“Consultancy services for ESIA for three Solar Parks, namely, Agar Solar Park (550 MW), Shajapur Solar Park (450 MW) and Neemuch Solar Park (500 MW), including internal evacuation infrastructure and associated transmission lines, of three parks of aggregate capacity of 1500 MW in the State of Madhya Pradesh, India”: Shajapur Solar Park

Rewa Ultra Mega Solar Limited

Final Report

15 October 2020

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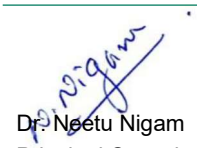
Final Report

Aniket Jalgaonkar
Principal Consultant



Dr. Neetu Nigam
Principal Consultant

Sumati Bhatia
Technical Director

Dr. Arun Venkataraman
Technical Director

Neena Singh
Managing Partner

ERM India Private Limited

Building 10A
4th Floor, DLF Cyber City
Gurgaon, NCR – 122002

Tel: 91 124 417 0300
Fax: 91 124 417 0301

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Acronyms and Abbreviations

Name	Description
AMSL	Above Mean Sea Level
AoI	Area of Influence
CGWB	Central Ground Water Board
CPCB	Central Pollution Control Board
DEM	Digital Elevation Model
E&S	Environmental and Social
EHS	Environment, Health and Safety
EPC	Engineering, Procurement and Construction
ERM	Environmental Resource Management India Pvt. Ltd.
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
GoI	Government of India
GoMP	Government of Madhya Pradesh
GSS	Grid Sub Station
Ha	Hectares
Ham	Hectare metre
IFC	International Financial Corporation
KL	Kilo Litre
KV	Kilo Volt
LRP	Livelihood Restoration Plan
LUPA	Land Use Permission Agreement
MDR	Major District Road
MNRE	Ministry of New and Renewable Energy
MoEFCC	Ministry of Environment, Forest and Climate Change
MoP	Ministry of Power
MPPCB	Madhya Pradesh Pollution Control Board
MPUVNL	Madhya Pradesh Urja Vikas Nigam Limited
MW	Mega Watt
NH	National Highway
PAF	Project Affected Family
PCA	Primary Census Abstract
PSS	Pooling Sub Station
PV	Photo Voltaic
PVHI	Photo Voltaic Heat Island
RAP	Resettlement Action Plan
RoW	Right of Way
RPO	Renewable Purchase Obligation
RUMSL	Rewa Ultra Mega Solar Limited
SECI	Solar Energy Corporation of India Limited
SH	State Highway
SPO	Solar Purchase Obligation
TL	Transmission Line
VD	Village Directory
WB	World Bank

EXECUTIVE SUMMARY

Introduction

ERM India Pvt. Ltd. (ERM) has been engaged by Rewa Ultra Mega Solar Limited (RUMSL) to undertake an Environmental and Social Impact Assessment (ESIA) of three Solar Parks, including internal evacuation infrastructure and associated transmission lines (TLs) of aggregate capacity of 1500 MW in the Neemuch, Agar and Shajapur Districts of Madhya Pradesh, India.

The ESIA for the aggregate 1500 MW Solar Parks has been divided into four distinct studies:

- ESIA for Neemuch Solar Park of 500 MW capacity;
- ESIA for Agar Solar Park of 550 MW capacity;
- ESIA for Shajapur Solar Park of 450 MW capacity; and
- ESIA for the external Transmission Line[1] infrastructure for all three Solar Parks.

The present report is the environmental and social impact assessment study for the Shajapur Solar Park of 450 MW capacity and located in two tehsil i.e. Moman Badodiya tehsil (termed as Unit 6 & Unit 7 of 220 MW and 105 MW each) and Shajapur tehsil (termed as Unit 8 of 125 MW) of Shajapur district. The Unit 6 & 7 are spread across eight villages at Moman Badodiya- Dehripal, Burlay, Jawadi, Parsula, Fawaka, Dhatrawada, Chauma and Bijnakhedi and Unit 8 is spread across four villages- Hanoti, Surajpur, Lalpur and Upadi in Shajapur district in the State of Madhya Pradesh.

The Resettlement Action Plan (RAP) and Indigenous People Plan (IPP) will be prepared as separate deliverables. The subsequent RAP and IPP report will contain baseline information on the households from the villages falling in the project boundary, as well as the associated impacts. RAP and IPP shall be referred for most updated information on the social baseline and impacts.

Project Description

A brief description of Project is given in table below:

Table 0.1 Brief Description of Project

S. No.	Particulars	Description
1.	Project Village location	Unit 6 and 7 (Moman Badodiya): Dehripal, Burlay, Jawadi, Parsula, Fawaka, Dhatrawada, Chauma and Bijnakhedi; Unit 8 (South Shajapur): Hanoti, Surajpur, Lalpur and Upadi
2.	Tehsil	Moman Badodiya Tehsil and Shajapur Tehsil
3.	District Name/State	Shajapur, Madhya Pradesh
4.	Location Coordinates	■ Unit 6: 23°40'43.40"N and 76°15'18.53"E ■ Unit 7: 23°38'32.67"N and 76°16'14.81"E ■ Unit 8: 23°14'12.98"N and 76°13'20.31"E
5.	Capacity	■ Unit 6: 220 MW ■ Unit 7: 105 MW ■ Unit 8: 125 MW
6.	Power Evacuation	The evacuation from the proposed Solar Park at Shajapur shall be carried out through the development of 33/220 kV substation at each unit. All Units shall further connect to the proposed 220/400 kV ISTS substation of PGCIL at Agar.

[1] The external transmission line infrastructure refers to the power evacuation from the solar park site to the grid substation.

S. No.	Particulars	Description
7.	Climatic zone	Semi arid and Tropical wet & dry type of climate
8.	Average Elevation	~390 m to~525 m amsl; High gradient land area (>8°): Unit 6: ~12 ha; Unit 7: ~13.5 ha; Unit 8: ~2 ha.
9.	Site Conditions	Barren rocky surfaces, flat land, hilly at some portions
10.	Road Accessibility	Through existing State highway and village roads
11.	Roads crossing Project site	Village roads
12.	Nearest Airport	Devi Ahilyabai Holkar Indore Airport
13.	Nearest Railway station	■ Shajapur railway station ■ Berchha railway Station ■ Maksi railway Station
15.	River/canal/nallah/ pond present in project footprint	Small water bodies are present in the project footprint; A nallah is present in unit 8 (South Shajapur)
16.	Protected areas (National Park/ Sanctuary)/ Forest land	None
17.	Any other feature existing in Project Area	GAIL Tower and ~ 400m long and 48 m wide pipeline corridor in Unit 6 (excluded from usable land for the Project); Existing crusher in Unit 6; Existing Transmission Line in all Units;
18.	Land Area	974.7 Ha
19.	Water Requirement	■ Construction Phase: 250-300 KLD ■ Operation Phase: ■ 277 KLD for solar panel cleaning; ■ 9 KLD domestic water, assuming 200 no. of O&M staff and 45 LPCD; ■ 7 KLD for green belt maintenance (as per DPR); ■ 30 KL for firefighting and miscellaneous.
20.	Source of Water	■ Construction Phase: Tankers ■ Operation Phase: Borewells
21.	DG sets	For backup power requirement during construction phase; No. and capacity yet to be determined.
22.	Soil Characteristics	Sandy Loam and Loamy Sand
23.	Seismic Zone	Zone II: Low damage risk zone
24.	Flood prone zone	Not prone to floods
25.	Wind zone	Moderate Damage Risk Zone V_t= 44 m/s

Land Requirement and Status

The key land requirements for the project comprises of the permanent land for the solar park, the tower footing for the transmission line, access roads, the land use restrictions within the RoW and the temporary land requirements (if not located within the identified project footprint) during the construction phase.

Table 0.2 Village Wise details of Land considered in Units

S No.	Village Name	Govt. land (NRED allotted)	Govt. Land Identified	Private Land	Patta Land	Total Land Area (Ha) (Govt. Land + Pvt. Land)
1	Burlay*	23.7	0.0	6.4	0.0	30.1
2	Jawadi	32.2	0.0	2.0	0.0	34.2
3	Dhatrawada	172.2	0.0	9.7	0.0	181.9
Sub- Total (Unit 6)		***228.1***	***0.0***	***18.1***	**0.0**	**246.2**
4	Parsula	116.2	0.0	0.0	5.2	121.4
5	Dehripal	111.1	0.0	21.8	0.0	132.9
6	Bijnakhedi	95.4	0.0	22.6	0.0	118.0
7	Fawaka	17.1	0.0	0.2	0.0	17.3
8	Chouma	32.7	0.0	9.5	0.0	42.2
9	Burlay*	41.7	0.0	0.0	0.0	41.7
Sub- Total (Unit 7)		**414.2**	**0**	**54.1**	**5.2**	**473.5**
10	Surajpur	22.7	0.7	18.2	0.0	41.6
11	Lalupura	49.8	0.8	0.0	0.0	50.6
12	Hanoti	131.9	12.5	18.5	0.0	162.9
Sub- Total (Unit 8)		**204.3**	**14.0**	**36.7**	**0.0**	**255.1**
Total (Unit 6, 7,8)		***846.6***	***14.0***	***108.9***	***5.2***	***974.7***

Source: Final DPR Aug 2020

The private land comprises approximately 11% land of Solar Park, whereas government land (i.e. both allotted by the state Government for the project and extra Government. land identified for the project) comprises 88.3% of the total land considered for the Solar Park. The boundary for the solar park is defined by feasible avoidance of land being used for habitations, residential structures, religious and cultural structures, access routes, etc.

Land Procurement

The land procurement process for the Solar Park commenced in 2016-17, where RUMSL identified potential land parcels potential project areas, with large chunks of unused government land. This was driven by the intent to use Government land for the project to minimize the use of Private or Patta lands the extent possible.

The land identification was followed by screening and scoping exercises, in order to identify the possible exclusions and avoidances on the identified land, comprising avoiding certain settlements/ clusters of structures. Based on the recommendations from the scoping exercise, another drone survey of the identified land parcels were undertaken, to further optimize the land requirement in a manner, that impacts to private and patta land owners and associated livelihoods are minimized.
A Land Use Permission Agreement (LUPA) will be signed between New and Renewable Energy Department, Government of MP and RUMSL for the life of the project. Subsequently, M/S RUMSL will have a back-to-back Land Use Permission Agreement with the Solar Project developers, which would enable them to use the land for development of the solar project as per the agreed terms of the LUPA.

The private land for the project shall be purchased as per prevailing laws and policies in the State of Madhya Pradesh (through MP Mutual Consent based Land Purchase Policy' dated 14th November, 2014.

Under the policy, the District Collector (DC), may purchase private and patta land based on the requirement, due to non-availability of government land and or shortfall in meeting the project land requirement through government land.

Applicable Reference Framework

- Applicable Indian (national, state and local) Environmental and Social Regulations;
- Applicable Permits (licences, approvals and consents) and permitting agencies;
- IFCs Performance Standards on Environmental and Social Sustainability (2012) (IFC, 2012);
- World Bank Environmental and Social Safeguard Policies;
- IFC/ WB General EHS Guidelines (2007) (IFC, 2007);
- IFC EHS Guidelines for Electric Power Transmission and Distribution, 2007;
- MNRE Environmental and Social Management Framework for Solar PV Park, February, 2017; and
- Applicable National Environmental Standards for Ambient Air, Noise, Water etc.

Current Baseline Status

The following table provides a summary of the baseline in the study area

Table 0.3 Summary of Current Baseline Status

S.	Category	Description of Baseline
1.	Location Characteristics	■ Unit 6: 23°40'43.40"N and 76°15'18.53"E ■ Unit 7: 23°38'32.67"N and 76°16'14.81"E ■ Unit 8: 23°14'12.98"N and 76°13'20.31"E ■ Unit 6 & 7 of Shajapur Solar Park is located at a distance of approximately 26 km from Shajapur town and can be accessed by State Highway 41, linking Agar to Sarangpur. ■ Unit 8 of Shajapur Solar Park is around 19 km away from Shajapur town. This Unit can be accessed through a village road from Jhonkar to Hanoti at a distance of approximately 6 km.
2.	Study Area	The area of up to 5 km radius from the Project boundary (Solar Park area) has been demarcated as study area for the Project.
3.	Land Use and Land Cover	■ The current land use of the proposed project site is agricultural land, grazing land, and scrub land with some trees ■ Some are is under water features like natural drains, ponds
4.	Topography	■ The Project site area has undulating land; ■ The high gradient area, i.e. area > 8°is present.
5.	Drainage	■ Project site have small water bodies and 3rd or 4th order dendritic drainage channels within the site area.
6.	Soil	■ Soil in the area is medium black cotton soil; ■ No major anthropogenic activities are carried out in the area which may lead to soil contamination.
7.	Ground Water	■ The Project sites are located in a 'Over exploited' (Moman Badodiya) and Semi Critical' (Shajapur) block as per CGWB; ■ Water bodies present in the study area includes seasonal rainfed and perennial water bodies. These are used for domestic purposes as washing of clothes and for domestic animals. The Palsavad Son reservoir is used for both domestic and irrigation purposes.

S.	Category	Description of Baseline
8.	Ambient Air Quality	■ As per baseline monitoring conducted for the Project, ambient air quality parameters (PM_{10}, $PM_{2.5}$, SO_2, NO_X) were within the prescribed CPCB limits.
9.	Ambient Noise Quality	■ As per baseline monitoring conducted for the Project, the noise levels during day time and night time were observed exceeding the CPCB prescribed limits.
10.	Biological Environment	■ The project site and the surrounding habitats are modified habitats with presence of IUCN listed threatened species (VU-Vulnerable).
11.	Demographic Profile	■ The 11 Project Villages comprise 7246 households with a population of 35,581 individuals. ■ The average size of the households is 5 in the Study Area.
12.	Social Stratification	■ The entire population in the Study Area falls in the rural category. The villages comprise of majorly Prajapati, Sondiya, Malviya Thakur Brahmin, Rajput, Patel, and Banjara communities, with some households of the Bhil (ST) community. ■ As understood through consultations undertaken across Project villages, “Banjara” community is also present in the Study area, near the project
13.	Gender Profile	■ Dhatrawada village has the highest sex ratio amongst the Project villages. The AoI has a sex ratio of 935 females per 1000 males, which is slightly lower than the district figure (938) but better than the state figure of 931. ■ The Project Villages exhibit adult sex ratio (927) and child sex ratio (945) which is nearly equivalent to the AoI, tehsil, district and the state figures of sex ratio. ■ Women are responsible for domestic roles in a household along with working on agricultural farms, while men are engaged in activities of sale, purchase of goods and livestock grazing.
14.	Education and Literacy	■ The total literacy rate (62%) in project villages is relatively higher than the AoI, Study Area, Tehsil and district figures; however the male literacy rate (78%) and female literacy (46%) rate in the Project Villages is lower as compared to the AoI, Study Area, Tehsil and district figures. ■ The female literacy rates are substantially lower than male literacy rates across the study area, which represents the relatively lower focus on education of females in the area.
15.	Land Ownership	■ Census 2011 figures for land area indicate that 18.3 percent of the total land area in the Project villages is categorised barren and uncultivable land, 63.2 percent is net sown area, out of which approximately 55 percent is unirrigated land and 45 percent is irrigated by some sources, i.e. wells, tube- wells, hand-pumps, canals etc. ■ The Project villages have no forest land, 10.2 percent area under non-agricultural use and nearly 4 percent as culturable waste land. ■ Additionally, 0.10 percent is land comprising of miscellaneous tree crops. Land under permanent pastures and other grazing land is about 4 percent. ■ Current fallows area and fallow lands other than current fallows comprise 0.09 percent and 0.16 percent respectively.
16.	Livelihood Profile	■ The Project villages have nearly 50 percent working population, with a majority categorised as Main Workers (66%) and 33.4% Marginal workers out of the total working population. ■ Agriculture forms the mainstay in the area with majority of population working as cultivators and agricultural labourers.
17.	Water Supply and Sanitation	■ The source of water for both drinking and agricultural purposes, are uncovered wells and hand pumps. The census data of 2011 shows that canal/ river water was available only in Chouma village during 2011; however the condition on ground has reportedly improved in the past decade, as during consultation in Lalupura, Jawadi and Burlay people informed that there is canal water source in their village for the past 3-5 years. ■ The census data, 2011 below shows that there is tap water connection in Burlay, Bijnakhedi and Lalupura villages.

S.	Category	Description of Baseline
18.	Health facilities and Health Seeking Behaviour	■ The health facilities in the Study Area follow a three-tier health infrastructure system, as also applies to the state of MP. As per Census 2011 data, in the Project Villages, however, there are no Community Health Centres (CHCs) or Primary Health Centres (PHCs). ■ It can be understood from the Census 2011 data, that there is one primary health sub-centre and one dispensary in the Project villages. ■ There is one Primary health centre and 2 Primary health sub-centres in AoI villages, however there are no maternity and child welfare centres, dispensaries, veterinary hospitals and family welfare centres in AoI villages.

Stakeholder Consultations and Disclosure

During the ESIA process, a stakeholder identification and prioritization was conducted for identifying the key stakeholders of the project, while keeping in mind the nature of the project and its setting. Furthermore, consultations were conducted with these identified stakeholders through a participatory approach.

The table below gives the list of primary and secondary stakeholders, depending on the extent of impact (direct/ indirect) on the stakeholder by the project. Those person(s) or groups who will be directly impacted by the project are Primary Stakeholders and those who have an indirect influence or the Project impacts indirectly are the Secondary Stakeholders.

Stakeholder Groups	Primary Stakeholders	Secondary Stakeholders
Community	■ Private land owners from project villages; ■ Patta holders (i.e. ~10-15 HHs in each village from SC & ST community) including those who are not cultivating on their allotted patta land parcel and have squatted upon a separate/ new land parcel, in the nearby areas; ■ Non recognized Patta owners who have purchased land from registered Patta holders, based on the verbal agreement. ■ Agricultural labours; ■ People/ farmers utilizing nearby Government land or fallow land for their livestock grazing, i.e. Graziers; ■ Vulnerable Social Groups (i.e. women headed households, handicapped and households of SC and ST community) from project villages and surrounding areas; ■ EPC/ Construction Contractors, sub-contractors; ■ Potential unskilled labours to be engaged for the construction phase of the project; ■ Owners of land required for temporary occupation or use; ■ Squatters on the Government land parcels identified for project; ■ Banjara households	■ Fence line community
Institutional Stakeholders	■ Gram Panchayats (GPs) – Surajpur for Surajpur and Lalupura villages – Fawaka for Parsula and Fawaka villages – Bijnakhedi for Chouma village, – Sangadiya for Jawadi village, – Dehripal, Burlay and Dhatrawada;	■ Local Political Groups ■ Civil Society/ Local NGOs

Stakeholder Groups	Primary Stakeholders	Secondary Stakeholders
	■ Zila Panchayat/ Janpad Panchayat of Moman Badodiya & Shajapur; ■ Tehsil Officials	
Government Bodies/Regulatory Authorities	■ District Administration ■ Regulatory Authorities – MP Urja Vikas Nigam Ltd. – MP Pollution Control Board; – Central Pollution Control Board (CPCB) – Ministry of Environment Forest and Climate Change (MoEFCC) – Local Fire Authority; – Ministry of Road Transport and Highways – State Transport Authority; – District Collector and Revenue Department; – Block Development Officer & Patwari – Central Electrical Authority through C.E(P&D) Jabalpur; – Department of Telegraph – Communication, Govt. of Madhya Pradesh; – Department of Panchayat Raj, Madhya Pradesh; – Labour Department; – Wildlife Warden, State Forest Department; ■ District and State Forest Department, MoEFCC.	

Potential Environmental and Social Impacts

Assessment of potential impacts on the various environmental, ecological and social elements due to the Project activities were carried out for this ESIA study. The likely impacts on loss of land, land-based and non-land based livelihoods, vulnerable groups (women, youth etc.), labour, water environment, air environment, biological environment and socio-economic environment has been identified based on the actual and foreseeable events/Project activities. For the impact assessment, wherever necessary, professional judgement, experience and knowledge on similar projects have been used. The extent and potential consequences of the impacts have been compared against applicable standards and guidelines. Mitigation measures have been suggested for each of the identified potential impacts.

The following table provides a summary of potential environmental and social impacts due to the project. The mitigation measures are also recommended to mitigate the adverse impacts.

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
Planning Phase				
Impact due to Private Land Purchase	■ Approx. 108.9 ha. of private land (refer ***Table 2.2*** for village wise break up), is being considered for purchase by the project, which forms nearly 11 percent of the total area identified for the project; ■ The private land parcels that are identified are not being used for residential purposes, thus there is understood to be no physical displacement due to project; however, this is subject to confirmation on site, during the RAP survey ■ It is expected that **economic displacement** will occur affecting livelihoods and incomes for all those employed (seasonally or otherwise) by the private land sellers whose land parcels will be purchased for project related activities; ■ **Landlessness** may potentially result due to purchase of private land parcels in some cases; however, the total land holding and proportion of land remaining with the sellers after the mutual consent based sale, is not known currently, and shall be assessed during the RAP survey; ■ Loss of access or easement for the local community due to diversions/ barricading of areas due to construction phase activities may also occur.	■ The private land sellers should be provided with either alternate land parcels with similar nature of productivity and financial assistance to prepare the land for cultivation or adequate payment against land purchase which should be above the prevalent market price, as per the Mutual Consent Policy 2014; ■ A Resettlement Action Plan shall be formulated to cover economic displacement categories (subject to the qualifications stated under embedded controls) to address the following: – Displacement impacts to people who had encroached/squatted upon government land, based on their status and tenure – Livelihood impacts on the land owners if the holdings that remain are sub-optimal, or owners are rendered landless; – Additional livelihood assistance to vulnerable households, or women headed households, with skill trainings or entrepreneurship support, etc. under the LRP; – Impacts on land users or regular agricultural labourers affected	Moderate	Minor

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
		– The general community being impacted due to access restrictions/easements; – Other impacts on private land owners. ■ Preference to members of the families rendered landless or with sub-optimal holdings post selling land to the project for employment opportunities in the Construction/operation phase and/or small contracts; ■ Timely sharing of project related information with all relevant stakeholders; ■ Provision of Grievance Redressal Mechanism to all impacted stakeholders in order to raise and register their grievances.		
Impacts due to Patta land Purchase	■ Approximately 5.2 ha. of Patta land from Parsula village is being considered for purchase by the project, which forms approximately 0.5 percent of the total area identified for the project (refer Table 2.2 for details); ■ **Economic displacement** will occur for the Patta Land holders who have invested cost and efforts in the Patta land to make it cultivable and are currently undertaking agricultural activities- it is yet to be determined whether the land value will take these improvements into account for the amount determined as per the Mutual Consent Policy;	■ Patta is being treated at par with ownership, for the land procurement process. Thus treatment of Patta Land holders will be similar to Private land owners and Patta holders shall be provided with either alternate land parcels with either alternate land parcels with similar nature of productivity and financial assistance to prepare the land for cultivation or adequate payment against land purchase which should be above the prevalent market price, as per the Mutual Consent Policy 2014;	Minor	Negligible

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
	■ Typically Patta land owners are likely to be from vulnerable households like SC, ST and other previously landless households and the land purchase for the project may lead to cases of **landlessness, (which is more likely to be in this category than the category of private land holders, as landlessness is a baseline criteria for initial award of pattas)**; ■ It is understood that certain Patta Land parcels have been sold off based on a 'verbal agreement' by the household it was originally allotted to, without a change in records. Although this is not allowed as per the terms of the allotment, it is reported as a practice. In such cases, the households using the Patta lands through this arrangement are also understood to be impacted, in addition to original owners, who are still on record as 'patta holders' and therefore the legal claimants; ■ Agricultural labourers, if any, working on the Patta land parcels identified for purchase for the project will experience **loss of income/ livelihoods**; ■ **Loss of access or easement** for the local community may occur, due to diversions/ barricading of areas due to construction phase activities.	■ A Resettlement Action Plan-shall be formulated to cover economic displacement categories (subject to the qualifications stated under embedded controls) to address: – Livelihood impacts on the land owners if the holdings that remain are sub-optimal, or owners are rendered landless; – Additional livelihood assistance to vulnerable households, or women headed households, with skill trainings or entrepreneurship support, etc. under the LRP; – Impacts on land users or regular agricultural labourers affected – The general community being impacted due to access restrictions/easements; – Other impacts on patta land owners. ■ Preference to members (rendered landless or with sub-optimal holdings) of the families post selling land to the project for employment opportunities in the Construction/operation phase and/or small contracts; ■ Additional safeguards to be addressed through the RAP-LRP for Patta Land owners, including those who may have 'purchased' the patta		

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
		informally from the original allottees based on a verbal agreement and without documentation ■ Timely sharing of project related information with all relevant stakeholders; ■ Provision of Grievance Redressal Mechanism to all impacted stakeholders in order to raise and register their grievances.		
Impacts due to Land Use Permission Agreement (LUPA) of Government land	■ Government land being identified for the project from the project villages, amounts to 860.6 ha as presented in ***Table 2.2*** which forms nearly 88.2 percent of the total land required for project. ■ This land has different uses for the local community: - Livestock grazing in the open areas; - Collection of firewood for domestic use'; - Easements, access to assets and other resources not within the project boundary, etc. and the change in use and ownership of Government land will affect the users in the community to varying degrees. ■ The Impacts on users of this land type comprise the following: – Loss of Grazing land for the livestock in the area; – Loss or severance of access for the community, livestock, etc.;	■ Provision for alternate grazing land for livestock shall be made near the project villages or confirmation of adequacy of remaining grazing land shall be provided through discussion meetings with Sarpanch and Village Secretaries and consultations with the affected community, with representation by all groups, to be confirmed during the RAP survey (including the assessment of access and quality of the remaining area); ■ Development of a program to include grazing area improvement and fodder intensification (cultivation) in designated areas, as agreed with the Tehsil office and the local dependent community of graziers. This may include the development of community fodder lots under the Livelihood restoration activity in the area as part of Resettlement Action Plan. This, if feasible, shall serve the purpose of improving the quality of	Major	Moderate

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
	■ Loss of cultural resources in terms of religious trees, structures, etc.	the grazing land, ensuring access and as an income generating activity for people losing land based livelihoods. ■ Preference of members of Project affected households (PAH) in employment opportunities during construction phase; ■ In case of crop losses for Squatters and encroachers, RUMSL shall ensure the provisions of the RAP-LRP, based on the ESMF are followed and loss of standing crops are compensated at full replacement value, though no compensation for land will be made; ■ Compensation for loss of structures shall also be covered as part of RAP report; ■ The RAP-LRP will contain mitigation/compensations determined, based on the ESMF and applicable frameworks, for the eligible encroachers/occupiers/squatters on government land, after the RAP survey is concluded. ■ Timely sharing of project related information with all relevant stakeholders in order to serve advance notice and reduce the extent of impacts and losses; ■ Provision of Grievance Redressal Mechanism to all impacted stakeholders in order to raise and register their grievances.		

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
Impact on Vulnerable Groups	■ Out of the three phases, the Indigenous Communities and vulnerable groups are understood to be impacted the most during Planning phase of the project, on account of loss of livelihoods linked to land being procured for project. ■ Since this group (Bhil tribe) is understood to have encroached land for agriculture and work as agricultural workers, they are not documented owners or users of land as per records and the project related land-purchase or compensation measures would not be directly reaching out to this group.	■ To identify and assess the extent of impacts on this group, a review of the scope of FPIC and IPP, in terms of remaining impacts on IP groups, their traditional livelihoods and customary land use; including dependence on natural resources, will be undertaken; ■ Based on this review, the target groups for the FPIC process will be identified in terms of villages and number of households in each village. ■ It should be noted that the exact number of households may be identified only post the site walk through and social mapping. ■ Review the consultation process carried out as part of allotment process of unoccupied government land through discussions with personnel from the Land Division of District Magistrate office to access the Gram Sabha resolutions as part of the land allotment process. ■ Relevant details in relation to the Gram Sabha Resolution will be collected to understand implications for any legacy issues. ■ As part of the stakeholder engagement, ensure adequate representation of the Indigenous groups	Moderate	Minor

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
		and vulnerable groups, and specific engagement activities are undertaken with these groups; ■ Ensure that the grievance management mechanism established is accessible to these groups.		
Construction Phase				
Land use and Land cover	■ The establishment of the Solar Park will convert scrub land and agricultural land to industrial use for the long term (at least 25 years). The total land area of more than 1,000 ha will undergo land use change, out of which almost 90% is government land. ■ In the construction phase, temporary land use changes will occur at contractor facilities and labour camps, material storage areas; ■ During construction phase, there will be permanent change of the land use within the land parcels where the Solar Park and pooling substation will be established.	■ Construction activities should be restricted to designated area; ■ On completion of construction activities, land used for temporary facilities such as Contractor office, batching plant (if any), stockyard, labour camp should be restored to the extent possible; ■ The land use around permanent Project facilities should not be disturbed; and ■ The land should be restored back to the original state to the extent possible after completion of life cycle of the Project and in case there are plans not to continue further at the site	Moderate	Moderate
Soil erosion and compaction	■ The site clearance activities, excavation and levelling of ground will cause disturbance of the soil strata and impact on soil quality. ■ The project will undertake the soil compaction activity to ensure soil stability during the establishment of storage	■ The topsoil present in the construction shall be removed and stock pilled in separate area; ■ The stock pile should be protected from natural elements to prevent from erosion and also degradation;	Minor	Negligible

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
	areas, labour camp, access road, installation of batching plant, establishment of substation, SCADA building etc. ■ During construction activities, there would be compaction of soil in the Project area during movement of vehicles/ construction machinery and work force movement. ■ In addition, laying of electrical wires in the agricultural field during erection of internal electrical lines will also lead to the compaction of agricultural soil to certain extent.	■ Topsoil to be reused on site for landscaping purpose; ■ Defined routes for transportation and construction vehicles, workers etc. to minimize soil compaction; ■ Good drainage as per the natural slope condition should be provided to reduce surface runoff and associated erosion; ■ Back filling and revegetation of the area disturbed will be undertaken phase wise immediately after the completion; and ■ Site clearance, piling, excavation and access road construction will not be carried out during the monsoon season to minimize erosion and run-off.		
Waste generation and soil contamination	■ General construction waste generated onsite will comprise of concrete, steel cuttings/filings, packaging materials or plastic. ■ Municipal solid wastes consisting of food waste, plastic, glass and waste paper will also be generated by the construction workforce at canteen facility/ labour camp. ■ A small proportion of the waste generated during construction phase will be hazardous and will include waste fuel, grease, broken modules, paints, chemicals and waste oil containing rags.	■ Construction and Demolition Waste should be stored separately and disposed through approved facility/landfill; ■ All waste should be stored in a shed that is protected from the elements (wind, rain, storms, etc.) and away from natural drainage channels; ■ A log book should be maintained for quantity and type of hazardous waste generated;	Minor	Minor

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
		■ Designated areas should be provided for Solid Municipal Waste and daily collection and period disposal should be ensured; ■ EPC Contractor should ensure that no unauthorized dumping of used oil and other hazardous waste is undertaken at the site; ■ Hazardous waste to be disposed through MPPCB authorised vendors; ■ In case of accidental/unintended spillage, the contaminated soil should be immediately collected and stored as hazardous waste; ■ The guidelines and procedures shall be prepared and followed for immediate clean-up actions following any spillages; ■ Damaged/ discarded solar panels to be disposed with the help of authorised recycling vendors/ module installation contractors/ supplier; and ■ Other wastes such as e-waste, used discarded batteries shall be disposed off in accordance to E-waste rules and batteries management and handling rules		
Topography and Drainage	■ Impact on topography of the Project site due to site levelling activities.	■ Project shall ensure to avoid any unnecessary changes in the topography especially during the preconstruction and construction phase;	Moderate	Moderate to minor

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
	■ Any changes to topography in the area will advertently impact the drainage channels and might result in water logging in adjoining areas of the Project site.	■ Micro drainage channel should be particularly avoided when constructing access roads or planning the Transmission Line pathway in order to ensure no change to the topography of the area. ■ Storm water drains must be designed in line with the natural topography and eventually drain into the natural seasonal streams in the Site area		
Water resources	■ Stress on local water resources due to water requirement for the foundation activities, establishment of substation, labour camp during construction phase	■ No ground water abstraction during construction phase ■ As part of project designing, SPD shall consider the rainwater harvesting ponds in the open area depending on the topography, slope, natural drainage etc. Accordingly infrastructure such as drains/ piping network system/ size of pond etc. shall be designed. ■ Similarly, in case water is sourced from surface water bodies, infrastructure requirements shall be identified and planned in project design. ■ Construction labour deputed onsite to be sensitised about water conservation and encouraged for optimal use of water ■ Regular inspection for identification of water leakages and preventing wastage of is necessary for efficient utilisation of water	Major	Major to Moderate

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
Water Quality	■ The quality of water in the water bodies could be affected due to surface runoff from contaminated soil (soil contamination due to oil/ fuel spillage and leakages) especially during monsoon season. ■ The surface runoff carrying the loose top soil will lead to increased sedimentation in the receiving water bodies.	■ Ensure proper cover and stacking of loose construction material at site to prevent surface runoff and contamination of receiving water body; ■ Open defecation and random disposal of sewage will be strictly restricted; ■ Planning of toilets, soak pits and septic tanks, waste collection areas away from natural drainage channels; ■ Provision of number of toilets across with easily accessible location as the project site is spread across large area of 2 Units separated geographically; ■ Use of licensed contractors for management and disposal of waste and sludge; ■ Labourers will be given training towards proactive use of designated areas/bins for waste disposal and encouraged for use of toilets; ■ Provision for impervious storage area, especially for fuel & lubricant, hazardous waste, etc. will be made onsite; and ■ Spill/ leakage clearance plan to be adopted for immediate cleaning of spills and leakages.	Moderate	Minor

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
Ambient air quality	■ Fugitive dust emissions from site clearance, piling work, handling of construction materials, emission due to movement of vehicles on unpaved roads, plying of vehicles, etc. ■ Vehicular emissions due to increased traffic movement on site and on the approach roads; ■ Exhaust emissions from construction machinery and other equipment such as batching plant, if any; and ■ Emissions from diesel generators required to be run for construction power purposes	■ The construction site shall be barricaded; ■ Keeping areas of open excavation to a minimum; ■ Minimising stockpiling by coordinating excavations, spreading, re-grading, compaction activities; ■ Cease or phase down work if excess fugitive dust is observed, investigate source and take suppression measures; ■ Speed of vehicles on site to be limited to 10-15 km/hr; ■ The emissions from diesel generator shall be by optimised operations, orientation at the site and providing adequate stack height for wider dispersion of gaseous emissions ■ Switch off machinery and equipment when not in use; ■ Prevent idling of vehicles and equipment; and ■ Vehicle engines will be properly maintained and will have a valid Pollution under Control (PUC) to ensure minimization in vehicular emissions	Minor	Minor
Ambient noise quality	■ Noise generation due to construction activities, operation of equipment's, machineries, D.G. sets, movement of vehicles and heavy earth moving machineries. ;	■ Ensure safe distance of project related activities from schools, hospitals, etc.;	Moderate	Moderate to Minor

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
	■ Local communities may get disturb due to higher than anticipated noise.	■ Only well-maintained equipment to be operated on-site; ■ If it is noticed that any particular equipment is generating too much noise then lubricating moving parts, tightening loose parts and replacing worn out components to be carried out to bring down the noise. It is to be ensured that such machinery are kept far away from the households; ■ Machinery and construction equipment that may be in intermittent use to be shut down or throttled down during non-work periods; ■ Low noise equipment shall be used as far as practicable; ■ The number of equipment operating simultaneously shall be reduced as far as practicable; ■ Install enclosures around construction area, in order to reduce the extent of noise emanating due to project related activities; ■ DG set with acoustic enclosures shall be used; ■ Vehicular movement through village roads should be planned to avoid traffic jam and inconvenience to local residents;		

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
		■ Equipment noise should be 85 dB (A) at 1 m from the source in line with WB/IFC EHS guidelines; ■ Minimal use of vehicle horns needs to be encouraged; ■ Limit construction related activities to day time in order to restrict the noise related nuisance in the evenings, where permissible noise threshold is lesser; ■ Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievances pertinent to noise and dust related issues		
Occupational health and safety	■ Construction of support structure for PV module would require operation of pile drivers. ■ The installation of solar module will involve operation of cranes and other mechanical lifting equipment. ■ Laying of interconnecting cable with require digging. ■ The commissioning of the inverter rooms and Transmission Line will also involve live power lines. ■ Working on live wires carrying power has dangers of electric shock and electrocution. ■ Construction and commissioning of PSS and associated structures will involve multiple hazards i.e, working at	■ A specific SOP shall be prepared for working close to GAIL pipeline. The SPD/ contractor shall coordinate with GAIL officials during construction activities in vicinity of this area; ■ Health & safety training to be provided during both construction and operation phase; ■ Prior to start of work, workers should be informed about the related safety risks and precautions to be taken through tool box meetings; ■ Manual lifting by adult men to be less than 55 kg and for women it should be less than 30 kg;	Minor	Minor

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
	height, use of cranes and mechanical lifting equipment, working with high voltage power; ■ Besides this, there could be slip and trip hazards especially during monsoon season; and ■ The area experiences extreme winter and summer condition. Working during very high and low temperature could cause health hazards. ■ The Project site also needs to implement proper measures for fire safety, structural safety and any for emergency situations. ■ Additional safety risk while working in proximity of GAIL pipeline corridor.	■ Adequate PPEs to be provided for all activities at site including for welding, cutting or similar operations which may cause hazard to eyes; ■ All persons performing construction work to wear safety shoes and helmets confirming to national standard; ■ Every worker engaged in handling sharp objects which may cause injury to hand shall be provided suitable hand gloves; ■ While working in hot conditions, measures such as work break at regular intervals, keeping hydrated by drinking water and liquids, covering face with damp cloth etc. shall be used; ■ Obtain and check Contractor's safety method statements; ■ Monitor health and safety performance and have an operating audit system; ■ Permitting system should be implemented to ensure that cranes and lifting equipment is operated by trained and authorized persons only; ■ Appropriate safety harnesses and lowering/raising tools should be used for working at heights; ■ All equipment should be turned off and checked when not in use;		

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
		■ Emergency contact numbers and route to the nearest hospital to be displayed at the construction site; ■ The local/ host community to be kept at safe distance from construction site; ■ Site specific safety or emergency response plan should be in place to account for natural disasters, accidents and any emergency situations; ■ Site specific/ activity specific Hazards Identification and Risk Assessment (HIRA) should be developed prior to start of the activities at site; and ■ Provide H&S achievement information to employees.		
Impact due to Vegetation Clearance and Construction Activity	■ Loss of Scrub land/Grassland and Agricultural Habitat and associated vegetation that may be used by species commonly found in the rural landscape of the study area. ■ Loss of foraging resources, shelter and shade for resident fauna	■ Vegetation clearance should be kept restricted to project site only and should be avoided wherever possible. ■ It is recommended that the selected EPC contractor should display and educate labourers not to collect fuel wood from adjacent areas and alternate arrangement for fuel, like LPG must be made available in the labour camps for cooking.	Minor	Negligible

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
		■ Provision for identifying grazing areas for the livestock village wise and development of grass plots in 5 acre area with local grass species; ■ Sufficient arrangement for identifying water holes based on the terrain gradient to tap the surface water runoff during rains ■ Strengthening of existing waterbodies in the study area and development of water channels to connect the surface runoff to them		
Impact due to Influx of Migrant Labour and Labour Camp	■ Impacts such as direct hunting or trapping, careless disposal of kitchen waste like discarded vegetable materials and excess food, may attract scavengers like golden jackal etc. This unwanted interaction with wild animals may lead to human-wildlife conflict. Collection of fuel wood for cooking from outside project area, may result in additional habitat degradation	■ The likelihood of threatened and protected fauna venturing into the Project site is small but proper precautions should be taken to prevent any human-wildlife conflict. ■ It is recommended that the selected EPC contractor should display and educate labourers and staff about the hunting, poaching, trapping, injuring or killing of wildlife in the region. ■ Any such activity of hunting and poaching should be covered under contractual obligations of the EPC contractor; ■ The EPC contractor should in consultation with Forest Department should explore the options to minimize wildlife human interactions in the study area	Minor	Negligible

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
Impact on the ecosystem services	The project and surrounding areas are known to be utilized for grazing by the local livestock as well as wild animals such as Nilgai Chinkara, Indian Hare and hunting ground for mammals such as Jackal, Bengal Fox, and Indian Grey Mongoose. The South Shajapur Site (Unit 8) is adjacent to the Palsawad Son dam and there is a likelihood of the roosting of the migratory species on the project site. Post construction this area will be not available for above said activities.	■ Nesting trees should be avoided to the extent possible when it falls within the Solar Park site. ■ Larger mature trees with significant height and girth should be avoided to the extent possible when constructing the Solar Park. Larger trees can be set aside within the Solar Park and avoided as part of the micro-siting of the solar modules. ■ Seeding of native plant species outside of the Solar Park especially in areas where the soil layers have been impacted and around water bodies to offset the loss of floral resources and dependent ecosystem services. ■ Pollution and spill control mechanisms should be implemented and strictly enforced around Water Bodies to ensure that there is no impact to the water quality or any drainage channels into the water body.	Minor	Not Significant
Temporary Occupation of Land for Construction phase activities	■ The land required for temporary activities like setting up of a number of labour camps for the required duration, land for safety setbacks, storage areas, parking areas and other construction related temporary land requirements, if these are located outside the boundary of the Project Area. If all these activities can be accommodated with the Project footprint, the impacts from temporary land lease-rent, will be avoided;	■ Provision of adequate lease on rental amounts to the land owners shall be ensured by RUMSL; ■ The land leased/ rented shall be restored to its original state (or made better) at the time of handing it back to the owners;	Minor	Negligible

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
	■ COVID 19 related infection risks may persist and may be enhanced for workers, and may need to be especially managed both, within labour camps and in the interactions of workers and the local community	■ Provision of compensation for the loss of livelihoods to the users of the land required for temporary use as this will temporarily economically displace them; ■ Timely dissemination of project related information with all relevant stakeholders, in order to serve advance notice and reduce the extent of losses/ impacts; ■ Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievance.		
Community health and safety	■ The movement of material and machinery would pose health and safety risks to the community and livestock as the vehicular movement will increase in the area and may result in collision and accident risks, and create additional vehicular and dust pollution, affecting people, animals and potentially affecting crops in the vicinity of the corridor of movement; ■ Labour influx in the area due to construction phase may lead to community health and safety related impacts or risks which may include - Potential spread of communicable diseases (infectious and vector-borne), if external labour will be sourced from outside the region,	*Responsibilities of RUMSL* ■ Ensuring stakeholder engagement through the project cycle and provision of an effective Grievance Redressal Mechanism to avoid, mitigate and mange conflicts and disagreements; ■ As part of the stakeholder engagement and information disclosure process, the community will be provided with an understanding of the activities to be undertaken and the precautions to be taken for safety; ■ RUMSL shall maintain safe distance of project components from schools, hospitals, etc. in order to avoid interactions with community hotspots and hence risks of accidents;	Minor	Negligible

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
	- The issue of COVID-19 related infections may remain a relevant concern and may need to be especially managed both, within labour camps and in the interactions of workers and the local community Conflicts with local community resulting from disagreements over other issues and local impacts	■ The Contractors to be engaged by RUMSL shall be informed of the EHSS practices that are expected from its workers during the construction phase engagement. Obligations like preparation of Traffic Management Plan, Local Procurement Plan, EHSS Plan (including for managing COVID 19 related risks), etc. shall be communicated to them at the time of selection and appropriate clauses should be included at the time of contract finalization; ■ The contractor shall be required to adhere to IFC's accommodation guidelines, for the labour camps in terms of provisions, sanitation facilities, etc. thus limiting the probability of diseases and infections in the local community on account of improper management of waste; ■ RUMSL shall put in place a grievance redressal mechanism to allow community members to report any concern or grievance related to project activities. The contractors engaged shall also be contractually required to put in place a similar mechanism to deal with concerns raised by the community (or external stakeholders) and the workers engaged during construction phases. *Responsibilities of Contractors*		

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
		■ The contractor shall induct migrant workers on health and safety awareness and practices to be followed at site during construction phase; ■ The contractors shall cordon off areas that are under construction and put relevant safety signs to restrict movement of local community members or workers engaged at site, which may become safety threats; ■ The Contractors shall prepare a Traffic Management Plan and traffic movement due to the project in the area will be regulated to ensure road and pedestrian (including livestock) safety; ■ Additionally, training on vehicular safety shall be organised for the transport workers. ■ The movement of workers from the project site and labour camps shall be regulated and similarly the project boundary and labour accommodation to check for unauthorized visitors/ outsiders entering the site in order to avoid any possible interactions leading to conflicts or tensions between the migrant workforce and host community; ■ Contractors shall ensure that regular health check-ups are conducted for the construction phase workers (especially migrant workers		

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
		staying in temporary labour accommodation) and any major illnesses are reported in the Block level medical authorities at the earliest; The labour accommodation should be clean and hygienic and disposal of kitchen waste and food waste shall be done on a daily basis in an appropriate manner; ■ Proper sanitation facilities shall be provided, taking into account the number of labourers that will be using the facilities, both at construction site, as well as labour accommodation.		
Stress on Community Resources	■ Depletion of water resources in the area may take place due to use for project related activities like construction, use for drinking water, cooking and sanitary purposes, etc. potentially affecting water availability for the local population, that depends on the same resources; ■ Potential loss of forest resources due to exploitation triggered by influx of labour in the area, thereby affecting the stock available for the local community; ■ Wear and tear of roads may take place due to movement of heavy machinery on the roads, creating movement problems and risks for local road users.	*RUMSL responsibilities* ■ There will be a worker Code of Conduct defined by RUMSL that prevents workers and contractors from using the local resources like water, forest, which will be shared with private SPDs for onward sharing with sub-contractors and its workers; ■ An induction session will be organised for the migrant workers where they will be sensitized on the Do's and Don'ts during their stay near project location, which would include aspects on conservation of community's resources; ■ The contractor shall be asked to use Tanker water supply during the summer months, which	Minor	Negligible

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
		are dry months in which water scarcity issues are reported by the community; ■ Periodic maintenance activities for roads used for transportation of goods for the project shall be the undertaken by RUMSL, through its contractors; ■ Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievance on misuse of locally available resources.		
Impact on employment entrepreneurship opportunities during construction	■ The construction phase will provide a boost to the local employment as a higher number is expected to be engaged as construction labour during construction phase; ■ Development of smaller vendors in the area through small shops, petty contractors, etc. providing essential goods and services during the construction phase; ■ There will be an impact on the local food basket due to increased demand for agricultural products and food items.	**Enhancement Measures** ■ The sourcing of local labour wherever possible should be made obligatory by RUMSL (through contractual provisions) for the Solar Project Developers and sub-contractors and in all major procurement activities; ■ Preference should be given to the land losers and vulnerable population in the Project Villages, to the extent practicable; ■ Employment of members of SC-STs and Women Headed households should be ensured by the Solar Project Developers through documented agreement with contractors/ sub-contractors;	Positive (Moderate)	Positive (Moderate)

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
		■ Engagement of local vendors, to the extent possible, for the goods and services required for the project during construction phase; ■ The project proponent will establish a mechanism to audit subcontractors and suppliers with respect to compliance of utilizing local labour and resources; ■ Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievance with respect to information sharing related to jobs and opportunities for vendor-ship.		
Impact on women	■ At this stage, the details of land owners are not known. Therefore, assessment of women land owners and associated impacts on livelihood, income, economic dependability, and significance of these impacts compared to other groups who face similar impacts will be determined and included in the RAP-LRP. Other than this, impacts on women groups can be linked to: ■ Safety and security from the migrant labourers, ■ Loss of livelihood and income; ■ Potential impacts on women within households affected by private and patta land procurement, where women are not land owners:	■ A Gender Action Plan is being prepared for the Project where women focussed engagement is detailed in **– Appendix E**; ■ Provide alternative arrangements for grazing land, and create access for ease of use to collect fuelwood, and fodder; ■ Ensure the participation of women in the grazing area improvement and fodder intensification programme, proposed as part of livelihoods restoration activities but may also be expanded to cover the local population through support from	Moderate	Minor

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
	- Women may be potentially affected more severely in such households, if they are being rendered land-less - Risk of gender based violence from delayed payments or other land ownership based conflicts ■ Women Headed households (both Joint as well as independent) may potentially become more vulnerable in cases of sale of land for the project, if land is not in their name, or they do not receive the benefits. ■ Women land owners may face additional risks of not being included in negotiations, or other key meetings due to prevailing cultural norms and may not therefore receive the benefits and advantages compared to those who do participate ■ Access to jobs during the construction phases generally skews in favour of males, thus preventing women from availing project benefits. ■ Women and girls are disproportionately at risk in terms of safety (gender based violence, harassment, curtailed movement, reduced access to resources) during the construction phase, with the arrival of migrant labourers in the construction phase and their accommodation being planned near the project villages.	the community development programme of the SPD (as part of CSR). ■ Ensure that the employment of women from vulnerable households is done for the project and efforts are made for development of women owned enterprises in the area, from where procurement for project related needs is undertaken; ■ Undertake a profiling of the various social groups in the Study Area, to understand the individual needs and concerns of the various women belonging to different social groups and design community development and CSR programmes in light of the same; ■ As part of the stakeholder engagement, RUMSL shall ensure and communicate to the private Solar Project developers, that Women focussed discussions are conducted in order to ensure adequate representation of the Women and their needs and concerns in order to design specific engagement activities; ■ Include provisions of coverage of women under skill training and Financial literacy training programs, as part of livelihood restoration activities by the project or through developmental programs of SPDs		

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
		■ Provision of Grievance Redressal Mechanism to all the stakeholders in order to raise and register their grievances.		
Operations Phase				
Soil Environment	■ Operation phase will generate small amount of municipal waste from site office and waste such as broken solar panels. The hazardous waste generated at substation include used/spent oil, oil soaked cotton and filter waste, waste containers/tins of paints, used lead acid batteries, nonferrous scrap, insulated aluminium and copper wires/cables, waste dry chemical residues etc. which needs proper storage and disposal. ■ Improper management of broken panels will cause damage to the environment.	■ SPD shall prepared SOP for storage and disposal of broken solar panels and tie up with an authorized dismantling agency for disposal of panels. MNRE had prepared a concept note for storage and disposal of used solar panels. The recommendations such as recycling of glass, storage of discarded panels in cover shed etc. shall be adopted in the Project; (1) ■ The broken solar panels shall not be mixed with normal glass. ■ RUMSL shall prepare a waste audit checklist as part of their routine site monitoring and auditing plan during operation phase for monitoring of waste management at site. ■ A waste management plan is provided in **Appendix E** of report	Minor	Minor

(1) http://164.100.94.214/sites/default/files/webform/notices/DraftBluePrintAntimony.pdf

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
Water resources and quality	■ Moman Badodiya Block falls under Overexploited category whereas South Shajapur is under Semi-Critical category. ■ The utilization of ground water for operation phase of the project may compromise with competitive users (drinking water requirement of villages and irrigation purposes) in the district based on ground water availability; ■ Any discharge of waste water from site to waterbodies will impact the water quality of water bodies.	**Conserving Water Resources** ■ Dry robotic cleaning of modules to be explored as recommended by MNRE (1); ■ Alternate sources of water shall be explored ■ Ground water abstraction shall be done in accordance to CGWB guidelines. ■ Implement rainwater harvesting and/or groundwater recharge and replenishment opportunities within Site premises especially near the low-lying and gently sloping area. ■ Optimising water usage in the SCADA building by application of water conservation measures such as sensor based taps, low flush urinals etc.; ■ Maintain logbook for water consumption; ■ Implement groundwater and wastewater monitoring vis-à-vis quality/quantity; ■ Adopt less water consuming module cleaning methods; ■ The surface runoff from during solar panel cleaning shall be diverted to a settlement tank for settlement of suspended solids. The overflow	Major	Major to Moderate

(1) MNRE had issued a letter dated 3 June 2019 to Principal Secretaries of States and Solar Association of all States regarding optimal utilization of water and preferably use Robotic technology for cleaning of modules.

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
		shall be treated in water treatment unit and recycled in the Project. ■ Use of water from multiple sources to avoid dependency on one particular source (groundwater or surface water). This also includes tapping of rainwater received during the monsoons for the long-term and uninterrupted operations. ■ The Project should implement principles of water stewardship to ensure water security not just for the site, but also for other stakeholders within the watershed. Some of the water stewardship frameworks/ standards that can be adopted are UN Global Compact's CEO Water Mandate or AWS Standards. ■ Identify stakeholders directly impacted by the groundwater use at the Project site and develop long- term stakeholder engagement plan particularly focused on stakeholders near site to develop positive perception towards Project and its operations. **Rain Water Harvesting** Rainwater harvesting pond shall be provided at site. In addition, groundwater recharge shall be undertaken within the Site to replenish the shallow aquifer zones.		

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
		Piezometers to be installed to monitor the groundwater level changes in the aquifer trapped by the abstraction wells at Project site. **Water Quality** ■ Ensure proper cover and stacking of loose construction material at site to prevent surface runoff and contamination of receiving water body; ■ Open defecation and random disposal of sewage will be strictly restricted; ■ Planning of toilets, soak pits and septic tanks, waste collection areas away from natural drainage channels; ■ Provision of number of toilets across with easily accessible location as the project site is spread across large area of Units; ■ Use of licensed contractors for management and disposal of waste and sludge; ■ Labourers will be given training towards proactive use of designated areas/bins for waste disposal and encouraged for use of toilets; ■ Provision for impervious storage area, especially for fuel & lubricant, hazardous waste, etc. will be made onsite; and		

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
		■ Spill/ leakage clearance plan to be adopted for immediate cleaning of spills and leakages. **Other Management Aspects** Preparing an inventory of water consumption during construction and O&M activities. A water management plan is provided in **Appendix E** of report		
Occupational Health and safety	■ Electrical and mechanical risks during O&M activities; ■ Fire hazards; ■ Contact with the transmission line can result in electrocution; ■ At substation location, risks associated with transformer blast, electrical hazards are predicted; ■ Risks while working in vicinity of GAIL pipeline.	■ Periodic Health & safety training to be provided to team; ■ Activity specific Hazards Identification and Risk Assessment (HIRA) should be conducted and accordingly SOPs shall be prepared for all O&M activities. ■ The lock in-lock out system will be followed during maintenance/ repair activities at substation and Transmission Line; ■ Records of incident/ accidents shall be maintained; ■ Root cause analysis shall be carried out for any incident/ accident ■ All persons performing maintenance/repairing work to wear safety shoes and helmets confirming to national standard;	Minor	Minor to Negligible

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
		■ Appropriate safety harnesses and lowering/raising tools should be used for working at heights; ■ All equipment should be turned off and checked when not in use; ■ Emergency contact numbers and route to the nearest hospital to be displayed at the construction site; ■ The local/ host community to be kept at safe distance from construction site; ■ Site specific safety or emergency response plan should be in place to account for natural disasters, accidents and any emergency situations; ■ Provide H&S achievement information to employees; ■ Specific SOP for any O&M activities in the vicinity of GAIL pipeline		
Photovoltaic Heat Island Effect	■ PVHI effect are detectable in the day, the real significant warming occurs in the evening hours, partially because these large photovoltaic installations took longer to cool down in the night time hours; The increase in localized temperature may cause discomfort to the habitation and wildlife in the vicinity of Solar Park	■ The existing ground vegetation in the Solar Park area shall be disturbed to minimum extent; ■ Ground vegetation shall be planted in the buffer areas/open areas available in the Solar Park; ■ The feasibility of mixed land use development in the Solar Park shall be explored		

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
Flood Likelihood Assessment	■ Likelihood of flooding event and its impact in and around the Site is evaluated as 'Low' to 'Moderate'.	■ Carry out a Site specific preliminary Flood Risk Assessment based on inundation and hazard mapping to understand the extent and magnitude of inundation and water logging at Units 7A and 7B of Moman Badodiya Site. This will help in designing and implementing adequate flood mitigtion measures. ■ Develop a robust "Storm Water Management Plan (SWMP)" for both Moman Badodiya and Shajapur Sites to effectively and safely manage surface runoff during heavy rainfall events. SWMP must consider protection and development of natural drainage channels and water features within the Site area to prevent localized inundation and safely evacuate surface runoff. ■ Enhance structural stability of banks of all seasonal streams which originate within the Site or pass through the Site and provide robust erosion protection to withstand flash flood during heavy downpour. ■ Significant area in the central and eastern portion of Shajapur Site is relatively low lying (localized depression) and may be subjected to periodic and intermittent water logging during peak rainy season. Water level data, frequency, duration and extent of inundation or water logging at these seasonal features would not be available from secondary sources. It is recommended to undertake consultations with local communities and carry out physical field assessment to understand maximum potential extent of land submergence and depth of inundation during high rainfall year. This will serve to define 'zones' of concern within the Site, plan the locations of key electrical infrastructure at the Site, assist in designing storm water management plan and structural design of the solar array mounting racks specific to the 'zone of concern'.		
Collision and electrocution risk	■ Several species of birds, like Raptors use transmission lines and poles as perching sites and are under threat of	■ If possible transmission line should be aligned away from the waterbody.	Moderate	Minor

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
	collision and electrocution from the transmission lines. Some birds also utilize the transmission towers for nesting	■ Insulators should be suspended in order to reduce the electrocution of bird species; ■ Jump connectors should be insulated of at least 60 cm in length (determined based on the average wing span of common avifauna) to reduce chances of electrocution of species flying through and wing tips coming into contact with the conductors and ■ Marking overhead cables using diffractors and avoiding use in areas of high bird concentrations of species vulnerable to collision.		
Community health and safety	The Operations phase would have very limited activity outside the project site as the construction phase would have been over and the scale of activity and workforce at the project footprint area would have reduced significantly. This would lead to far fewer impacts: ■ Less or negligible noise, ■ Fewer workers at site on near project villages, ■ Reduced traffic load (compared to construction phase) from the movement of people and goods.	■ Where community residential clusters are closer to the project boundary, keep a safety setback (as relevant) to mitigate the heat island effect. ■ Community sensitization sessions should be re-organised at the beginning of Operations phase, in order to mention about the new developments in the area and provided an understanding of the precautions to be taken for safety; ■ Project's Grievance Redressal Mechanism for the community shall still be in implementation to deal with any concerns of community health and safety, being raised by the local community.	Minor	Negligible
Impact on employment	■ The Operations phase would require much smaller workforce as compared to construction phase and the skillset of the required workforce shall be different.	■ The private SPDs shall advertise the roles of Technical staff required during operations phases, in the local newspapers to enable hiring	Minor	Minor

Category	Impacts	Mitigation Measures	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
	■ The Operations phase would require Engineers, Technicians to manage the Plant operations and amongst the requirement of semi-skilled workers in limited numbers for housekeeping and Security related jobs, on the payroll of RUMSL. ■ Additionally, there may be some vacancies with the private Solar Project Developers (SPDs) that may have some local employment, if feasible	of competent people from nearby areas, to the extent feasible; ■ The SPDs shall also designate a dedicated supervisor for management of social and community related aspects at the project site; ■ Preference shall be given (to the extent feasible) to hire competent members from PAHs for semi-skilled jobs like housekeeping or Security Guards.		
Impact on women	■ The nature of impacts envisaged, affecting women in the Operations phase are likely to be as follows: – The extent of outsiders and migrant population in the area would have reduced along with risk to their safety; – There would be limited requirement of labourers' jobs or vendor-ship opportunities in Operations phase, which might render them in search of livelihood options again.	The SPDs shall ensure appropriate measures for hiring of women, as per required skill set, are put in place, during the Operations phases	Minor	Negligible

Analysis of Alternatives

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

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

The selected Project has following advantages:

- The Project is environment friendly with minimal greenhouse gas emissions;
- It is the most feasible choice of power generation in the State of Madhya Pradesh; and
- It will contribute towards the state of Madhya Pradesh attaining self-sufficiency in power supply
- Site with high solar irradiation;
- ~ 90% of Land area is government land;
- Most of the land parcels selected are scrubland with barren rocky surfaces with sparse vegetation;
- No physical displacement for Project;
- No ecological sensitive receptor such as National Parks, Wildlife Sanctuary, within 5 km radius;
- There are no places of Archaeologically Important Places (ASI recognized);

Environmental and Social Management Plan

The ESMP identifies potential impacts from the planned activities and outlines mitigation measures required to reduce the likely negative effects on the physical, biological and social environment. This is in accordance to Environmental and Social Management Framework, February, 2017. A separate RAP-LRP document will contain the management plan for resettlement related impacts.

The ESMP describes the mitigation measures for all the identified potential impacts associated with the proposed project during its planning, construction and operation phases. The ESMP delineates the monitoring and management measures to avoid and/or minimize such impacts by allocating management responsibility and suggesting skill requirement for implementation of these measures. The ESMP shall ensure a continuous communication process between RUMSL, EPC contractor, workers (including sub-contractors), local community and other stakeholders. RUMSL have an obligation to ensure compliance to all the commitments towards Environment, Social, Health and Safety Standards while executing all the project related activities for the proposed project.

A designated EHS Manager and a Supervisor for overseeing social and community aspects shall be appointed for the project and shall be responsible for implementation of ESMP at site, its monitoring, liaison with local community and reporting. An indicative budget for ESMP implementation and monitoring indicators are also given.

As part of ESMP, Project specific management plans have been identified and developed. Following management plans have been developed for the Project:

- Waste Management Plan;
- Water Management Plan;
- Occupational Health and Safety Plan;
- Disaster Management and Emergency Response Plan;
- Contractor and Labour Management Plan;
- Gender Action Plan; and

- Stakeholder Action Plan

Grievance Redressal Mechanism

Presently, RUMSL does not have a formal grievance redressal mechanism in place for external stakeholders. In order to manage these risks, it needs an internal mechanism to allow the aggrieved party/s to lodge their complaints and get them amicably settled prior to approaching the formal legal mode of solutions.

The primary objective of the GRM shall be to provide an accessible mechanism to the stakeholders of the project and resolve any social and environmental related grievances. For this purpose, a Grievance Redressal Cell (GRC) shall be established, to resolve non-judicial disputes arising out of various matters related to the implementation of the ESMP, as well as other aspects of the project, as deemed fit to be raised before the GRC. The GRC will comprise of members from the EPC contractor team, RUMSL, community representatives, members of Gram Panchayat, women representatives.

The GRC will be driven internally by the Project team and shall have representation from the following teams to ensure fair and timely solution to the grievances:

- Site Manager/Project Manager;
- EHS Officer;
- Community Relations Officer;
- Senior representation on behalf of the Project Company; and
- Any other concerned person with decision making authority in relevance to the grievance or aggrieved party.

Formats for recording of grievances and maintaining the grievance records have been provided as part of the report.

Conclusion

The ESIA has assessed the overall acceptability of environmental and social impacts likely to arise as a result of construction and operation of Shajapur Solar Park.

- Project's potential environmental impacts will be mostly confined to construction phase and site-specific. These impacts include change in land use, stress on ground water resources, increase noise & vibration and air quality, etc. during the site preparation of Solar Park, pooling substations and community health and safety during material transportation.
- The proposed project will require water for cleaning of solar modules during operation phase. The Unit 6 & 7 (Moman Badodiya) and Unit 8 (South Shajapur) falls under Over Exploited and Semi Critical category respectively in terms of ground water availability. Water requirement for the project will be met mainly through ground water. Project will require to explore the dry cleaning method or alternate sources of water.
- The usable land area for the project is ~1000 hectares for Solar Park. Potential social impacts due to loss of access to land for farming, grazing, loss of land-based livelihood sources for the households in the PFA can be mitigated through the RAP-LRP for the Project. Impact on common property resources will be limited and can be avoided by providing access to the villagers to continue their existing use of such occupied land parcels/water bodies, etc.
- The impact on community resources and community health and safety is limited to construction phase, while on the other hand, short term employment will also be generated.

The Environmental and Social Management Plan (ESMP) describes mitigation measures for impacts specific to Project activities and also discuss implementation mechanism. Project specific management plans are also provided for certain Project activities such as waste management, occupational health & safety, contractor and labour management plan, gender action plan, stakeholder management plan, grievance redressal, etc. This ESIA study together with mitigation measures and follow up of recommendations on management actions will help RUMSL in complying with the environmental standards.

1. INTRODUCTION

ERM India Pvt. Ltd. (ERM) has been engaged by Rewa Ultra Mega Solar Limited (RUMSL) to undertake an Environmental and Social Impact Assessment (ESIA) of three Solar Parks, including internal evacuation infrastructure and associated transmission lines of aggregate capacity of 1500 MW in the Neemuch, Agar and Shajapur Districts of Madhya Pradesh, India.

The ESIA for the aggregate 1500 MW Solar Parks has been divided into four distinct studies:

- ESIA for Neemuch Solar Park of 500 MW capacity;
- ESIA for Agar Solar Park of 550 MW capacity;
- ESIA for Shajapur Solar Park of 450 MW capacity; and
- ESIA for the external Transmission Line[1] infrastructure for all three Solar Parks.

The present report is the environmental and social impact assessment study for the Shajapur Solar Park of 450 MW capacity and located in two tehsil i.e. Moman Badodiya tehsil (termed as Unit 6 & Unit 7 of 220 MW and 105 MW each) and Shajapur tehsil (termed as Unit 8 of 125 MW) of Shajapur district. The subsequent Resettlement Action Plan (RAP) and Indigenous People Plan (IPP) report will contain baseline information on the households from the villages falling in the project boundary, as well as the associated impacts.

The Unit 6 & 7 are spread across eight villages at Moman Badodiya- Dehripal, Burlay, Jawadi, Parsula, Fawaka, Dhatrawada, Chauma and Bijnakhedi and Unit 8 is spread across four villages- Hanoti, Surajpur, Lalpur and Upadi in Shajapur district in the State of Madhya Pradesh.

1.1 Project Background

The Government of India has identified the solar power sector as one of the critical components for infrastructure development and overall economic growth. The Government of Madhya Pradesh (GoMP), through Ministry of New and Renewable Energy (MNRE), is developing ground mounted grid connected solar power projects in Madhya Pradesh.

