ecological and Social Components was 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, and Monitoring Plan: Environmental and Social Management, and Monitoring Plan (ESMP) suggesting economically feasible technologies and procedures to minimize any impact on environment and social receptors throughout the project life cycle have been developed and presented as part of the IESE

1.5 Limitations

- According to the information provided by the local community and an examination of available secondary data, it has been determined that there are no civil society organizations (CSO) operating within the study area. Consequently, there have been no consultations or engagements conducted with such organizations as part of the Initial Environmental and Social Examination (IESE) process.
- Based on observations during site visit and review of secondary information, Arabian sea is located approximately 130 km from the Project towards west direction. Since there are no tidal activities of the Arabian sea within 25 km of the project, baseline conditions such as tide, wave, current, depth, bottom topography of Arabian sea has not been considered as part of the IESE.
- Due to the absence of consent from the local community, consultations with women's groups were not conducted as part of the IESE assessment. The absence of consent is due to the project site being within the BSF and having no nearby village, and the villagers does not envisage any impact on local community.
- Additionally, due to scheduling conflicts, the consultations with government representatives from the revenue department, GPCL, and other Solar Power Developers could not be undertaken. Consequently, pertinent environmental and social information related to the 30 GW RE solar park was not obtained from these departments.
- Ecological survey was conducted during the daylight hours (in non-migratory season) and thus the avifaunal and faunal activities recorded were restricted to diurnal hours only.

1.6 Structure of the Report

Chapter 1	Introduction (this section)
Chapter 2	Project Description
Chapter 3	Applicable Legislative Regulatory & Administrative Regime for the Proposed Project
Chapter 4	Environment & Social Baseline Conditions
Chapter 5	Stakeholder Identification & Analysis
Chapter 6	Climate Change Vulnerability Assessment
Chapter 7	Impact Assessment & Mitigation Measures
Chapter 8	Environment & Social Management and Monitoring Plan
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Appendix 1	Documents Reviewed
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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 30 GW Renewable Energy Park

The 30 GW RE Park developed by Gujarat Power Corporation Limited (GPCL) is a project that aims to generate electricity from both solar and wind sources. It is located near the international border between India and Pakistan, in an area of approximately. 72,400 hectares[1]. The 30 GW RE park is divided into two (2) zones: a hybrid park zone that will accommodate wind and solar power plants of 24.8 GW capacity, and an exclusive wind power zone that will have 3 GW capacity. The project has been allotted to six (6) developers, who have to complete their respective capacities within five (5) years. The details of six (6) developers are provided below:

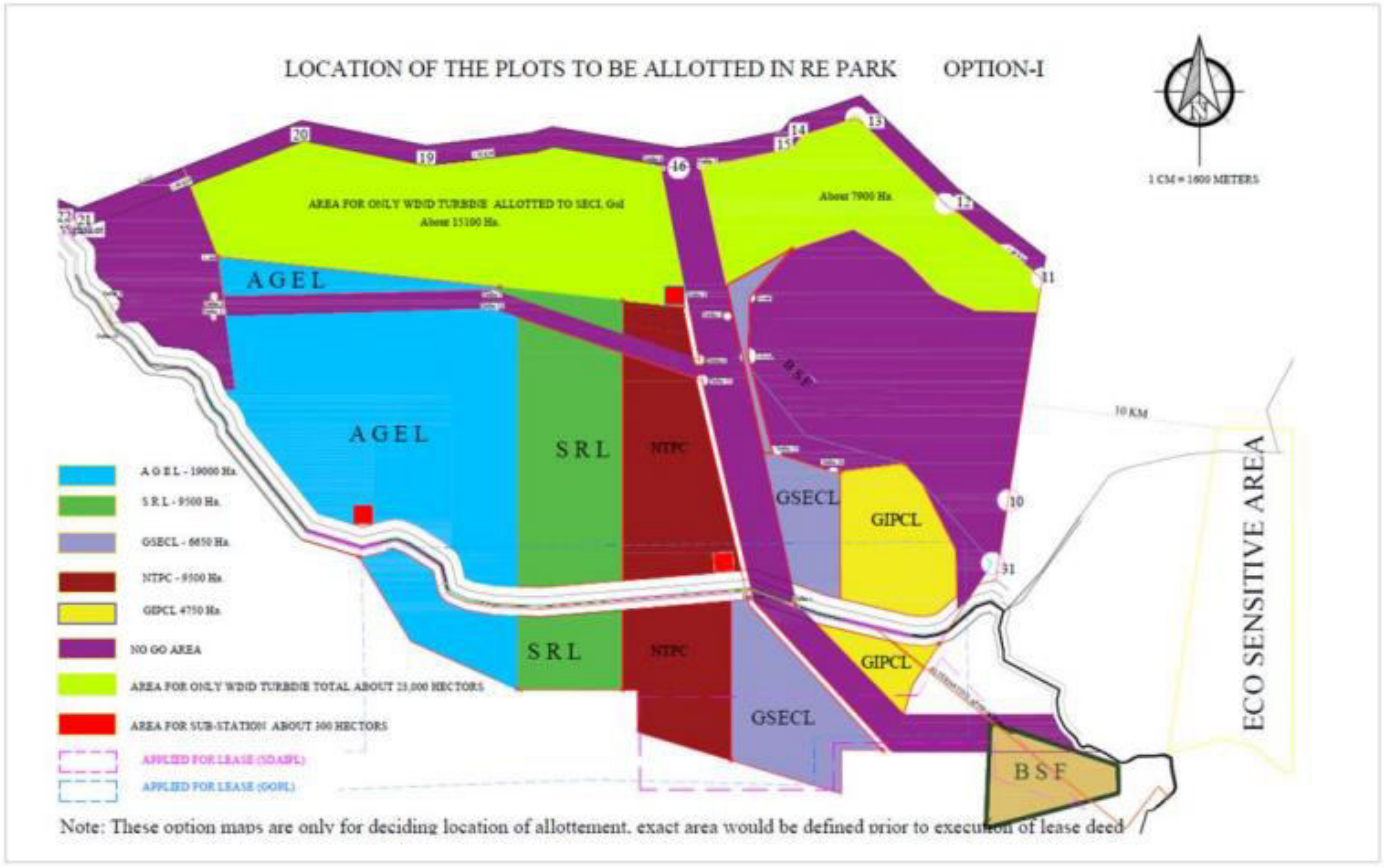
Sr. No	Name of Park Developers	Solar-Wind Hybrid Capacity (MW)	Allocated Land
1.	Gujarat Industrial Power Company Limited (GIPCL)	2,375 (2.375 GW)	4,750 hectares
2.	***Gujarat State Electricity Corporate Limited (GSECL)***	***3,325 (3.325 GW)***	***6,650 hectares***
3.	National Thermal Power Corporation Limited (NTPC)	4,750 (4.75 GW)	9,500 hectares
4.	Adani Green Energy Limited (AGEL)	9,500 (9.5 GW)	19,000 hectares
5.	Sarjan Realities Limited (SRL)	4,750 (4.75 GW)	9,500 hectares
6.	Solar Energy Corporation of India Limited (SECI)	3,000 – only wind power plants (3 GW)	23,000 hectares
	Total	**27,700 (27.7 GW)**	**72,400 hectares**

Source: https://gpcl.gujarat.gov.in/showpage.aspx?contentid=4354 (Accessed on September 13, 2023)

The layout of the 30 GW Renewable Energy (RE) park has been presented in ***Figure 2-1.***

[1] https://gpcl.gujarat.gov.in/showpage.aspx?contentid=4354 (Accessed on September 13, 2023)

Figure 2-1 Layout of 30 GW RE Park in Khavda



Source: DPR, 3325 MW RE Park, GSECL

2.1.1 3,325 MW Solar Power Park within 30 GW RE Park

The Gujarat State Electricity Corporation Limited (GSECL) has been designated as the Solar Power Park Developer (SPPD) by Government of Gujarat for facilitation and implementation of Khavada Ultra Mega Renewable Energy Power Park (KUMREPP) with a capacity of 3,325 MW within the 30 GW RE Park. The SPPD has obtained approval to set up the KUMREPP from Government of Gujarat and Ministry of New And Renewable Energy (MNRE) vide letters SLR/11/2019/ GOI-54/ B1 dated 13.05.2021 and 320/9/2021-NSM dated 12.08.2021 respectively.

GSECL has been allocated 6,650 hectares of land by GPCL for development of 3,325 MW of solar power park within the 30 GE RE park. The SPPD has further divided the total land allocated by GPCL for 3,325 MW solar power park into two blocks i.e. North Block (2,756 hectares) with a solar power capacity of 1,360.24 MW and South Block (3,894 hectares) with a capacity of 1,964.76 MW. The SPPD has agreed to allot land in the north and south blocks of the 3,325 MW solar park to the Solar Power Developers (SPD) who were selected through competitive bidding conducted by Gujarat Urja Vikas Nigam Limited (GUVNL) on 20.05.2023.

As per the Request for Selection (RfS) document dated 20.05.2023, the successful bidders shall set up the solar power project on the allocated land including the power evacuation cable up to the pooling station at its own cost. All approvals, permits and clearances required for setting up of the Project (including connectivity) and those required from State Government and local bodies shall be in the scope of GSECL and the Project SPVs shall enter into an Implementation & Support Agreement (ISA) with GSECL for the same. GSECL will be also responsible for setting up common infrastructure within the 3,325 MW solar park which will be shared between all the successful SPDs within north and south block. The common infrastructure to be developed by GSECL for the SPDs include the following:

- Allocation of land on lease at maximum rate of 1.85Ha / MW.
- Availability of connectivity at 33 kV/ 400kV pooling station of GSECL. Power from GSECL pooling station will be transmitted to 400/765 KV Khavda PS-II pooling station of Central Transmission Utility of India Limited (CTUIL)
- Right of Way for installation of underground cable from project to Pooling Station.
- Water Supply during operation period.

- Storm Water Drainage System / Bunding as decided by GSECL
- Outer fencing of Solar Park as decided by GSECL
- Solar Radiation Resource Assessment (SRRA) and Weather Station
- Fire Safety
- Support in Power Supply during construction

Based on discussion with GSECL during site visit, GSECL will support the SPDs by providing cable corridor/ tranche within their respective project boundaries, where the SPDs will lay 33kV cross-linked polyethylene (XLPE) cable connecting their respective solar power projects to the 33kV/400kV pooling substation of GSECL. According to the Detailed Project Report for 3325 MW Solar park by GSECL, two separate pooling substations of 33 kV/400 kV will be developed by GSECL for north block and south block. The power from the pooling substation of north block will be evacuated through single circuit 400 kV transmission line whereas from south block pooling substation will be evacuated through double circuit transmission line of 400 kV by GSECL to the 400 kV Central Transmission Utility of Power Grid Corporation of India Limited (PGCIL).

During the site visit, it was reported by GSECL that GUVNL has selected the following SPDs for 2200 MW solar power project within north block and south block of the 3325 MW solar power park.

- SAEL Industries Limited: 800 MW
- National Hydroelectric Power Corporation (NHPC) Limited: 200 MW
- National Thermal Power Corporation (NTPC) Limited: 200 MW
- Satluj Jal Vidyut Nigam (SJVN) Limited: 200 MW
- KPI Green Energy Limited: 200 MW
- NLC India Limited: 600 MW

As reported by GSECL, out of the 3325 MW solar power park, 2200 MW has been allotted to the selected SPDs and bidding process for remaining 1125 MW solar park is yet to be conducted by GUVNL.

2.1.2 800 MW Solar Power Project within 3325 MW Solar Power Park

M/s SAEL Industries Limited participated in the competitive bidding process conducted by GUVNL on 20.05.2023 and was declared as the successful bidder for setting up 800 MW solar power project i.e., base capacity of 400 MW and greenshoe[2] capacity of 400 MW within the 3325 MW solar park. SAEL has been allotted with 1480 hectare of land within the south block of the solar park to develop the 800 MW solar power project. The Letter of Intent (LoI) was issued by GUVNL on 03.08.2023 with a clause to execute power purchase agreement with GUVNL within 60 days of issuance of LoI or within 10 days from adoption of tariff by Gujarat Electricity Regulatory Commission (GERC), whichever is later.

Based on discussion with Client, it is understood that two SPVs have been developed by SAEL for development of 400 MW solar power project each and two separate power purchase agreement will be executed between GUVNL and the SPVs. The power purchase agreement is yet to be signed between the aforementioned parties.

The salient features of the project have been presented in ***Table 2-1*** and the Project layout has been presented in ***Figure 2-1.***

Table 2-1 Salient Features of the 800 MW Solar Power Plant

Sr. No.	Components	800 MW Solar Power Plant
General Details		
1.	SPV Name	• 400 MW: SAEL Solar P4 Private Limited (SSP4PL) • 400 MW: SAEL Solar P5 Private Limited (SSP5PL) (*Hereinafter referred to as "Project SPVs*)
2.	Project Capacity	800 MW
3.	Site coordinates	• Northern Boundary: 24° 2'49.06"N, 69°32'16.94"E • Southern Boundary: 23°59'12.49"N, 69°33'17.39"E • Eastern Boundary: 23°59'47.92"N, 69°35'47.38"E

[2] A greenshoe option is a clause that allows the bidder to bid for additional capacity beyond the contracted capacity. The additional capacity is usually up to 100% of the contracted capacity.

Sr. No.	Components	800 MW Solar Power Plant
		• Western Boundary: 24° 1'0.28"N, 69°31'50.52"E
4.	Site Location	The Project is located within NBSF boundary, 20 km from Khavda village in Bhuj tehsil of Kachchh district in the state of Gujarat
5.	Nearest Highway	SH-45 located at an aerial distance of 15 km from project boundary towards south east direction.
6.	Nearest Railway Station	Bhuj railway station located at an aerial distance of 82 km from the project boundary towards south direction.
7.	Nearest Airport	Bhuj Airport located at an aerial distance of 80 km from project boundary towards south direction.
8.	Current Project Status	The project is currently under project stage where land lease agreement and power purchase agreement is yet to be executed between the Project SPVs and GSECL and GUVNL respectively. As reported by the client, the lease agreement will be signed after signing of power purchase agreement between GSECL and Project SPVs.
9.	Commercial Operation Date	Tentatively December 2024 (as per Project schedule)
Project Component		
10.	Total PV Modules	16,00,000 for 800 MW solar project
11.	Module Make	Jinko / Trina / SAEL
12.	Solar Technology	Photovoltaic (PV) System
13.	Mounting type	Ground Mounted
14.	Module Cleaning Type	As per Client, the Project team is evaluating feasibility of 100% dry robotic cleaning, based on the climatic factors of the Project area. However, there is a potential that the project may adopt both dry as well as wet module cleaning for the 800 MW Project
15.	Total Inverters	256 no.s of 3.125 kVA each for 800 MW
16.	Inverter Make	Sineng / Sungrow
17.	Transformers	64 no,s of 12.5 mVA for 800 MW
Power Transmission Details		
18.	Transmission Line type	33 kV XLPE cable
19.	Transmission Line length	The length of the transmission line is yet to be finalized. The Project will lay 33 kV underground XLPE cable within the corridor/tranche to be set up by GSECL along the Project boundary. The 33 kV XLPE cable will connect the Project to the south block pooling substation of GSECL. Power from the pooling substation will be evacuated by GSECL through 400 kV double circuit overhead transmission line having 9 towers to the PGCIL grid substation. *Note: Project SPVs will not have any role in power evacuation from GSECL pooling substation to the 400 kV grid substation*.
20.	Pooling Substation	33 kV/400 kV pooling substation (24° 3'12.45"N, 69°32'5.70"E) of GSECL within south block of the 3325 MW Solar power park located at an aerial distance of 600 m from the northern boundary of the Project towards north direction.
21.	Grid Substation	400 kV grid substation of PGCIL (24° 4'41.93"N, 69°31'19.65"E) located at an aerial distance of 3.5 km from the northern boundary of the Project towards the north direction. *Note: Power Evacuation from Pooling Substation of GSECL to the Grid Substation of PGCIL does not fall under the purview of Project SPVs.*
22.	Power Purchase Agreement	The Power Purchase Agreement is yet to be initiated between Project SPVs and GUVNL. The tentative PPA execution date is estimated to be 1st October 2023.

Sr. No.	Components	800 MW Solar Power Plant
Additional Project Infrastructure		
23.	Additional Project Infrastructure	It is expected that separate store room, site office, scrap yard, labour camp, batching plant (for construction phase) will be set up within the respective project boundary.
24.	3325 MW Solar Power Park Infrastructure	As per the Implementation and Support Agreement (ISA), GSECL will be responsible for providing common infrastructure within the solar power park which can be shared by the SPDs including 800 MW Project. These will include internal pooling substation, transmission system up to the PGCIL grid substation, roads within the 3325 MW solar park to approach respective solar project, 1 MLD desalination plant with water supply for operation phase, storm drainage system, fencing and security points within the solar park, SRRA and weather station to monitor solar irradiation and other necessary weather data, common fire station and support in power supply connection during construction phase.
Project Land Details		
25.	Land Requirement for the project	The total land requirement for the project is 1,480 hectares (refer to Table 2-2 for details).
E&S Sensitivities		
26.	Surface water bodies within 25 km radius	As per google earth imagery dated 30.10.2022 and site observations, the project location is surrounded by salt pans towards south direction. Additionally, there are small water ponds in all directions of the project which leads to deposition of salt on ground post evaporation of water. The site was also observed be water logged at two -three locations due to rainfall in the area. The water at site will start evaporating in the month of October leading to deposition of salt on the ground. Rann of Kutch lake which is part of Kachchh Desert Wildlife Sanctuary is located at an aerial distance of 18 km from the project's eastern boundary towards east direction.
27.	Groundwater Status	According to Dynamic Groundwater Resources of India, 2022[3], Bhuj tehsil, where the proposed project is falling is categorized as over exploited in terms of groundwater development and extraction.
28.	Presence of National Park, Protected Area, or ecologically sensitive sites in near vicinity	There is no protected area[4] as well as Important Bird and Biodiversity Area (IBA)[5] within the proximity of 10 km. The nearest protected area (PA), Kachchh Desert Wildlife Sanctuary is located about 15 km from the project boundary in East direction; while the nearest Important Bird and Biodiversity Areas (IBAs) **i.** Banni Grassland and Chhari Dhand and **ii.** Flamingo City are located about 18 km from the project boundary in South and East directions respectively.
29.	Presence of Indigenous People	The project area does not fall within the Schedule V areas as designated by the Ministry of Tribal Affairs, Government of India. Additionally, the allocated land has remained unaffected by any form of human settlement, encroachment, agricultural use, grazing, or other human activities. Consequently, the allocation of this land has not led to any adverse impacts on communities or groups of Indigenous Peoples who maintain a collective attachment to distinct habitats or ancestral territories, including the natural resources within these areas. Furthermore, the implementation of the project will not result in the loss of collective attachment to distinct habitats or ancestral territories by any communities or groups of Indigenous Peoples.
30.	Presence of common property usage or culturally sensitive areas within 5 km radius of the project	As confirmed during the site visit and consultation with the local community, no cultural heritage is impacted by the Project or any of its activities. Further, as the land allotted to the project is free from any human settlement and the project activities will not result in any impact on cultural heritage, which refers to (i) tangible forms

[3] http://cgwb.gov.in/sites/default/files/inline-files/2022-11-11-gwra_2022_1_compressed.pdf

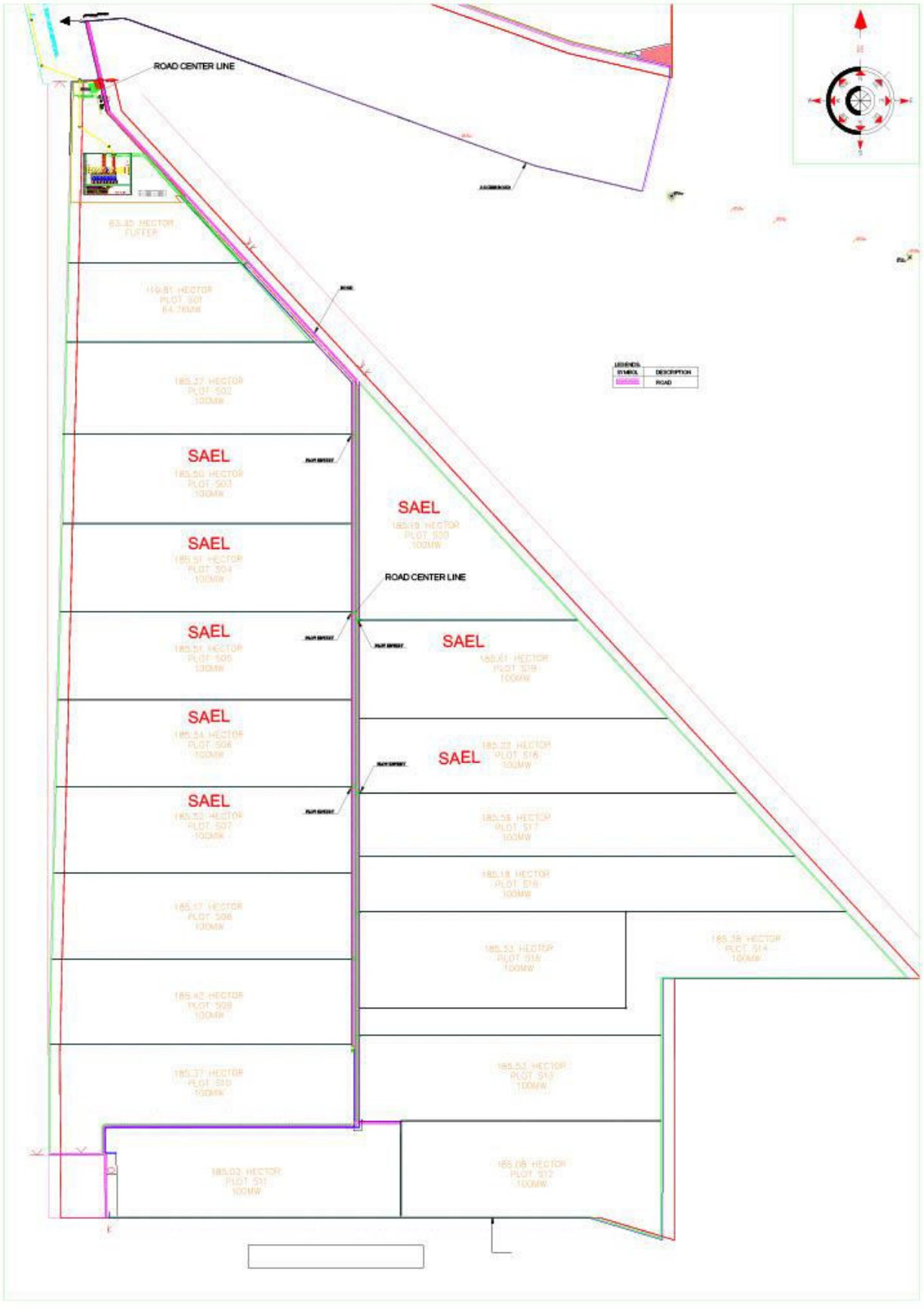
4 http://wiienvis.nic.in/Database/Maps_PAs_1267.aspx

5 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.

Sr. No.	Components	800 MW Solar Power Plant
		of cultural heritage, such as tangible moveable or immovable objects, property, sites, structures, or groups of structures, having archaeological (prehistoric), paleontological, historical, cultural, artistic, and religious values; (ii) unique natural features or tangible objects that embody cultural values, such as sacred groves, rocks, lakes, and waterfalls; and (iii) certain instances of intangible forms of culture such as cultural knowledge, innovations, and practices of communities embodying traditional lifestyles.

Source: Site visit, Google Earth Imagery dated 30.10.2022 and data shared by Client

Figure 2-2 Layout of the 800 MW Solar Power Project within 3325 MW Solar Power Park



Source: SAEL

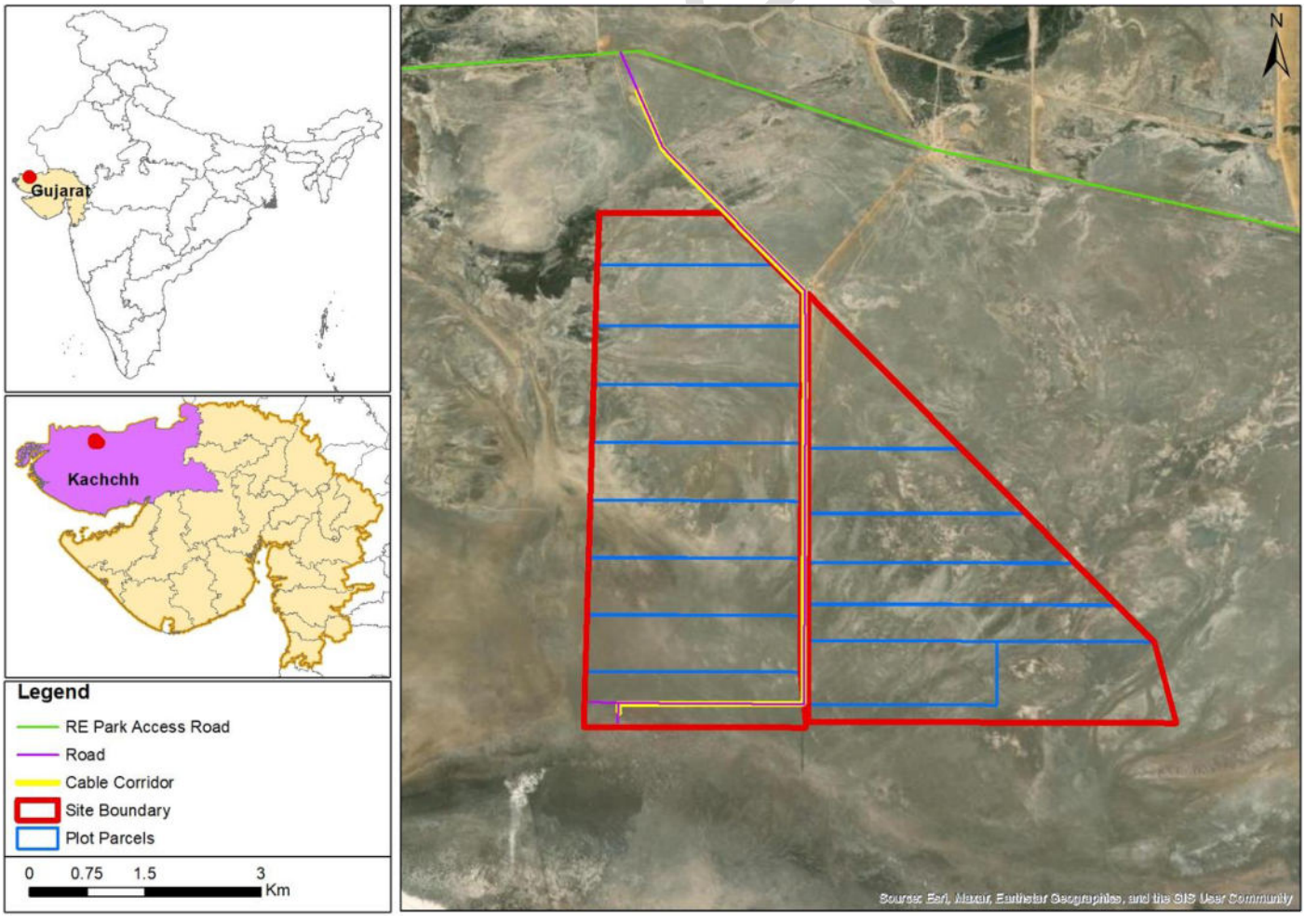
2.2 Project Location and Site setting

The 800 MW solar power project is located within the 3,325 MW solar park of GSECL. The project is located on flat coastal plain with elevation ranging between 0-16 m. The project is located on eight (8) land parcels demarcated by GSECL of 100 MW each and measuring 1,480 hectares. Notably, as per the allocation letter issued by the District Collector, Kachchh, the allocated land is categorized as unsurveyed desert terrain devoid of human settlements. Prior to its allocation for the 30 GW RE Park, the allotted land fell within the purview of the Border Security Force (BSF) due to its proximity to the India-Pakistan international borders. The project is currently surrounded by barren lands in all the directions which have been allotted to different SPDs for development of solar power projects (refer ***Figure 2-1***). There are salt pans and salt marshes located towards the south direction of the project and Rann of Kutch Lake, which is part of Kachchh Desert Wildlife Sanctuary is located at an aerial distance of 18 km from the eastern boundary of the project towards east direction. During site visit, water logging was observed within the site at two-three locations due to rainfall in the project area. The project area is exposed to high evaporation rate in the month of October. Due to presence of salt pans in the project region, evaporation of water lead to deposition of salt on the land parcels. India bridge is located approximately 17 km (aerial distance) from the eastern boundary of the project towards east direction. The Arabian Sea is located approximately 130 km (aerial distance) from the project boundary towards the west direction.

There are no settlements located within 15 km of the project radius. Nearest village to the project is Dhrobana located at an aerial distance of 19 km towards southeast direction. The project is accessible through state highway-45 which gets connected to RE park road at the BSF check post located 15 km (aerial distance) from project boundary towards east direction. From the RE park road, GSECL has developed internal solar park road to access the 800 MW solar power project. The project is located approximately at an aerial distance of 2km from the RE park road.

The project location map has been presented in ***Figure 2-3.***

Figure 2-3 Map showing Project Location



Source: Arc GIS Mapping

2.3 Project Transportation route and planning

As reported, the transportation of heavy material by the project will include solar panels and transformers. For the transportation of these materials, the Project will use the existing state highway no. 341 from Bhuj city to the boundary of 30 GW RE Solar Park. Inside the solar park boundary, the Project will use the existing road developed by GUVNL and GSECL.

Further, as observed, in the current scenario, the state highway and road developed by GUVNL are used by other private solar plant developers to transport heavy materials. The roads were observed to be in good condition for transporting material. Additionally, GSECL is still in the process of developing internal roads for the 3.325 GW project, and these roads will be appropriate for transporting heavy materials by the Project.

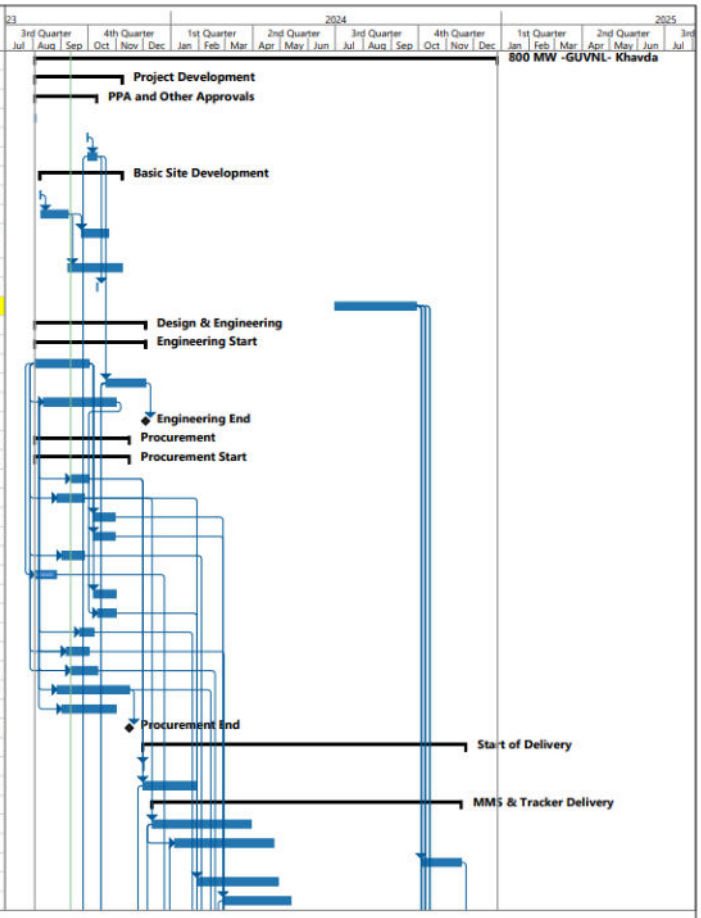
2.4 Project Schedule

According to the Project Schedule shared by Client, it is understood that the project planning was initiated in August 2023 post issue of Letter of Intent by GUVNL to SAEL on 03.08.2023. The project is currently under planning stage with PPA expected to be executed by first week of October 2023. The site mobilization, staffing and development of project office in Bhuj city is expected to be initiated by October 2023. The construction work (initiation of fencing work) is expected to be initiated by December 2023 and completed by December 2024. The approvals for commissioning and equipment testing for the 800 MW solar power project are expected to be completed between October 2024 to December 2024. The tentative project commissioning date estimated by Project SPVs is between 18.12.2024 to 27.12.2024.

The project schedule for the 800 MW solar power project has been presented in ***Figure 2-4.***

Figure 2-4 Project Schedule for 800 MW solar power project

ID	Task Name	Duration	Start	Finish
1	**800 MW -GUVNL- Khavda**	**513 days**	**Thu 03-08-23**	**Fri 27-12-24**
2	**Project Development**	**97 days**	**Thu 03-08-23**	**Tue 07-11-23**
3	**PPA and Other Approvals**	**69 days**	**Thu 03-08-23**	**Tue 10-10-23**
4	LOA	1 day	Thu 03-08-23	Thu 03-08-23
5	PPA	1 day	Sat 30-09-23	Sat 30-09-23
6	Land Lease & possession from GSECL	10 days	Sun 01-10-23	Tue 10-10-23
7	**Basic Site Development**	**91 days**	**Wed 09-08-23**	**Tue 07-11-23**
8	Initial Manpower Deployment	1 day	Wed 09-08-23	Wed 09-08-23
9	Office Setup In Bhuj	30 days	Thu 10-08-23	Fri 08-09-23
10	Pre-construction Approvals(work permits,Labour License etc.)	30 days	Sun 24-09-23	Mon 23-10-23
11	Site Set-up(Accomodation, Security etc.)	60 days	Sat 09-09-23	Tue 07-11-23
12	**NTP (Notice to Proceed)**	1 day	Wed 11-10-23	Wed 11-10-23
13	**Non Working Period at Site (Due to rainy Season)**	90 edays	Mon 01-07-24	Sun 29-09-24
14	**Design & Engineering**	**123 days**	**Thu 03-08-23**	**Sun 03-12-23**
15	**Engineering Start**	**123 days**	**Thu 03-08-23**	**Sun 03-12-23**
16	Major Equipment technical closure	60 days	Thu 03-08-23	Sun 01-10-23
17	Good for Construction Release	44 days	Sat 21-10-23	Sun 03-12-23
18	Bill of Quantity Finalization	80 days	Sun 13-08-23	Tue 31-10-23
19	**Engineering End**	0 days	Sun 03-12-23	Sun 03-12-23
20	**Procurement**	**105 days**	**Thu 03-08-23**	**Wed 15-11-23**
21	**Procurement Start**	**105 days**	**Thu 03-08-23**	**Wed 15-11-23**
22	Fencing Material	20 days	Tue 12-09-23	Sun 01-10-23
23	MMS with Tracker	30 days	Mon 28-08-23	Tue 26-09-23
24	LT and HT Cables	24 days	Sat 07-10-23	Mon 30-10-23
25	Solar Cables	24 days	Sat 07-10-23	Mon 30-10-23
26	Module	25 days	Sat 02-09-23	Tue 26-09-23
27	Central Inverter	24 days	Thu 03-08-23	Sat 26-08-23
28	SVG(Var Compensation)	25 days	Sat 07-10-23	Tue 31-10-23
29	String Combiner Box	20 days	Thu 12-10-23	Tue 31-10-23
30	Earthing Material	15 days	Fri 22-09-23	Fri 06-10-23
31	Inverter Duty Transformer's	25 days	Thu 07-09-23	Sun 01-10-23
32	HT Panel and Electrical equipments	30 days	Tue 12-09-23	Wed 11-10-23
33	Misc Material	80 days	Mon 28-08-23	Wed 15-11-23
34	Sub-Contractor Finalization	60 days	Sat 02-09-23	Tue 31-10-23
35	**Procurement End**	0 days	Wed 15-11-23	Wed 15-11-23
36	**Start of Delivery**	**358 days**	**Fri 01-12-23**	**Fri 22-11-24**
37	Start of supply	1 day	Fri 01-12-23	Fri 01-12-23
38	Fencing material	60 days	Fri 01-12-23	Mon 29-01-24
39	**MMS & Tracker Delivery**	**343 days**	**Mon 11-12-23**	**Sun 17-11-24**
40	MMS Column Delivery	110 days	Mon 11-12-23	Fri 29-03-24
41	MMS Top Parts First Lot(750 MWp)	110 days	Fri 05-01-24	Tue 23-04-24
42	MMS Top Parts Second Lot(250 MWp)	45 days	Fri 04-10-24	Sun 17-11-24
43	Tracker	90 days	Tue 30-01-24	Sun 28-04-24
44	Solar Cable	75 days	Wed 28-02-24	Sun 12-05-24



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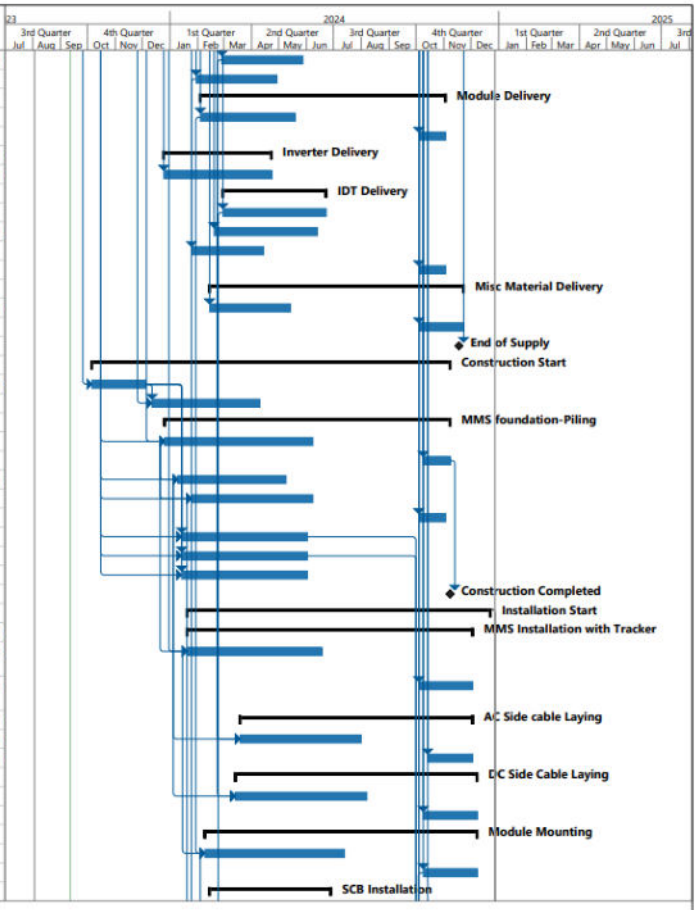
ID	Task Name	Duration	Start	Finish
45	LT & HT Cables	90 days	Wed 28-02-24	Mon 27-05-24
46	String Combiner Box	90 days	Tue 30-01-24	Sun 28-04-24
47	**Module Delivery**	**273 days**	**Sun 04-02-24**	**Sat 02-11-24**
48	Module Delivery First Lot (Approx-75% Qty)	105 days	Sun 04-02-24	Sat 18-05-24
49	Module Delivery Second Lot (Approx-25% Qty)	30 days	Fri 04-10-24	Sat 02-11-24
50	**Inverter Delivery**	**120 days**	**Mon 25-12-23**	**Mon 22-04-24**
51	Inverter Delivery	120 days	Mon 25-12-23	Mon 22-04-24
52	**IDT Delivery**	**115 days**	**Thu 29-02-24**	**Sat 22-06-24**
53	Inverter duty Transformer	115 days	Thu 29-02-24	Sat 22-06-24
54	HT Panel and Electrical equipments	115 days	Mon 19-02-24	Wed 12-06-24
55	Earthing Material First Lot	80 days	Thu 25-01-24	Sat 13-04-24
56	Earthing Material Second Lot	30 days	Fri 04-10-24	Sat 02-11-24
57	**Misc Material Delivery**	**283 days**	**Wed 14-02-24**	**Fri 22-11-24**
58	Misc Material First Lot	90 days	Wed 14-02-24	Mon 13-05-24
59	Misc Material Second Lot	50 days	Fri 04-10-24	Fri 22-11-24
60	**End of Supply**	0 days	Sun 17-11-24	Sun 17-11-24
61	**Construction Start**	**399 days**	**Fri 06-10-23**	**Thu 07-11-24**
62	Site Mobilisation,Staffing & Development Work	60 days	Fri 06-10-23	Mon 04-12-23
63	Fencing Work	120 days	Tue 12-12-23	Tue 09-04-24
64	**MMS foundation-Piling**	**318 days**	**Tue 26-12-23**	**Thu 07-11-24**
65	Module Structure Foundation (Piling) First Lot	165 days	Tue 26-12-23	Fri 07-06-24
66	Module Structure foundation (Piling) Second Lot	30 days	Wed 09-10-24	Thu 07-11-24
67	Cable trench Work/Civil Blocks	120 days	Wed 10-01-24	Wed 08-05-24
68	Civil Foundation For SCB first Lot	135 days	Thu 25-01-24	Fri 07-06-24
69	Civil Foundation For SCB Second Lot	30 days	Fri 04-10-24	Sat 02-11-24
70	Foundation for ICR	140 days	Sun 14-01-24	Sat 01-06-24
71	Civil Work for MCR	140 days	Sun 14-01-24	Sat 01-06-24
72	Inverter Duty Transformers Foundation	140 days	Sun 14-01-24	Sat 01-06-24
73	**Construction Completed**	0 days	Thu 07-11-24	Thu 07-11-24
74	**Installation Start**	**338 days**	**Sat 20-01-24**	**Sun 22-12-24**
75	**MMS Installation with Tracker**	**318 days**	**Sat 20-01-24**	**Mon 02-12-24**
76	Module Mounting structure Installation First Lot(750 MWp)	150 days	Sat 20-01-24	Mon 17-06-24
77	Module mounting Structure Installation Second Lot (250 MWp)	60 days	Fri 04-10-24	Mon 02-12-24
78	**AC Side cable Laying**	**259 days**	**Tue 19-03-24**	**Mon 02-12-24**
79	AC-LT & HT Cable Laying first part	135 days	Tue 19-03-24	Wed 31-07-24
80	AC-HT Cable Laying Second part	50 days	Mon 14-10-24	Mon 02-12-24
81	**DC Side Cable Laying**	**269 days**	**Thu 14-03-24**	**Sat 07-12-24**
82	Solar Cable and DC Cable Laying-First Part	146 days	Thu 14-03-24	Tue 06-08-24
83	Solar Cable and DC Cable Laying-Second Part	60 days	Wed 09-10-24	Sat 07-12-24
84	**Module Mounting**	**303 days**	**Fri 09-02-24**	**Sat 07-12-24**
85	Solar Panel/PV Module First Lot	155 days	Fri 09-02-24	Fri 12-07-24
86	Solar Panel/PV Module Second Lot	60 days	Wed 09-10-24	Sat 07-12-24
87	**SCB Installation**	**135 days**	**Wed 14-02-24**	**Thu 27-06-24**



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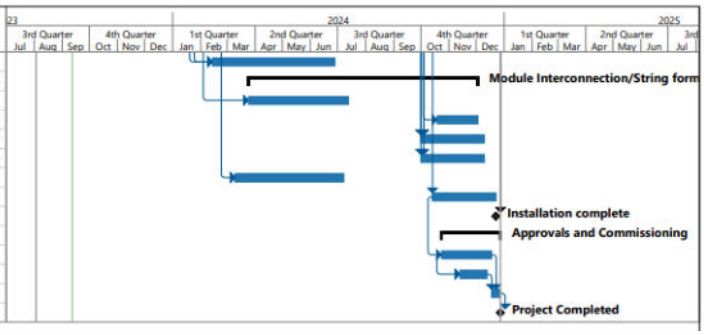
ID	Task Name	Duration	Start	Finish
88	String Combiner Box	135 days	Wed 14-02-24	Thu 27-06-24
89	**Module Interconnection/String formation**	**253 days**	**Mon 25-03-24**	**Mon 02-12-24**
90	Module Interconnections 1st Lot	110 days	Mon 25-03-24	Fri 12-07-24
91	Module Interconnections 2nd Lot	45 days	Sat 19-10-24	Mon 02-12-24
92	Inverter and other ICR Instruments	70 days	Tue 01-10-24	Mon 09-12-24
93	HT Panel and other electrical panel	70 days	Tue 01-10-24	Mon 09-12-24
94	Installation of Inverter Duty Transformer	120 days	Sun 10-03-24	Sun 07-07-24
95	Cable Terminations (All AC and DC circuits)	70 days	Mon 14-10-24	Sun 22-12-24
96	**Installation complete**	0 days	Sun 22-12-24	Sun 22-12-24
97	**Approvals and Commissioning**	**65 days**	**Thu 24-10-24**	**Fri 27-12-24**
98	Pre commissioning & Equipment testing	55 days	Thu 24-10-24	Tue 17-12-24
99	CEIG of the Plant	30 days	Wed 13-11-24	Thu 12-12-24
100	Commissioning of the plant	10 days	Wed 18-12-24	Fri 27-12-24
101	**Project Completed**	0 days	Fri 27-12-24	Fri 27-12-24



2.5 Land Requirement for the project

This section provides an understanding of the land requirement of the project and the land procurement process, reviews the consideration of safeguards put in place for land take process for the project. The review compares adopted land procurement with safeguards to be adopted for land taken in accordance with the applicable reference framework of this assessment.

2.5.1 Total Land Requirement for the Project

The total land requirement for the Project is provided below:

Table 2-2 Total Land Requirement for the Project

Project Component	Total Leased out Land Size (hectares)	Easement Rights (in hectares)	Total land requirement (hectares)	Land Category	Remarks
Solar Power Plant Parcel 1	1,480	Not applicable	1,480	Government Owned Land	Based on the consultation with GSECL and the review of the Implementation and Support Agreement (ISA) for Grid Connected solar photo Voltic Project for 800 MW, GSECL will leased out the land to the project at per the rate of 1.85 hectares per MW.
Transmission Line	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Based on discussion with GSECL during site visit, GSECL will support the SPDs by providing cable corridor/ tranche within their respective project boundaries, where the SPDs will lay 33kV cross-linked polyethylene (XLPE) cable connecting their respective solar power projects to the 33kV/400kV pooling substation of GSECL. Therefore, the project will follow the same process of laying down of 33 kV cable in the provided cable corridor. Further, the land for the cable corridor will be under the purview of GSECL.
External transmission line (400 kV)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	The power from the 33 kV/400 kV pooling substation of north block will be evacuated through single circuit 400 kV transmission line whereas from south block pooling substation will be evacuated through 1.5 km double circuit transmission line of 400 kV by GSECL to the 400 kV Central Transmission Utility of Power Grid Corporation of India Limited (PGCIL). The construction and operation & maintenance of this external transmission line will be under the purview of GSECL, and the project will not procure any land for the external transmission line.
Workers' Accommodation	Not Available	Not Applicable	Not Applicable	Project allotted government owned land and	As reported by project representatives, the project intends to establish workers' accommodation within the project's boundary to accommodate all contractual construction workers. Additionally, the project intends to take on residential

Project Component	Total Leased out Land Size (hectares)	Easement Rights (in hectares)	Total land requirement (hectares)	Land Category	Remarks
				privately owned houses	accommodations in the Khavda village to accommodate managerial-level employees employed directly by the Project.
Access Road	Not Available	Not Applicable	Not Applicable	Not Available	The project will utilize the pre-existing access road constructed by GSECL for its operational needs and will not construct a new external access road. However, it is essential for the project to undertake the development of internal access roads within the designated power plant boundary. It is noteworthy that the internal access road development will not necessitate the allotment of additional land beyond the initially allocated area, which encompasses 1480 hectares.
Total Land	**1,480**	**Not applicable**	**1,480**		

2.5.2 Brief of the land procurement Process

The District Collector of Kachchh has granted a 40-year lease for the land at a rate of 2 hectares per megawatt, equating to 55,400 hectares, for the establishment of the 30 GW RE Park to the Gujarat Power Corporation Limited (GPCL). This allocation was formalized through a letter with reference number Jaman-7/vasi/RE Park/340/2020, dated December 2020. Notably, as per the allocation letter, the allocated land is categorized as unsurvey desert terrain devoid of human settlements.