Rewa Ultra Mega Solar Limited (RUMSL) is a Public Undertaking Company incorporated on 10th July 2015 as a 50:50 joint venture (JV) company between Solar Energy Corporation of India Limited (SECI) and Madhya Pradesh Urja Vikas Nigam Limited (MPUVNL). Its primary objective is to develop and facilitate development of large scale solar power projects in the state of Madhya Pradesh.

RUMSL is planning to develop following three Solar Parks and their associated internal evacuation infrastructure and transmission lines:

- Agar Solar Park of 550 MW capacity
- Shajapur Solar Park of 450 MW capacity and
- Neemuch Solar Park of 500 MW capacity

RUMSL is in discussion with World Bank (WB) to provide financial support for the Project. International Finance Corporation (IFC) is providing investment advisory services to Government of Madhya Pradesh to develop the Project on a Public Private Partnership mode and to support GoMP

[1] The external transmission line infrastructure refers to the power evacuation from the solar park site to the grid substation.

in meeting its energy requirements and in the process, to meet GoMP's Renewable Purchase Obligation (RPO)[1] and Solar Purchase Obligation (SPO)[2].

Scoping Study

An Environmental and Social Scoping Study for the entire 1500 MW Project had been previously undertaken during September 2018- March 2019. The key outcomes of the scoping study that are relevant to the Shajapur Project site have been described below:

- The project land take will result in a significant reduction in the total grazing land available in the villages, which in turn may have an adverse impact on the livestock holdings in the villages, which are key to the livelihood, sustenance and socio-cultural fabric of the community.
- There are a couple of seasonal water bodies within the project footprint which are used by the community for irrigation. Also, there is a dam on the northern boundary of the southern sub unit of Mohan Badodiya sub-site.
- In Moman Badodiya, it was reported that some of the villagers sold off their pattas to others in an informal manner, one of the main reasons being debt re-payment incurred due to marriage ceremonies expenses.
- There is an existing stone quarry (approx. 3-4 ha) in Moman Badodiya and South Shajapur (Badshah Constructions, 20 ha.). There are certain structures within the project footprint at Moman Badodiya that may or may not be inhabited, although no population was observed around these structures.
- There are also some religious structures (Mazaars and Temples) in the project footprint. The temple at Hanoti, South Shajapur was reported to be important for the community with most of the major festivals and pujas being celebrated at the temple.
- The Project may impact *patta* land (3), which was uncultivable at the time of allotment. The community was afraid that the compensation provided for these land parcels may not consider the time, money and effort put into these land parcels to make them cultivable;
- The groundwater resources in the Shajapur District had been categorized as 'semi-critical' and "over exploited zones.
- The South Shajapur site has been identified to fall within a very high vulnerable zone for flooding as indicated in the Flood Vulnerability Index developed by Government of India National Remote Sensing Centre (NRSC) due to the presence of Palsavad dam ;
- Applicability of Critical Habitat (CH) for the transmission lines from all projects that could potentially affect vulture (*Gyps bengalensis*, *Sacrogyps calvus* and *Neophron percnopterus*) habitat[4] has been identified.

The defined list of impacts has been revisited during the ESIA study to confirm/validate the scoping study outcome as provided in ***Section 6***.

[1] Renewable Purchase Obligations (RPOs) refers to the obligation imposed by law on some entities to either buy electricity generated by specific 'green' sources or buy, in lieu of that, renewable energy certificates from the market. The obligated entities are mostly electricity distribution companies and large consumers of powers.

[2] Solar Purchase Obligations (SPOs) are state-specific obligations for solar RPOs that have been created as per the National Tariff Policy.

(3) Patta land comprises of land assigned to certain households in the project area by the Government.

[4] Note that the Transmission Lines of the projects are being covered in a separate ESIA assessment for all Solar Parks under the aggregate 1500 MW.

1.2 Objective and Scope of the Assessment

The key objective of this assignment is to conduct ESIA with a view to identify the critical environmental, ecological and social concerns of the proposed Shajapur Solar Park, including the internal transmission line, and address them as an integral part of project design.

The specific scope of work includes:

- To assess the existing environment and social status in the study area and area of influence and to identify issues which have potential to adversely impact important environmental, ecological and social features of the project influence area.
- Carry out environmental, ecological and social assessment of Solar Park area and potential activities envisaged under the project, including internal evacuation infrastructure and associated transmission lines up to pooling sub-station.
- Analyse various options available in the site layout and arrangements for ancillary facilities, like water supply, with special reference to sources – whether local groundwater or water from distant sources would be used; in case of the latter situation, conveyance facilities will also be analyzed for impacts, drainage, access, etc. to minimize adverse impacts and enhance positive impacts, where feasible.
- Based on final land footprint and georeferenced site boundaries of the project, the ESIA will also include a Resettlement Action Plan (RAP) and a Livelihood Restoration Plan (LRP) with an identification of the project affected households; assessment of loss of livelihood/ common property resources for affected communities and/or using the proposed site and in its immediate vicinity and also covering transmission line alignment through primary surveys covering all project affected families/ consultations.
- Conducting labour influx risk assessment with key impacts on local community associated with the temporary influx of labour during construction activities.
- Assess impacts on the indigenous/marginalized communities within the site and its influence area. Involve the services of a suitably experienced Indigenous People Expert to assist with the development of the approach and implementation of a Free, Prior, Informed Consent (FPIC) process. The overall principles, engagement process, and criteria for obtaining FPIC should be agreed on with the affected Indigenous People (IP) communities. Therefore, the focus of this task will be on seeking consent from affected IP communities for a draft package of proposed impact mitigation measures and benefits.
- To undertake consultations with potentially affected people to understand their views/concerns, taking into account perspectives from different social groups, women and men, to obtain their inputs regarding environmental and social issues, and to take these into account during the preparation of the plans that would be executed before the developers start working on the site.
- To assist the client in establishing the site boundary on-site by integrating the total station outputs (available with client department) with the baseline study output.
- To identify the environmental and social issues associated with implementation of Solar Parks and develop environmental codes of practices for common activities that need to be followed during various stages, such as planning, construction and operation & maintenance.
- Preparation of site-specific ESIA reports, in line with agreed Environment and Social Management Framework (ESMF) already in place for RUMSL.

- To prepare an Environmental and Social Management Plan (ESMP); Gender Action Plan (GAP) Stakeholder Engagement Plan, in line with agreed Environment and Social Management Framework (ESMF) and, Grievance Redress Mechanism for the mitigation/enhancement activities that will be undertaken by RUMSL. The ESMP / GAP will include the description of relevant activities, institutional To identify portions of the codes of practice/management framework that need to be integrated with the bidding documents to ensure that the prospective Bidders are aware of what all will be required during project implementation and operation from an environmental, health and safety, as well as social perspective.

1.2.1 Applicable Framework

The applicable reference framework for the ESIA study are as follows:

- Relevant environmental, land labour and other relevant policies, laws, regulations and rules of the state of MP, and the Government of India;
- World Bank Safeguard Policies;
- IFC Performance Standards, 2012;
- Environmental and Social Management Framework by Ministry of New and Renewable Energy Department, February 2017;
- IFC/WB General EHS Guidelines and sector specific guidelines for Electric Power Transmission and Distribution;
- IFC/EBRD Guidance note for Worker's Accommodation, 2009; and
- IFC Project Developer's Guide to Utility-scale Solar Photovoltaic Power Plants.

1.3 Approach and Methodology

The approach and methodology utilized for the ESIA Study has been described in the relevant sections, and summarised below.

1.3.1 Kick-off Meeting

ERM undertook a kick-off meeting with RUMSL, IFC and WB on 21 October 2019, prior to site reconnaissance visit. A discussion was also held with regard to the expectations from this assessment in terms of scope of work, deliverables, timeline and the methodology to be followed for the same.

1.3.2 Desk-based Review

ERM undertook a desk-based review of the Project to identify any environmental, social and ecological sensitivities around the Project site. The key sources of information that was reviewed as part of the study has been provided below.

Table 1.1 Key sources of information reviewed for the desk-based study

S.N.	Source
1.	Environmental and social scoping study conducted in 2018 for proposed 1500 MW solar park project
2.	Topographic Sheets
3.	Detailed Project Report for the Project, August 2020
4.	Land details provided by RUMSL dated 19 June 2020
5.	The Project boundary map provided by RUMSL dated 19 June 2020

S.N.	Source
6.	Land Allotment letters for government land

1.3.3 Inception Report

A site reconnaissance study for the entire 1500 MW Solar Park was undertaken from 22 October 2019 to 25 October 2019. The purpose of the site reconnaissance was to understand the Project setting, associated facilities, confirm discussion outcomes of the kick-off meeting, undertake limited documentation review and conduct onsite discussions with the RUMSL team. Post reconnaissance site visit, an Inception report for the complete 1500 MW Project was prepared and submitted to client. This inception report provided an understanding of the following:

- An understanding of the Project and Project setting and the associated facilities based on the kick-off meeting, documentation review, discussions with RUMSL and reconnaissance site visit undertaken;
- The status of ongoing activities related to the Project;
- Validation of earlier screening and scoping carried out for the ESIA of Solar Parks and Transmission Lines and identification of any changes since previous studies were conducted;
- The proposed work plan and methodology for next step in assignment including status of other inter- linked Project activities.

1.3.4 Site Visit and Baseline Data Collection

An ERM team comprising of environment, biodiversity and social experts undertook a site visit during 10-13 December, 2019 and social team during 27 Jan- 1 Feb, 2020 to understand the site setting, environmental and social sensitivities and to identify the relevant local stakeholders.

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

- Identification of key social and environmental risks/receptors in the study area;
- 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; and
- Consultations with the local communities and focused group discussions in the vicinity to understand their views and concerns of the Project.
- Environmental baseline data was collected through primary monitoring and surveys of the study area (5 km distance from Project area) during 10-13 December 2019. Secondary information through literature surveys was also collected for the study area of the Project.

The details of environmental and social baseline conditions in the study area is provided in **Section 4** of this report. Photo-documentation of the site visit has been provided in ***Appendix A.***

1.3.5 Stakeholder Consultation

The consultations with various stakeholders during site visit, has been guided by an internal stakeholder engagement strategy developed by ERM, to streamline the communication and messaging, for the ERM teams engaged for various tasks, viz, ESIA, RAP and IPP. During site visit, the team undertook consultations with various stakeholders of the Project. The summary of the stakeholder consultations undertaken for the Project has been provided in ***Appendix B*** and a detailed identification and categorization and analysis is provided in ***Section 5.***

1.3.6 Impact Assessment

Impact identification and assessment starts with scoping and continues through the remainder of the Assessment of potential impacts on the various environmental, ecological and social elements due to the Project activities were carried out for this ESIA study. The likely impacts on loss of land, land-based and non-land based livelihoods, vulnerable groups (women, youth etc.), labour, water environment, air environment, biological environment and socio-economic environment has been identified based on the actual and foreseeable events/Project activities. For the impact assessment, wherever necessary, professional judgement, experience and knowledge on similar projects have been used. The extent and potential consequences of the impacts have been compared against applicable standards and guidelines. Mitigation measures have been suggested for each of the identified potential impacts. The detailed Impact Assessment is provided in **Section 6** of this report.

1.3.7 Environmental and Social Management Plan

The Environmental and Social Management Plan (ESMP) has been developed to include the following:

- Introduction of purpose and objectives of the ESMP;
- Summary of significant adverse impacts and potential risks;
- Mitigations and control technologies as well as safeguards etc. to minimize adverse impacts on air, water, soil, ecological and socioeconomic environment;
- Institutional mechanism - roles and responsibilities for ESMP implementation including training of ESMP implementation team;
- Action Plans for effective control measures to minimize adverse impacts/risks; and
- Monitoring program for effective implementation of the mitigations and ascertain efficacy of the environmental management and risk control systems in place.

1.3.7.1 Management Plans

As part of ESMP, Project specific management plans have been identified and developed. Following management plans have been developed for the Project:

- Waste Management Plan;
- Water Management Plan;
- Occupational Health and Safety Plan;
- Disaster Management and Emergency Response Plan;
- Contractor and Labour Management Plan;
- Gender Action Plan; and

- Stakeholder Action Plan

The Management Plans have been provided in ***Appendix E*** of this report. The Resettlement Action Plan (including a Livelihoods Restoration Plan) and Indigenous People Plan (IPP) will be prepared as separate deliverables.

1.4 Limitations

This ESIA report is based on scientific principles and professional judgment applied to facts with resultant subjective interpretations. Professional judgments expressed herein are based on the analysis of available data and information. The report was prepared with the following limitations:

- The ESIA report has been prepared based on the site assessment undertaken till February 2020 and information provided until 19 June 2020. All public domain information source also been accessed until 30 June 2020. If there is any change in the site conditions, documented information and/or public domain information post the above cited dates, then the same has not been captured in the report.
- Solar projects do not require an Environmental Clearance under the EIA Notification, 2006 and as amended. The ESIA has therefore been prepared based on international lender requirements defined in ***Section 3***.
- The details pertaining to temporary facilities (batching plants, contractor facilities, labour accommodation and storage yards) were not determined at the time of the ESIA visit. ERM conducted a reconnaissance of environmental, social and ecological sensitivities associated with the entire land parcel being procured for the Project but has not identified any site-specific sensitivities associated with the temporary facilities.
- At the time of writing the report, the optimized Project boundaries were received by ERM (received on 19 June 2020) based on prior identification of E&S sensitivities. However it is understood that the final Project boundary may change as a result of certain avoidance criteria used and exclusion principles applied.

1.5 Uses of the Report

ERM is not engaged in consulting or reporting for the purpose of advertising, sales promotion, or endorsement of any client interests, including raising investment capital, recommending investment decisions, or other publicity purposes. Client acknowledges that none of its advertising, sales promotion, or other publicity matter containing information obtained from this assessment and report will mention or imply the name of ERM. Nothing contained in this report shall be construed as a warranty or affirmation by ERM that the site and property described in the report are suitable collateral for any loan or that acquisition of such property by any lender through foreclosure proceedings or otherwise will not expose the lender to potential environmental or social liability.

1.6 Structure of the Report

The structure of this ESIA report is as given in ***Table 1.2.***

Table 1.2 Structure of the report

Section	Title	Description
	Executive Summary	
Section 1	Introduction	*(this section)* Introduction to the Project and ESIA methodology
Section 2	Project Description	Technical description of the Project & related infrastructure and activities

Section	Title	Description
Section 3	Policy, Legal and Institutional Framework	Discussion of the applicable environmental and social regulatory framework and its relevance for the Project.
Section 4	Environmental and Social Baseline	An outline of the Environmental, Social and flora & fauna baseline status in the area of the Project.
Section 5	Stakeholder Identification, Information disclosure, Consultation and Participation	Identification and engagement with the key stakeholders, in order to assess the impact of the Project on them and their influence on the Project.
Section 6	Environmental and Social Impacts	This section includes details of identified environmental impacts and associated risks due to Project activities, assessment of significance of impacts and presents mitigation measures for minimizing and /or offsetting adverse impacts identified.
Section 7	Analysis of Alternatives	This sections provides an analysis of alternatives considered for the project w.r.t to location, technology etc.
Section 8	Environmental and Social Management Plan	Outline of the Environmental and Social Management Plan (ESMP) taking into account identified impacts and planned mitigation measures and monitoring requirements. This section also includes details of institutional arrangements for the Project, monitoring and reporting indicators for performance of ESMP and budgetary allocation.
Section 9	Grievance Redressal Mechanism	This section provides the grievance redressal mechanism proposed for the Project.
Section 10	Conclusion	This section summarize the conclusion of ESIA study
Section 11	References	-
Appendices		
Appendix A	Photo- Documentation	
Appendix B	Details of Consultations undertaken during Shajapur ESIA preparation	
Appendix C	Environmental Monitoring Results	
Appendix D	Flood Likelihood Assessment	
Appendix E	ESMP- Management Plans	

2. PROJECT DESCRIPTION

This section provides an overview of the proposed Project in terms of location, project components and associated infrastructure, resource requirements, land requirement and acquisition and activities to be performed during the construction, operation and decommissioning stages of the project.

A brief description of the project is given in ***Table 2.1.***

Table 2.1 Brief Description of Project

S. No.	Particulars	Description
1.	Project Village location	Unit 6 and 7 (Moman Badodiya): Dehripal, Burlay, Jawadi, Parsula, Fawaka, Dhatrawada, Chauma and Bijnakhedi; Unit 8 (South Shajapur): Hanoti, Surajpur, Lalpur and Upadi
2.	Tehsil	Moman Badodiya Tehsil and Shajapur Tehsil
3.	District Name/State	Shajapur, Madhya Pradesh
4.	Location Coordinates	■ Unit 6: 23°40'43.40"N and 76°15'18.53"E ■ Unit 7: 23°38'32.67"N and 76°16'14.81"E ■ Unit 8: 23°14'12.98"N and 76°13'20.31"E
5.	Capacity	■ Unit 6: 220 MW ■ Unit 7: 105 MW ■ Unit 8: 125 MW
6.	Power Evacuation	The evacuation from the proposed Solar Park at Shajapur shall be carried out through the development of 33/220 kV substation at each unit. All Units shall further connect to the proposed 220/400 kV ISTS substation of PGCIL at Agar.
7.	Climatic zone	Semi arid and Tropical wet & dry type of climate
8.	Average Elevation	~390 m to~525 m amsl; High gradient land area (>8°): Unit 6: ~12 ha; Unit 7: ~13.5 ha; Unit 8: ~2 ha.
9.	Site Conditions	Barren rocky surfaces, flat land, hilly at some portions
10.	Road Accessibility	Through existing State highway and village roads
11.	Roads crossing Project site	Village roads
12.	Nearest Airport	Devi Ahilyabai Holkar Indore Airport
13.	Nearest Railway station	■ Shajapur railway station ■ Berchha railway Station ■ Maksi railway Station
15.	River/canal/nallah/ pond present in project footprint	Small water bodies are present in the project footprint; A nallah is present in unit 8 (South Shajapur)
16.	Protected areas (National Park/ Sanctuary)/ Forest land	None
17.	Any other feature existing in Project Area	GAIL Tower and ~ 400m long and 48 m wide pipeline corridor in Unit 6 (excluded from usable land for the Project); Existing crusher in Unit 6; Existing Transmission Line in all Units;
18.	Land Availability	974.7 Ha
19.	Water Requirement	■ Construction Phase: 250-300 KLD ■ Operation Phase: ■ 277 KLD for solar panel cleaning;

S. No.	Particulars	Description
		■ 9 KLD domestic water, assuming 200 no. of O&M staff and 45 LPCD; ■ 7 KLD for green belt maintenance (as per DPR); ■ 30 KL for firefighting and miscellaneous.
20.	Source of Water	■ Construction Phase: Tankers ■ Operation Phase: Borewells
21.	DG sets	For backup power requirement during construction phase; No. and capacity yet to be determined.
22.	Soil Characteristics	Sandy Loam and Loamy Sand
23.	Seismic Zone	Zone II: Low damage risk zone
24.	Flood prone zone	Not prone to floods
25.	Wind zone	Moderate Damage Risk Zone V_t= 44 m/s

Source: RUMSL, site visit, DPR August 2020 and secondary literature

2.1 Project Location

The proposed 450 MW Shajapur Solar Park is proposed to be developed in two tehsils wiz. Moman Badodiya and South Shajapur tehsil of Shajapur district. The 450 MW solar park will be developed as three units. Unit 6 of capacity 220 MW and Unit 7 of capacity 105 MW at Moman Badodiya tehsil and Unit 8 of 125 MW at Shajapur tehsil.

Unit 6 & 7 of Shajapur Solar Park is located at a distance of approximately 26 km from Shajapur town and can be accessed by State Highway 41, linking Agar to Sarangpur. The nearest railway station is located at Shajapur railway station (Unit 6 & 7) is at an aerial distance of~23 km and the nearest airport is Indore airport located at an aerial distance of ~113 km from the proposed Project Site. The existing road approaching the site has a width of ~4-5 meter.

Unit 8 of Shajapur Solar Park is around 19 km away from Shajapur town. This Unit can be accessed through a village road from Jhonkar to Hanoti at a distance of approximately 6 km. The existing village road has a width of ~7-7.5 meter. The nearest Railway station is located at Maksi Railway station, Madhya Pradesh which is at an aerial distance of~4 km and the nearest airport is Indore airport located at a distance of ~68 km from the proposed site.

Site location map is presented as **Figure 2.1** and **Figure 2.2**.

Figure 2.1 Location Map of Unit 6 & 7 (Moman Badodiya) Site

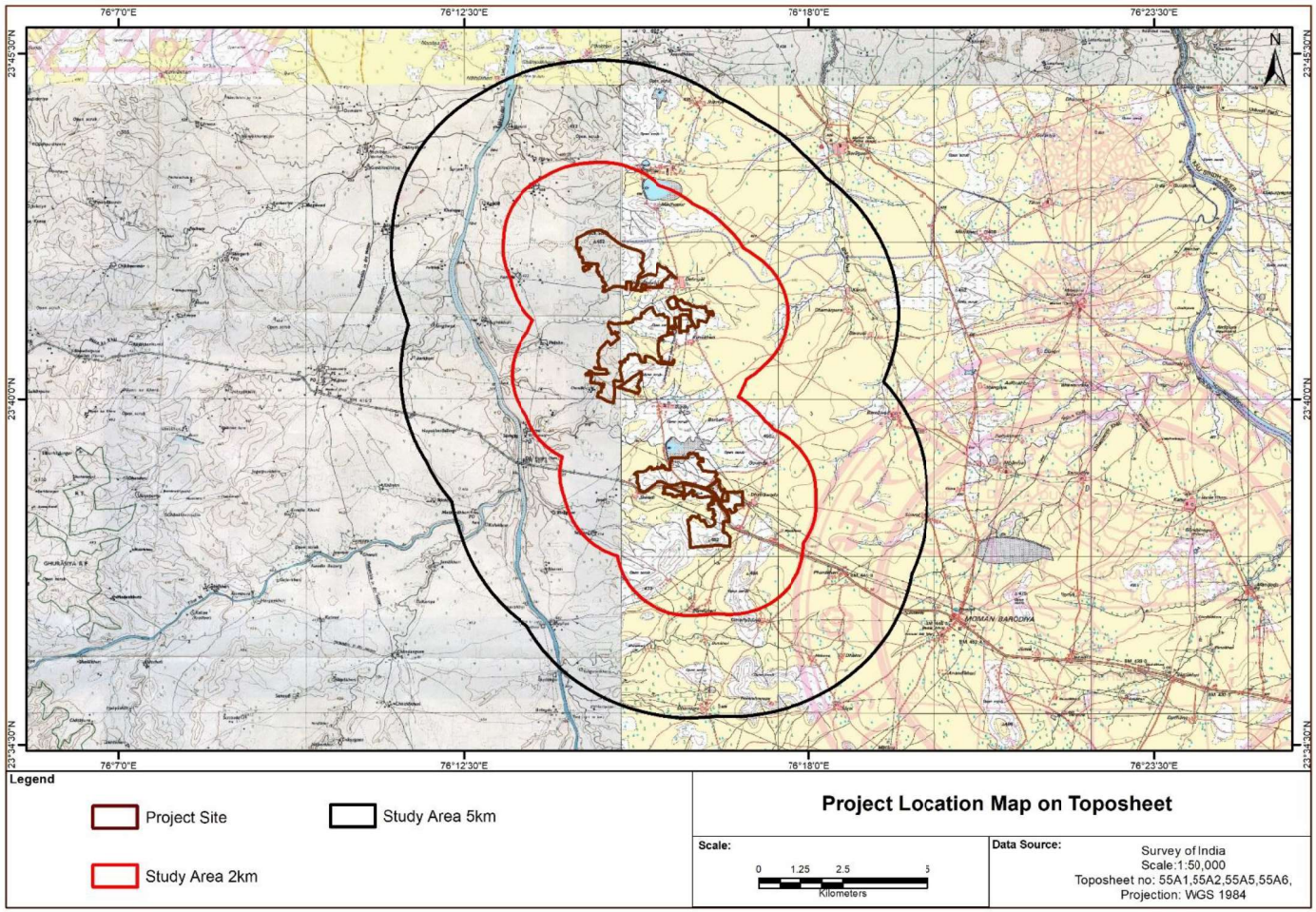
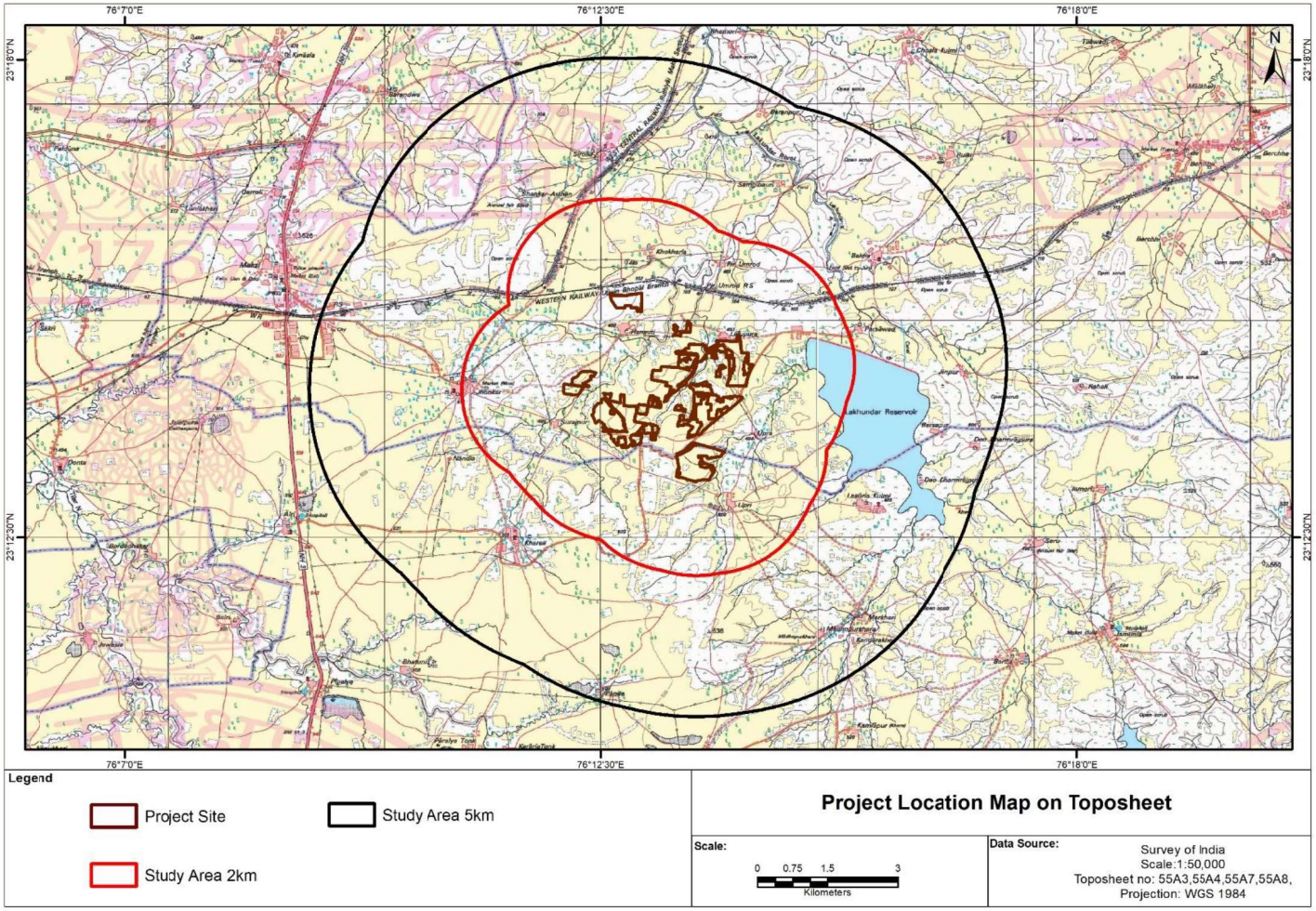


Figure 2.2 Location Map of Unit 8 (South Shajapur) Site



2.2 Site Setting

2.2.1 Unit 6 and 7 (Moman Badodiya)

Proposed project site is primarily scrub land (used for grazing), with some agricultural land (private land and patta holders). There are also encroachments and squatting on the land identified for the project; however details of the quantification of extent of land encroached and number of households affected shall emerge in the RAP report. A transmission line is also passing through the project footprint. There is also land belonging to the horticulture department, Indian gas and Gail India within the project footprint. A crusher is present in Unit 6. Burlay lake and Gondalmau village lake are present near Unit 6 and 7 outside Project boundary.

2.2.2 Unit 8 (South Shajapur)

Proposed Project Site is primarily scrub land, with some agricultural land (private land and patta holders) and seasonal water bodies. There are also encroachments and squatters on the land identified, an assessment of which will be included in the RAP-LRP. Palsavad dam is located near the proposed Project Site outside Project boundary.

Figure 2.3 Overview of Project Site

Overview of Unit 6

Overview of Unit 7

Overview of Unit 8

Palsavad dam

2.3 Overview of the Project

The proposed 450 MW project is widely distributed over Shajapur District in State of Madhya Pradesh, India. Due to issues in land contiguity and availability, solar park are divided into 3 units- Unit 6, Unit 7 and Unit 8.

Each land parcel will be designed in consideration of MNRE guidelines. It is to be noted that the description of the layout plan for the project is presently unavailable as the project is in planning stage.

2.3.1 Project Components

- Solar PV Modules
  - Solar PV Modules based on Poly/Mono Crystalline and/or Thin Film (CdTe) technologies of different rated capacities with fixed tilt and single axis tracking Module mounting structure are proposed to be installed.
- Power Conditioning Unit (PCU) or Inverter
  - As per DPR, TMIEC make Inverter of 2500 kW rating is proposed to be installed. However, it will be decided by SPD.
- Cables
  - The cable rack method is envisaged to be adopted by Solar Project Developers to connect plant to 33 kV outdoor air insulated substation for the solar projects because of increased internal grid availability, low cost, lower losses and no impact of shading on generation etc.
- Main Control Room Infrastructure
  - The control rooms are envisaged at the pooling substation. This will have the facility for gathering data on monitoring, forecasting, scheduling and dispatching for the submission to the load dispatch center. The Main Control Building has been proposed to have the Switchgear Room, SCADA/ Control Room, telecommunication infrastructure, Battery/ Auxiliary Room apart from rooms for staff, supervisor and administrative purposes, one Pantry along with Toilets, Stores etc. Air conditioning shall be provided in the SCADA/ Control Room and Heat Ventilation System shall be provided in the Switchgear Room, Auxiliary Room, Battery Room and Toilets. The entire building shall be provided with fire protection and detection system.

2.3.2 Associated Components

2.3.2.1 Power Evacuation

Pooling Substations (PSS)

RUMSL plans to develop three 33/220 kV Pooling Substations (PSS), with one PSS at each individual unit. The Solar Project developer will be responsible to connect plant to 33/220 kV Pooling Substation through appropriate 33 kV cable arrangement.

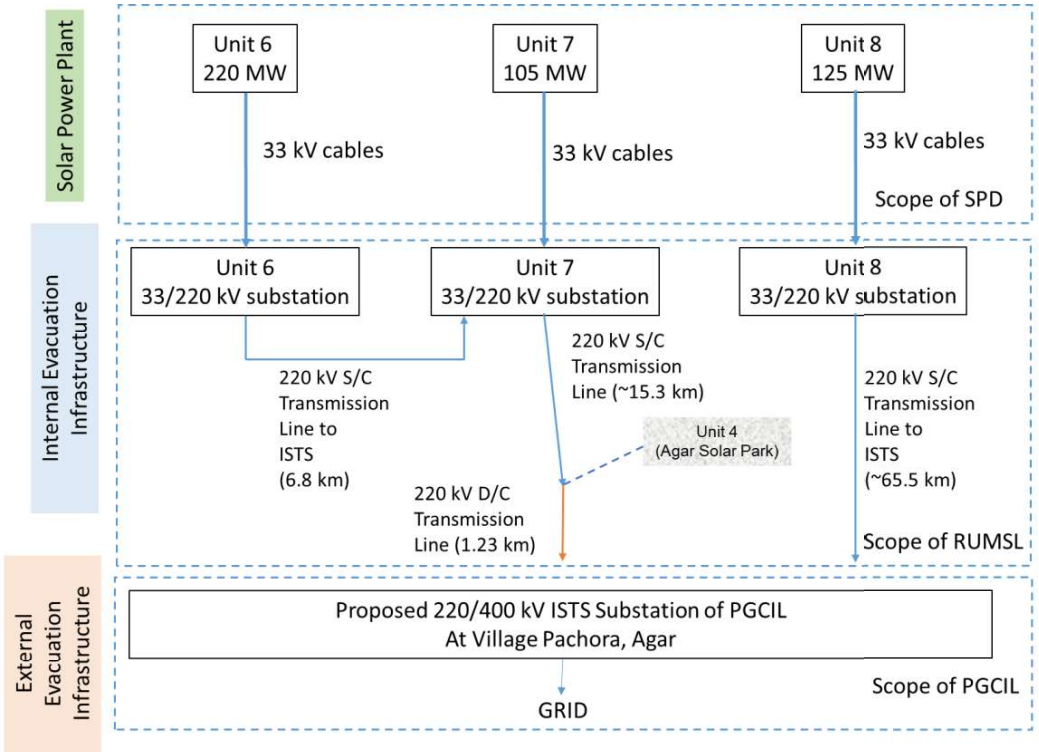
ISTS Substation

The power generated from the Solar Park will be evacuated through the proposed 220/400 kV ISTS substation of Power Grid Corporation of India Limited (PGCIL) planned in Pachora village, Agar. The connection of internal pooling substation to grid substation will be established through proposed 220 kV single circuit and double circuit transmission line.

Transmission Line

It is proposed to erect single circuit and double circuit 220 kV transmission lines to connect Solar Park to 220/400 ISTS substation of PGCIL at village Pachora, Agar. Unit 6 will be interconnected to PSS of Unit 7 through single circuit 220 kV transmission line of ~ 6.8 km length. The single circuit 220 kV transmission line from Unit 7 will be of 15.3 km length, where it will be interconnected with transmission line of Unit 4 (Agar Solar Park). Post interconnection, a double circuit line of 1.23 km will be erected upto ISTS substation of PGCIL. Unit 8 will be connected to ISTS substation through single circuit 220 kV transmission line of 65.5 km length. The evacuation arrangement for the project is as presented in ***Figure 2.4*** below.

Figure 2.4 Power Evacuation Arrangement



Source: RUMSL

2.3.2.2 Access Roads (as per DPR, August 2020)

Access roads planned as a part of this project includes:

Access to Unit 6: This Unit can be accessed through single lane bituminous village road connecting Agar – Sarangpur State Highway 41. The existing village road has a width of ~4-5 meter and existing State highways has a width of ~7.5 meter. The road length of ~2.5 km will be strengthened and repaired to suit the need during the development phase.

Access to Unit 7: This Unit can be accessed through single lane bituminous village road connecting Agar – Sarangpur State Highway 41. The road length of ~2 km will be strengthened and repaired to suit the need during the development phase.

Access to Unit 8: The Unit is connected with village road from Jhonkar to Hanoti at a distance 0f ~6 km from Jhonkar. The existing road is a two-lane bituminous concrete road with width ~7-7.5 meters and a new bituminous road with width ~7.5 meters and length ~500 meters is proposed to connect 33/220 kV plant substation. The road length of ~2 km will be strengthened and repaired to suit the need during the development phase.

As per DPR, in accordance to the MNRE guidelines, the main access roads (connecting internal pooling substation) shall have 10-meter width and secondary road shall be of 7.5-meter width. Thus, new roads shall be laid, or existing roads shall be strengthened to aforementioned width with shoulders of 0.5-meter width on both sides. The road widening repairing of existing roads is proposed for a length of 6.5 km which shall be undertaken by RUMSL.

The maps showing road network in the Project area are shown in Figure 2.5 and Figure 2.6.

Figure 2.5 Map showing road network – Unit 6 & 7 (Moman Badodiya)

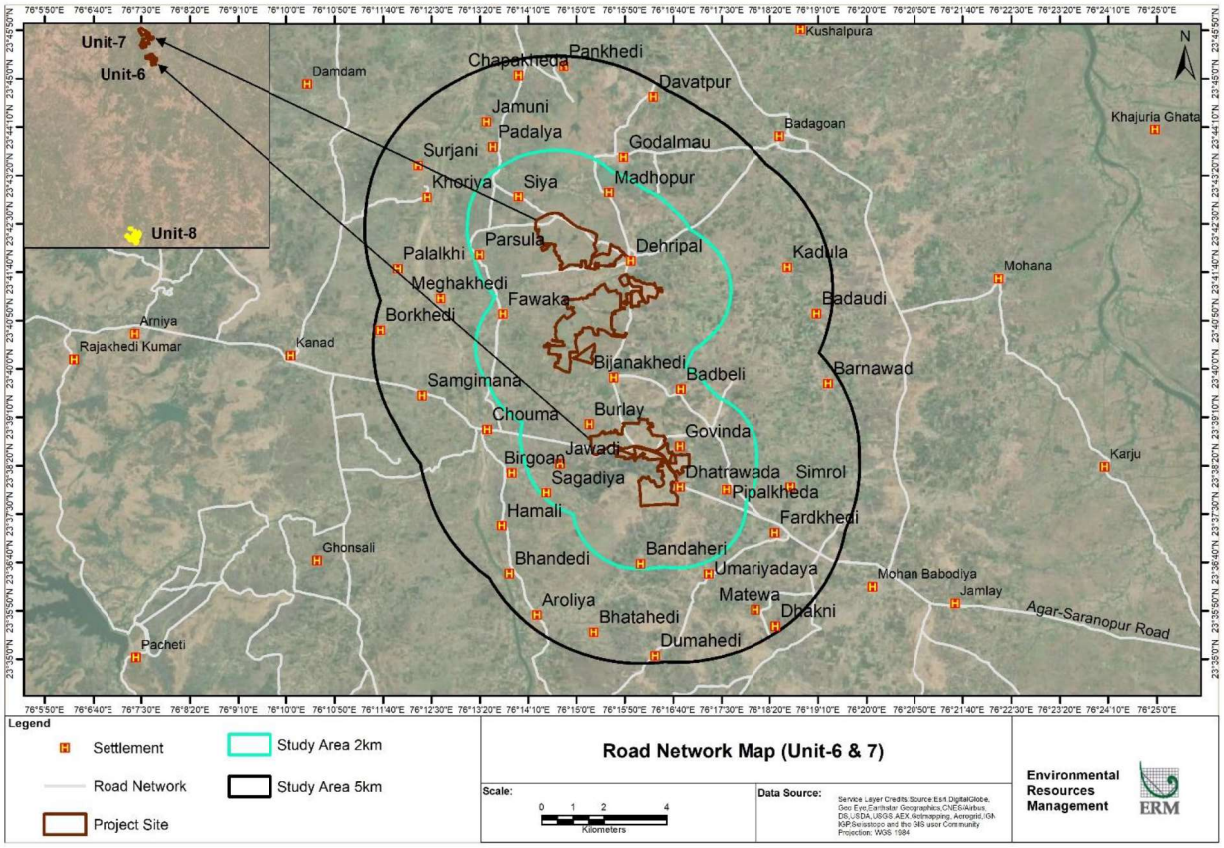
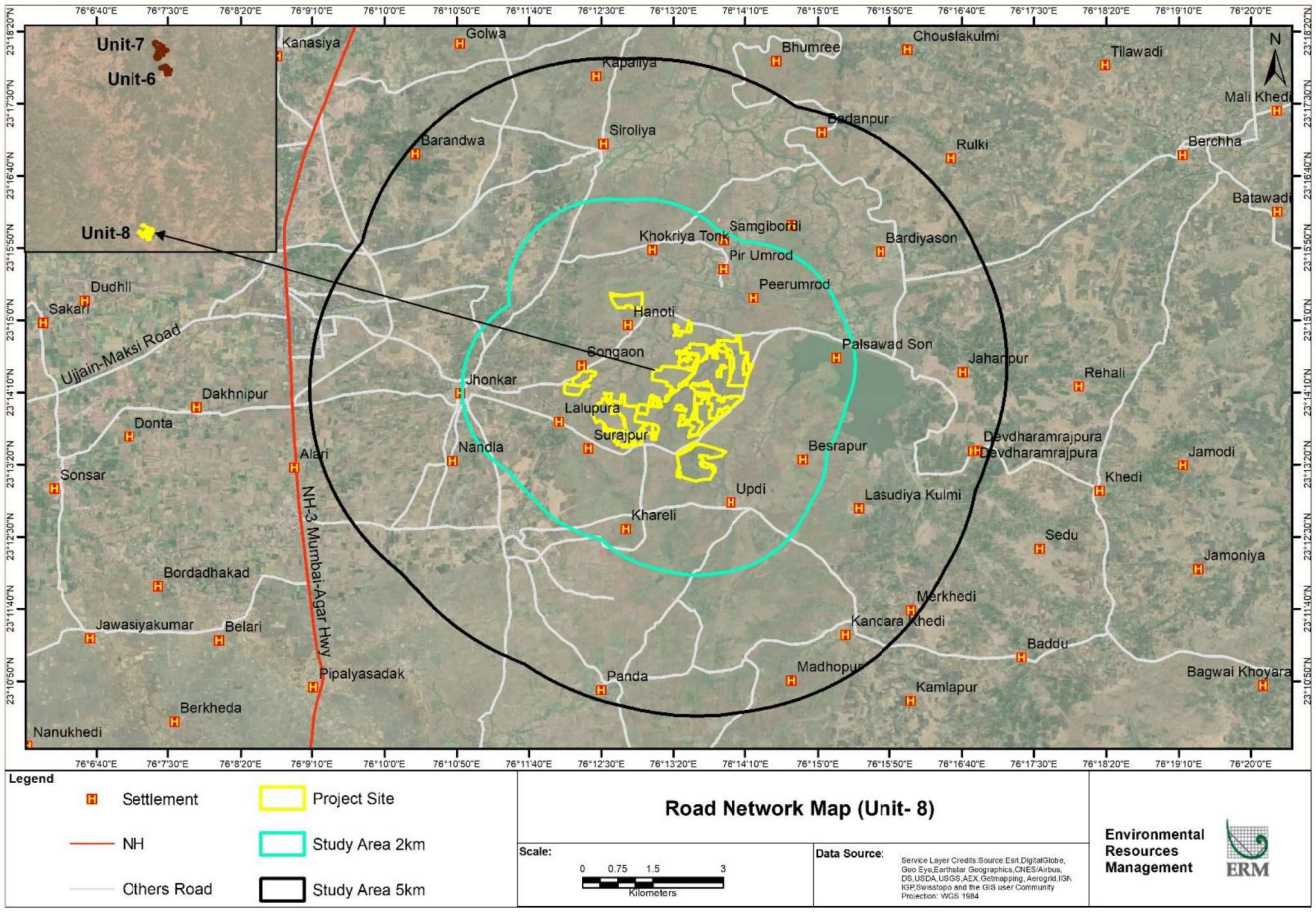


Figure 2.6 Map showing road network – Unit 8 (South Shajapur)



2.3.2.3 Greenbelt

Greenbelt is proposed to be developed close to utility area and nearby fencing & boundaries.

2.3.2.4 Common facilities

It is proposed that key amenities and facilities such as lighting, drainage, office building of RUMSL, firefighting arrangement, telecommunication infrastructure, sewage treatment, waste collection, medical facility, weather monitoring station, water and power shall be provided in all the three Units.

Temporary labour camps shall be set up within the land identified for the project during the construction phase of the Solar Park, which is expected to be around 21 months.

2.4 Summary of Project Activities

Key project activities during different phases of the Project have been summarised below:

2.4.1 Planning and Pre-Construction Phase

The planning phase includes the following components:

- Identification of land area and site;
- Site surveys as topographic, geo-technical investigations, solar radiation and yield study, electrical grid studies, etc.;
- Obtaining all necessary approvals/clearances;
- Land procurement;
- Selection of Solar Project Developers (SPDs); and
- Appointment of contractors.

Identification and land procurement is a key component of the planning and pre-construction phase. The process of land procurement can be divided into following

(a) Land survey;

(b) Land title verification;

(c) Land compensation; and

(d) Land procurement.

The land survey and final demarcation of land footprint was under process at the time of assessment and shall be handed over to the SPPD.

2.4.2 Construction Phase

Construction phase of project activities will include the following:

- Contractor mobilization;
- Site Preparation including fencing, clearing of bushes, pit filling, levelling and grading;
- Construction of site office and internal roads;
- Construction of temporary storage facilities;
- Foundation laying for ground mounted structures;
- Storage of PV modules delivery and their installation;
- Laying of internal electrical connections;

- Construction of sub-station and office buildings;
- Installation of inverter and transformers;
- Excavation foundation and setting up of external transmission line towers; and
- Stringing of transmission lines.

2.4.3 Operation and Maintenance

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

- Routine cleaning of PV modules;
- Control of vegetation viz. weeds, bushes etc. within the site and those immediately surrounding it;
- Routine inspection of all PV modules and associated structures viz. cables, transformers, inverters, mounting structures etc.;
- Operation and maintenance of ancillary facilities such as power substation;
- Inspection and maintenance of transmission lines; and
- Inspection and maintenance of internal site pathways/access roads.

The Project proposes to have a dedicated operations and maintenance (O&M) team comprising of technical staff to conduct the aforesaid maintenance activities. This will also require additional resources in the form of water (for module cleaning), consumable spares and insurance.

2.5 Resource Requirement

As mentioned above, the project site is in stage of planning, details on the resources such as raw materials, man power requirement, definite water sources, power supply and backup etc. are not yet decided. However, per the detailed project report prepared for the project the details have been provided in the sub-sections stated below.

2.5.1 Raw Materials

Construction Phase

The major raw materials for the Project includes cement, aggregates, sand, electrical installations, capacitors, stringing wires, transformers, transmission tower components such as steel tower structure, circuit plates etc. As informed by site representatives, construction materials such cement, aggregates, sand etc. will be procured from local market. The project specific components will be purchased from selected vendors via procurement tendering process.

Operation Phase

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

2.5.2 Water Requirement

Construction Phase

During construction phase, water will be primarily required for foundations of establishing solar panels, electrical installations at PSS at solar park and foundations for Transmission towers. Besides this, civil construction activities such as construction of control room, security guard room, utilities, labour camp etc. will also have water requirement.

As stated in the detailed project report, water requirements for construction purposes shall be met by tanker water.

Based on industry practices, it is estimated that approximately 250-300 KLD of water would be required for civil works during construction stage. Water will also be required for domestic use by workers at Project site. Considering peak worker requirement of 500-600 workers, daily water requirement is estimated as 80-90 KLD. The water requirement will be met through tanker water and nearby surface water bodies. Bottled water will be used for drinking purpose.

Operation Phase

During operation phase, water requirement will be mainly for cleaning of solar panels and domestic consumption at substations. Wet cleaning of the PV modules may be done either by pressurized water supplied using a mobile tanker mounted pump or water supplied through a permanent piping network laid across the length and breadth of the plant or section of the plant.

During operation and maintenance phase of the solar power projects, apart from the module cleaning, the water will be required for the other purposes such as potable water for manpower at site, electrical operation of different pooling substations, firefighting system and marginal availability. As per DPR, total workforce during operation phase will be 200 for the operation and maintenance of entire solar project.

As per DPR, total water requirement is estimated as 323 KLD and described below:

- 277 KLD for solar panel cleaning, assuming 2.5 litres per sq.m for panel cleaning and considering 12 cleaning cycles per year
- 9 KLD domestic water, assuming 200 no. of O&M staff and 45 LPCD;
- 7 KLD for green belt maintenance;
- 30 KL for firefighting and miscellaneous.

2.5.3 Power Requirement

Construction Phase

Construction Power shall be met through individual DG sets and for each unit or through temporary supply from Distribution Company.

Operation Phase

Based on initial assumptions, power requirement during daytime would be met through auxiliary generation. Night time power requirement would be met through the grid as per applicable regulations. DG sets would also be kept at the control room for emergency power backup.

2.5.4 Fire Safety and Security

Construction Phase

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

Operation Phase

The Solar Park shall be equipped with suitable Fire Protection and Fighting Systems for all common infrastructure and Pooling Sub-station as per the National Fire Protection Association (NFPA) and

CEA Fire Safety Standards and requirements of Government of Madhya Pradesh. Following firefighting protection system are proposed:

- Portable Fire Extinguishers of DCP, CO2, Foam type.
- Fire Buckets, painted red with additional handle at the bottom with fine sand and fixed on an angle iron frame as per requirement of Local Authorities.
- Automatic Fire Detection cum Alarm System in the Switchyard, Main Control Building and Administration Building.
- Fire Detection and Alarm System integrated with required cabling to a single Fire Alarm Control Panel with long range audible alarm facility.
- Manual Call Points and Hooters integrated with the Fire Alarm Control Panel in the respective Control Rooms.

2.5.5 Man Power Requirement

2.5.5.1 Construction Phase

Currently, manpower requirement for construction, labour camp requirement etc., are under planning stage. It is estimated that average 500-600 workers will be deployed on site.

During the operation phase, technicians would be deployed at site. Apart from these, project will also deploy housekeeping and security guards. Total work force during operation phase is estimated to be ~200.

2.5.5.2 Labour Accommodation

As reported by RUMSL, during construction phase, labour accommodation will be provided by SPD within the Solar Park site area. The IFC/EBRD guidelines for Worker's Accommodation shall be followed during establishment of the labour camp for the project.

Box 2.1 Guidelines for Worker's accommodation- Summary

- Living facilities shall be located to avoid flooding and other natural hazards. Where possible, living facilities are located within a reasonable distance from the worksite;
- Transport from the living facilities to worksite is safe and free;
- The living facilities shall be built with adequate materials, kept in good repair and kept clean and free from rubbish and other refuse;
- The building site shall be adequately drained to avoid the accumulation of stagnant water;
- Heating, air-conditioning and ventilation should be appropriate for the climatic conditions;
- Access to an adequate and convenient supply of free potable water shall be always available. Drinking water shall meets national/local or WHO drinking water standards;
- Wastewater, sewage, food and any other waste materials shall be adequately discharged, in compliance with local or World Bank standards;
- Specific containers for rubbish collection shall be provided and emptied on a regular basis;
- Rooms/dormitories shall be kept in good condition, aired and cleaned at regular intervals;
- A separate bed for each worker shall be provided. The practice of "hot-bedding" should be avoided;
- Sanitary facilities shall be provided separately for men and women. Sanitary and toilet facilities shall be constructed of materials that are easily cleanable;
- An adequate number of toilets, facilities for washing and bathing shall be provided to workers;
- Canteen, cooking and laundry facilities shall be kept in a clean and sanitary condition. If workers can cook their own meals, kitchen space is provided separate from sleeping areas;
- An adequate number of staff/workers shall be trained to provide first aid;
- Security at worker's accommodation shall be ensured.

In addition, National/State/Local guidelines shall be followed amid of COVID Pandemic

Source: Workers' accommodation: processes and standards, A guidance note by IFC and the EBRD

2.6 Land Requirement and Allotment Process

All land procurement activities are being undertaken in the planning phase of the project. All payments (compensation, purchase-related, and other allowances, as applicable) will be completed within this phase, before the land is handed over for boundary construction and commencing construction activities.

The key land requirements for the project comprises of the permanent land for the solar park, the tower footing for the transmission line; access roads, the land use restrictions within the RoW and the temporary land requirements (if not located within the identified project footprint) during the construction phase. ***Table 2.2*** provides the summary of the land requirement for all the three units of Shajapur Solar Park project based on the information available. The discussion on the existing land use in the villages within which the project is being planned and the potential dependence of communities on the land identified is discussed in ***Sections 6.***

2.6.1 Land Details

The Shajapur Solar Park will be spread across eleven villages in Shajapur and Moman Badodiya Tehsils of Shajapur District. The land required for the 450 MW Solar Park including, roads, transmission and distribution network is 974.7 hectares (including 108.9 hectares of private land). The Shajapur Solar Park plot comprises of three Units which are well separated.

The identified land falls in three broad categories in terms of ownership (Government Land, Private Land and Patta Land). The description of each type is below.

Private Land – Private Land is the land owned by the local population ancestrally and the ownership is backed by land documents in the name of the owners;

Patta Land – Patta land comprises of land granted to (at the time) landless households, under special provisions of the state government and though similar to ownership is several respects, it is subject to restrictions. A key restriction is that it cannot be sold[1]. The records of allotment of land with reference to particular scheme or to specific groups of community is not available; however, it is understood through site consultations that households from landless and backward communities (SCs and STs) were granted Patta Land. The last lot of Patta land granted was about 20 years ago.

Government Land – Government Land is owned by the Government and may be further categorized based on its permitted use by the communities. This land category (by ownership) comprises the majority of the identified land for the project. While this land is available for livestock grazing by the people of the village and other common uses, several areas of this land are being used for cultivation by members of the local community through squatting and encroachments.

The following table provides a summary of the land requirement by village and land category.

Table 2.2 Village Wise details of Land considered in Units

S No.	Village Name	Govt. land (NRED allotted)	Govt. Land Identified	Private Land	Patta Land	Total Land Area (Ha) (Govt. Land + Pvt. Land)
1	Burlay*	23.7	0.0	6.4	0.0	30.1
2	Jawadi	32.2	0.0	2.0	0.0	34.2
3	Dhatrawada	172.2	0.0	9.7	0.0	181.9
Sub- Total (Unit 6)		***228.1***	***0.0***	***18.1***	**0.0**	**246.2**
4	Parsula	116.2	0.0	0.0	5.2	121.4

[1] Special permission needs to be sought from the District Collector to allow the sale of patta land, and this is granted only under special circumstances, at least in the first 20 years after it is granted. Any 'sale' of patta land without this permission is not considered valid, and may be treated as a violation of the terms of the grant of the 'patta'.

S No.	Village Name	Govt. land (NRED allotted)	Govt. Land Identified	Private Land	Patta Land	Total Land Area (Ha) (Govt. Land + Pvt. Land)
5	Dehripal	111.1	0.0	21.8	0.0	132.9
6	Bijnakhedi	95.4	0.0	22.6	0.0	118.0
7	Fawaka	17.1	0.0	0.2	0.0	17.3
8	Chouma	32.7	0.0	9.5	0.0	42.2
9	Burlay*	41.7	0.0	0.0	0.0	41.7
Sub- Total (Unit 7)		**414.2**	**0**	**54.1**	**5.2**	**473.5**
10	Surajpur	22.7	0.7	18.2	0.0	41.6
11	Lalupura	49.8	0.8	0.0	0.0	50.6
12	Hanoti	131.9	12.5	18.5	0.0	162.9
Sub- Total (Unit 8)		**204.3**	**14.0**	**36.7**	**0.0**	**255.1**
Total (Unit 6, 7,8)		***846.6***	***14.0***	***108.9***	***5.2***	***974.7***

Source: Final DPR, August, 2020
Note: There are total 11 villages. Burlay village has been considered both in Unit 6 and 7

The private land comprises approximately 11 percent land of the Solar Park, whereas government land (860.6 ha comprising. both, land currently allotted by the state government for the project and additional Government land identified for the project) comprises 88.2 percent of the total land considered for the Solar Park. The boundary for the solar park is defined by feasible avoidance of land being used for habitations, residential structures, religious and cultural structures, access routes, etc. Some portion of the government land considered for the Shajapur Solar Park, though classified as government land is currently (informally) used/ encroached or squatted upon by the village community for agriculture or as livestock sheds‘; however, this use/status is not indicated in the land records. No formal and updated Government records of the encroached or squatted upon government land are available.

There is limited information available with regards to land owners who are likely to have private or patta land within the proposed solar park boundary; however, 34 land owners have been identified for Unit 8 in South Shajapur. This list will be confirmed and updated during the RAP surveys in the field. An approximate component wise break-up of land is as provided in the Final DPR is presented below.

Table 2.3 Component wise break up of land

S. No	Land Use Description	Estimated Area (Hectares)
1.	Unit 6	732.1
2.	Unit 7	471.1
3.	Unit 8	252.8
4.	33/220 kV substation 1	1.79
5.	33/220 kV substation 2	1.79
6.	33/220 kV substation 3	1.79
7.	Common facilities at Unit 6	0.50
8.	Common facilities at Unit 7	0.50
9.	Common facilities at Unit 8	0.50
	Total	974.7

Source: DPR of Shajapur Solar Park, August, 2020

2.6.2 Land Procurement Process

The land procurement process for the Solar Park commenced in 2016-17, where RUMSL identified potential land parcels potential project areas, with large areas of unused government land. This was driven by the intent to use government land for the project to the extent possible and minimize the use of private or *Patta* lands.

The land identification was followed by screening and scoping exercises, in order to identify exclusions and avoidances on the identified land, comprising sensitivities, such as settlements/ clusters of structures, etc. Based on the recommendations from the scoping exercise, a drone survey of the identified land was undertaken, to further optimize the land requirement in a manner, such that impacts to private and patta land owners and associated livelihoods are minimized. .

The land optimization exercise conducted by RUMSL for reducing potential impacts to the local community, based on drone survey imageries, has led to the exclusion of previously identified land parcels belonging to private and patta land owners. The land details provided to the ERM team depict that certain land categories like land used for habitation and access route for habitation have been avoided to the extent feasible in the villages of Burlay, Jawadi and Dhatrawada while access route for private land/ patta land that is through government land has been avoided in Dhatrawada village. Similarly, land identified for the project which is isolated from the main land parcel has been excluded in Dhatrawada, Lalupura and Hanoti villages. Waterbodies have been avoided in Dhatrawada village. The details of avoidances are in ***Table 6.13*** which presents the land initially identified for the Shajapur Solar Park.

Certain land parcels which were situated far from the main land parcel for Solar Park, have also been screened out from the initially considered land during the land optimization process.

The subsequent subsections outline the procurement process to be followed for each type of land identified for the project area

2.6.2.1 Process for procurement of Government Land

A Land Use Permission Agreement (LUPA) will be signed between New and Renewable Energy Department, Government of MP and RUMSL for the life of the project. The duration of construction phase will be incorporated in the project life to ensure that the LUPA is for a period of 25 years from the day of commissioning. M/S RUMSL will sign the LUPA with the Government of Madhya Pradesh for the Government land. The transfer of rights is undertaken once the allotment is finalized and approved by the Superintendent of Land Records (SLR) of the district. Subsequently, M/S RUMSL will have a back-to-back Land Use Permission Agreement with the Solar Project developers, which would enable them to use the land for development of solar project as per the agreed terms of the LUPA.

2.6.2.2 Process for procurement of Private and Patta land

The private land for the project shall be purchased as per prevailing laws and policies in the State of Madhya Pradesh (through MP Mutual Consent Land Purchase Policy' dated 14th November, 2014. Under the policy, the District Collector (DC), based on the information regarding the requirement of private land in the Project area, due to non-availability of government land and or shortfall in meeting the project land requirement through government land.

The broad steps under the MP Mutual Consent Land Purchase Policy 2014, are given below:

- The Designated official from the Department/ Enterprise (in this case RUMSL) will submit an application to the collector for the purchase of the land as per the MP Mutual Consent based Land Purchase Policy 2014. RUMSL to undertake land survey and demarcate the land to be acquired and submit the information to the District Collector for verification;
- The application would include the following particulars:
    a. Name of the project and purpose';
    b. Area of the land proposed to be purchased;
    c. Details of budget availability with the Department/ Enterprise for the purpose of land purchase for the project; as assessed, based on the Policy

d. Land details (survey number, plot number, nazool sheet number, area, village, tehsil and map)

e. Land owner details;

f. Estimated land value based on the prevailing market rates, also known as the Collector Guideline Rate;

g. Estimated value of the assets available on the land

h. Any other details which Department/ Enterprise would like to provide;

- In case of land requirement for the purpose of the infrastructure and development projects of various projects and enterprises of the state government, the collector will firstly allocate suitable government land available as per the established rules.
- The District Collector (DC) identifies private land parcels (only after government land options have been exhausted);
- Private land to be identified and shortlisted. The rate for the same to be decided, based on the guidelines issued by the District Collector's office;
- The DC after receiving the application from the concerned department/ enterprise

  a. Will require the Tehsildar to submit a report ascertaining claims over the land and whether the land title is clear or not. A team from the district and the tehsil visit the parcel and undertake an inventory of the assets thereon;

  b. The DC will also ask the concerned departments (Forest, horticulture, Public work s dep to measure the assets, as relevant (house, well, trees, boundary wall, etc.) and undertake the valuation of the assets.

  c. As per the guidelines the land value (double the district level official market rate which is technically known as the Collector Guideline Rate plus a one-time Solatium) and the asset value (double the value of the asset assessment) arrives at the final value to be offered

- After verification of land use of the private land parcels, if the DC feels that the land is suitable for purchase, then the DC office submits a "Bhoomi Kray Prastav" or an Initial Offer to the land owner which has the proposed price. After being notified through the Bhoomi Kray Prastav (prastav), the landowner has 15 days to provide consent. This timeline can however be extended by the DC as per need.
- In addition to providing the (first) consent, the land owner will also need to make an undertaking that the land is free of any litigations and/or encumbrances (sahmati patra); and in case there are encumbrances or other claims, the land owner will provide all the necessary details to the collector.
- After the undertaking has been received from all landowners, the DC to publish a Public Notification to raise any concern, within a timeline of fifteen (15) days from the date of publication of notification. The publication to be published in local newspaper, and available with the Panchayat or an equivalent village level administration office, Tehsil office and the District Collector's Office;
- If any objection is received regarding ownership disputes pertaining to the identified land, or regarding the compensation amount, the land procurement would not proceed. In case of no objections are received, the DC will allow the land purchase to proceed.
- After seeking land owner and public consent, the payment of the consideration amount to the land seller should be completed within one year from the date of consent provided by the landowner; Any expenses pertaining to the land registration such as stamp duty, registration cost will be borne by the concerned government department/ agency;

- After the registration, the Mutation process (to update the land records) will be completed in the name of the MP government and the name of the concerned department/ agency will also be mentioned;
- In case the proposed project for which the land is purchased fails or does not move forward for any reason, the concerned Department/ Agency will transfer this land to the Revenue Department, and Revenue Department will be free to give it for any other project, as required.
- Any Government land given on patta for agriculture by the Government will be treated like private land for the purpose of seeking consent and payment of consideration to the patta holder.
- The required private land for the Project M/S RUMSL will hold ownership of all such private land parcels and sign sub-lease agreements with Solar Project Developers.

RUMSL intends to procure all private and patta land through the MP Mutual Concent based Land Purchase Policyand the RFCTLARR 2013 Act may only be used for land parcels that either do not have clear titles, or have ownership related disputes.

Any additional private land, if required for temporary use outside the project footprint, during the construction phase will be taken on lease based on negotiations with landowners. However, no such need for temporary land has been assessed, as RUMSL intends to use the land within the project boundary for all temporary requirements, such as temporary labour camps, lay down and storage areas etc., during the construction phase.. According to the discussion with the project team, to the extent possible, the temporary land requirement for the construction phase will be accommodated within the identified project footprint.

The land area and land boundaries finalised during this stage will be further assessed as part of RAP and FPIC resource mapping surveys, in terms of extent of economic losses, confirmation on the number and types of Project affected families (General, SC, ST, Women Headed Households, etc.), nature of impacts and whether landlessness is arising out of the land procurement for the project.

2.7 Pollution Stream

Pollution streams during construction and operation phase of solar power plant will include air emissions, wastewater generation and solid waste generation.

2.7.1 Solid Waste Generation

2.7.1.1 Construction Phase

The solid waste generated by the Project will consist of domestic solid waste, packaging waste, metal scrap and construction debris. The main types of waste that would likely be generated and its sources are shown in ***Table 2.4.***

Table 2.4 Waste generated, source of waste and method of disposal to be adopted for the Project

S. No	Waste Type	Source	Method of disposal
Non-Hazardous Waste			
1.	Domestic solid waste	Temporary site office, storage area, labour activities	Waste shall be segregated onsite and shall be disposed of as approved by local authority.
2.	Construction debris	Construction activities within Solar Park including construction	Excavated materials shall be used for backfilling and levelling and

S. No	Waste Type	Source	Method of disposal
		of access road, substation, storage yard etc.	other construction debris shall be used for road construction.
3.	Packaging waste containing wood, cardboard and other recyclables.	Packaging material from solar panels, cables and accessories	Return back to the supplier or used as storage boxes/ racks at site.
4.	Sludge from Septic Tank	Site Office and labour camp	Collected and disposed off through contractors.
5.	All non-recyclables waste	Construction activities	Collected and disposed off by the contractor at designated municipal landfill site.
6	Plastic waste	Packaging material	Shall be collected and disposed of through recycler
7	Biomedical waste	First aid kits kept at construction site and site office	Shall be collected, transported and disposed through an authorised agency as prescribed in *Bio-Medical Waste (Management and Handling) Rules 2016, as amended*.
8	Broken solar panels and other electronics waste (E waste)	Solar Park, PSS and Site Office	Shall be sent back to vendor as a buy back arrangement
9	Batteries	Solar Park, PSS and Site Office	Batteries shall be disposed through manufacturer under the buy-back arrangement.
Hazardous Waste			
1.	Used oil/waste oil, lubricants and oil contaminated rags	DG set, construction machinery	Hazardous wastes shall be stored onsite at separate designated covered area provided with impervious flooring and secondary containment. The storage containers/ bins/ drum will be clearly marked and identified for their hazards. Before completion of 90 days, hazardous waste materials shall be sent to MPPCB/CPCB authorised vendor for eventual disposal at the Common Hazardous Waste Treatment, Storage and Disposal Facility (CHWTSDF). The nearest CHWTSDF facility is located in Pithampura, ~ 100 km away from the site.

2.7.1.2 Operation Phase

Waste expected to be generated during operation phase from the Project will include domestic waste at site office, scrap materials like scrap tools, damaged personal protective equipment (PPEs) etc.; hazardous waste like waste oil, lubricants, used transformer oil; damaged batteries; damaged PV modules etc. Main types of waste generation and its disposal is as presented in table below.