Prior to its allocation for the 30 GW RE Park, the allotted land was under the jurisdiction of the District Collector, Kachchh. However, it fell within the purview of the Border Security Force (BSF) due to its proximity to the India-Pakistan international borders.

Furthermore, in the context of the 3.325 GW sub-solar park, which is under the purview of the Gujarat State Electricity Corporation Limited (GSECL), the land was expected to be transferred from the Gujarat Power Corporation Limited (GPCL) to GSECL through a tri-party agreement involving the District Collector of Kachchh, GPCL, and GSECL. DTTILLP site visit, this tri-party agreement has not been finalized.

Additionally, it was reported that after the tri-party agreement, a Power Purchase Agreement (PPA) will be executed between GSECL and the Project Special Purpose Vehicles (SPVs). Following the execution of the PPA, the land would then be allocated to the Project SPVs on a size of 1.85 hectares per megawatt, resulting in a total land allocation of 1,480 hectares for the development of the Project.

2.5.3 Review of Draft Land Lease Agreement

GSECL has developed a draft land lease agreement, which will be signed in between GSECL and the Project SPVs. The agreement will be signed after the execution of the PPA. A review of the terms and conditions of the land lease agreement is provided below:

- Signing Authority: The land lease agreement shall be signed by GSECL and the Project SPV
- Selection of Solar Power Developer (SPD): Project SPV (SPD) has been selected through Competitive Bidding vide Tender No. GUVNL/800 MW/Khavda/Solar dated May 20, 2023
- Extent of the Land: The land to Project SPVs will be allotted at the rate of 1.85 hectares per MW, equating to 1,480 hectares
- Lease Period: GSECL will allot the land to the Project SPVs for a period of 25 years from the date of the Project's Schedule Commercial Operation (SCOD). Furthermore, there exists a provision for potential extensions, subject to written agreement and the stipulated terms and conditions, should GSECL and the Project SPVs mutually consent. It's worth noting that in the event of the termination of the current PPA and/or implementation & support agreement for any reason, this agreement will automatically be terminated as well.
- Handing over of Land: Upon execution of the land lease agreement, GSECL will provide the Project SPVs with vacant possession of the specified land, entirely free from any encumbrances. This transfer of land is to take place within 15 days from either the date of agreement signing or the signing of the implementation and support agreement, whichever occurs later
- Development of common infrastructure: GSECL will develop common infrastructure in the 3.27 MW Solar Park such as Internal Transmission System, Water Supply, Road Connectivity, Drainage System, Cable Support Structures, Fire and Weather Stations and Street Lighting.

2.5.4 Sensitivities on Allotted Land

2.5.4.1 Land Acquisition and Involuntary Resettlement

The allocated land for the 3.325 GW solar power park is under the ownership of the District Collector, Kachchh which has leased out the land to the solar park, and no land acquisition process was undertaken for the 3.325 GW Solar Park (under which the project will be developed). Additionally, the allotted land had not been subject to any form of human settlement, encroachment, agricultural use, grazing, or other human activities. Consequently, the land allocation did not lead to any form of involuntary resettlement. Furthermore, no land-related transactions of the following nature were associated with the land allotment:

- Land rights or land use rights acquired through expropriation or other compulsory procedures in accordance with the legal system of India
- Land rights or land use rights acquired through negotiated settlements with property owners or those with legal rights to the land if failure to reach settlement that have resulted in expropriation or other compulsory procedures
- Project situations where involuntary restrictions on land use and access to natural resources cause a community or groups within a community to lose access to resource usage where they have traditional or recognizable usage rights
- Allotted land result in evictions of people occupying land without formal, traditional, or recognizable usage rights

- Restriction on access to land or use of other resources including communal property and natural resources such as marine and aquatic resources, timber and non-timber forest products, freshwater, medicinal plants, hunting and gathering grounds and grazing and cropping areas

2.5.4.2 Impact on Indigenous people

The project area does not fall within the Schedule V areas as designated by the Ministry of Tribal Affairs, Government of India. Additionally, the allocated land has remained unaffected by any form of human settlement, encroachment, agricultural use, grazing, or other human activities. Consequently, the allocation of this land has not led to any adverse impacts on communities or groups of Indigenous Peoples who maintain a collective attachment to distinct habitats or ancestral territories, including the natural resources within these areas.

Furthermore, the implementation of the project will not result in the loss of collective attachment to distinct habitats or ancestral territories by any communities or groups of Indigenous Peoples.

2.6 Resource Requirement

The resource requirement during construction and operation phase of the Project has been summarised in ***Table 2-3.***

Table 2-3 Resource Requirement

Sr. No.	Resource	Approximate Quantity	Source
1.	Manpower	**Construction Phase** As reported, by the Project's representative, the project will require ~800-1000 workers during the peak construction of the project. All of the workers will be appointed on a contractual basis by the Engineering and Procurement Contractor (EPC). Further, Project will deploy ~25-30 on-roll employees to supervise the construction work. **Operation Phase** As reported, there will be ~200 workers employed during the operation phase. However, the project has not finalized the bifurcation of these workers in between different designation, department and nature of work	The information is shared by Project Representatives
2.	Water	<u>Construction Phase</u> Water during construction phase will be required for civil work, domestic purpose and drinking purpose. As per information shared by Client, approximately 5000 KL of water for 400 MW project each (total 10,000 KL for 800 MW) will be required for the entire civil work. Furthermore, for domestic and drinking purpose, approximately 4000 KL water will be required for 1000 workers at the 800 MW project during construction phase. <u>Operation Phase</u> During operation phase of solar power projects typically water is required for module cleaning, domestic and drinking purposes. As mentioned in ***Table 2-1,*** the project is exploring the feasibility to adopt 100% dry module cleaning, however, there is a potential that the project may adopt both dry as well as wet module cleaning for the 800 MW Project. Considering 6 KL/MW/cycle of water will be required (as per ISA), approximately 4800 KL of water will be required for cleaning 16 lakh modules per cycle.	<u>Construction Phase</u> Based on discussion with GSECL and review of ISA, it is understood that GSECL shall not be responsible for providing water during construction phase and the SPDs shall be required to make its own arrangement for water during construction phase. Based on discussion with Project team, it is understood that the Project will be securing water from nearby village borewells i.e., Khavda village for meeting water requirement during construction phase. Adequate NOC from Central Groundwater Board shall be obtained prior to abstracting water from the borewells. Since the TDS in the groundwater is high in the area, the project may plan to install a reverse osmosis (RO) plant within the site or supply of water for domestic purpose. <u>Operation phase</u> As per the ISA, GSECL shall provide water supply for operation of the power projects. GSECL shall set up a 1 MLD brackish water desalination plant for supply of water up to the offtake point of the SPD. GSECL will provide water at a single source/offtake point through a meter for each plot. Project SPVs shall collect the water supplied by

		For domestic and drinking purpose, approximately 16 KLD water considering 80 litres/person/day[6] for 200 workers, will be required.	GSECL in a ground level water tank and water from this tank shall be used by Project SPVs during operation phase.
3.	Construction Material	**Cement** As per data shared by client, 3,50,000 bags of cement will be required for each 400 MW project i.e., ~7,00,000 bags for 800 MW power project. **Stone** As per data shared by client, approximately 40,000 tonnes of stones will be required for each 400 MW project i.e., ~80,000 tonnes for 800 MW power project. **Steel** As per data shared by client, approximately 25,000 tonnes of steel will be required for each 400 MW project i.e., ~50,000 tonnes for 800 MW power project. **Sand** As per data shared by client, approximately 35,000 tonnes of sand will be required for each 400 MW project i.e., ~70,000 tonnes for 800 MW power project. **Aggregate** As per data shared by client, approximately 50,000 tonnes of aggregates will be required for each 400 MW project i.e., ~1,00,000 tonnes for 800 MW power project	The procurement of the construction material falls under the purview of EPC contractor which is yet to be decided. However, based on discussion with project team, it was reported that the construction material is expected to be procured from local suppliers
4.	Major Equipment	**Batching Plant** As per data shared by client, 3-4 no.s of batching plant will be set up within the premises of 800 MW project. **Ajax Mixture** As per data shared by client, 20-25 no.s of Ajax mixture will be deployed for the 800 MW project **Transit Mixture** As per data shared by client, 5-6 no.s of transit mixtures will be deployed for the 800 MW Project	The deployment of construction equipment falls under the purview of EPC contractor which is yet to be decided.
5.	Construction vehicles	As per data shared by client, it is understood that more than 100 trucks and trolleys will be deployed on the access roads per month for initial 5-6 months for transportation of construction material at the Project site.	
6.	Solar Panels	During Operation Phase, approximately, 16,00,000 solar modules will be installed for the 800 MW solar power project	The Project has shortlisted a pool of ~5-10 suppliers including SAEL Solar Manufacturing Private Limited.
7.	Power	**Construction phase** As per the ISA agreement, GSECL will extend support to in obtaining power supply connection by the SPDs. However, the SPDs will be required to apply to local power distribution authorities in the prescribed application form at its own cost. As per data shared by client, Project SPVs plans to install DG sets during construction phase. Approximately 2 MW power will be required for development of 800 MW solar power project. The quantity and capacity of each DG sets are yet to be finalized. **Operation Phase** During operation phase, power will be sourced from solar plant for auxiliary consumption and one DG set (capacity yet to be decided) will be set up for power back up	
8.	Fuel Requirement	**Construction Phase** As per data shared by client, approximately 300 KL fuel will be required for DG sets and other construction machinery (as appropriate). Fuel will be procured from nearby petrol pump as and when required. Additionally, project may store limited quantity of fuel at the batching plant area to meet immediate fuel requirement at the under-construction project.	

[6] IFC Worker's accommodation Guideline

		Operation Phase During operation phase fuel will be required for one DG set to be installed for power back up. The quantity of fuel for one DG set will be limited and it will be procured from nearby petrol pump as and when required. No fuel will be stored at project premises.
9.	Fire Safety and Security	**Construction Phase** Based on discussion with site team, it is understood that 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, Gujarat Fire Prevention and Life Safety Measures Act, 2013 and Gujarat Fire Prevention and Life Safety Measures Rules, 2014 . **Operation Phase** During operation phase, GSECL shall establish common a Fire Station for the entire Solar Park with a fire tender to assist the SPDs in case of fire. Additionally, Project SPVs are expected to set up firefighting system including portable fire extinguishers, fire buckets and automatic fire detection system at the inverter stations, main control room 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 to comply 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.

Source: Data shared by Client

2.7 Waste Management Practice for Proposed 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 2-4.***

Table 2-4 Waste Management at Proposed Project

Waste Type	Project Phase	Proposed Management Practice
Domestic solid waste including food waste from site office and labour camps during construction phase and site office, SCADA building during operation phase	Construction and Operation Phase	Since the Project area does not fall under the jurisdiction of local municipal body, there is no provision of daily collection of solid waste by the local garbage collector. However, the project will dispose municipal solid waste from worker accommodation and site office through an authorized third party contractor on daily basis. Refer ***Table 7-1*** for options for disposal of solid waste.
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 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 storeroom with secondary containment. The storage containers will be clearly marked and identified for their hazards. Within 90 days of their generation, hazardous waste materials will be sent to Gujarat Pollution Control Board (GPCB)/Central Pollution Control Board (CPCB) authorized vendor for disposal at the Common Hazardous Waste Treatment, Storage and Disposal Facility (CHWTSDF). Hazardous waste

Waste Type	Project Phase	Proposed Management Practice
		authorized vendor is yet to be identified by Project SPVs
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.
Sewage from site office, labour camps and SCADA building	Construction Phase and Operation Phase	Sewage from site office, SCADA room and labour camps and other areas will dispose 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 project such as blood contaminated bandages, (if any) will be disposed through nearby hospital tie up. Expired medicines and ointments will be disposed through 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.

2.8 Common Infrastructure Facilities of GSECL

As per the ISA, GSECL will develop common infrastructure in the 3325 MW Solar Park which will include the following:

2.8.1.1.1 Internal Evacuation System

According to the ISA, GSECL shall provide all necessary evacuation facilities such as 400/ 33 KV Substation and its associated transmission lines for interconnection of the Project and evacuation of power from the Project up to interconnection point. The Project SPVs shall be required to connect to 33 KV bus of 400/ 33 KV Internal Sub- station by 33 KV cables at its own cost. The internal pooling sub-stations are connected with 400/765 KV Khavda PS-II (CTUIL) Station with Back-to-Back Connectivity. GSECL shall provide metering system at the 400 kV side of 400/ 33 KV, 33kV side of 400/33KV PSS and 400/765 KV Khavda PS-II Pooling Substation.

2.8.1.1.2 Right of Way

GSECL shall provide Right of Way to install necessary 33 KV cable up to Internal Evacuation Substation. Project SPVs shall install underground cable from the project to the 400/ 33 KV Pooling Substation at its own cost.

2.8.1.1.3 Main Road

GSECL shall lay and maintain the main roads i.e., at least one approach road so as to provide access to all the plots in the Solar Park. Internal access roads within plot and connectivity road with the plot shall have to be laid by the Project SPVs at its own cost.

2.8.1.1.4 Fencing and Security Points at Solar Park

GSECL shall arrange fencing on the outer periphery of Solar Park, wherever necessary. GSECL shall also arrange security point/s for security of entire Park. However, Project SPVs shall have to fence their own plot boundary and arrange for their own security point within their allotted plot.

2.8.1.1.5 Water Supply System

GSECL shall not provide water supply during the construction phase. Project SPVs shall make its own arrangements for obtaining water during construction. GSECL shall arrange and provide the necessary water supply for operations and maintenance of the

Solar Power Plants. GSECL shall develop 1MLD brackish water desalination plant for supply of water up to offtake point. Supply of water shall be governed as per the contract between GSECL and Project SPVs.

Payment towards water charges would be charged to Project SPVs along with administrative charges on pro- rata basis either based on MW or water quantity declared by Project SPVs or water used as the case may be.

2.8.1.1.6 Storm Water Drainage System

GSECL shall lay and maintain the main drains along the main road, or as proposed in the master plan to which Project SPVs may connect their internal plant drains. Major streams are suggested to be channelized by Project SPVs as tentatively indicated in the plot plan & obtain necessary approvals from GSECL for maintaining continuity in existing streams at the boundary of individual plots.

2.8.1.1.7 Solar Radiation Resource Assessment (SRRA) and Weather Station

GSECL shall establish and maintain SRRA and the weather station to monitor the solar irradiation and other necessary weather data. SRRA and Weather Station are additional facilities. It shall not legally bind GSECL for its validity and accuracy.

2.8.1.1.8 Fire Safety

GSECL shall establish a common Fire Station for the entire Solar Park with a fire tender to assist the Project SPVs in case of fire. However, the Project SPVs shall establish and maintain its own firefighting and safety equipment to avoid/minimize the loss/damage of property/equipment in case of fire. GSECL shall, however, not in any manner, be held responsible for any loss/damage of property/equipment of Project SPVs due to fire accidents.

2.8.1.1.9 Power Supply during Construction

In respect of power supply required during construction period, Project SPVs have to apply to local power distribution authorities in the prescribed application form at its own cost and the Project SPVs shall also be responsible for all including timely payments etc. However, GSECL will extend necessary support in obtaining the power supply connection. Project SPVs may use any other source of power, subject to approval/consent from competent authority.

2.9 Analysis of Alternatives

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

2.9.1 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.

2.9.1.1 Power Requirement in Gujarat

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 Gujarat and the entire western region. The actual power scenario in Gujarat for FY 2022-23 has been presented in ***Table 2-5***.

Table 2-5 Power Supply Scenario of Gujarat and Western Region in FY 2022-23

State/Region	Requirement (MU)	Availability (MU)	Deficit (MU)	Deficit (%)
Gujarat	139,245	139,201	-44	- 0.1
Western Region	474,458	473,870	-588	- 0.1

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[7]. 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 of Gujarat as well as of India.

2.9.2 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. Even though 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[8].

Solar energy is an eco-friendly process that is infinite and has a small environmental impact. The plant will require minimal 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 12 months after micro siting, approvals, and land procurement). As per the estimations of International Atomic Energy Agency (IAEA)[9] the grams of carbon-equivalent (including CO_2, CH_4, N_2O, 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 Greenhouse Gas 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; favorable 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 Project tehsil and district, solar energy-based power generation is the most appropriate alternative in Gujarat.

2.9.3 Suitability of the 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 6.0-6.5 kWh/m^2/day[10] and availability of 300 sunny days. The final selection of the project site depends upon availability solar irradiation, contiguous patch of land that is willingly sold by landowners. Since the project was won by the Project SPVs as part of bidding process and further the project is a part of

[7] Conventional sources of energy are non-renewable sources of energy that are present in limited quantities and take a long time to create. Examples of conventional sources of energy include oil, natural gas, coal.
[8] https://powermin.gov.in/en/content/power-sector-glance-all-india
[9] https://www.iaea.org/sites/default/files/42204981924.PDF
[10] https://nsrdb.nrel.gov/data-viewer

3325 MW solar power park of GSECL located within the larger 30 GW RE park of GPCL, hence, the option of choosing an alternative area for 800 MW solar power project is not available to the project developer.

The proposed project land has the following location advantages:

- Land parcels high solar irradiation;
- Since the past land use of the project was unused barren land under the possession of BSF, there is no dependency of local community on the identified land parcels for the project
- No ecological sensitive areas such as national Parks, wildlife sanctuary and Important Bird & Biodiversity Area (IBA) located within 10 km radius of the project
- No cultural property of archaeological importance within 25 km radius of the project.
- There exist no obstacles around the site in the form of major trees, buildings etc. that could lead to near shading.
- Additionally, since the project is part of 3325 MW solar power park, common infrastructure facilities will be provided by the solar power park developer i.e., GSECL which will support the Project SPV in terms of resource requirement and infrastructure for the development and operation of the 800 MW project.

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 Gujarat to be self-sufficient in power generation and supply.

3 Applicable Legislative, Regulatory and Administrative Regime

This section highlights the environmental and social regulations applicable to the proposed project

3.1 National Administration Requirement

In India, the national level laws are formulated by Ministry of Environment Forests and Climate Change (MoEFCC), Ministry of Labour & Employment and state governments are required to consider these regulations as base level for implementation. The state Pollution Control Boards (SPCBs), State Labour Department, District Revenue Department are responsible for state level environmental, labour and land related regulations. A brief description of the relevant enforcement agencies both at central 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) was formed for controlling water, air and noise pollution, land degradation, 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-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

Sr. No	Agency	Function
		• 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 borewells in 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 "notified areas” further extraction is regulated 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 is 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 regarding 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 of 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	Gujarat Energy Development Agency (GEDA)	Different states have created Energy Development Agency as the designated agency to co-ordinate, regulate and enforce the provisions of the Energy Conservation Act and implement schemes under the said Act within the State. The objective is to undertake development of renewable energy and facilitate energy conservation, as a state nodal agency under the umbrella of the MNRE. The objective of GEDA are • Undertake or sponsor, techno-economic/socio-economic feasibility studies/cost-benefit analysis. • Formulate and implement a broad-based program for conservation of energy at all stages, including extraction, conversion, distribution and consumption in all sectors of the economy. • Study the environmental effects of all energy-related processes. • Establish an Energy Resources Centre that will collect and collate energy and inter-related information. • Develop and support Documentation Services in area of energy in general and renewable energy in particular.

Sr. No	Agency	Function
		• Develop Communication and Education projects for widespread dissemination of energy and environmental issues
8	Gujarat State Pollution Control Board (GSPCB)	The Government of Gujarat constituted the GPCB (Gujarat Pollution Control Board) on 15.10.1974 as per provisions under the Water (Prevention and Control of Pollution) Act, 1974 with a view to protect the environment, prevent and control the pollution of water in the State of Gujarat, that occupies a prominent niche in progressive and industrial development of the country. The Board has been entrusted with the Central Acts and relevant Rules for pollution control as notified thereof from time to time. The function of the Board is to enforce is to provisions of the following Acts, Rules and Directives issued by the Authorities from time to time.
9	Board of Revenue, Gujarat	The Department administers State Land and Revenue generation, survey and settlement apart from updating of Land records, provide financial assistance to allot tees of surplus land, survey the tribal areas, maintain computerization of land records, registrations and transfer of property, etc. E-dhara computerization of Land records is managed Initiative by the Revenue Department. Use of Government wasteland to be made cultivable for modern technology and providing funds to aid Disaster management in case of earthquake or natural calamities, are some initiatives of the Department. On bifurcation of greater Bombay state and separate Gujarat state coming into existence, Gujarat Revenue Tribunal has been formed. This tribunal has been constituted under Gujarat Revenue Tribunal Act 1957. In Gujarat State, separate Tribunal exists since 1960. The tribunal consists of one chairman and members decided by the Government. Generally, 1 + 4 total 5 members' office works as tribunal. An officer of rank of Deputy Collector acts as registrar.
10	Gram Panchayats	The local Panchayats are empowered with management of local resources like forests, groundwater, common land and infrastructure like roads, buildings etc.
11	Labour & Employment Department, Government of Gujarat	The Department of Labour is responsible for formulation, implementation, and enforcement of the labour laws in the state of Gujarat. Decent Working Conditions and Improved Quality of Life of Workers, Ensuring India without Child Labour and Enhancing Employability on a Sustainable Basis. Formulating and Implementing Policies / Programmes / Schemes / Projects for Providing Social Security and Welfare, Regulating Conditions of Work, Occupational Health and Safety of Workers, Eliminating Child Labour, Promoting Harmonious Industrial Relations, Ensuring Enforcement of Labour Laws and Promoting Employment Services. The most important functions of the Commissionerate of Labour include maintaining peaceful atmosphere in the labour sector; ensure co-operation and healthy relation between employers and the employees, systematic implementation of labour legislation, enhancing welfare of workers through better policies and programmes.
12	Private Security Agency, Gujarat	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. To provide: • Better services to the PSARA Controlling Authorities, private security agencies as well as to the citizen • Quick implementation of government policies from time to time. • Improved/transparent image of Government & Department • Instant access to information related to private security agencies To improve the quality-of-service delivery to the citizen and the quality of the work environment of the PSARA licensing authorities.
13	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 • Eliminating inequality and discrimination in the workplace • 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. The main activities Directorate Industrial Safety and Health Department are:

Sr. No	Agency	Function
		• To create awareness for Health & Safety amongst workers and factory management through seminars and other programs. • To update with the latest trend department, arrange the Safety Conference every year. • To encourage and appreciate the workers contribution in the industry by Shram Awards • To facilitate implementation of various welfares schemes for Construction workers. • To conduct required Health & Hygiene Survey in various industrial sectors.
14	The Forests & Environment Department	The Forests & Environment Department in the Government of Gujarat has environment wing and forest wing. The environment wing of the Department is the apex body in the Gujarat State 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. The Department has four executing agencies viz Gujarat Pollution Control Board, Gujarat Ecology Commission, Gujarat Institute of Desert Ecology and Gujarat Environmental Management Institute, for discharging its functions.

3.2 Gujarat Power Policy, 2021

In order to promote Solar Power Projects, and meeting the energy requirements of Gujarat and India, the Government of Gujarat has introduced Gujarat Solar Power Policy, 2021[11] with the following objectives:

- To rapidly scale up the state's solar energy capacity in order to contribute to India's overall renewable energy targets keeping in mind India's commitments under international climate agreements.
- To reduce the dependence on fossil fuels and further energy security in the State.
- To further the Sustainable Development Goals (SDG) of Gujarat.
- Employment generation and skill enhancement and promotion of local manufacturing facilities.
- To establish core technical competence in professionals by promoting research, development, deployment and innovation in the solar energy sector.
- To spread awareness about solar power technologies amongst all the electricity consumers.

To create an investment-friendly environment that can provide a win-win situation for all stakeholders in the Power Sector. According to the Gujarat Solar Policy 2021, the State intends to meet its sustainable development goals by advancing the development of solar energy in a manner that would position it as a mainstream source of energy supply as well as a primary contributor to the national target of 100 GW Solar Capacity by 2022 as part of India's Global Commitment.

[11] https://suryagujarat.guvnl.in/Gujarat-Solar-Power-Policy-2021.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
Environment Protection						
•	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).
•	Coastal Regulation Zone (CRZ) Clearance under CRZ Notification, 2019	✓	×	×	MoEFCC, Gujarat Coastal Zone Management Authority (GCZMA)	According to the CRZ boundary, the 30 GW Solar Power Park may require obtaining CRZ clearance from MoEFCC after receiving recommendation from GCZMA. The CRZ clearance will be applicable for the entire 30 GW RE park such that GPCL shall be responsible for obtaining the clearance. GSECL as well as Project SPVs shall have no role in obtaining the CRZ clearance.
•	Consent to Establish (CTE) and Consent to Operate (CTO) under the Air (Prevention and Control of Pollution) Act, 1981. The Water (Prevention and Control of Pollution) Act 1974	×	✓	×	GPCB 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 (State Pollution Control Board) and Pollution Control Committee (PCC) office. However, as mentioned earlier in the report, the installation of batching plant falls under the purview of EPC contractor, which is yet to be decided. The Project SPV is required to ensure that all the necessary permits and compliance to the permit condition is maintained by the respective contractors.
•	Hazardous Waste Authorization under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 as amended till date	×	✓	✓	GPCB 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 GPCB authorised hazardous waste recycler. Project SPV is yet to identify an authorised recycler for disposal of hazardous waste from site. The maintenance of waste records indicated in the Hazardous and Other Wastes Rules, 2016 also needs to be complied.
•	Environment Protection Act, 1986 and as amended till date	✓	✓	✓	MoEFCC CPCB GPCB	Permissible limits for ambient air quality, water quality, noise limits have been laid down by CPCB under EP Act, 1986 which requires to be complied with
•	The Noise (Regulation & Control) Rules, 2000 and as amended up to 2010 Ambient Noise Standards	×	✓	✓	GPCB 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, project SPVs and their contractors will need to abide by the limits prescribed for residential zones.
•	Solid Waste Management Rules 2016 as amended	×	✓	✓	GPCB/ local municipal body	All bio-degradable, non-biodegradable and domestic hazardous wastes generated from the project will be managed by Project SPVs (the waste generator) in accordance with the relevant provision of this Rule.
•	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.
•	Manufacture, Storage, and Import of Hazardous Chemicals (MSIHC) Rules, 1989 and as amended	×	✓	✓	GPCB	Rules will be applicable during construction and operation phases if chemicals stored at site satisfy the criteria laid down in the Rules
•	Battery Waste Management Rules, 2022	×	✓	✓	GPCB	Rules will be applicable during construction and operation phases as the project will use Batteries for power back up.
•	E-waste (Management) Rules 2022	×	✓	✓	GPCB	Rules will be applicable if electrical and electronics as listed in the Schedule I of the mentioned rules will be used and will require replacement within the lifecycle of the project

Sr. No.	Applicable Regulation/Permit	Pre-Construction	Construction	Operation	Responsible Authority	Applicability to the Project/ Status
•	Bio-Medical Waste Management Rules, 2016	×	✓	✓	GPCB	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.
•	Ground water extraction permission will be required if the project plans to abstract groundwater for fulfilling water demand.	✓	✓	✓	GPCB	As per the information provided by CGWB in the Dynamic Groundwater Resources of India (2022), the proposed Project fall in an area categorised as over exploited in terms of groundwater development. However, the water in the area is saline in nature. As per 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). However, as stated in the same notification, abstraction of saline ground water in areas having either saline ground water at all depths or pockets of saline ground water in an otherwise freshwater area for use by industries/ dewatering by infrastructure/mining projects including those located in over-exploited areas would be encouraged. Such industries shall be exempted from paying ground water abstraction charges. The list of such assessment units having saline ground water at all depths as per the latest assessment of dynamic ground water resources will be made available by the CGWA in their website. However, due care shall be taken in respect of disposal of effluents by the units so as to protect the water bodies and the aquifers from pollution. NOC for abstraction of saline water shall be granted by CGWB and the Project shall be required to adhere to the conditions stipulated in the NOC.
•	Petroleum and Explosives Safety Organisation (PESO) License under Petroleum Act, 1934 and Petroleum Rules, 2002 and as amended	×	✓	×	PESO	PESO license will be applicable to the project, in case project plans to store or transport petroleum Class B product greater than 2500 litres in non-bulk (i.e. drums) or 1000 litres in a receptacle / tank (i.e. bulk) within project premises.
Labour						
•	Contract Labour (Regulation & Abolition) Central Act 1970 and Contract Labour (Regulation and Abolition) Rules, 1972 Gujarat	×	✓	✓	Labour Department	The Act applies to: • To every establishment in which twenty or more workers 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 workers The Act details out conditions of licensing of contractors[12] 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[13]
•	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
•	Equal Remuneration Act 1976	×	✓	✓	Labour Department	Puts in place rules and regulations governing the remuneration payable to workers and employees

[12] 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
[13] 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
•	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
•	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. • 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.
•	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.
•	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,
•	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 or not 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
•	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**

Sr. No.	Applicable Regulation/Permit	Pre-Construction	Construction	Operation	Responsible Authority	Applicability to the Project/ Status
						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
•	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.
•	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
•	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
•	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.
•	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.
•	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
•	The Building and other Construction Workers Act, 1996	×	✓	✓	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.
•	The Industries Disputes (Amendment) Act, 2010	×	✓	✓	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

Sr. No.	Applicable Regulation/Permit	Pre-Construction	Construction	Operation	Responsible Authority	Applicability to the Project/ Status
						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
•	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
•	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- ○ Blindness or low vision ○ Bearing impairment ○ 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.
•	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
•	The Gujarat Factory Rule, 1963	×	×	✓	Factories Inspector from Labour Department	The Factories Act is a social legislation that has been enacted for occupational safety, health, and welfare of workers at workplace. The Act is applicable to all factories, including State and Central Government, in the premises wherein: • 10 or more workers are employed with the use of power. • 20 or more workers are employed without the use of power. • Less than 10 workers, if activity is notified by the State Government. • Engaged in manufacturing activities.

Note:
The Government of India has introduced four (4) new labour codes[14], which were passed by Parliament between 2019 and 2020. However, these codes have not yet been implemented. Based on a review of secondary information, it is anticipated that these codes may be implemented in the year 2024. Nevertheless, the Project SPV should proactively prepare for the forthcoming implementation of the new labour codes and ensure that its relevant policies and legal registers are updated accordingly.

[14] The four labour codes are:
They are:
- **The Code on Wages, 2019:** This code replaces four (4) laws related to wages, minimum wages, payment of wages and bonus. It ensures the right to minimum wages and timely payment of wages for all workers, regardless of the sector or industry. It also introduces a statutory floor wage, a national minimum wage, and a mechanism for regular revision of wages.
- **The Code on Social Security, 2020:** This code replaces nine laws related to social security, provident fund, pension, maternity benefit, gratuity, insurance, and unorganised workers. It extends social security coverage to all workers, including those in the informal sector, gig economy and platform workers. It also provides for the establishment of a National Social Security Board, a Social Security Fund, and a National Database for Unorganised Workers
- **The Occupational Safety, Health, and Working Conditions Code, 2020:** This code replaces 13 laws related to occupational safety, health and working conditions of workers. It applies to all establishments employing 10 or more workers, except mines and docks. It provides for the issuance of a single licence, registration, and annual return for multiple activities. It also lays down the duties and rights of employers and employees, the standards for working hours, leave, welfare facilities, health and safety measures and grievance redressal mechanisms
- **The Industrial Relations Code, 2020:** This code replaces three laws related to trade unions, industrial disputes and collective bargaining. It applies to all industrial establishments employing 20 or more workers, except those engaged in charitable, educational or research activities. It provides for the recognition of trade unions, the formation of a two-tier system of industrial tribunals, the regulation of strikes and lockouts, the prevention of unfair labour practices and the promotion of fixed term employment

Sr. No.	Applicable Regulation/Permit	Pre-Construction	Construction	Operation	Responsible Authority	Applicability to the Project/ Status
Ecology						
•	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 study area, the proponent should implement conservation measures for their protection.

3.4 ADB's Requirement

In July 2009, ADB's Board of Directors approved the Safeguard Policy Statement (SPS) governing the environmental and social safeguards of ADB's operations. The SPS builds upon ADB's previous safeguard policies on the Environment, Involuntary Resettlement, and Indigenous Peoples, and brings them into one consolidated policy framework with enhanced consistency and coherence, and more comprehensively addresses environmental and social impacts and risks. The SPS applies to all ADB-supported projects reviewed by ADB's management after 20 January 2010. ADB works with borrowers to put policy principles and requirements into practice through project review and supervision, and capacity development support.

ADB adopts a set of specific safeguard requirements that are required to address environmental and social impacts and risks:

- Safeguard Requirement 1:Environment – The Environmental safeguards are triggered if a project is likely to have potential environmental risks and impacts. The projects are initially screened to determine the level of assessment that is required. ADB categorizes the projects into three project categories based on the severity, sensitivity, and the magnitude of its potential environmental impacts: Category A (if the project likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. An environmental impact assessment (EIA), including an environmental management plan (EMP), is required); Category B (if the project likely to have potential impacts are less adverse than category A and minor impacts expected can be mitigated. An initial environmental examination (IEE), including an EMP, is required); and Category C (if the projects likely to have minimal or no adverse environmental impacts. An EIA or IEE is not required)
- Safeguard Requirement 2: Involuntary Resettlement – The policy is designed to avoid the risk of impoverishment among those displaced as a direct result of ADB investment. The policy recognizes that restoring the incomes and living standards of the affected people is complex, and requires a development strategy that encompasses compensation, resettlement and rehabilitation packages to improve, or at least restore, their social and economic base. The ADB's Policy on Involuntary Resettlement stipulates three important elements in involuntary resettlement: (i) compensation for lost assets and loss of livelihood and income, (ii) assistance in relocation including provision of relocation sites with appropriate facilities and services, and (iii) assistance with rehabilitation to achieve at least the same level of well-being with the project as before.
- Safeguard Requirements 3: Indigenous Peoples[15] - The Policy on Indigenous Peoples is triggered if a project directly or indirectly affects the dignity, human rights, livelihood systems, or culture of indigenous peoples or affects the territories or natural or cultural resources that indigenous peoples own, use, occupy, or claim as an ancestral domain or asset. The policy on states that the borrower/ client will ensure (i) that affected indigenous peoples receive culturally appropriate social and economic benefits; and (ii) that when potential adverse impacts on indigenous peoples are identified, these will be avoided to the maximum extent possible. Where this avoidance is not feasible, based on meaningful consultation with indigenous communities, the Indigenous Peoples Plan (IPP) will be prepared which outlines measures to minimize, mitigate, and compensate for the adverse impacts.
- Social Protection Strategy (2001) – The key in ADB's Social Protection Strategy is that it requires compliance with the ILO's core labor standards. The four internationally recognized core labor standards (CLS) represent the eight ILO conventions which are covered in ADB's social protection strategy is governed by. These CLS include: 1. Freedom from child labour (No. 138, 182), 2. Freedom from forced labour (No.29, 105), 3. Freedom from discrimination at work (No. 100, 111), 4. Freedom to form and join a union, and to bargain collectively (No.87, 98).
- Gender and Development (1998) – ADB aims to operationalize its policy on gender and development (GAD) primarily through mainstreaming gender considerations into all ADB operations. However, ADB will continue to develop and finance stand-alone projects directed at correcting gender disparities and promoting the empowerment of women, especially in developing member countries (DMCs) with glaring gender inequalities.
- Access to Information Policy (2018) – The policy reflects ADB's commitment to transparency, accountability, and participation by stakeholders in ADB-supported development activities in Asia and the Pacific. It also recognizes the right of people to seek, receive, and impart information about ADB's operations.

[15] Indigenous Peoples may be referred to in different countries by such terms as Indigenous ethnic minorities, indigenous cultural communities, aboriginals, hill tribes, minority nationalities, scheduled tribes, or tribal groups. Such groups can be considered Indigenous Peoples.

3.5 World Bank EHS Guidelines

3.5.1 General Environment, Health & Safety (EHS) Guidelines, 2007

The World Bank's General Environment, Health and Safety (EHS) Guidelines are a set of technical reference documents that provide guidance on how to manage environmental, health and safety issues in various sectors and projects. The General EHS Guidelines cover topics such as air emissions, energy conservation, wastewater, water conservation, hazardous materials management, waste management, noise and contaminated land. They also provide performance levels and measures that are considered to be achievable by existing technology at reasonable costs. The General EHS Guidelines are designed to be used together with the Industry Sector EHS Guidelines, which provide specific guidance for different types of industries, such as mining, oil and gas, power generation, construction, etc.

3.5.2 Guidelines for electric power transmission and distribution, 2007

The World Bank's Guidelines for Electric Power Transmission and Distribution (2007) are a set of technical reference documents that provide guidance on how to manage environmental, health and safety issues in various sectors and projects related to electric power transmission and distribution. They are part of the World Bank Group's Environmental, Health and Safety Guidelines, which are applied when the World Bank Group is involved in a project, as required by its policies and standards. The Guidelines cover topics such as air emissions, energy conservation, wastewater, water conservation, hazardous materials management, waste management, noise and contaminated land.

3.6 IFC and European Bank for Reconstruction and Development (EBRD) Guidance Note on Workers' Accommodations: Processes and Standards, 2009

The International Finance Corporation (IFC) and the European Bank for Reconstruction and Development (EBRD) Guidance Note on Workers' Accommodation: Processes and Standards is a document that provides practical guidance to IFC and EBRD specialists, consultants, and clients on how to plan, design, construct, operate and manage workers' accommodation facilities in relation to projects funded by IFC or EBRD. The document covers the following topics:

- The rationale and objectives of providing workers' accommodation
- The types of workers' accommodation that may be required by various projects, such as temporary exploration camps, construction camps and permanent dormitories
- The processes and standards that should be applied to the provision of workers' accommodation, including environmental and social impact assessment, site selection, design and construction, operation, and management, decommissioning and closure
- The international standards and guidance on food safety, water sanitation, waste management, fire safety, building regulations, health care, security, human rights, and labour rights that should be followed by IFC and EBRD clients

The document also provides a checklist of key issues to consider when planning and implementing workers' accommodation projects. The document is intended to be used together with the IFC Performance Standards on Environmental and Social Sustainability and the EBRD Performance Requirements on Environmental and Social Policy.

3.7 International Covenant on Biodiversity, Economic, Cultural and Social Rights and relevant ILO Core Labour Standards Conventions

India ratified the International Covenant on Economic, Social and Cultural Rights (ICESCR) on 10 April 1979[16]. The ICESCR is a treaty that recognizes the rights of all people to enjoy a range of economic, social and cultural rights, such as the right to work, the right to education, the right to health, and the right to an adequate standard of living. The ICESCR also obliges its states parties to take steps, individually and through international cooperation, to progressively realize these rights by all appropriate means. India is also a party to the eight core labour standards conventions of the International Labour Organization (ILO), which are considered essential for the promotion of social justice and human dignity in the world of work. The ILO core labour standards focus on specific aspects of labour rights and labour standards that are essential for decent work, such as freedom of association, elimination of forced labour, abolition of child labour, and elimination of discrimination. The ICESCR and the ILO core labour standards are complementary and mutually reinforcing instruments that aim to protect and promote the human rights of workers

[16] - OHCHR Dashboard (Accessed on September 14, 2023)

and other people. As a state party, India is obliged to respect, protect and fulfill its obligations under these instruments, and to report periodically on its progress to the relevant treaty bodies.

Since gaining independence, India has actively participated in significant international events related to environmental and biodiversity conservation. The country has made substantial contributions to shaping agreed-upon texts and has ratified and complied with commitments outlined in various international conventions pertaining to biodiversity. Some of the key conventions ratified by India include:

I. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
II. Convention on the Conservation of Migratory Species of Wild Animals (CMS)
III. Convention on Wetlands of International Importance (Ramsar Convention)
IV. The Wildlife Trade Monitoring Network (TRAFFIC)
V. World Natural Heritage Convention (WNHC)
VI. Convention on Biological Diversity (CBD)

As a state party to these conventions, India is obligated to uphold, safeguard, and fulfill the responsibilities outlined in the final draft of these agreements. Additionally, India is required to provide periodic reports on its progress and actions taken to the relevant treaty bodies, demonstrating its commitment to international biodiversity conservation efforts.

3.8 Applicability of ADB Safeguards

The applicability of ADB safeguards to the Project has been summarized in Table 3-3.

Table 3-3 Applicability of ADB Safeguards to the Project

Sr. No.	ADB Safeguard	Applicability/ Compliance
1.	**Safeguard Requirement 1: Environment**	**Applicable** An Initial Environmental & Social Examination (IESE) for the project has been undertaken to identify and assess any potentially adverse environmental and social impacts associated with the proposed Project, assess compliance with applicable laws and the applicable reference framework, determine the measures needed to prevent or minimize and mitigate the adverse impacts, and identify potential environmental and social opportunities, including those that would improve the environmental and social sustainability of the Project.
2.	**Safeguard Requirement 2: Involuntary Resettlement**	**Not Applicable** The allocated land for the 3.325 GW solar power park is under the ownership of the District Collector, Kachchh which has leased out the land to the solar park, and no land acquisition process was undertaken for the 3.325 GW Solar Park (under which the project will be developed). Additionally, the allotted land had not been subject to any form of human settlement, encroachment, agricultural use, grazing, or other human activities. Consequently, the land allocation did not lead to any form of involuntary resettlement. Furthermore, no land-related transactions of the following nature were associated with the land allotment: • Land rights or land use rights acquired through expropriation or other compulsory procedures in accordance with the legal system of India • Land rights or land use rights acquired through negotiated settlements with property owners or those with legal rights to the land if failure to reach settlement that have resulted in expropriation or other compulsory procedures • Project situations where involuntary restrictions on land use and access to natural resources cause a community or groups within a community to lose access to resource usage where they have traditional or recognizable usage rights • Allotted land result in evictions of people occupying land without formal, traditional, or recognizable usage rights • Restriction on access to land or use of other resources including communal property and natural resources such as marine and aquatic resources, timber and non-timber forest products, freshwater, medicinal plants, hunting and gathering grounds and grazing and cropping areas

Sr. No.	ADB Safeguard	Applicability/ Compliance
3.	**Safeguard Requirement 3: Indigenous Peoples**	**Not Applicable** The allotted land had not been subject to any form of human settlement, encroachment, agricultural use, grazing, or other human activities. Thus, the allotment of land has not result in any form of impact on communities or groups of Indigenous Peoples 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. Further, the development of Project will also not be result into the loss of collective attachment to distinct habitats or ancestral territories by the communities or groups of Indigenous People.

4 Environmental and Social Baseline Conditions

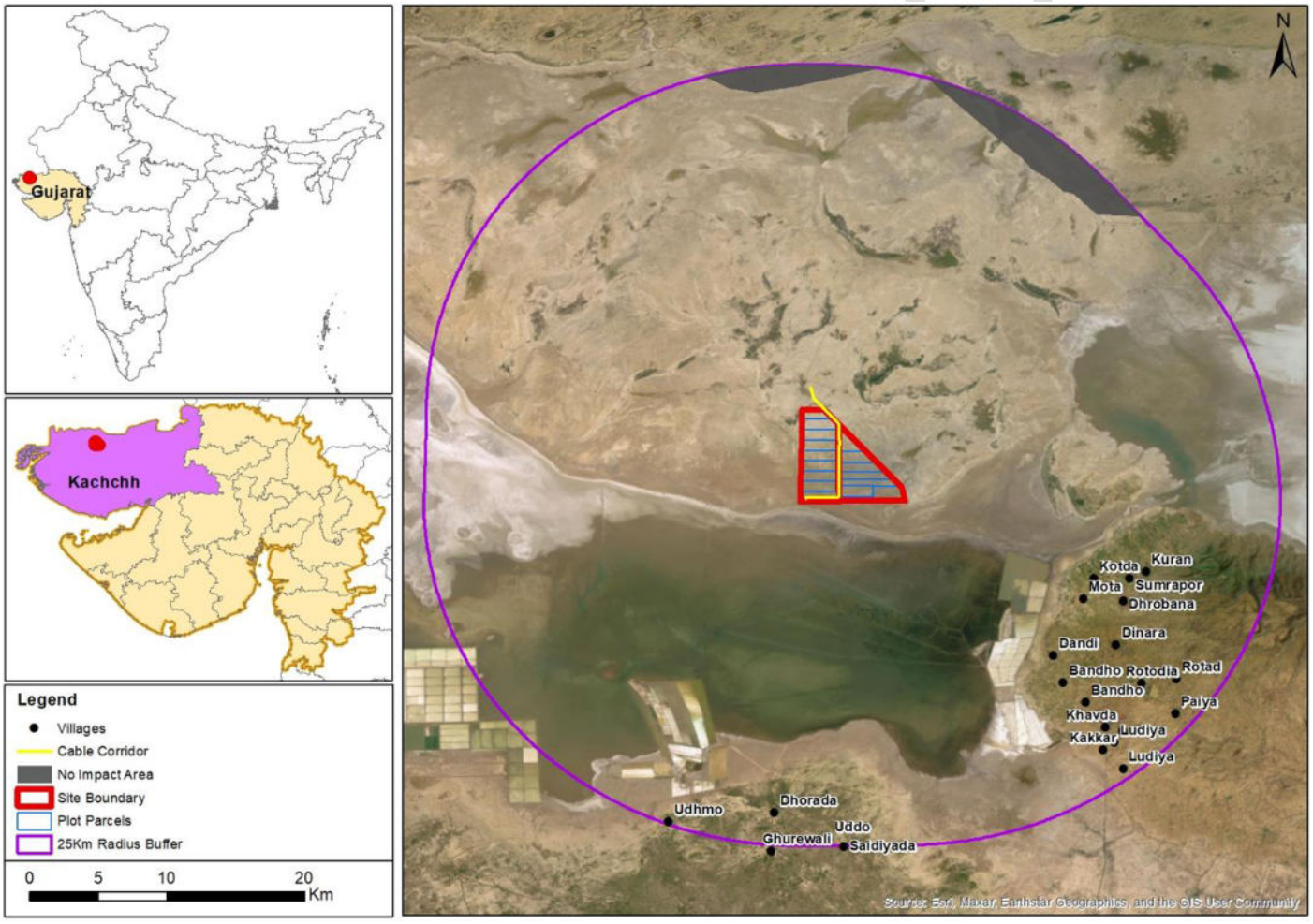
This section describes the existing environmental and social sensitivities of the study area (as described below). The sensitivities include the relevant components of the physical, biological, and socio-economic environment. The purpose of describing the environmental and social sensitivities of the 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 during the scoping process
- 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 AoI 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 study area of up to 25 km radius from the project boundary 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 water resources, human settlement, traffic management, and biodiversity.

Figure 4-1 Identified Study area for the Project



Source: Arc GIS 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 setting up the power plant, storage area, site office, storage of material and equipment, and transmission line infrastructure.

4.1.2 Area of Influence

The effects of the project and project activities on a particular resource or receptor will have spatial (distance) and temporal (time) dimensions, the scale of which is dependent on a number of actors, 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 increased 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 extent.