Table 2.5 Waste Management during Operation Phase

S. No	Waste Type	Source	Method of Disposal
Non Hazardous Waste			
1	Domestic solid waste and office waste	Site Office	Will be disposed of through local municipal corporation
2	Metal Scrap	Site Office and PSS	Will be disposed of with the help of authorised scrap dealer
3	Damaged PPEs	Site Office and PSS	Through authorised vendor
Hazardous Waste			
4	Used oil/waste oil, lubricants and oil contaminated rags	Maintenance activities at site	stored temporarily onsite at separate designated covered area provided with impervious flooring and secondary containment and will be disposed in accordance with Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, as amended
5	Broken solar panels, batteries (dry type or wet type), electronics	Site office and PSS	will be sent back to the vendor as part of buyback arrangement

2.7.2 Air Emissions

2.7.2.1 Construction Phase

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

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

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

2.7.2.2 Operation Phase

Under normal operating conditions there would be no gaseous emissions from the operating areas. However, there is a likelihood of gaseous and fugitive dust emissions, albeit in smaller concentrations, owing to the operating of maintenance vehicles. As a means of best practice and adherence to

country regulations, well maintained vehicles with proper PUC will only be used for operation and maintenance purposes.

2.7.3 Wastewater Generation

2.7.3.1 Construction Phase

Liquid effluents generated during the construction phase will include domestic sewage from temporary site office as well as from labour camps if any. As part of the site preparation stage, a drainage and sewerage system will be constructed for the site office. The sewerage system will consist of soak pits for the collection of wastewater from the kitchen and washing areas and Office facility. Sewage from the toilets will go into lined septic tanks. Sewage disposal trucks will be used to periodically remove the sludge/sewage from the site.

2.7.3.2 Operation Phase

The operational phase will have ~7 KLD of wastewater generation at site office. Septic tank and soak pits will be provided at the site offices, pooling substations of each Units for disposal of sewage.

2.7.4 Noise Emission

2.7.4.1 Construction Phase

During the construction phase noise will be generated primarily during the day time. Noise will be generated from pilling, moving vehicles as well as construction equipment and machineries, including the DG sets utilized for power. Since there are settlements in the near vicinity of the construction site, the receptors of noise pollution will be the residents of the settlements and the construction workers.

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

2.7.4.2 Operation Phase

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

3. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

This section presents key environmental and social rules and regulations as well as international safeguard requirements that will be applicable to the Project, during different phases with respect to the following reference framework:

- Applicable Indian (national, state and local) Environmental and Social Regulations; ˝
- IFCs Performance Standards on Environmental and Social Sustainability (2012);
- World Bank Environmental and Social Safeguard Policies;
- IFC/ WB General EHS Guidelines (2007);
- IFC Project Developer's Guide to Utility-scale Solar Photovoltaic Power Plants;
- Environmental and Social Management Framework for Solar PV Park, February, 2017; and
- Applicable National Environmental Standards for Ambient Air, Noise, Water etc.

3.1 Applicable Reference Framework

A list of applicable environmental legislations and their specific application for the proposed Project are given in ***Table 3.1 .*** The International Standards and their applicability for the Project is provided in ***Table 3.2***. Earlier, a preliminary review of applicable regulations was conducted in the scoping stage. The present table has been built upon that and is an outcome of revised review. The table will be updated as the project progresses.

Table 3.1 Applicability of Key Legislations in India and Reference Framework in Different Phases of the Project

Applicable Indian Legislation/Guidelines/International Conventions	Pre-construction	Construction	Operations	Agency Responsible	Remarks
Environment Protection					
Environment Protection Act, 1986 and as amended	X	√	√	Madhya Pradesh Pollution Control Board (MPPCB) Central Pollution Control Board (CPCB) Ministry of Environment Forest and Climate Change (MoEFCC)	Permissible limits for ambient air quality, water quality, noise limits has been laid down by CPCB under EP Act, 1986 which requires to be complied with during Project lifecycle.
Noise Pollution (Regulation and Control) Rules, 2000 and the Noise Pollution (Regulation and Control) (Amendment) Rules, 2010	X	√	√	MPPCB	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, the rules for residential areas would need to be followed.
The Water (Prevention and Control of Pollution) Act, 1974, as amended	X	√	√	MPPCB	The conditions within the Water and Air Act need to be followed through construction and operation of the project. As per MPPCB Notification no. 4551 dated 27.12.2016, Solar Parks are listed under White Category and does not require Consent to Establish/Operate.
The Air (Prevention and Control of Pollution) Act 1981, as amended	X	√	√	MPPCB	
Guidelines/Criteria for Evaluation of Proposals/Requests for Groundwater Abstraction, 2012 as amended	X	√	√	MPPCB	Per the guidelines, any ground water abstraction for project will require permission from Central Ground Water Authority (CGWA). Presently, DPR of the Project has identified tanker water and ground water as source of water to meet water requirements of the Project during construction and operation phases respectively.

Applicable Indian Legislation/Guidelines/International Conventions	Pre-construction	Construction	Operations	Agency Responsible	Remarks
Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, as amended	X	√	√	MPPCB	Generation of used oil/diesel, paint cans, oil contaminated rags transformer oil, oil contaminated materials at Solar Park and substation site attracts the provisions of Hazardous and Other Waste Rules, 2016. As per amendment vide G.S.R 178 dated 1st March 2019, Project does not require HW authorisation as the project does not require consent to establish and consent to operate under white category provided. HW and other wastes generated from the project shall be given to the actual user, waster collector or operator of the disposal facility in accordance with CPCB guidelines.
Explosive Rules 2008	X	√	X	Chief Controller of Explosives, Petroleum and Explosives Safety Organisation	If any controlled blasting is proposed in the project for site levelling, these Rules will be applicable. The Project will have to obtain a license for storage and use of explosives from the Chief Controller. The rules with respect to storage requirements, safety, labelling and records/submission of annual returns needs to be followed as indicated in the explosive rules.
Batteries (Management and Handling) Rules, 2001, as amended	X	√	√	MPPCB	Batteries need to be managed and stored with respect to the Batteries Management and Handling Rules and disposed through an authorized recycler.
E-waste (Management) Rules, 2016, as amended	X	√	√	MPPCB	Electrical and electronic waste needs to be managed and stored with respect to the electronic waste rules and disposed through an authorized recycler.
Construction and Demolition (C&D) Waste Management Rules, 2016	X	√	X	MPPCB	If there is any demolition for structures in the Project during construction and decommissioning activities, these Rules will be applicable. The C&D waste has to be disposed as per the Rules.
Manufacture, Storage & Import of Hazardous Chemical Rules, 1989 as amended	X	√	√	MPPCB	Storage and handling of hazardous chemicals in the form of diesel and transformer oil will be carried out in accordance to the relevant provision of this Rule. All chemical storage to be appropriately labelled with Material Safety Data Sheets (MSDS) available and displayed.

Applicable Indian Legislation/Guidelines/International Conventions	Pre-construction	Construction	Operations	Agency Responsible	Remarks
The Madhya Pradesh Bhumi Vikas Rules, 1984	X	√	√	Local Fire Authority	The Project will require Fire NOC for substations if the height of control room qualifies category of High rise building (height of building above 18 m) as given in the Rules.
The Motor Vehicles Act, 1988 as amended	X	√	√	Ministry of Road Transport and Highways State Transport Authority	■ Compliance of stipulated standards under Rule; ■ Display of emergency information panel by vehicles carrying hazardous substances as per Rule 134; ■ Vehicular pollution control measures; ■ Other environmental and safety compliance under the Rules.
Social					

Applicable Indian Legislation/Guidelines/International Conventions	Pre-construction	Construction	Operations	Agency Responsible	Remarks
The Madhya Pradesh Land Revenue Code,1959 and amendment 2018	√	X	X	District Collector and Revenue Department	This Code provides guidance on the evaluation of government and patta land and assets impacted; According to this Act, "Market Value" means the value of land assessed according to guidelines issued by the Collector under the Madhya Pradesh Bajar Mulya Margdarshak Siddhanton ka Banaya Jana Tatha. Unka Punrikshan Niyam, 2000 made under the Indian Stamp Act, 1899 Chapter 18 of the Act puts in place the provisions for the declaration of Nistar rights by the Sub-Divisional officer, for each village. The Nistar Patrak may include matters such as: ■ Terms and conditions on which grazing of livestock in the village may be permitted ■ The terms and conditions on which and the extent to which any resident may obtain - Wood, timber, fuel or any other forest produce - Mooram, kankar, sand, earth, clay, stones or any other minor mineral etc. The Wajib-ul-arz document, also with the Sub-Divisional Officer, is a record of customary land on non-vacant land- rights suck as easements and wayleaves, rights of water use for irrigation, fishing etc. The code also allows for the Collector to set apart unoccupied land for uses including timber and fuel reserve, pasture grass bir or fodder reserve, gaothan, encamping ground, threshing floor etc.

Applicable Indian Legislation/Guidelines/International Conventions	Pre-construction	Construction	Operations	Agency Responsible	Remarks
MP Mutual Consent Policy, 2014 *(Aapasi sehmati se Bhu kraya Niti, 2014)*	√	X	X	Revenue department	The government agencies requiring land for various infrastructure projects can procure land with the mutual consent of the land owners as it saves time, ensure timely payment of land value to owners and the procedures are less cumbersome. The objective is to purchase land from owners with their consent and making them understand the social and economic benefits as a result of the project. The policy will facilitate speedy procurement of land and the sellers will receive the land and asset value based on the provisions of the policy, in a timely manner.
The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act 2013	*	X	X	District Collector and Revenue Department	This act is only planned to be used for private or patta land parcels that do not have clear titles or have ownership disputes. All other private and patta land will be procured using the MP Mutual Concent based Land Purchase Policy 2014. Such parcels within the area required for the project will not exceed 100 acres for any unit The Section 45.1 and 45.2 of the Act require that in case the land for acquisition is => 100 acres; a R & R Committee will be formed, with the collector as the Chairman. The purpose of the committee will be to monitor and review the progress of the implementation of the R & R Scheme and to undertake post-completion audits in consultation with the GS and municipalities.
The Indian Telegraph Act, 1885	√	X	X	Department of Telecommunication, Govt. of Madhya Pradesh	■ The Electricity Act and Telegraph Act define the compensation payable for damages to crops/ trees and structures along the transmission line route

Applicable Indian Legislation/Guidelines/International Conventions	Pre-construction	Construction	Operations	Agency Responsible	Remarks
Seventy Third Constitution Amendment Act,	√	X	X	Department of Panchayati Raj, State Government	■ The Act enables participation of Panchayat level institutions in decision-making. Panchayats at the village level will be involved for preparation and implementation of the project.
MoP Guidelines for Payment of Compensation Towards Damages in regard to RoW, 2015	√	X	X	Revenue Department	Guidelines for payment of compensation towards damages in regard to Right of Way for transmission lines. the guidelines have 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 Magistrate or any authority based on circle rate/ guideline value/ stamp value/ stamp act.
Labour					

Applicable Indian Legislation/Guidelines/International Conventions	Pre-construction	Construction	Operations	Agency Responsible	Remarks
Factories Act, 1948 and Madhya Pradesh Factories Rules 1962		√		Labour Department	The act to regulate the work of labour in factories. The state amendments introduced in the central act include: A male adult worker will be allowed to work for more than 48 hours in a week subject to – ■ The total numbers of hours in a day does not exceed 12; ■ The spread over, including rest interval does not exceed 13 hours in a day; ■ The total number of work hours in a week, including overtime does not exceed 60; ■ No worker shall work overtime for more than 7 days at a stretch and the total overtime hours in a quarter shall not exceed 125; ■ Such overtime shall not be made compulsory or obligatory; ■ For women, who are required to work between 8 PM and 6 AM, the state government shall specify conditions of safety; ■ For worker who has worked for more than 180 days in a calendar year, shall be entitled to annual leaves. The Act and the subsequent rules are applicable to all factories, in the premises wherein 10 or more workers are employed with the use of power.

Applicable Indian Legislation/Guidelines/International Conventions	Pre-construction	Construction	Operations	Agency Responsible	Remarks
The Industrial Disputes Act (1948) amended in 2010					The amended act of 2010 introduced the following provisions: ■ Wage ceiling for supervisors was raised from INR 1600/month to INR 10,000/month; ■ Direct access for workmen to labour court in case of disputes arising on retrenchment, discharge or termination of service; Establishment of Grievance Redressal Mechanism (GRM) for establishments with more than 20 workers
Minimum Wages Act 1948		√	√	Labour Department	The act ensures minimum wages for each category of workers
Equal Remuneration Act and Rules 1976;		√	√	Labour Department	Puts in place rules and regulations governing the remuneration payable to workers and employees. The Rules put in place the forms for complaints and claims under the Act.
The Payment of Wages Act, 1936, amended in 2005 and 2017;		√	√	Labour Department	Under the 2017 central amendment, Section 6 was substituted with the following: ■ All wages shall be paid in current currency or by cheque or by crediting the wage in the bank account of the employee

Applicable Indian Legislation/Guidelines/International Conventions	Pre-construction	Construction	Operations	Agency Responsible	Remarks
The E.P.F. and Miscellaneous Provisions act, 1952 and The Madhya Pradesh Labour Laws (Amendment) And Miscellaneous Provisions Act 2015 was passed under the Madhya Pradesh Act (21 of 2015) in November 2015; Payment of Bonus Act, 1965 and rules and subsequent amendment Payment of Gratuity Act, 1972;		√	√	Labour Department	The central amendment of 2015 introduced the following changes: ■ Revision of wage threshold- the wage has been upwardly revised from INR 10,000/month to INR 21,000/month ■ Change in the wage ceiling for calculation of bonus- the calculation ceiling was raised from INR 3500/month to INR 7000/month
ESI Act , 1948 (Employees State Insurance Act, 1948) and Central Amendment Rules, 2016		√	√	Labour Department	The central amendment of 2016 brought about four major changes are: ■ An employee whose average daily wage is upto INR 137 is exempted from contribution (it was INR 100 earlier) ■ In areas where the Act is implemented for the first time; the rates of contribution for the first 24 months is: Employer – 3% of wages, Employee - 1% of wages ■ Wage limit for coverance of an employee has been enhanced from INR 15,000 to 21,000

Applicable Indian Legislation/Guidelines/International Conventions	Pre-construction	Construction	Operations	Agency Responsible	Remarks
Workmen's Compensation Act, 1923 amended in 2017 and renamed as Employees Compensation Act		√	√	Labour Department	The central amendment introduced in 2017 had the following changes: ■ It is the duty of the employer to inform the employee of his/her rights to compensation under the Act; ■ The minimum penalty payable under Section 18A (penalties on employer) was increased from INR 50,000 to INR 1,00,000. Also, failure to inform the employee regarding the act has been included as a penal offence; ■ The minimum amount in dispute has been raised from INR 300 to INR 1000 for an appeal to High court against the order of the Labour Commissioner; Section 30A, which dealt with withholding amounts payable to employee through Commissioner's order has been omitted
Child Labour (Prohibition and Regulation) Act, 1986 amended in 2016		√	√	Labour Department	Prohibits employment of children below 14 years of age. Under the 2016 amendment, the following provisions were introduced: ■ Adolescent term introduced (person between 14 and 18 years), and adolescents will be prohibited from employment in hazardous occupations and processes; ■ Regulation of working conditions of adolescents with regards to working hours limited to 6 hours in a day, 1 hour rest after every 3 hours of work, and no overtime; Prohibition of employment of a child (under 14 years) in all occupations except where the child helps the family after school hours

Applicable Indian Legislation/Guidelines/International Conventions	Pre-construction	Construction	Operations	Agency Responsible	Remarks
Contract Labour (Regulation & Abolition) Central Act 1970 and Rules, 1971 (Madhya Pradesh Amendment, 2015)	√	√	√	Labour Department	Ensure basic welfare measures to be made available to the contract workers by the employer. Under the state amendment (2015), two provisions have been introduced: ■ Provision of deemed registration if the registering officer fails to pass an order either granting or refusing or objecting to grant or amend the registration within a period of 30 days after submission of an application; Provision of duly licensed if the registering officer fails to pass an order either granting or refusing or objecting to grant or renew or amend the registration within a period of 30 days after submission of an application.
The Bonded Labour System (Abolition) Act 1976;	√	√	√	Labour Department	Abolishes Forced labour in the country
Inter-state Migrant Workmen Act 1979 (Madhya Pradesh Amendment, 2015)	√	√	√	Labour Department	Regulate the condition of service of inter-state labourers in Indian labour law. Under the state amendment (2015), one provision has been introduced: The registration deemed to be duly granted, if no adverse order is passed within thirty days from the date of submission of application.

Applicable Indian Legislation/Guidelines/International Conventions	Pre-construction	Construction	Operations	Agency Responsible	Remarks
The Building and other Construction Workers Act, 1996 (Madhya Pradesh Amendment, 2015)	√	√	√	Labour Department	Ensure safety measures at construction work site and other welfare measures such as canteens, first-aid facilities, ambulance, and housing accommodation for Workers near the Workplace etc. Under the state amendment (2015), two provisions have been introduced: ■ The State Government, by notification, may exclude cost on purchase and transportation of plant and machinery to be used in a factory and such other costs from the cost of construction; An employer aggrieved by an order of assessment made under Section 5 or by an order imposing penalty under Section 9, may appeal to the appellate authority against the said order in such manner as prescribed.
The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013		√	√	Labour Department	An act to protect women from sexual harassment at their place of work.
Indigenous People					

Safeguards in the Indian Constitution					"Scheduled Tribes" means such tribes or tribal communities or parts of or groups within such tribes or tribal communities as are deemed under article 342 to be Scheduled Tribes for the purposes of the Constitution. As it is stipulated in the constitution, the President (President of India) may with respect to any State or Union Territory, and where it is a State, after consultation with the Governor thereof, by public notification, specify the tribes, or tribal communities or parts of or groups within tribes or tribal communities which shall for the purposes of this Constitution be deemed to be Scheduled Tribes in relation to that State or Union Territory, as the case may be. With regard to inclusion or exclusion, Parliament may by law include in or exclude from the list of Scheduled Tribes specified in a notification, any tribe or tribal community or part of or group within any tribe or tribal community. Prohibition of Discrimination As per this provision, the States shall not discriminate against any citizen on grounds only of religion, race, caste, sex, place of birth or any of them. Other provisions are; No citizen shall, on grounds only of religion, race, caste, sex, place of birth or any of them, be subject to any disability, liability, restriction or condition with regard to (a.) access to shops, public restaurants, hotels and places of public entertainment; or (b.) the use of wells, tanks, bathing Ghats, roads and places of public resort maintained wholly or partly out of State funds or dedicated to the use of general public. Nothing (clause (2) of article 29) shall prevent the State from making any special provision for the advancement of any socially and educationally backward classes of citizens or for the Scheduled Castes and the Scheduled Tribes. Nothing (sub-clause (g) of clause (1) of article 19) shall prevent the State from making any special provision, by law, for the advancement of any socially and educationally backward classes of citizens or for the Scheduled Castes or the Scheduled Tribes in so far as such special provisions relate to their admission to educational institutions including private educational institutions, whether aided or unaided by the State, other than the minority educational institutions referred to in clause (1) of article 30.

The SCs and the STs (Prevention of Atrocities) Act, 1989					The act was passed in 1989 to prevent Scheduled Castes and Scheduled Tribes from atrocities. The act suggests Precautionary and Preventive Measures under which State Government shall identify the area where it has reason to believe that atrocity may take place or there is an apprehension of reoccurrence of an offence under the Act: The state shall order the concerned officer to visit the identified area and review the law and order situation. If deemed necessary, in the identified area cancel the arms licenses of the persons, not being a member of the Scheduled Castes or Scheduled Tribes, their near relations, servants or employees and family friends and get such arms deposited in the Government Armoury. The act suggests constitution of a high-power State-level committee, district, and divisional level committees or such number of other committees as deemed proper and necessary for assisting the Government in implementation of the provisions of the Act; The act has made provision to set-up a vigilance and monitoring committee to suggest effective measures to implement the provisions of the Act. The state can set-up Awareness Centres and organise Workshops in the identified area or at some other place to educate the persons belonging to the Scheduled Castes and the Scheduled Tribes about their rights and the protection available to them under the provisions of various Central and State enactments or rules, regulations and schemes framed there under. Under the act, Non-Government Organisations are encouraged for establishing and maintaining Awareness Centres and organizing Workshops and provide them necessary financial and other sort of assistance. As per the provision of the act, the State Governments shall set up a Scheduled Castes and the Scheduled Tribes Protection Cell at the State head quarter under the charge of Director General of Police/Inspector General of Police. This Cell shall be responsible for (i) conducting survey of the identified area; (ii) maintaining public order and tranquillity in the identified area; (iii) recommending to the State Government for deployment of special police force or establishment of special police post in the identified area; (iv) making investigations about the probable causes leading to an offence under the Act; (v) restoring the feeling of security amongst the

Applicable Indian Legislation/Guidelines/International Conventions	Pre-construction	Construction	Operations	Agency Responsible	Remarks
					members of the Scheduled Castes and the Scheduled Tribes; (vi) informing the nodal officer and special officer about the law and order situation in the identified area; (vii) making enquiries about the investigation and spot inspections conducted by various officers; (viii) making enquiries about the action taken by the Superintendent of Police in the cases where an officer in-charge of the police station has refused to enter an information in a book to be maintained by that police station; (ix) making enquiries about the wilful negligence by a public servant.
Biodiversity Conservation					
Wildlife Protection Act, 1972, 2002 and Rules, 2003 and as amended	√	√	√	Wildlife Warden, State Forest Department	If any protected/ endangered flora or fauna (as listed in Schedules of WP Act, 1972) are found in the project area, the proponent should implement conservation measures for their protection.
Forests (Conservation) Act, 1980 and Rules 1981 as amended	√	√	√	District and State Forest Department MoEFCC.	In case, if any Protected or Reserve Forest land is acquired for the project or its component, it shall require a prior Forest Clearance from the state and central authorities.

Table 3.2 International Standards- IFC Performance Standards and WB Safeguard Policies

S. No.	IFC PS (2012)	WB- Safeguard Policies	Requirement	Standard Triggered	Applicability/ Compliance
1.	PS 1: Assessment and Management of Environmental and Social Risks and Impacts	OP 4.01: Environmental Assessment	Social and Environmental Assessment and Management Systems for managing social and environmental performance throughout the life cycle of the Project and runs through all subsequent standards.	Yes	The Project will have moderate impacts on environment, health, safety and social aspects throughout its lifecycle and will need to be managed and monitored through the implementation of policies and procedures in compliance with IFC PS 1 and OP 4.01.

S. No.	IFC PS (2012)	WB- Safeguard Policies	Requirement	Standard Triggered	Applicability/ Compliance
			World Bank compliant ESMF is already developed for the project and will guide the impact assessment and management plans. (***Section 6 and 8***) Identification of the area of impact, types of impacts and affected stakeholders, to be addressed/ mitigated/ managed and consulted, respectively. Conducting environmental and social assessment of the Project to identify E&S risks and impacts of the project. It shall inform the design of the project, and be used to identify mitigation measures and actions		
2.	PS 2: Labour and Working Conditions	OP 4.01: Environmental Assessment	The economic growth through employment creation and income generation is recognised and balanced protecting the basic rights of workers. This standard outlines the minimum requirements of working conditions, protection to the workforce (including issues of child and forced labour) and ensuring occupational health and safety of both its employees as well as non-employees' working through contractors.	Yes	The construction and operation phase for the Project will include employment of labour for varying activities such as widening of access roads, site preparation, boundary wall construction and module installation The Project will also require the establishment of temporary labour camps during the construction phase at all sites and staff accommodation during the operation phase that fall within the purview of IFC PS 2 and OP 4.01.
3.	PS 3: Resource Efficiency and Pollution Prevention	OP 4.01: Environmental Assessment	The Standard outlines the approach to pollution prevention and abatement in line with internationally disseminated technologies and practices.	Yes	Some air emissions and pollution discharge is anticipated from the Project including use of D.G. sets, use of groundwater in project activities (both during construction and operation phase) and labour camp, impact on drainage, wastewater discharge from labour camps, solid waste disposal such as broken solar panels, general office waste, waste generated during repair and maintenance during project life cycle. Water requirement during construction and operation phase, will also lead to stress on available water resources. The above activities fall within the purview of PS 3 and OP 4.01.

S. No.	IFC PS (2012)	WB- Safeguard Policies	Requirement	Standard Triggered	Applicability/ Compliance
4.	PS 4: Community Health, Safety & Security	OP 4.01: Environmental Assessment	The Standard requires a project to evaluate risks and impacts to the health and safety of the affected community during the Project life cycle and establish measures to avoid minimize and reduce risks and impacts from the Project.	Yes	The construction and operational phases of the project will have impacts on neighbouring communities particularly traffic safety risks during movement of construction materials and machinery. Electrocution risk linked to transmission line and substations during operation phase. In addition, there will be interaction of community with security personnel during construction and operation phases. These falls under purview of PS 4 and OP 4.01.
5.	PS 5: Land Acquisition and Involuntary Resettlement	OP 4.12: Involuntary Resettlement	The PS-5 applies to physical or economic displacement resulting from the <u>following types of land transactions</u>: ***Type I:*** Land rights for a private sector project acquired through expropriation or other compulsory procedures; ***Type II:*** Land rights for a private sector project acquired through negotiated settlements with property owners or those with legal rights to land, including customary or traditional rights recognised or recognisable under the laws of the country, if expropriation or other compulsory process would have resulted upon the failure of negotiation The O.P 4.12 applies to direct physical and economic displacement resulting from the following types of land acquisition or restrictions on land use undertaken or imposed in connection with project implementation: (a) involuntary taking of land resulting in relocation or loss of shelter, loss of assets or access to assets, or loss of income sources or means of livelihood; (b) Involuntary restriction of access to legally designated parks and protected areas that	Yes (for Private and Patta land) Yes- for encroached/ squatted upon land	The Project will involve land procurement (Government and Private land) for development of Solar Park and its associated facilities. The IFC PS and WB OP 4.12 are likely to be applicable on the project if land is taken in the types of transactions identified and will result in physical or economic displacement. This will in turn guide the land procurement process, the Resettlement Action Plan and Livelihood Restoration Plan for the project. It is RUMSL's intention to use the MP Mutual Consent-based Land Purchase Policy, 2014 for land procurement of private and patta land. However the land act may be used for the parcels that do not have clear titles or have ownership disputes, if any are found during the MP Mutual Consent process. The process of land procurement is understood to be through negotiated settlement hence, PS 5 is applicable. Economic displacement of households without legal rights or claims to private land, or those occupying government land for agriculture, and common land used

S. No.	IFC PS (2012)	WB- Safeguard Policies	Requirement	Standard Triggered	Applicability/ Compliance
			might result in adverse impacts on the livelihoods of the displaced persons To address the above impacts, a resettlement action plan (RAP) is required that will cover the following: (a) Displaced persons are informed about their options and rights pertaining to resettlement; (b) Consulted on the relocation options; (c) Provided with prompt and effective compensation at full replacement cost for loss of assets If the impacts include physical displacement, the RAP then should ensure that: (a) Moving allowances are provided for relocation; (b) Residential housing/housing sites/agricultural sites as required in combination is provided; (c) Provided with development assistance for land preparation, credit facilities, training or job facilities; (d) Offer transitional allowance for the time needed to restore livelihood and standard of living		for grazing, collection of fodder, etc. will be covered through RAP-LRP, as their displacement and related impacts will be a result of involuntary land take.
6.	PS 6: Biodiversity Conservation and Sustainable Management of Natural Living Resources	OP 4.04: Natural Habitats	The Standard aims at protecting and conserving biodiversity, the variety of life in all its forms, including genetic, species and ecosystem diversity and its ability to change and evolve, is fundamental to sustainable development.	Yes	The project site harbours many Indian Wildlife Protection Act 1972 along with the other IUCN NT Species. The species are currently using the habitat and might be displaced nearby areas once the construction activities are started.
7.	PS 7: Indigenous Peoples	OP 4.10: Indigenous Peoples	The Standard acknowledges the possibility of vulnerability of indigenous people owing to their culture, beliefs, institutions and living standards, and that it may further get compromised by one or other project activity throughout the life cycle of the project.	Yes	The villages in the project footprint area are comprised of ST population (primarily Bhil,) who may be impacted by the project activities, in terms of loss of Common property resources, loss of structures and impact on livelihoods. The PS is thus applicable for all three sites.

S. No.	IFC PS (2012)	WB- Safeguard Policies	Requirement	Standard Triggered	Applicability/ Compliance
			The O.P 4.10 (revised in 2013) recognizes the linkage between land and the cultural identity of Indigenous People (IP), and requires a social assessment, process of free, prior and informed consultation with the affected IP community at each stage of the project, preparation of Indigenous People's Plan (IPP) and disclosure of the same.		The FPIC approach paper has identified one village (Parsula) where the process will be carried out to seek consent for the project.(Details are included in the Draft FPIC approach note, submitted 3rd Sept 2020)
8.	PS 8: Cultural Heritage	OP 4.11: Physical Cultural Resources	The Standard aims to protect the irreplaceable cultural heritage and to guide clients on protecting cultural heritage in the course of their business operations. In addition, the requirements of this PS on project's use of cultural heritage are based in part on standards set by the Convention on Biological Diversity	No	Presently the Standard is not expected to be triggered for the project. However, structures or places with religious or cultural significance may be identified during the resource mapping process for FPIC and during the RAP survey, the applicability of the Standard will be reviewed and management plans prepared, if avoidance is not feasible.
			WB/IFC EHS Guidelines		
9.	General EHS Guidelines		The IFC/WB General Environmental, Health and Safety (EHS) Guidelines documents Good International Industry Practices (GIIPs) by covering the ambit of environmental, social and ecological concerns associated with establishing and managing a project. The aspects covered in the guidelines include ambient air quality monitoring, energy conservation, wastewater management, water conservation processes, hazardous materials management, waste management, noise reduction processes, occupational health and safety, community health and safety and project phase-specific concerns.	Yes	General EHS Guidelines will need to be followed during the construction and operation phase of the project.
10.	Electric Power Transmission and Distribution		The IFC/WB EHS Guideline for Electric Power Transmission and Distribution covers industry-specific issues associated with laying, operation and	Yes	Aspects of the EHS guidelines with respect to occupational health and safety, right of way maintenance and hazardous materials management as

S. No.	IFC PS (2012)	WB- Safeguard Policies	Requirement	Standard Triggered	Applicability/ Compliance
			dismantling of transmission towers, lines and substations. Key issues covered in the guidelines include terrestrial habitat alteration, right-of-way access, right of-way maintenance, electrocution risk to bird and bat species, health and safety of working with or near electric and magnetic fields, storage and maintenance of hazardous materials (e.g. oils, fuels, preservatives) and aircraft navigational safety.		is relevant for internal transmission lines and the pooling substation infrastructure has been covered in the report.
11.	IFC/EBRD Workers' accommodation: processes and standards		This guidance note, provide guidance on the provision of housing or accommodation for workers by employers and the issues that arise from the planning, construction and management of such facilities.	Yes	These guidelines will need to be followed during establishment of labour camps for the project.

3.1.1 Environmental and Social Management Framework of Ministry of New and Renewable Energy

Ministry of New and Renewable Energy have framed an Environmental and Social Management Framework for Solar PV Park, dated February 2017. The framework had identified the following key environmental and social issues/ impacts to be kept in consideration for sub-projects:

- Impacts on biological environment, especially forest land;
- Impacts due to water requirements as most projects are located in water scarce regions;
- Impacts on livelihoods of land owners and land users;
- Impacts on common property resources
- Impacts due to soil erosion and dust;

In keeping with the impacts identified, the ESMF requires the formulation of a project specific Environmental and Social Management Plan, which would include relevant management plans, such as the following:

- Resettlement Action Plan/ Framework
- Gender Action Plan
- Indigenous Peoples Policy Framework
- Stakeholder Engagement Plan
- Grievance Redressal Mechanism

3.2 Applicable Environmental Standards

3.2.1 National Level Standards

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

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

3.2.2 IFC/ WB Standards

The General EHS Guidelines (30th April 2007) of IFC/ WB have outlined following environmental standards which needs to be complied for the project.

- IFC/WB Air Emissions and Ambient Air Quality Standards;
- IFC/WB Guidelines for treated sanitary sewage discharges; and
- IFC/WB Noise Standards

4. ENVIRONMENTAL AND SOCIAL BASELINE

This section describes the physical, biological, cultural and human conditions that will prevail in the absence of the Project, including interactions amongst them. It also includes projected changes that will be used by the Project such as existing traffic, population etc. The baseline information has been collected through primary and secondary sources with specific reference to project aspects which may influence the surrounding environment from the solar park development activities. This data had been collected through a concerted effort of:

- Reconnaissance survey and field visits;
- Primary monitoring of key environmental parameters like air, water, soil, noise, ecological and socioeconomic survey during summer season;
- Stakeholder consultations with local people, government departments such as Forest Department, Panchayats etc.; and
- Review of literature on available secondary information.

The purpose of describing the environmental and social baseline 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 study area and its importance for sustaining species of conservation importance, in terms of providing habitat contiguity to the surrounding region and dependency of surrounding communities.

4.1 Study Area

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

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 Project includes land used for the setting up the Solar PV panels, transformer rooms, site office, access roads, storage of material and equipment, labour camps and pooling substation at Solar Park site. It was informed by RUMSL that all temporary structures during construction phase, i.e. material storage area, labour camp, site office etc. will be established only within the Solar Park area. The Project footprint details provided by RUMSL dated 19 June, 2020 has been considered for writing this report.

4.1.2 Project Area of Influence (AoI)

The effects of the Project and Project activities on a particular resource or receptor will have spatial (distance) and temporal (time) dimensions, the scale of which is dependent on a number of factors, including:

- Nature of the activity;
- Specific resource or receptor;
- Sensitivity of that resource or receptor; and

- Whether the impact is direct or indirect (e.g. a secondary effect).

These factors are all incorporated in the definition of the Project's Area of Influence (AoI).

The Project area of influence 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 expected impacts.

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

- **Environmental parameters:** Project site boundary, immediate vicinity, access road and surroundings, i.e. a study area of approximately 2 km distance from the Solar Park site. The AoI for individual environmental attributes is as below:
  - *Air Quality*: Dust emissions, fugitive dust –typically up to 500 m – 1 km from major construction areas;
  - *Noise*: Noise impact area (defined as the area over which an increase in environmental noise levels due to the Project can be detected) – typically 500 m from construction site;
  - *Soil environment*: The impacts on soil and land- typically upto 500 m from project foot print area;
  - *Water Environment:* The impacts on water quality of water bodies – on the water bodies present within the Project footprint and in nearby area of project activities.
- ***Flora and Fauna (Terrestrial and Aquatic)*:** This includes the areas immediately adjacent to the project footprint within which a zone of ecological disturbance is created through increased dust, human presence and project related activities (e.g., trampling, transportation activities). This kind of disturbance has been estimated to occur within 5 km of the project footprint;
- **Social and Cultural:** The project footprint is spread across 11 villages (excluding Transmission Line, the alignment for which is being finalised). Roads for movement of materials and people during the construction phase will be included in the Area of influence, based on volume and intensity. This is taken as the area of influence, though social impacts are likely to largely remain confined to these villages. Other villages/groups may come to be included if it emerges during RAP consultations that there is economic dependence on the proposed project areas. The detailed baseline will emerge after the RAP survey and analysis have been completed and this will be included in the RAP document.

4.2 Physical Environment

4.2.1 Site Visit

ERM team undertook a site survey from 10 to 25 December 2019 to understand the site setting and to map environmental sensitivities in the area. The collection of soil and water samples was undertaken from 11 to 13 December 2019. Air and noise monitoring was carried out from 19 to 25 December 2019 and traffic count was undertaken on 20 December 2019.

4.2.1.1 Primary Baseline Data Collection

M/s Netel India Private Limited, an MoEF&CC and NABL (National Accreditation Board for Testing and Calibration Laboratories) accredited laboratory was engaged for collection of baseline information on ambient air quality, surface water quality, ground water quality, ambient noise quality, soil quality and traffic count. The primary baseline data was collected for aspect detailed out in Table 4.1.

Table 4.1 Primary Baseline Data Collection

S.N.	Environmental Attribute	No. of Locations/ Area	Frequency	Remarks
1	Ambient Air Quality	2 for Unit 6 & 7 and 2 for Unit 8	24 hourly, twice a week for one week	Ambient air quality samples of nearest village in both upwind and downwind direction was monitored to understand baseline AAQ of the area
2	Ambient Noise Quality	5 for Unit 6 & 7 and 5 for Unit 8	Once for 24 hours during monitoring period	Ambient noise samples were collected over a 24 hour period from within the villages
3	Ground Water Quality	4 for Unit 6 & 7 and 4 for Unit 8	Once during monitoring period	Groundwater was mainly collected from the primary drinking water source such as hand pumps/dug wells to analyse ground water quality
4	Surface Water Quality	3 for Unit 6 & 7 and 2 for Unit 8	Once during monitoring period	Water samples was collected from ponds/lakes from the study area villages that were found to be used by the inhabitants for washing/bathing etc.
5	Soil Quality	3 for Unit 6 & 7 and 3 for Unit 8	Once during monitoring period	Soil samples covering different land uses were collected from the study area
6	Traffic Count	1 traffic junction for Unit 6 & 7 and 1 for Unit 8	Once during monitoring period	Traffic count was done on hourly basis for 24 hours at the road proposed to be used for transportation of raw material and manpower during construction phase

The monitoring location map for Unit 6 & 7 (Moman Badodiya) and Unit 8 (South Shajapur) are shown below in ***Figure 4.1*** and ***Figure 4.2***.

4.2.1.2 Secondary Baseline Data Collection

Secondary baseline data collection involved identifying and collecting available published material and documents. Information on various environmental aspects like soil, geology, hydrogeology, hydrology, drainage pattern, ecology, meteorology, etc. were collected from different institutions, government offices and literatures etc. Secondary data was collected for the aspects as given in ***Table 4.2***.

Table 4.2 Sources of Secondary Baseline Data Collection

S.N.	Attribute	Source of Data Collection
1	Meteorological data	India Meteorological Department (IMD)
2	Geology, geomorphology, hydrogeology and hydrology	■ U.S. Department of the Interior, U.S. Geological Survey, 2017 ■ National Remote Sensing Centre (NRSC)-Bhuvan services ■ Central Ground Water Board (CGWB) ■ Geological Survey of India (GSI) ■ India Water Tool - Ministry of Water Resources, 2014 ■ Water Resources Department Madhya Pradesh (MPWRD) ■ National Water Development Agency (NWDA) ■ Department of Agriculture, Cooperation & Farmers Welfare (AGRICOOP)
3	Land use	■ Topographical maps ■ Satellite imageries ■ Google earth imageries

S.N.	Attribute	Source of Data Collection
4	Natural Hazards	■ National Flood Vulnerability Assessment System ■ World Resource Institute (WRI) ■ Vulnerability Atlas of India ■ Building Materials and Technology Promotion Council

Environmental baseline data was collected through primary surveys as well as through secondary sources by literature survey and discussions with the concerned departments/agencies. Details of data collected are summarized in subsequent sections.

Figure 4.1 Location Map of Environmental Baseline Monitoring Stations at Unit 6 & 7 (Moman Badodiya)

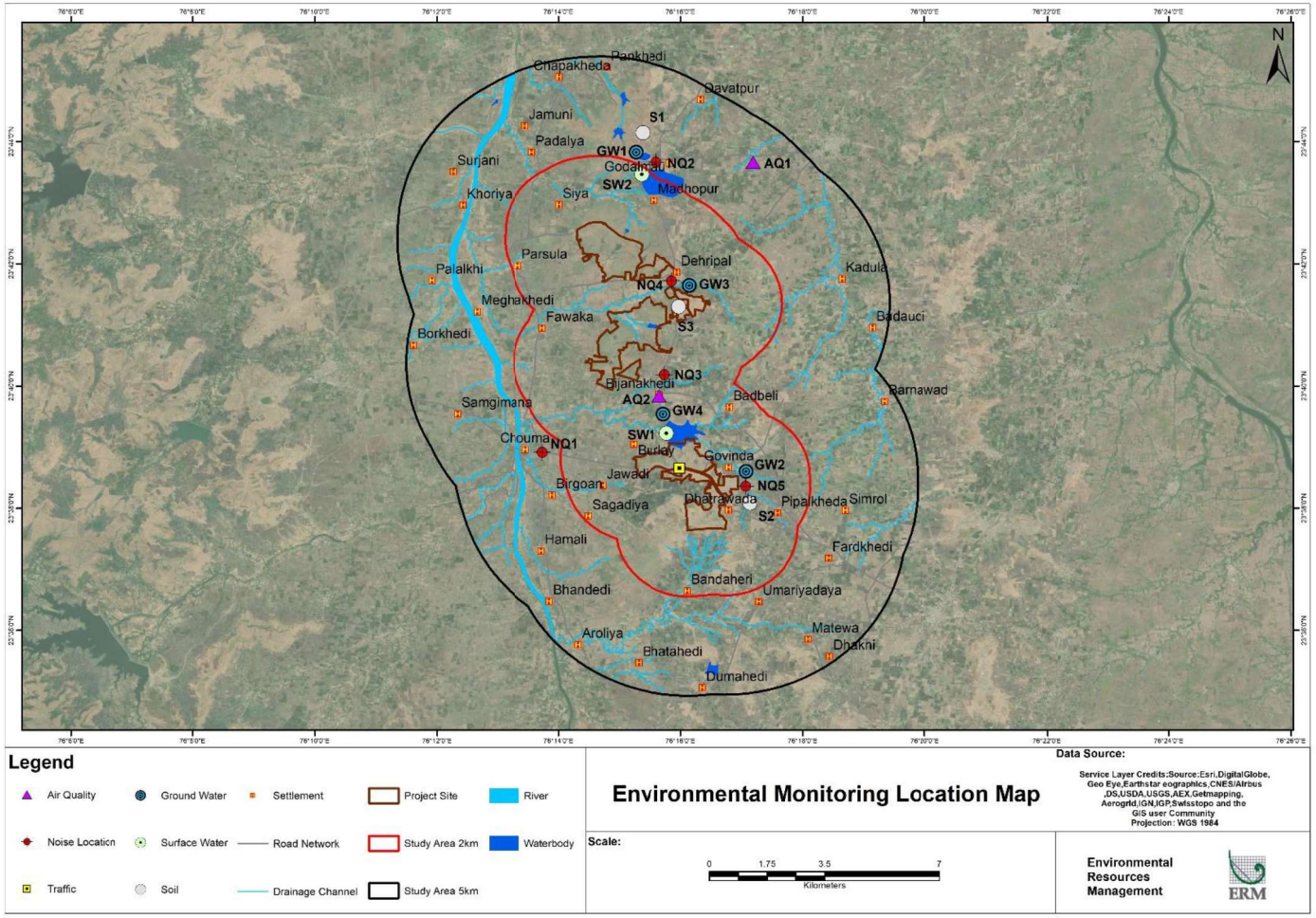
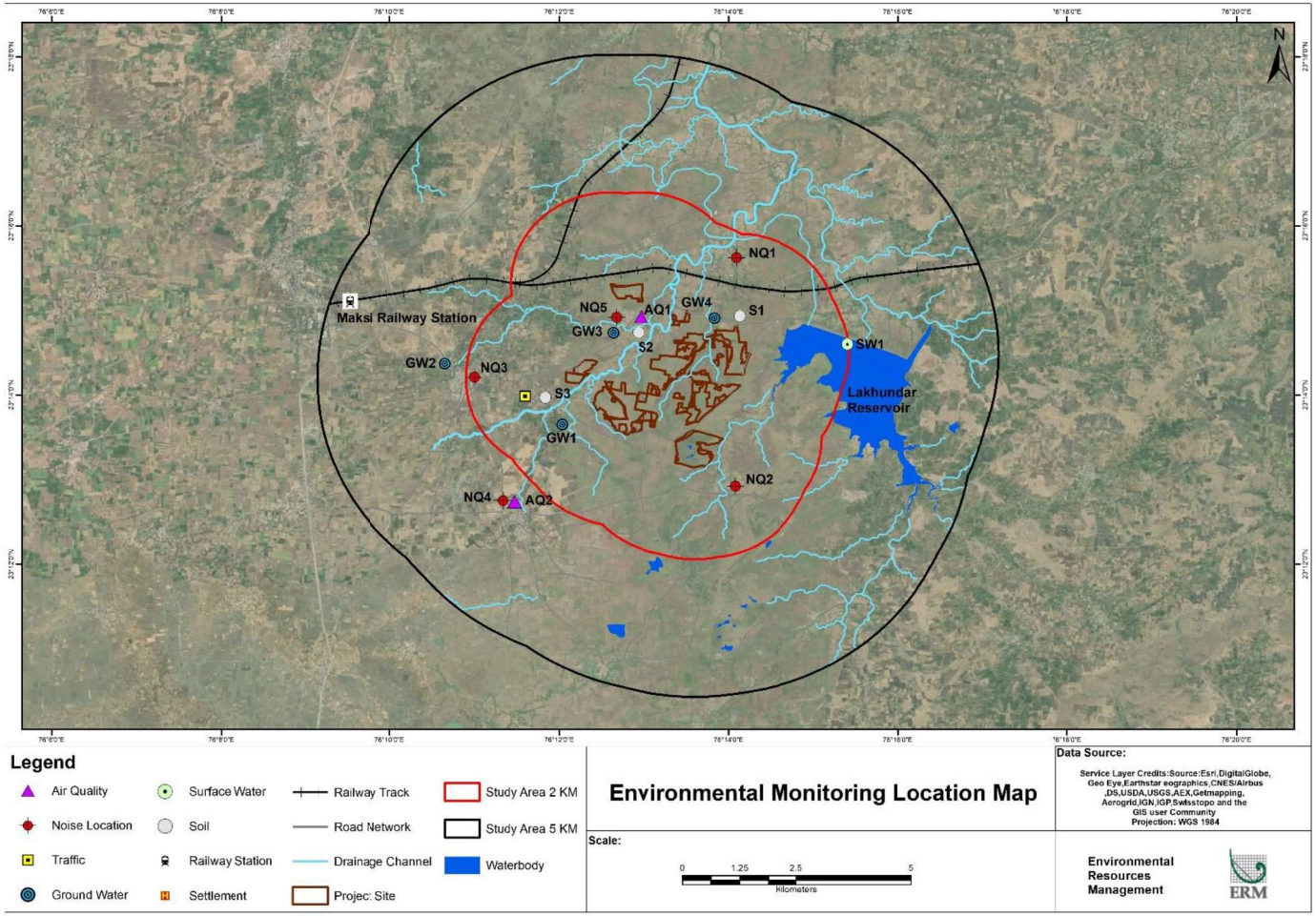


Figure 4.2 Location Map of Environmental Baseline Monitoring Stations at Unit 8 (South Shajapur)



4.3 Physical Environment Baseline

4.3.1 Land use and Land cover

The land use and land cover (LULC) map for the proposed Project is prepared by adopting interpretation techniques of the high resolution (30m or less) satellite image along with ground truthing surveys undertaken during site reconnaissance by the Project team members, Survey of India toposheet and census records. Image classification was done using visual interpretation techniques and digital classification image processing software say ArcGIS.

For the present study, ArcGIS 10.7.1 software was used for pre-processing, rectification, and classifying the satellite data for preparation of land use land cover map for assessing and monitoring the temporal changes in land use land cover and land developmental activities. The methodology followed in the digital classification of satellite data is as under:

- Digitization of administrative base maps of the district and bring them to a projection system. For the current study UTM projection is used. The details are as below:
  - Projection: Universal Transverse Mercator (UTM)
  - Projected Coordinate System: WGS_1984_UTM_Zone_43Q
- Landsat8 (30m resolution) imagery for land use and land cover mapping was geo-referenced with Google Earth Images. The satellite scenes covering the said district were put in the form of mosaic.
- Land use and land cover mapping was done using the supervised image classification of Landsat8. The accuracy of classified image was checked through confusion matrix. The classification was further refined till the desired accuracy is reached.
- The classified raster image was converted to vector layer and then brought under GIS environment for generation of Land-use and land cover maps with proper labels. Finally the area calculation for various categories of land use and land cover was done.

The breakup of land use in the 5 km study area of Shajapur sites is provided in ***Table 4.3*** and shown in ***Figure 4.3*** and ***Figure 4.4***. The table suggests that the land use is primarily agricultural (~77.62% and ~71.81%) followed by scrub land (~17.70% and ~20.68%) practices in the 5 km study area of Moman Badodiya and South Shajapur sites.

Table 4.3 Land use of Shajapur Solar Park (5-km radius Study Area)

S.N.	Land Use Type	Unit 6& 7 (Moman Badodiya)	Unit 8 (South Shajapur)
		Area (in %)	Area (in %)
1.	Open Scrub	17.70	20.68
2.	Agriculture Land	77.62	71.81
3.	Drainage Channels	0.76	1.57
4.	Road Network	0.28	0.64
5.	River	1.25	-
6.	Settlement	1.64	1.76
7.	Waterbody	0.76	2.90
8.	Under construction Road	-	0.15
9.	Industry	-	0.28

S.N.	Land Use Type	Unit 6& 7 (Moman Badodiya)	Unit 8 (South Shajapur)
		Area (in %)	Area (in %)
10.	Railway Track	-	0.21
	Total	**100%**	**100%**

Source: GIS based assessment for the Project; Data Source: Esri, Digital Globe, Geo Eye, Earthstar geographics, CNES/Airbus, DS, USDA, AEX, Getmapping, Aerogrid, IGN,IGP,Swisstopo and the GIS user community

The land use break-up of the Project Site foot print is given in ***Table 4.4*** below and shown in ***Figure 4.5*** and ***Figure 4.6***.

Table 4.4 Land use of Shajapur Solar Park Project Boundary

S.N.	Land use Type	Unit 6 & 7 (Moman Badodiya)	Unit 8 (South Shajapur)
		Area (in %)	Area (in %)
1.	Open Scrub	88.55	91.93
2.	Agriculture Land	9.40	7.54
3.	Drainage Channels	0.26	0.10
4.	Road Network	0.15	0.13
5.	Settlement	0.50	0.01
6.	Waterbody	1.13	0.30
	Total	**100.0**	**100.0**

Source: GIS based assessment for the Project; Data Source: GIS based assessment for the Project , Data Source: Esri, Digital Globe, Geo Eye, Earthstar geographics, CNES/Airbus, DS, USDA, AEX, Getmapping, Aerogrid, IGN,IGP,Swisstopo and the GIS user community

The above table suggests that the Project Site footprint is almost open scrubland (88.55% & 91.93%) followed by small patches of agriculture land (9.4% & 7.54%) at Moman Badodiya and South Shajapur Site.

Figure 4.3 Land Use Map – Unit 6 and 7 (Moman Badodiya) – 5 km Study Area

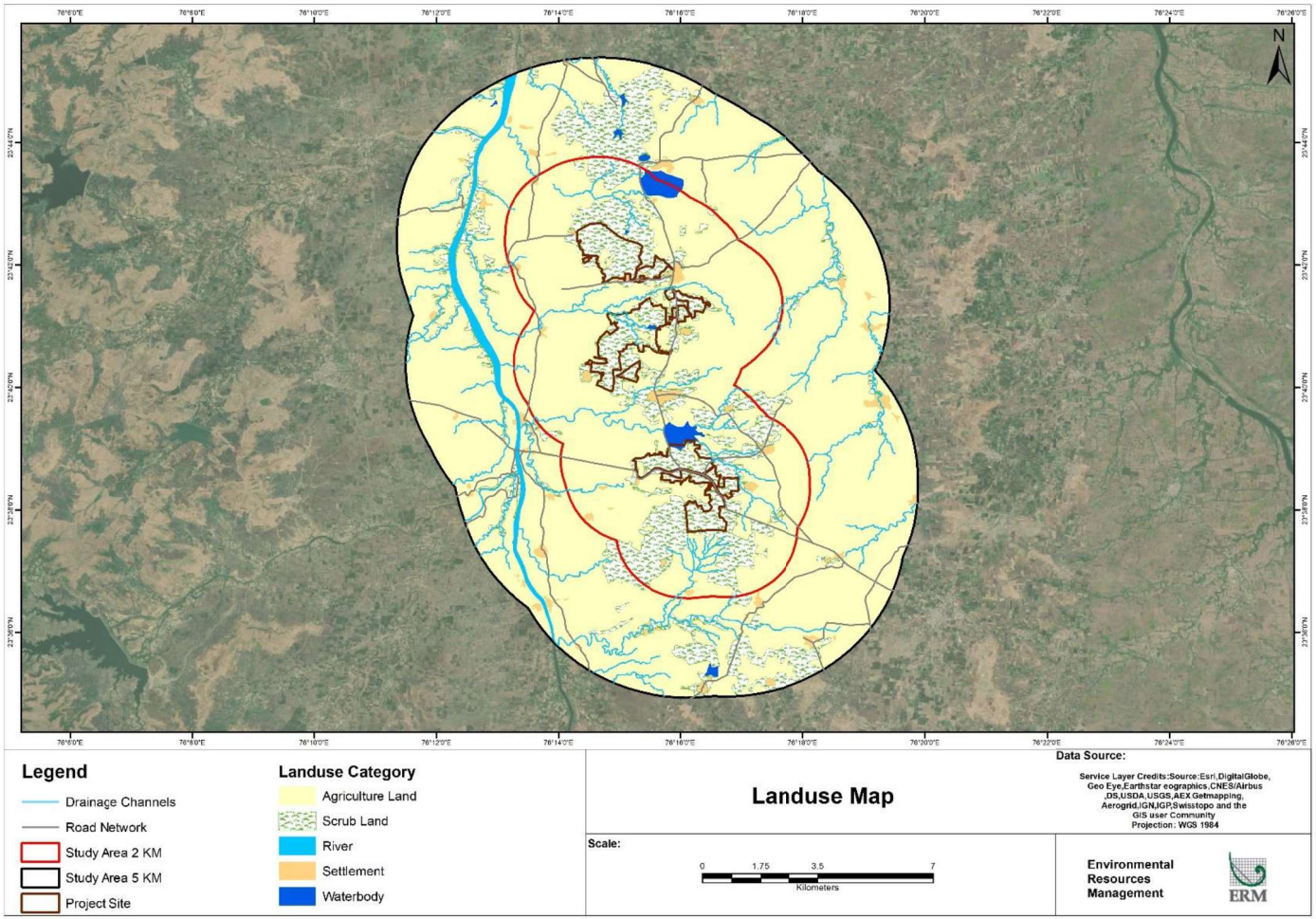


Figure 4.4 Land Use Map – Unit 8 (South Shajapur) – 5 km Study Area

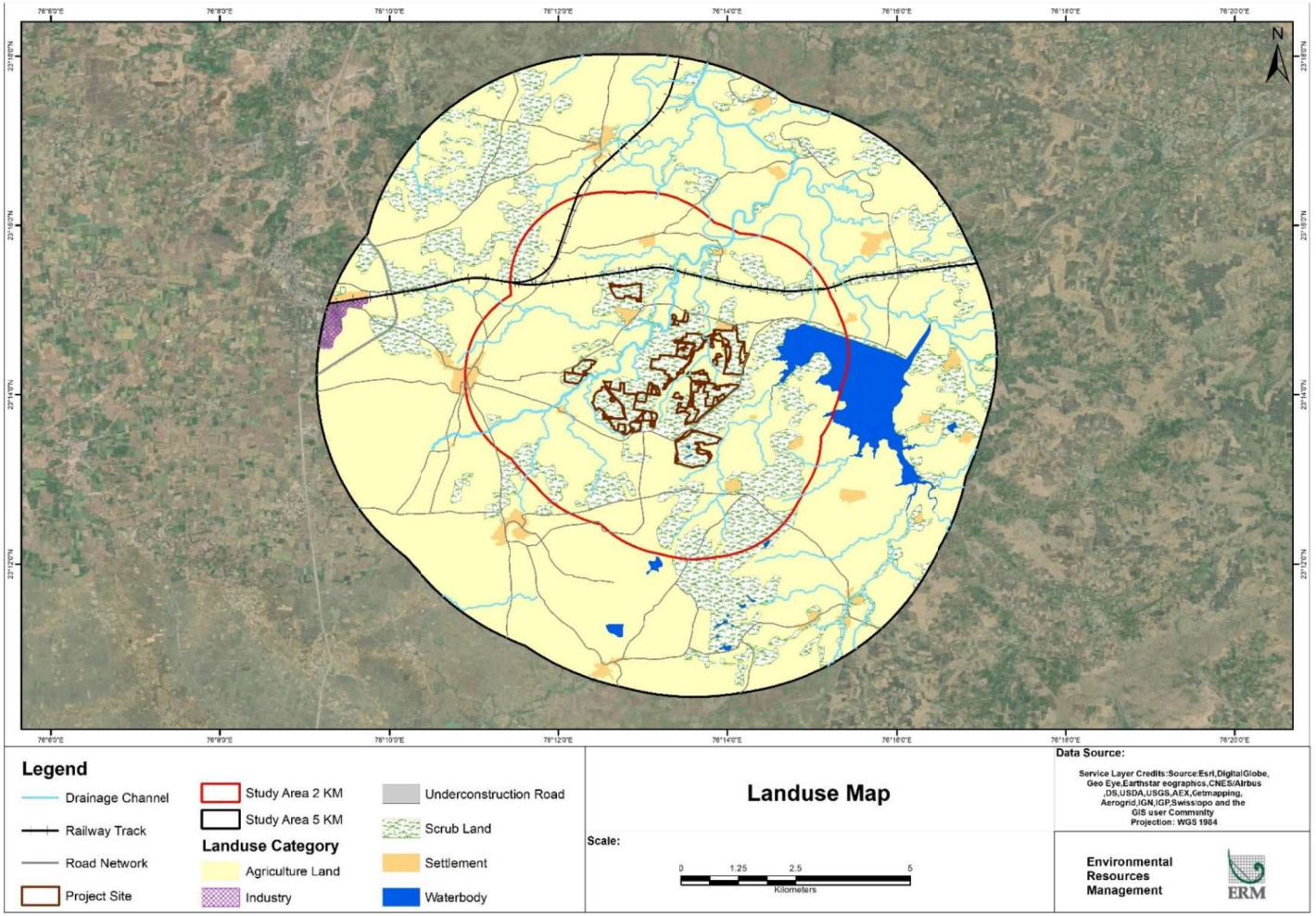


Figure 4.5 Land Use Map - Unit 6 and 7 (Moman Badodiya) Project Boundary

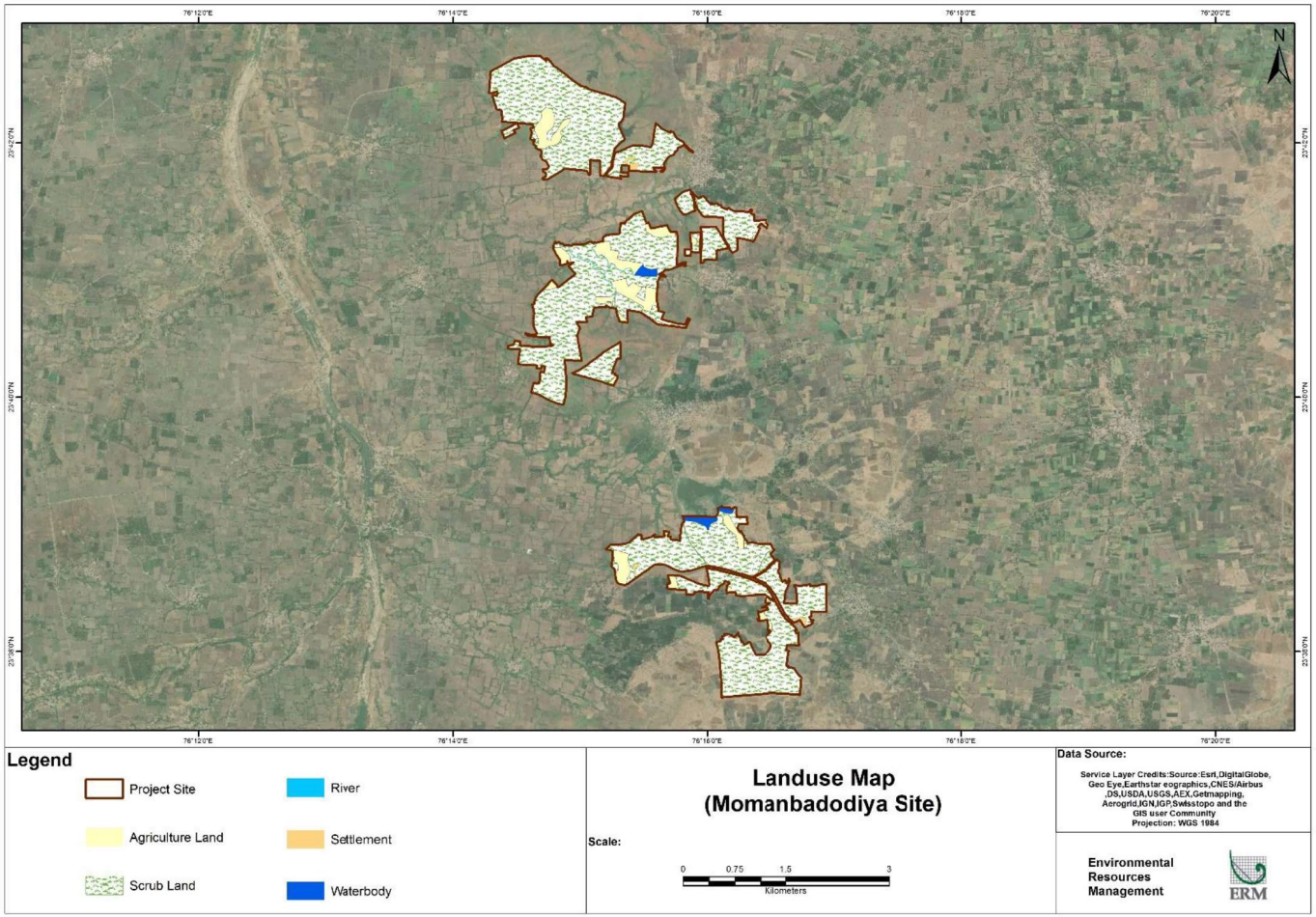
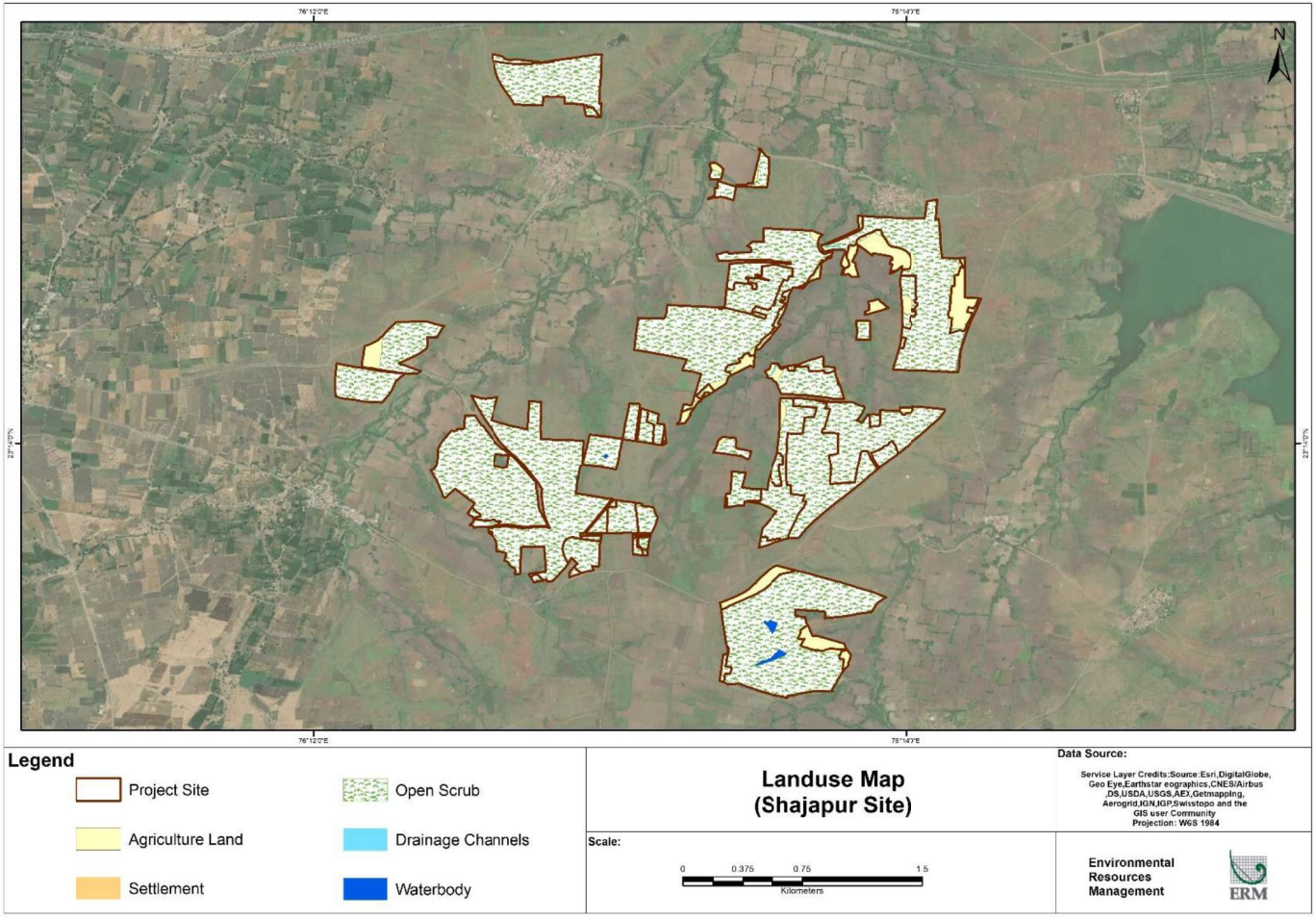


Figure 4.6 Land Use Map – Unit 8 (South Shajapur) Project Boundary



4.3.2 Topography and Slope

The topography and slope information plays a vital role in understanding land use and runoff-recharge characteristics of the terrain. Topography of Unit 6 and 7 (Moman Badodiya) Site varies between ~390 m above mean sea level (amsl) and ~525 m amsl along the ~30 km extent. The topographic highs were observed in the western and south-eastern parts of the site. The topographic lows were observed mostly along major stream which runs along the centre from south to north.