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

- Ecological Parameters: Based on identified sensitivity during desk-based review and site-based assessment, the study area for ecological assessment of solar power plant was demarcated as:
    - *Core Area:* Boundary of the proposed project, and
    - *Buffer Area:* 5 km radius from the project boundary.
- Environmental Parameters: The area of up to 25 km radius from the project boundary has been demarcated as study area or Area of Influence for the Project by considering the fact that the project will utilize statehighway-68 for transportation and commuting purpose during construction and operation phase. State Highway 68 is located 15 km from the site towards east direction. Additionally, the project will abstract water for construction phase from Khavda village which is located 20 km from site towards south east direction. Therefore, study area of 25 km has been considered to assess the extent of project impact on natural resources.
- Social Parameters: The area of up to 25 km has been identified as study area for the social parameters. The following reasoning for considering the 25 km are provided below:
    - The nearest settlement to the project location is ~20 km from the project boundary
    - The villages falling under the 25 km will be the direct receptors for migrant workers
    - The villages will also be the director receptors for increase in traffic due to the proposed project

4.2 Physical Environmental Sensitivities and Baseline Conditions

4.2.1 Primary Environmental Monitoring

Primary environmental baseline monitoring was conducted within the study area by a National Accreditation Board for Testing and Calibration Laboratories (NABL) under the supervision of DTTILLP to understand the baseline conditions of the project study area. Monitoring locations considered for the project has been presented in ***Table 4-1.*** Map showing monitoring locations has been presented in ***Figure 4-2.***

Table 4-1 Monitoring Locations considered for the Project

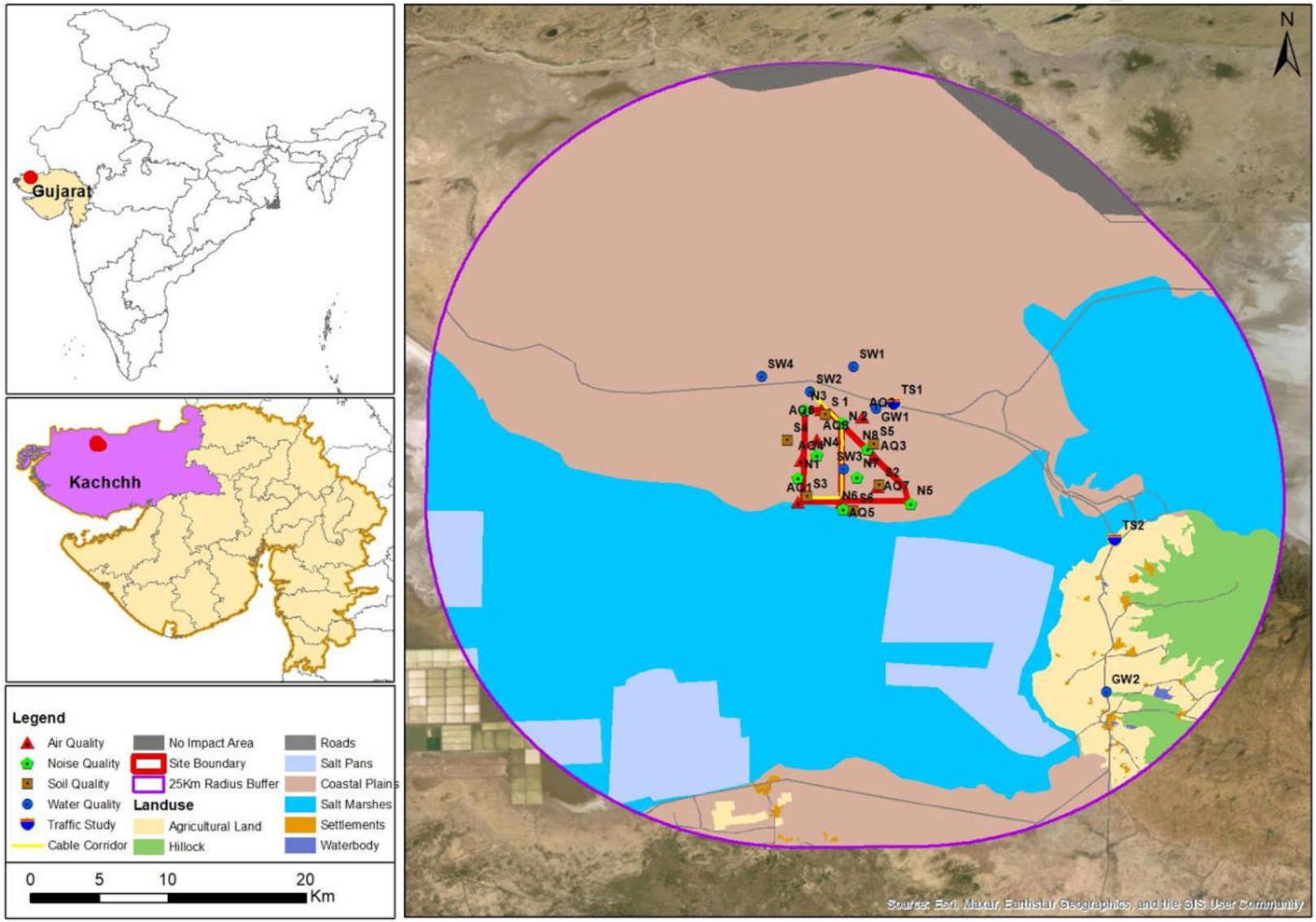
Parameter	Location Code	Name of the Location	Coordinates	Location Criteria
Ground Water	GW 1	Near Project Land Parcel	24°02'51"N / 69°34'40"E	GW 1 Collected from borewell within the 3325 solar Park to assess the groundwater quality that shall be used during operation phase. Similarly, GW2 was collected near Khavda village which has been considered as a source of water by Project SPVs for construction purpose.
	GW 2	Near Village Khavda	23°51'46"N / 69°43'43"E	
Surface Water	SW 1	Near Project Land Parcel towards northeast direction	24°04'29.0"N / 69°33'48.0"E	Collected from water ponds/pools to assess the surface water quality in the study area.
	SW 2	Near Project Land Parcel towards west direction	24°03'31.8"N / 69°32'05.0"E	

	SW 3	Within Project Land Parcel	24°00'29.4"N / 69°33'23.7"E	There are no major surface waterbodies within the project area which may be impacted due to the project. Therefore, minor water pools/ponds located within 5 km radius were selected to assess the existing surface water quality.
	SW 4	Near Project Land Parcel towards north west direction	24°04'06.2"N / 69°30'12.6"E	
Soil	S1	Within Project Land parcel towards North Direction	24°02'26.0"N / 69°33'09.0"E	Soil samples were collected from downgradient and upgradient location relative to the project site. Additionally, soil samples were also collected within the project site to understand the soil quality of the project study area.
	S2	Within Project Land parcel towards Southeast Direction	24°00'28.0"N / 69°34'03.0"E	
	S3	Within Project Land parcel towards South Direction	24°00'35.0"N / 69°32'14.0"E	
	S4	Near Land Parcel towards West Direction	24°01'42.0"N / 69°31'36.0"E	
	S5	Near Land Parcel towards East Direction	24°01'26.0"N / 69°34'30.0"E	
	S6	Near Land Parcel towards South Direction	23°59'40.0"N / 69°33'09.0"E	
Ambient Air	AAQ1	Near Land Parcel towards south west direction	24°00'32.0"N / 69°32'00.0"E	Collected in and around project site to assess the baseline air quality for 24 hours. The locations were selected based on predominant wind direction in the study area. The predominant wind direction in the study area is WSW, such that air monitoring devices were installed in upwind, downwind and crosswind directions to WSW.
	AAQ2	Near Land Parcel towards north east direction	24°02'29.0"N / 69°33'52.0"E	
	AAQ3	Within land parcel towards east direction	24°01'54.0"N / 69°33'45.0"E	
	AAQ4	Near Land Parcel towards west direction	24°01'07.0"N / 69°31'43.0"E	
	AAQ5	Near Land Parcel towards south direction	24°00'07.1"N / 69°33'19.3"E	
	AAQ6	Near land parcel towards north direction	24°03'46.1"N / 69°30'11.4"E	
	AAQ7	Within land parcel towards south east direction	24°00'28.0"N / 69°34'03.0"E	
	AAQ8	Within land parcel towards north direction	24°01'59.3"N / 69°33'18.5"E	
Ambient Noise	N1	Near land parcel towards south west direction	24°00'32.0"N / 69°32'00.0"E	Once for 24 hours in and around project covering all directions in as per MoEFCC guidelines. The monitoring locations were selected considering the landuse of the Project study area. The Project and surrounding landuse is categorized as coastal plains with no agricultural land, residential settlements or commercial establishments within 15 km radius. Therefore, considering there will be other solar power projects within the 3325 MW park, the noise locations has been identified within site and nearby areas and assessed against noise limits for industrial areas.
	N2	Near land Parcel towards north east direction	24°02'29.0"N / 69°33'52.0"E	
	N3	Near Project land parcel towards north direction	24°01'54.0"N / 69°33'45.0"E	
	N4	Within land parcel towards west direction	24°01'07.0"N / 69°31'43.0"E	
	N5	Near land parcel towards south east direction	24°00'07.1"N / 69°33'19.3"E	
	N6	Near land parcel towards south direction	24°03'46.1"N / 69°30'11.4"E	
	N7	Within the Centre of land parcel	24°00'28.0"N / 69°34'03.0"E	
	N8	On eastern boundary of Project	24° 1'15.70"N / 69°34'20.55"E	
Traffic	T1	RE Park Road	24°03'00.0"N / 69°35'21.0"E	The two access roads were selected to estimate the total traffic on the roads since the same will be used
	T2	SH-45 near BSF check post	23°57'42.0"N / 69°44'02.0"E	

	during construction and operation phase by the Project SPVs

Source: Site Visit by DTTILLP and NABL Accredited Lab

Figure 4-2 Map showing Primary Environmental Monitoring Locations within Project Study Area



Source: ArcGIS Mapping

4.2.1.1 Ground Water Quality Assessment

As part of the IESE, groundwater quality assessment was conducted by a NABL accredited lab to understand the groundwater quality in the study area of the Project. Two samples of groundwater were collected within 25 km radius of the Project. The water samples were collected by the lab under the supervision of DTTILLP and the samples were analyzed against IS 10500:2012 drinking water standards adopted by Bureau of Indian Standards (BIS).

The results of the assessment have been presented in ***Table 4-2.***

Table 4-2 Results of Primary Groundwater Quality within Project Study Area

Sr. No.	Parameters	Unit	Ground Water Sample		Desirable Limit	Permissible Limit
			GW 1	GW 2		
Physical Parameters						
1.	Color	Hazen	BDL(DL:1.0)	BDL(DL:1.0)	5	5
2.	Odor	None	AGREEABLE	AGREEABLE	Agreeable	Agreeable
3	Taste	None	AGREEABLE	AGREEABLE	Agreeable	Agreeable
3.	pH	None	6.7	7.89	6.5-8.5	No Relaxation
4.	Turbidity	NTU	114	2	1	5
5.	Total Dissolved Solid (TDS)	mg/l	33000	1300	500	2000
General Parameters						
6.	Aluminum (Al)	mg/l	BDL(DL:0.01)	BDL(DL:0.01)	0.03	0.2
7.	Ammonia (N)	mg/l	BDL(DL:0.1)	BDL(DL:0.1)	0.5	No Relaxation
8.	Anionic Detergent	mg/l	BDL(DL:0.05)	BDL(DL:0.05)	0.2	0.01
9.	Boron (B)	mg/l	BDL(DL:0.25)	BDL(DL:0.25)	0.5	1
10.	Barium (Ba)	mg/l	BDL(DL:0.1)	BDL(DL:0.1)	0.7	No Relaxation
11.	Calcium (Ca)	mg/l	839.52	110.88	75	200
12.	Chloramines (Cl2)	mg/l	BDL(DL:0.1)	BDL(DL:0.1)	4	No Relaxation
13.	Chloride (Cl)	mg/l	17634.53	480.05	250	1000
14.	Copper (Cu)	mg/l	BDL(DL:0.02)	BDL(DL:0.02)	0.05	1.5
15.	Fluoride (F)	mg/l	0.32	0.38	1	1.5
16.	Free Residual Chlorine	mg/l	BDL(DL:0.1)	BDL(DL:0.1)	0.2	0.1
17.	Iron (Fe)	mg/l	5.6	0.15	0.3	No Relaxation
18.	Magnesium (Mg)	mg/l	418.18	47.52	30	100
19.	Manganese (Mn)	mg/l	BDL(DL:0.02)	BDL(DL:0.02)	0.1	0.3
20.	Mineral Oil	mg/l	BDL(DL:0.5)	BDL(DL:0.5)	0.5	No Relaxation
21.	Nitrate (NO_3)	mg/l	3.05	1.02	45	No Relaxation
22.	Phenolic Compounds (C_6H_5OH)	mg/l	BDL(DL:0.001)	BDL(DL:0.001)	0.001	0.002
23.	Selenium (Se)	mg/l	BDL(DL:0.005)	BDL(DL:0.005)	0.01	No Relaxation
24.	Silver (Ag)	mg/l	BDL(DL:0.005)	BDL(DL:0.005)	0.1	No Relaxation
25.	Sulphate (SO_4)	mg/l	30.8	15.6	200	400

Sr. No.	Parameters	Unit	Ground Water Sample		Desirable Limit	Permissible Limit
			GW 1	GW 2		
26.	Hydrogen Sulphide (H_2S)	mg/l	BDL(DL:0.02)	BDL(DL:0.02)	0.05	No Relaxation
27.	Total Alkalinity	mg/l	155.2	291	200	600
28.	Total Hardness	mg/l	3841.2	475.2	200	600
29.	Zinc (Zn)	mg/l	BDL(DL:0.02)	BDL(DL:0.02)	5	15
Toxic Substances						
31.	Cadmium (Cd)	mg/l	BDL(DL:0.001)	BDL(DL:0.001)	0.003	No Relaxation
32.	Cyanide (CN)	mg/l	BDL(DL:0.01)	BDL(DL:0.01)	0.05	No Relaxation
33.	Lead (Pb)	mg/l	BDL(DL:0.005)	BDL(DL:0.005)	0.01	No Relaxation
34.	Mercury (Hg)	mg/l	BDL(DL:0.0002)	BDL(DL:0.0002)	0.001	No Relaxation
35.	Molybdenum (Mo)	mg/l	BDL(DL:0.05)	BDL(DL:0.05)	0.07	No Relaxation
36.	Nickel (Ni)	mg/l	BDL(DL:0.01)	BDL(DL:0.01)	0.02	No Relaxation
37.	Arsenic (As)	mg/l	BDL(DL:0.05)	BDL(DL:0.005)	0.01	0.05
38.	Chromium (Cr)	mg/l	BDL(DL:0.01)	BDL(DL:0.01)	0.05	No Relaxation
39.	Polychlorinated Biphenyl (PCB)	mg/l	BDL(DL:0.0005)	BDL(DL:0.0005)	0.0005	No Relaxation
40.	Polynuclear Aromatic Hydrocarbons (PAH)	mg/l	BDL(DL:0.0001)	BDL(DL:0.0001)	0.0001	No Relaxation
Trihalomethanes						
41.	Bromoform	mg/l	BDL(DL:0.01)	BDL(DL:0.01)	0.1	No Relaxation
42.	Dibromochloromethane	mg/l	BDL(DL:0.01)	BDL(DL:0.01)	0.1	No Relaxation
43.	Bromodichloromethane	mg/l	BDL(DL:0.01)	BDL(DL:0.01)	0.06	No Relaxation
44.	Chloroform	mg/l	BDL(DL:0.01)	BDL(DL:0.01)	0.2	No Relaxation
Pesticides Residues						
45.	Alachlor	µg/l	BDL(DL:0.02)	BDL(DL:0.02)	20	20
46.	Atrazine	µg/l	BDL(DL:0.02)	BDL(DL:0.02)	2	2
47.	Aldrin	µg/l	BDL(DL:0.01)	BDL(DL:0.01)	0.03	0.03
48.	Dieldrin	µg/l	BDL(DL:0.01)	BDL(DL:0.01)	0.03	0.03
49.	Alpha-HCH	µg/l	BDL(DL:0.01)	BDL(DL:0.01)	0.01	0.01
50.	Beta-HCH	µg/l	BDL(DL:0.01)	BDL(DL:0.01)	0.04	0.04
51.	Butachlor	µg/l	BDL(DL:0.02)	BDL(DL:0.02)	125	125
52.	Chlorpyrifos	µg/l	BDL(DL:0.02)	BDL(DL:0.02)	30	30
53.	Delta-HCH	µg/l	BDL(DL:0.01)	BDL(DL:0.01)	0.04	0.04
54.	2,4-Dichlorophenoxyacetic acid	µg/l	BDL(DL:0.01)	BDL(DL:0.01)	30	30
55.	o,p-DDT	µg/l	BDL(DL:0.01)	BDL(DL:0.01)	1	1
56.	p,p-DDT	µg/l	BDL(DL:0.01)	BDL(DL:0.01)	1	1

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

Source: NABL Accredited Lab

4.2.1.1.1 Analysis of Groundwater Quality Results

As per the above results, it was observed that most of the parameters were within the permissible limit except for the following:

- **Turbidity**: The turbidity level in GW 1 was observed to be 114 NTU which exceeded the desirable limit of 1 NTU as well as Permissible limit of 5 NTU. This indicated that the GW1 water is cloudy due to presence of suspended particles.. The turbidity level in GW 2 was observed to be 2 NTU which exceeded the desirable limit but was within the permissible limit. This indicated presence of minimal suspended particles causing low turbidity.
- **Total Dissolved Solid (TDS):** The TDS in GW 1 was observed to be 33,000 mg/l which exceeded both desirable and permissible limits, where as it was found to be 1300 mg/l in GW2 which exceeded the desirable limit but it was within permissible limit. The high TDS value may be attributed to presence of inorganic salts within the groundwater due to presence of salt marshes and salt pans in the project study area.
- **Calcium:** The concentration of calcium in GW 1 was observed to 839.52 mg/l which exceeded both desirable and permissible limits and that in GW 2 was 110.88 which exceeded the desirable limit. High concentration of calcium may be attributed to the presence of naturally occurring salts and minerals within the water samples.
- **Chloride:** The chloride concentration in GW1 was observed to be exceeding the desirable and permissible limits, whereas the chloride concentration in GW 2 exceeded only desirable limit. This can be attributed to soil weathering and dissolved salts from geological formations into the water samples. Since GW 1 was collected from coastal plains and GW 2 sample was collected from village area, chloride concentration level in GW 1 was higher as compared to GW 2.
- **Iron:** The level of iron in GW 1 was observed to be exceeding the desirable and permissible limit but it was within limits for GW2. This may be attributed to presence of iron bearing minerals and rocks near the water sample.
- **Magnesium:** The concentration of magnesium in GW 1 was 418.18 mg/l which exceeded both desirable and permissible limit. The concentration of magnesium in GW 2 was observed to be 47.52 mg/l which exceeded the desirable limit but it was within permissible limit. The high concentration of magnesium may be attributed to the high content of TDS in groundwater.
- **Total Hardness:** The total hardness in GW1 was observed to be 3841.2 mg/l which exceeded both desirable and permissible limit, however, the total hardness in GW2 exceeded only the desirable limit. Total hardness of water is correlated to the

presence of bivalent metallic ions viz. calcium and magnesium. Since the samples have higher concentration of magnesium, therefore, there is high concentration of total hardness in both samples.

- **Total coliform bacteria:** Total coliform bacteria was detected in GW2 sample. This may be due to presence of water borne pathogens within the sample.

4.2.1.2 Surface Water Quality Assessment

As part of the IESE, surface water quality assessment was conducted by a National Accreditation Board for Testing and Calibration Laboratories (NABL) accredited lab in September 2023 to understand the surface water quality in the study area. Four samples of surface water was collected in and around the Project within 25 km radius under the supervision of DTTILLP and the samples were analyzed against IS 10500:2012 standard.

The results of the assessment has been presented in ***Table 4-3.***

Table 4-3 Results of Primary Surface Water Quality within Project Study Area

Sr. No.	Parameters	Unit	Surface Water Samples				Permissible Limit as per IS 2296 Inland surface Water class C
			SW 1	SW 2	SW 3	SW 4	
1.	Color	Hazen	<1.0	<1.0	<1.0	<1.0	300
2.	pH	None	7.81	7.23	8.88	7.65	6.5-8.5
3.	Turbidity	NTU	4	5.8	17	12	-
4.	Total Dissolved Solid (TDS)	mg/l	16,200	29,898	17,290	43,014	1500 max
5.	Calcium (Ca)	mg/l	880	1152	664	1800	-
6.	Chloride (Cl)	mg/l	6861	12,496	6371	21,121	600
7.	Copper (Cu)	mg/l	<0.02	<0.02	<0.02	<0.02	-
8.	Fluoride (F)	mg/l	0.37	0.42	0.44	0.68	1.5
9.	Iron (Fe)	mg/l	<0.05	<0.05	<0.05	<0.05	50
10.	Magnesium (Mg)	mg/l	427	634	349	619	-
11.	Manganese (Mn)	mg/l	<0.02	<0.02	0.02	<0.02	-
12.	Nitrate (NO_3)	mg/l	<0.3	<0.3	<0.3	<0.3	50
13.	Phenolic Compounds (C_6H_5OH)	mg/l	<0.001	<0.001	<0.001	<0.001	-
14.	Sulphate (SO_4)	mg/l	720	800	660	560	400
15.	Total Alkalinity	mg/l	235	333	549	392	-
16.	Total Hardness	mg/l	3980	5520	3100	7080	-
17.	Zinc (Zn)	mg/l	<0.02	<0.02	<0.02	<0.02	15
18.	Cobalt (Co)	mg/l	<0.05	<0.05	<0.05	<0.05	-
19.	Total Suspended Solid (as TSS)	mg/l	23	76	295	126	-
20.	Temperature	Deg C	25	25	25	25	-
21.	Conductivity	Us/cm	29000	48400	31500	62400	-

Sr. No.	Parameters	Unit	Surface Water Samples				Permissible Limit as per IS 2296 Inland surface Water class C
			SW 1	SW 2	SW 3	SW 4	
22.	Biochemical Oxygen Demand (as BOD)	mg/l	<2.0	<2.0	<2.0	<2.0	3
23.	Chemical Oxygen Demand (COD)	mg/l	<4.0	<4.0	<4.0	<4.0	-
24.	Oil and Grease	mg/l	<0.3	<3.0	<3.0	<3.0	0.1
25.	Salinity	None	24(ppt)	35(ppt)	21(ppt)	39(ppt)	-
26.	Phosphate (as PO4)	mg/l	<0.03	<0.03	<0.03	<0.03	-
27.	DO	mg/l	5.6	5.8	5.4	5.7	4 Minimum
28.	Cadmium (Cd)	mg/l	<0.002	<0.002	<0.002	<0.002	0.01
29.	Lead (Pb)	mg/l	<0.005	<0.005	<0.005	<0.005	0.1
30.	Mercury (Hg)	mg/l	<0.001	<0.001	<0.001	<0.001	-
31.	Nickel (Ni)	mg/l	<0.02	<0.02	<0.02	<0.02	-
32.	Arsenic (As)	mg/l	<0.005	<0.005	<0.005	<0.005	0.2
33.	Chromium (Cr)	mg/l	<0.1	<0.1	<0.1	<0.1	0.05
34.	E.coli	/100ml	<2.0	<2.0	<2.0	<2.0	-
35.	Total coliform bacteria	/100ml	<2.0	<2.0	<2.0	<2.0	5000

Source: NABL Accredited Lab

4.2.1.2.1 Analysis of Surface Water Quality Monitoring

As per the above results, majority of the parameters in the water samples were within limit as per Water Quality Standards (IS 2296, Class C) except for the following.

- **Total Dissolved Solid (TDS):** The TDS in the water samples were found to be 16,200 mg/l (S1), 29,898 mg/l (S2), 17,290 mg/l (S3) and 43,014 mg/l (S4) which exceeded the permissible limit of 1500 mg/l. This can be attributed to the fact that there are salt marshes near to the Project area. During falling tides, marsh platform is gradually exposed such that groundwater seeps out from the marsh sediments into creeks. This exchange of water between the marsh and creeks can contribute to the high total dissolved solids (TDS) in surface water near salt marshes. Additionally, since road construction work was underway by GSECL near the water bodies, deposition of soil and sediments into the surface water may also lead to increase in TDS in the water samples.
- **Chloride:** The chloride concentration in all the water samples was observed to be exceeding the permissible limit of 600 mg/l. This can be attributed to soil weathering and dissolved salts from geological formations into the water samples.
- **Sulphate:** The sulphate concentration in all the water samples was observed to be exceeding the permissible limit of 400 mg/l. This can be due to Sulphur containing mineral dissolution containing in the water samples due to geological formation.

4.2.1.3 Soil Quality Assessment

Soil characteristics within the study area, especially the physical quality of the soil has been characterized by analysing soil samples collected from six (06) locations under the supervision of DTTILLP through a NABL accredited Lab in September 2023. Soil analysis and results have been presented in .

Table 4-4.

Table 4-4 Results of Soil Sampling in Study Area

Sr. No.	Parameter	Units	S1	S2	S3	S4	S5	S6	Method
1.	pH Value	None	8.22	8.04	8.25	8.39	8.17	8.13	IS 2720 (Part 26) -1987, Rffm : 2011
2.	Texture	None	Clay	Clay	Clay	Clay	Clay	Clay	TPM/MSK/P&E/1/36A
3.	Electrical Conductivity (1:2.5) at 25℃	µs/cm	11970	11500	17370	2200	25500	21500	IS 14767:2000, RA2016
4.	Permeability	Cm/hr	0.08	0.11	0.10	0.14	0.18	0.09	IS 2720 (Part 17) -1986, Rffm : 2011
5.	Phosphate (as PO4)	None	10.8	12.8	22.6	10.5	18.5	12	TPM/MSK/P&E/1/12
6.	Sand	%	36	30	33	32	38	28	TPM/MSK/P&E/1/36A
7.	Silt	%	17	14	19	22	20	15	TPM/MSK/P&E/1/36A
8.	Clay	%	47	56	48	46	42	57	TPM/MSK/P&E/1/36A
9.	Porosity	Mg/kg	49	50	51	49	48	51	TPM/MSK/P&E/1/30
10.	Nitrites (as NO2)	mg/kg	2.1	<0.5	1.1	<0.5	1.8	<0.5	TPM/MSK/P&E/1/20
11.	Nitrates (as NO3)	%	32	8.1	14	4.3	22	17	TPM/MSK/P&E/1/19
12.	Total Petroleum Hydrocarbon as TPH	%	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	IS 3025 (Part 39)-1991, Rffm : 2014
13.	Iron (as Fe)	%	23	24	6.8	10	56	6.2	EPA 6010D
14.	Lead (as Pb)	%	5.1	7.4	10.5	6.6	6.8	3.6	EPA 6010D
15.	Manganese (as Mn)	mg/kg	278	273	285	316	311	224	EPA 6010D
16.	Nickel (as Ni)	mg/kg	19	25	26	20	23	18	EPA 6010D
17.	Barium (as Ba)	mg/kg	24	31	32	4.2	46	26	EPA 6010D
18.	Zinc (as Zn)	mg/kg	30	39	40	37	36	27	EPA 6010D
19.	Copper (as Cu)	mg/kg	11	16	17	21	17	12	EPA 6010D
20.	Cadmium (as Cd)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	EPA 6010D
21.	Total Chromium (as Cr)	mg/kg	18	22	23	21	20	16	EPA 6010D
22.	Arsenic (as As)	mg/kg	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	EPA 6010D
23.	Mercury (as Hg)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	USEPA 245.5
24.	Total Hydrocarbon	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	IS 3025 (Part 39)-1991, Rffm : 2014
25.	Cation Exchange Capacity	mg/kg	15.7	8.1	8.6	4.4	24.9	28.0	IS 2720 (Part 24)-1976, Rffm : 2015

Source: NABL Accredited Lab

Table 4-5 Soil Classification Standards

S.No.	Soil Test Parameters	Classification
1	pH	<4.5 Extremely acidic

S.No.	Soil Test Parameters	Classification
		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

4.2.1.3.1 Analysis of Soil Quality Monitoring

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

- ***pH***: The pH value of the six soil samples were found to be 8.22 (S1), 8.04 (S2), 8.25 (S3), 8.39 (S4), 8.17 (S5) and 8.13 (S6). As per the standard soil classification, the soil in the project area is moderate alkaline in nature.
- ***Texture:*** The texture of all the soil samples were found to be Clayey in nature with small and fine particles due to which it has high water retention capacity.
- ***Electrical Conductivity (EC):*** EC is used to estimate the salinity in soil. The electrical conductivity of the soil samples were found to be 11,970 µs/cm (S1), 11,500 µs/cm (S2), 17,370 µs/cm (S3), 2200 µs/cm (S4), 25,500 µs/cm (S5) and 21,500 µs/cm (S6) which indicated high concentration of nutrients and high salinity in the soil samples.
- ***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 to be 23 mg/kg (S1), 24 mg/kg (S2), 6.8 mg/kg (S3), 10 mg/kg (S4), 56 mg/kg (S5) and 6.2 mg/kg (S6) indicating low concentration of iron in all the soil samples.

The concentration of copper in the soil samples were found to be 11 mg/kg (S1), 16 mg/kg (S2), 17 mg/kg (S3), 21 mg/kg (S4), 17 mg/kg (S5) and 12 mg/kg (S6) indicating optimum concentration of copper in all the samples.
The level of zinc in the soil samples were found to be 30 mg/kg (S1), 39 mg/kg (S2), 40 mg/kg (S3), 37 mg/kg (S4), 36 mg/kg (S5) and 27 mg/kg (S6) indicating low concentration of copper in all the soil samples.

4.2.1.4 Ambient Air Quality Assessment

Existing ambient air quality of the study area was monitored at eight (08) locations for 24 hours[17]. 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 micrometers) and $PM_{2.5}$ (particulate matter of particle size less than 2.5 micrometers), 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 in the study area.

The results of the air quality monitoring has been presented in ***Table 4-6.***

Table 4-6 Results of Ambient Air Quality Monitoring in Study Area

Parameter	Units	Air Quality Samples				National Ambient Air Quality Standards (NAAQS) Permissible Limits (µg/m³)	IFC/WB Ambient Air Quality Standards (WHO Guidelines)
		AAQ1	AAQ2	AAQ3	AAQ4		
Particulate matter (PM 10)	µg/m³	51.09	50.05	33.15	53.77	100 (24 Hours)	24 hour values • 150 (Interim target 1) • 100 (Interim target 2) • 75 (Interim target 3) • 50 (IFC EHS guideline)
Particulate matter (PM 2.5) in µg/m3	µg/m³	25.42	25.84	20.42	28.76	60 (24 Hours)	24 hour values 1. 75 (Interim target 1) 2. 50 (Interim target 2) 3. 37.5 (Interim target 3) 4. 25 (IFC EHS guideline)
Sulphur dioxide (SO2)	µg/m³	<6.0	<6.0	<6.0	<6.0	80 (24 Hours)	24 hour values • 125 (Interim target 1) • 50 (Interim target 2) • 20 (IFC EHS guideline)
Nitrogen dioxide (NO2)	µg/m³	16.59	10.87	15.44	14.59	80 (24 Hours)	• 1 year: 40 (IFC EHS guideline) • 1 hour: 200 (IFC EHS guideline)
Carbon monoxide (CO)	mg/m³	0.52	0.50	0.41	0.36	2 (8 hours)	-
Parameter	Units	AAQ5	AAQ6	AAQ7	AAQ8	National Ambient Air Quality Standards (NAAQS) Permissible Limits (µg/m³)	IFC/WB Ambient Air Quality Standards (WHO Guidelines)
Particulate matter (PM 10)	µg/m³	45.82	58.92	68.90	52.64	100 (24 Hours)	24 hour values • 150 (Interim target 1) • 100 (Interim target 2) • 75 (Interim target 3) • 50 (IFC EHS guideline)
Particulate matter (PM 2.5) in µg/m3	µg/m³	27.92	33.34	35.01	32.51	60 (24 Hours)	24 hour values 5. 75 (Interim target 1)

[17] Considering solar power projects are less polluting source of energy and development and operation of the Project will have limited to negligible impact on the existing ambient air quality. Therefore, monitoring has been conducted for 24 hours to understand the existing baseline conditions.

Parameter	Units	Air Quality Samples				National Ambient Air Quality Standards (NAAQS) Permissible Limits (µg/m³)	IFC/WB Ambient Air Quality Standards (WHO Guidelines)
		AAQ1	AAQ2	AAQ3	AAQ4		
							6. 50 (Interim target 2) 7. 37.5 (Interim target 3) 8. 25 (IFC EHS guideline)
Sulphur dioxide (SO2)	µg/m³	<6.0	<6.0	<6.0	<6.0	80 (24 Hours)	24 hour values • 125 (Interim target 1) • 50 (Interim target 2) • 20 (IFC EHS guideline)
Nitrogen dioxide (NO2)	µg/m³	13.15	16.59	10.29	13.73	80 (24 Hours)	• 1 year: 40 (IFC EHS guideline) • 1 hour: 200 (IFC EHS guideline)
Carbon monoxide (CO)	mg/m³	0.66	0.43	0.47	0.41	2 (8 hours)	-

4.2.1.4.1 Analysis of Ambient Air Quality Monitoring

As per the above results, all the parameters were found to be within NAAQS CPCB permissible limit. However, the levels of PM 10 in AAQ 1, AAQ 2, AAQ4, AAQ 6, AAQ7 and AAQ 8 exceeded the standards as per IFC EHS guidelines value but were within the Interim Target-3 values. Similarly, the PM 2.5 levels in AAQ 1, AAQ2, AAQ4, AAQ5, AAQ6, AAQ7 and AAQ8 exceeded the standards as per IFC EHS guidelines value but were within the Interim Target-3 values. Therefore, the airshed can be considered as degraded for 24 hours mean for PM10 and PM2.5 levels as per IFC EHS guidelines.

4.2.1.5 Noise Quality Assessment

Noise levels were recorded at eight locations once during the study period with the aid of a digital noise level meter. Noise levels were recorded for 24 hours[18] 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. Since the Project is located in an area where there are no settlements, commercial places, institutions located within 10 km radius, therefore, noise levels have been assessed against national and international standards for industrial area, considering renewable energy projects will be developed in the project vicinity. The results of the ambient noise monitoring have been presented in ***Table 4-7.***

Table 4-7 Ambient Noise Quality Monitoring in Study Area

Sr. No.	Sampling ID	Results Leq dB(A)		CPCB Limit, Industrial Area Leq dB(A)		Limit as per EHS guidelines of IFC, Industrial, commercial area (Leq hourly)	
		Leq Day	Leq Night	Leq Day	Leq Night	Leq Day	Leq Night
1.	N1	64.0	57.7	75	70	70	70
2.	N2	59.6	44.0	75	70	70	70
3.	N3	61.2	45.4	75	70	70	70
4.	N4	67.1	64.1	75	70	70	70
5.	N5	66.7	51.1	75	70	70	70

[18] IFC EHS guidelines recommends 48 hours of sampling including one weekday and one weekend which is typically applicable to urban areas. However, since the monitoring has been conducted in area with no settlements, institutions, commercial shops within 10 km, therefore only 24 hours sampling has been considered. The location has been considered as industrial area.

Sr. No.	Sampling ID	Results Leq dB(A)		CPCB Limit, Industrial Area Leq dB(A)		Limit as per EHS guidelines of IFC, Industrial, commercial area (Leq hourly)	
		Leq Day	Leq Night	Leq Day	Leq Night	Leq Day	Leq Night
6.	N6	68.7	53.2	75	70	70	70
7.	N7	58.4	42.7	75	70	70	70
8.	N8	63.6	47.9	75	70	70	70

Source: NABL Accredited Lab

4.2.1.5.1 Analysis of Noise Quality Monitoring

As per the above results, the Leq Day and Leq Night values of all the samples were found to be within CPCB limits as well as IFC standards for industrial area.

4.2.1.6 Traffic Survey

The primary traffic survey was conducted on the RE park road and on the SH-45, near BSF check post. It is expected that during construction and operation phase of the project, materials and equipment will be transported to site through these roads. Therefore, to understand the existing traffic (up and down) on these roads a primary traffic survey was conducted by a NABL accredited lab for 24 hours. The results of the survey has been presented in ***Table 4-8.***

Table 4-8 Traffic Density Monitoring Results in Study Area

Sr. No.	Time (Hours)	Motorized Vehicles			Non-Motorized Vehicles	Total Vehicles
		Heavy Motor Vehicles (Truck, Bus, Dumper, Tanker, Trailer)	Light Motor Vehicles (Car, Jeep, Van, Metador, Tractor, Tempo)	Two/Three Wheelers (Scooter, M. Cycle, Auto, Moped)	Bicycle, Tricycle	
		T1 (Up + Down)				
1.	09.00-10.00	40	35	0	0	75
2.	10.00-11.00	42	39	0	0	81
3.	11.00-12.00	48	42	0	0	90
4.	12.00-13.00	50	48	0	0	98
5.	13.00-14.00	51	53	0	0	104
6.	14.00-15.00	55	57	0	0	112
7.	15.00-16.00	57	60	0	0	117
8.	16.00-17.00	60	62	0	0	122
9.	17.00-18.00	55	65	0	0	120
10.	18.00-19.00	48	55	0	0	103
11.	19.00-20.00	42	50	0	0	92
12.	20.00-21.00	35	47	0	0	82
13.	21.00-22.00	30	35	0	0	65
14.	22.00-23.00	25	32	0	0	57
15.	23.00-00.00	20	30	0	0	20
16.	00.00-01.00	18	25	0	0	0
17.	01.00-02.00	14	22	0	0	0

Sr. No.	Time (Hours)	Motorized Vehicles			Non-Motorized Vehicles	Total Vehicles
		Heavy Motor Vehicles (Truck, Bus, Dumper, Tanker, Trailer)	Light Motor Vehicles (Car, Jeep, Van, Metador, Tractor, Tempo)	Two/Three Wheelers (Scooter, M. Cycle, Auto, Moped)	Bicycle, Tricycle	
18.	02.00-03.00	12	18	0	0	18
19.	03.00-04.00	10	15	0	0	15
20.	04.00-05.00	18	10	0	0	28
21.	05.00-06.00	25	18	0	0	43
22.	06.00-07.00	33	25	0	0	58
23.	07.00-08.00	42	32	0	0	74
24.	08.00-09.00	55	45	0	0	100
	Total	**831**	**843**	**0**	**0**	**1674**
			T2 (Up + Down)			
1.	09.00-10.00	45	32	0	0	**77**
2.	10.00-11.00	48	35	0	0	**83**
3.	11.00-12.00	52	40	0	0	**92**
4.	12.00-13.00	58	43	0	0	**101**
5.	13.00-14.00	60	48	0	0	**108**
6.	14.00-15.00	65	50	0	0	**115**
7.	15.00-16.00	70	55	0	0	**125**
8.	16.00-17.00	72	59	0	0	**131**
9.	17.00-18.00	75	60	0	0	**135**
10.	18.00-19.00	66	62	0	0	**128**
11.	19.00-20.00	60	55	0	0	**115**
12.	20.00-21.00	54	49	0	0	**103**
13.	21.00-22.00	50	42	0	0	**92**
14.	22.00-23.00	42	30	0	0	**72**
15.	23.00-00.00	35	35	0	0	**70**
16.	00.00-01.00	25	25	0	0	**50**
17.	01.00-02.00	20	22	0	0	**42**
18.	02.00-03.00	15	20	0	0	**35**
19.	03.00-04.00	11	15	0	0	**11**
20.	04.00-05.00	20	25	0	0	**45**
21.	05.00-06.00	28	28	0	0	**56**
22.	06.00-07.00	35	30	0	0	**65**
23.	07.00-08.00	42	32	0	0	**74**
24.	08.00-09.00	55	40	0	0	**95**
	Total	**1103**	**917**	**0**	**0**	**2020**

Source: NABL Accredited Lab

4.2.1.6.1 Analysis of Traffic Survey

Based on the traffic survey data, it was observed that T2 (SH-45) is busier than T1 (RE Park Road) with daily traffic (up and down) accounting for 2020 vehicles. The traffic scenario depicted that the majority of traffic in the T2 road is during 11:00 to 18:00 due to movement of heavy motor vehicles comprising of Truck, Bus, Dumper, Tanker, Trailer travelling up and down the roads followed by light motor vehicles. The majority of traffic in T1 road was during 11:00 to 17:00 due to movement of both heavy and light motor vehicles. The movement of heavy motor vehicles in T2 location contributed towards 55 % of the total vehicles deployed on the road during the survey, whereas it contributed to 50% of the total vehicles deployed on T1 location. Similarly, movement of light motor vehicles contributed towards 45% of the total vehicles deployed in T2 location during the survey, whereas in T1 location it contributed to 50% of the total vehicles. There was no movement of two/three-wheeler vehicles or non-motorised vehicles on both the roads. The deployment of heavy motor vehicles on both the roads was due to initiation of construction work by SPDs within the 30 GW RE park.

4.2.2 Review of Secondary Information

To establish the environmental baseline for the study area, a review of the secondary information along with primary site observations was carried out based on data available in the public domain. The list of secondary sources of information used for developing the environmental baseline has been presented ***Table 4-9.***

Table 4-9 Sources of Secondary Information

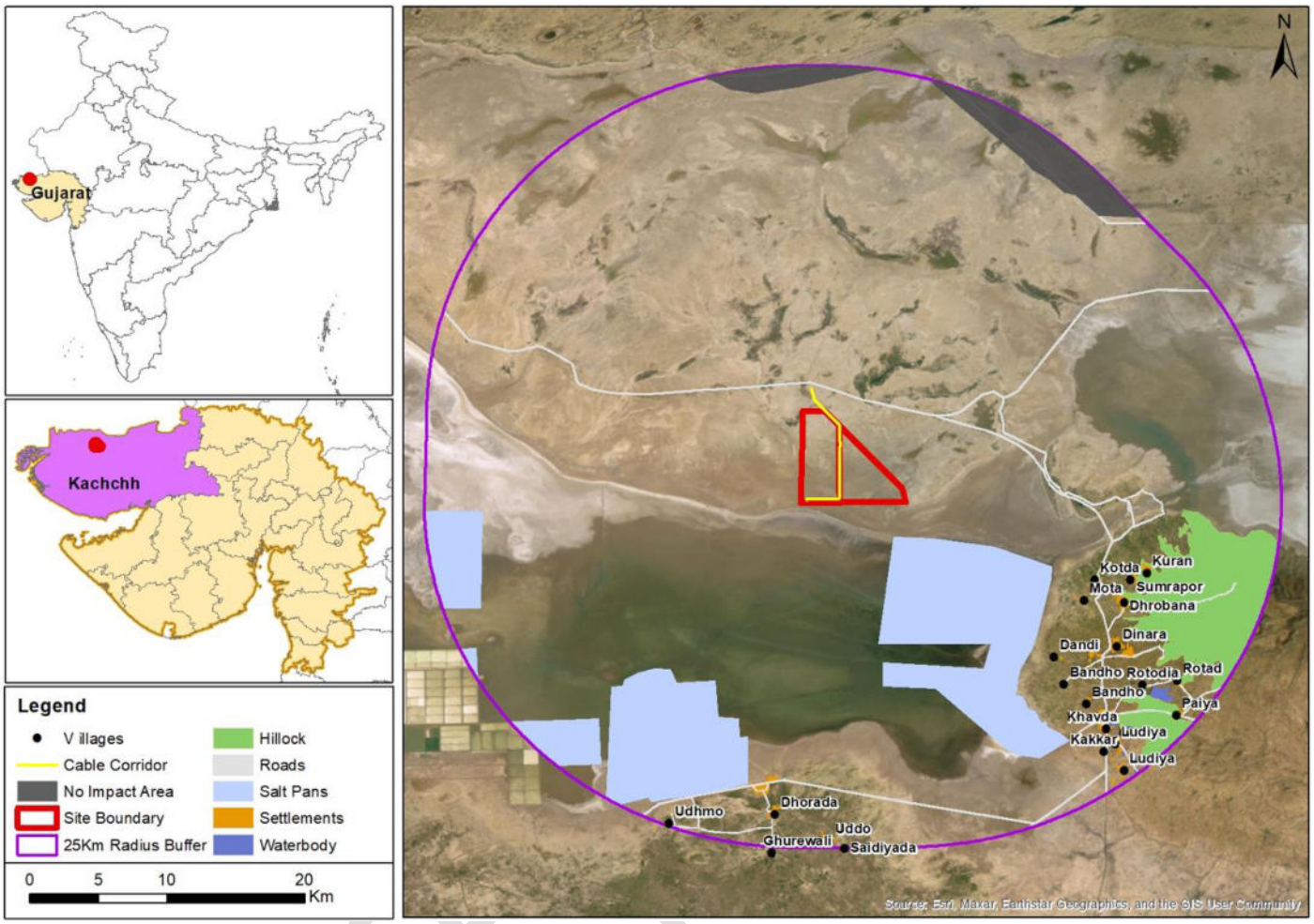
Sr. No.	Parameter	Secondary Information Source
1.	Physical Features within Study Area	Google Earth Imagery and Arc GIS Mapping
2.	Meteorological data	India Meteorological Department (IMD), National Institute of Wind Energy
3.	Geology and hydrogeology	Central Ground Water Board,
4.	Land use	Through Satellite Imageries and Arc GIS Mapping
5.	Soil Type and Water Resources	Central Ground Water Board and Kutch District Disaster Management Plan 2022
6.	Natural Hazards	Kutch District Disaster Management Plan 2022 and Building Materials & Technology Promotion Council (BMTPC)

4.2.2.1 Physical Features

The physical features map of the study area of the project has been showcased in ***Figure 4-3.*** The map displays the following features that are located within 25 km radius of the Project

- The location of the proposed Project sites
- Settlements located in Study area
- Road network within study area
- Hillocks
- Salt pans
- Water Body

Figure 4-3 Map showing physical features within Project Study Area



Source: Arc GIS Mapping

4.2.2.2 Climate and Meteorology

The climate of the Kachchh district is classified as semi-arid and has the following seasons:

- Winter season: November to February
- Pre-monsoon season: March to May
- Monsoon season: June to September
- Post Monsoon season: October – November

According to District Disaster Management Plan of Kutch District 2022, the Climate of Kachchh District can be observed as dry with hot summers and mildly cold winters, where it is generally pleasant all throughout the year.

The temperature of the district ranges from 45.8°C (June) in summer and 2.0°C (January) in winters. Maximum relative Humidity 100%.

The range of sea water temperature is 16.8°C to 31.8°C.

The long-term climatology (period 1991-2020) based on data recorded at the nearest observatory station to the Project i.e., India Meteorological Department (IMD) station at Bhuj is presented in ***Table 4-10.***

Table 4-10 Climatological Data of Bhuj IMD Station (1991-2020)

Month	Max Temp (Deg.C)	Min Temp (Deg.C)	Relative Humidity (%) (at 1004.4 hPa station level pressure)
January	27.5`	11.3	33
February	30.7	14.1	30
March	35.5	18.9	27
April	38.9	22.8	28
May	39.3	25.7	40
June	37.5	27.2	52
July	34.1	26.4	65
August	32.7	25.3	67
September	34.4	24.4	56
October	36.7	22.6	34
November	33.3	17.7	31
December	29.1	12.8	33

Source: IMD-Climatological Table (1991-2020)

As per the above data, temperature in the Project area vary from season to season. The summers are generally hot, and winters are pleasant. Mean maximum temperature ranges between 27.5°C during January to about 39.3°C during May and the mean minimum temperatures vary between 11.3°C during January and 27.2°C during June. The relative humidity in the Project area is about 27 % in the month of March to 65%-67 % in the month of July-August due to onset of monsoon.

4.2.2.3 Rainfall

According to Groundwater year book 2021-22 for Gujarat State by central Groundwater Board, droughts are frequent in the state of Gujarat including Kachchh region due to poor and erratic rainfall. The state receives rainfall during the south western monsoon period.