Topography within the Unit 8 (Shajapur) Site varies between ~425 m above mean sea level (amsl) and ~525 m amsl along the ~25 km extent. The topographic highs were observed along the eastern, western and southern periphery of the area. The topographic lows were observed mostly along the major stream which runs from south-east to north-west of the area. The lowest elevation was observed in the northern and central parts of the area, near the outlet of the stream.

The 5-km radius Digital Elevation Map (DEM) of the study area for Unit 6 and 7 (Moman Badodiya) and Unit 8 (South Shajapur) subprojects are presented in ***Figure 4.7*** and ***Figure 4.8*** respectively.

Slope information plays a vital role in understanding land use and runoff- recharge characteristics of the terrain. The slopes of watersheds were classified into following categories: Flat (0-2%), gentle (2-9%), moderate (9 -15%), steep (15 -30%) and very steep (above 30%). Slope map incorporating this classification is presented in ***Figure 4.9.***

Slope in the watershed of Shajapur and Moman Badodiya Sites was observed to be under 8 % ranging from very flat to gentle category. Only few patches of moderate slope was observed in both the watersheds.

The slopes in the watershed of Moman Badodiya Site ranging from flat to gentle were observed along the western and eastern parts of the watershed. Relatively gentle slopes were observed along the major stream flowing from south to north in central part of the watershed. Slope in the Site area mainly ranged from flat to gentle. The slope pattern at the watershed and Moman Badodiya Sites (Unit 6, Unit 7A and Unit 7B) generally facilitate lower runoff, higher infiltration and higher stagnation of water. Furthermore, these slopes would increase the flood risks in case of extreme precipitation.

Very flat to gentle slope was uniformly distributed in the watershed of Shajapur Site. Relatively steeper slope was observed along the northern and south-eastern periphery of the watershed. Slope in the Site area mainly ranged from flat to gentle with few patches of very flat slope. The slope pattern in the watershed and the Site is likely to facilitate lower runoff, higher infiltration and higher stagnation of water. Furthermore, these slopes would increase the flood risks in case of extreme precipitation.

Figure 4.7 Digital Elevation Map (DEM) of Unit 6 and 7 (Moman Badodiya)

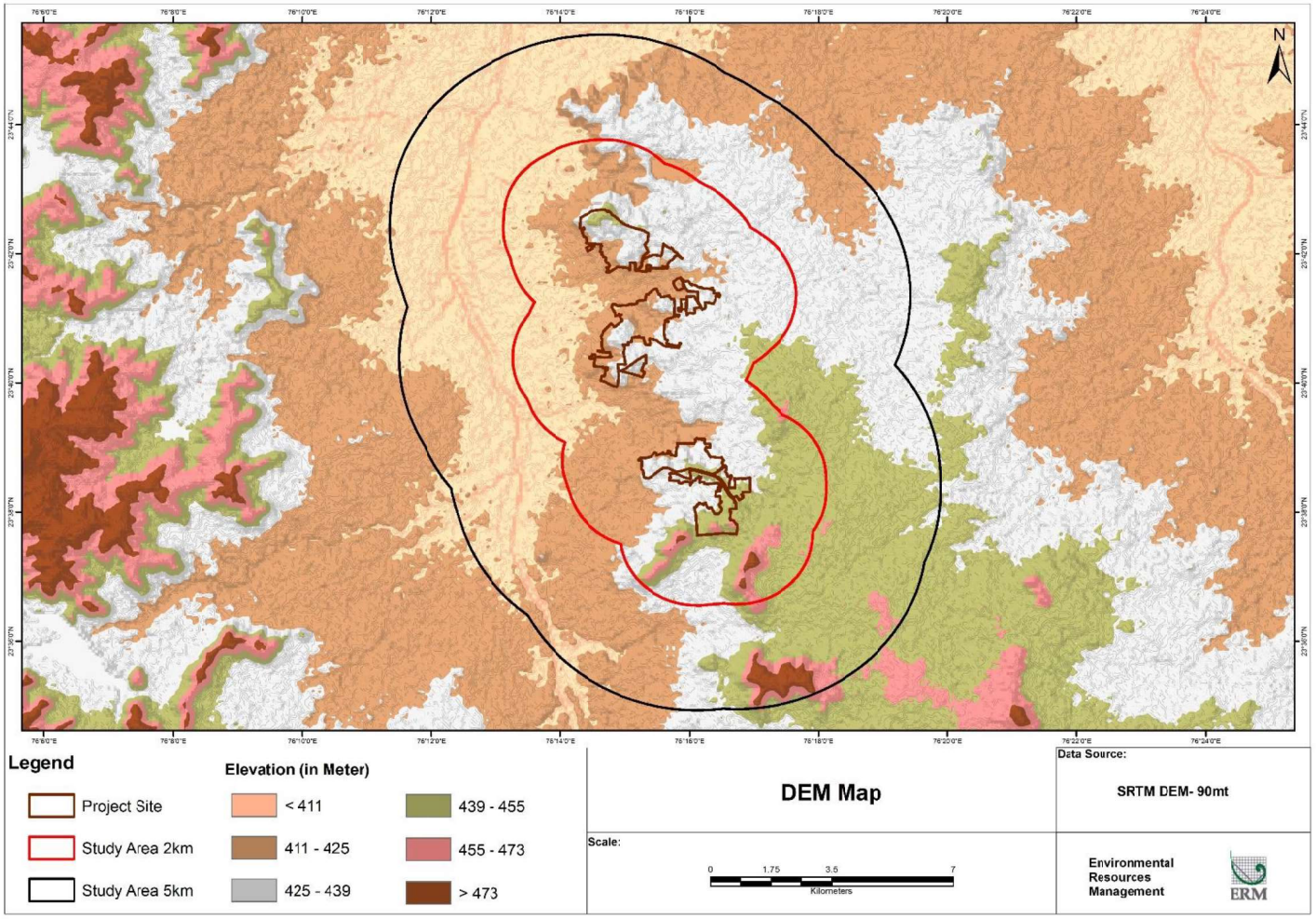


Figure 4.8 Digital Elevation Map of Unit 8 (South Shajapur)

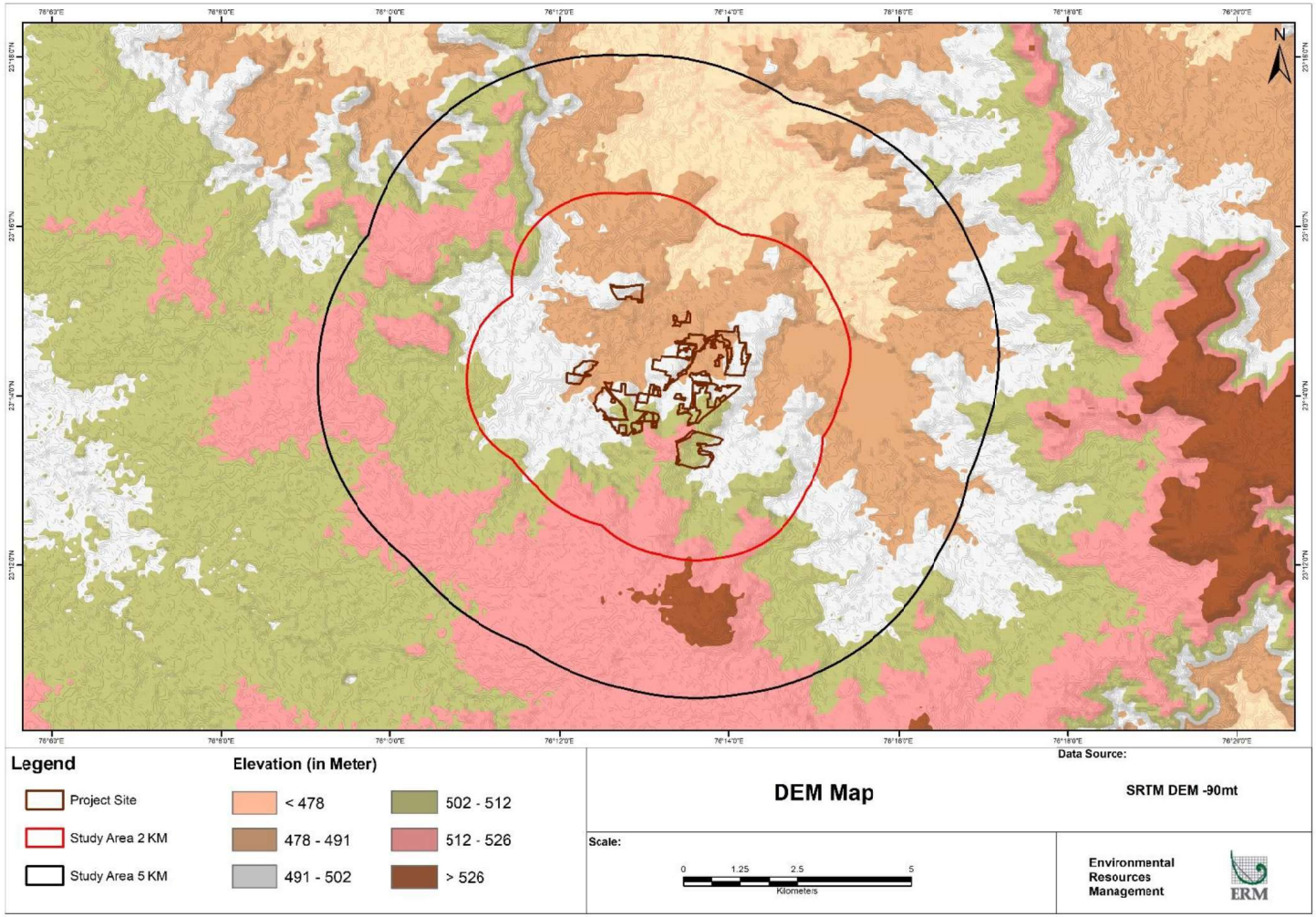
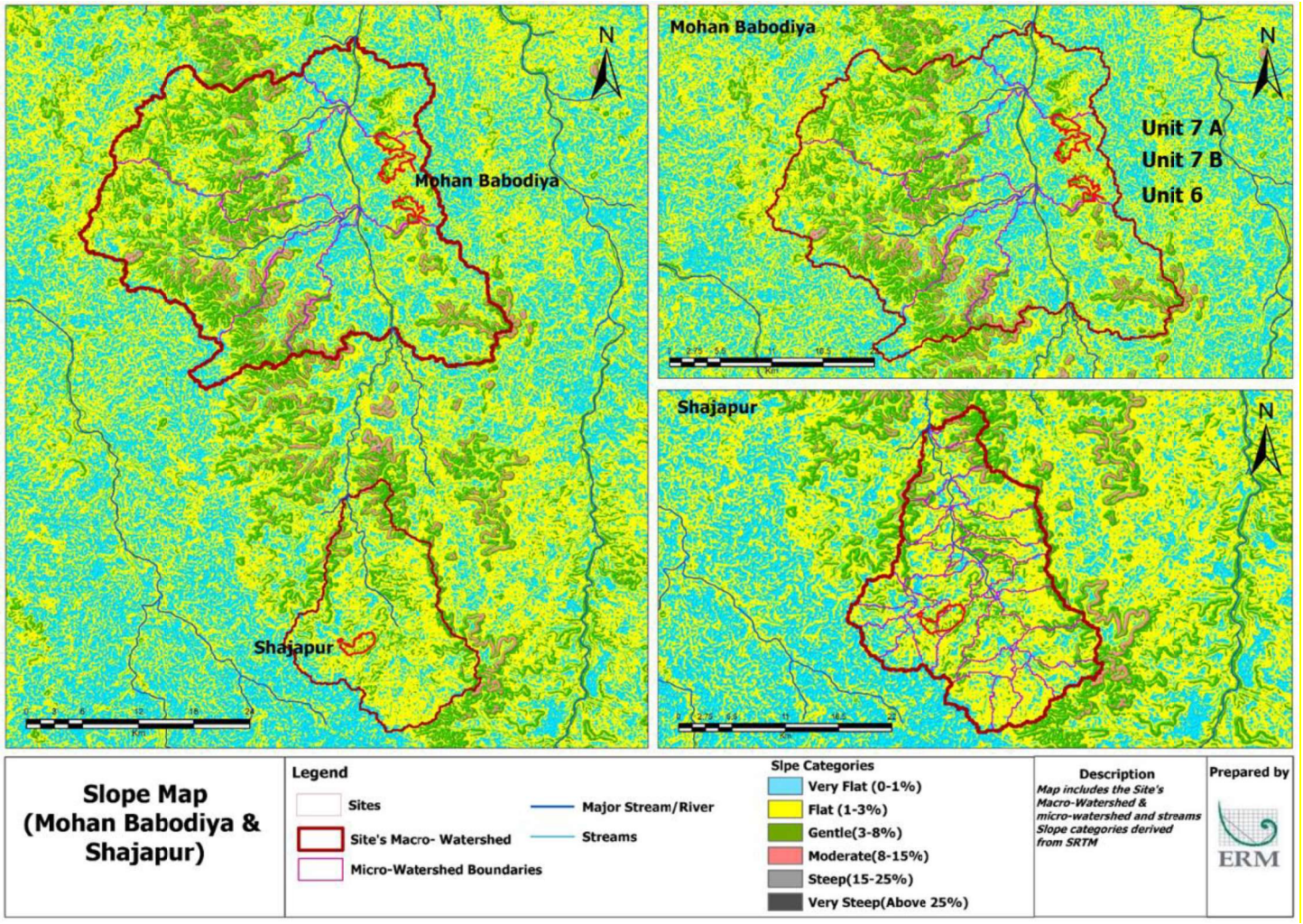


Figure 4.9 Slope Map



4.3.3 Geology and Geomorphology

4.3.3.1 Geology

The Chambal watershed region is a junction between the north-western lobe of the Vindhyan watershed and the south-eastern fringe of the Aravalli range such that the younger formations of the Vindhyan period have truncated and faulted against the Gwalior formation.

The north-western part comprises the intensely folded Archean formations while the south-eastern part is composed of horizontally reposing Vindhyan system. The Vindhyans of the southern part are covered by the Deccan Trap. In particular, the study region comprising of districts such as Neemuch, Agar and Shajapur is located in Malwa region of Madhya Pradesh and is underlain by rocks of Vindhyan Super Group (Pre-Cambrian) and the Deccan Traps (Upper Cretaceous to lower Eocene). ***Table 4.5*** presents the geology of the region.

Table 4.5 Stratigraphic succession of the Region

Age	Super Group	Member
Sub-Recent to Recent	Laterite, Quaternary	Alluvium, Laterite
Lower Eocene to Upper Creataceous	Deccan Traps	Basaltic lava flow
Pre-Cambrian	Lower Vindhyan	Limestone and conglomerate

4.3.3.2 Geomorphology

Geomorphic features integrated with geology and hydrogeology controls the occurrence, movement and quality of groundwater. The geomorphological features of the Site's watershed were extracted from National Remote Sensing Centre (NRSC) - Bhuvan services[1] and are presented in ***Figure 4.10.***

The Shajapur district lies on a part of Malwa plateau and are characterized by a typical Trappean geomorphology comprising extensive plain, low lying hills and hills clusters with gentle northerly slope. Western, south, south-eastern parts are highly undulated with broad flat topped hills, cluster terraces and isolated hills[2].

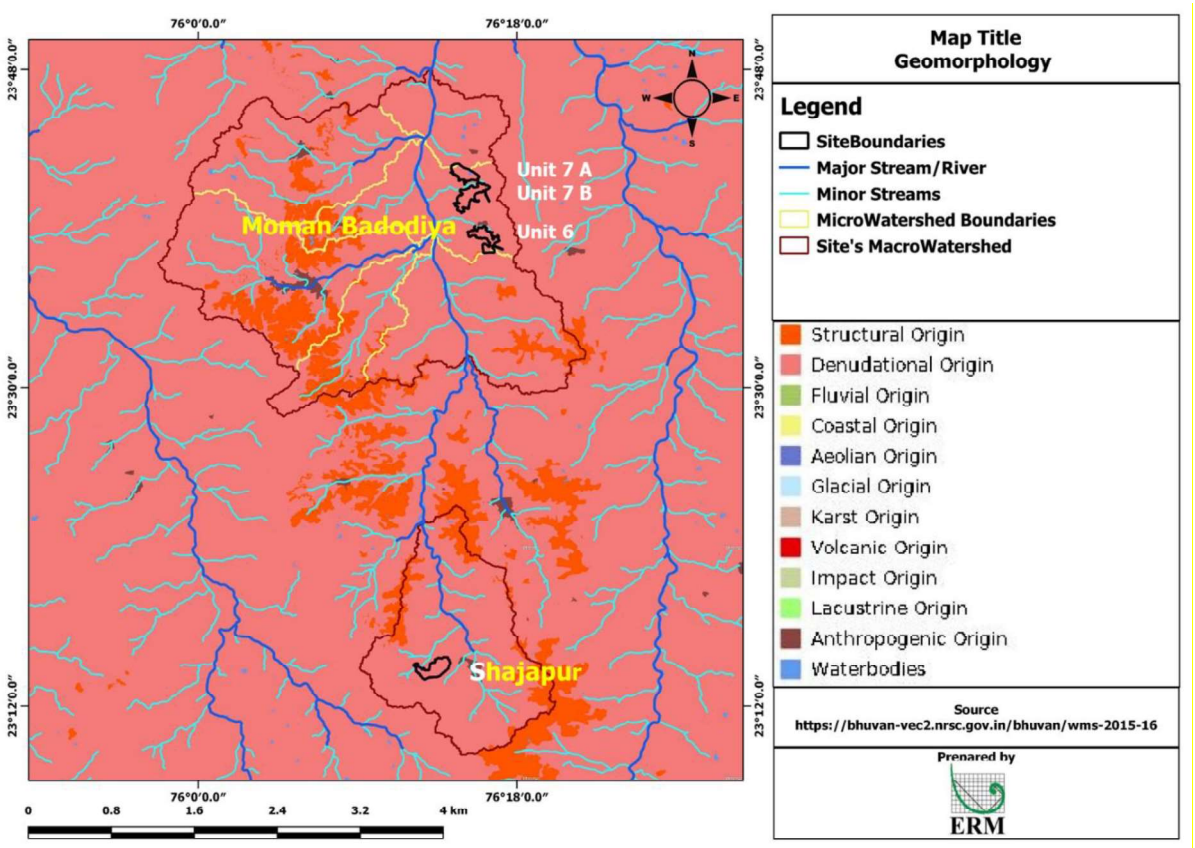
The watershed of both the Sites (Moman Badodiya and Shajapur) was observed to be under pediment complex of denudational origin with patches of structural origin along the western part of Moman Badodiya Site's watershed and northern periphery of Shajapur Site's watershed. Denudational origin features were reported along the flow of the major stream indicating their influence on topography through weathering caused by the flow of water. Geomorphic features of structural origin were observed only in patches in both the watersheds- these topographic features were formed by the differential wearing of rocks and the deposition of the resulting debris under the influence of exogenic geomorphic forces. The geomorphology of the region is not supportive of groundwater recharge due to presence of denudational features in large parts of the watershed. This is likely to result in poor yield and limited scope for groundwater development in the watershed. However, existence of major fractures/lineaments/ faults might influence the groundwater yield.

Within the Moman Badodiya and Shajapur Sites, topography is mainly influenced by denudational features. The prospects of groundwater recharge and occurrence are anticipated to be low resulting in limited scope for groundwater development. Few lineaments were reported in the vicinity of Moman Badodiya and Shajapur Sites. These are developed generally due to tectonic stress and strain and provide an important clue on surface features that are responsible for infiltration of surface run off into sub-surface and movement/ storage of groundwater. Lineaments in the pediplain or valley fill are

[1] http://bhuvan.nrsc.gov.in/bhuvan_links.php
[2] http://cgwb.gov.in/District_Profile/MP/Shajapur.pdf

considered significant in groundwater prospects. Further, the flood plains along the river course are expected to have good groundwater prospects.

Figure 4.10 Geomorphology Map of Site and Watershed



4.3.4 Soil Quality

The soil in the Shajapur district are of mixed type and there is no distinct boundary in between any two type of soils. There are three categories of soils identified in the district area – black cotton (cultivated areas), lateritic (plateau area) and alluvium soil (river bank areas). Soil Quality Monitoring and Analysis

The soil characteristics within the study area, especially the physical quality and fertility of the soil have been characterized by analysing the soil sample collected from six (6) locations within the study area. ***Table 4.6*** provides details of soil sampling locations. Soil sampling locations for Unit 6 and 7 (Moman Badodiya) and Unit 8 (South Shajapur) are presented in ***Figure 4.1*** and ***Figure 4.2***.

Table 4.6 Soil Sampling Location Details of Shajapur Solar Park

Location Code	Sub-Site	Location	Zone	Easting (E)	Northing (N)	Type of land
SQ1	Unit 6 & 7 (Moman Badodiya)	Gondalmau	43Q	627997.55 m	2625384.85 m	Agricultural Field
SQ2		Dhatrawada	43Q	631032.77 m	2614709.18 m	Agricultural Field

Location Code	Sub-Site	Location	Zone	Easting (E)	Northing (N)	Type of land
SQ3		Dehripal	43Q	629076.36 m	2620768.99 m	Agricultural Field
SQ4	Unit 8 (South Shajapur)	Peer Umrod	43Q	625922.30 m	2571550.74 m	Agricultural Field
SQ5		Hanoti	43Q	624090.36 m	2571363.69 m	Agricultural Field
SQ6		Lalupura	43Q	622713.48 m	2569591.68 m	Agricultural Field

The soil quality analysis results are presented in ***Table 4.7*** and described in the further subsections. Selected few parameters of the soil quality results (i.e., pH, EC) have been compared with standard soil classification as given in *Handbook of Agriculture, Indian Council of Agricultural Research, New Delhi*.

Table 4.7 Results of Soil Analysis of Shajapur Solar Project

S. N.	Parameter	Unit	Unit 6 & 7 (Moman Badodiya)			Unit 8 (South Shajapur)		
			SQ1	SQ2	SQ3	SQ4	SQ5	SQ6
1	Particle size distribution							
a	Sand	%	80.8	86.2	86.6	84.5	81.2	78.5
b	Silt	%	5.6	5.6	7.2	1.3	4.3	8.1
c	Clay	%	13.6	8.2	6.2	14.2	14.5	13.4
2	Texture	-	Sandy Loam	Loamy Sand	Loamy Sand	Loamy Sand	Sandy Loam	Sandy Loam
3	Bulk Density	g/cm^3	1.39	1.29	1.42	1.53	1.40	1.40
4	pH	-	7.10	7.60	7.10	7.42	7.49	7.34
5	Electrical Conductivity	mmhos/cm	0.25	0.33	0.55	0.28	0.36	0.35
6	Moisture Content	%	14.1	18.8	10.0	10.5	14.6	11.5
7	Cation Exchange Capacity	meq/100gm	57.6	68.2	76.4	62.1	50	64.7
8	SAR	-	1.5	5.4	3.4	2.7	4.9	4.1
9	Water Holding Capacity	%	55.1	54.0	58.1	47.8	52.4	53.0
11	Total Nitrogen	mg/kg	467.1	426.2	2,438.8	165.8	1,013.9	322.3
12	Sulphate	mg/kg	22.6	24.7	121.0	43.2	24.4	23.8
13	Chloride	mg/kg	56.9	47.8	38.3	47.3	57.8	56.5
14	Sodium (Na)	mg/kg	397.1	420.7	235.7	199.5	365.2	292.7

S. N.	Parameter	Unit	Unit 6 & 7 (Moman Badodiya)			Unit 8 (South Shajapur)		
			SQ1	SQ2	SQ3	SQ4	SQ5	SQ6
15	Total Potassium (K)	mg/kg	461.1	1,102.3	1,885.9	1,313.4	527.72	1,306.4
16	Calcium (Ca)	mg/kg	6,407.5	6,842.2	5,252.0	6,022.6	6,735.9	5,548.6
17	Magnesium (Mg)	mg/kg	2,990.2	1,080.3	1,125.5	1,129.2	898.1	1,109.7
18	Permeability	cm/sec	0.05	0.02	0.02	0.03	0.04	0.03

4.3.4.1 Discussion of Results

Texture and Electrical Conductivity: Soil texture is an important soil characteristic that could influence water retention capacity, aeration, drainage, and susceptibility to erosion, which drives crop production and management. Samples collected from the monitoring locations exhibited two types of soil texture viz. loamy sand and sandy loam. Electrical conductivity is used to estimate the soluble salt concentration in soil, and is commonly used as a measure of salinity. The electrical conductivity (EC) of soil samples were recorded to be within a range of 0.25 mmhos/cm to 0.55 mmhos/cm which can be assessed to be average for germination.

***pH*:** Generally, soil pH in the range of 6.5-7.0 is considered to be best suited for growing most crops. The pH level in soil samples was recorded to be varying from 7.10 to 7.60 indicating slightly alkaline pH.

Bulk Density: Soils with low bulk density are generally more suitable for agriculture, since the high pore space has a greater potential to store water and allow roots to grow more readily. Sandy soils tend to have a higher bulk density than clay or loamy soils and also have a higher critical density for root penetration. The bulk density in the study area for both the sub projects vary from 1.29 g/cm^3 (SQ2 – Dhatrawada) to 1.53 g/cm^3 (SQ4 – Peer Umrod). As per available literature, the bulk density is below the critical limits that restricts the growth of roots and therefore should be sufficient for agricultural use.

***Sodium Adsorption Ratio (SAR)*:** The sodicity[1] hazard of soil, which affects water infiltration in the soil is expressed as the Sodium Adsorption Ratio (SAR). Soil with high level of exchangeable sodium may cause dispersion of soil particles leading to the replacement of major cations (calcium and magnesium) adsorbed on the soil. This could possibly lead to deterioration of soil structures and water infiltration problems. The SAR value in the soil was observed to be 1.5 – 40.1 (agricultural land parcel).

Total Nitrogen: Value of total nitrogen in the soil samples ranges from 165.8 mg/kg to 2,438.8 mg/kg (agricultural land).

Total Potassium: Value of total potassium in the samples collected ranges from 461.1 to 1,885.9 mg/kg.

Water holding capacity: Water Holding Capacity in the samples ranges from 47.8 % - 58.1 %.

The results suggests that the soil in Lalupura has very high Sodium Absorption Ratio which indicates the soil to be sodic. Excess sodium in sodic soils causes soil particles to repel each other, preventing the formation of soil aggregates. This results in a very tight soil structure with poor water infiltration,

1 Sodicity is a term given to the amount of Sodicity is a term given to the amount of sodium held in a soil. Sodium is a cation (positive ion) that is held loosely on clay particles in soil. It is one of many types of cations that are bound to clay particles in soil.

poor aeration and surface crusting, which makes tillage difficult and restricts seedling emergence and root growth (Munshower, 1994; Seelig, 2000; Horneck et al., 2007).

4.3.5 Hydrogeology

Deccan trap basaltic rock occupies the large parts of the study area. It consists of lava flows wherein a typical flow unit comprises of a lower dense massive horizon passing upwards into a vesicular, amygdaloidal or jointed basalt. At places, top of individual flows are marked by reddish brown clayey material (Red bole) of few cm to 5 m thickness. Usually the red- bole and vesicular basalt are prone to weathering and give rise to extensive black cotton soil. There are sixteen basaltic flows which were identified by Geological Survey of India in a vertical column of 275 m between altitude of 335 to 610 m amsl) in entire Shajapur district. The various flows of basalts are at times inter-bedded and fossiliferous inter trappen (CGWB Shajapur)[1].

- Ground Water movement occurs in different lava flows driven by its porosity (primary and secondary). In weathered and vesicular rocks, primary porosity drives the flow while secondary porosity becomes a significant driver in jointed and fractured basalt unit. Alternating sequence of pervious and compact horizon function as a multi aquifer system. Shallow ground water occurs in the weathered and vesicular, jointed and fractured zones of basaltic flows. The occurrence of shallow groundwater may range from unconfined to semi-confined to confined conditions depending on the rock properties vis-à-vis the structural system.
- Groundwater was also reported at shallow depths in alluvium along Lakhundar, Kalisindh, Newaj and Parvati river courses.
- Laterite development on basalt is not extensive except in and around Agar town where the traps have undergone maximum degree of leaching (CGWB, Shajapur). In general, the occurrence of laterites was reported in patches in different parts of the district.

The groundwater aquifers at all sub-sites, were reported in discontinuous basalt formations (weathered and intensely fractured) with yield ranging from 0 to 149 m^3/day in weathered and 12 to 600 m^3/day in intense fractured basalt. The variability in the yield may largely be due to the variability in the thickness of weathered basalt and density of fractures and joints. Further, it was reported that the Upper Chambal Sub-Watershed in Malwa region of Madhya Pradesh is one of the most water deficit hydrological unit in India despite low irrigation development (Mukesh Chauhan, 2013)[2].

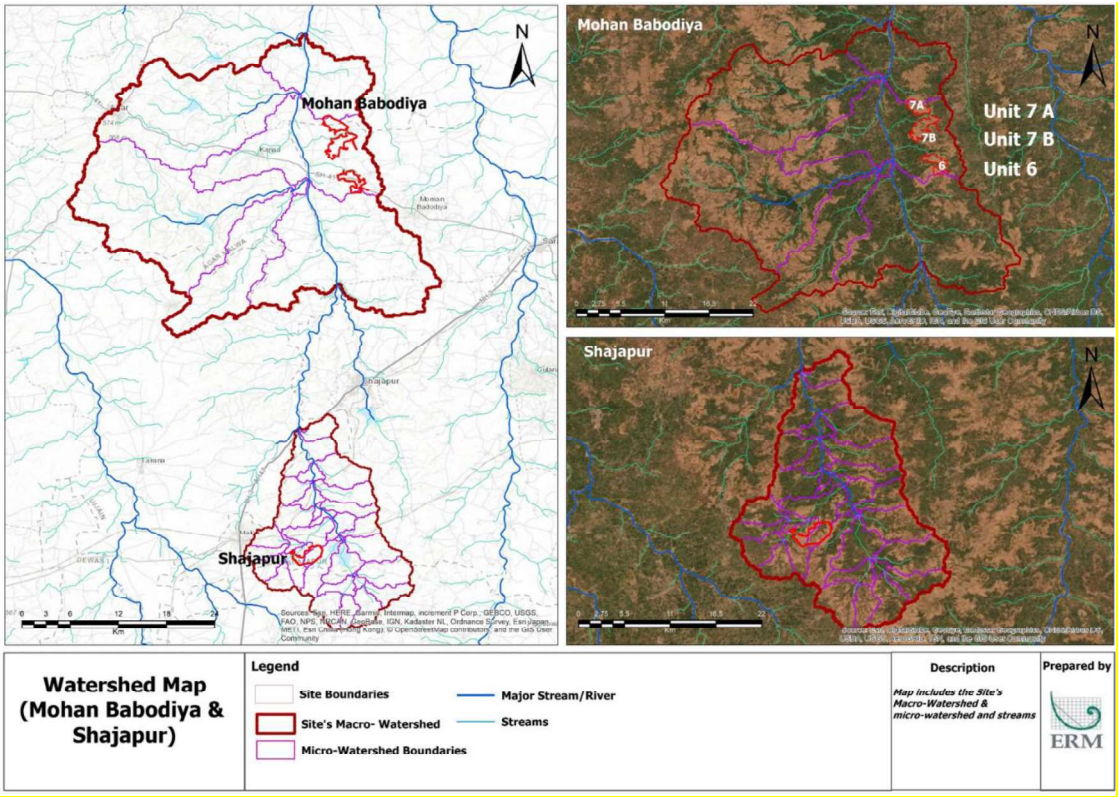
4.3.6 Hydrology

Based on the Digital Elevation Model (DEM) developed for the Project Site and its surrounding area from USGS SRTM data set[3] (U.S. Department of the Interior, U.S. Geological Survey, 2017), available Google Earth Imagery and the secondary information such as NRSC Bhuvan Services, ERM identified key topographic features in the study area such as topographic highs and lows and natural drainage network to delineate the catchment area of the micro-watershed of Project Site. The spatial resolution of SRTM DEM data set utilised for the Plant Site and their surrounding area was 1 arc second (~30 m). The base map of the watershed of the Moman Badodiya and Shajapur Sites is presented in ***Figure 4.11***. The base map indicates that Moman Badodiya Sites are located in the eastern part while the Shajapur Site is located in the central part of their respective catchments.

[1] http://cgwb.gov.in/District_Profile/MP/Shajapur.pdf
[2] http://www.iwrs.org.in/journal/april2013/5apr.pdf

[3] https://lta.cr.usgs.gov/SRTM

Figure 4.11 Base Map of the Watershed of the Shajapur Solar Park



4.3.6.1 Drainage

The stream network in both watersheds is dendritic. Based on the topographical conditions, the general surface water flow direction in the Moman Badodiya Site's watershed was anticipated from south to north. The central part of the watershed from north to south along the major stream is a low-lying area with a potential of surface water inundation and logging. This may increase the likelihood of flood in the area around the major stream.

The general surface water flow direction in the South Shajapur Site's watershed was anticipated from south-east to north-west. The Sites is located at a relatively higher elevation compared to the remaining part of its watershed indicating the likelihood of drainage of stagnant water during the rainy season and hence reducing the risk of inundation at the Site. Drainage maps for the Unit 6 and 7 (Moman Badodiya) and Unit 8 (South Shajapur) are provided in ***Figure 4.12*** and ***Figure 4.13*** respectively.

Figure 4.12 Drainage Map of Unit 6 and 7 (Moman Badodiya)

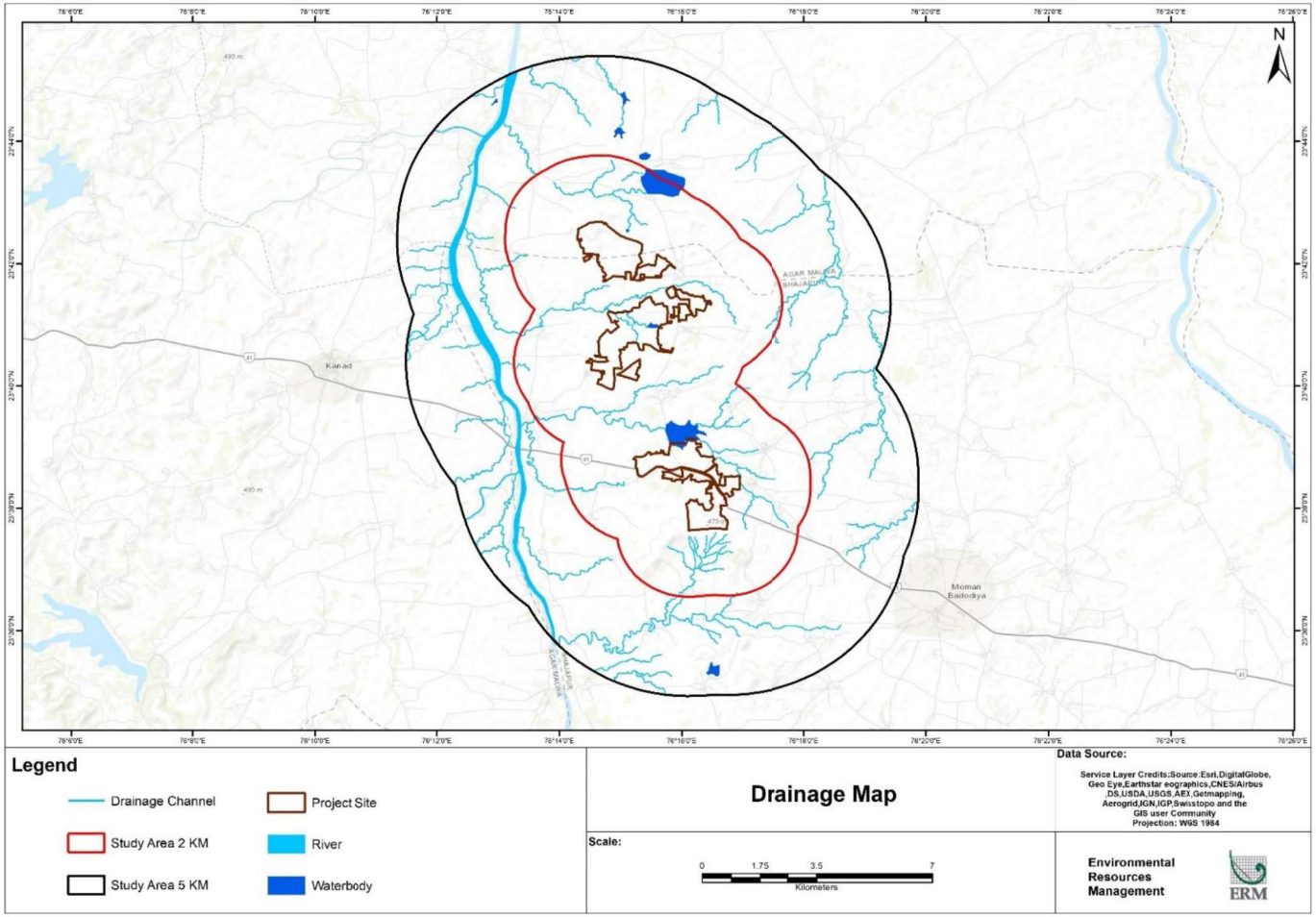
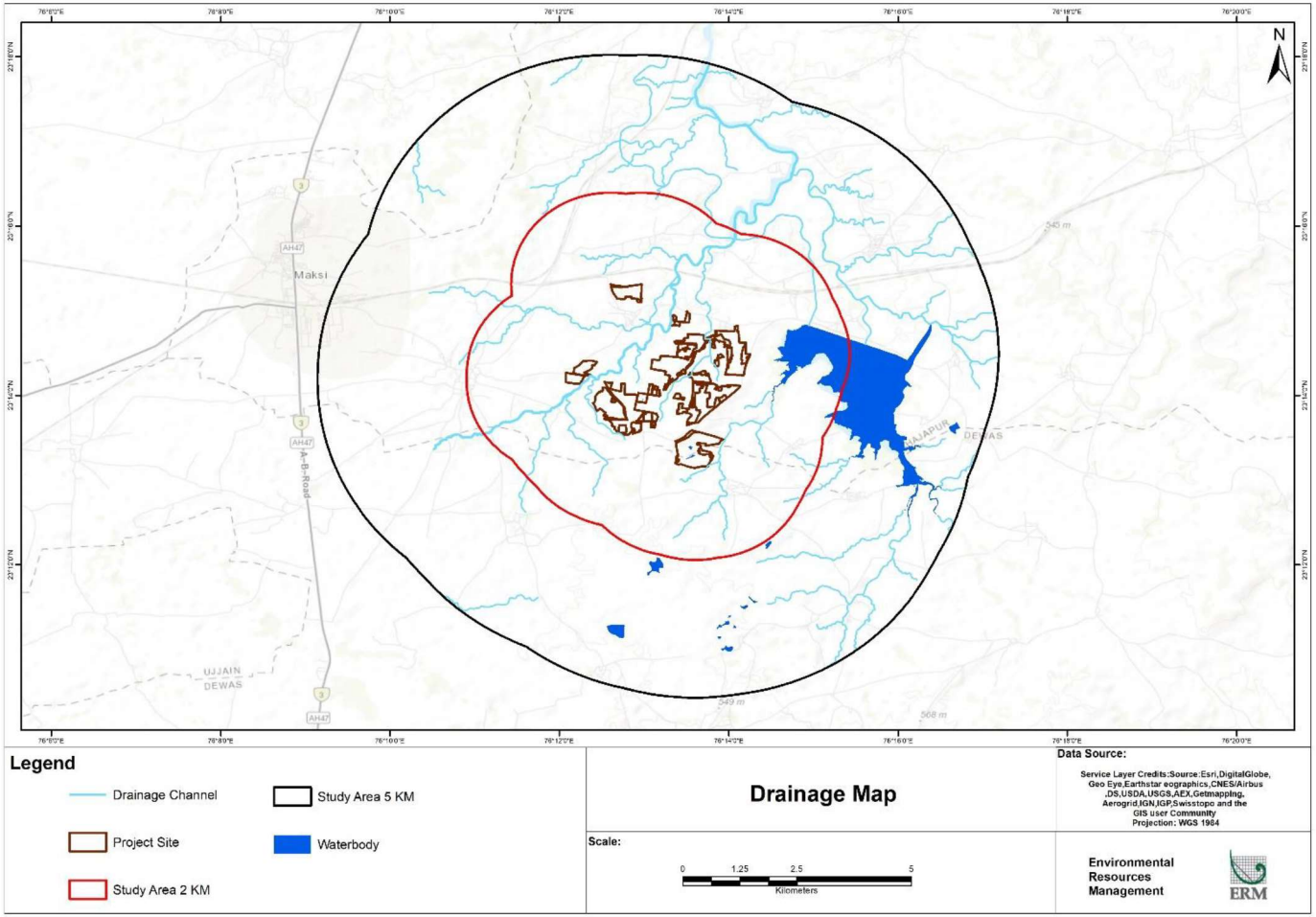


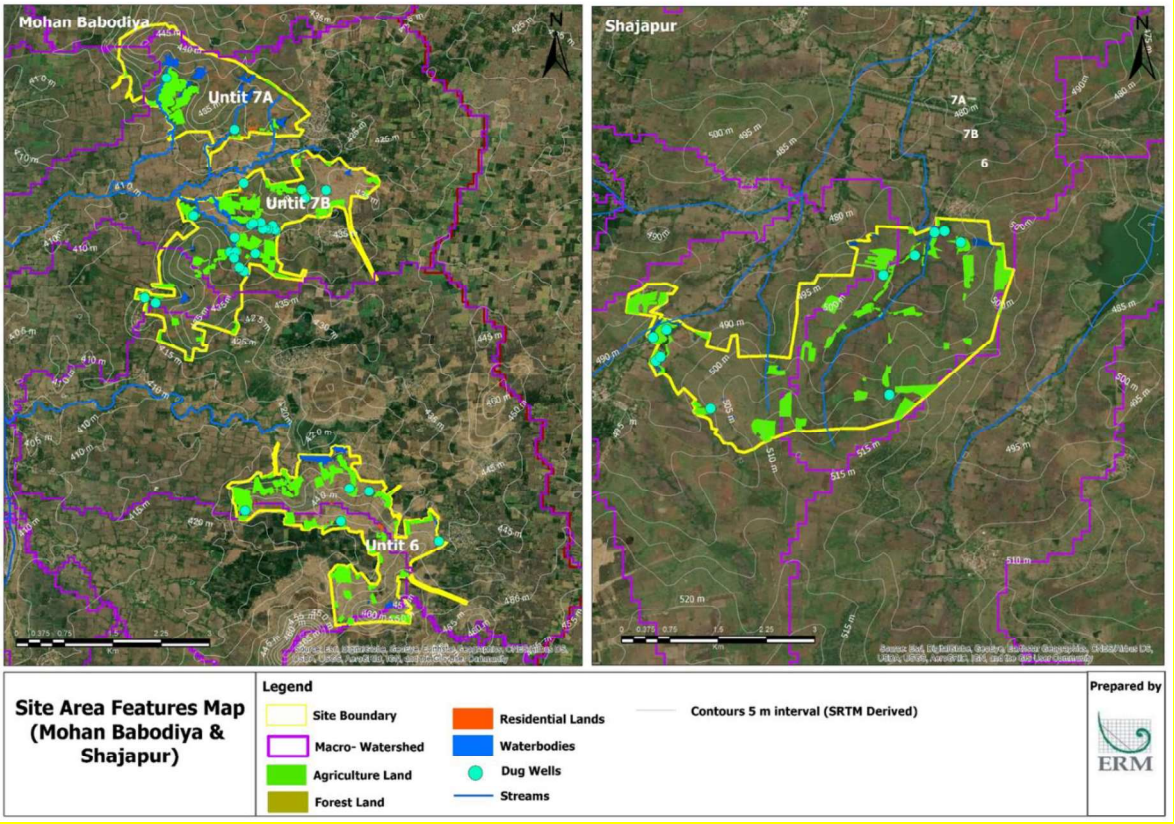
Figure 4.13 Drainage Map of Unit 8 (South Shajapur)



4.3.7 Water Resources – Availability and Quality

Groundwater was reported as the primary source of water around Moman Badodiya and Shajapur Sites with some seasonal streams also flowing through the area. A surface water reservoir was observed in the north- east of the Shajapur Site and was reportedly used for irrigation. Some of the surface water bodies and groundwater structures identified at Moman Badodiya and Shajapur Sites are presented in Figure 4.14. Groundwater dug wells and bore wells were also reported at Moman Badodiya and Shajapur Sites. However, locations of only some of these structures was available for review.

Figure 4.14 Map showing water sources- Unit 6 & 7 (Moman Badodiya) and Unit 8 (South Shajapur)



Ground Water Levels

Variation of ground water levels is an important component of hydrological cycle because it is a physical reflection of aquifer system. As the change in ground water level is directly related to ground water balance and its continuous records provide direct information of sub surface geo environmental changes due to withdrawal of ground water. To monitor the seasonal & annual fluctuation, change in quantity and quality of ground water, CGWB has established. Ground water monitoring wells and piezometers in entire Shajapur district. The monitoring of ground water levels in these wells is being carried out by CGWB during the month of May, August, November and January. High frequency ground water level monitoring is being carried out at many places deep piezometers using automatic water level recorders.

Depth to Water level

Depth to water (DTW) levels in pre-monsoon (May) of 2016 varied from 5 m to 20 m in the district. DTW during monsoon (August) of 2016 varied between <2 m to 5m and between 2m to 20 m during

post monsoon (November) of 2016 while it remains same in winter (January) of 2017 between 5 m to 20 m in the district.

Decadal Water level fluctuations

The ground water levels of May 2016 were compared with the 10 years May (2006-2015) average ground water levels to decipher the long-term changes in the ground water regime. The long term behaviour of water levels of the phreatic zone using the average water level data of last ten years shows that there is a general rising trend of up to 0.20 m/year in the entire Shajapur District during both pre monsoon (May 2007 to May 2016) and post monsoon (Nov 2007 to Nov 2016). The rising trend in pre monsoon indicates that either the developmental activities have reduced, or that, recharge due to sources other than the rainfall, such as applied irrigation has increased. The rising trend in post monsoon shows that additional water is being stored in the aquifer, due either to increased rainfall or to seepage through applied irrigation[1].

4.3.7.2 Water Availability

Water availability at the watershed/ study area of Project Site was evaluated using the online water risk assessment tool Aqueduct Water Risk Atlas developed by World Resource Institute (WRI)[2] and the India Water Tool (IWT). A total of eight (8) parameters were considered to evaluate water availability. These parameters are Baseline Water Stress (BWS); Baseline Water Depletion (BWD); Inter Annual Variability (IAV); Seasonal Variability (SV); Availability Index (AI); Total Annual Rainfall (TAR), Hydrogeology, and Block Categorisation (BC).The water risks were evaluated and ranked on a traffic-light based risk matrix, categorising water risk from each parameter into 'high', 'medium', and 'low'. ***Table 4.8*** presents the original and new classification of water risk indicators.

Table 4.8 Classification of Water Risk Indicators

Sr. No.	Water Risk Indicator	Original Categorization (3)	Modified Categorization (4)
1	Baseline Water Stress (BWS)	Low: <10%	Low: <20%
		Low-Medium: 10-20%	Medium: 20-40%
		Medium-High: 20-40%	High: >40%
		High: 40-80%	
		Extremely High: >80%	
2	Baseline Water Depletion (BWD)	Low: <5%	Low: <5%
		Low-Medium: 5-25%	Medium: 5-25%
		Medium-High: 25-50%	High: >25%

[1] Groundwater Year Book, Madhya Pradesh (2016-2017), Central Ground Water Board, North Central Region, Ministry of Water Resources, River Development and Ganga Rejuvenation, Government of India, January 2018

[2] Hofste, R., S. Kuzma, S. Walker, E.H. Sutanudjaja, et. al. 2019. "Aqueduct 3.0: Updated DecisionRelevant Global Water Risk Indicators." Technical Note.Washington, DC: World Resources Institute. Available online at: https://www.wri.org/publication/aqueduct-30

(3) Hofste, R., S. Kuzma, S. Walker, E.H. Sutanudjaja, et. al. 2019. "Aqueduct 3.0: Updated DecisionRelevant Global Water Risk Indicators." Technical Note.Washington, DC: World Resources Institute. Available online at: https://www.wri.org/publication/aqueduct'

India Water Tool

(4) Modified by ERM

Sr. No.	Water Risk Indicator	Original Categorization [3]	Modified Categorization [4]
		High: 50-75%	
		Extremely High: >75%	
3	Inter Annual Variability (IAV)	Low: <0.25	Low: <0.25
		Low-Medium: 0.25-0.5	Medium: 0.25-0.5
		Medium-High: 0.5-0.75	High: >0.5
		High: 0.75-1	
		Extremely High: >1	
4	Seasonal Variability (SV)	Low: <0.33	Low: <0.33
		Low-Medium: 0.33-0.66	Medium:0.33-0.66
		Medium-High: 0.66-1	High: >0.66
		High: 1-1.33	
5	Availability Index (AI)	Extremely Low	High
		Low	
		Low-Medium	
		Medium-High	Medium
		High	Low
		Extremely High	
6	Total Annual Rainfall (TAR)	Low (0-708 mm/year)	High
		Low-Medium (709 -1104 mm/year)	Medium
		Medium (1105-1500 mm/year)	
		Medium-High (1501-1896mm/year)	Low
		High (1896+ mm/year)	
7	Hydrogeological Map (HM)	>40 (Unconsolidated)	Low
		25-40 (Unconsolidated)	

Sr. No.	Water Risk Indicator	Original Categorization (3)	Modified Categorization (4)
		10-25 (Unconsolidated)	Medium
		<10 (Unconsolidated)	
		1-25 (Consolidated/semi-consolidated)	High
		1-10 (Consolidated/semi-consolidated)	
		1-5 (Consolidated/semi-consolidated)	
		<1 (Hilly areas)	
8	Block Categorisation (BC)[1]	Safe	Low
		Semi-Critical	
		Critical	Medium

[1] The ground water resources are assessed in units, i.e., blocks/ talukas/ mandals/ watersheds. The blocks are generally be of the same size (or lesser) as the Talukas. These assessment units are categorized for ground water development based on two criteria - a) stage of ground water development, and b) long-term of pre and post monsoon water levels.
The groundwater resources are typically assessed by CGWB (Central Ground Water Board) and categorized for groundwater development based on two (2) criteria:

- Stage of groundwater development; and
- Long-term trend of pre- and post-monsoon water levels

The long-term groundwater level trends are computed generally for a period of ten (10) years. Based on the above, groundwater resource units are typically divided into 'Notified' and 'Non-notified' areas**.** The Non-notified areas are further divided into the following categories:

- 'Safe' areas which have ground water potential for development;
- 'Semi-critical' areas where cautious groundwater development is recommended;
- 'Critical' areas and 'Over-exploited' areas, where there should be intensive monitoring and evaluation and future ground development will be linked with water conservation measures.

The details of criteria for categorization of assessment units are provided in the table below.

Criteria for groundwater categorisation

Serial No.	Stage of Groundwater Development	Significant Long-term Decline		Categorization
		Pre-monsoon	Post-monsoon	
1.	<= 70%	No	No	Safe
2.	>70% and <=90%	No	No	Safe
		Yes/No	No/Yes	Semi-critical
3.	>90% and <=100%	Yes/No	No/ Yes	Semi-critical
		Yes	Yes	Critical
4.	>100%	Yes/No	No/Yes	Over-Exploited
		Yes	Yes	Over-Exploited

Sr. No.	Water Risk Indicator	Original Categorization [3]	Modified Categorization [4]
		Over-Exploited	High

The assessment against these parameters is provided in ***Table 4.9***.

Table 4.9 Parameters included to assess water availability

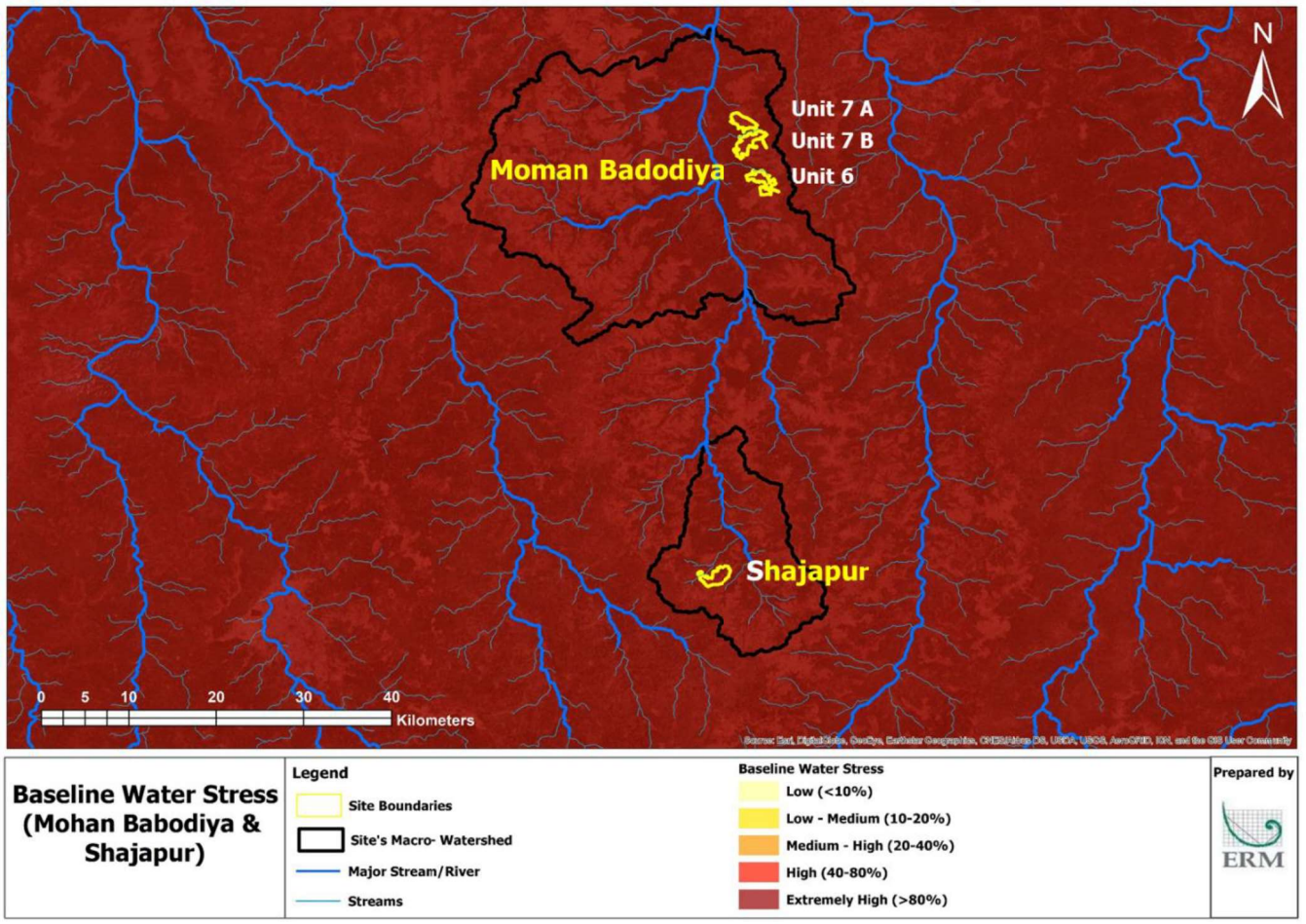
S. No.	Parameter	Definition	Analysis
1	Baseline Water Stress (BWS) *Aqueduct*	Baseline water stress is defined as the ratio of the total annual water withdrawals to the total available annual water renewable supply, accounting for upstream consumptive use. Higher value indicate more competition among users.	BWS map is presented in ***Figure 4.15***. This map, originally developed for the world, also captures baseline water stress for the Subject Sites. This map was developed based on BWS at the watershed- level for different regions of the world. The Subject Sites - Moman Badodiya and Shajapur site fall in the region of extremely high baseline water stress. This indicates '***High***' risk of water stress in Moman Badodiya and Shajapur Site areas
2	Baseline Water Depletion (BWD) *Aqueduct*	Baseline water depletion measures the ratio of total water consumption to available renewable water supplies. Total water consumption includes domestic, industrial, irrigation and livestock consumptive uses. Available renewable water supplies include surface and groundwater supplies and considers the impact of upstream consumptive water users and large dams on downstream water availability. Higher values indicate larger impact on the local water supply and decreased water availability for downstream users.	BWD map is presented in ***Figure 4.16***. Both the Sites (Moman Badodiya and Shajapur) fall in the region of high baseline water depletion indicating '***High***' risk of depletion.
3	Inter Annual Variability (IAV) *Aqueduct*	It indicates the variation in water supply from year to year.	Inter Annual Variability (IAV) map is presented in ***Figure 4.17***. This map, originally developed for the world, also captures IAV for both the Sites and its watershed. Both the Sites fall in the region of 'medium to high' IAV. This indicates ***'High'*** risk from inter-annual variability.
4	Seasonal Variability (SV) *Aqueduct*	Seasonal variability indicates variation in water supply between months of the year.	SV map is presented in ***Figure 4.18***. This map, originally developed for the world, also captures SV for subject Sites located in Moman Badodiya and Shajapur. Both the Sites fall in the region of medium-high seasonal variability indicating non-uniform availability of water supply over different month/seasons in a year. Hence, the water risk from seasonal variability was estimated to be '***High***'.

S. No.	Parameter	Definition	Analysis
5	Availability Index (AI) *India Water Tool*	This indicator – the Normalised Difference Water Index (NDWI)- is a remote sensing derived index estimating surface water availability by recording water level in open surface water. Positive values are typically open water areas and negative values are non-water features (i.e. terrestrial vegetation, bare soil etc.). Source: National Aeronautics and Space Administration and U.S. Geological Survey, 2001-2016; Data processed with the support of the Earth Genome	AI map for both the Sites is presented in ***Figure 4.19***. Both the Sites (Moman Badodiya and Shajapur) fall in the region of low availability index indicating relatively lower availability of surface water. This indicates '***High***' risk for surface water availability in the area.
6	Total Annual Rainfall (TAR) *India Water Tool*	This indicator is the arithmetic average of the annual rainfall recorded at all Meteorological stations under each district. Source: India Meteorological Department, 2004-2013 Unit: mm	TAR map is presented in ***Figure 4.20***. The Total Annual Rainfall Map indicates 'low to medium' annual rainfall at both the Site regions which is indicative of low replenishment of water in surface and groundwater reservoirs. The risk of water availability is estimated to be '***High***'.
7	Hydrogeological Map *India Water Tool*	The indicator gives the broad types of geological formations – Unconsolidated, Semi-consolidated and Consolidated - that inform the groundwater potential and control the hydraulics of groundwater. This is a relatively qualitative estimate based on the tentative water yielding potential of the geological unit and does not include the groundwater availability in the region. Source: Central Ground Water Board, 2011	Hydrogeological map (HM) for the Subject Sites is presented in ***Figure 4.21***. The map provides information on the aquifer yield of hydrogeological formations in the regions where the Site is located. Both the Sites are located in aquifers with 'low' groundwater yield (1-5 %) indicating lower possibility of water availability and hence has a ***'High'*** likelihood of groundwater risk.