The rainfall data of Bhuj (nearest IMD station to Project) developed by IMD for year 1991 to 2020 has been presented in ***Table 4-11***

Table 4-11 Rainfall Data as per IMD station at Bhuj (1991-2020)

Month	Rainfall(mm)
January	1.3

Month	Rainfall(mm)
February	0.3
March	1.1
April	0.2
May	1.1
June	36.3
July	141.1
August	108.1
September	71.7
October	7.6
November	1.4
December	0.1
Total	**370.2**

Source: IMD-Climatological Table (1991-2020)

According to the above results, long-term average annual rainfall for Bhuj IMD station is 370.2 mm. Most of the rainfall is received during the month of July and August.

The maximum rainfall occurred in the month of July- 141.1 mm, followed by August which recorded rainfall of 108.1 mm. Bhuj experience low to negligible rainfall in the months of November– May.

According to Groundwater year book 2021-22 for Gujarat State by Central Groundwater Board (CGWB), Kachchh district received 15.60% more rainfall in the year 2021 as compared to the long term average annual rainfall (1991-2020). Kachchh district received 511.3 mm of rainfall in 2021 as compared to 442.3 mm received during average annual rainfall between 1991-2020. Furthermore, the Bhuj tehsil received 598 mm of rainfall in 2021 as compared to 370.2 mm rainfall during average annual rainfall between 1991-2020. Additionally, due to effects of Biparjoy cyclone, it is anticipated that the Kachchh district as well as Bhuj tehsil has received high rainfall in the year 2023 as compared to long term average annual rainfall (1991-2020). However, the rainfall data for 2023 is currently unavailable on public domain to validate the same.

4.2.2.4 Wind

The wind data as per IMD Bhuj station (nearest station to Project) has been presented ***Table 4-12.***

Table 4-12 Wind Speed Data, Bhuj

Month	Wind Speed. Kmpd	Predominant Wind Direction of Khavda
January	4.7	North

Month	Wind Speed. Kmpd	Predominant Wind Direction of Khavda
February	5.5	West
March	6.4	West-Southwest
April	8.6	West-Southwest
May	12.4	West-Southwest
June	12.9	West-Southwest
July	12.0	West-Southwest
August	10.9	West-Southwest
September	8.2	West-Southwest
October	5.1	West-Southwest
November	4.3	North and East
December	4.4	North
Mean	**7.9**	**West-Southwest (WSW)**

Source: IMD-Climatological Table (1991-2020) and Integrated Wind and Solar Resource Assessment through Mapping and Measurements by National Institute of Wind Energy[19]

As per the above data, the Project area experiences highest wind speed in the month May and June i.e., 12.4 m/s and 12.9 m/s respectively. The minimum wind speed in the project area is experienced in the month November and December i.e., 4.3 m/s and 4.4 m/s respectively. The predominant wind direction of Khavda area as per National Institute of Wind Energy is West-South West (WSW).

According to Integrated Wind and Solar Resource Assessment through Mapping and Measurements by National Institute of Wind Energy, the average wind speed experienced in Khavda region in the year 2021 was 7.77 m/s.

4.2.2.5 Land Use

Land use inventories are an essential component in land resource evaluation and environmental studies due to the changing nature of land use patterns in the AoI. As observed during site visit and as per satellite imagery dated 30.10.2021, the current land use of the project is coastal plains which was previously under the possession of BSF. The land use of the Project site along with the immediate surrounding area will be converted to industrial land for development of the 800 MW solar power project and further 3325 MW solar park and 30 GW RE park.

According to the land use mapping of the study area, it is understood that the study are is majorly composed of Coastal plains (50.23%), followed by salt marshes (30.59 %). A snapshot of the land use pattern of the study area has been presented in ***Table 4-13.*** Map showing the land use pattern of the Project's study area has been presented in ***Figure 4-4.***

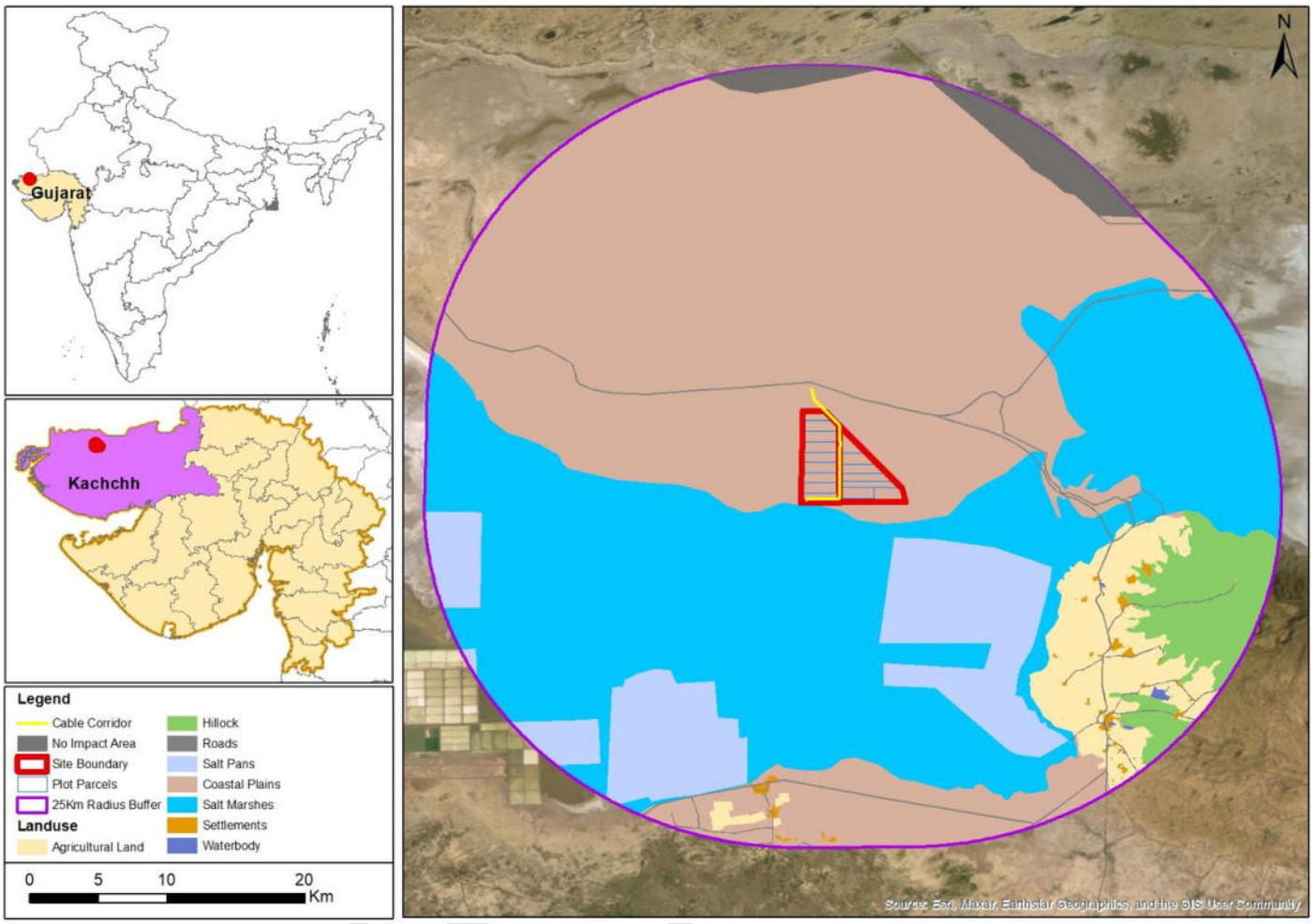
[19] https://v1-api.mnre-research.com/publications/Data_Analysis_Report_NIWE_Integrated_Resource_Assessment.pdf

Table 4-13 Land use Pattern of the Study Area

Sr. No.	Land use Category	Area (Sq Km)	%
1.	Settlements	11.80	0.33
2.	Agricultural Land	159.73	4.47
3.	Open / Scrub Land	1793.06	50.23
4.	Salt Pans	319.48	8.95
5.	Hillock	167.08	4.68
6.	Sea Water	1092.14	30.59
7.	Waterbody	9.74	0.27
8.	Roads	16.87	0.47
Total Area (Sq Km)		**3569.90**	**100.00**

Source: ArcGIS Mapping

Figure 4-4 Map Showing Land Use Patten of the Study Area



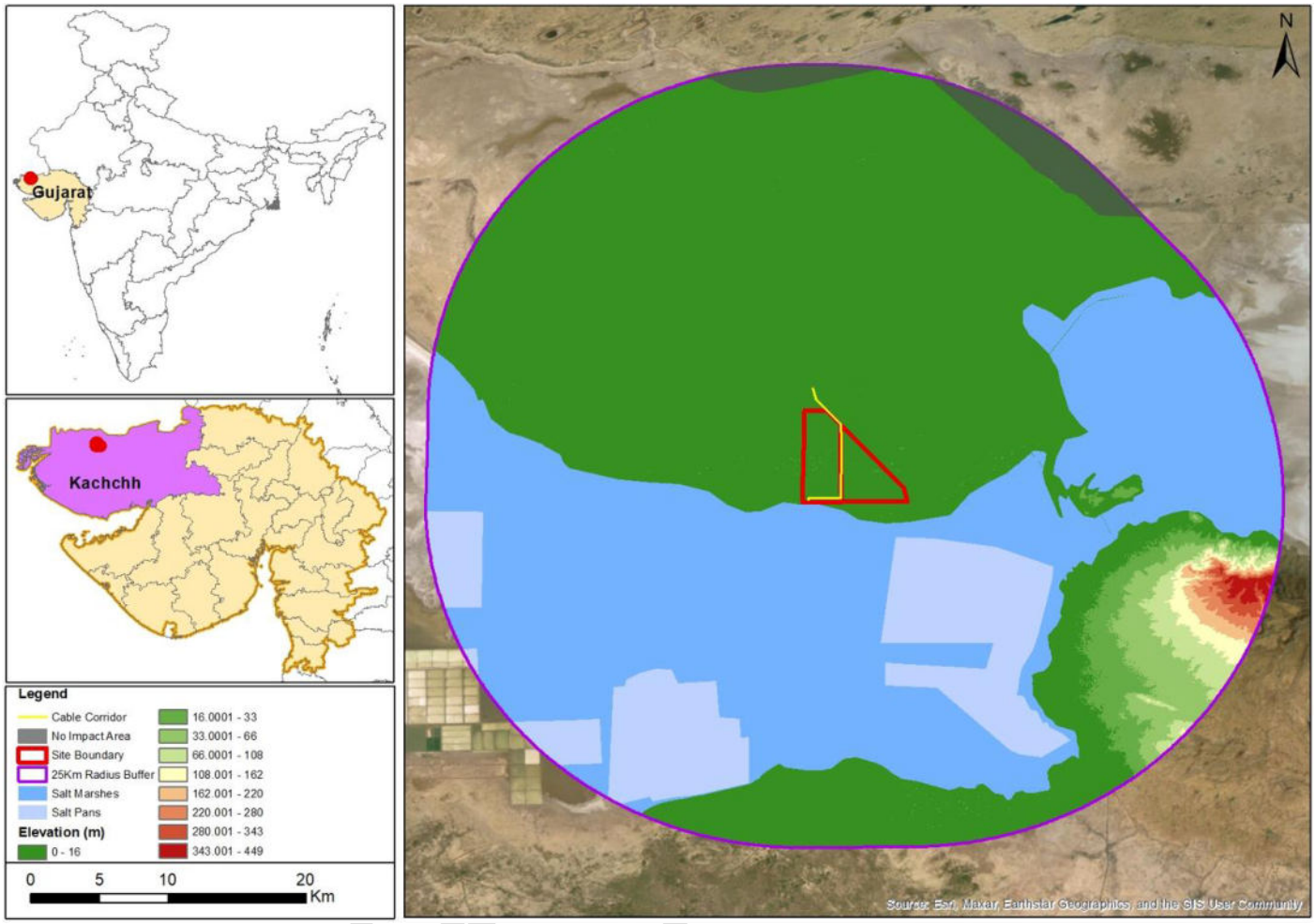
Source: Arc GIS Mapping

4.2.2.6 Topography

Topography of the study area is primarily flat. As per google earth imagery dated 30.10.2022, elevation in the study area ranges from 0 to 10 m above mean sea level (AMSL). Lower elevations are observed towards southern and south eastern parts of the Project area, located close to the salt marshes. The Project site was observed to be composed of coastal plains.

According to Digital Elevation Mapping (DEM), the elevation in the Project study area ranges between 0 m to 16 m. The map showing topography of the Project study area has been presented in ***Figure 4-5.***

Figure 4-5 Map Showing Topography of the Project Study Area



Source: ArcGIS Mapping

4.2.2.7 Geology and Hydrogeology

According to Groundwater yearbook of Gujarat state by CGWB, 2021-22, the entire Kachchh region is occupied by a variety of hard and fissured formations which include basalt and consolidated sedimentary formations with semi consolidated sediments along the low-lying coastal areas. The compact and fissured nature of rocks gives rise to discontinuous aquifers with moderate yield potential. The friable semi consolidated sandstone forms an aquifer with moderate yield potential. The coastal and deltaic areas in the state form a narrow linear strip and are underlain by Tertiary sediments and Alluvium. Though highly potential aquifers occur in these areas, salinity is a constraint for groundwater development. The quality of groundwater in both hard rock and alluvial terrain is, by and large suitable except, in the coastal areas, estuarine tract and the Rann where the degree of mineralization in groundwater is rather high and salinity is common.

As per the Central Ground Water Board (CGWB) groundwater brochure of Kutch district (2013), Sedimentary rocks of marine and non-marine origin formed under different environmental conditions during middle Jurassic to Recent period occur in the district besides volcanic and intrusive rocks (Deccan Trap) of middle Cretaceous to lower Eocene. The formations forming aquifer or hydrogeological units in the district can be grouped as:

- Mesozoic formations
- Deccan trap (Hard rock) as aquifer
- Tertiary formations
- Quaternary sediments

The ground water conditions, its occurrence and movement, hydraulic characteristics and chemical quality aspects are considered in each hydrogeological group.

Mesozoic Formation

The sediments belonging to Mesozoic period include both marine and non-marine sedimentary formation and occupy almost 60% of the district. Patcham, Chari and Katrol series belong to Jurassic period where as Umia or Bhuj (tehsil of the project) represent lower Cretaceous. According to Groundwater yearbook of Gujarat state by CGWB, 2021-22, the hydrological units in the Project study area comprise of salt marshes.

Deccan Traps

Deccan trap occurs as almost one continuous belt from Anjar to Lakhpat Taluka with a lateral dislocation near the injunctions of Nakhatrana, Abdasa and Mandvi Talukas. It mainly comprises of Light to dark grey basalt & dolerite as moderately extensive flows.

Tertiary Formations

The Tertiary sediments belonging to Eocene to Miocene period are of marine origin & are largely argillaceous and calcareous in nature and do not contain arenaceous members and thus mostly have inferior quality of formation water.

Quaternary Formations

Milliolite limestone, which is white to dull grey, medium - grained limestone comprising Milliolite Foraminifer, occurs along hill slopes and faulted plains. There is no ground water development in this formation.

4.2.2.8 Soil Type

According to District Disaster Management Plan of Kutch District 2022, Soil of the district is Red in a reasonable part of the district with abundant rocky terrain and hillocks. Kutch also has a significant part in form of marshy land known as Rann locally which is basically a salty desert which dries up seasonally and at other parts of the years is filled with shallow water. The desert touches Bhuj (proposed project location), Rapar, Nakhatrana, Lakhpat, and Bhachau tehsils.

4.2.2.9 Salt Works

According to District Disaster Management Plan of Kutch District 2022, due to the coastline in the District, Salt Industries have developed very well. The district has total 972 salt works (salt production unit) and 17456 salt workers are working in salt production. Annual Production of salt in the district is around two Lakhs tonnes

4.2.2.10 Water Resources

The drainage pattern as well as groundwater resources in the Kachchh district has been presented in subsequent sections.

4.2.2.10.1 Drainage Pattern

As per the Central Ground Water Board (CGWB) groundwater brochure of Kutch district (2013), only minor rivers and streams occupy Kachchh district, and no major rivers occur in the district. The rivers that drain the district though have deep cut river courses and are of ephemeral type and carry water only during the period of southwest monsoon for a few hours in a day and for couple of days in a year. The rivers originate from the central uplands and flow to either the Great Rann in the north and little Rann in the southeast and towards the sea in the south.

According to District Disaster Management Plan of Kutch District 2022, there are no major dams in Kachchh-Bhuj District. There are 20 medium and minor dams controlled under state irrigation department and 16 minor dams controlled under the District Panchayat. Among these dams, Rudramata dam is the biggest dam in the district.

4.2.2.10.2 Drainage Pattern within Study area

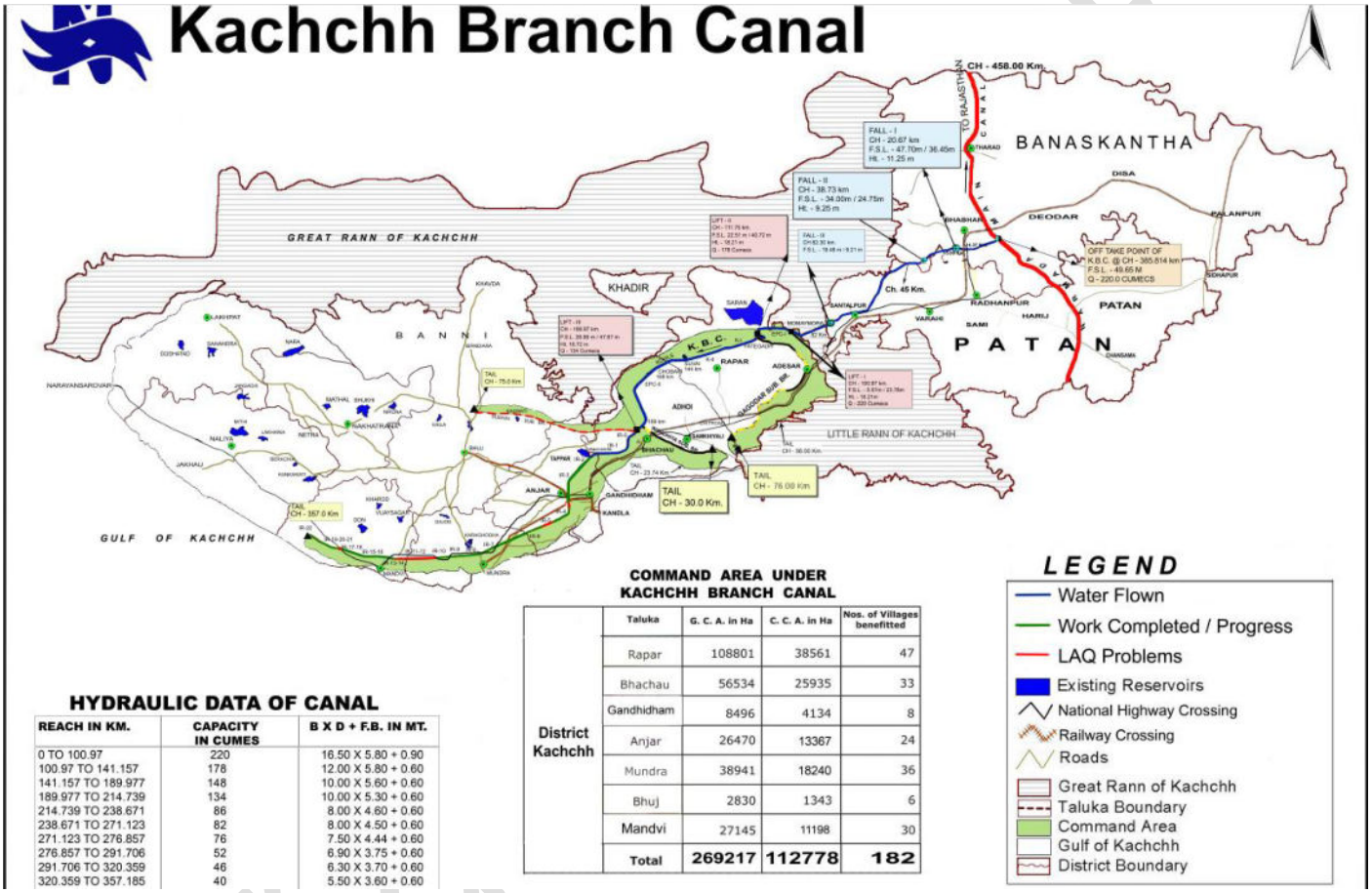
As observed during site visit, there are no major rivers located within 25 km of the Project location. The project study area is predominantly composed of salt marshes which is filled with water during monsoon period. Rann of Kutch lake which is part of Kachchh Desert Wildlife sanctuary is located approximately 18 km (aerial distance) from the site towards east direction. Based on discussion with local community, it is understood that the salinity in the Rann of Kachchh lake is high due to presence of salt marshes in the vicinity of the lake. The arabian sea is located approximately 130 km (aerial distance) from site towards west direction. The Rudramata dam is located approximately 70 km (aerial distance) from site towards south direction.

Additionally, based on discussion with local community and as observed in google earth imagery dated 30.10.2022, Kachchh branch canal which is part of Narmada water canal is located 90 km from the Project location towards south east direction. The Kachchh branch canal supply drinking water to few villages falling within Bhuj tehsil.

Kachchh Branch Canal

The Kutch Branch Canal (KBC) is a 360 km long branch canal that draws water for the Kutch district from the Narmada Main Canal. It stretches from the Sardar Sarovar Narmada Dam in Narmada district to the last of the villages of Gujarat's Mandvi tehsil. The canal is acclaimed as the "longest branch canal in the world" by Sardar Sarovar Narmada Nigam Ltd (SSNNL) officials. The canal is aimed to provide water for irrigation to 182 villages that have a culturable command area (CCA) of 1,12,778 hectares (278,561 acres). It will also provide drinking water in all 948 villages and 10 towns of the Kutch district. The command area of the Kachchh Branch Canal has been presented in ***Figure 4-6.*** According to the below map, there are 6 villages in Bhuj tehsil with a command area of 2830 hectare which will be benefited from the canal.