<table>
<tr><th>S. No.</th><th>Parameter</th><th>Definition</th><th>Analysis</th></tr>
<tr><td>8</td><td>Block Categorisation
India Water Tool</td><td>The ground water resources are assessed in units, i.e. blocks/ talukas/ mandals/ watersheds. These assessment units are categorized for ground water development based on two criteria - a) stage of ground water development, and b) long-term of pre and post monsoon water levels. The long term ground water level trends are computed generally for the period of 10 years. The significant rate of water level decline are taken between 10 and 20 cm per year depending upon the local hydrogeological conditions. There are four categories, namely - 'Safe' areas which have ground water potential for development; 'Semi-critical' areas where cautious groundwater development is recommended; 'Critical' areas; and 'Over-exploited' areas, where there should be intensive monitoring and evaluation and future ground development be linked with water conservation measures.</td><td>Block Categorisation (BC) data for Moman Badodiya and Shajapur blocks is summarised below for the years 2004, 2009, 2011 and 2017. The category provides an understanding of the overall status of groundwater in the block. As per the latest data available for 2017, Moman Badodiya is categorised as ‘over-exploited’ block indicating ‘<u>high</u>’ risk of groundwater in the area as groundwater development in the region is relatively high. Shajapur block was categorised as semi-critical in 2017 indicating a ‘<u>medium</u>’ risk of groundwater.
<table>
<tr><th>Block Name</th><th>2004 Block Category</th><th>2009 Block Category</th><th>2011 Block Category</th><th>2017 Block Category[1]</th></tr>
<tr><td>Moman Badodiya</td><td>Overexploited</td><td>Overexploited</td><td>Overexploited</td><td>Overexploited</td></tr>
<tr><td>Shajapur</td><td>Semi-critical</td><td>Semi-critical</td><td>Semi-critical</td><td>Semi-critical</td></tr>
</table>
</td></tr>
</table>

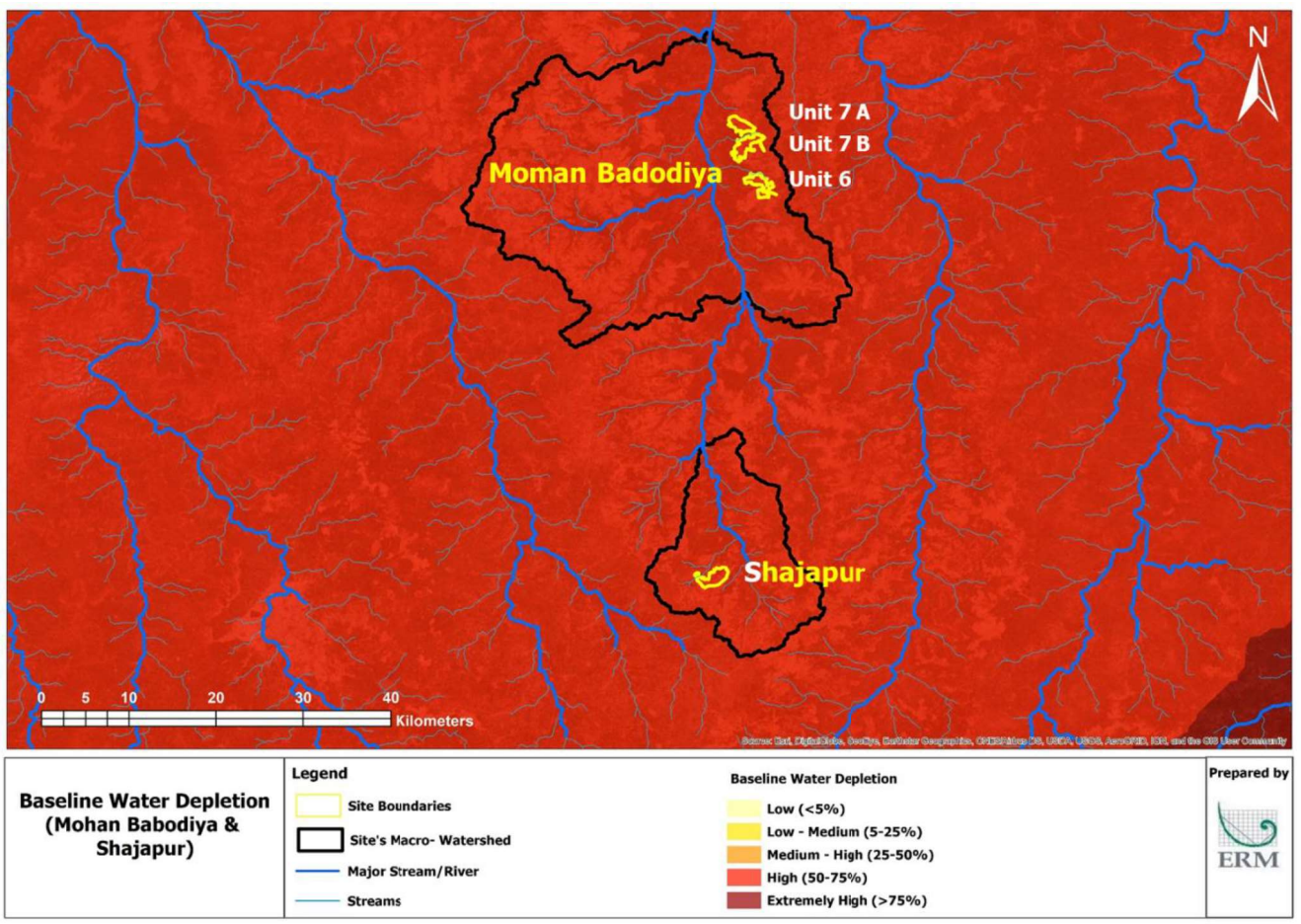
[1] http://cgwb.gov.in/GW-Assessment/GWRA-2017-National-Compilation.pdf

Figure 4.15 Baseline Water Stress Map of the Project Sites and Watershed



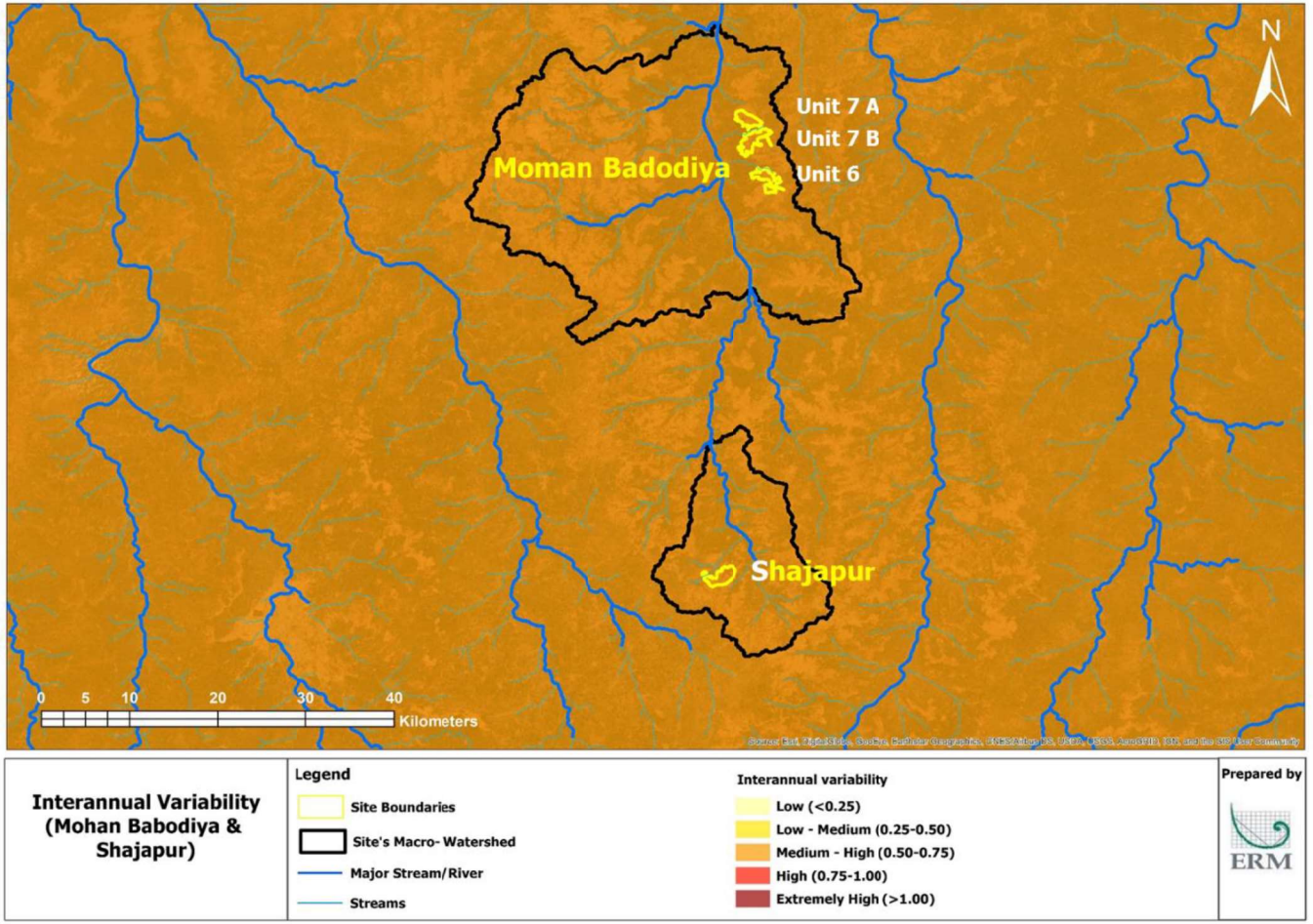
Source: Hofste, R., S. Kuzma, S. Walker, E.H. Sutanudjaja, et. al. 2019. "Aqueduct 3.0: Updated DecisionRelevant Global Water Risk Indicators." Technical Note.Washington, DC: World Resources Institute. Available online at: https://www.wri.org/publication/aqueduct-30

Figure 4.16 Water Depletion Map of the Project Sites and Watershed



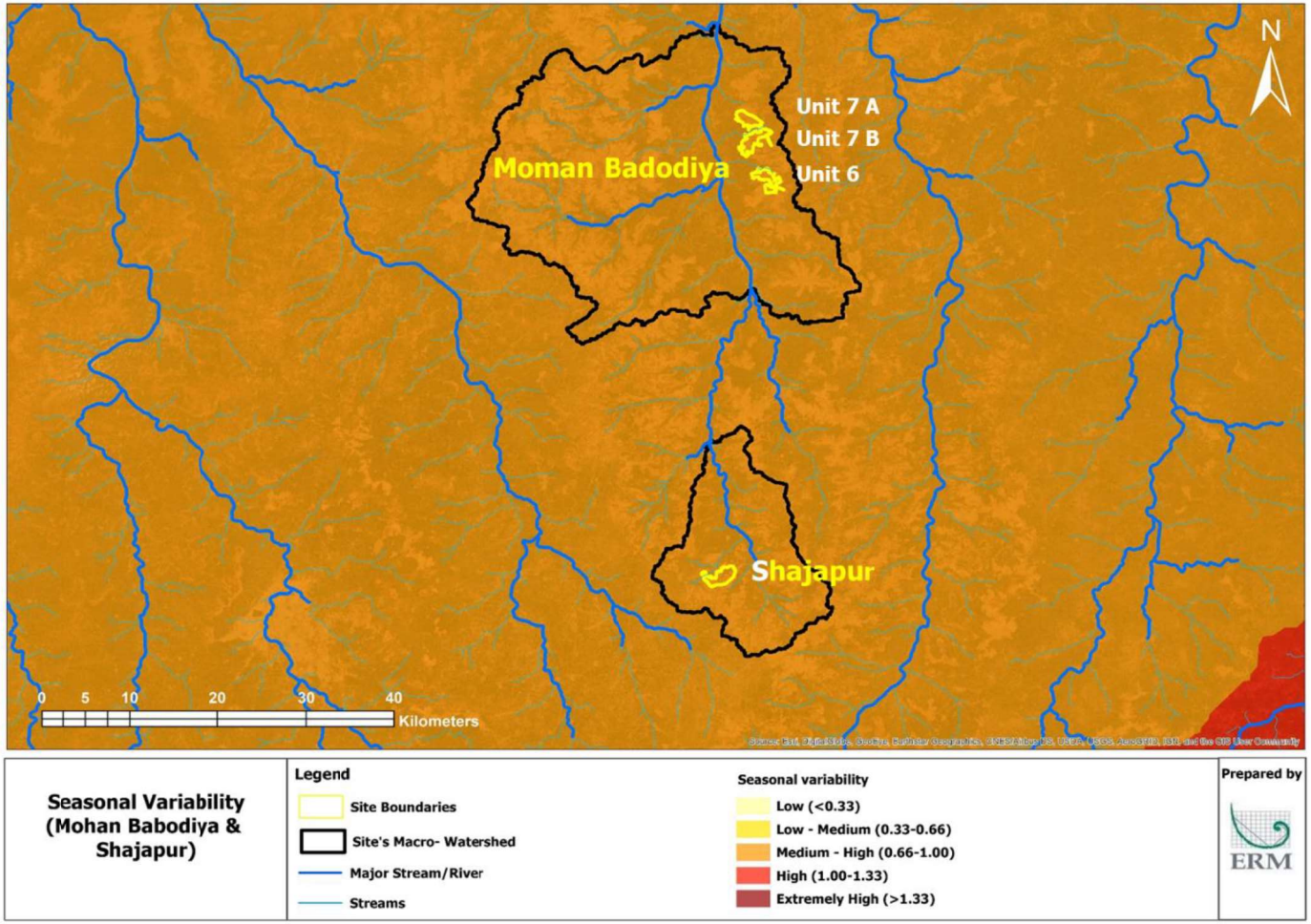
Source: Hofste, R., S. Kuzma, S. Walker, E.H. Sutanudjaja, et. al. 2019. "Aqueduct 3.0: Updated DecisionRelevant Global Water Risk Indicators." Technical Note.Washington, DC: World Resources Institute. Available online at: https://www.wri.org/publication/aqueduct-30 (2019)

Figure 4.17 Inter Annual Variability Map of Project Sites and Watershed



Source: Hofste, R., S. Kuzma, S. Walker, E.H. Sutanudjaja, et. al. 2019. "Aqueduct 3.0: Updated DecisionRelevant Global Water Risk Indicators." Technical Note.Washington, DC: World Resources Institute. Available online at: https://www.wri.org/publication/aqueduct-30

Figure 4.18 Seasonal Variability Map of Project Sites and Watershed

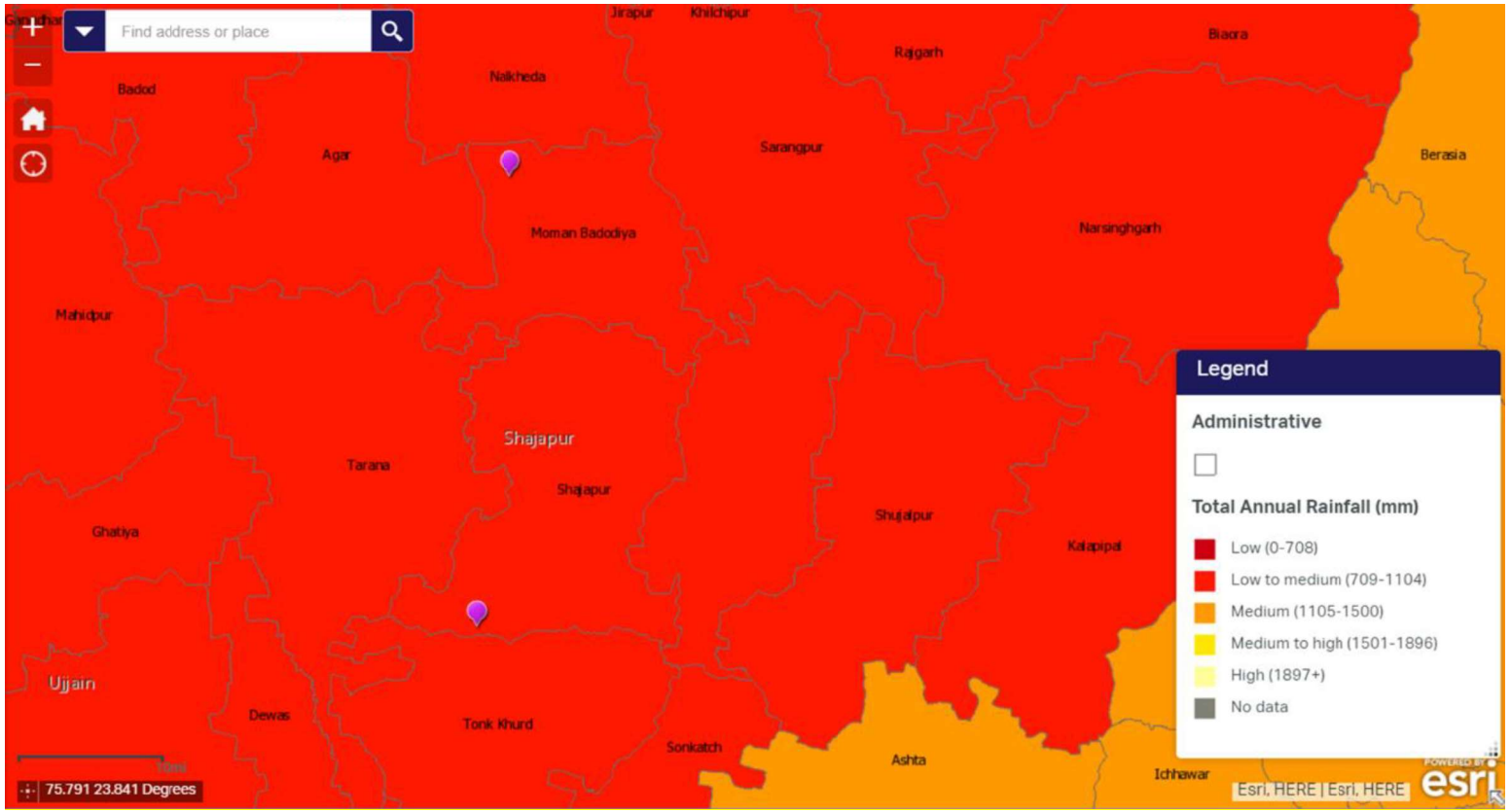


Source: Hofste, R., S. Kuzma, S. Walker, E.H. Sutanudjaja, et. al. 2019. "Aqueduct 3.0: Updated DecisionRelevant Global Water Risk Indicators." Technical Note.Washington, DC: World Resources Institute. Available online at: https://www.wri.org/publication/aqueduct-30 (2019)

Figure 4.19 Availability Index Map of Project Sites

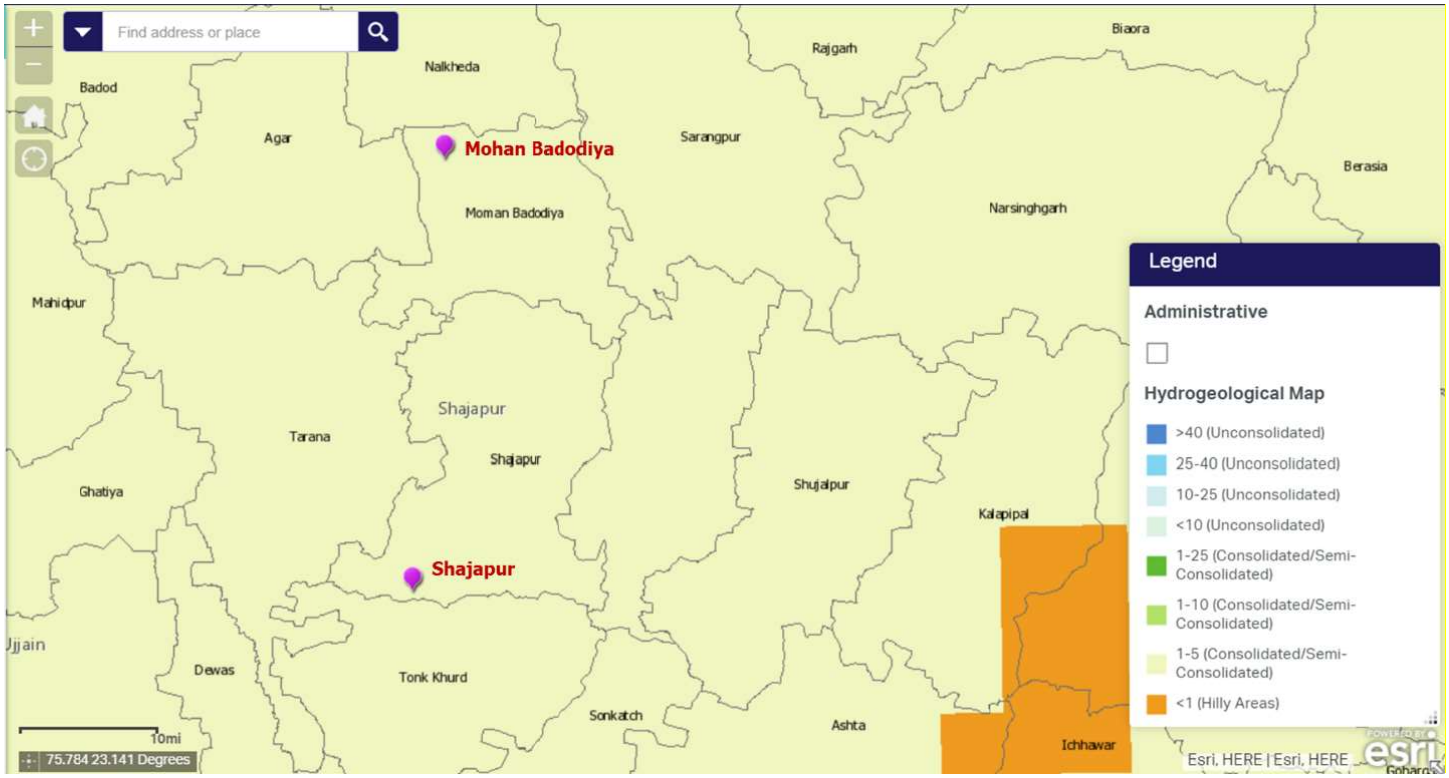
Source: The India Water Tool Version 3 (IWT 3.0) is an easy-to-use, online tool for companies and other users to understand their water-related risks and prioritize actions toward sustainable water management. IWT 3.0 combines data from Indian government agencies and water stress indicators from the World Resources Institute and Columbia Water Centre. http://www.indiawatertool.in/

Figure 4.20 Total Annual Rainfall Map of the Project Sites



Source: The India Water Tool Version 3 (IWT 3.0) is an easy-to-use, online tool for companies and other users to understand their water-related risks and prioritize actions toward sustainable water management. IWT 3.0 combines data from Indian government agencies and water stress indicators from the World Resources Institute and Columbia Water Centre. http://www.indiawatertool.in/

Figure 4.21 Hydrogeological Map of the Project Sites



Source: The India Water Tool Version 3 (IWT 3.0) is an easy-to-use, online tool for companies and other users to understand their water-related risks and prioritize actions toward sustainable water management. IWT 3.0 combines data from Indian government agencies and water stress indicators from the World Resources Institute and Columbia Water Centre. http://www.indiawatertool.in/

Overall Water Resources Availability Risk

The overall water risk was evaluated based groundwater and surface water risk. Groundwater risk was estimated based on Block Categorization and Hydrogeology while surface water risk was estimated based on Inter Annual Variability, Seasonal Variability, Availability Index and Total Annual Rainfall. Baseline Water Stress and Baseline Water Depletion were evaluated as risk factors common to both groundwater and surface water risk. For each asset, total water risk was evaluated based BWS and BWD while groundwater and surface water risks were evaluated based on the aforementioned individual factors.

- Groundwater risk was estimated to be '***High***' due to high risk of availability of resources and medium-high risk from BC.
- Surface Water risk was estimated to be '***High***' due to high risk from AI, SV, IAV and TAR.
- Overall water risk was estimated to be '***High***' due to high risk from BWS and BWD.

4.3.7.3 Surface Water Quality

Surface water quality monitoring was conducted within the project study area at 3 locations (outside the Project site) during winter season (December 2019). These samples were analysed against the designated best use classification of Central Pollution Control Board (CPCB) as given in Table 4.10. The details of water sampling locations are given in Table 4.11. Samples were taken from water bodies such as river, lakes, and ponds in and around the villages in the AoI. Field parameters viz. temperature, pH, dissolved oxygen were analysed at the site.

Table 4.10 Water Quality Standards by CPCB for Best Designated Usage

Designated-Best-Use	Class of water	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	■ Total Coliforms Organism MPN/100ml shall be 50 or less ■ pH between 6.5 and 8.5 ■ Dissolved Oxygen 6mg/l or more ■ Biochemical Oxygen Demand 5 days 20°C 2mg/l or less
Outdoor bathing (Organised)	B	■ Total Coliforms Organism MPN/100ml shall be 500 or less ■ pH between 6.5 and 8.5 ■ Dissolved Oxygen 5mg/l or more ■ Biochemical Oxygen Demand 5 days 20°C 3mg/l or less
Drinking water source after conventional treatment and disinfection	C	■ Total Coliforms Organism MPN/100ml shall be 5000 or less ■ pH between 6 to 9 ■ Dissolved Oxygen 4mg/l or more ■ Biochemical Oxygen Demand 5 days 20°C 3mg/l or less
Propagation of Wild life and Fisheries	D	■ pH between 6.5 to 8.5 ■ Dissolved Oxygen 4mg/l or more ■ Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	■ pH between 6.0 to 8.5 ■ Electrical Conductivity at 25°C micro mhos/cm Max.2250 ■ Sodium absorption Ratio Max. 26 ■ Boron Max. 2mg/l
-	Below-E	Not Meeting A, B, C, D & E Criteria

Table 4.11 Surface Water Sampling Locations

S.N.	Location	Sample Code	Zone	Easting (E)	Northing (N)
1	Burlay lake	SW1	43Q	628786.75 m	2616465.99 m
2.	Gondalmau lake	SW2	43Q	628007.32 m	2624277.57 m
3.	Palsavad dam	SW3	43Q	628579.30 m	2571013.71 m

Source: ERM's Site Assessment

The results obtained are shown below in ***Table 4.12***:

Table 4.12 Surface Water Sampling Results

S.N.	Parameter	Unit	SW1	SW2	SW3
Physicochemical Parameters					
1.	pH at 25 ˚C	-	7.34	7.31	7.11
2.	Temperature	°C	26	24.5	25
3.	Turbidity	NTU	0.6	1.1	1.6
Chemical Parameters					
4.	Total Alkalinity	mg/l	132	64.8	122.4
5.	Total Hardness	mg/l	126.7	122.9	126.7
6.	DO	mg/l	6.5	6.5	6.3
7.	Chloride (as Cl)	mg/l	14.5	8.7	19.3
8.	Fluorides (as F)	mg/l	0.35	0.3	1.1
9.	Sulphate (as SO_4)	mg/l	6.9	<1	14.9
10.	Nitrite	mg/l	<0.01	0.06	<0.01
11.	Nitrate	mg/l	<0.1	<0.1	0.8
12.	Total Nitrogen	mg/l	1.80	4.98	3.32
13.	COD	mg/l	<10	12	16
14.	BOD	mg/l	<5	<5	6
15.	Phenol	mg/l	<0.0005	<0.0005	<0.0005
16.	Salinity	ppt	<0.05	<0.05	<0.05
17.	Iron (as Fe)	mg/l	<0.1	<0.1	0.4
18.	Silver (as Ag)	mg/l	<0.05	<0.05	<0.05
19.	Lead (as Pb)	mg/l	<0.01	<0.01	<0.01
20.	Cadmium (as Cd)	mg/l	<0.003	<0.003	<0.003
21.	Zinc (as Zn)	mg/l	<0.05	<0.05	<0.05
22.	Copper (as Cu)	mg/l	<0.04	<0.04	<0.04
23.	Nickel (as Ni)	mg/l	<0.01	<0.01	<0.01
24.	Manganese (as Mn)	mg/l	<0.1	<0.1	0.11
25.	Chromium (as Cr)	mg/l	<0.01	<0.01	<0.01
26.	Sodium (as Na)	mg/l	15.2	9.9	11.9
27.	Potassium (as K)	mg/l	<0.1	<0.1	<0.1
28.	Total Phosphorus	mg/l	<1	<1	<1
29.	Oil and grease	mg/l	<0.2	<0.2	<0.2
30.	Total Coliform	MPN/100ml	12	24	40
31.	Faecal Coliform		Absent	Absent	Absent

Note: the Symbol '<' indicates BDL i.e., Below Detectable Limits

Observations from the surface water analysis results from the study area have been discussed below:

- SW1: Water sample test results from lake at village Burlay show total coliform as12 MPN per 100 ml, pH as 7.34, dissolved oxygen as 6.5 mg/l, BOD as BDL (detection limit of 5 mg/l). The COD levels of <10 mg/l is much below the wastewater limits of 250 mg/l. The oil and grease, phenols and heavy metals Fe, Ag, Pb, Cd, Zn, Mn, K, and P were all BDL. These levels indicate that the

inorganic and organic pollution load of the water body is much lower and can be used as a drinking water source without conventional treatment but after disinfection (Class A);

- SW 2: Water sample test results from lake at village Gondalmau show total coliform as 24 MPN per 100 ml, pH as 7.31, dissolved oxygen as 6.5 mg/l, BOD as BDL (detection limit of 5 mg/l). The COD levels of 12 mg/l is much below the wastewater limits of 250 mg/l. The oil and grease, phenols and heavy metals Fe, Ag, Pb, Cd, Zn, Mn, K, and P were all BDL. These levels indicate that the inorganic and organic pollution load of the water body is low and can be used as a drinking water source without conventional treatment but after disinfection (Class A);
- SW 3: Water sample test results from Palsavad dam/ reservoir show total coliform as 40 MPN per 100 ml, pH as 7.11, dissolved oxygen as 6.3 mg/l, BOD as 6 mg/l. The COD levels of 16 mg/l is much below the wastewater limits of 250 mg/l. The oil and grease, phenols and heavy metals Ag, Pb, Cd, Zn, K, and P were all BDL. As per CPCB criteria, the water quality is of Class D-Propagation of Wild life and Fisheries.

The physico-chemical analysis of the monitored surface water indicate satisfactory quality at all the locations and can be used as a drinking water source without conventional treatment but after disinfection.

4.3.7.4 Groundwater Quality

The groundwater quality assessment was done to understand the baseline water (groundwater) quality of the study area. Ground water samples were collected from 8 locations within the Study area/ AoI during winter season (December 2019) and assessed against the BIS 10500:2012 standards. The sampling locations is given in ***Table 4.13.***

Table 4.13 Groundwater Monitoring Locations

Location Code	Location		Zone	Easting (mE)	Northing (mN)	Selection Criteria
GW-1	Gondalmau	Unit 6 & 7 (Moman Badodiya)	43Q	628002.38 m E	2624836.75 m N	Understanding the existing ground water quality in the nearby habitation and assess any impact on ground water quality due to proposed Project
GW-2	Dhatrawada		43Q	631032.77 m E	2614709.18 m N	
GW-3	Dehripal		43Q	629089.59 m E	2621115.78 m N	
GW-4	Burlay		43Q	628465.69 m E	2617631.90 m N	
GW-5	Lalupura	Unit 8 (South Shajapur)	43Q	622839.04 m E	2569505.37 m N	
GW-6	Jhonkar		43Q	620470.03 m E	2570525.57 m N	
GW-7	Hanoti		43Q	624090.36 m E	2571363.69 m N	
GW-8	Peer umrod		43Q	625922.30 m E	2571550.74 m N	

The groundwater monitoring results are given in ***Table 4.14***.

Table 4.14 Groundwater Analysis Results

S.N.	Parameter	Unit	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8	IS: 10500-2012 Limits	
											Desirable	Permissible
Physico-Chemical parameters												
1.	Colour	Hazen	<5	<5	<5	<5	<5	<5	<5	<5	5	15
2.	Temperature	˚C	25.8	25.8	24.5	24.3	24.8	25	24.5	24.3	-	-
3.	Turbidity	NTU	0.7	0.2	0.2	2.1	<0.1	0.7	<0.1	0.2	1	5
4.	pH	-	7.10	7.20	6.87	7.78	7.19	7.03	6.93	7.00	6.5-8.5	No relaxation
5.	Electrical Conductivity	µmhos/cm	<5	<5	<5	<5	<5	<5	<5	<5	-	-
6.	Total Dissolved Solids	mg/l	449	395	685	910	391	612	507	584	500	2000
Chemical Parameters												
7.	Total Alkalinity	mg/l	353.3	328.8	360	228	158.4	321.6	27.2	324	200	600
8.	Total Hardness	mg/l	295.2	314.9	303.4	226.6	107.5	353.3	288	372.5	200	600
9.	Dissolved Oxygen	mg/l	6.8	6.5	6.5	5.9	6.6	5.7	6.3	6.7	-	-
10.	Chemical Oxygen Demand	mg/l	20	20	16	68	<10	20	20	28	-	-
11.	Biochemical Oxygen Demand	mg/l	7	6	5	19	<5	7	8	9	-	-
12.	Chloride	mg/l	48.2	14.5	90.6	269.9	83.8	96.4	74.25	59.78	250	1000
13.	Salinity	ppt	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-
14.	Sulphate	mg/l	42.6	24.9	71.8	88.2	35.8	77.9	43.8	90.8	200	400
15.	Fluoride	mg/l	0.36	0.39	0.69	1.92	1.5	1.6	0.81	1.2	1.0	1.5
16.	Nitrate	mg/l	5	1.9	5.4	6.3	<0.1	4.32	4.99	6.42	45	No Relaxation
17.	Phenol	mg/l	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.001	0.002

S.N.	Parameter	Unit	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8	IS: 10500-2012 Limits	
											Desirable	Permissible
18.	Iron (Fe)	mg/l	<0.1	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	0.3	No Relaxation
19.	Manganese (Mn)	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.3
20.	Cadmium (Cd)	mg/l	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003		
21.	Silver (Ag)	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.1	No Relaxation
22.	Lead (Pb)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	No Relaxation
23.	Zinc (Zn)	mg/l	0.14	<0.05	<0.05	0.17	0.05	1.57	0.3	0.08	5	15
24.	Copper (Cu)	mg/l	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.05	1.5
25.	Nickel (Ni)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	No Relaxation
26.	Chromium (Cr)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.05	No Relaxation
27.	Sodium (Na)	mg/l	19.7	35.7	139.6	245.7	94.1	37.0	63.0	62.6		
28.	Potassium (K)	mg/l	<0.1	<0.1	<0.1	4.82	<0.1	<0.1	<0.1	16.48		
29.	Magnesium (Mg)	mg/l	28.6	51.6	35.9	29.5	13.8	63.6	32.3	48.8	30	100
30.	Calcium (Ca)	mg/l	93.7	39.9	61.4	41.5	20	35.3	61.4	67.6	75	200
31.	Oil & Grease	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		
32.	Total Coliform	MPN /100ml	920	26	1600	84	32	14	47	540	Shall not be detectable in any 100 ml sample	
33.	Faecal Coliform	-	12	Absent	12	Absent	0	Absent	Absent	17		
34.	Total Phosphorous	mg/l	<3	<3	<3	<3	<3	<3	<3	<3	-	-

Observations from the surface water analysis results from the study area have been discussed below:

- pH of the groundwater samples were found from 6.87 (at Dehripal village) to 7.78 (in Burlay village), which are in compliance with the IS 10500 standard of 6.5 to 8.5;
- Turbidity value of GW 4 (Burlay) was found highest amongst all the samples with 2.1 NTU. However it is below the permissible limit of 5 NTU;
- Total dissolved solids of five samples were found exceeding the desirable limit of 500 mg/l in villages Dehripal, Burlay, Jhonkar, Hanoti and Peer Umrod, but are within the permissible limit of 2000 mg/l as stipulated in IS 10500 standards;
- Hardness of water is considered to be an important factor to determine the portability and its domestic usage particularly for washing. Total hardness of water is correlated to the presence of bivalent metallic ions viz. calcium and magnesium. Total hardness values in all the groundwater samples were found exceeding the acceptable i.e. 200 mg/l except only one i.e. of Lalupura, and all the samples are within the permissible limits of IS 10500 i.e. 600 mg/l;
- Total Alkalinity values of all the ground water samples were found exceed the acceptable limit (200 mg/l) of IS 10500 except two samples i.e. of Lalupura and Hanoti;
- In half of the groundwater samples (Gondalmau, Dhatrawada, Dehripal, Hanoti) concentration of fluoride were found within the desirable limit of 1.0 mg/l. However, all the samples except the Burlay and Jhonkar groundwater samples were found within the permissible limit of 1.5 mg/l of IS 10500.
- Concentration of magnesium in three of the ground water samples (Gondalmau, Burlay, and Lalupur) were found within the acceptable limit of 30 mg/l, but all falls within the permissible limit of 100 mg/l of IS 10500.
- Concentration of toxic substances such as cadmium, lead, mercury, molybdenum, nickel, arsenic and chromium were found to be below the detectable limit while no presence of cyanide was obtained;
- The total coliform & faecal coliforms were found present in all the groundwater samples exceeding the acceptable and permissible limits as specified by IS 10500.

The analysis results indicate the groundwater to be in compliance for most of the parameters as per prescribed standards at all monitored locations. High BOD and COD in GW4 sample indicates the localized contamination of GW in the area. However, the presence of total and faecal coliform in GW1, GW5 and GW6 indicates that they would require conventional treatment and disinfection prior to being used for drinking purposes.

4.3.8 Natural Hazards

Various relevant natural hazards were analysed based on secondary information. This includes floods, earthquake and drought severity.

4.3.8.1 Earthquake Risk

As per the Earthquake Hazard/Zoning Map[1], India is classified into four (4) zones based on the severity of probable earthquake on the Medvedev-Sponheuer-Karnik Scale (MSK), as shown below:

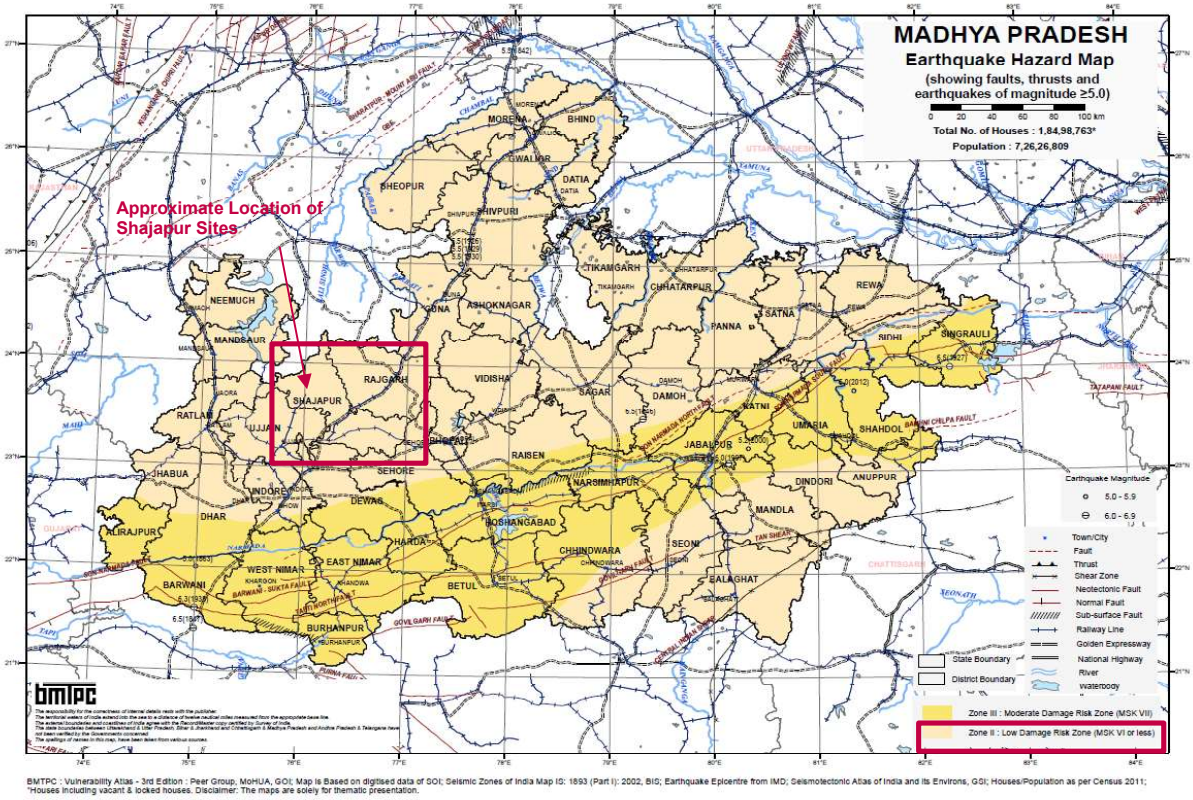
- Zone V: Very High Damage Risk Zone (MSK IX or more);
- Zone IV: High Damage Risk Zone (MSK VIII);
- Zone III: Moderate Damage Risk Zone (MSK VII); and
- Zone II: Low Damage Risk Zone (MSK VI or less)

MSK Intensity Scale is a macro-seismic intensity scale used to evaluate the severity of ground shaking on the basis of observed effects in an area of the earthquake occurrence. The MSK scale comprises of twelve (12) intensity degrees ranging from I to XII, where 'I' represents least severe and XII represents most severe intensity. The zoning was defined primarily depending on the known seismic history of the region, the postulated seismic activity of the future, and the indicative time intervals between two (2)

[1] Building Materials and Technology Promotion Council (BMTPC), Ministry of Housing and Urban Affairs, Government of India. Earthquake Zoning Map: http://bmtpc.org/DataFiles/CMS/file/VAI2019/MAP/eqmap/EQ_JPG/EQ_INDIA.jpg

consecutive occurrences in the same area[1] . The earthquake hazard map is presented in ***Figure 4.22***. Based on the review of the earthquake data and map, the location of the Project site falls under Zone II (low damage risk zone/ degree VI or less earthquake hazard on the MSK scale). Hence the risk of earthquake in the Site and its study area is anticipated to be ***'Low'***.

Figure 4.22 Earthquake Hazard Map of Madhya Pradesh



BMTPC : Vulnerability Atlas - 3rd Edition : Peer Group, MoHUA, GOI; Map is Based on digitised data of SOI; Seismic Zones of India Map IS: 1893 (Part I): 2002, BIS; Earthquake Epicentre from IMD; Seismotectonic Atlas of India and its Environs, GSI; Houses/Population as per Census 2011; *Houses including vacant & locked houses. Disclaimer: The maps are solely for thematic presentation.

Source: Building Materials and Technology Promotion Council (BMTPC), 2019. Vulnerability Atlas of India, Ministry of Housing and Urban Affairs, Government of India: http://bmtpc.org/DataFiles/CMS/file/VAI2019/index.html

4.3.8.2 Wind and Cyclones

Wind hazard for Project site was evaluated based on two (2) wind hazard maps. These are Average Wind Speed Map (available in Global Wind Atlas 2.0 and developed by DTU) and Basic Wind Speed Map of India (developed by BMTPC). Basic Wind Speed is defined as the peak wind velocity over a 50 years return period, and is considered to be an extreme and conservative estimate of wind speed at the Site and in surrounding areas. On the other hand, the average wind speed is defined as long term annual mean wind velocity.

The macro-level wind speed zones of India have been formulated and published in IS: 875 (Part 3) - 1987 entitled as 'Indian Standard Code of Practice for Design Loads (other than earthquakes) for Buildings and Structures, Part 3, Wind Loads'. The six (6) wind speed zones and extent of likely damage corresponding to each wind speed zone are presented in ***Table 4.15***. The basic wind hazard map of the study region is shown in ***Figure 4.23***. The basic wind speeds are applicable to 10 m height above mean ground level in an open terrain with a return period of 50 years[2] . The basic wind speeds (as per BMTPC) were compared against the Beaufort Scale of Wind Classification[3] as presented in ***Figure 4.24***. The Beaufort scale is an empirical measure that relates wind speed to observed conditions at sea or on land. The scale

[1] Building Materials and Technology Promotion Council (BMTPC), 2019. Vulnerability Atlas of India, Ministry of Housing and Urban Affairs, Government of India: http://bmtpc.org/DataFiles/CMS/file/VAI2019/index.html

[2] Building Materials and Technology Promotion Council (BMTPC), 2019. Vulnerability Atlas of India, Ministry of Housing and Urban Affairs, Government of India:
http://bmtpc.org/DataFiles/CMS/file/VAI2019/index.html

[3] The Beaufort Scale. Royal Meteorological Society: https://www.rmets.org/resource/beaufort-scale

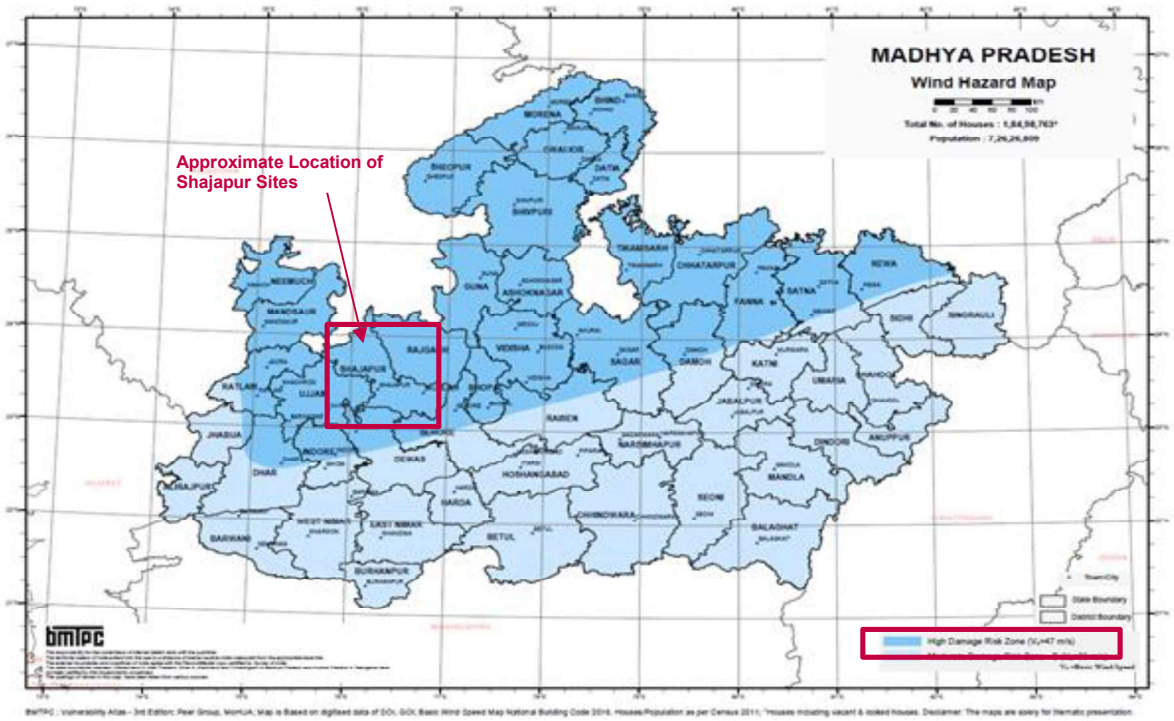
classifies mean speeds, usually averaged over 10 minutes by convention, and does not capture the speed of wind gusts. The quoted wind speed is that measured at 10 m above ground, not at the surface (which, at 2 m, may be only 50-70% of these estimates).

Table 4.15 Wind Hazard Categorisation

S.N.	Wind Speed (m/s and km/hr)	Wind Damage Zone
1	55 m/s (198 km/h)	Very High Damage Risk Zone - A
2	50 m/s (180 km/h)	Very High Damage Risk Zone - B
3	47 m/s (169.2 km/h)	High Damage Risk Zone
4	44 m/s (158.4 km/h)	Moderate Damage Risk Zone - A
5	39 m/s (140.4 km/h)	Moderate Damage Risk Zone - B
6	33 m/s (118.8 km/h)	Low Damage Risk Zone

Source: Building Materials and Technology Promotion Council (BMTPC), 2019. Vulnerability Atlas of India, Ministry of Housing and Urban Affairs, Government of India: http://bmtpc.org/DataFiles/CMS/file/VAI2019/index.html

Figure 4.23 Basic Wind Hazard Map of Madhya Pradesh



Source: https://bmtpc.org/DataFiles/CMS/file/VAI2019/map/windmap/WIND_madhya%20pradesh.pdf

Figure 4.24 Beaufort Scale of Wind Speed Characterization

Wind Force	Description	km/h	mph	knots	Specifications
0	Calm	<1	<1	<1	Smoke rises vertically
1	Light Air	1-5	1-3	1-3	Direction shown by smoke drift but not by wind vanes
2	Light Breeze	6-11	4-7	4-6	Wind felt on face; leaves rustle; wind vane moved by wind
3	Gentle Breeze	12-19	8-12	7-10	Leaves and small twigs in constant motion; light flags extended
4	Moderate Breeze	20-28	13-18	11-16	Raises dust and loose paper; small branches moved
5	Fresh Breeze	29-38	19-24	17-21	Small trees in leaf begin to sway; crested wavelets form on inland waters
6	Strong Breeze	39-49	25-31	22-27	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty
7	Near Gale	50-61	32-38	28-33	Whole trees in motion; inconvenience felt when walking against the wind
8	Gale	62-74	39-46	34-40	Twigs break off trees; generally impedes progress
9	Strong Gale	75-88	47-54	41-47	Slight structural damage (chimney pots and slates removed)
10	Storm	89-102	55-63	48-55	Seldom experienced inland; trees uprooted; considerable structural damage
11	Violent Storm	103-117	64-72	56-63	Very rarely experienced; accompanied by widespread damage
12	Hurricane	118 plus	73 plus	64 plus	Devastation

From wind damage viewpoint, the Project site falls in the region with a basic wind speed of 47 m/s (169.2 km/h) which is classified as 'high risk zone', considering the damage it can cause on built and natural environment. Based on the basic wind speed maps, the likelihood of risk at the Project site was evaluated as ***High*** based on BMTPC scale and Beaufort scale of wind classification (***Table 4.16***).

Table 4.16 Summary of Wind Hazard Categorisation

Asset Name	(A) Wind Hazard Zone per BMTPC Map	(B) Beaufort Scale as per Basic Wind Speed	Wind Hazard Category (higher of (A) and (B)
Shajapur Solar Park	High Damage Risk Zone	High	High

4.3.8.3 Flood Hazard

The 2 km radius area around the Project Sites is largely occupied by open lands; scrubland; agricultural land along the stream and low lying areas; forest land; scattered residential settlements; and river channels of the Kali Sindh River and its tributaries.

A tributary (major stream) of Kali Sindh River is located in the west at distances of ~2.5 to 3.0 km parallel to the Moman Badodiya Site, flowing from south to north. No major streams were found in the vicinity of these Sites except few local streams which originate at the Site ridge and flow from east to west during the rains. One (1) village pond was observed at northern boundary of the Unit 6 Site in Moman Badodiya.

A tributary (major stream) of Kali Sindh River flows at distance of ~2.0 km north to the Shajapur Site, flowing along south – north direction. This major stream stretches in northward vector. No major streams were observed in the vicinity of Shajapur Site, though few first order (seasonal) streams originate at the Site ridge and flow along east-west direction. One village pond found at northern boundary of the Shajapur Site.

- Per the global estimated risk index for flood hazard map developed by UNEP/GRID-Europe, Units 7A and 7B of Moman Badodiya Site are partially located in '***Moderate***' flood risk area. Whereas Unit 6 of Moman Badodiya Site and Shajapur Site are not prone to flooding;
- Per the global flood hazard map developed by FM Global, both Moman Badodiya Site and Shajapur Site are **not prone** to high or medium flood risk;
- Based on Aqueduct's global flood hazard map, both Moman Badodiya Site and Shajapur Site fall in the "**Low**" river flooding hazard zone;
- Based on global flood hazard frequency and distribution map developed by Data Basin, the Site and its surroundings at Moman Badodiya and Shajapur are **not prone** to flooding.

Considering the above mentioned attributes, the Site is '***Low***' to '***Moderately***' *susceptible* to flooding, inundation and/or water logging. Detailed Flood Likelihood Assessment is provided in **Appendix D**.

4.3.9 Climate and Meteorology

The climate of Shajapur district is characterized by hot summer and general dryness except during the south-west monsoon season. The year may be divided into four seasons; summer season from March–May, rainy season from June–September, post- monsoon season October and November, and the winter season from December–February.

The long term (period 1981-2010) meteorology of the region was based on data recorded at the nearest observatory station of India Meteorological Department (IMD) at Shajapur that is ~20-22 km (aerial) from the proposed Solar site at Moman Badodiya and South Shajapur. The climatological data of Shajapur observatory is presented in ***Table 4.17*** and described in subsequent sections.

Table 4.17 Climatological Variations at Shajapur Station (1981-2010)

Month	Temperature (°C)		Relative Humidity (%)		Rainfall (mm)	Predominant Winds (wind from)		Mean Wind Speed (kmph)
	Daily Max	Daily Min	08:30 hrs	17.30 hrs		08:30 hrs	17.30 hrs	
January	26.1	8.8	69	43	8.0	NE	NE	2.4
February	29.1	10.7	57	33	4.2	NE	W	2.8
March	34.6	15.7	44	24	1.6	W	W	3.5
April	39.3	21.6	33	18	3.0	W, NW	W, NW	4.9
May	41.4	26.2	42	22	11.4	W, NW	W, NW	6.5
June	38.1	25.8	63	43	95.1	W, NW	W, NW	7.3
July	32.0	23.9	81	67	239.4	SW, W	SW, W	7.0
August	29.7	23.1	86	76	318.3	W, NW	W, NW	5.7
September	32.0	22.2	79	65	126.8	W, NW	W, NW	3.9
October	33.6	17.8	62	43	24.9	W, NW	N, NE	2.2
November	30.5	12.4	59	43	10.6	SE, NE	NE, N	2.0
December	27.3	9.2	65	46	4.5	SE, NE	NE, N	1.8
Annual	**32.8**	**18.1**	**61**	**43**	**847.7**	**W**	**NW**	**4.2**

Source: Climatological Normals, 1981-2010, issued by Office of Additional Director General of Meteorology, India Meteorological Department, Pune

Temperature

Temperatures vary considerably from season to season. The summers are generally hot and winters are mildly cool. Mean maximum temperature ranges between 26.1°C during January to about 41.4°C during May and the mean minimum temperatures vary between 8.°C during January and 26.2°C during May. The annual average maximum temperature was 32.8°C and minimum of 18.1°C.

Relative humidity

The monthly average relative humidity ranged from 33% to 86% at 08.30 am and from 18% to 76% at 17.30 pm. The annual average relative humidity ranged from 43% at 17.30 hrs to 61% at 08.30 am. The relative humidity during morning was always recorded to be higher than evenings. This is because the cooler morning air is closer to saturation than the hot afternoon air, even with the same amount of water vapor.

Wind Speed and Wind Direction

The monthly mean wind speed varied between 1.8 kmph (~0.5 m/s) in December to 7.3 kmph (~2.0 m/s) in June. The annual average wind speed was 4.2 kmph (~1.2 m/s). The predominant wind directions at 08.30 am and 17.30 pm was wind blowing from NE, W and NW.

Rainfall

Long-term (1981 - 2010) average annual total rainfall for Shajapur station was 848 mm, as per IMD Climatological Table. Most of the rainfall is received during the month of August (318 mm) and minimum in April (1.6 mm). Rainfall recorded in Shajapur district from 2014 - 2018 has been presented in ***Table 4.18***. As per this table, total annual rainfall from 2016 to 2018 was 1,360, 816 and 820 mm respectively with maximum rainfall occurring in August for 2016 and July for other years.

Table 4.18 Rainfall Data of Shajapur Region

Year	January	February	March	April	May	June	July	August	September	October	November	December	Total (mm)
2014	26.9	18.1	0.0	1.7	3.6	16.5	264.3	205.2	194.8	2.5	0.0	20.0	753.6
2015	61.3	2.0	34.1	6.5	0.4	278.0	789.6	378.3	27.3	1.0	0.0	0.0	1578.5
2016	11.7	0.0	1.1	0.0	9.0	151.0	479.0	393.0	109.5	8.5	0.0	0.0	1162.8
2017	0.0	0.0	0.0	0.0	3.2	147.5	236.0	90.8	174.7	9.0	1.3	0.7	663.2
2018	0.0	0.0	0.8	0.0	2.5	139.5	379.5	151.5	82.5	4.6	0.0	0.0	760.9

Source: http://hydro.imd.gov.in/hydrometweb/(S(ethtoq454bqlzby11fi4ejut))/DistrictRaifall.aspx

4.3.10 Ambient Air Quality

The existing ambient air quality of the study area was monitored at two (2) locations for each sub sites during the study period. The monitoring parameters includes Respirable Particulate Matter (RPM) i.e. PM_{10} (particulate matter of particle size less than 10 micrometres) and $PM_{2.5}$ (particulate matter of particle size less than 2.5 micrometres), Sulphur Dioxide (SO_2), Oxides of Nitrogen (NO_x) and Hydrocarbons (HC). The parameters were monitored on 24 hourly basis twice a week for a week during the study period.

Selection of Sampling Locations

The baseline status of the ambient air quality has been established through ambient air quality monitoring network and the sampling locations were selected taking into consideration the factors such as:

- Predominant wind direction for winter season based on IMD climatological information;
- Topography of the study area;
- Information on existing and proposed pollution sources; and
- Location of dense settlement.

The details of monitoring locations within the study area has been presented in Table 4.19 below. Map showing location of ambient air quality monitoring locations for Moman Badodiya and South Shajapur sub-Sites are presented in Figure 4.1 and Figure 4.2.

Table 4.19 Details of Ambient Air Monitoring Stations

Location Code	Sampling location	Zone	Easting (E)	Northing (N)	Direction and distance from project site
AAQ1	Gondalmau	43Q	628254.98 m	2624671.03 m	~2.25 km NE of Moman Badodiya Unit 7
AAQ2	Burlay	43Q	628558.82 m	2617558.59 m	~1.5 km NE of Moman Badodiya Unit 6 & ~0.7 km SE of Moman Badodiya Unit 7
AAQ3	Hanoti	43Q	624065.00 m	2571581.55 m	~0.9 km NW of South Shajapur Unit 8
AAQ4	Khareli	43Q	621660.41 m	2567542.57 m	~2.7 km SW of South Shajapur Unit 8

Source: ERM site visit

The applied testing procedures are given in ***Table 4.21***.

Table 4.20 Details of Methods for different Air Quality Parameters

S. N	Parameter	Range/ Detection Methods
1	PM_{10}	IS-5182 (Part -23):2006 & CPCB Guidelines Volume 1 (2012-2013)
2	$PM_{2.5}$	CPCB Guidelines Volume 1 (2012-2013)
3	SO_2	IS-5182 (Part-II):2001
4	NOx	IS-5182 (Part-VI):2006
5	HC	NIOSH (1994) Hydrocarbons : Method 1500, Hydrocarbons BP 36◦C -216◦C, NIOSH manual of Analytical Methods (NMAM), Isssue-3, March 15 2003;

Summarised AAQ results as monitored at various locations are presented in ***Table 4.21***. The ambient air quality results have been presented in **Appendix C**.

Table 4.21 Ambient Air Quality Monitoring Results in the Study Area

Parameter	Units	Observed	AAQ1 (Gondalmau)	AAQ2 (Burlay)	AAQ3 (Hanoti)	AAQ4 (Khareli)	Inferences
PM_{10}	µg/m^3	Minimum	60.3	62.1	55.7	58.0	The PM_{10} concentration recorded at both the sampling locations was within the National Ambient Air Quality Standards (NAAQS).
		Maximum	61.3	63.0	60.6	62.3	
		Average	60.80	62.55	58.15	60.15	
		NAAQS	**100**	**100**	**100**	**100**	
$PM_{2.5}$	µg/m^3	Minimum	19.5	20.4	20.4	17.0	The $PM_{2.5}$ values were observed to be within the prescribed NAAQS standards (60 µg/m^3).
		Maximum	22.2	24.8	22.2	17.8	
		Average	20.85	22.60	21.30	17.40	
		NAAQS	**60**	**60**	**60**	**60**	
SO_2	µg/m^3	Minimum	6.9	7.3	6.9	6.7	All the values were observed to
		Maximum	7.2	7.8	7.5	7.9	

Parameter	Units	Observed	AAQ1 (Gondalmau)	AAQ2 (Burlay)	AAQ3 (Hanoti)	AAQ4 (Khareli)	Inferences
		Average	7.05	7.57	7.22	7.28	be within the prescribed NAAQS standards (80 µg/m^3).
		NAAQS	**80**	**80**	**80**	**80**	
NOx	µg/m^3	Minimum	17.5	18.2	17.4	19.1	All the values were observed to be within the prescribed NAAQS standards (80 µg/m^3).
		Maximum	20.4	22.1	18.2	20.4	
		Average	18.95	20.15	17.80	19.75	
		NAAQS	**80**	**80**	**80**	**80**	
HC	µg/m^3	Minimum	9.5	6.4	10.8	15.1	
		Maximum	14.3	7.5	14.9	19.2	
		Average	11.9	6.95	12.85	17.15	

Figure 4.25 PM10 Concentration in the Study Area

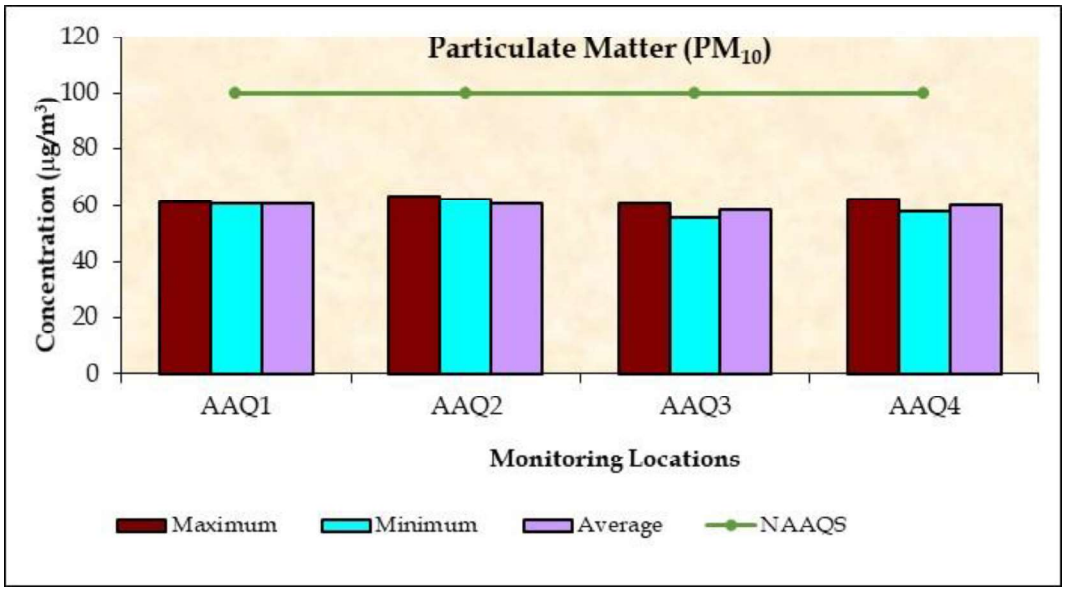


Figure 4.26 $PM_{2.5}$ Concentration in the Study Area

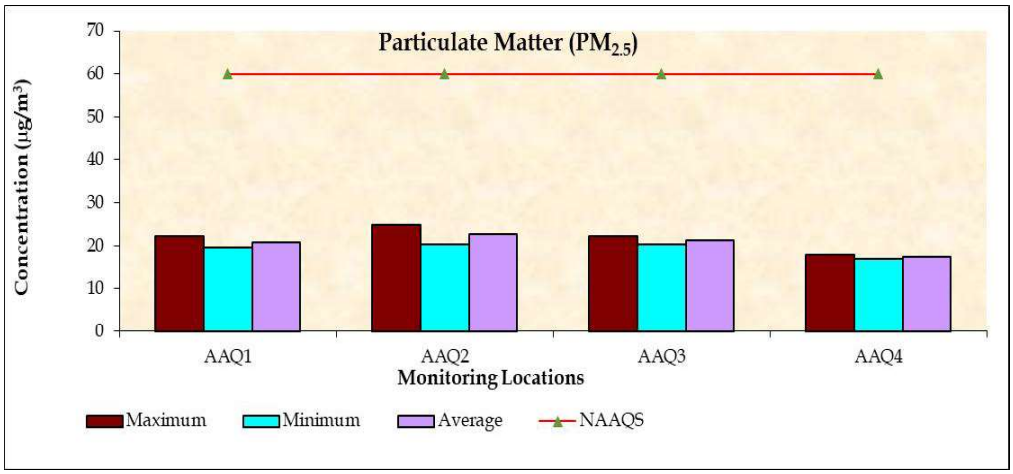


Figure 4.27 SO_2 Concentration in the Study Area

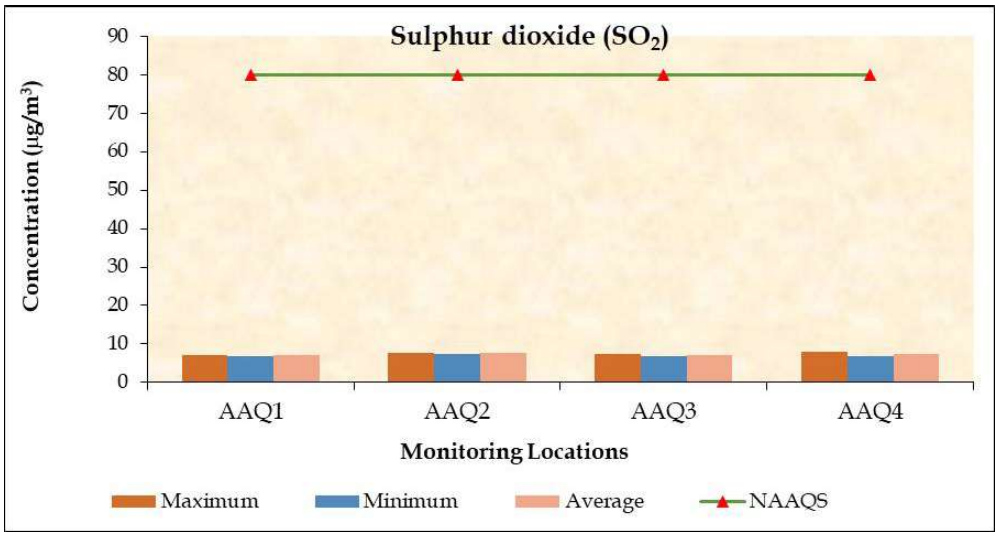


Figure 4.28 NO_x Concentration in the Study Area

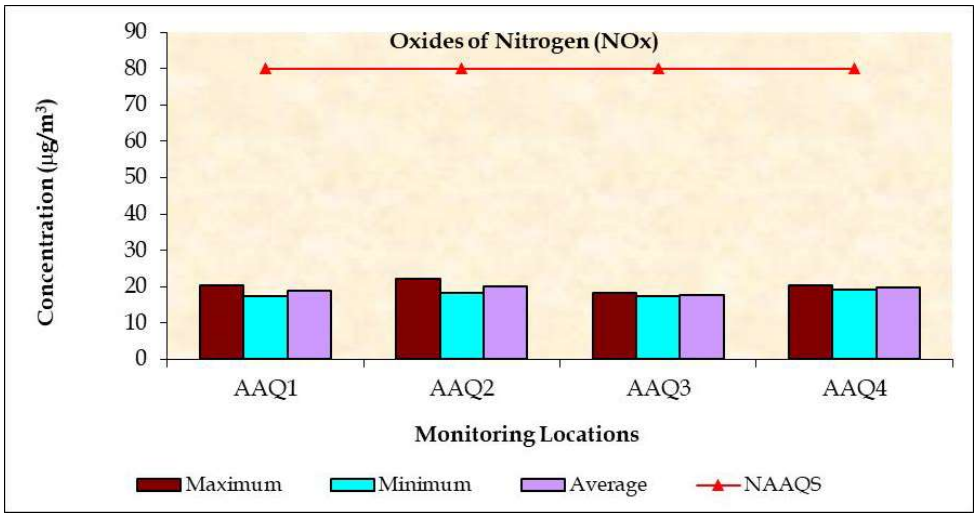
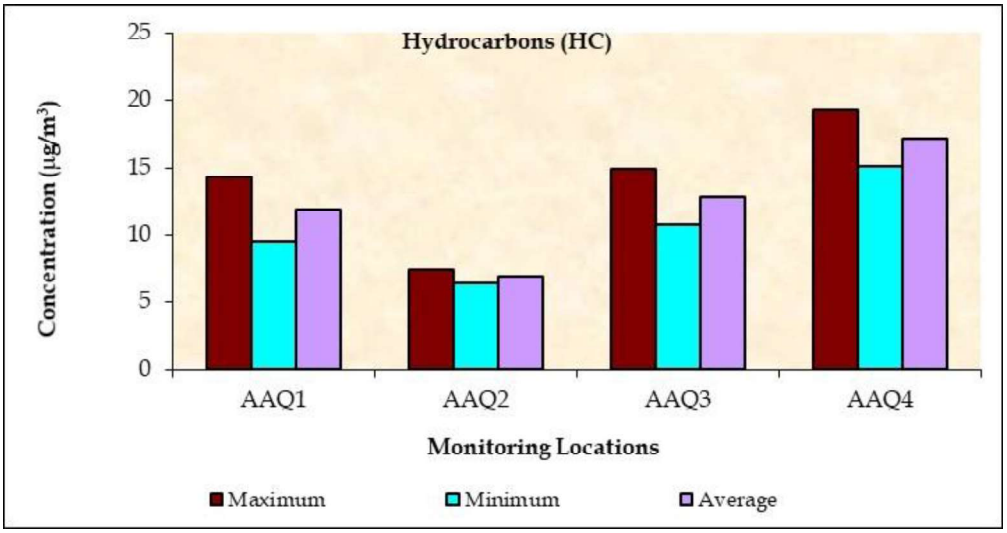


Figure 4.29 HC Concentration in the Study Area



4.3.11 Ambient Noise

The ambient noise levels within the study area was monitored at five (05) locations each for sub sites within 2-5 km radius of the site. The details regarding the samples collected and the results obtained are discussed below. Map showing noise monitoring locations have been presented in ***Figure 4.1*** and ***Figure 4.2.***

Table 4.22 Details of Noise Sampling Locations

S.N.	Location	Sample Code	Zone	Easting (mE)	Northing (mN)	Distance and direction from Project Site
1	Chouma	NQ1	43 Q	625342.49 m	2615860.35 m	~2.6 km in west from Moman Badodiya Unit 6
2.	Gondalmau	NQ2	43 Q	628265.34 m	2624670.88 m	~2.7 km in North from Moman Badodiya Unit 7
3	Burlay	NQ3	43Q	628563.27 m	2617862.79 m	~0.7 km in East from Moman Badodiya Unit 7
4	Dehripal	NQ4	43Q	628896.27 m	2621067.55 m	~0.4 km in North from Moman Badodiya Unit 7

S.N.	Location	Sample Code	Zone	Easting (mE)	Northing (mN)	Distance and direction from Project Site
5	Dhatrawada	NQ5	43Q	631008.39 m	2614886.27 m	~0.2 km in East from Moman Badodiya Unit 6
6	Peer Umrod	NQ6	43Q	626322.62 m	2572882.83 m	~1.6 km in North of South Shajapur Unit 8
7	Updi	NQ7	43Q	626339.27 m	2567897.40 m	~0.8 km in South East of South Shajapur Unit 8
8	Jhonkar	NQ8	43Q	621068.97 m	2570231.23 m	~1.8 km in West of South Shajapur Unit 8
9	Khareli	NQ9	43Q	621660.41 m	2567542.57 m	~0.9 km NW of South Shajapur Unit 8
10	Hanoti	NQ10	43Q	624065.00 m	2571581.55 m	~2.7 km SW of South Shajapur Unit 8

Source: ERM's Site Assessment
Note: The Coordinates have been presented in the UTM Format

Sound pressure level (SPL) measurements in dB(A) was recorded for 24 hours with the noise values computed as Leq (Daytime) and Leq (Night time) for each location. Daytime is considered between 06:00 to 22:00 hours and night from 22:00 hours to 06:00 hours. The results so obtained were compared with ambient noise standards specified for respective category under the Noise Pollution (Regulation & Control) Rules, 2000. The summary of noise quality results is presented in ***Table 4.23.***

Table 4.23 Ambient Noise Monitoring Results

SN.	Location	$L_{eq\ day}$	CPCB and WHO limits* Leq	$L_{eq\ night}$	CPCB and WHO limits Leq
1	Chouma	50.0	55	48.8	45
2	Gondalmau	53.0	55	50.0	45
3	Burlay	59.2	55	58.1	45
4	Dehripal	47.7	55	44.5	45
5	Dhatrawada	59.9	55	57.8	45
6	Peer Umrod	57.8	55	56.4	45
7	Updi	50.5	55	46.6	45
8	Jhonkar	57.7	55	56.9	45
9	Khareli	57.2	55	57.6	45
10	Hanoti	55.3	55	52.6	45

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

Discussion of Results

The observations from noise monitoring at different locations in the study area indicate that the recorded Leq day levels varied from 47.7 dBA (Dehripal) to 59.9 dBA (Dhatrawada) both falling within Moman Badodiya. The Leq night levels varied from 44.5 dBA (Dehripal) to 58.1 dBA (Burlay) again both falling within the Moman Badodiya. The day time noise levels were found to be exceeding the prescribed standards (55 dBA) at NQ3 (Burlay), NQ5 (Dhatrawada), NQ6 (Peer Umrod), NQ8 (Jhonkar), NQ9 (Khareli) and NQ10 (Hanoti). Night time noise levels were exceeding the standards at all the locations except NQ4 (Dehripal). The high noise levels could be due to the reason that the village are densely populated and therefore noise does not dissipates in the environment properly.

Thus, the noise quality in the areas falling under all the Units – Moman Badodiya and South Shajapur was not found to be satisfactory and care will have to be taken during construction and operation phases of the proposed project to try and minimise the further increase in noise levels.

4.3.12 Traffic Monitoring

Traffic count survey was conducted at 2 intersections which forms the important access to the site for the baseline. Detail of traffic survey locations is given in Table 4.24.

Table 4.24 Traffic Count Survey Location

Monitoring Location	Distance & Direction w.r.t Project Site	Justification for Selection of Location
Agar to Sarangpur Road	Adjacent to Moman Badodiya sub-site	Access road to project site
Jhonkar to Palsavad Road	0.7 km in west of the South Shajapur sub-site	Access road to project site

The summarised results of the traffic survey are given in ***Table 4.25*** & ***Table 4.26.*** Refer **Appendix C.** for detailed results of traffic survey.

Table 4.25 Existing Traffic (Motorised) Volumes in Study Area

Description	Agar to Sarangpur Road	Jhonkar to Palsavad Road
Total Traffic (Nos.) / 24 Hours (To & fro)	2037	1152
Average Traffic Flow / hr.	85	48
Max Traffic Flow (nos.) / hr.	151	122
Min Traffic Flow (nos.) / hr.	17	05
Max Traffic Flow (Time- hours)	14:00- 15:00 hrs	14:00- 15:00 hrs
Min Traffic Flow (Time-hours)	04:00- 05:00 hrs	04:00- 05:00 hrs

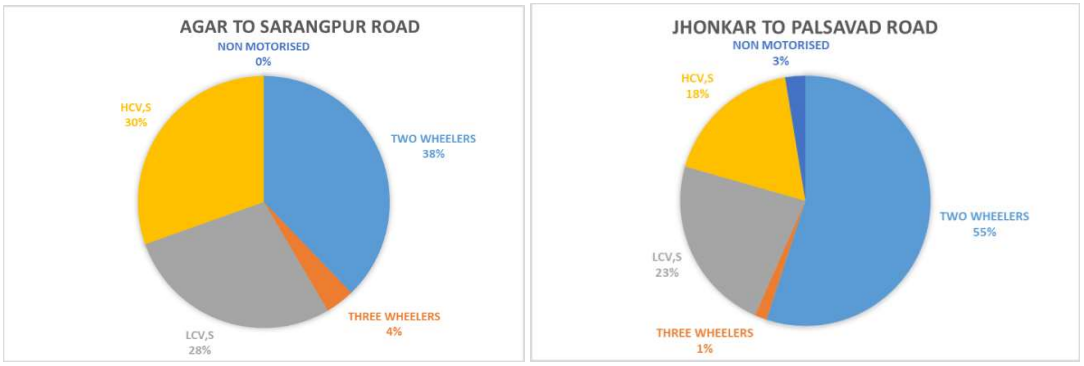
Table 4.26 Percentage Composition of Vehicles in Study Area

Location	Percentage Composition				
	Non-Motorised	Two Wheeler	Three Wheeler	LMV	HMV
Agar to Sarangpur Road	0%	37.80%	3.73%	28.03%	30.44%
Jhonkar to Palsavad Road	2.60%	55.03%	1.56%	22.83%	17.97%

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

The percentage composition of different vehicle categories in the total traffic at monitored locations is shown in ***Figure 4.30***.

Figure 4.30 Percentage Composition of Different Vehicles Categories



4.4 Biological Environment- Flora and Fauna

The ecological baseline data was collected in two session i.e., first session from 10th -13th December 2019 and second session from 22nd to 24th January 2020 in the project area and surrounding 5 km radial area in order to assess and establish an ecological baseline of the study area, which helps to understand

the impacts of the project on the floral and faunal species and habitats in the surrounding areas and finally in the management strategy and mitigation. The study was conducted with following objectives:

- Identification of the sensitive areas falling within and adjoining areas;
- Classification of flora for any endangered or protected or endemic floral species prevailing in the Area of Influence (including solar plant) based on field surveys; and
- Identification of areas protected under international conventions, national or local legislation and those recognized nationally and internationally for their ecological, landscape, cultural or other related value.
- Identification of fauna (specifically birds, amphibians, mammals and reptiles) based on direct sightings, calls, pugmarks, droppings, nests, etc.;
- Identification and classification of any species recognized as threatened (in accordance with International Union for the Conservation of Nature [IUCN] Red List Online Version 2019-2) and according to the schedules of the Wildlife (Protection) Act, 1972; and
- Identification of areas which are important or sensitive for ecological reasons including their breeding, nesting, foraging, resting, overwintering areas including wildlife migratory corridors/avian migratory routes; and
- Identification and assessment of aquatic ecological resources within the study area.

4.4.1 Approach and Methodology for Baseline Data Collection

Determining Study Area

The study area of the ecological surveys has been determined as follows:

- **Project Footprint:** It includes the proposed project area boundary and its immediate vicinity.
- **AoI:** 5 km radius from the project boundary based on the ERMs past experience of projects of similar nature and probable area for representation of species that could be affected by the under-construction and operational solar project.

The study area for the ecological surveys varies from the environmental baseline due to the relatively longer range of biological receptors and to capture movement of the potentially affected species.

The methodology followed for floral and faunal analysis is given in ***Table 4.27.***

Table 4.27 Methodology for ecological survey

Particular	Methodology
Floral Analysis	The major vegetation habitats identified in the proposed Solar Park area and 5 km area include vegetation on plateau, open scrub, grasslands and agricultural lands. Habitat specific vegetation survey was undertaken to enumerate the trees, shrubs and herbs in the Area of Influence.
Faunal Analysis	
Herpetofaunal	Intensive search was made along the hedges of all the aquatic habitats and open wells located in the study area were checked to identify and list the amphibians. Status of reptiles was assessed using Intensive Time Constrained Search Methods (1)(2) covering different micro habitats surveyed within the Solar Park area and 5 km radius of the Area of Influence.
Avifauna	Avifaunal species were enumerated by habitat surveys at the representative areas in different available habitats. Avian nomenclature followed Standard field guides (3)

(1) Welsh, H.H., jr. 1987. Monitoring herpetofauna in woodlands of north western California and south west Oregon: a comparative strategy. Pp. 203-213. In. Multiple – Use Management of Califirnia's hardwood resources. T.R. Plumb, N.H. Pillisbury (eds. Gen. Tech. Regional Environmental Planning. PSW – 100) US Department of Agriculture, Forest Service
(2) Welsh, H.H. Jr. and Lind, A. 1991. The structure of the herpetofaunal assemblage in the Douglas-fir/hardwood forests of northwestern California and south western Oregon. Pp: 395-411. In: Wildlife and vegetation of unmanaged Douglas-fir forests. (Tech.Coords). L.F. Ruggiero, K.B. Aubry, A.B. Carey and M.H. Huff. Ge. Tech. Rep. PNW-GTR-285. Portland, OR: US. Department of Agriculture, Forest Service.
(3) Birds of India, Srilanka, Pakistan, Nepal, Bhutan, Bangladesh and Maldives. 2000. Krys Kazmeierczak and Ber Van `Perlo. Om Field Guides.

Particular	Methodology
Mammals	Habitat survey for mammals was conducted. Identification was followed by standard literature (1) (2)

Secondary literature from published books and research publications were also consulted for the flora and fauna of the study area. Review of Forest Working Plan of the area was undertaken to validate the findings of the primary survey. The enumerated list of faunal species assessed with the IUCN Red data list (v2019.3) and schedule 1-6 of Wildlife Protection Act, 1972 to confirm their conservation status. In addition to this information was also obtained through online databases including Wildlife Institute of India ENVIS Centre (wiienvis.nic.in), Birdlife International Data Zone (datazone.birdlife.org/home), UNESCO World Heritage Sites (whc.unesco.org) and Alliance for Zero Extinction Sites (zeroextinction.org). Consultation was also undertaken with local communities to determine presence of threatened and protected species and identify key roosting/nesting sites (e.g. bat roosting sites) across the study area.

4.4.2 Habitat and Floral Survey

Moman Badodiya Site

The study site comes under 4B: Semi-Arid – Gujarat Rajputana Biogeographical Province of India[3]; Deccan Plateau Agro Ecological Sub Region (ICAR)[4] and Western Plateau and Hills Region (IX) Agro-Climatic Region[5]. As per the Champion and Seth forest classification[6], the study area represents Tropical Dry deciduous Babul Forest (5/E3) and Secondary Dry Deciduous Forests (5/2S_1) types of vegetation. In the Moman Badodiya study area, the project site is dominated with scrublands; while the agricultural land is dominated in the surrounding area (Figure 4.31). The project site is dominated with few drought resistance trees, *Acacia senegal* (L.) Willd., *Acacia nilotica* (L.) Delile, *Butea monosperma* (Lam.) Taub., *Acacia leucophloea* (Roxb.) Willd., etc.; shrubs, *Acacia jacquemontii* Benth., *Ziziphus nummularia* (Burm.f.) Wight & Arn., *Senna tora* (L.) Roxb., *Agave sisalana* Perrine, etc.; herbs, *Solanum virginianum* L., *Tridax procumbens* L., *Alternanthera sessilis* (L.) R.Br. ex DC., etc.; grass, *Cenchrus ciliaris* L. *Chrysopogon fulvus* (Spreng.) Chiov., *Eragrostis amabilis* (L.) Wight & Arn., etc.

The surrounding area is represented by agricultural lands with the scattered trees [e.g., *Acacia nilotica* (L.) Delile, *Azadirachta indica* A. Juss, *Ficus benghalensis* L., *Ficus religiosa* L., *Ficus racemosa* L., *Leucaena leucocephala* (Lam.) de Wit, *Prosopis juliflora* (Sw.) DC., *Phoenix sylvestris* (L.) Roxb., *Holoptelea integrifolia* (Roxb.) Planch, *Mallotus nudiflorus* (L.) Kulju & Welzen, *Tamarindus indica* L., *Mangifera indica* L., *Melia azedarach* L., *Ailanthus excelsa* Roxb., *Dalbergia sissoo* Sensu Miq., *Pongamia pinnata* (L.) Pierre, *Albizia lebbeck* (L.) Benth., *Ziziphus jujuba* Mill., *Bombax ceiba* L., *Eucalyptus* sp., etc.]; *Dendrocalamus strictus* (Roxb.) Nees and shrubs [e.g., *Ziziphus nummularia* (Burm.f.) Wight & Arn., *Lantana camara* L., *Jatropha curcas* L., *Ricinus communis* L., *Calotropis procera* (Aiton) W.T.Aiton, *Ipomoea carnea* Jacq., etc.

(1) Prater. S. H. 2005. The Book of Indian Animals. Bombay Natural History Society and Oxford University press 12th Edn. pp. 316.
(2) Menon, V. 2003. A field guide to Indian Mammals. Dorling Kindersley (India) Ltd. New Delhi. 201 p.

[3] Wildlife Institute of India - ENVIS Centre

[4] http://iasri.res.in/agridata//12data%5Cchapter1%5Cdb2012tb1_3.pdf

[5] http://iasri.res.in/agridata//12data%5Cchapter1%5Cdb2012tb1_2.pdf

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

Figure 4.31 Habitats in study area

Scrub land

Agriculture land with Wheat crop

Waterbody

Open Scrub

Open Scrub/Grassland

Figure 4.32 Representative Flora of the region

Butea monosperma (Lam.) Taub.

Acacia nilotica (L.) Delile.

Leucaena leucocephala (Lam.) de Wit

Prosopis juliflora (Sw.) DC.

Phoenix sylvestris (L.) Roxb.

Ipomoea carnea Jacq.

South Shajapur Site

The study site comes under 4B: Semi-Arid – Gujarat Rajputana Biogeographical Province of India[1]; Deccan Plateau Agro Ecological Sub Region (ICAR)[2] and Western Plateau and Hills Region (IX) Agro-Climatic Region[3]. As per the Champion and Seth forest classification[4], the study area represents Tropical Dry deciduous Babul Forest (5/E3) and Southern Thorn Forest (6A/C_1) types of vegetation.
In the Shajapur study area, the project site is dominated with scrublands; while the agricultural land is dominated in the surrounding area (***Figure 4.33***). The project site is dominated with few drought resistance trees, *Acacia senegal* (L.) Willd., *Acacia nilotica* (L.) Delile, *Butea monosperma* (Lam.) Taub., *Phoenix sylvestris* (L.) Roxb., etc.; shrubs, *Ziziphus nummularia* (Burm.f.) Wight & Arn., *Lantana camara* L., *Senna auriculata* (L.) Roxb., *Senna tora* (L.) Roxb., etc.; herbs, *Alternanthera sessilis* (L.) R.Br. ex DC., *Euphorbia hirta* L., etc.; grass, *Chrysopogon fulvus* (Spreng.) Chiov., *Apluda mutica* L., etc.

The surrounding area is represented by agricultural lands with the scattered trees [e.g., *Acacia nilotica* (L.) Delile, *Azadirachta indica* A. Juss, *Ficus benghalensis* L., *Leucaena leucocephala* (Lam.) de Wit, *Prosopis juliflora* (Sw.) DC., *Tamarindus indica* L., *Mangifera indica* L., *Ailanthus excelsa* Roxb., *Dalbergia sissoo* Sensu Miq., *Pongamia pinnata* (L.) Pierre, *Ziziphus jujuba* Mill., *Parkinsonia aculeata* L.,

[1] Wildlife Institute of India - ENVIS Centre

[2] http://iasri.res.in/agridata//12data%5Cchapter1%5Cdb2012tb1_3.pdf

[3] http://iasri.res.in/agridata//12data%5Cchapter1%5Cdb2012tb1_2.pdf

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

etc.] and shrubs [e.g., *Ziziphus nummularia* (Burm.f.) Wight & Arn., *Lantana camara* L., *Calotropis procera* (Aiton) W.T.Aiton, etc.] The list of species is presented in the ***Table 4.28*** below and represented in the ***Figure 4.34***.

Figure 4.33 Habitats in study area

Scrub land

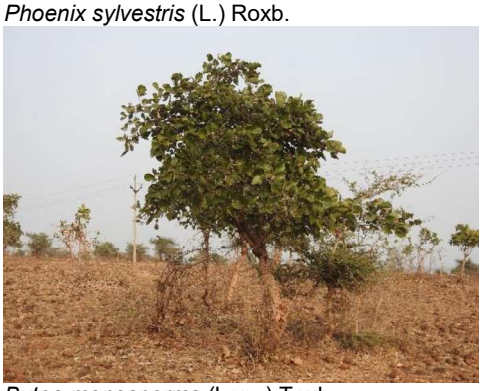
Agriculture land with Wheat crop

Waterbody

Open Scrub/Grassland

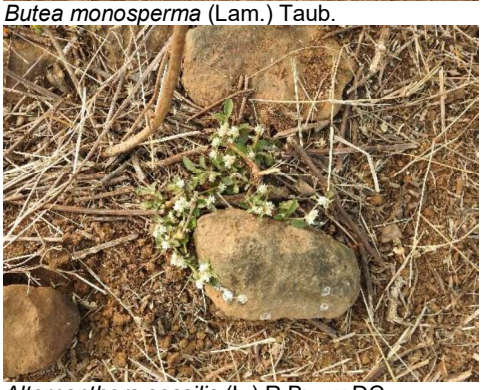
Figure 4.34 Representative flora

Phoenix sylvestris (L.) Roxb.

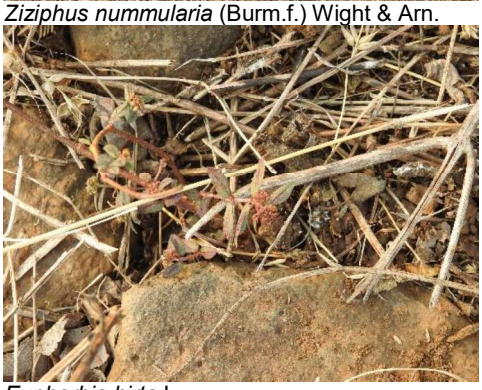


Acacia senegal (L.) Willd.

Butea monosperma (Lam.) Taub.



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



Alternanthera sessilis (L.) R.Br. ex DC.

Euphorbia hirta L.

Table 4.28 Floral species observed in the Unit 6 & 7 (Moman Badodiya) site and Unit 8 (South Shajapur) site

S.N.	Scientific Name	Family	Common Name	Life Form	Project Location	
					South Shajapur	Moman Badodiya
1	*Acacia jacquemontii* Benth.	Fabaceae	Baonli	Tree		*
2	*Acacia leucophloea* (Roxb.) Willd.	Fabaceae	White Bark Acacia, Safed Babool	Tree		*
3	*Acacia nilotica* (L.) Delile	Fabaceae	Gum Arabic, Babool	Tree	*	*
4	*Acacia senegal* (L.) Willd.	Fabaceae	Gum Senegal Tree, Kumttha	Tree	*	*
5	*Agave sisalana* Perrine	Agavaceae	Sisal Agave	Herb		*
6	*Ailanthus excelsa* Roxb.	Simaroubaceae	Indian Tree of Heaven, Mahanimb	Tree	*	*
7	*Albizia lebbeck* (L.) Benth.	Fabaceae	Siris tree	Tree		*
8	*Alternanthera sessilis* (L.) R.Br. ex DC.	Amaranthaceae	Dwarf Copperleaf, Garundi	Herb	*	*
9	*Apluda mutica* L.	Poaceae	Mauritian Grass, Pongta	Grass	*	
10	*Azadirachta indica* A. Juss	Meliaceae	Neem	Tree	*	*
11	*Bombax ceiba* L.	Bombacaceae	Silk Cotton Tree, Semal	Tree		*
12	*Butea monosperma* (Lam.) Taub.	Fabaceae	Flame of the Forest, Palash	Tree	*	*
13	*Calotropis procera* (Aiton) W.T.Aiton	Apocynaceae	Rubber Bush, Madar	Shrub	*	*
14	*Cenchrus ciliaris* L.	Poaceae	Buffel Grass, Dhaman	Grass		*
15	*Chrysopogon fulvus* (Spreng.) Chiov.	Poaceae	Reddish-Yellow Beardgrass, Dhaulu	Grass	*	*
16	*Dalbergia sissoo* Sensu Miq.	Fabaceae	Indian Rosewood, Shisham	Tree	*	*
17	*Dendrocalamus strictus* (Roxb.) Nees	Poaceae	Calcutta Bamboo	Tree like grass		*
18	*Eragrostis amabilis* (L.) Wight & Arn.	Poaceae	Chinese Lovegrass	Grass		*
19	*Eucalyptus* sp.	Myrtaceae	Safeda	Tree		*
20	*Euphorbia hirta* L.	Euphorbiaceae	Asthma Weed, Dudhi	Herb	*	
21	*Ficus benghalensis* L.	Moraceae	Banyan, Bargad	Tree	*	*
22	*Ficus racemosa* L.	Moraceae	Cluster Fig, Goolar	Tree		*

S.N.	Scientific Name	Family	Common Name	Life Form	Project Location	
					South Shajapur	Moman Badodiya
23	*Ficus religiosa* L.	Moraceae	Holy Fig Tree, Peepal	Tree		*
24	*Holoptelea integrifolia* (Roxb.) Planch	Ulmaceae	Indian Elm, Chilbil	Tree		*
25	*Ipomoea carnea* Jacq.	Convolvulaceae	Bush Morning Glory, Besharam	Shrub		*
26	*Jatropha curcas* L.	Euphorbiaceae	Physic Nut, Jatropha, Ratanjot	Shrub		*
27	*Lantana camara* L.	Verbenaceae	Lantana, Raimuniya	Shrub	*	*
28	*Leucaena leucocephala* (Lam.) de Wit	Fabaceae	Wild Tamarind, Safed Babool	Tree	*	*
29	*Mallotus nudiflorus* (L.) Kulju & Welzen	Euphorbiaceae	False White Teak, Pindalu	Tree		*
30	*Mangifera indica* L.	Anacardiaceae	Mango, Aam	Tree	*	*
31	*Melia azedarach* L.	Meliaceae	Pride of India, Bakain	Tree		*
32	*Parkinsonia aculeata* L.	Fabaceae	Jerusalem Thorn, Vilayti Kikar, Ram Babul	Tree	*	
33	*Phoenix sylvestris* (L.) Roxb.	Arecaceae	Wild Date Palm, Khajur	Tree	*	*
34	*Pongamia pinnata* (L.) Pierre	Fabaceae	Indian Beech Tree, Karanj	Tree	*	*
35	*Prosopis juliflora* (Sw.) DC.	Fabaceae	Algaroba, Vilayati Babul	Tree	*	*
36	*Ricinus communis* L.	Euphorbiaceae	Castor Bean, Arand	Tree		*
37	*Senna auriculata* (L.) Roxb.	Fabaceae	Tanner's Cassia, Tarwar	Shrub	*	
38	*Senna tora* (L.) Roxb.	Fabaceae	Stinking Cassia, Chakvat	Shrub	*	*
39	*Solanum virginianum* L.	Solanaceae	Thorny Nightshade, Kateli	Herb		*
40	*Tamarindus indica* L.	Fabaceae	Tamarind, Imli	Tree	*	*
41	*Tridax procumbens* L.	Asteraceae	Tridax Daisy, Kanphuli	Herb		*
42	*Ziziphus jujuba* Mill.	Rhamnaceae	Jujube, Bada Ber	Tree	*	*
43	*Ziziphus nummularia* (Burm.f.) Wight & Arn.	Rhamnaceae	Jhar Beri	Shrub	*	*

Note: * = Present
Source: ERM Primary Ecological Survey

4.4.3 Faunal Assessment

Faunal species from the study area were recorded based on direct sightings, indirect evidences such as dung, droppings, scats, pugmarks, scratch signs, burrows, nests etc. and consultation with Forest Department officials and local community. During consultation with communities, pictorial representations of species from field guides and other literature of the faunal species of India were shown for identification of species. The species occurring within the study area are discussed in the following sections.

Amphibian

A total of four (04) species of amphibians were observed in the study area. The list is provided in ***Table 4.29.*** None of species were observed under IUCN (v2020.1) Threatened species.

Table 4.29 Amphibians in the Study Area

S.N.	Common Name	Zoological Name	Family	WPA Schedule / IUCN 2020.1 Status	Moman Badodiya Site	South Shajapur Site
1	Common Indian Toad	*Duttaphrynus melanostictus*	Bufonidae	-/ LC	Y	Y
2	Indian Bull Frog	*Hoplobatrachus tigerinus*	Dicroglossidae	-/LC	Y	Y
3	Indian Pond Frog	*Euphlyctis hexadactylus*	Dicroglossidae	-/LC	Y	Y
4	Indian Skipper Frog	*Euphlyctis cyanophlyctis*	Dicroglossidae	LC /Not Listed	Y	Y

Notes: LC-Least Concern,

Source: Source: ERM Primary Ecological Survey and review of Forest Working Plan Shajapur Forest Division

Reptiles

A total of 16 species of reptiles were either observed or reported from the study area. None of the species are listed as threatened as per IUCN (v2020.1) categorization. One species Flap Shell Turtle (*Lissemys punctata*) is listed as Schedule I species as per Indian Wildlife Protection Act, 1972. The list of the species is given in ***Table 4.30***.

Table 4.30 Reptiles in the Study Area

S.N.	English / Popular Name	Scientific Name	Family	WPA Schedule / IUCN 2020.1 Status	Moman Badodiya Site	South Shajapur Site
1	Flap Shell Turtle	*Lissemys punctata*	Pythonidae	I / LC	Y	Y
2	Beaked Worm Snake	*Tyhlops acutus*	Tylopidae	IV/LC	Y	N
3	Black Cobra	*Naja naja oxiana*	Elapidae	II/LC	Y	Y
4	Buffed-striped Keelback	*Amphiesma stolata*	Colubridae	IV/LC	Y	N
5	Checkered Keelback Water Snake	*Xenchrophis piscator*	Colubridae	II/ LC	N	Y
6	Common Indian Krait	*Bungarus fasciatus*	Elapidae	IV/LC	Y	Y
7	Common Indian Trinket Snake	*Elaphe helena helena*	Colubridae	IV/ LC	Y	N

S.N.	English / Popular Name	Scientific Name	Family	WPA Schedule / IUCN 2020.1 Status	Moman Badodiya Site	South Shajapur Site
8	Common Sand Boa	*Eryx conica*	Uropeltidae	IV/LC	Y	Y
9	Common Wolf Snake	*Lycodon aulicus*	Colubridae	IV/ LC	Y	Y
10	Flat tailed Gecko	*Hemidactylus platyurus*	Gekkonidae	-/-	Y	Y
11	Hardwicke's bloodsucker	*Brachysaura minor*	Agamidae	-/DD	Y	Y
12	Indian Garden Lizard	*Calotes versicolor*	Agamidae	-/-	Y	Y
13	Keeled Grass Skink	*Eutropis carinata*	Scincidae	-/ LC	Y	Y
14	Rat snake	*Ptyas mucosa*	Colubridae	IV/LC	Y	Y
15	Russell's Viper	*Daboia russelii*	Viperidae	IV/ LC	Y	Y
16	Saw-scaled viper	*Echis carinata*	Viperidae	IV/LC	Y	Y

Notes: DD- Data Deficient, LC-Least Concern, NT-Near Threatened

Source: Source: ERM Primary Ecological Survey and review of Forest Working Plan Shajapur Forest Division

Avifauna

The avifaunal survey was undertaken twice during the migratory season. A total of 105 species of avifauna were observed and report ed from the study area among which 14 species were reported to be migratory species and 91 species as resident species. There are no historic records of large congregations in the study area

Three species Woolly-necked stork (*Ciconia episcopus*), Common Pochard (*Aythya ferina*) and Sarus Crane (*Grus antigone*) were listed as Vulnerable as per IUCN v2020.1. Nine species namely Black Kite (*Milvus migrans*), Black winged Kite (*Elanus caeruleus*), Brahminy Kite (*Haliastur indus*), Indian Grey Hornbill (*Ocyceros birostris*), Indian peafowl (*Pavo cristatus*), Oriental Honey Buzzard (*Pernis ptilorhynchus*), Shikra (*Accipiter badius*), Short toed Snake Eagle (*Circaetus gallicus*), White Eyed Buzzard (*Butastur teesa*) are listed as Sch I species as per Indian Wildlife Protection Act, 1972. The list of species is provided in ***Table 4.31*** and photographically represented in ***Figure 4.35***.

Table 4.31 Avifauna in the Study Area

S. N.	Common Name	Scientific Name	Family	Migratory Status	A/T	Conservation Status		Moman Badodiya Site	South Shajapur Site
						IUCN 2020.1	IWPA,72		
1	Ashy crowned Sparrow Lark	*Eremopterix griseus*	Alaudidae	Resident	T	LC	IV	Y	Y
2	Asian Koel	*Eudynamys scolopaceus*	Cuculidae	Resident	T	LC	IV	Y	Y
3	Asian Palm Swift	*Cypsiurus balasiensis*	Apodidae	Resident	T	LC	IV	Y	Y
4	Asian Pied Starling	*Gracupica contra*	Sturnidae	Resident	T	LC	IV	Y	N
5	Bar-headed Geese	*Anser indicus*	Anatidae	Migratory	A	LC	IV	Y	N

S. N.	Common Name	Scientific Name	Family	Migratory Status	A/T	Conservation Status		Moman Badodiya Site	South Shajapur Site
						IUCN 2020.1	IWPA,72		
6	Bay-backed Shrike	*Lanius vittatus*	Laniidae	Resident	T	LC	IV	Y	Y
7	Black Drongo	*Dicrurus macrocercus*	Dicruridae	Resident	T	LC	IV	Y	Y
8	Black headed Ibis	*Threskiornis melanocephalus*	Threskiornithidae	Resident	A	NT	IV	Y	Y
9	Black Kite	*Milvus migrans*	Accipitridae	Resident	T	LC	I	Y	Y
10	Black Redstart	*Phoenicurus ochruros*	Muscicapidae	Migratory	T	LC	IV	Y	Y
11	Black Stork	*Ciconia nigra*	Ciconiidae	Migratory	A	LC	IV	Y	N
12	Black winged Kite	*Elanus caeruleus*	Accipitridae	Resident	T	LC	I	Y	Y
13	Black Winged Stilt	*Himantopus himantopus*	Recurvirostridae	Resident	A	LC	IV	Y	Y
14	Black-naped Oriole	*Oriolus chinensis*	Oriolidae	Resident	T	LC	IV	Y	Y
15	Brahminy Kite	*Haliastur indus*	Accipitridae	Resident	T	LC	I	Y	Y
16	Brahminy Starling	*Sturnia pagodarum*	Sturnidae	Resident	T	LC	IV	Y	Y
17	Livestock Egret	*Bubulcus ibis*	Ardeidae	Resident	T	LC	IV	Y	Y
18	Chestnut-bellied Sandgrouse	*Pterocles exustus*	Pteroclididae	Resident	T	LC	IV	Y	Y
19	Common Coot	*Fulica atra*	Rallidae	Resident	A	LC	IV	Y	Y
20	Common Hoopee	*Upupa epops*	Upupidae	Resident	T	LC	IV	Y	Y
21	Common Kestral	*Falco tinnunculus*	Falconidae	Migratory	T	LC	IV	Y	Y
22	Common Kingfisher	*Alcedo atthis*	Alcedinidae	Resident	T	LC	IV	Y	Y
23	Common Myna	*Acridotheres tristis*	Sturnidae	Resident	T	LC	IV	Y	Y
24	Common Pochard	*Aythya ferina*	Anatidae	Migratory	A	VU	IV	Y	Y
25	Common Stonechat	*Saxicola maurus*	Muscicapidae	Migratory	T	LC	IV	Y	Y
26	Common Tailer Bird	*Orthotomus sutorius*	Cisticolidae	Resident	T	LC	IV	Y	Y
27	Common Teal	*Anas crecca*	Anatidae	Migratory	A	LC	IV	Y	Y
28	Coppersmith Barbet	*Megalaima haemacephala*	Megalaimidae	Resident	T	LC	IV	Y	Y

S. N.	Common Name	Scientific Name	Family	Migratory Status	A/T	Conservation Status		Moman Badodiya Site	South Shajapur Site
						IUCN 2020.1	IWPA,72		
29	Cotton-pygmy Goose	*Nettapus coromandelianus*	Anatidae	Resident	A	LC	IV	Y	N
30	Desert Wheatear	*Oenanthe deserti*	Muscicapidae	Resident	T	LC	IV	N	Y
31	Eurasian Thick knee	*Burhinus oedicnemus*	Burhinidae	Resident	T	LC	IV	Y	Y
32	Eurasian Collared Dove	*Streptopelia decaocto*	Columbidae	Resident	T	LC	IV	Y	Y
33	Eurasian Spoonbill	*Platalea leucorodia*	Threskiornithidae	Resident	A	LC	IV	Y	Y
34	Garganey	*Anas querquedula*	Anatidae	Migratory	A	LC	IV	Y	Y
35	Great Egret	*Ardea alba*	Ardeidae	Resident	A	LC	IV	Y	Y
36	Great Thicknee	*Esacus recurvirostris*	Burhinidae	Resident	A	NT	IV	Y	Y
37	Greater Coucal	*Centropus sinensis*	Cuculidae	Resident	T	LC	IV	Y	Y
38	Greater Flamingo	*Phoenicopterus roseus*	Phoenicopteridae	Migratory	A	LC	IV	Y	Y
39	Green Bee-eater	*Merops orientalis*	Meropidae	Resident	T	LC	IV	Y	Y
40	Green Sandpiper	*Tringa ochropus*	Scolopacidae	Migratory	A	LC	IV	Y	Y
41	Grey Francolin	*Francolinus pondicerianus*	Phasianidae	Resident	T	LC	IV	Y	Y
42	Grey Heron	*Ardea cinerea*	Ardeidae	Resident	A	LC	IV	Y	Y
43	House Crow	*Corvus splendens*	Corvidae	Resident	T	LC	IV	Y	Y
44	House Sparrow	*Passer domesticus*	Passeridae	Resident	T	LC	IV	Y	Y
45	House Swift	*Apus nipalensis*	Apodidae	Resident	T	LC	IV	Y	Y
46	Indian Courser	*Cursorius coromandelicus*	Glareolidae	Resident	T	LC	IV	N	Y
47	Indian Eagle Owl	*Bubo bengalensis*	Strigidae	Resident	T	LC	IV	N	Y
48	Indian Grey Hornbill	*Ocyceros birostris*	Bucerotidae	Resident	T	LC	I	Y	Y
49	Indian Nightjar	*Caprimulgus asiaticus*	Caprimulgidae	Resident	T	LC	IV	Y	Y
50	Indian peafowl	*Pavo cristatus*	Phasianidae	Resident	T	LC	I	Y	Y
51	Indian Pond Heron	*Ardeola grayii*	Ardeidae	Resident	A	LC	IV	Y	Y
52	Indian Robin	*Saxicoloides fulicatus*	Muscicapidae	Resident	T	LC	IV	Y	Y

S. N.	Common Name	Scientific Name	Family	Migratory Status	A/T	Conservation Status		Moman Badodiya Site	South Shajapur Site
						IUCN 2020.1	IWPA,72		
53	Indian Roller	*Coracias benghalensis*	Coraciidae	Resident	T	LC	IV	Y	Y
54	Indian Silverbill	*Lonchura malabarica*	Estrildidae	Resident	T	LC	IV	Y	Y
55	Intermediate Egret	*Mesophoyx intermedia*	Ardeidae	Resident	A	LC	IV	Y	Y
56	Jungle Crow	*Corvus macrorhynchos*	Corvidae	Resident	T	LC	IV	Y	Y
57	Large Grey Babbler	*Turdoides malcolmi*	Leiothrichidae	Resident	T	LC	IV	Y	Y
58	Laughing Dove	*Spilopelia senegalensis*	Columbidae	Resident	T	LC	IV	Y	Y
59	Little Cormorant	*Microcarbo niger*	Phalacrocoracidae	Resident	A	LC	IV	Y	Y
60	Little Egret	*Egretta garzetta*	Ardeidae	Resident	A	LC	IV	Y	Y
61	Little Grebe	*Tachybaptus ruficollis*	Podicipedidae	Resident	A	LC	IV	Y	Y
62	Long tailed Shrike	*Lanius schach*	Laniidae	Resident	T	LC	IV	Y	Y
63	Oriental Darter	*Anhinga melanogaster*	Anhingidae	Resident	A	NT	IV	N	Y
64	Oriental Honey Buzzard	*Pernis ptilorhynchus*	Accipitridae	Resident	T	LC	I	Y	Y
65	Oriental Skylark	*Alauda gulgula*	Alaudidae	Resident	T	LC	IV	Y	Y
66	Paddyfield Pipit	*Anthus rufulus*	Motacillidae	Resident	T	LC	IV	Y	Y
67	Painted Stork	*Mycteria leucocephala*	Ciconiidae	Resident	A	NT	IV	Y	Y
68	Pied Bush Chat	*Saxicola caprata*	Muscicapidae	Resident	T	LC	IV	Y	Y
69	Pied Kingfisher	*Ceryle rudis*	Cerylidae	Resident	A	LC	IV	Y	Y
70	Plain Prinia	*Prinia inornata*	Cisticolidae	Resident	T	LC	IV	Y	Y
71	Plum headed Parakeet	*Psittacula cyanocephala*	Psittaculidae	Resident	T	LC	IV	Y	Y
72	Purple rumped Sunbird	*Leptocoma zeylonica*	Nectariniidae	Resident	T	LC	IV	Y	Y
73	Purple Sunbird	*Cinnyris asiaticus*	Nectariniidae	Resident	T	LC	IV	Y	Y
74	Red collared Dove	*Streptopelia tranquebarica*	Columbidae	Resident	T	LC	IV	Y	Y
75	Red napped Ibis	*Pseudibis papillosa*	Threskiornithidae	Resident	A	LC	IV	Y	Y
76	Red rumped Swallow	*Cecropis daurica*	Hirundinidae	Resident	T	LC	IV	Y	Y

S. N.	Common Name	Scientific Name	Family	Migratory Status	A/T	Conservation Status		Moman Badodiya Site	South Shajapur Site
						IUCN 2020.1	IWPA,72		
77	Red Throated Flycatcher	*Ficedula albicilla*	Muscicapidae	Resident	T	LC	IV	Y	Y
78	Red vented Bulbul	*Pycnonotus cafer*	Pycnonotidae	Resident	T	LC	IV	Y	Y
79	Red Wattled Lapwing	*Vanellus indicus*	Charadriidae	Resident	T	LC	IV	Y	Y
80	Red wattled Lapwing	*Vanellus indicus*	Charadriidae	Resident	A	LC	IV	Y	Y
81	Red Whiskered Bulbul	*Pycnonotus jocosus*	Pycnonotidae	Resident	T	LC	IV	Y	Y
82	River Tern	*Sterna aurantia*	Sternidae	Resident	A	NT	IV	Y	Y
83	Rose ringed Parakeet	*Psittacula krameri*	Psittaculidae	Resident	T	LC	IV	Y	Y
84	Rosy Starling	*Pastor roseus*	Sturnidae	Migratory	T	LC	IV	Y	Y
85	Ruddy Shellduck	*Tadorna ferruginea*	Tadorninae	Migratory	A	LC	IV	Y	Y
86	Rufous Tailed Lark	*Ammomanes phoenicura*	Alaudidae	Resident	T	LC	IV	Y	Y
87	Rufous tailed Lark	*Ammomanes phoenicura*	Alaudidae	Resident	T	LC	IV	Y	Y
88	Sarus Crane	*Grus antigone*	Gruidae	Resident	A/T	VU	IV	Y	Y
89	Shikra	*Accipiter badius*	Accipitridae	Resident	T	LC	I	Y	Y
90	Short toed Snake Eagle	*Circaetus gallicus*	Accipitridae	Resident	T	LC	I	Y	Y
91	Spot Billed Duck	*Anas poecilorhyncha*	Anatidae	Resident	A	LC	IV	Y	Y
92	Spotted Dove	*Spilopelia chinensis*	Columbidae	Resident	T	LC	IV	Y	Y
93	Spotted Owlet	*Athene brama*	Strigidae	Resident	T	LC	IV	N	Y
94	Spotted Redshank	*Tringa erythropus*	Scolopacidae	Migratory	A	LC	IV	Y	Y
95	Western Yellow Wagtail	*Motacilla flava*	Motacillidae	Resident	T	LC	IV	Y	Y
96	White breasted Water hen	*Amaurornis phoenicurus*	Rallidae	Resident	A	LC	IV	Y	Y
97	White Eyed Buzzard	*Butastur teesa*	Accipitridae	Resident	T	LC	I	Y	Y
98	White Throated Kingfisher	*Halcyon smyrnensis*	Halcyonidae	Resident	A	LC	IV	Y	Y
99	White Wagtail	*Motacilla alba*	Motacillidae	Resident	T	LC	IV	Y	Y

S. N.	Common Name	Scientific Name	Family	Migratory Status	A/T	Conservation Status		Moman Badodiya Site	South Shajapur Site
						IUCN 2020.1	IWPA,72		
100	Wood Sandpiper	*Tringa glareola*	Scolopacidae	Migratory	A	LC	IV	Y	Y
101	Woolly necked Stork	*Ciconia episcopus*	Ciconiidae	Resident	A	VU	IV	N	Y
102	Yellow legged Buttonquail	*Turnix tanki*	Turnicidae	Resident	T	LC	IV	Y	Y
103	Yellow Wattled Lapwing	*Vanellus malabaricus*	Charadriidae	Resident	T	LC	IV	Y	Y
104	Yellow-eyed babbler	*Chrysomma sinense*	Sylviidae	Resident	T	LC	IV	Y	Y
105	Zitting Cisticola	*Cisticola juncidis*	Cisticolidae	Resident	T	LC	IV	Y	Y

Notes: LC-Least Concern, NT-Near Threatened, VU-Vulnerable, IUCN- International Union for the Conservation of Nature, IWPA,72-Indian Wild Life Protection Act 1972 as amended thereof;

Source: Source: ERM Primary Ecological Survey and review of Forest Working Plan Shajapur Forest Division

Figure 4.35 Avifauna observed in the Study Area

Indian Roller	Black winged Kite	Great Egret
Black Kite	Indian Pond Heron	Plum headed Parakeet
Desert Wheatear	Short toed Lark	Woolly necked Stork

Mammals

A total of 12 species of mammals were observed and reported from the study area. None of the species are listed as Threatened species as per IUCN v2020.1. Chinkara (*Gazella bennettii*) is the only species listed as Sch.I as per Indian Wildlife Protection Act, 1972. The list of species are presented in ***Table 4.32.***

Table 4.32 Mammals in the Study Area

S.N.	English Name	Scientific Name	Family	Moman Badodiya Site	South Shajapur Site	IWPA Schedule / IUCN Status
1	Bandicoot rat	*Bandicota indica*	Muridae	Y	Y	V/LC
2	Chinkara	*Gazella bennettii*	Bovidae	Y	Y	I/ NT

S.N.	English Name	Scientific Name	Family	Moman Badodiya Site	South Shajapur Site	IWPA Schedule / IUCN Status
3	Common Fox	*Vulpes bengalensis*	Canidae	Y	Y	II/LC
4	Five Striped Squirrel	*Funambulus pennantii*	Sciuridae	Y	Y	IV/LC
5	Indian Flying Fox	*Pteropus giganteus*	Pteropodidae	N	Y	V/LC
6	Indian Grey Mongoose	*Herpestes edwardsii*	Herpestidae	Y	Y	II/LC
7	Indian Hare	*Lepus nigricollis*	Leporidae	Y	Y	IV /LC
8	Jackal	*Canis aureus*	Canidae	Y	Y	II/LC
9	Jungle Cat	*Felis chaus*	Felidae	Y	Y	II/LC
10	Nilgai	*Boselaphus tragocamelus*	Bovidae	Y	Y	III/LC
11	Northern plains gray langur	*Semnopithecus entellus*	Cercopithecidae	Y	N	II/LC
12	Rhesus Macaque	*Macaca mulatta*	Cercopithecidae	Y	Y	II/LC

Notes: IUCN-International Union for Conservation of Nature, IWPA-Indian Wildlife Protection Act ,1972, LC-Least Concern, NT-Near Threatened

*Source; Forest Working Plan Shajapur Forest Division

4.4.4 Protected Areas

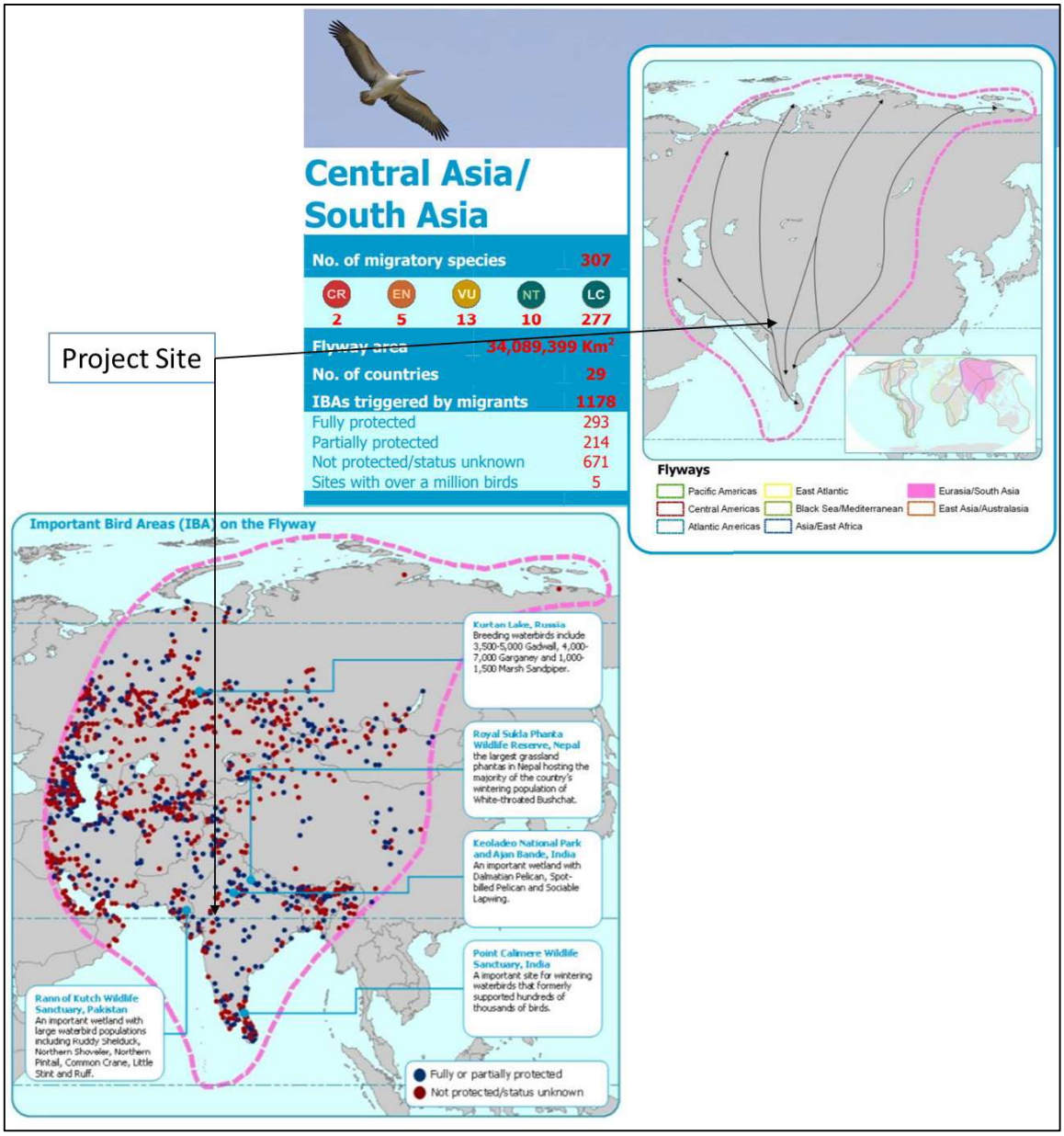
No protected area falls within 25 km radius of the project site. No sites identified as Internationally Recognized Areas such as Key Biodiversity Area (KBA) that include Important Bird areas (IBA) and Alliance for Zero Extinction (AZE) sites fall within 25 km radius of the project sites.

4.4.5 Migratory Flyways

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

The site is located along the Central Asian Flyway. The project site falls within the Central Asian Flyway. A total of 14 avifaunal species were reported from site which migrate along the Central Asian Flyway and winter in the Indian Subcontinent. This assessment is based on the two site visits undertaken in December 2019 and January 2020. The map of Central Asian Flyway is provided in the Figure 4.36.

Figure 4.36 Central Asian Flyway



4.4.6 Determination of Critical, Natural and Modified Habitat

The delineation of critical, natural and modified habitats is presented in the **Table 4.33** below.

Table 4.33 Delineation of Habitats (Critical, Natural and Modified)

Habitat Type	Discussion	Conclusion
Scrub Land and grassland (Study area comprising Unit 6, 7 and 8 and 5 km radius of the Project site)	The scrub lands in the study area (open scrub and dense scrub) forms the largest land use in the study area. It was observed that the flora and fauna of the area are largely disturbed by human activity. A lot of agricultural and grazing activity was observed at the site and surrounding areas. The main activity during post monsoon season is livestock grazing due to the availability of fodder. The IUCN listed threatened species (VU-Vulnerable) such as Woolly-necked stork (*Ciconia episcopus*) and Sarus Crane (*Grus antigone*) were found to use this habitat type. The habitat still supports a large variety of avifaunal and mammalian species. These includes IWPA Sch-I listed mammalian and avifaunal species including IUCN listed threatened species Scrub land area within and surrounding Moman Badodiya site is comprised of 88.5% of the project site and 17.70% of the study area, Scrub land area within and surrounding South Shajapur site, constitutes 91.93% of the project site and 20.68% of the study area.	The habitat can thus be considered as MODIFIED habitat
Agricultural Land (Study area comprising Unit 6, 7 and 8 and 5 km radius of the Project site)	Agricultural land is largely influenced by the anthropogenic activities were in the native flora and fauna are disturbed to a great degree. The native vegetation includes the weeds on the agricultural land boundary and in fallow land. Presence of mammals such as Chinkara *Gazella bennettii,* Indian Hare *Lepus nigricollis* and Nilgai *Boselaphus tragocamelus* is also reported in this habitat. Agricultural land area within and surrounding Moman Badodiya site is comprised of 9.40% of the project site and 77.62% of the study area Agricultural land area within and surrounding South Shajapur site, constitutes 7.54% of the project site and 71.81% of the study area.	Owing to the disturbance the habitat can be considered MODIFIED habitat
Waterbodies (Study area comprising Unit 6, 7 and 8 and 5 km radius of the Project site)	The Study area do not have large natural waterbodies. The has large man-made reservoirs for accumulating rain water for irrigation in non-monsoon months. Fish farming is also undertaken in these large reservoirs. IUCN listed Threatened species such as Common Pochard (*Aythya ferina*) VU, IUCN v2020.1 and several other migratory species use this habitat Waterbody area within and surrounding Moman Badodiya site is comprised of 1.13% of the project site and 0.76% of the study area Waterbody area within and surrounding South Shajapur site, constitutes 0.30% of the project site and 2.90% of the study area.	As there was significant interaction between humans and habitat, there was significant disturbance in the habitat which can be considered MODIFIED habitat

The study area as a whole does not bear any critical habitats based on the following criteria's as per PS6

Criteria 1: The presence of IUCN CR and EN species was not observed or reported.

Criteria 2: The presence of restricted range species was not observed or reported

Criteria 3: A total of 14 species of migratory avifauna was reported but the survey does not recorded nor it was reported to have habitats (aquatic/terrestrial) to hold more than 10% of the global population.

4.5 Social Environment

The purpose of this section is to provide a general socio-economic profile of the area and the issues relevant to the project area. This section provides an understanding of the following aspects:

- Administrative set up of the district,
- Demographic profile of the villages in the project area,
- Social groups present,
- Vulnerable groups identified,
- Livelihood profile of the community,
- Land use patterns in the area,
- Common property resources,
- Social and physical infrastructure available in terms of the education and health infrastructure and
- Water supply for irrigation and drinking purposes, sanitation facilities and connectivity.

The social baseline for the project area is based on the secondary information available at district, sub-district and village level (as per Census of India 2011) as well as information gathered through consultations and visual observations made during site survey. ***Section 1.3*** provides an understanding of the methodology followed for the social baseline data collection.

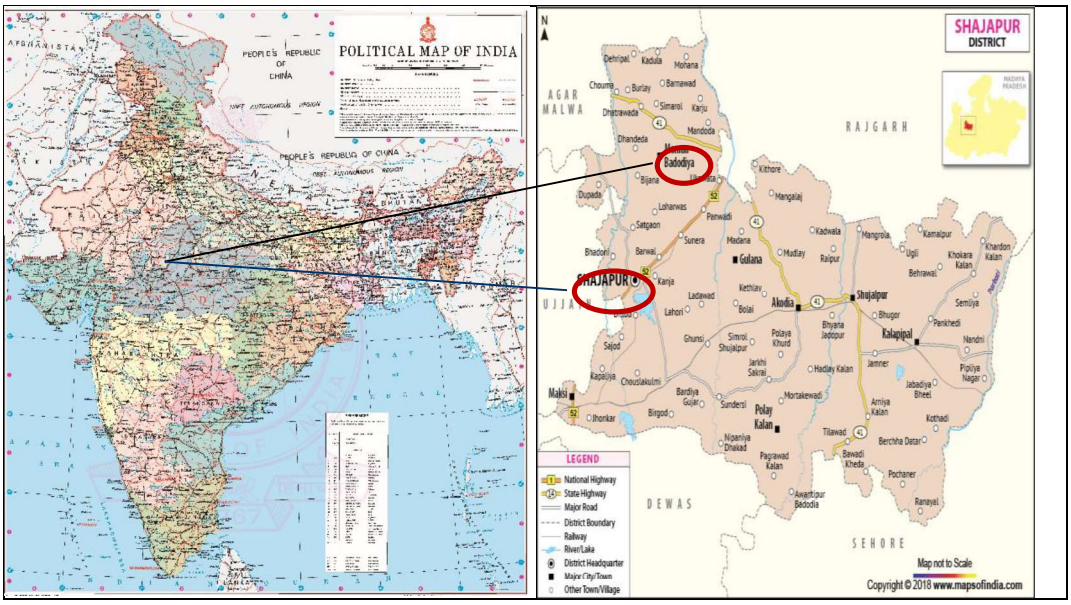
4.5.1 Socio Economic Setting

The project is located in Moman Badodiya and Shajapur tehsil of Shajapur district in the state of Madhya Pradesh in India. The sections below provide an overview of these administrative units

4.5.1.1 State Profile: Madhya Pradesh

Madhya Pradesh (MP) is a state in central India having Bhopal as its capital. The largest city of MP is Indore, with Gwalior, Jabalpur and Ujjain being the other major cities. It is the second largest Indian state by having an area of 3,08,000 sq.km after Rajasthan and the fifth largest state by population with over 75 million residents. It borders the states of Uttar Pradesh to the northeast, Chhattisgarh to the southeast, Maharashtra to the south, Gujarat to the west, and Rajasthan to the northwest.

Figure 4.37 Madhya Pradesh and Shajapur District



Source: Survey of India website http://www.surveyofindia.gov.in/files/Political%20Map%20of%20India.jpg

Madhya Pradesh has 52 Districts, which are grouped into 10 divisions. As of 2013, the state has 52 jila (district) panchayats, 376 tehsils, 313 janpad panchayats/blocks, and 23,043 gram (village) panchayats. The municipalities in the state include 16 Nagar Nigams, 100 Nagar Palikas and 264 Nagar Panchayats.

The state comprises a population of 72,626,809 individuals, who pre-dominantly live in rural areas and make up 72.3 percent of the state's total population. The decadal population growth has reduced from 24.3 percent during the period 1991-2001 to 20.3 percent during 2001 to 2011. The sex ratio in the state is 931, which has increased from 920 in the past decade; however, it is still lower than the sex ratio of India, being 940 females per 1000 males. The population density of India is 382 persons/sq. km. while that of Madhya Pradesh is 236 persons/sq. km. The state has the second largest geographical area, of any state in the country.

The ***Table 4.34*** below gives a description of the demography of the entire state.

Table 4.34 Madhya Pradesh Demographic Profile

Attribute	Number (% of India)
Area (sq. km)	3,08,252 (9.4% of India)
Total population	7,26,26,809 (6% of India)
Males	3,76,12,306 (6% of India)
Females	3,50,14,503 (5.97% of India)
Sex ratio	931
Percentage of rural Population	72.3
Percentage of urban population	25.6
Population density	236
Percentage of SC population	15.6
Percentage of ST population	21.1
Total literacy rate	69.3
Male Literacy rate	78.7
Female Literacy Rate	54.5
Rural Literacy	63.9

Source: Census of India, 2011

The literacy rate of Madhya Pradesh is nearly 70 percent (of which the rural literacy stands at 63.9 percent which is lower than that of the country, at 74.0 percent The male literacy rate is relatively higher, at 78.73 percent while the female literacy rate is 54.5 percent which is quite low when compared to the national female literacy rate of 65.5 percent.

Madhya Pradesh ranks 1st amongst all States and Union Territories with regards to Scheduled Tribe (ST) population and 12th in terms of Scheduled Caste (SC) population. The proportion of ST population in the state is 21.1 percent and SC population is 15.6 percent.

4.5.1.2 District Profile: Shajapur

Shajapur District is situated in the north-western part of Madhya Pradesh and lies between latitudes 32"06' and 24" 19' North and longitudes 75" 41' and 77" 02' East. It is part of the Malwa Plateau and the town of Shajapur is the district headquarters.

The district is bounded by Ujjain District to the west, Agar district to north west, Dewas and Sehore to the south and south east respectively and Rajgarh to the north. Shajapur district is part of Ujjain Division. ***Figure 4.38*** helps in understanding the various sub-divisions of the district.

Figure 4.38 Shajapur District Divisions

Source: Google map

The population density of Shajapur district is relatively higher than that of Madhya Pradesh. The proportion of Scheduled Caste population forms 23.4 percent of Shajapur's total population, which is significantly higher than the state. The Scheduled Tribe population in Shajapur is negligible as compared with the state. The sex ratio of the district is slightly higher than the state figure of 931 and lower than the country's sex ratio of 940 females per thousand males. However, the child sex ratio in 2011 has increased from 927 girls per 1000 boys to 938 girls per 1000 boys.

The status of literacy in the district is comparable to the state both for total literacy and female literacy. Rural population is nearly 81 percent of the total district population.

Table 4.35 Shajapur District Demographic Profile vis-à-vis Madhya Pradesh

Attribute	Madhya Pradesh	Shajapur District
Population	72,626,809	15,12,681
Population Density	236	244
% of SC population	15.6	23.4
% of ST population	21.1	2.5
Sex Ratio	931	938
% total literacy rate	70	69
% female literacy rate	55	56
% rural population	64	81

Source: Census Data, 2011

4.5.1.3 Tehsil Profile: Moman Badodiya and Shajapur

The Project villages are located in two tehsils namely, Shajapur and Moman Badodiya, and the "Area of Influence" spreads across villages in Shajapur, Moman Badodiya, Gulana, Nalkheda and Susner Tehsils under Shajapur District and Tonk Khurd tehsil under Dewas District., though all direct impacts are likely to be sustained within the Project villages.

The ***Table 4.36***, below gives a demographic description of Shajapur and Moman Badodiya tehsils which comprise of all the villages where the project will be developed. From the table it is evident that sex ratio in Shajapur tehsil is lower in comparison to Moman Badodiya tehsil and Shajapur District.

The total literacy rate and female literacy is similar in both the tehsils and at district level. Moman Badodiya tehsil has ST population of 6 percent and Shajapur tehsil, 2 percent. The SC population in both the tehsils is similar at 27 percent and 29 percent respectively in Moman Badodiya and Shajapur Tehsils.

Table 4.36 Demographic Profile of Tehsils

Attribute	Shajapur District	Moman Badodiya Tehsil	Shajapur Tehsil
Population	15,12,681	2,08,047	2,03,407
% of District Population	NA	13.8	13.5
% SC population	23.4	27.1	28.7
% ST population	2.5	6.1	2.3
Sex Ratio	938	931	929
% Total literacy rate	69	68.6	68.5
% Female literacy rate	56	54.1	54.5

Source: Census of India, 2011

4.5.2 Study Area

The Study Area for the current assessment comprises of the area identified for the project as well as villages which might be impacted directly or indirectly by the project. The use of term "Study Area" in the social baseline and impacts sections would comprise consolidated data from Project Villages and Area of Influence. It differs slightly from the manner Study Area is defined for the Environment and Ecology sections of this report.

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

- Project footprint – Project Footprint comprises of the area within the proposed boundary of Shajapur Solar Park;
- Project Villages – The eleven villages under Shajapur and Moman Badodiya Tehsil from where land has been identified for the project. This area will now be referred as Project villages and the details have been given below in ***Table 4.37.***
- Area of influence - Area of Influence comprises of the villages falling within the 5 km radius of the project, apart from Project Villages, that may be directly or indirectly affected.

Table 4.37 Land considered for the Solar Park

S No.	Village Name	Govt. land (NRED allotted)	Govt. Land Identified	Private Land	Patta Land	Total Land Area (Ha) (Govt. Land + Pvt. Land)
1	Burlay*	23.7	0.0	6.4	0.0	30.1
2	Jawadi	32.2	0.0	2.0	0.0	34.2
3	Dhatrawada	172.2	0.0	9.7	0.0	181.9
Sub- Total (Unit 6)		***228.1***	***0.0***	***18.1***	**0.0**	**246.2**
4	Parsula	116.2	0.0	0.0	5.2	121.4
5	Dehripal	111.1	0.0	21.8	0.0	132.9
6	Bijnakhedi	95.4	0.0	22.6	0.0	118.0
7	Fawaka	17.1	0.0	0.2	0.0	17.3
8	Chouma	32.7	0.0	9.5	0.0	42.2
9	Burlay*	41.7	0.0	0.0	0.0	41.7
Sub- Total (Unit 7)		**414.2**	**0**	**54.1**	**5.2**	**473.5**
10	Surajpur	22.7	0.7	18.2	0.0	41.6
11	Lalupura	49.8	0.8	0.0	0.0	50.6
12	Hanoti	131.9	12.5	18.5	0.0	162.9
Sub- Total (Unit 8)		**204.3**	**14.0**	**36.7**	**0.0**	**255.1**
Total (Unit 6, 7,8)		***846.6***	***14.0***	***108.9***	***5.2***	***974.7***

Source: Final DPR, August, 2020
Note: There are total 11 villages. Burlay village has been considered both in Unit 6 and 7

While the project footprint is in Shajapur and Moman Badodiya tehsil, the Area of Influence villages spread across Shajapur, Moman Badodiya, Gulana, Nalkheda and Susner tehsils of Shajapur District and Tonk Khurd tehsil of Dewas District. In the Study Area, the concentration of villages is higher in Moman Badodiya and Shajapur tehsils compared to the rest, as depicted in Table 4.38
The Figure 4.39 and Figure 4.40 illustrates the Study Area, which shows the villages present within 5 km radius of the project site. The Project villages lying in the Project Footprint and AoI are also listed below in Table 4.38.