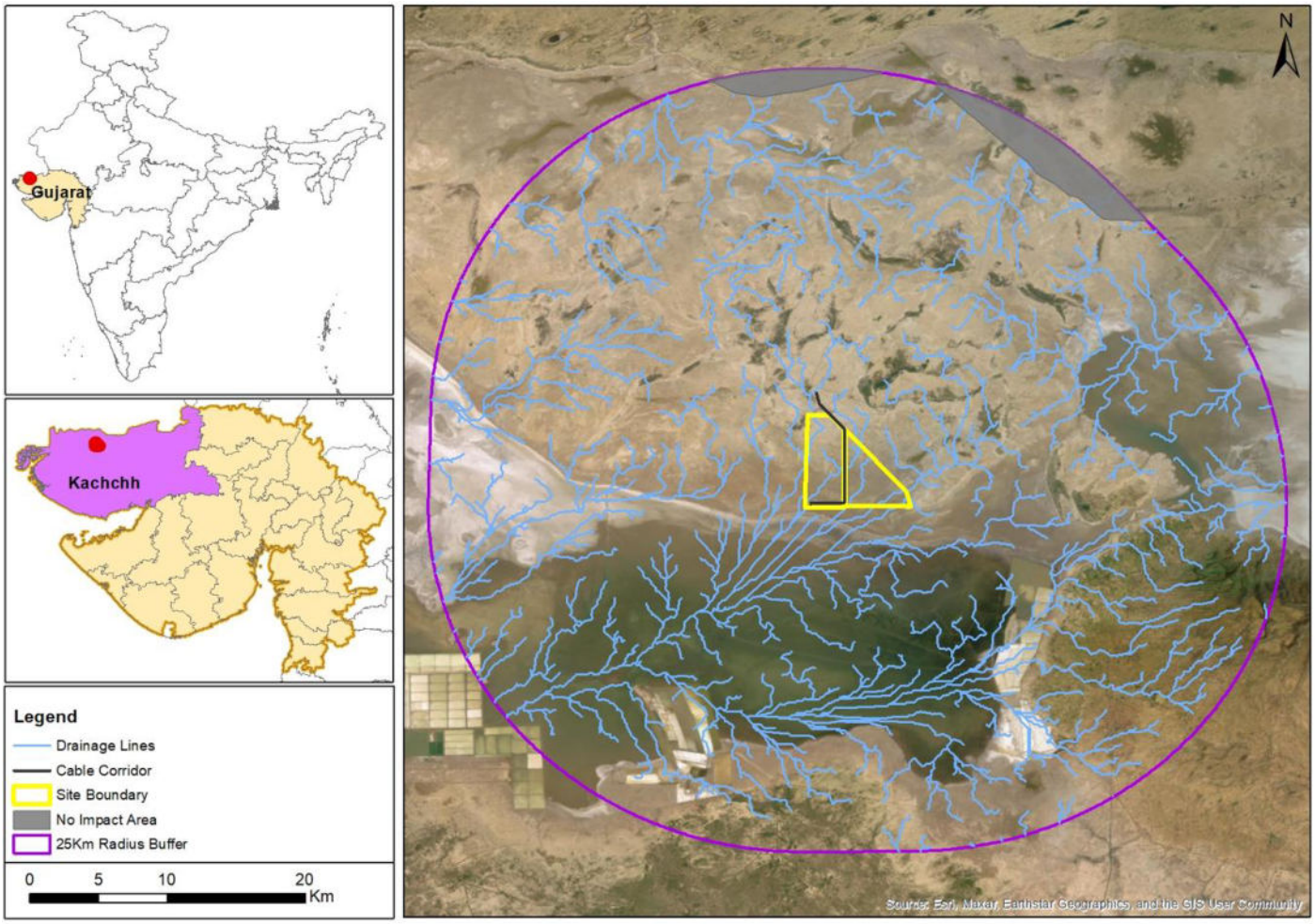
Figure 4-6 Command Area of Kachchh Branch Canal



Source: Sardar Sarovar Narmada Nigam Limited

According to the Drainage map of the Project study area, there are no major water bodies within the project study area except for dendritic to sub densdritic drainage lines. The map showing drainage pattern of the Project study area is presented in ***Figure 4-7.***

Figure 4-7 Map showing Drainage Pattern of Project Study Area



Source: ArcGIS Mapping

4.2.2.10.3 Groundwater Resources

According to Dynamic Groundwater Resources of India, 2022, Bhuj tehsil, where the proposed project is located is categorized as over exploited in terms of groundwater development and extraction.

Depth to Water Level in Kachchh Region

According to Groundwater yearbook of Gujarat state by CGWB, 2021-22, it is understood that for the purpose of presentation, Gujarat state has been divided into three regions, namely, (a) the Kachchh region comprising Kachchh district[20], (b) the Saurashtra region comprising Amreli, Bhavnagar, Botad, Devbhumi Dwarka, Gir Somnath, Jamnagar, Junagadh, Morbi, Porbander Rajkot and Surendranagar districts; and (c) the mainland Gujarat. The mainland Gujarat has been further subdivided into two regions, namely, North Gujarat comprising, Ahmedabad, Anand, Arvalli, Banaskantha, Dahod, Gandhinagar, Kheda, Mahesana, Mahisagar, Panchmahals, Patan and Sabarkantha districts; South Gujarat comprising Bharuch, Chhota Udepur, Narmda, Navsari, Surat, Tapi, The Dangs Vadodara and Valsad districts. The Union Territory of Daman and Diu has been described separately.

During pre-monsoon period in Kachchh region, the water level was observed between 5 to 20 m below ground level (mbgl) in May 2021. Western part of the area shows water level ranges 2 to 5 m bgl. The water levels more than 20 m occur as isolated patches scattered in the central-eastern part of the Kachchh district. In the month of August 2021, the water level ranged less than 20 m bgl in Kachchh region. Isolated patches of water level ranged between 20 to 40 mbgl and found in central and eastern part of the area. The deepest water level of 33.00 m bgl was recorded at Gagodar and the shallowest water level of 0.29 m bgl has been recorded at Haboi.

Similarly, the depth to water level during post monsoon i.e., November 2021, the water level ranged within 20 m bgl in major part of the district. Central and eastern part of the district showed water level range between 10 to 20 m bgl. The deepest water level of 33.00 m bgl was recorded at Gagodar and the shallowest water level of 0.39 m bgl was recorded at Haboi. The water level in the month of January 2022 was found to be less than 20 mbgl in major part of the district. In central part of Kachchh, the water level ranged between 20 to 40 m bgl in isolated patches. The deepest water level of 40.80 m bgl was recorded at Ugardi and the shallowest water level of 0.39 m bgl at Lilpur.

Depth to Water Level in Khavda (Proposed Project Location)

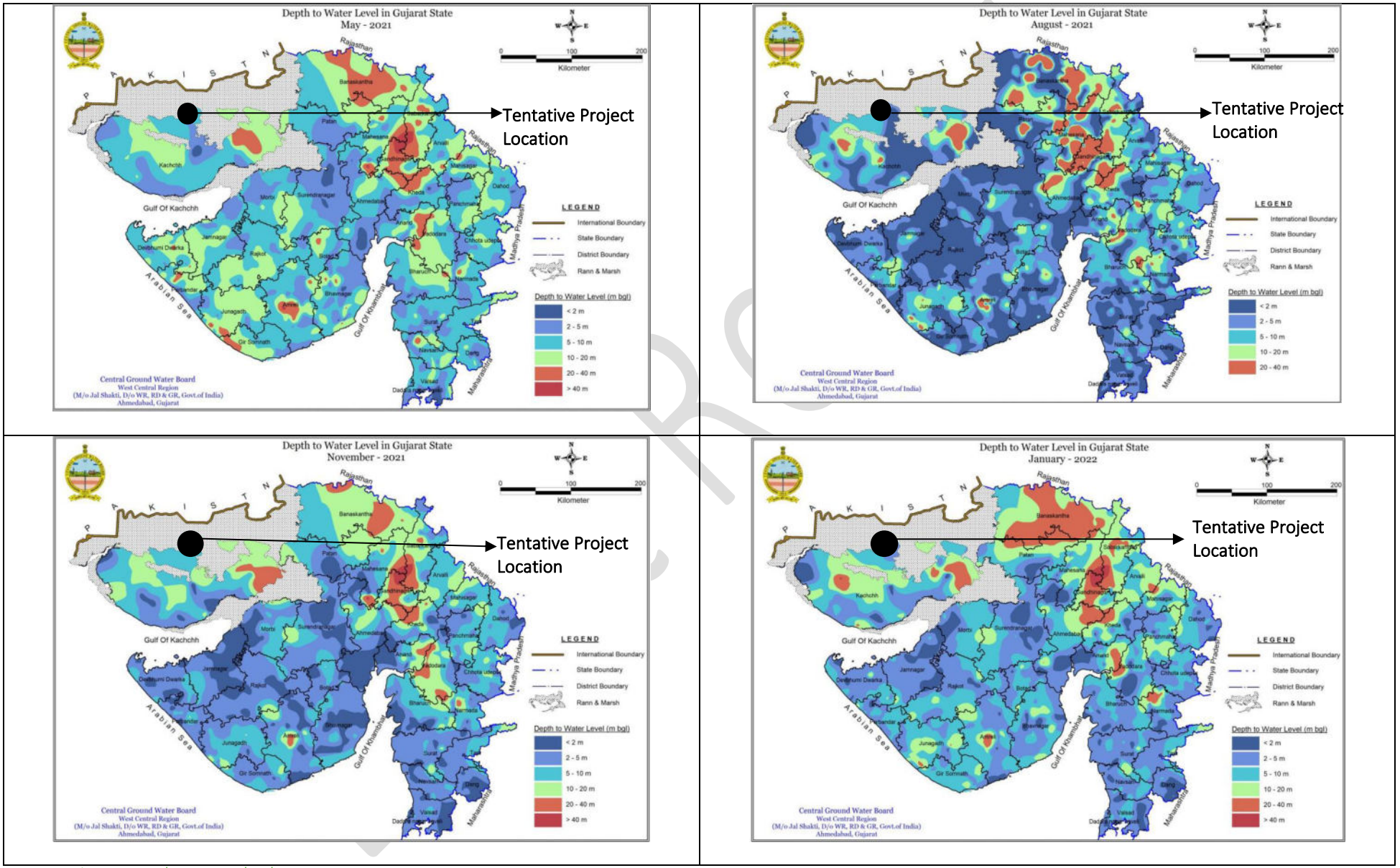
According to Groundwater yearbook of Gujarat state by CGWB, 2021-22, the project is located in the salt marshes area of Khavda. The groundwater level during pre-monsoon period in Khavda was observed to be 4.77 m in the month of May 2021 and 5.08 m in August 2021.

During post monsoon, the water level in Khavda in the month of November 2021 was observed to be 5.67 m and 3.8 m during January 2022.

The map showing groundwater level in the Kachchh district and project Study area has been presented ***Figure 4-8***.

[20] Since the project is located within Kachchh district, data on groundwater level for Kachchh has been presented in this report.

Figure 4-8 Map showing groundwater level in the Kachchh district and Project Study Area



Source; Gujarat Groundwater Yearbook, 2022

4.2.2.11 Natural Hazards

Building Materials & Technology Promotion Council (BMTPC), Government of India, have published hazard maps for all the states of India. According to the BMTPC, floods, wind, and earthquakes are the main natural hazards that can cause damage to life and property. Additionally, as per District Disaster Management Plan of Kachchh, 2022, earthquake, cyclones, drought, flood and heat wave are the major natural hazards in the district. The vulnerability of the Project study area to natural hazards have been presented below.

- Earthquake: According to BMTPC, the project is located in an area designated as Zone V i.e, very high damage risk zone with MSK IX or more. As per District Disaster Management Plan of Kachchh, 2022, the probability of earthquake occurrence in Kachchh district as well as project area is throughout the year. The earthquake event magnitude in project area is >4.0 to 5.0.

  The massive Gujarat earthquake that occurred in 2001 with a magnitude of 7.6 led to 12216 life and cattle loss in Bhuj, fully damage to 1,46,087 houses, medium damage to 27,8,217 houses and other infrastructures.

- Cyclone/Wind: The Project is located in an area designated as High Damage Risk Zone with wind speed of 47 m/s. As per District Disaster Management Plan of Kachchh, 2022, the probability of cyclone occurrence in Kachchh district as well as project area is between March to May and September to November.

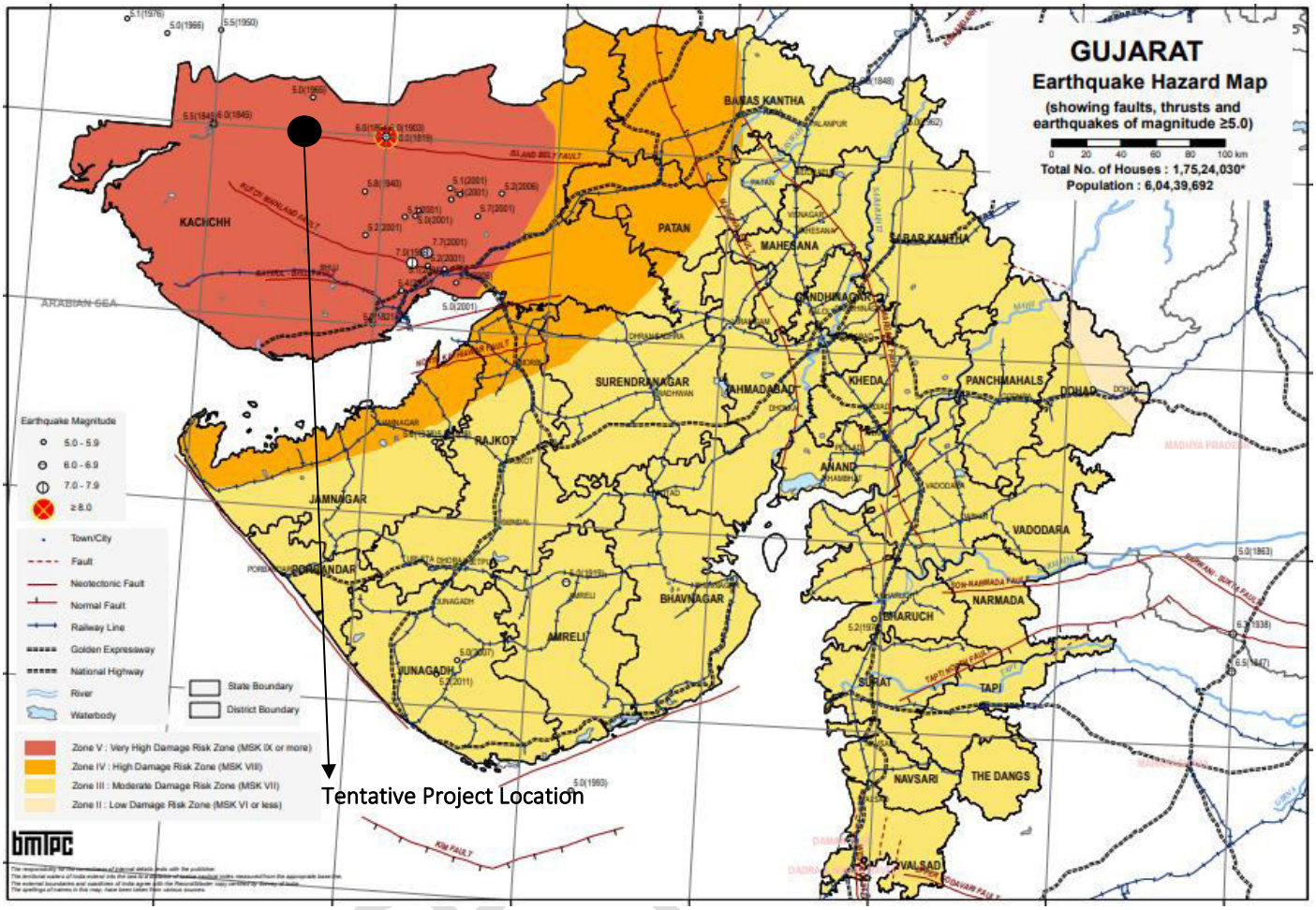
- Flood: The Project is located in an area with low vulnerability to flood. As per District Disaster Management Plan of Kachchh, 2022, the probability of flood occurrence in Kachchh district is low but may occur between June to September due to very heavy rainfall, sea surge or Tsunami.

  River flooding is a not a major hazard faced by the district as most of the rivers are seasonal and rainfall is less. All the river systems in the district are very slow flooding. Occasional localized urban flooding happens in urban areas like Bhuj, Gandhidham, and Anjar primarily due to heavy rain and inadequate drainage and increased run-off loads in hard surfaces. But no major incidents have been reported regarding urban floods.

- Tsunami: As per District Disaster Management Plan of Kachchh, 2022, Tsunamis are ocean waves produced by earthquakes or underwater landslides. Tsunamis are often incorrectly referred to as tidal waves, but a tsunami is actually a series of waves that can travel at speeds averaging 450 (and up to 600) miles per hour in the open ocean. However, waves that are 10 to 20 feet high can be very destructive and cause many deaths or injuries. Tsunamis are most often generated by the earthquake induced movement of the ocean floor. Landslides, volcanic eruptions, and even meteorites can also generate a tsunami. Areas at greatest risk are less than 25 feet above sea level and within one mile of the shoreline. Kachchh district has 6 coastal tehsils i, e, Mundra, Mandvi, Gandhidham, Bhachau, Anjar and Lakhpat and as per analysis of Mean Sea level of Kutch District there are 72 villages of 6 coastal tehsils which are less than 2 km far from the sea and on less than 10 meters of height from ocean level. Since Bhuj tehsil is not a coastal tehsil and project is located 130 km away from the sea, it is anticipated that the Project is not vulnerable to Tsunami.

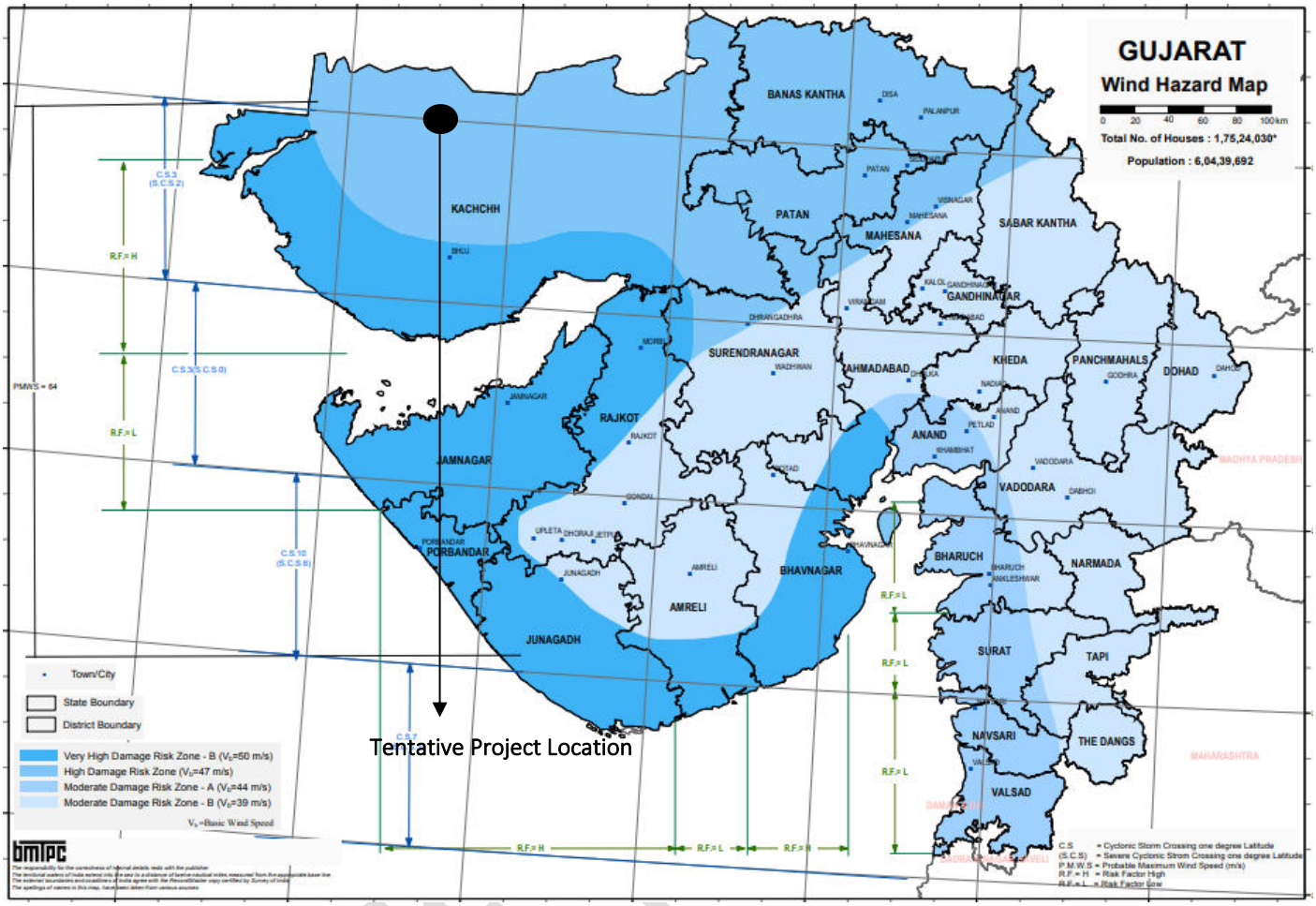
- Drought: As per District Disaster Management Plan of Kachchh, 2022. The entire Kachchh district is vulnerable to drought and probability of occurrence of drought in Kachchh and project area is July to October.

Figure 4-9 Map Showing Earthquake Hazard in Project District



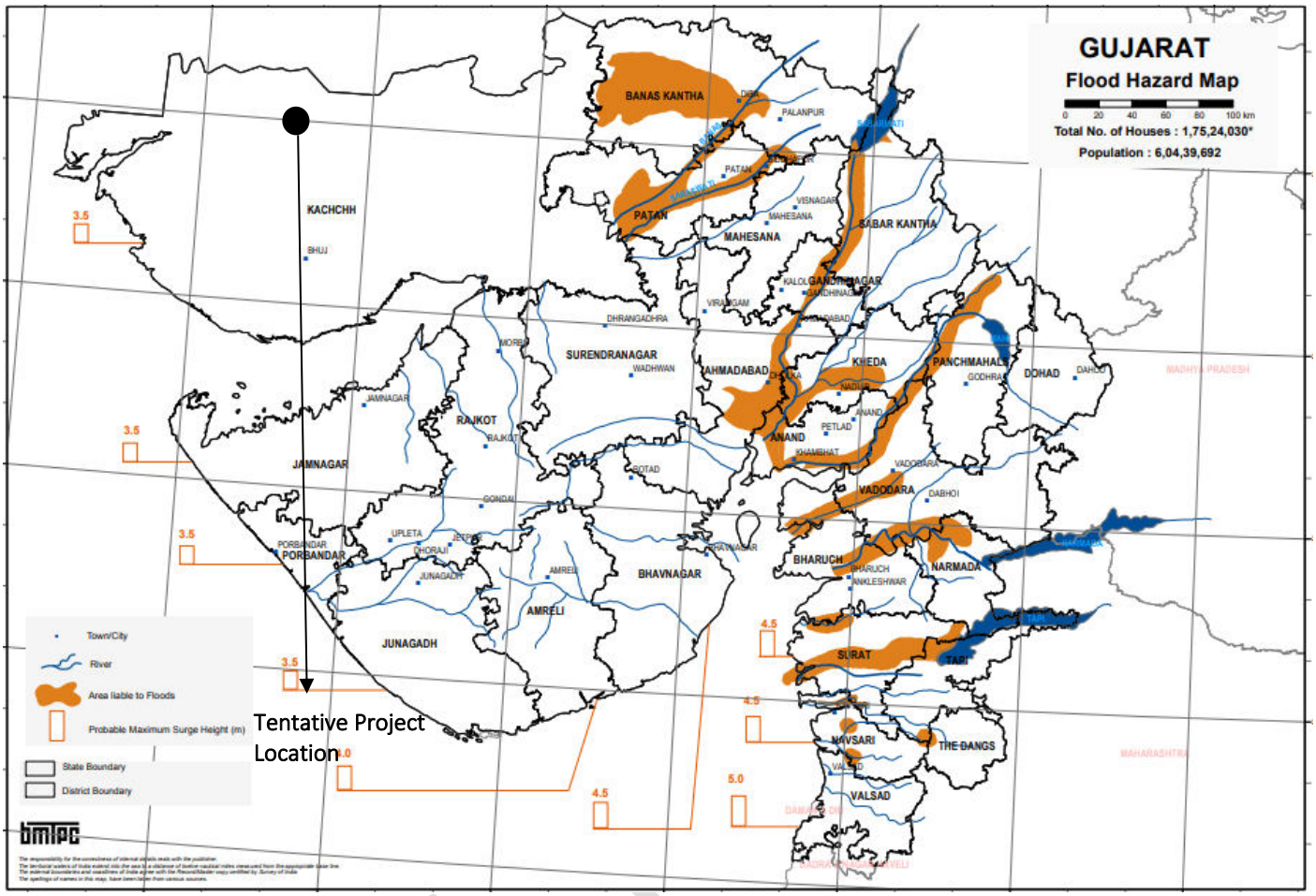
Source: Building Materials & Technology Promotion Council (BMTPC), Government of India

Figure 4-10 Map showing Wind/Cyclone Hazard in Project District



Source: Building Materials & Technology Promotion Council (BMTPC), Government of India

Figure 4-11 Map Showing Flood Hazard In Project District



Source: Building Materials & Technology Promotion Council (BMTPC), Government of India