Table 4.38 Project Villages and AoI Villages

S. No.	Tehsils (Project villages)	Project villages	Tehsils (AoI villages)	Area of Influence villages
1.	Moman Badodiya	Jawadi	Susner	Badiya
2.	Moman Badodiya	Parsula	Susner	Nandna
3.	Moman Badodiya	Fawaka	Shajapur	Siroliya
4.	Moman Badodiya	Dhatrawada	Shajapur	Peerumrod
5.	Moman Badodiya	Dehripal	Shajapur	Jhonkar
6.	Moman Badodiya	Chouma	Shajapur	Upda
7.	Moman Badodiya	Burlay	Shajapur	Rulki
8.	Moman Badodiya	Bijanakhedi	Tonk Khurd	Updi
9.	Shajapur	Hanoti	Tonk Khurd	Kandara Khedi
10.	Shajapur	Surajpur	Tonk Khurd	Merkhedi
11.	Shajapur	Lalupura	Tonk Khurd	Panda
			Gulana	Palsawad
			Nalkheda	Madhopur

Source: ERM India Pvt. Ltd

Figure 4.39 Map depicting villages in the Study Area of Moman Badodiya tehsil

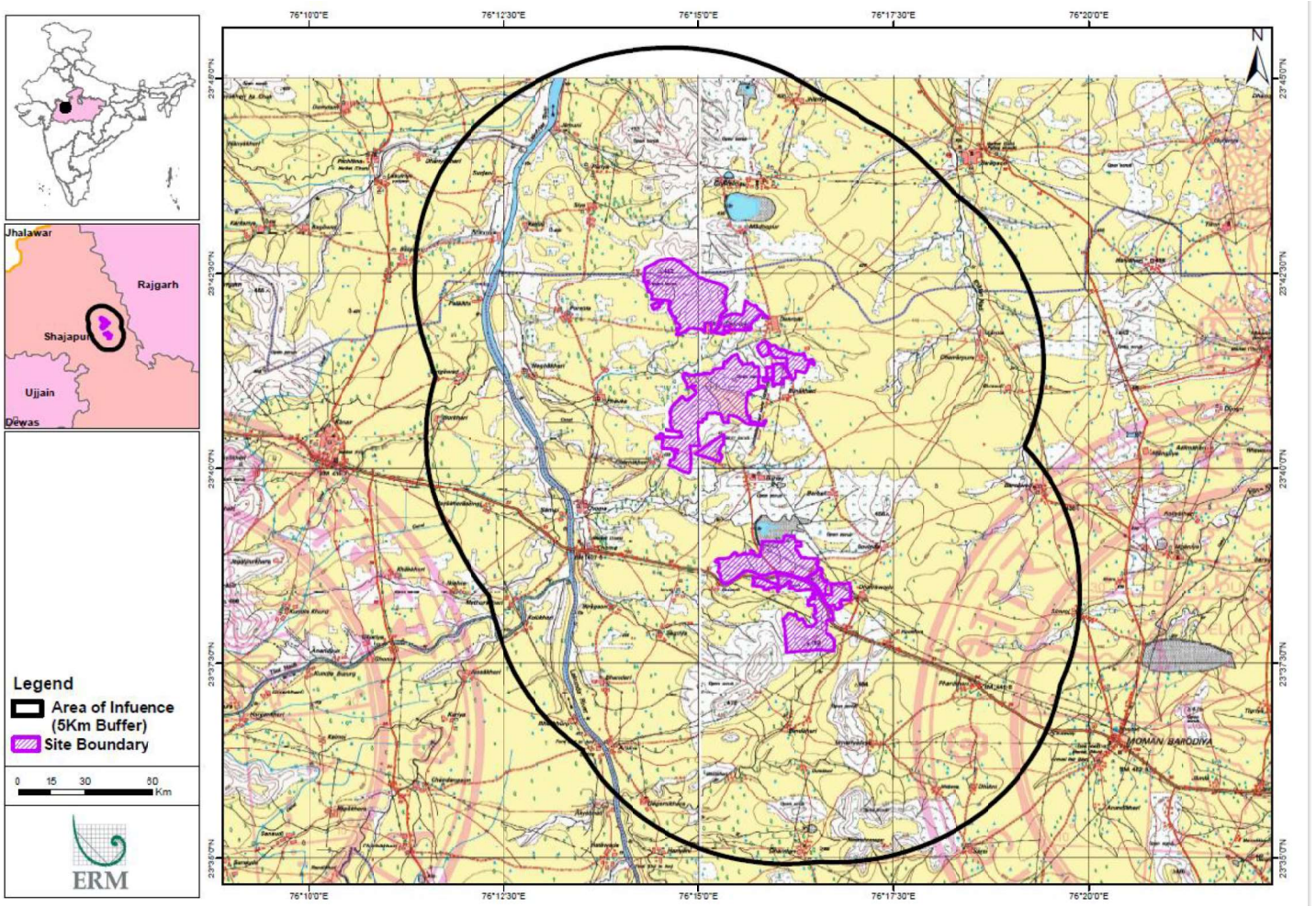
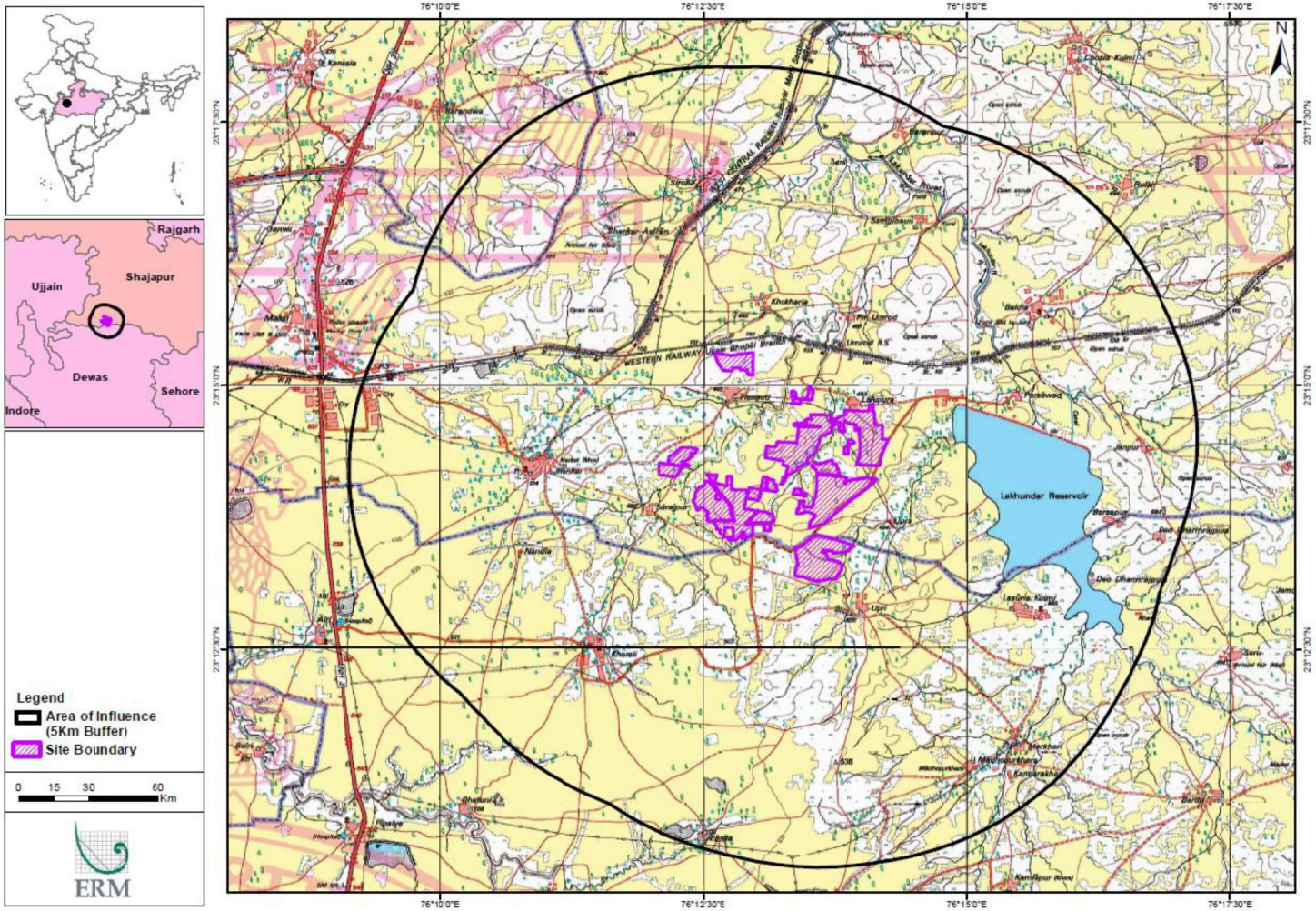


Figure 4.40 Map depicting villages in the Study Area of Shajapur tehsil



4.5.3 Demographic Profile of Study Area

The project footprint falls in eleven villages (known as "Project Villages" while the AoI has total 13 villages, as depicted above in Table 4.38. The Project Villages comprise 7246 households with a population of 35,581 individuals. The average size of the households is 5 in the Study Area. Dhatrawada village has the highest sex ratio amongst the Project villages. The AoI has a sex ratio of 935 females per 1000 males, which is slightly lower than the district figure (938) but better than the state figure of 931.

Table 4.39 Demographic Profile of Study Area

Village	No of HHs	Population	Sex Ratio	% SC	% ST	% Lit	% F Lit
Project Villages							
Jawadi	183	880	872	32.8	0.3	50.9	34.8
Parsula	226	1097	882	20.3	17.7	71.1	56.4
Fawaka	269	1177	880	34.8	2.4	66.9	50.0
Dhatrawada	258	1156	1007	16.8	0.0	59.2	44.4
Dehripal	585	2688	961	6.4	0.2	62.8	45.5
Chouma	544	2625	952	39.7	0.7	62.8	48.7
Burlay	383	1954	895	33.0	0.0	56.4	39.1
Bijnakhedi	201	781	928	14.1	0.0	60.2	38.8
Hanoti	171	919	931	3.7	0.0	65.4	47.7
Surajpur	151	785	869	20.0	2.0	73.1	54.3
Lalupura	91	497	972	44.1	0.0	58.1	40.7
Total	3062	14559	927	24.0	1.8	62.4	45.8
Area of Influence							
AoI Total	4184	21022	935	27.2	1.1	68.4	55.1
Study Area Total	7246	35581	932	25.9	1.4	66.0	51.4

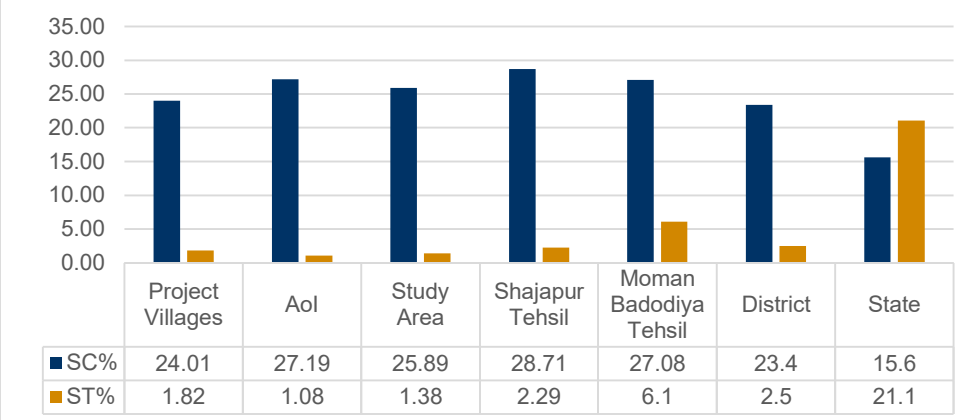
Source: Census of India, 2011

The total literacy in the Study Area is 66 percent whereas the female literacy rate by comparison is quite low. Within the Study Area, the female literacy is higher in the AoI than the Project Villages. The proportion of SC population ranges from 4 percent to 44 percent in the Project Villages. The ST population is low both in Project villages and the AoI, except in Parsula village, where it is 18 percent.

4.5.4 Social Stratification

The entire population in the Study Area falls in the rural category. The villages comprise of majorly Prajapati, Sondiya, Malviya Thakur Brahmin, Rajput, Patel, and Banjara communities, with some households of the Bhil (ST) community.

Figure 4.41 Proportion of SC/ST Population in the villages of Study Area vis-à-vis Tehsil/ District



	Project Villages	AoI	Study Area	Shajapur Tehsil	Moman Badodiya Tehsil	District	State
SC%	24.01	27.19	25.89	28.71	27.08	23.4	15.6
ST%	1.82	1.08	1.38	2.29	6.1	2.5	21.1

Source: Census of India, 2011

As understood through consultations undertaken across Project villages, a "Banjara" community settlement is also present in the Study area. The Banjara community in Madhya Pradesh is designated as OBC. As per consultations they are not originally the inhabitants of these villages or the tehsil. They have migrated from other places and settled in the project villages, nearly three decades ago. They are reported to not own land and are largely engaged in trading of handmade goods and usually seasonally migrate to nearby states for selling their products like, blankets, clothes etc.

The Banjara community currently resides in Dehripal Chak village (close to project footprint area); the extent and nature of encroachment by the community on the land identified for the project has been assessed during the RAP consultations and will be included in the RAP-LRP document.

4.5.4.1 Scheduled Caste Population

The major sub castes of SC population inhabiting the area are Malviya, Prajapati, Khati, Balai, Bagri, Chamar, Nai, etc. The livelihood pattern of SC population does not significantly differ from the General community; however, they reportedly possess smaller landholdings and their dependence is higher over agriculture labour and wage labour due to lack of or access to limited landholdings. There is segregated habitation pattern of SCs from other community groups observed in some Project villages.

4.5.4.2 Scheduled Tribe Population

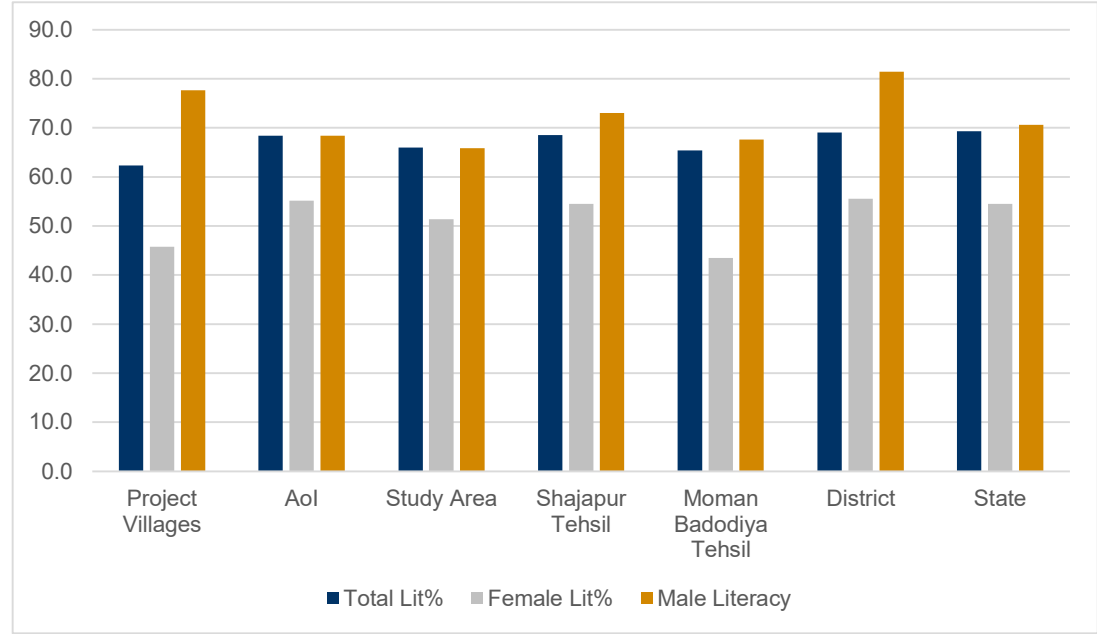
Madhya Pradesh has a high proportion of ST population; however, the presence of ST population is low (at 2.5 percent) in Shajapur district and 1.38 percent in the Study Area. The ST groups that inhabit the study area are majorly from the Bhil and Bhilala tribe.

It was understood during consultations with local community that majority of these Scheduled Tribe (ST) households residing in the Project villages were landless earlier and had been awarded patta land for agriculture by District Collector nearly 20 years ago. The Bhil community presently has smaller and fewer land holdings as compared to the General households (due to fragmentation of land across generations) and undertake cultivation on the same in addition to working as agricultural labourers on others' fields. The Free Prior Informed Consent (FPIC) process shall be undertaken in Parsula, the village identified in the FPIC approach note (submitted 3rd Sept 2020), where the process will be followed to seek consent for the project from the ST community.

4.5.5 Literacy and Education

The total literacy rate and female literacy rate in the Project Villages is lower as compared to the AoI, Study Area, Tehsil and district figures. This represents the relatively lower focus on education of females in the area.

Figure 4.42 Comparative Overview of the Literacy Rate across Study Area, District and State



Source: Census of India, 2011

There is a changing scenario in terms of education of girl children, such that all girls in the Project Villages reportedly attend school; however dropouts take place if the girls have to travel to other villages for attaining higher education, due to safety concerns and lack of transportation facilities. During consultation in Project villages, it was understood that mostly girls complete their education till middle school as there is a government middle school in every project village, except Jawadi. The drop-out rates among girls rises with higher levels of education, as for high school and college they would be required to travel to nearby villages or tehsils and the commute is considered unsafe by the local community.

The boys commute by local transportation, bicycles etc. to nearby villages, tehsils or districts for pursuing higher education and usually complete their senior secondary education, after which most of them get engaged in agriculture and allied activities to support their family. During consultations with youths present in the village level meeting, they said that some of them (approx. 5-7 in each village) prepare for entrance tests for government jobs, i.e. armed forces, Staff Selection commission (SSC)[1], banking etc.; some said they were pursuing short term technical courses at the ITI in Shajapur.

The inclination of boys towards completing education beyond 12th standards/ senior secondary school is low, as the people reportedly do not get gainful employment after attaining higher education; hence the cost of higher studies or associated transport and boarding costs are perceived as an unrewarding investment. The youth usually join their family in agriculture or migrate to nearby tehsils, cities to work as construction labours, in shops, solar parks etc.

[1] Staff Selection Commission - Combined Graduate Level Examination, often referred to as SSC CGL is an examination conducted to recruit staff to various posts in ministries, departments and organisations of the Government of India

4.5.6 Land ownership and use

This section presents an overview of the ownership and use of land in the project area, based on the Census 2011; however, it does not include recent aerial imagery based updates. The area has an agrarian economy and hence the dependence on land as a resource is high, which is also reflected through details presented in the table for land utilization.

4.5.6.1 Land Category Breakup

The table given below gives details about typology of land in the study area and it's break-up.

Table 4.40 Land Use in the Study Area (in ha)

Village Name	Total Area	Forest Area[1]	Area under Non-Agricultural Uses [2]	Barren & Un-cultivable[3]	Permanent Pastures and Other Grazing[4]	Land Under Miscell-aneous Tree Crops etc.[5]	Culturable Waste[6]	Fallow Land other than Current Fallows[7]	Current Fallows[8]	Net Sown Area[9]
Project Villages										
Jawadi	304.7	0.0	35.7	11.5	19.5	0.0	15.6	1.5	0.8	220.2
Parsula	693.0	0.0	152.1	11.7	17.3	0.0	28.1	1.8	0.4	481.6
Fawaka	587.6	0.0	76.6	45.7	11.7	0.0	2.7	0.7	0.6	449.6
Dhatrawada	661.0	0.0	52.0	170.9	79.6	0.0	33.3	1.5	0.9	322.9
Dehripal	944.5	0.0	64.9	215.0	18.9	0.0	40.2	1.0	0.4	604.1
Chouma	871.3	0.0	78.6	47.7	34.4	0.0	13.9	0.9	0.6	695.3
Burlay	948.4	0.0	108.6	214.9	44.1	6.4	20.1	2.1	1.1	551.0
Bijanakhedi	385.6	0.0	31.6	112.1	16.6	0.0	16.5	1.5	1.1	206.1
Hanoti	698.3	0.0	49.5	288.2	11.0	0.4	40.7	0.0	0.0	308.4
Surajpur	300.8	0.0	14.9	18.9	5.2	0.0	45.1	0.0	0.0	216.8
Lalupura	308.6	0.0	17.2	89.0	4.7	0.0	13.8	0.0	0.0	183.9
Total	**6703.6**	**0.0**	**681.7**	**1225.4**	**263.0**	**6.8**	**270.0**	**11.0**	**6.0**	**4239.8**
AoI Total	**8496.5**	**397.2**	**860.7**	**217.8**	**436.6**	**24.0**	**229.5**	**92.4**	**121.6**	**6116.8**
Study Area Total	**15200.0**	**397.2**	**1542.4**	**1443.2**	**699.5**	**30.8**	**499.5**	**103.4**	**127.5**	**10356.6**

Source: Census of India, 2011

The table given above shows that approximately 18.3 percent of the total land area in the Project villages is categorised barren and uncultivable land, 63.2 percent is net sown area, out of which approximately

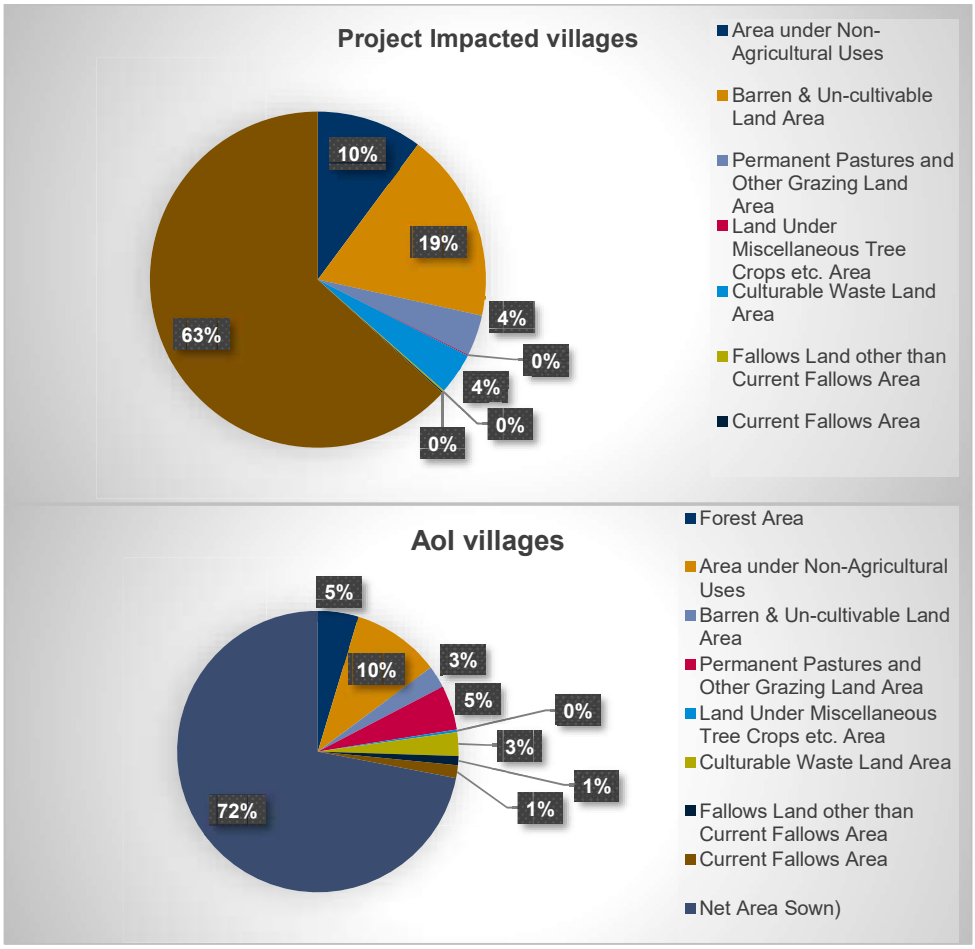
[1] All lands available for cultivation whether not taken up for cultivation or taken up for cultivation once but not cultivated during the current year and the last five years or more in succession for one reason or the other. Such lands may be either wholly or partly covered with shrubs and jungles, which are not put to any use. Land once cultivated but not cultivated for five years in succession would also be included in this category
[2] All lands available for cultivation whether not taken up for cultivation or taken up for cultivation once but not cultivated during the current year and the last five years or more in succession for one reason or the other. Such lands may be either wholly or partly covered with shrubs and jungles, which are not put to any use. Land once cultivated but not cultivated for five years in succession would also be included in this category
[3] all barren and unculturable land like mountains, deserts, etc.
[4] all grazing lands whether they are permanent pastures and meadows
[5] all cultivable land which is not included in 'Net area sown' but is put to some agricultural uses
[6] This includes lands available for cultivation, whether not taken up for cultivation or taken up for cultivation once but not cultivated during the current year and the last five years
[7] All lands, which were taken up for cultivation but are temporarily out of cultivation for a period of not less than one year and not more than five years
[8] This represents cropped area, which are kept fallow during the current year
[9] Net sown area is the total area sown with crops and orchards, counting area sown more than once in the same year, only once

55 percent is unirrigated land and 45 percent is irrigated by some sources, i.e. wells, tube- wells, hand-pumps, canals etc. The Project villages have no forest land, 10.2 percent area under non-agricultural use and nearly 4 percent as culturable waste land. Additionally, 0.10 percent is land comprising of miscellaneous tree crops. Land under permanent pastures and other grazing land is about 4 percent. Current fallows area and fallow lands other than current fallows comprise 0.09 percent and 0.16 percent respectively.

This data is a decade old and during consultations with local communities in the project villages it is understood that with the availability of reliable electricity in recent years, more people have invested in installing bore wells and have brought more land into agricultural use, largely privately owned land, patta land and even government land (by squatting or encroachment).

In the AoI, approximately 72 percent of the land is categorised as net sown area out of which nearly 47.6 percent is un-irrigated land and 52.4 percent is irrigated land by several sources, i.e. canals, bore-wells etc. Approximately 2.6 percent of total land area is barren and uncultivable land, 4.7 percent is forest area, nearly10 percent is under non- agricultural uses, 2.7 percent is culturable wasteland, 0.3 percent is land comprising of miscellaneous tree crops, and 5.1 percent comprise of permanent pastures and other grazing land. Current fallows area and fallow lands other than current fallows comprise of 1.4 percent and 1 percent respectively in the AoI.

Figure 4.43 Proportion of Land Use in Study Area



Source: Census of India, 2011

4.5.6.2 Land Ownership and Occupation (Squatting/ Encroachment)

It was understood during consultations in Project villages that the average land-holding in the project villages is about 3-4 bighas or 1 ha per household. There are some households (mostly from Rajput and Patel households) in nearly every village that own landholdings ranging from 15- 25 bigha (around 2-4 ha). These households with higher landholdings employ agricultural labourers or may enter into sharecropping arrangements with other households that own less or no land. Nearly every household owns land in the villages except 6-7 households- these landless households are from SC and ST social groups.

In addition to private ownership of agricultural lands, there are also 10-15 percent households from SC and ST groups in every village who possess Patta land allotted nearly 20 years ago.

Patta land is present in all the villages, which were allotted to landless households (5 bigha each, or 0.55 hectare) by the government as part of various schemes (detailed records of the schemes are not available with the Tehsil land records office. The holder of patta land cannot transfer the rights of use or ownership to any other person, without the permission of the District Collector. New patta land allotments have stopped since 2003). In spite of land allocation, there are several landless households in the Project Villages, for the reasons as stated below.

- The households have split since the last allocation without corresponding division of their patta land holdings; and thus there are certain new households who do not own land;
- Some households sold their patta land (through informal verbal agreement) and started working as daily wage labourers (refer Box 4.3) ;
- Since the land allotted to households as Patta land was of poor quality (unirrigated and infertile), some left their allotted patta land unused- leaving these parcels vulnerable to encroachment or squatting by others. Some people in Fawaka claim that this is the situation with a few patta land parcels allotted (but not used) by some SC households in their village; this land, they assert, is now in possession of and being used by others. The presence of this land within land identified for the project is being confirmed as part of the RAP survey.

Consultation with both private and patta land owners, revealed that they also encroach on adjoining or nearby government land in addition to their private/ patta land and use the occupied land for livestock sheds and for agriculture. It has been reported during consultations that Government land parcels near Pursula and Dehripal village boundaries have been encroached and squatted and are used for cultivation by Bhil community households.

A few Bhil households reported that they have given their encroached/squatted land to members of the Banajara community from Dehripal Chak for share cropping, due to proximity of these community with the land. The consultations in Pursula and Dehripal villages also highlight that there is an active land market for occupied (squatted-upon) Government land parcels, which is informal verbal, and based on historic possession by a household. The existing rates for sale of occupied land parcels ranges from INR 70,000 to INR1,50,000 per Bigha (approximately INR 2,80,000 to INR 6,00,000 per acre).

Box 4.1 Informal transactions on Patta land in the project area

The cases of informal sale of patta land from owning household to others without change in legal documentation and ownership records have been reported across the Project villages. These transaction are undertaken by households to meet their financial needs, for sellers and low cost land requirements of the buyers. It is to be noted here that the sale of Patta land is not allowed as per legal provisions; hence the land remains in the name of original patta holders on official records, but is no longer in possession of the allottee households who may or may not own other land. Thus, both sides are disadvantaged as the seller gets a price lower than market value for similar private land, and the buyer carries the risk of not being the legal and registered owner on record.

The discussion on these informal transactions of patta land was undertaken with the Tehsildar of Shajapur Tehsil (in Maksi). It was reported that the cases of allotment of patta land are dealt with by the District Collector's office and the Tehsildar's role is limited to investigation of the ground level aspects and provide inputs in the form of a report to the District Collector's office. There is no official information reportedly available with the Tehsildar office regarding the informal sale and purchase of Patta land

The District Collector may review cases (based on the seller's circumstances and need) and allow Patta holders to sell their land. Patta land sale is usually permitted when the patta is more than 20 years old.

Use of Government Land – Occupied for Agriculture

The vacant government land in every Project village is used for multiple purposes, some that are permitted uses (grazing, firewood collection, etc. as described below) and others that are not. The non-permitted uses and occupation of government land include:

- Encroachment or squatting for cultivation;
- Encroachment for making livestock sheds, fodder storage, constructing residential structures

Squatting/ encroachment happens in the project villages when private land holders and patta holders extend their land area boundary and start cultivating on the adjoining government land.

There are other forms of encroachment done by Patta holders in the project villages. As per information shared by local community and its validation by Patwaris of Moman Badodiya and Shajapur, the patta-holders who have been assigned poor quality or infertile land parcels by the government or land that lacked irrigation facilities, abandoned their allotted patta land and occupied nearby vacant government land for cultivation. Usually, the land squatted upon by any Patta-holder is nearly the same as the area of Patta land allotted by the government. This practice is not new and has been carried on for a few generations. The fine/ penalty levied on encroached or squatted upon land is small in proportion to the income derived from cultivating/using it. A penalty amount of INR 400- 500 is imposed for one bigha of land, as reported in Parsula village- the frequency was not stated and this was an amount that was recalled as being paid recently. Usually the penalty amount and the method for calculating the fine varies from one village to another. In some places it is reported to be calculated based on yield. The RAP document will contain further information gathered during the field studies.

Tehsildars of Moman Badodiya and Shajapur Tehsils said that they do not force farmers/ encroachers to remove their encroachment and the reason for the fine being low is that their land occupation is small and the land productivity is low. In some exceptional cases the Land Revenue department exempts some encroachers/ squatters/ households of marginal land holding (usually 1-2 bigha) farmers from paying the penalty/ fine.

Use of Government Land for Grazing

Cows, buffaloes and goats are the major livestock owned by the households of the Project villages. Census data, 2011 shows that approximately 4 percent of the total geographical area in Project villages is under permanent pastures, in terms of land use, implying grazing land, though other areas may also be

used for grazing. Charagah/charnoi[1] has land is documented in official records in the Nistar Patrak. This category of land cannot be allotted for projects as there is a requirement to maintain grazing land (Charnoi, charagah), the area of which should not be less than 2 percent of the total agricultural land in the village. It was stated that these principles were considered at the time of allotting land to RUMSL.

Key uses permitted on open government land, to the households of the village include:

- Grazing their livestock/livestock, especially during the monsoon season;
- Dry wood collection for domestic fuel;
- Collection making and drying of cow-dung for fuel;
- Collection of grass, leaves etc. as fodder

During consultation with the local community it was understood that the local community stores crop residue after harvest of wheat, soybean and mustard as dry fodder for livestock, based on suitability. This is used during the summer season and the stored fodder lasts for around 8-10 months. The stored fodder, is supplemented with green fodder from government land for open grazing, or private lands, for those with larger land holdings. The dependence on government land for grazing increases during the monsoon season due to increased availability of grass which is used as green fodder. As estimated by the people consulted, nearly 50 percent of the required dry fodder is available from crop residue (husk, soybean) and the remaining 50 percent is purchased from the market. The cost of buying fodder is about INR 2,000 per trolley. It takes approximately 1 bigha (0.11 ha) land to grow one trolley-load of fodder.

Nearly every household in the Project villages has approximately 3-4 heads of livestock (i.e. cows, buffaloes) and also goats, except for a few SC and ST households. There are also some households, mostly from the more socially dominant communities, in this case, Rajputs and Patels, who own around 10-15 livestock per household.

Other uses on Government Land

Apart from grazing purposes, government lands are also encroached by villagers for livestock-sheds. During community consultations in Lalupura village, residents informed that they encroach or squat upon nearby government land (i.e. close to their livestock shed, settlement, and agricultural field) for storing fodder. Households having large land-holdings (largely from. Rajput and Patel communities) tend to encroach more land as compared to the marginal or landless households that lack the means and the resources to utilize encroached land and prepare it for cultivation.-.

Additionally, it has also been reported during consultations that the Government land is used by the seasonal migrants from nearby states (viz., Shepherd community of Rajasthan) for resting and livestock grazing for nearly 4-5 months every year.

4.5.7 Occupational Profile

The Study Area has nearly 50 percent working population, with a majority categorised as Main Workers[2], i.e. being employed for more than 6 months in a year. The Project Villages have nearly 66.6 percent main workers of the total working population. The ***Table 4.41*** depicts that women are nearly equal contributors to the Main Working Population as men in Chouma, Hanoti and Lalupura villages of Project villages

[1] [1] According to the discussions with the Revenue department officials conducted in 2018 (scoping stage), these land categories pertain to land classified for community use such as grazing, fire wood collection etc.

Charnoi - Common grazing land for cattle;

Charagah - Pasture land;

[2] Main Workers are those workers who had worked for the major part of the reference period (i.e. 6 months or more)

though more women are marginal workers[1] in all Project villages. The scenario is similar in the Study Area for females as Main and Marginal workers, where the total male marginal workers and female marginal workers are 17.9 percent and 41.4 percent respectively.

Table 4.41 Working Population in the Study Area (2011)

Villages	WPR	Main (% of WPR)	Main M (% of WPR)	Main F (% of WPR)	Marg (% of WPR)	Marg M (% of WPR)	Marg F (% of WPR)	Non Work (% of Total Population)
Project Villages								
Jawadi	55.1	27.6	49.0	5.8	72.4	51.0	94.2	44.9
Parsula	55.9	75.4	94.6	52.7	24.6	5.4	47.3	44.1
Fawaka	55.4	36.5	60.1	9.8	63.5	39.9	90.2	44.6
Dhatrawada	40.0	69.9	93.5	15.1	30.1	6.5	84.9	60.0
Dehripal	44.2	75.1	85.6	58.7	24.9	14.4	41.3	55.8
Chouma	43.9	94.3	96.7	90.4	5.7	3.4	9.6	56.1
Burlay	54.2	56.9	71.0	40.5	43.1	29.0	59.6	45.8
Bijanakhedi	38.8	81.9	96.8	42.2	18.2	3.2	57.8	61.2
Hanoti	57.3	59.6	60.3	58.9	40.4	39.7	41.2	42.7
Surajpur	51.2	46.0	64.4	19.9	54.0	35.6	80.1	48.8
Lalupura	61.2	89.5	93.9	85.3	10.5	6.1	14.7	38.8
Project Villages Total	49.1	66.6	80.6	47.4	33.4	19.4	52.6	50.9
AoI Total	50.1	76.1	83.2	66.2	23.9	16.8	33.8	49.9
Study Area Total	49.7	72.2	82.2	58.6	27.8	17.9	41.4	50.3

Source: Census of India, 2011

The ***Table 4.42*** and ***Figure 4.44***, present the worker participation details in Project villages during the previous decade, obtained from the 2001 Census of India. It is observed that the overall worker work participation has decreased from 2001 Census to 2011 Census, thereby bringing about an increase in the proportion of Non-Working population, especially in the female category. This change may be a result of number of factors, some of them being increasing landlessness or sub-optimal land holdings, women dropping out of the workforce to take on household work (for economic and cultural reasons), increasing unemployment over the decade as more youth spends longer time studying in adulthood, and waiting to join jobs rather than join the agricultural workforce, etc.

Table 4.42 Working Population in the Study Area (2001)

Villages	WPR	Main (% of WPR)	Main M (% of WPR)	Main F (% of WPR)	Marg (% of WPR)	Marg M (% of WPR)	Marg F (% of WPR)	Non Work (% of Total Population)
Project Villages								
Jawadi	54.7	60.2	99.5	15.6	39.8	0.5	84.4	45.3
Parsula	59.1	57.5	91.8	18.6	42.6	8.2	81.4	40.9
Fawaka	48.8	96.5	98.2	94.3	3.5	1.8	5.7	51.2
Dhatrawada	54.6	57.9	92.3	15.4	42.1	7.8	84.6	45.4
Dehripal	49.2	72.7	99.0	40.6	27.4	1.0	59.4	50.8
Chouma	53.8	80.4	90.6	68.1	19.6	9.4	31.9	46.2
Burlay	55.6	40.9	72.1	3.1	59.2	27.9	96.9	44.4
Bijanakhedi	56.4	99.1	98.7	99.4	0.9	1.3	0.6	43.6
Hanoti	53.6	99.5	99.6	99.3	0.6	0.5	0.7	46.4
Surajpur	50.3	100.0	100.0	100.0	0.0	0.0	0.0	49.7

[1] Marginal Workers are those workers who have not worked for major portion of reference period (i.e. less than 6 months)

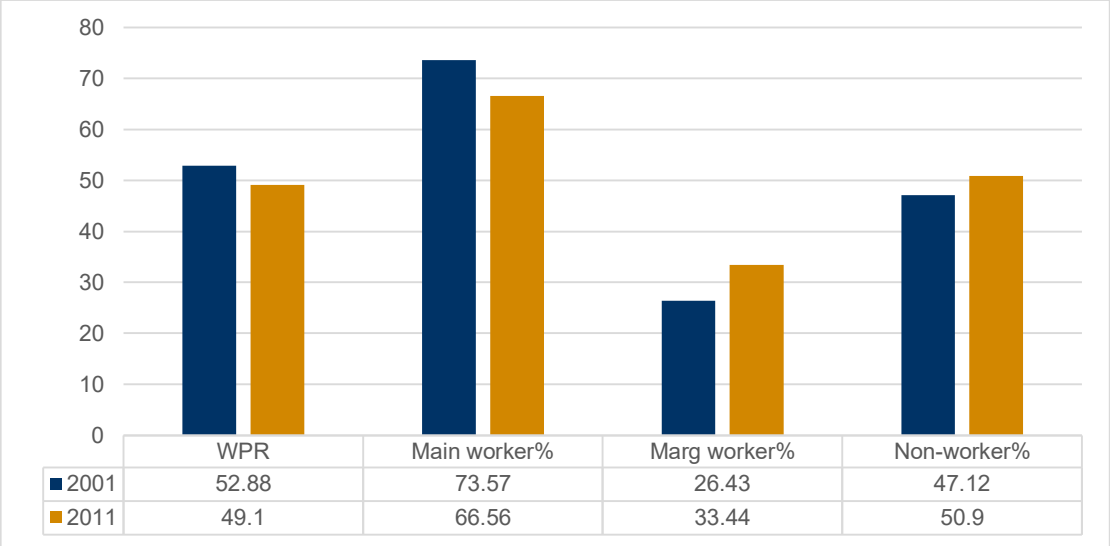
Villages	WPR	Main (% of WPR)	Main M (% of WPR)	Main F (% of WPR)	Marg (% of WPR)	Marg M (% of WPR)	Marg F (% of WPR)	Non Work (% of Total Population)
Lalupura	44.6	99.5	100.0	98.7	0.5	0.0	1.4	55.4
Project Villages Total	**52.9**	**73.6**	**92.5**	**50.2**	**26.4**	**7.5**	**49.8**	**47.1**
AoI Total	46.7	63.3	77.6	42.9	36.7	22.4	57.1	53.3
Study Area Total	49.1	67.6	83.7	46.1	32.4	16.4	53.9	50.9

Source: Census of India, 2001

During community consultations in Dehripal, Fawaka, Lalupura and Surajpur villages it was informed that approximately 50 percent of the youth are either enrolled in ITI trainings, prepare and join armed services or migrate to nearby cities of Indore, Dewas and states like Karnataka and Tamil Nadu to work as construction labour.

The ***Figure 4.44*** below, gives a trend of working population in 2001 and 2011 on the basis of census data. The figure depicts the same trend as mentioned above in table; the main working proportion has decreased over a period of decade while the proportion of marginal workers have increased in year 2011. As a result main workers have decreased in year 2011 as compared to main working proportion in 2001.

Figure 4.44 Decadal comparison of Working trends in the Project villages



Source: Census 2001 and 2011 data

Out of the Main Working Population, majority of the population are Cultivators[1] or Agricultural Labourers[2], underscoring the fact that the region runs on an agrarian economy, with strong dependence on land. Less than 7 percent from Project villages and 13 percent in AoI villages were engaged in other works[3], like construction labour, working in solar plants in Rajasthan, working in nearby shops at Shajapur and

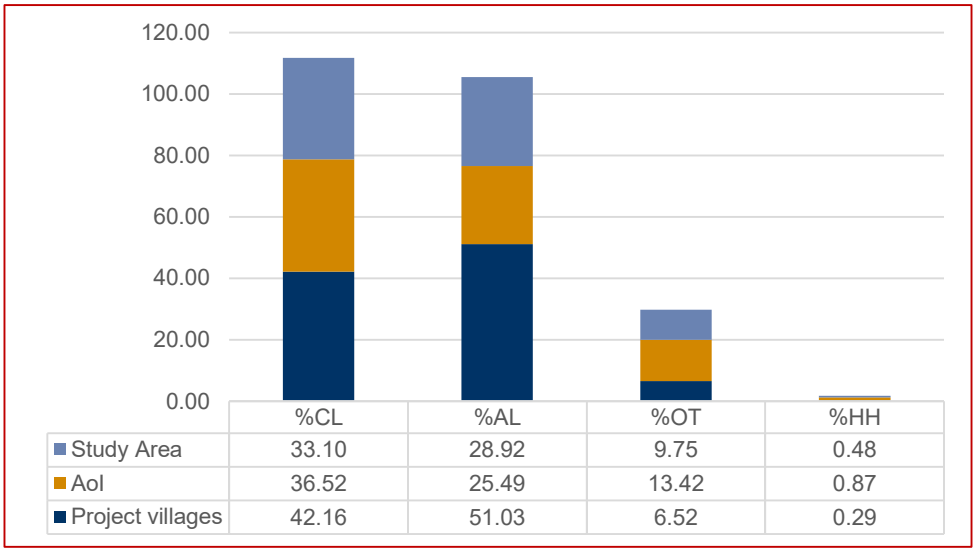
[1] A person is classified as cultivator if he or she is engaged in cultivation of land owned or held from Government or held from private persons or institutions for payment in money, kind or share. Cultivation includes effective supervision or direction in cultivation

[2] A person who works on another person's land for wages in money, or kind or share is regarded as agriculture labourer. He or she has no risk in the cultivation, but merely works on another person's land for wages. An agriculture labourer has no right of lease or contract on which she or he works

[3] All workers i.e. those who have engaged in some economic activity during the last one year, but are not cultivators or agriculture labourers or in household industry are 'Other Workers'

Moman Badodiya. The proportion of Household workers[1] is negligible, less than 1 percent at all three levels, i.e. Project villages, AoI and Study area villages, as depicted in ***Figure 4.45.***

Figure 4.45 Distribution of Main Working Population in the Study Area



	%CL	%AL	%OT	%HH
Study Area	33.10	28.92	9.75	0.48
AoI	36.52	25.49	13.42	0.87
Project villages	42.16	51.03	6.52	0.29

Source: Census of India, 2011

Based on consultations with the local community in the project villages, the livelihood activities of the population in the Study area, are:

- Farm Based Activities : cultivators, agricultural labourers and livestock rearing);
- Non-farm based activities: contractual labour for construction, working in shops, solar plants etc.)

4.5.7.1 Farm Based Livelihoods

As depicted in the ***Figure 4.45*** approximately 62 percent of the main working population is dependent on agriculture and allied activities in the Study area. In comparison 93.2 percent population is dependent on agriculture and its allied activities in Project villages and 62 percent in AoI villages. The entire study area and especially Project villages have a low Water table, with availability of water at 400- 500 ft. except in Dhatrawada where the ground water level is at 200- 250 ft. There are reported issues of water scarcity, especially during summer months. Wells, tube-wells as well the supply of electricity for a period of 6-10 hours per day for irrigation, form the major sources of irrigation across villages. The current dependence on land and livestock rearing in the area is high, as borne out by the occupation and livelihoods figures.

Dependence on Agriculture in the Project Villages

People in these villages cultivate their own private land or patta land. In addition, some farmers (especially large private land holders) also encroach government land, which is adjacent to the boundary of their private land. The encroached government land varies between 1-2 bighas to 3-4 bighas, depending on the availability of adjacent government land and clout of the farmer in the village power dynamics.

[1] Household industry is defined as an industry being run by one or more member of a household at home or within village in rural areas and only within the precincts of the house where the household lives in urban areas. The larger proportion of workers in the household industry consists of members of household. The industry is not run on the scale of a registered factory which would qualify or has to be registered under the Indian Factories Act.

The farmers from SC and ST groups who own 2-3 bighas of patta land granted by the government, also encroach squat on government land for cultivation or in some cases they leave their own patta land and cultivate on a different area on a government land parcel, which may not necessarily be close to their allotted patta land if it is poor quality land.

Crops and cropping pattern in the Project villages

The primary crops grown in the project villages include soybean, wheat, mustard, urad dal, gram (chana), and vegetables like potatoes, onions etc. some families, approximately 20 percent of the household in the project villages also grow oranges.

Apart from onions and potatoes, vegetables such as cabbage, cauliflower etc. are mostly used for self-consumption and the rest is sold in the nearby markets. Irrigation facilities like wells and bore-wells are used in all the villages. There are canals in some of the villages like Lalupura, Jawadi and Burlay. It was informed during consultation in Surajpur villages that they may get water for irrigation through canal from Narmada River in the next two years. The ground water level goes down further during the summer season (May- June) thus leading to a continued dependence on rain-fed agriculture.

Table 4.43 Productivity and related costing of major crops in Project Villages

Crop	Agricultural Season	Input cost per Acre (INR)	Yield per Acre (in Quintals)	Sales Price per quintal
Soybean	June - October	20,000- 25,000	10-15	3000
Wheat	November - April	15,000- 20,000	20- 30	2000
Pulses (Urad)	June - October	~ 50,000	20-25	8,000- 9,000
Gram (Chana)	October - April	25,000 - 30,000	5- 7	4500
Mustard	October - April	25,0000 - 30,000	20-25	3500-4000
Potato	October - December	75,000 - 1,00,000	200- 225	1000-1200
Onion	January - March	90,000 – 1,25,000	190-200	3000- 4000
Oranges	December- February	25,000 - 30,000	45- 50	600-1000

Source: Community Consultations undertaken by ERM India

Onion cultivation has been profitable for farmers due to rise in its price; also productions of other crops like soybean, mustard etc. have grown, due to water availability from canals, bore- wells and good rainfall recorded in last few years.

Some villages have diversified their farming pattern and grow oranges though it has not been very remunerative for farmers in the Project villages. A few years ago in Chouma, nearly 75 percent of the farmers used to cultivate oranges, however this proportion has decreased to around 25 percent in the current year due to non- fruiting. Farmers used approximately 1 bigha of agricultural land to grow ~ 80 orange plants, out of which approximately 20 plants came to fruition. The land used for orange cultivation is also used for double cropping where crops like masoor (a type of pulse) and soybean are grown in the same agricultural field. .

The people retain a part of the crop produce for self-consumption while the surplus is sold in markets of Agar, Moman Badodiya, Maksi and Kanad to local traders. The farmers sell their agricultural produce to individual traders and not at the government mandis, due to flexibility in terms of time of sale, lack of documentation required, preference for getting cash payments, against the less preferred practice of receiving cheques for sale in government mandis.

Livestock rearing

As discussed above, agriculture is the main occupation in the project villages, combined with livestock rearing. In addition to monetary gains, livestock rearing also provides milk, meat, butter etc. which provides the required nutritional intake to the family as well as the animal dung serves as a steady source of manure for fields and fuel for cooking, while LPG remains a supplementary domestic fuel source.

Almost every family has livestock except some of the landless families in Project villages, most of whom are from ST and SC groups. The average livestock ownership in the Project villages is approximately 3-4 livestock/ household and while some families in the village owned as many as10-15 livestock.

The livestock by-products like milk and *ghee* (clarified butter) are consumed by families primarily and surplus milk is sold in the nearby dairies. During consultation with local community it was understood that there are government and private dairies in almost every village and the value of milk is decided on the fat content in the milk. On an average milk sale fetches INR 35- 40/ litre. Some households cultivate fodder on smaller portions of their agricultural fields which helps in reduced dependence on purchased fodder from outside. The collection of this fodder for stall feeding is sometimes undertaken by the women however men are primarily responsible for grazing of livestock.

Goats are usually sold for meat in the local weekly mandi/ market held on every Saturday at Maksi and Kanad at rates varying from INR 5000 to INR 10,000, depending on the animal's weight. In-addition to goats, buffaloes are also sold and purchased from this weekly mandi/ market at the rate of approximate INR 20,000- 50,000. The ***Table 4.44***, gives the detail of different types of livestock in project villages of Shajapur and Moman Badodiya tehsils. The data states that there is a significant number of buffaloes in the project villages followed by other native-bovine animals (cows), with lesser number of goats and no sheep at all. It has been understood that the villages of Burlay, Dhatrawad, Dehripal and Chouma have highest livestock ownership amongst the project villages.

Table 4.44 Livestock ownership in the Project Villages

Villages	Livestock	Buffalo	Goat	Total Livestock
Burlay	264	918	213	1395
Jawadi	102	425	93	620
Dhatrawada	454	1095	224	1773
Parsula	170	191	66	427
Dehripal	530	539	267	1336
Bijanakhedi	263	534	58	855
Fawaka	156	219	8	383
Chouma	671	401	408	1480
Hanoti	106	232	117	455
Lalupura	100	253	101	454
Surajpur	311	350	138	799
Total	**3127**	**5157**	**1693**	**9977**

Source: Livestock Census data 2019

Box 4.2 Issue of Stray Cows in Project Villages (Awaara Gai)

As per consultations with the local community in Dehripal, Jawadi, Bijnakhedi, Surajpur, Chauma and Lalupura villages, "Awaara Gai"/Stray cows are a cause for concern in these villages. "Awaara Gai"/ Stray cows are abandoned unproductive cows. Due to the expense of fodder, cattle-owners abandon their cows in nearby village commons. The number of these stray cows has increased in the project villages in recent years and these stray cows cause crop damages in the nearby fields.

The community in Jawadi village informed that there are nearly 500 "Awaara Gai"/ Stray cows in and around their village. Currently there is one cattle-shed/ "Gaushala" under construction in Burlay village, which is 4-5 km away from Jawadi. Similarly, in Chauma, village, the community said that there are nearly 150 'Awaara Gai" near their village. A Cattle shed/ Gaushala with a capacity for 150 cows, is being constructed in Baddi village, which is nearly 1 km from main settlement area, to control crop damage caused by these stray cows. Approximately 59 Bigha land is reported to be allotted by the District Collector's officer for this Gaushala/ cattle shed.

Source: Community Consultations in project villages, January 2020

4.5.7.2 Non- Farm Based Livelihoods

The ***Figure 4.45*** depicts that the non-farm based livelihood categorized as Other Works in the graph in the Study Area is around 9.75 percent. It plays a key role in supplementing the source of income at the household level in Project villages. The non-farm based livelihoods in the project villages mainly comprise of daily wage construction labours, workers in shop, solar plants etc. The people work in the nearby village or at tehsil level and also migrate to the nearby cities and states.

The proportion of youth migrating out of their village for work varies across the Project villages, with nearly 30-50 percent of total youth migrating to cities in Karnataka, Tamil Nadu, Gujarat and other cities of Madhya Pradesh from percent Project villages. These emigrants work in shops, factories, petrol pumps or as construction labour, earning a daily wage of INR 300-500.

During consultations held in Surajpur village, the local community informed that nearly 30 percent of the youth from the village are employed in the armed forces. Several youths from this village and nearby villages said that they prepare for entrances exams to the armed forces and/or enrol in the Industrial Training Institute for short courses. They stated that approximately 50 percent of ITI trained students get employment with a monthly wage of INR 8000- 10000, in nearby cities. The ITI training centres near the Project villages are in Shajapur, Tonk and Devas.

It is expected that several migrant workers would have returned to their villages from various cities where they were employed, on account of the COVID 19 related lockdown and significant reduction of manufacturing and construction work. While this estimate is not available, or how these trends may pan out over the near terms, it can be expected that the returned migrants would be looking for employment, or may plan to join in agriculture and livestock rearing, while they are in the village, thereby increasing the stress on land-based activities.

4.5.8 Physical Infrastructure

4.5.8.1 Water Sources

The source of water for both drinking and agricultural purposes, as depicted in ***Table 4.45*** are uncovered wells and hand pumps. The census data of 2011 shows that canal/ river water was available only in Chouma village during 2011; however the condition on ground has reportedly improved in the past decade, as during consultation in Lalupura, Jawadi and Burlay people informed that there is canal water source in their village for the past 3-5 years.

The census data, 2011 below shows that there is tap water connection in Burlay, Bijanakhedi and Lalupura villages. Over the past decade some more villages have been added to this list; communities in Dehripal village informed that nearly 50 percent households have tap water connections, with water supply once in 3 days for 2 hours but not during summer season. The tap water connection has been provided by Gram Panchayat.

Table 4.45 Water sources in project villages & AoI

Villages	Tap Water- Treated	Tap Water Untreated	Covered Well	Uncovered Well	Hand Pump	Tube Wells/Borehole	River/ Canal
Project villages							
Jawadi	No	No	No	Yes	Yes	No	No
Parsula	No	No	No	Yes	Yes	Yes	No
Fawaka	No	No	No	Yes	Yes	Yes	No
Dhatrawada	No	No	No	Yes	Yes	No	No
Dehripal	No	No	No	Yes	Yes	Yes	No
Chouma	No	No	No	Yes	Yes	Yes	Yes
Burlay	No	Yes	No	Yes	Yes	No	No
Bijanakhedi	No	Yes	No	Yes	Yes	No	No

Villages	Tap Water-Treated	Tap Water Untreated	Covered Well	Uncovered Well	Hand Pump	Tube Wells/Borehole	River/ Canal
Hanoti	No	No	No	Yes	Yes	No	No
Surajpur	No	No	No	Yes	Yes	No	No
Lalupura	No	Yes	Yes	No	Yes	No	No

Source: Census of India, 2011

4.5.8.2 Drainage

The ***Table 4.46*** below gives a description of drainage system in the entire study area. From the given table it can be seen that there are no closed drains or open pucca drains in any of the Project villages, while there are open drains and open kuccha drains in in 8 out of 11 Project villages.

Storm and waste water is discharged directly into water bodies.

Table 4.46 Drainage system in Project impacted villages & AoI

Villages	Closed Drainage	Open Drainage	No Drainage	Open Pucca Drainage Covered with Tiles Slabs	Open Pucca Drainage Uncovered	Open Kuccha Drainage	Drain water discharged directly into water bodies
Jawadi	No	Yes	No	No	No	Yes	Yes
Parsula	No	Yes	No	No	No	Yes	Yes
Fawaka	No	Yes	No	No	No	Yes	Yes
Dhatrawada	No	Yes	No	No	Yes	No	Yes
Dehripal	No	Yes	No	No	No	No	Yes
Chouma	No	Yes	No	No	No	No	Yes
Burlay	No	Yes	No	No	No	Yes	Yes
Bijanakhedi	No	Yes	Yes	No	No	Yes	Yes
Hanoti	No	No	Yes	No	No	Yes	No
Surajpur	No	No	Yes	No	No	Yes	No
Lalupura	No	No	Yes	No	No	Yes	No

Source: Census of India, 2011

4.5.8.3 Toilets and sanitation

The census data of 2011 states that there were no community toilets in any of the Project villages also there were no toilets at household level. The situation has improved after introduction of government schemes like “Swachh Bharat Mission”; as the local community informed that there are toilets in nearly every household however these are not all used by residents due to their habit (preferring open defecation); some people also stated that having toilets within the house was culturally not acceptable . Defunct and non-existent water connections are also reported to be a key practical impediment to toilet usage. Interestingly, the usage of toilets reportedly goes up during rainy seasons due to ease of access and availability of water, bringing to question, statements about cultural taboos and habits.

Areas used for open defecation tend to be just outside the settlement, on government land, some of which may fall within the project boundary.

4.5.9 Social Infrastructure

4.5.9.1 Education Infrastructure

The Project villages have government primary schools and government middle schools in all the villages except Jawadi and Lalupura, where there are no government middle schools[1]. Few project villages have government secondary schools; there is only one government secondary school in Chouma. There are no senior secondary schools in any of the Project villages while there is only one in the AoI. This problem of distance is a reason for high dropout rates among girls after middle school, There is only one secondary school and no senior secondary school in the Project villages and parents do not prefer their daughters to go out of the village for education.

Apart from government schools in the Project villages there are also private schools in Fawaka, Chouma and Dehripal. People prefer sending their children to private schools up to Primary school due to better education facilities, after which they send their children to government schools as there are very few secondary and senior secondary private schools in the Project villages.

Table 4.47 Availability of Schools in the Study Area

Villages	Government Primary school (P)	Government Middle school (M)	Government Secondary School (S)	Government Senior Secondary school (SS)
Project Villages				
Jawadi	2	0	0	0
Parsula	2	1	0	0
Fawaka	2	1	0	0
Dhatrawada	1	1	0	0
Dehripal	3	1	0	0
Chouma	3	1	1	0
Burlay	1	1	0	0
Bijanakhedi	1	1	0	0
Hanoti	1	1	0	0
Surajpur	1	1	0	0
Lalupura	1	0	0	0
Project Affected villages Total	**18**	**9**	**1**	**0**
AoI Total	**16**	**9**	**2**	**1**
Study Area Total	**34**	**18**	**3**	**1**

Source: Census of India, 2011

4.5.9.2 Health Infrastructure and Health Seeking Behaviour

The health facilities in India follow a three-tier health infrastructure system, as also applies to the state of MP[2]. It can be understood from the table below, that there is one primary health sub-centre and one dispensary in the Project villages.

There is one Primary health centre and 2 Primary health sub-centres in AoI villages, however there are no maternity and child welfare centres, dispensaries, veterinary hospitals and family welfare centres in AoI villages.

[1] According to Census of India, Primary Schools provide education from class 1st to 5th, Middle Schools cater to children studying from classes 6th to 8th, secondary school provides education to students of classes 9th and 10th and similarly, senior secondary school teaches children studying in classes 11th and 12th. One interesting fact here is that, a composite school with classes 1st to 12th, will be treated as four separate units and will be counted separately as a Primary, Middle, Secondary and Senior Secondary school.
[2] The health facilities available at the village level comprise of Primary Health Sub Centres and Public Health Centres (PHC). While the sub centres cater to a population of 5,000 individuals, the PHCs are for a population of 10,000-30,000 individuals. While the PHCs are mostly for OPD (Out Patient Department) and basic IPD (Indoor Patient Department) cases, sub centres usually have a delivery room and two resident nurses (one male and one female). Each PHC has 5-6 sub centres under them. In turn, a cluster of 6-10 PHCs come under a CHC (Community Health Centre), which caters to a population exceeding 1 lakh, and also provides emergency services. The CHCs in turn report to the public hospitals at the district level.

Table 4.48 Availability of health facilities in the Study Area

Village Name	Primary Health Centres	Primary Health Sub Centres	Maternity &Child Welfare Centres	Dispensaries
Jawadi	0	0	0	0
Parsula	0	0	0	0
Fawaka	0	0	0	0
Dhatrawada	0	0	0	0
Dehripal	0	0	0	0
Chouma	0	1	0	1
Burlay	0	0	0	0
Bijanakhedi	0	0	0	0
Hanoti	0	0	0	0
Surajpur	0	0	0	0
Lalupura	0	0	0	0
Project Villages	**0**	**1**	**0**	**1**
AoI Villages	**1**	**2**	**0**	**0**
Study Area villages	**1**	**3**	**0**	**1**

Source: Census of India, 2011

4.5.10 Energy Use

The people in the Study Area use both LPG as well as dung cakes (as fuel source) to meet their daily domestic energy requirements. While LPG adoption and availability across the villages has improved over the past few years; firewood and burning dung cakes as fuel continues to be the main domestic fuel for cooking requirements.

During consultation it was understood that LPG is mostly used for making tea, re-heating of food etc. The dependency on LPG increases during the rainy season as there is lack of dry wood around. Fuel wood such as Babool, khankar etc. used for cooking purposes, are collected from private lands.

Fire wood is also purchased by households during need while cow dung cakes are available in nearly every household, as every household rears some livestock. In cases where the family does not own livestock, (usually landless households), they collect dung for use as fuel from nearby grazing land or government land, including from areas frequented by abandoned cows/ *awara gai*.

The plan for the cow shelter or gaushala, to house the abandoned livestock is also premised on the utility of dung collection, for use as cooking fuel.

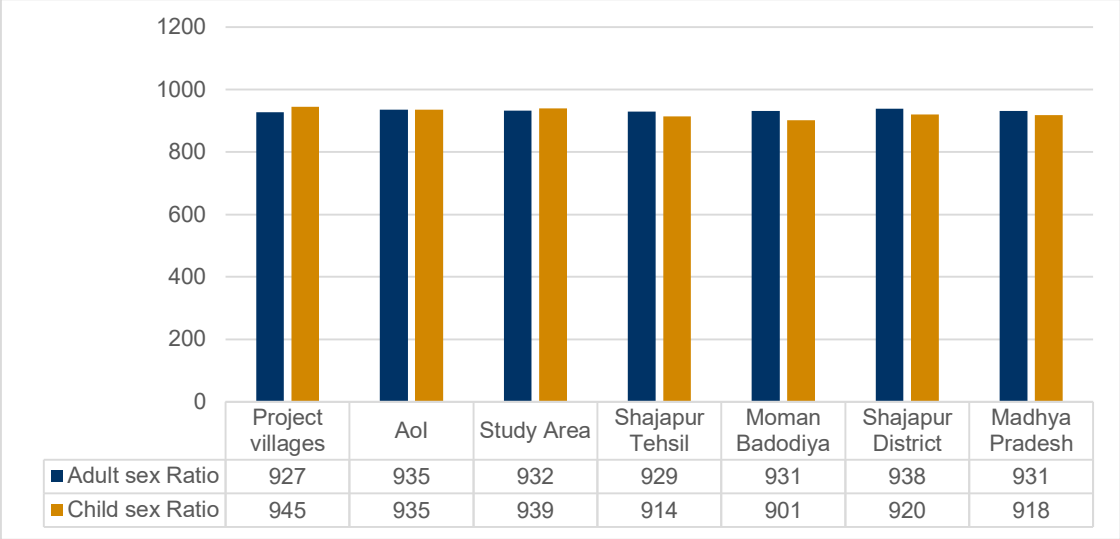
4.5.11 Gender: Role in Society

The Project Villages report a lower adult sex ratio and child sex ratio as compared to the AoI, Tehsil, district and the state figures of sex ratio (both adult and child). This may be attributable to higher infant mortality rates among girls resulting from a strong cultural preference for male children, possibly combined with sex selective abortions, together, these have led to an imbalance in the sex composition in the region. The practice of differential treatment of boys and girls could not be gauged through the consultations conducted in the project area villages, as most people claimed not to discriminate between sons and daughters.

The higher child sex ratio figures compared to adult sex ratio in Project villages as depicted in ***Figure 4.46*** may point towards a shift, through a decrease in infant mortality rate, improved child nutrition, prohibition of sex determination before birth and perhaps, some change in the strong biases.

The cultural bias against girls was gauged during consultations; where it was understood that girls are allowed to attain education only to a limited extent, due to safety and security concerns. In cases of economic stress/need, girls are the first to be pulled out of formal education to support the family with household chores or work in the field.

Figure 4.46 Comparison of Adult and Child Sex Ratios across Study Area, Tehsil and District



	Project villages	AoI	Study Area	Shajapur Tehsil	Moman Badodiya	Shajapur District	Madhya Pradesh
Adult sex Ratio	927	935	932	929	931	938	931
Child sex Ratio	945	935	939	914	901	920	918

Source: Census of India, 2011

The consultations suggest that in a household, women from most social and caste groups, take equal ownership and responsibilities of working on agricultural fields owned by the household, taking care of domestic chores of cooking, cleaning, fetching water from community water points to their respective houses, caretaking of children and elderly as well as tending to livestock owned by the family. Men are largely responsible for their share of tasks in the fields, management of financial resources, sale and purchase of goods (including agricultural inputs and produce, and, livestock and related products), etc. and their contribution to domestic chores of cleaning, cooking, caretaking is limited.

The occupational profile of the community is detailed in ***Section 4.5.7***, where men's employment options comprise working as cultivators, agricultural labours, construction labours, etc. There have not been any cases reported for women working as construction labourers or in any enterprise outside their respective villages.

4.5.11.1 Gender Roles in Livestock management and Agriculture

Women take care of stall feeding of livestock, cleaning of livestock and their sheds, preparation of dung cakes, milking, etc.; but are not responsible for grazing of livestock outside the household premises. Male members of the household are responsible for livestock grazing near the villages, sale and purchase of livestock, livestock feed and by products. The women from Rajput, Patel and Brahmin households (regarded as higher in the social hierarchy and usually relatively wealthier), are only responsible for household chores and have limited movement outside the house and do not work in the fields Women from all other social groups, especially those with smaller land holdings and fewer livestock may take on additional agricultural labour and work in the fields of the wealthier families.

On the agricultural fields, women are involved in cutting, sowing, threshing, watering, and collecting fuel wood. The women engaged as agricultural laborers are paid an amount of INR 100-200 per day where as men are paid INR 200-300 and usually take on different tasks in the field The tasks that are taken care of

by men include sale and purchase of agricultural inputs, sale of crops in markets and Mandis and other farm based activities.

4.5.11.2 Gender profile in Asset ownership

The exposure of women outside the realms of their villages was observed to be limited in general as few travel outside other than for functions or religious events. There are no Self Help Groups reported to be active in the project villages, in the village consultations. The ownership of land and assets by women is also understood to be minimal and in cases where women own land legally, the management of the same in terms of sale, purchase or usage is decided by the men in the family, with limited or no consultations with women. The proceeds from sale of land and its usage is also usually discussed within households but the final decision on usage of money is taken by male members of the household. This understanding was corroborated based on consultations in the Project villages, both in Shajapur and Moman badodiya tehsil villages, where very few women were aware of the total land holding of their household or average income of the household.

The men have more social exposure and access to cash and linkage to banking services, understanding of financial and legal instruments, etc. which makes them the natural decision making authority in a household. Women are restricted in their movement outside villages due to socio-cultural practices and safety issues and in spite of being equal contributors to the household (which forms unpaid work); have less access to cash and resources for discretionary spending.

Women Headed Household

There are some women headed households in the project villages; however in most cases these Women Headed families are provided financial support and security by other members of their extended family, as part of the prevalent joint family and living systems. However, certain independent women headed households that are living independently from their extended families, have to fend for themselves, by working as labourers on agricultural fields.

These Women headed households (both joint as well as independent) face additional risks of not being included in negotiations, or other key meetings due to prevailing cultural norms and may not therefore receive the benefits and advantages compared to those who do participate. Thus they become a little more vulnerable in cases of sale of land for the project, where there is a chance that the proceeds from sale of land do not reach them.

4.5.11.3 Gender Roles as community leaders

There are biases present with respect to women's role as community leaders along with inhibitions of women in interacting with the general public due to cultural practices. Some such cases observed in Chouma and Dhatrawada villages are presented below.

Box 4.3 Role of Women as Elected Representatives

In Chouma and Dhatrawada village, women have been elected as a Sarpanch on a seat reserved for women; however , brother of Chouma Sarpanch and husband of Dhatrawada Sarpanch (i.e. brother of Sarpanch and Sarpanch Pati/ husband of Sarpanch) took part in community consultation and informed that they undertake duties and decision making related to Panchayat, meetings etc.

During consultation in both the villages the local community said that, participation of women Sarpanch in Gram Sabha meetings is also limited and these elected women representatives do not usually attend Gram Sabha meetings during presence of men, due to cultural norms. Even during consultation with ERM the Sarpanch Pati and brother attended meetings and spoke about village related issues, statistics and development.

While reservation of seats has ensured that more women are elected, functional participation and leadership is still not taken on by women representatives as cultural norms prescribe that they be represented by their proxies, who are male members of their families. This appears to be the work-around to the provision of reserved seats to enhance women's participation in local representation and governance.

Source: ERM Site visit

The next section discusses the various stakeholders identified during the analysis of baseline conditions and an analysis based on their potential interactions with the project.

5. STAKEHOLDER IDENTIFICATION, INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

5.1 Stakeholder Identification and Categorization

A stakeholder is defined as "any identifiable group or individual who can affect the achievement of an organization's objectives or who is affected by the achievement of an organization's objectives". Stakeholders thus vary in terms of degree of interest, influence and control they have over the project. While those stakeholders who have a direct impact on or are directly impacted by the project are known as **Primary Stakeholders,** those who have an indirect impact or are indirectly impacted are known as **Secondary Stakeholders**.

During the ESIA process, a stakeholder identification and prioritization was conducted for identifying the key stakeholders of the project, while keeping in mind the nature of the project and its setting. Furthermore, consultations were conducted with these identified stakeholders through a participatory approach. The ***Table 5.1*** below presents the key stakeholders of the project.

Table 5.1 Stakeholder Group Categorisation

Stakeholder Groups	Primary Stakeholders	Secondary Stakeholders
Community	■ Private land owners from project villages; ■ Patta holders (i.e. ~10-15 HHs in each village from SC & ST community) including those who are not cultivating on their allotted patta land parcel and have squatted upon a separate/ new land parcel, in the nearby areas; ■ Non recognized Patta owners who have purchased land from registered Patta holders, based on the verbal agreement. ■ Agricultural labours; ■ People/ farmers utilizing nearby Government land or fallow land for their livestock grazing, i.e. Graziers; ■ Vulnerable Social Groups (i.e. women headed households, handicapped and households of SC and ST community) from project villages and surrounding areas; ■ EPC/ Construction Contractors, sub-contractors; ■ Potential unskilled labours to be engaged for the construction phase of the project; ■ Owners of land required for temporary occupation or use ■ Squatters on the Government land parcels identified for project ■ Banjara households	■ Fence line community
Institutional Stakeholders	■ Gram Panchayats (GPs) – Surajpur for Surajpur and Lalupura villages – Fawaka for Parsula and Fawaka villages	■ Local Political Groups ■ Civil Society/ Local NGOs

Stakeholder Groups	Primary Stakeholders	Secondary Stakeholders
	– Bijanakhedi for Chouma village, – Sangadiya for Jawadi village, – Dehripal, Burlay and Dhatrawada; ■ Zila Panchayat/ Janpad Panchayat of Moman Badodiya & Shajapur; ■ Tehsil Officials,	
Government Bodies/Regulatory Authorities	■ District Administration ■ Regulatory Authorities – MP Urja Vikas Nigam Ltd. – MP Pollution Control Board; – Central Pollution Control Board (CPCB) – Ministry of Environment Forest and Climate Change (MoEFCC) – Local Fire Authority; – Ministry of Road Transport and Highways – State Transport Authority; – District Collector and Revenue Department; – Block Development Officer & Patwari – Central Electrical Authority through C.E(P&D) Jabalpur; – Department of Telegraph – Communication, Govt. of Madhya Pradesh; – Department of Panchayat Raj, Madhya Pradesh; – Labour Department; – Wildlife Warden, State Forest Department; – District and State Forest Department, MoEFCC.	

5.2 Stakeholder Analysis

The significance of a stakeholder group is categorized considering the magnitude of impact (type, extent, duration, scale and frequency) or degree of influence (power and proximity) of stakeholder group and urgency/ likelihood of the impact associated with the particular stakeholder group in the project context.

The magnitude of stakeholder impact/influence is assessed taking the power/responsibility and proximity of the stakeholder group and the group is consequently categorized as negligible, small, medium or large. The urgency or likelihood of the impact on/influence by the stakeholder is assessed on a scale of low, medium and high. The overall significance of the stakeholder group is assessed as per the matrix provided in ***Table 5.2*** below.

Table 5.2 Stakeholder Significance and Engagement Requirement

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

The influence and priority have both been primarily rated as:

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

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

The coverage of stakeholders as stated above includes any person, group, institution or organization that is likely to be impacted (directly or indirectly) or may have interest/ influence over project. Keeping this wide scope of inclusion in stakeholder category and the long life of project, it is difficult to identify all potential stakeholders and gauge their level of influence over project at the outset of the project. Therefore the project proponent is advised to consider this stakeholder mapping as a live document which should be revised in a timely manner so as to make it comprehensive for any given period of time. The ***Figure 5.1*** below is for the for the consultations held in project villages

Figure 5.1 Stakeholder Consultations undertaken in the project villages

Source: ERM Site visit January 2020

Table 5.3 Stakeholder Analysis

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
Primary Stakeholder					
Private land owners and Patta Holders from project villages This includes people who have 'purchased patta land' based on verbal agreements with the original patta holders	■ Private landowners, whose land parcels fall within the project footprint area (footprint area identified for project) ■ Patta holders comprises of households who were landless in past and were provided Government land on Patta, around 20 years ago by then District Collector; ■ As stated during consultations, these landless households (largely from SC & ST groups) were given 5 bighas of Patta land nearly 20-30 years ago, at different points of time and under different circumstances. The 5 bigha patta land allotted then, has now reduced to only 2-3 bighas per household due to family growth and sub-division among families in the decades since the allotment; ■ Based on the consultation with Tehsildar it was understood that land was given to any landless households by the District Collector, irrespective of their caste; however the specific criteria for allotting land to Patta Holders is not known as reportedly these documents were lost over time and are not available;	■ The dependence on land for agriculture and livestock in the area is high, as evident in the Census data and as reported during consultations; ■ The procurement of private and patta land for the project will affect this stakeholder group leading to reduced land holdings or landlessness, in some cases; ■ Provision of alternate land as a land-for-land exchange has not been stated by RUMSL However, if this were to be considered, at a later stage, the quality of alternate land parcels and the effort and investment required to make it fit for cultivation, is likely to be a key concern, as there are several rocky patches of land in and around the project area;	■ The stakeholder groups' influence on the project is directly linked to their agreement to a Mutual Consent agreement to sell their land (MP Mutual Consent Policy 2014). ■ Their ongoing support will also be key to the smooth functioning of the construction phase activities, and the timely completion of the project activities; ■ Ongoing support in the operations phase will also be useful, through their influence at that stage may be significantly lower	■ The major concern of the landowners from the project is to get adequate payment as per the MP Mutual Consent Policy, (twice the market rate established by the collector office) and get timely payment of the amount; ■ Adequate compensation for their land, even if it is without any formal recognized rights including who may have 'bought' patta land based on a verbal agreement; ■ Potential employment opportunities that the project will generate, both in construction and operational stage. ■ Minimal disturbance to the community with regards to access issues, pollution, health and safety risks and influx of migrant workers	High (especially in the planning and construction phase of the project) Medium-low in the operations phase

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	■ This group is dependent on their land parcels for livelihood; ■ The exact number of private and patta-land owners, whose land may be impacted by the project, is not currently known but will be assessed during the RAP survey				
Encroachers and Squatters for agricultural purposes and for livestock shed, fodder storage etc.	■ This stakeholder group comprises of households that have illegally encroached Government Land, adjoining the private lands and was lying unused, in the project area and around; ■ Encroachment of Government land is a common practice in Project villages; where households having government land adjoining their private lands extend their cultivation area in the government land and encroach it even without any legal ownership of the land parcel; ■ During consultation it was informed by local communities that people with large land-holdings have more tendency to encroach government land. Usually the encroachers having large land-holding belong to Rajput and Patel communities; ■ Consultations with Bhil community highlighted that they have encroached/ squatted	■ The project would be set up on the encroached/ squatted land and would lead to disruption of livelihood activities and incomes to these households. ■ As understood, at least some of these stakeholder groups have been using the land for livelihood activities, as they are either landless or have marginal land-holdings. These stakeholder groups do not have any legal claims/ ownership over the encroached or squatted land parcel and are well aware of their illegal status;	■ The influence of this stakeholder group on the project is minimal at an individual level, considering they do not have legal rights on the land; however there is major dependence of farmers/ encroachers on these government land as they use it for cultivation, livestock shed, for fodder storage and even structure etc. ■ Since they have had the use of this land for a long period of time (usually more than 10 years) and have spent time, money and effort in making agriculture viable or making sheds for livestock; ■ There may be reasons for these individuals to lobby as a group, in which case their	■ The key concern of this stakeholder group is of losing the land parcels which they have been using for agriculture and as livestock sheds; ■ This group reports that they have spent considerable amount of effort and money to make the land cultivable and all this effort will be wasted after the project comes on this land; ■ The concern of farmers/ encroachers is more for the land parcels that have been encroached by them and is used for cultivation, rather than entire government land parcels; ■ The land identification/ mapping carried out for the project entirely have not distinguished government land parcels encroached. Thus raising a concern	Medium

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	upon Government land parcels, especially near Dehri pal and Parsula villages; ■ Furthermore, there have been land transactions reported on the encroached Government land by the community; ■ When the encroachment related practices are identified by the Government officials, a fine/ penalty is charged on them; in response encroachers pay the fine/ penalty charged on them and continue cultivating the encroached land. The assessment of the encroachment for the fine will usually not reflect the actual extent of encroachment.		influence on the Project may increase ■ Construction phase and implementation phase impacts will be the same as the earlier category.	among encroachers that they may not be considered for compensation; ■ This Stakeholder group may expect income generating activities or employment as construction labourers, masons, drivers, security etc. during the construction phase of the Project.	
Graziers	■ Out of the total project footprint area, nearly 846.6 ha. is Government land., which, in addition to squatting and encroachment, is used as grazing land by local communities; ■ The livestock ownership in the Project villages is higher amongst communities, like Sondhiya Thakur, Rajputs, Gurjars etc. The household from SC and ST groups also possess livestock, though not as many in number; ■ The grazing activity increases more during rainy season thus	■ The procurement of Government land that is being used shall reduce the amount of land available for grazing near the project villages; ■ The project boundaries may also impose a restriction on the left over/ available Govt. land to be used for grazing purposes; ■ The project construction work, movement of frequent vehicles, labour crowd etc. will also lead to disruption of livestock grazing activities	■ The influence of graziers on the project would be very low as individuals but given the numbers and the near universal dependence of all village households on grazing areas, they would gain significance and strength from lobbying together; ■ Restrictions on accessibility, lack of vegetation layer etc. during construction stage may lead to lack	■ The key expectations of this stakeholder group is to allow for the provision of adequate and accessible (2 percent to be confirmed) grazing land for livestock grazing, after taking the project area; ■ Easements shall be retained or replaced /provided through project design to have minimal impact on this stakeholder groups' ease of activities;	High-medium

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	limiting the amount of fodder to be purchased from the market.	and loss of vegetation cover in the nearby fields.	of fodder availability for livestock, thus leading to low bi-product (i.e. milk, meat) and/ or increased household spend on purchasing fodder from market.		
Agricultural Labourers	■ This stakeholder group comprises of those households that have marginal or limited land holdings and members of their families work as Agricultural labourers in the land parcels falling in the area identified for project across all three categories- private land, patta land (that is being cultivated), and encroached land under agriculture ■ As per consultation, people from SC and ST communities are largely landless and work as agricultural labours;	■ The land procurement for the project will be impacting their income sources, thereby leading to a deterioration of the household income.	■ The influence of this group on the project is limited, given that they do not have any legal claims on the land; ■ This group can be utilised during the construction phase of the project as unskilled labour with priority hiring and may additionally be included in Livelihood Restoration initiatives;	■ This Stakeholder group may expect employment as construction labourers, masons, drivers, etc. during the construction phase of the Project.	Low
Indigenous People	■ While the project is not located in a Schedule V area, the local community also has ST households, largely belonging to the Bhil tribe. ■ Nearly 1.8 percent of the total population belongs to ST group and is found in Parsula, Dehripal, Chouma and Fawaka villages; ■ This stakeholder group has also been understood to be engaged in encroachment and squatting	■ The influence of project on this group is similar in nature as the entire fence line community, as it is a subset of the same.	■ The involvement of this stakeholder group is expected to be as part of the larger local community; ■ In keeping with the requirements of the IFC PS 7, the project will require to obtain Free Prior Informed Consent from this stakeholder group prior to the initiation of project activities.	■ Priority in economic benefits and development opportunities created by the project; ■ Minimal disturbance to the community in regards to access issues, grazing land, pollution and influx of migrant workers.	High

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	of Government land for cultivation.				
Banjara households	■ There is one Banjara settlement near the project footprint area; ■ These groups largely reside near Dehri pal Chak village, are landless, and are engaged in share-cropping on many patta and government land parcels and are potential users of the government land identified for the project; ■ These groups are also understood to have squatted upon some patta land parcels belonging to other households; however the status of these patta land parcels in land identified for project needs to be confirmed during the RAP survey.	■ The project would lead loss of income for this stakeholder group, and also force them to shift to non-farm labour;	■ The influence of this group is similar to encroachers/squatters and their concerns are of similar nature. ■ Although this group forms part of the larger category of encroachers/squatters their concerns and impacts are to be treated separately as their livelihood profile and location profile is relatively unique compared to the overall profile of the village	■ The key concern of this stakeholder group is of losing the land parcels which they have been using for agriculture and as livestock sheds; ■ This Stakeholder group may expect alternate sites for income generating activities or employment as construction labourers, masons, drivers, security etc. during the construction phase of the Project.	Medium
EPC/ Construction Contractors, sub-contractors	■ This stakeholder group comprises of the EPC contractors and other contractors/ sub-contractors involved in the Project for various tasks, like access roads construction, laying down of Transmission Line towers, civil and electric works for the Solar Park, etc.	■ The project provides this group contractor-ship opportunities and steady flow of income.	■ This stakeholder group is critical for the smooth functioning and timely implementation of the Project; ■ This group may also play an important role in the formation of public opinion towards the project	■ Continued economic opportunities and work generation; ■ Clarity in terms of scope of work, expectations, key performance indicators, responsibilities and timelines for the project; ■ Timely and adequate disclosure of information to allow the project activities to be carried out;	High

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
				■ Fair business opportunities and contract closure; ■ Undertake project activities in keeping with the contractual agreements and applicable regulations in place.	
Unskilled labourers to be engaged for the construction phase of the project	■ This group is comprised of skilled and semi-skilled workers, who will be involved in the project on a contractual basis. ■ Labour may be local, regional or migrant (from other regions) and is likely to be comprised of skilled worker and any number of semi-skilled or unskilled workers This decision will be the contractors', depending on their requirements.	■ If local labour is used, it will help create goodwill locally and the project related opportunities would be shared with the local population. ■ If migrant labour is used in the persistent context of COVID 19, there may be local concerns from a community health and infectious disease perspective, putting this group at greater risk, and under greater local scrutiny	■ This stakeholder group will be critical for the smooth functioning and timely implementation of the project; ■ If migrant labour is used, their conduct may influence local support for the project, as in the COVID 19, context, they may be viewed with suspicion ■ This group may also play an important role in the formation of public opinion towards the project.	■ Concerns pertaining to wages, benefits, working hours and working conditions, etc.; ■ Health and safety measures relating to COVID 19 ■ Health and safety involved with the construction phase ■ Working hours at the construction site ■ Timely disbursement of wages; ■ Access to the GRM established for the project	Medium
Owners of land required for temporary occupation or use	■ Some of the project components may require short term leasing of land available, largely from Private and/ or Patta land owners; ■ This requirement would be better understood during the planning of the construction activity.	■ The short term leasing/rent of land by the project may bring in additional income from lease, if the land is not being used for any other commercial purposes; ■ The project related activities on these land parcels may be for purposes of storage, set up of labour camps, etc.	This stakeholder group is critical for availability of land parcels that are conveniently located from the project footprint (based on the needs) and are available without disturbances or issues during the lease period.	■ The expectations of this stakeholder group is clear communication of lease terms and amount and timely payments, as necessary; ■ Restoration of land to its original state, or better,	low

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
		and may result in change in land use due to construction or storage activities, contamination issues, etc.		at the time of handing it back to the owners.	
Gram Panchayats (GPs)	■ This stakeholder group is comprised of Sarpanch, ward member and Gram Sewak of Panchayats of project villages, as detailed in ***Table 5.1***	■ The influence of project on this stakeholder group is limited in terms of administrative control, however, this group may gain significance around the time of local elections, and if they decide to support local stakeholder groups/ specific concerns linked to the project.	■ This group has the ability to influence the perception of the community and specific stakeholder groups in regards to the Project and its activities	■ Involvement of this group in decision making process for the project, especially related to the land purchase process ■ Involvement in the formulation and implementation of the community development activities for the project; ■ Village and area level benefits from the local area development related investments of the project ■ Adequate communication of project information, in terms of timelines of key activities and their potential impacts.	Medium-Low
Tehsil Moman Badodiya & Shajapur/ District Shajapur officials	■ This group is comprised of the regulatory authorities at the tehsil and district level that are responsible for land demarcation for the project and for various permits and licenses pertaining to the project. ■ The authorities at tehsil level with whom the consultations	■ The project should be in compliance with the requirements stated and the processes governed by this stakeholder group. ■ Their involvement for resolution of patta land related issues, encroachment and informal use and occupation of	■ This stakeholder group is high in priority as this group provides the land demarcation and permits and licenses essential for the functioning of the project; ■ They also hold all official land records,	■ Developmental activities in the project area; ■ Smooth operations of the project related activities by causing minimal impacts on the community; ■ Adherence to regulations	High

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	were carried out by ERM team are: ○ Tehsildar of Shajapur; ○ Tehsildar of Moman Badodiya; ■ The local administration in this regard refers to the district and block level administration comprising of the offices of the Taluka Development Officer, District Collectors, and Revenue officer etc. The revenue department is responsible for allotment of Govt. land, mutation, updating and records and transfer of land; ■ The allotment of Government land for project purpose is provided by the District Collector on the basis of which the lease land will be granted.	government land, will be essential ■ They will be required to provide support for law and order for the smooth and peaceable functioning, of construction activities, and to resolve grievance that may be escalated to them	including a record of violations, fines, relating to encroachment, special permissions, and documents pertaining to easements, grazing areas, and community use (Nistar Patrak, Wajib-ul-arz) ■ Noncompliance to conditions laid down in permits issued by this group stakeholders group can result in penalties and fines being levied on the Project.	■ Maintaining law and order	
Regulatory Authorities	■ This stakeholder group is comprised of the central, state and district level regulatory authorities; ■ MP Urja Vikas Nigam Ltd. is the Nodal agency for renewable energy projects in state; ■ These authorities influence the project in terms of establishing policy, granting permits and approvals for the project, monitoring and enforcing compliance with the applicable rules and regulations;	■ The main concerns of the Regulatory Authorities from the Project Proponents is abidance to all applicable guidelines, policies and laws.	■ The ability of the project to comply with the various applicable rules and regulations may play a role in the timely implementation of the project.	■ Project's compliance to the regulatory requirements; ■ Timely disclosure of information and provisioning of updated through the life of the project ■ This stakeholder group is also critical for various permits/clearances required for the commissioning of the project	High

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	■ These groups include the labour department, pollution control board, forest department, district collector office etc.				
Secondary Stakeholders					
Fence Line Community	■ This stakeholder group is comprised of the local population in eleven project villages, coming under the project boundaries; ■ This stakeholder group has been using the land identified for the Project for grazing of their livestock, accessing their agricultural fields or using the land for other common activities. ■ Some sub-categories of the community are directly impacted by the project and are discussed above; while this stakeholder group is important on account of its presence near project and associated impacts.	■ The project will use land which is currently being used by this stakeholder group as grazing land for their livestock, for agricultural purposes (patta holders of SC and ST community) and other community purposes, etc.; ■ Some of the community members also use this land for cultivation (through encroachments) or work on the farm lands as agricultural labourers, etc. These activities will be disrupted after the project related activities commence on the identified land	■ This stakeholder group shall play a critical role in the smooth functioning of the Project.	■ Adequate provisions of easements while designing various project features in order to ensure minimal access restriction for this group; ■ Minimum disturbance to this group due to various activities of construction, operation and decommissioning phases.	High
Indigenous People	■ The project villages are not located in scheduled V area and the total population of ST community in Project villages is just 1.8 percent , which is very low; ■ Only village Parsula has the highest ST population of 17.7 percent in the entire Project villages;	■ There will be more impact on ST community compared to other communities in the Project villages, considering that they have very limited private land ownership and have got land mostly on patta for cultivation; ■ The Patta land have a clause that it cannot be transferred, sold,	■ The involvement of this stakeholder group is expected to be as part of the larger local community; ■ In keeping with the requirements of the IFC PS 7, the project will require to obtain Free Prior Informed Consent from this	■ Avoidance of procuring any patta land for the given project; ■ In case the patta land is procured and can't be avoided, a separate land parcel will be allotted by District Collector to every patta holder;	High

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
		exchanged etc. but it can be taken back or transferred to any private or government project on District Collectors order. The land for this project has been granted on District Collectors order;	stakeholder group prior to the initiation of project activities.	■ Priority in economic benefits and development opportunities created by the project; ■ Minimal disturbance to the community in regards to access issues, grazing land, pollution and influx of migrant workers.	
Local Political Groups	■ This stakeholder group is comprised of the political parties and local politicians active in the region; ■ This group might be active in the area and may play an important role in influencing of public opinion towards the Project, especially before elections.	■ The project will have minimal or no influence on this stakeholder group	■ This stakeholder group is expected to play a critical role in the development of the public opinion towards the project, especially in light of the current political environment, whether to do with local, project specific-issues, or to do with other regional/state/national issues.	■ The main expectation and concern of the stakeholder group from the project includes the project's role in the development of the area in keeping with the broader agenda of the projects and keeping the constituents and loyalists of the parties at the forefront.	Medium-High
Civil Society/Local NGOs	This stakeholder group comprises of NGOs and Civil Society Organizations of a national, state and local level who may be active in the area. Most of the NGOs and CSOs working in the region are state level NGOs, involved in literacy, water management, WASH and gender equality some of the key NGOs and CSOs working in the region include the following:	The level of influence of project on this stakeholder group is limited as it does not affect the functioning of this group.	■ The stakeholder group may play an important role in the development of public opinion for the project; ■ This stakeholder group may also be involved in the implementation of the community development plans	■ The main expectations and concerns of the stakeholder group from the project is likely to include the development of the project, in keeping with the applicable regulations and with minimal impacts on the local population, while contributing towards the	Medium

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	■ Water Aid ■ Madhya Bharat Social welfare & education society ■ Grask Gramin Rojgar Evam Samaj Kalyan Samiti Dewas ■ Samaj Pragati Sahayog ■ Jan Shree Foundation ■ Guru Shaheb Public Education Society			overall development of the area ■ The interest of this stakeholder group primarily pertains to the roles of the project in implementing community development activities in the area; ■ Involvement in the formulation and implementation of the community development activities for the project; and ■ Timely disclosure of information pertaining to the project.	

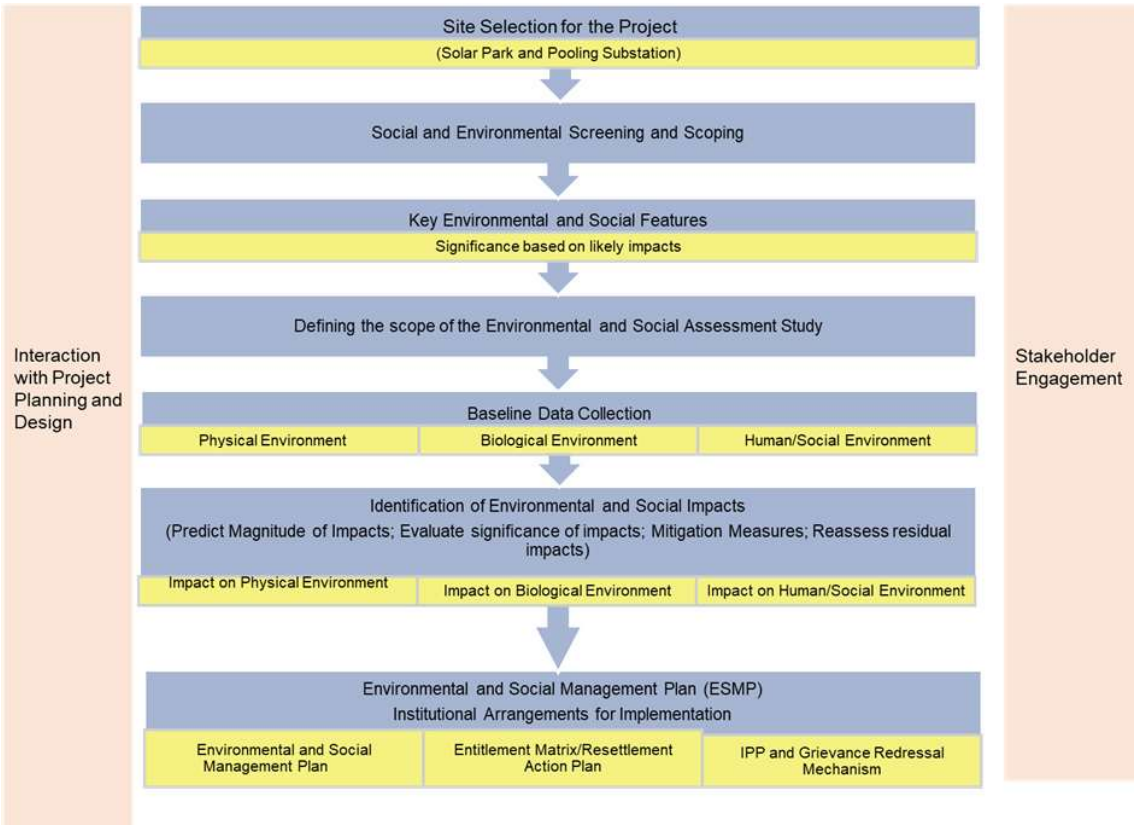
6. ENVIRONMENTAL AND SOCIAL IMPACTS

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

6.1 Impact Assessment Methodology

The ESMF for Solar Park (Feb 2017) states that sub-projects shall be appraised based on a step-by-step process beginning with screening stage. The overall process as depicted in the ESMF is reproduced here and followed in the study.

Figure 6.1 Impact Assessment Process



Source: Developed from ESMF process as per ESMF for Solar Park, Feb 2017, page-27. and ERM IA Standards

This section describes the impact assessment steps and methodology followed in this report which complies to the impact identification process and methodology (Section-4) of the ESMF for Solar Park.

6.1.1 Screening and Scoping

An Environmental and Social Scoping Study for the entire 1500 MW Project had been previously undertaken during September 2018- March 2019. The earlier identified impacts has been revisited during the ESIA study to confirm/validate the scoping study outcome. The screening checklist provided in ESMF for Solar Park (page 29) is used to identify relevant components to be investigated in detail during this study. The results of this screening are provided in table below.

Table 6.1 Screening for Impacts

Environmental and Social features	Status/Availability in and around site (study area)	Justification for Expectation of Potentially Significant Impacts
Physical Environment		
Land use and Land cover	■ The current land use of the proposed project site is agricultural land, grazing land, and scrub land with some trees ■ Some are is under water features like natural drains, ponds	■ In the construction phase, temporary land use changes will occur at contractor facilities and labour camps, material storage areas; ■ During construction phase, there will be permanent change of the land use within the land parcels where the Solar Park and pooling substation will be established.
Topography and Slope percentage	■ The Project site area has undulating land; ■ The high gradient area, i.e. area > 8°is present.	■ Impact on topography of the Project site due to site levelling activities.
Soil Environment	■ Soil in the area is medium black cotton soil; ■ No major anthropogenic activities are carried out in the area which may lead to soil contamination. ■ There is an existing crusher and GAIL pipeline in Unit 6.	■ Changes in soil quality: – Any use of controlled explosives in rocky strata that leave trace amounts of chemicals; – Use of drilling fluids (natural, oil-based or synthetic) that can leave trace amounts of chemicals; – Improper waste disposal; – Discharge from contractor facilities, labour camps and site office; – Soil contamination due to accidental leaks and spills of oil, lubricants, or fuel from construction equipment. ■ Compaction of soil during excavation, transportation of construction material & tower components, foundation work, backfilling, tower erection and stringing; ■ During operation phase, soil environment will mainly be impacted due to disposal of municipal solid waste, improper storage and disposal of broken solar panels, , accidental spill of transformer oil (Fresh and used oil) and waste water from site office. ■ Generation of hazardous waste during operation of Solar Park.
Ambient Air Quality	■ As per baseline monitoring conducted for the Project, ambient air quality parameters (PM_{10}, $PM_{2.5}$, SO_2, NO_X) were within the prescribed CPCB limits.	■ Dust emissions due to movement of machinery and vehicles; ■ Fugitive dust emissions due to site clearance activities, excavation and back filling activities etc.; ■ Air emissions due to operations of D.G. sets.
Ambient Noise Quality	■ As per baseline monitoring conducted for the Project, the noise levels during day time and night time were observed exceeding the CPCB prescribed limits.	■ Noise generation due to construction activities, operation of equipment's, machineries, D.G. sets, movement of vehicles and heavy earth moving machineries; ■ Local communities may get disturb due to higher than anticipated noise.

Environmental and Social features	Status/Availability in and around site (study area)	Justification for Expectation of Potentially Significant Impacts
Water Resources and Quality	■ The Project sites are located a 'Over exploited and Semi Critical' block as per CGWB; ■ Water bodies present in the study area includes seasonal rainfed and perennial water bodies. These are used for domestic purposes as washing of clothes and for domestic animals. The Palsavad Son reservoir is used for both domestic and irrigation purposes.	■ Stress on local water resources due to water requirement for the foundation activities, establishment of substation, labour camp during construction phase and domestic water use , module cleaning during operations; ■ Surface water and ground water contamination due to improper disposal of sewage at site and labour camp; ■ Impact on surface water quality due to runoff from storage area during monsoon; ■ Soil erosion and sediment transport to nearby water bodies.
Drainage	■ Project site have small water bodies and 3rd or 4th order dendritic drainage channels within the site area.	■ Any changes to topography in the area will advertently impact the drainage channels and might result in water logging in adjoining areas of the Project site.
Biological Environment		
Ecology	■ The project site and the surrounding habitats are modified habitats with presence of IUCN listed threatened species (VU-Vulnerable).	■ Impacts will be associated with habitat disturbance due to vegetation removal, construction activities at site during construction phase and risk of collision and electrocution in operation phase from the transmission line.
Occupational health and safety	-	■ Occupational health hazards; ■ Safety risk due to wrong handling of construction machinery, working at height, etc.; ■ Safety risk while working close to GAIL pipeline; ■ Exposure of workers to Electromagnetic Field (EMF) while working in proximity to charged electric power lines during construction and operation and maintenance.
Social Environment		
Demographics	■ The project footprint falls in 13 Project villages, The Project villages comprise of 3062 households with a population of 14,559 individuals (as per 2011 Census data while the current figure is expected to have increased significantly). ■ The average size of the households is 5 in the Study Area	■ The EPC contractor or its sub-contractors will bring in skilled migrant labour during construction phase of the project that is expected to last for about 21 months; while for most of unskilled and semi-skilled works, preference will be given to local people. Displacement of local people is not envisaged for the proposed Solar Park however there are chances of migration of members of land selling households to cities in search of wage labour jobs, in light of lesser or limited land holdings available in the village.
Economy and Employment	■ The population is currently engaged in agriculture,	■ Solar Park will generate employment opportunity for local people mostly during construction phase as well as for select activities (and in smaller

Environmental and Social features	Status/Availability in and around site (study area)	Justification for Expectation of Potentially Significant Impacts
	animal husbandry and jobs as agricultural labourers	numbers) like module cleaning, grass cutting and security related jobs during operation phase.
Land based Impacts	■ The population is currently engaged in agriculture, animal husbandry and jobs as agricultural labourers	■ Land based livelihood may be hampered due to procurement of Private, Patta and Government land for the project. The residents of the project villages are engaged in cultivation in and around the land identified for the project footprint; ■ There are understood to be more than 600 Project affected people due to land procurement related impacts. ■ The setting up of project would lead to loss or reduction of agricultural income for Private land owners, patta land holders, squatters and encroachers on Government land, agricultural labourers, Graziers, etc.
Community health and safety	Proposed Project site have settlements in proximity	■ Proposed project site have settlements in proximity. ■ Setting up of labour camps in the proximity of the communities and use of village roads for transportation of material and labour is likely to induce negative impacts such as road accidents, air pollution, noise pollution, potential conflict between the local community and labourers, increased risk of gender based violence, etc. ■ Transportation of construction materials and increased vehicular movement will lead to traffic hazards for community residing close to the access roads.
Indigenous People	There is presence of Bhil (ST) households across the Project villages; however, extent of impact by the project needs to be determined through focused consultations	This group is present and is understood to be working as agricultural laborers in private and patta land parcels (perhaps also on encroached Government land parcels) and thus will be economically displaced due to project related land procurement

6.1.2 Impact Matrix

In addition to the screening checklist, various project features and activities that could reasonably act as a source of impact were identified, and these have been listed down the vertical axis of a potential interactions matrix. The resources/receptors in the environment have been listed across the horizontal axis of the matrix. The interaction matrix enables a methodical identification of the potential interactions each Project activity may have on the range of resources/receptors within the Area of Influence i.e. the study area for the Project.

The completed Potential Interactions Matrix for Project activities and likely impacted resources/ receptors is presented in ***Table 6.2***. The matrix consists of a list of resources/receptors that could be affected against a list of activities for the proposed Solar Park. Entries in the matrix cells are colored to indicate whether:

- An interaction is not reasonably expected (white);

- An interaction is reasonably possible and the resulting impacts are likely to lead to low effects (grey); or
- The interaction is reasonably possible and at least one of the resulting impacts is likely to lead to medium or high effect (black).

Table 6.2 Activity Receptor Interaction Matrix

Project Activities	Resources/Receptors																		
	Land use and land classification	Soil Environment	Ambient Air Quality	Ground Water Resources and Quality	Surface water Resources and Quality	Topography and Drainage	Noise and Vibrations	Occupational health and Safety	Community Health and Safety	Electromagnetic field	Traffic	Terrestrial Ecology	Aquatic Ecology	Land based Livelihoods/ Economic Displacement	Labor Welfare	Social Infrastructure and Services	Indigenous People	Cultural Heritage
Pre- Construction/Planning Phase																		
Site Survey																		
Project designing and planning																		
Land use change for Solar Park and substations site																		
Construction Phase																		
Widening/ strengthening of access roads																		
Transport of equipment, machinery, materials and labour																		
Establishment of material storage area																		
Establishment of contractor facilities and labour camps																		
Site Clearance																		
Site preparation and levelling																		
Operation of Batching Plant, if any																		
Operation of D.G. set																		
Excavation, foundation and construction works for Solar Park, substations and internal TL																		
Installation of PV modules and other electrical equipment at park and substation																		

	Resources/Receptors																		
Project Activities	Land use and land classification	Soil Environment	Ambient Air Quality	Ground Water Resources and Quality	Surface water Resources and Quality	Topography and Drainage	Noise and Vibrations	Occupational health and Safety	Community Health and Safety	Electromagnetic field	Traffic	Terrestrial Ecology	Aquatic Ecology	Land based Livelihoods/ Economic Displacement	Labor Welfare	Social Infrastructure and Services	Indigenous People	Cultural Heritage
Operation Phase																		
Cleaning of PV modules																		
Operation and maintenance of Solar Park and associated facilities																		
Operation and maintenance of Substation																		
Grass Cutting																		

= Represents "no" interactions is reasonably expected,

= Represents interactions reasonably possible but none of the outcome will lead to significant impacts

= Represents interactions reasonably possible with one of the outcomes leading to potential significant impact

6.1.3 Prediction of Impacts

Prediction of impacts is carried out with an objective to determine what is likely to happen to the environment as a consequence of the Project and its associated activities. From the potentially significant interactions identified in scoping, the impacts to the various resources/receptors were elaborated and evaluated. The list of impacts which were identified from this for detailed assessment for different stages of the project is as follows:

Phase	Impact/Potential Impact Title
Planning Phase	Impact due to Private Land Purchase
	Impacts due to Patta land Purchase
	Impacts due to long lease of Government land
Planning and Construction Phase	Land use and Land cover
	Soil environment
	Topography and Drainage
	Water resources and quality
	Ambient air quality
	Ambient noise quality
	Occupational health and safety
	Impact due to Vegetation Clearance and Construction Activity
	Impact due to Influx of Migrant Labour and Labour Camp
	Impacts on Ecosystem Services
	Impacts due to temporary occupation of land for construction activities
	Impact on Community Health and Safety
	Stress on community resources
	Impact on Employment and Entrepreneurship opportunities
	Impact on women
Operation Phase	Soil Environment
	Water resources and quality
	Health and safety
	Collision and Electrical hazards from Transmission Infrastructure
	Community health and safety
	Impact on employment
	Impact on Indigenous Communities/Vulnerable groups
	Impact on women

6.1.4 Evaluation of Impacts- Impact Significance

Each impact was described in terms of its various relevant characteristics (e.g., type, scale, duration, frequency, extent). The terminology used to describe impact characteristics is as shown in ***Table 6.3***.

Table 6.3 Impact Characteristic Terminology

Characteristic	Definition	Designation
Type	A descriptor indicating the relationship of the impact to the project (in terms of cause and effect)	Direct Indirect Induced
Extent	The “reach” of the impact (e.g., confined to a small area around the Project Footprint, projected for several kilometres, etc.)	Local National Global

Characteristic	Definition	Designation
Duration	The time period over which a resource/ receptor is affected.	Temporary Short-term Long-term Permanent
Scale	The size of the impact (e.g., the size of the area damaged or impacted, the fraction of a resource that is lost or affected, etc.)	[no fixed designations; intended to be a numerical value or a qualitative description of "intensity"]
Frequency	A measure of the constancy or periodicity of the impact.	[no fixed designations; intended to be a numerical value or a qualitative description]

The definitions for the type designations are given in ***Table 6.4***. Definitions for the other designations are resource/receptor-specific.

Table 6.4 Impact Type Definitions

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

The above characteristics and definitions apply to planned and unplanned events. An additional characteristic that pertains only to unplanned events is likelihood. The likelihood of an unplanned event occurring was designated using a qualitative scale, as described in ***Table 6.5***.

Table 6.5 Definitions of Likelihood Designations

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

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

- Extent
- Duration
- Scale
- Frequency

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

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

- Positive
- Negligible
- Small
- Medium
- Large

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

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

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

- Low
- Medium
- High

Once magnitude of impact and sensitivity/ vulnerability/ importance of resource/ receptor have been characterised, the significance was assigned for each impact as below:

- **Negligible**: An impact of negligible significance is one where a resource/ receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations.
- **Minor**: An impact of minor significance is one where a resource/ receptor will experience a noticeable effect, but the impact magnitude is sufficiently small and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. In either case, the magnitude should be well within applicable standards/ guidelines.
- **Moderate**: An impact of moderate significance has an impact magnitude that is within applicable standards/guidelines, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.
- **Major**: An impact of major significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to medium valued/sensitive resource/receptors or

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

- **Critical**: An impact of critical significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. However, for some aspects there may be critical residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied), which needs to be offset.

Figure 6.2 Impact Significance Matrix

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

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

6.1.5 Identification of Mitigation and Enhancement Measures

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

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

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

6.1.6 Preparation of Environmental and Social Management Plan

The final stage in the IA Process is the definition of the basic management and monitoring measures that are needed to identify whether: a) impacts or their associated Project components remain in conformance with applicable standards/ guidelines; and b) mitigation measures are effectively addressing impacts and compensatory measures and offsets are reducing effects to the extent predicted. The mitigation measures recommended in individual impact assessments were compiled for project construction and operation phases. The ESMP prepared has also taken organization structure of RUMS and context of the project (sectoral, regional, and socio-cultural external environment) to determine practical and effective mitigation measures.

6.2 Impacts on Physical Environment

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

6.2.1 Assessment Criteria

ERM has defined impact assessment standards based on internal parameters that identifies the significance value of the impacts as a matrix between resource/receptor sensitivity or vulnerability and impact magnitude. The internal impact assessment standards for impacts on physical environment has been provided in ***Table 6.6*** and ***Table 6.7*** below.

Once magnitude of impact and sensitivity/ vulnerability/ importance of resource/ receptor have been characterised, the significance was assigned for each impact. Impact significance is designated using the matrix shown in ***Figure 6.2.***

Table 6.6 Criteria for Resource/ Receptor Sensitivity or Vulnerability

Environmental Attributes	Sub criteria	Low	Medium	High
Land use and Land cover		Land use not of relevant use by Community Negligible visual change.	Land use of local use by communities e.g. grazing, agriculture, but no major dependence Visual Change but common feature	Land use of regional importance. Change would impact Land use classification of the area. Land use of major dependence of local people for agriculture, livestock grazing, settlement etc. Visual Change aesthetically affecting locals.
Soil Environment	*Environment* The extent to which the soil and its quality plays an ecosystem role in terms of supporting biodiversity. This includes its role as in supporting a lifecycle stage	The soil quality does not support diverse habitat or populations and/or supports habitat or population of low quality	The soil quality supports diverse habitat or population of flora and fauna and supports habitats commonly available in the study area	The soil quality supports economically important or biologically unique species or provides essential habitat for such species
	Social The extent to which the soil and its quality provides a use (agricultural use) to the local communities and businesses, or is important in terms of national resource protection objectives, targets and legislation	The soil quality has little or no role in provisioning of services as agricultural uses for the local community.	The soil has local importance in terms of provisioning services as agricultural services but there is ample capacity and / or adequate opportunity for alternative sources of comparable quality i.e. ready availability across the study area.	The soil is wholly relied upon locally, with no suitable technically or economically feasible alternatives, or is important at a regional level for provisioning services.
Topography		Flat topography	Undulating topography	Hilly area
Water Resources - Surface water and ground water (quality/quantity)	*Environment* The extent to which the water resource plays an ecosystem or amenity role in terms of supporting biodiversity either directly or	The water resource does not support diverse aquatic habitat or populations, or supports aquatic habitat or population that is of low quality.	The water resource supports diverse populations of flora and / or fauna but available in the surface water bodies in the region	The water resource supports economically important or biologically unique aquatic species or provides essential habitat for such species

Environmental Attributes	Sub criteria	Low	Medium	High
	indirectly, particularly with respect to dependent ecosystems.			
	Social The extent to which the water resource provides or could provide a use (drinking water, agricultural uses, washing and other domestic or industrial, use as waterways) to the local communities and businesses, or is important in terms of national resource protection objectives, targets and legislation	The water resource has little or no role in terms of provisioning services as agricultural water source, other domestic uses as washing, bathing, industrial use and waterways for the local community. The groundwater resource is not currently abstracted and used in the vicinity of the Project, but is of sufficient quality and yield to be used for that purpose in the future (and there is a reasonable potential for future use). The ground water block is categorized as 'safe' by CGWB	The surface water resources have local importance in terms of provisioning services but there is ample capacity and / or adequate opportunity for alternative sources of comparable quality. The groundwater resource is an important water supply, and is currently used, but there is capacity and / or adequate opportunity for alternative sources of comparable quality. The ground water block is categorized as 'safe' by CGWB.	The surface water resources are wholly relied upon locally, with no suitable technically or economically feasible alternatives, or is important at a regional or transboundary watershed level for provisioning services. The groundwater resource is wholly relied upon locally, with no suitable technically or economically feasible alternatives, or is important at a regional or national level for water supply or contribution to groundwater dependent ecosystems (e.g. transboundary rivers). The ground water block is categorized as 'semi critical', 'critical' or 'over exploited' by CGWB.
Ambient Air Quality	Human Receptor	Locations where human exposure is transient.[1]	Few Receptors (settlements) within 500 m of the Project site	Densely populated receptors(settlements) within 500 m of Project site
	Ecological Receptor	Locally designated sites; and/or areas of specific ecological interest, not subject to statutory protection.	Nationally designated sites.	Internationally designated sites.

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

Environmental Attributes	Sub criteria	Low	Medium	High
Ambient Noise Quality	Human Receptor	Industrial area	Residential and Recreational place	Educational/ Religious/ Medical Facilities
	Ecological Receptor	Locally designated sites; and/or areas of specific ecological interest, not subject to statutory protection (for example, as defined by the Project ecology team).	Nationally designated sites.	Internationally designated sites.

Table 6.7 Criteria for Impact Magnitude

Magnitude Criteria	Negligible	Small	Medium	Large
Land use and Land cover	An imperceptible, barely or rarely perceptible change in land use characteristics. The change may be short term.	Subtle changes in land use character over a wide area of a more noticeable change either over a restricted area or infrequently perceived. The change may be short term to long term and is reversible.	A noticeable change in land use character, frequently perceived or continuous and over a wide area; or a clearly evident change over a restricted area that may be infrequently perceived. The change may be medium to long term and may not be reversible	A clearly evident, frequently perceived and continuous change in land use characteristics affecting an extensive area. The change may be long term and would not be reversible
Soil compaction and erosion	■ Qualitative-No perceptible or readily measurable change from baseline conditions ■ Scale-Localized area as Particular activity areas ■ Time-Short duration (few days) or one time as temporary	■ Perceptible change from baseline conditions but likely to easily revert back to earlier stage with mitigation ■ Scale- -Project site, activity areas and immediate vicinity not impacting any sensitive receptor ■ Short term-Only during particular activities or phase of the Project lifecycle as civil works or construction phase (few months)	■ Clearly evident (e.g. perceptible and readily measurable) change from baseline conditions and/or likely take time to revert back to earlier stage with mitigation ■ Scale- Project site, activity areas and immediate vicinity impacting sensitive receptor/s ■ Long term-Spread across several phases of the Project lifecycle (few years)	■ Major (e.g. order of magnitude) change in comparison to baseline conditions and/or likely difficult or may not to revert back to earlier stage with mitigation ■ Scale- Regional or international; Permanent change

Magnitude Criteria	Negligible	Small	Medium	Large
Soil contamination	Well within Dutch standard[1]	Well within Dutch standard	Exceeds Target Value but well within Interventional Value	Exceeds Interventional Value and needs intervention.
Topography	An imperceptible, barely or rarely perceptible change in topographical characteristics. The change may be short term	A subtle change in topography character over a wide area or a more noticeable change either over a restricted area or infrequently perceived. The change may be short term to long term and is reversible.	A noticeable change in topographic character, frequently perceived or continuous and over a wide area; or a clearly evident change over a restricted area that may be infrequently perceived. The change may be medium to long term and may not be reversible.	A clearly evident, frequently perceived and continuous change in topographic characteristics affecting an extensive area. The change may be long term and would not be reversible.
Water Resources - Surface water and ground water (quantity/availability)	There is likely to be negligible (less than 1% of lean season flow) or no consumption of surface water by the Project at any time. There is likely to be negligible or no abstraction, use of or discharge to the groundwater by the Project at any time.	The Project will consume surface water, but the amounts abstracted are likely to be relatively small in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation) The Project will consume groundwater or deliver discharge to groundwater, but the amounts abstracted / discharged are likely to be relatively small in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation).	The Project will consume surface water, and the amounts abstracted are likely to be significant in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation) The Project will consume groundwater or discharge to groundwater, and the amounts abstracted / discharged are likely to be significant in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation).	The Project will consume surface water, and the amounts abstracted are likely to be very significant in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation) The Project will consume groundwater or discharge to groundwater, and the amounts abstracted / discharged are likely to be very significant in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation).
Water Quality	Discharges are expected to be well within statutory limits	Discharges are expected to be within statutory limits.	Occasional breach(es) of statutory discharge limits (limited periods) expected.	Repeated breaches of statutory discharge limits (over extended periods) expected.

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

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

Magnitude Criteria	Negligible	Small	Medium	Large
	Abstractions from or discharge to aquifer(s) are unlikely to cause water quality issues	Groundwater quality be within ambient levels or allowable criteria or may exceed for 1-2 parameters which is common occurrence due to geological regime of the area. Abstraction or discharge to aquifer(s) may cause small but local changes in water quality in the aquifer system. These can be considered potential short-term localized effects on groundwater quality which is likely to return to equilibrium conditions within a short (months) timeframe.	Groundwater quality exceeds ambient levels or allowable criteria for key parameters. Abstraction or discharge to aquifer(s) are expected to cause potential localized effects on groundwater quality which are likely to be fairly long lasting and / or give rise to indirect ecological and / or socio-economic impacts	Groundwater quality exceeds ambient levels or allowable criteria. Abstractions or discharge to aquifer(s) are expected to cause potentially severe effects on groundwater quality which are likely to be long-lasting (e.g. years or permanent) and / or give rise to indirect ecological and / or socio-economic impacts.
Ambient Air Quality	Soil type with large grain size (e.g. sand); and/or No emissions/dust generation due to Project across all phases. Existing ambient air quality of the area is well below the Prescribed NAAQ limits	Soil type with large grain size (e.g. sand); and/or Limited emissions/dust generations for short duration Existing ambient air quality of the area is well below the Prescribed NAAQ limits.	Moderately dusty soil type (e.g. silt); and/or Dust generation and emissions from Projects for long duration Existing ambient air quality of the area is within the Prescribed NAAQ limits but with only deferential of 10- 20 microgm/m3	Potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size); and Significant process emissions from Project for the entire Project cycle. Existing ambient air quality of the area is exceeding the Prescribed NAAQ limits.
Ambient Noise Quality	Predicted noise levels are at or less than 3 dB (A) above the relevant limits / thresholds.	Predicted noise levels are 3 to less than 5 dB (A) above the relevant limits / thresholds	Predicted noise levels are between 5 and 10 dB (A) above the relevant limits / thresholds. Medium Term Exposure (1 to 6 months)	Predicted noise levels are more than 10 dB (A) above the relevant limits / thresholds. Long term exposure (> 6 months)

Magnitude Criteria	Negligible	Small	Medium	Large
	Short term exposure (Few hours in a day and not continuous)			

6.2.2 Planning and Construction Phase

6.2.2.1 Impact on Land use and Land Cover

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

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

Context and Receptor Sensitivity

The proposed Project site is located in a rural setup with no major industrial/ anthropogenic activities. The current land use of the proposed project is mostly scrub land, used for grazing with parcels of agricultural land, some of which are a result of encroachment. In the pre-construction phase, permanent change will occur to the land use (grazing and agriculture) where the project boundary will be established, to prepare for the next phases (construction and operations). In the construction phase, temporary land use changes will occur at contractor facilities and labour camps, material storage areas and there will be a long term change of the land use within the land parcels where the Solar Park and pooling substation will be located. Receptor sensitivity is envisaged to be ***medium*** considering the land use will change to industrial. It is understood that some avoidance of agricultural areas will be achieved but other areas will need the land use to be changed. All remaining scrub, currently available for grazing will be converted within the project boundary, affecting the dependence of the community on this area, though, it is understood, that some land for grazing will be set aside.

Embedded/In-built Controls

Construction activities will be restricted to within the acquired land and immediate surroundings only. Post construction activities, any land taken for a temporary basis for storage of material would be restored to their extent possible as acceptable to land owners to minimise impacts to land use. Existing roads will be used to the extent possible.

Impact Magnitude

The establishment of the Solar Park will convert scrub land and agricultural land to industrial use for the long term (at least 25 years). The total land area of ~ 1,000 ha will undergo land use change, out of which almost 90% is government land. Short term changes in land use are also envisaged from the establishment of the associated facilities such as storage yard, site offices, labour camp and switch yard. However, the impact on land use will only be within the Project boundary and will not affect any of the neighbouring areas. Furthermore, the changes to land use will be reversible. Thus, magnitude of the impact has been assessed to be ***medium***. Impacts on land use during construction phase due to establishment of temporary facilities like labour camp, storage area, will be for a shorter period of time.

Impact Significance

As per the impact significant assessment matrix (refer ***Figure 6.2)*** a combination of medium impact magnitude with medium receptor sensitivity results in impact significance as **moderate**.

Additional Mitigation Measures

- Construction activities should be restricted to designated area;
- On completion of construction activities, land used for temporary facilities such as Contractor office, batching plant (if any), stockyard, labour camp should be restored to the extent possible;
- The land use around permanent Project facilities should not be disturbed; and
- The land should be restored back to the original state to the extent possible after completion of life cycle of the Project and in case there are plans not to continue further at the site.

Residual Impact Significance

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

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

6.2.2.2 Soil Environment

The Project site has mostly open scrub land (~90%) and ~10% of agricultural land. Following Project activities during construction phase are envisaged that may impact the soil environment:

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

Soil Erosion and Compaction

The site clearance activities, excavation and levelling of ground will cause disturbance of the soil strata and impact on soil quality. The Project will also undertakes the soil compaction activity to ensure soil stability during the site levelling at site. The project will undertake the soil compaction activity to ensure soil stability during the establishment of storage areas, labour camp, access road, installation of batching plant, establishment of substation, SCADA building etc. During construction activities, there would be compaction of soil in the Project area during movement of vehicles/ construction machinery and work force movement. In addition, laying of electrical wires in the agricultural field during erection of internal electrical lines will also lead to the compaction of agricultural soil to certain extent. Hence, the receptor sensitivity has been assessed as **medium**.

Embedded/In-built Controls

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

Impact Magnitude

The site clearance, excavation, drilling for foundation and access road construction will largely affect the top layers of the soil. Compaction of soil during excavation, transportation of construction material & project components, foundation work, backfilling, erection of structures will lead to temporary effects on natural infiltration of rainwater, but these impacts were temporary and for short term. The baseline data indicates that the bulk density of the soil in the study area is higher and therefore will be compacted less. Further, site clearance will be restricted only in the Project site. Land close to the Project site will not be disturbed. Vehicles will be encouraged to utilize the existing roads with minor strengthening. The usage of existing roads by vehicles and minimal access road construction will reduce the impact from soil compaction in the area.

Based on the above, the Impact Magnitude has been assessed to be **small.**

Impact Significance

As per the impact significant assessment matrix (refer ***Figure 6.2***) a combination of small impact magnitude with medium receptor sensitivity results in impact significance as **minor**.

Additional Mitigation Measures

- The topsoil present in the construction shall be removed and stock pilled in separate area;
- The stock pile should be protected from natural elements to prevent from erosion and also degradation;
- Topsoil to be reused on site for landscaping purpose;
- Defined routes for transportation and construction vehicles, workers etc. to minimize soil compaction;
- Good drainage as per the natural slope condition should be provided to reduce surface runoff and associated erosion;
- Back filling and revegetation of the area disturbed will be undertaken phase wise immediately after the completion; and
- Site clearance, piling, excavation and access road construction will not be carried out during the monsoon season to minimize erosion and run-off.

Residual Impact Significance

The significance of residual impacts will lower down to **negligible** taking into account the recommended mitigation measures.

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

Waste Generation and Soil Contamination due to leaks and Spills

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

Embedded/In-built Control

- Spill control measures such as the storage and handling of chemicals and fuel in concrete areas with secondary containment will be implemented to minimize impacts in the event of a spill;
- The EPC contractors will have control over the amount and types of waste (hazardous and non-hazardous) produced at the site;
- The hazardous wastes to be stored onsite temporarily at separate designated covered area provided with impervious flooring and secondary containment and to be disposed in accordance with Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016; and
- Workers will be strictly instructed/ trained about random disposal of any waste generated from the construction activity.

Impact Magnitude

The construction contractors will have control over the amount and types of waste (hazardous and non- hazardous) produced at the site. The municipal waste from the labour camp will only be routed through proper collection and handover to local municipal body for further disposal. The hazardous wastes will be temporarily stored in labelled drums on impervious surface at designated area onsite and will be disposed off through approved vendors in accordance to Hazardous Wastes Rules, 2016. The impact magnitude has therefore been assessed as **small**.

Impact Significance

As per the impact significant assessment matrix (refer ***Figure 6.2***) a combination of small impact magnitude with medium receptor sensitivity results in impact significance as **minor**.

Additional Mitigation Measures

- Construction and Demolition Waste should be stored separately and disposed through approved facility/landfill;
- All waste should be stored in a shed that is protected from the elements (wind, rain, storms, etc.) and away from natural drainage channels;
- A log book should be maintained for quantity and type of hazardous waste generated;
- Designated areas should be provided for Solid Municipal Waste and daily collection and period disposal should be ensured;
- EPC Contractor should ensure that no unauthorized dumping of used oil and other hazardous waste is undertaken at the site;
- Hazardous waste to be disposed through MPPCB authorised vendors;
- In case of accidental/unintended spillage, the contaminated soil should be immediately collected and stored as hazardous waste;
- The guidelines and procedures shall be prepared and followed for immediate clean-up actions following any spillages;
- Damaged/ discarded solar panels to be disposed with the help of authorised recycling vendors/ module installation contractors/ supplier; and
- Other wastes such as e-waste, used discarded batteries shall be disposed off in accordance to E-waste rules and batteries management and handling rules.

Residual Impact Significance

The significance of impacts due to waste generation after implementation of mitigation measures has been considered as **minor.**

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

Residual Impact Significance	Significance of impact is considered **Minor**

6.2.2.3 Impact on Topography and Drainage

Context and Receptor Sensitivity

The proposed Project Site mainly exhibits undulating topography (varying between 390 amsl- 525 amsl at Moman Badodiya and 425 amsl to 525 amsl at South Shajapur) being located in the Malwa plateau region. All the Units have seasonal water bodies with 3rd or 4th order dendritic drainage channels from the streams of Lakhunder River (~2.4 km from Moman Badodiya boundary in West direction and ~ 300 m from South Shajapur boundary in West direction) within the study area which is the tributary of Kali Sindh River. A natural nallah exits in the Western part of Unit 8. Any changes to topography in the area will advertently impact the drainage channels and might result in water logging in adjoining areas of the project site. The receptor sensitivity has been assessed to be **medium** due to its undulating topography.

Embedded/In-built Control

- Design of the Solar Park will follow the natural topography, efforts will be taken to make limited change the topography.
- Project designing shall be done in a way to utilize existing topography to maximum;

Impact Magnitude

There will be a very limited change in the topographic character of the area within the project footprint. This change will long term and may not be reversible. The alteration in surface drainage pattern of the area due to construction activities will be limited to smaller areas located in project footprint. The project footprint of Unit 8 has scattered over many small land parcels, therefore natural flow of storm water will not be altered on contiguous larger area. Further, care will be taken to maintain the natural drainage in the area so that rain water can take its path without any restriction by the constructions at site. Hence impact magnitude is assessed to be **medium.**

Impact Significance

As per the impact significant assessment matrix (refer ***Figure 6.2***) a combination of small impact magnitude with low receptor sensitivity results in impact significance as **moderate**.

Additional Mitigation Measures

- Project shall ensure to avoid any unnecessary changes in the topography especially during the preconstruction and construction phase;
- Micro drainage channel should be particularly avoided when constructing access roads or planning the Transmission Line pathway in order to ensure no change to the topography of the area.
- The natural storm water flow pattern towards Nallah present in Unit 8 shall not be disturbed.

Significance of Residual Impacts

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

Impact	Change in topography and drainage		
Impact Nature	Negative	Positive	Neutral
Impact Type	Direct	Indirect	Induced

Impact Duration	Temporary	**Short-term**	Long-term	Permanent
Impact Extent	**Local**	Regional	National	International
Impact Scale	Limited to Project site and access road			
Impact Frequency	Construction Stage			
Impact Likelihood	Likely			
Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
Resource/ Receptor Sensitivity	Low	**Medium**	High	
Impact Significance	Negligible	Minor	**Moderate**	Major
	Significance of impact is considered **Moderate**			
Residual Impact Magnitude	Positive	Negligible	**Small**	**Medium**	Large
Residual Impact Significance	Negligible	**Minor**	Moderate	Major
	Significance of impact is considered **moderate to minor**			

6.2.2.4 Water Resources and Availability

Context and Resource Sensitivity

During construction phase, water will be primarily required for foundation works for installing solar panels, electrical installations at PSS at Solar Park. Besides this, civil construction activities such as construction of control room, security guard room, utilities, labour camp will also have water requirement.

As detailed in the baseline section (***Section 4.3.7)***, the overall water resource sensitivity was evaluated as **High** based groundwater and surface water risk. Groundwater risk was estimated based on Block Categorization and Hydrogeology while surface water risk was estimated based on Inter Annual Variability, Seasonal Variability, Availability Index and Total Annual Rainfall. Baseline Water Stress and Baseline Water Depletion were evaluated as risk factors common to both groundwater and surface water risk. For the site, total water risk was evaluated based BWS and BWD while groundwater and surface water risks were evaluated based on the aforementioned individual factors.

- Groundwater risk was estimated to be '***High***' due to high risk of availability of resources and medium-high risk from BC.
- Surface Water risk was estimated to be '***High***' due to high risk from AI, SV, IAV and TAR.

Embedded/In-built Controls

- No ground water abstraction for construction phase; Provision of water recharge system and rainwater harvesting will be part of the project.

Impact Magnitude

During construction phase ~250-300 KLD of water will be required for civil construction activities during peak construction such as foundations for solar panels, switch yards, control room, security guard room etc. and domestic requirements. As per DPR, water requirements for all purposes will be obtained through tanker water.

The construction phase will be of duration of 21 months during which there will be stress on water sources for tanker water supply. Hence, the magnitude of impact is assessed as **medium.**

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Impact Significance

The significance of impact for construction phase is assessed as ***Major.***

Additional Mitigation Measures

Following mitigation measures are proposed for conservation of water resources of the area:

- Tanker water supply shall be only through authorized sources;
- Construction labour deputed onsite to be sensitised about water conservation and encouraged for optimal use of water;
- Regular inspection for identification of water leakages and preventing wastage of is necessary for efficient utilisation of water;
- As part of project designing, SPD shall consider the rainwater harvesting ponds in the open area depending on the topography, slope, natural drainage etc. Accordingly infrastructure such as drains/ piping system/ size of pond etc. shall be designed.
- Similarly, in case water is sourced from surface water bodies, infrastructure requirements shall be identified and planned in project design.

(Refer ***Appendix E*** for Water Management Plan and section 6.2.3.2 for details)

Residual Impact Significance

After implementation of mitigation measures, the significance of residual impacts for construction activities will be **major to moderate**.

Impact	Water resources				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to Project areas				
Impact Frequency	Construction Stage				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Major.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Major
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **major to moderate.**				

6.2.2.5 Water Quality

Context and Receptor Sensitivity

Major source of wastewater generation during construction phase is labour camp, site office to be established for Solar Park. Approximately 70 KLD of sewage will be generated during construction

activities including labour camp. There is a potential for contamination of surface and groundwater resources resulting from improper management of sewage, accidental spillage of fuel, lubricants and wastes (waste oil / used oil) from storage areas or during the transfer of fuels and wastes.

There is many small surface water bodies located within the project foot print area which could get direct impact due to construction activities. These seasonal water bodies are used by local villagers for domestic purposes. The receptor sensitivity is therefore assessed as **medium** during construction stages for water quality.

Embedded/ in-built control

- Provision of septic tank and soak pits onsite and in labour camps and at site office for treatment and disposal of sewage, thereby minimizing the impacts of wastewater discharge.

Impact Magnitude

Primary monitoring of surface and groundwater suggests that the monitored surface water is satisfactory at all the locations and can be used as a drinking water source with conventional treatment and disinfection. As part of the site preparation stage, a drainage and sewerage system will be constructed for the site office and labour camp. The sewerage system will consist of soak pits for the collection of wastewater from the kitchen and washing areas and Office facility. Sewage from the toilets will be discharged into lined septic tanks.

Further, there is no direct discharge of wastewater in the ground water aquifer of the area. However, ground water quality of the area may get indirectly impacted due to soil contamination. Ground water in the district at many places is saline and due care is needed before its use. The soil type of the area is sandy/loamy. This type of soil allow easy percolation into the subsoil and subsequently the ground water. Any spillage of fuel, wastes, if unprotected, may potentially contaminate the ground water.

Hence magnitude of impact is assessed as **medium**.

Impact Significance

As per the impact significant assessment matrix (refer ***Figure 6.2***) a combination of medium impact magnitude with medium receptor sensitivity results in impact significance as **moderate.**

Additional Mitigation Measures

- Ensure proper cover and stacking of loose construction material at site to prevent surface runoff and contamination of receiving water body;
- Open defecation and random disposal of sewage will be strictly restricted;
- Planning of toilets, soak pits and septic tanks, waste collection areas away from natural drainage channels and water bodies;
- Provision of number of toilets across with easily accessible location as the project site is spread across large area of 3 units;
- Use of licensed contractors for management and disposal of waste and sludge;
- Labourers will be given training towards proactive use of designated areas/bins for waste disposal and encouraged for use of toilets;
- Provision for impervious storage area, especially for fuel & lubricant, hazardous waste, etc. will be made onsite; and
- Spill/ leakage clearance plan to be adopted for immediate cleaning of spills and leakages.

Residual Impact Significance

Residual significance of impacts during construction phase will be **minor.**

Impact	Water Quality				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	National		
Impact Scale	Limited to Project area				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **moderate**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor**				

6.2.2.6 Ambient Air Quality

Context and Receptor Sensitivity

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

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

The proposed Project site is located in a rural setup. The human receptors for dust emissions are located between Moman Badodiya and South Shajapur sub-sites such as Dehripal (NE), Gondalmau (NE), Burlay at Moman Badodiya and Hanoti (NW) and Khareli (SW) at South Shajapur. There are no ecologically protected areas in vicinity of the site. The receptor sensitivity is assessed as **medium.**

Embedded/in-built control

- Suppression of fugitive dust emissions by spraying water, wetting of the stockpile;
- Pre-identified and covered locations for material stockpiles, especially sand, cement;
- Screening or providing wind breaks for stockpiles, covering of trucks with tarpaulin sheets during transportation of material;
- Diesel generator use shall be restricted to emergencies and power back-up only to minimize air emissions;

- Vehicle engines need to be properly maintained and should have a valid Pollution Under Control (PUC) to ensure minimization in vehicular emissions; and
- Vehicular speed will be regulated (max. 40 km) and enforced to minimise suspended dust emissions.

Impact Magnitude

The major source of emissions in the construction phase is the fugitive dust emissions from construction activities. In addition, operation of DG sets will also cause gaseous emissions. There will be some impacts due to plying of vehicles on the access roads which runs across settlement area.

The ambient air quality analysis reveals that the air shed is unpolluted and the air pollutants- PM (PM_{10} and $PM_{2.5}$), SO_2, NO_x and HC are well below the prescribed CPCB and WHO guidelines.

The construction activities will occur for a small period of time (~21 months). The impact magnitude has been categorized as ***small*** because the soil type is loamy sand and dust emission will be limited to construction phase only for shorter duration.

Impact Significance

As per the impact significant assessment matrix (refer ***Figure 6.2***) a combination of small impact magnitude with medium receptor sensitivity results in impact significance as **minor.**

Additional Mitigation Measures

- The construction site shall be barricaded;
- Keeping areas of open excavation to a minimum;
- Minimising stockpiling by coordinating excavations, spreading, re-grading, compaction activities;
- Cease or phase down work if excess fugitive dust is observed, investigate source and take suppression measures;
- Speed of vehicles on site to be limited to 10-15 km/hr;
- The emissions from diesel generator shall be by optimised operations, orientation at the site and providing adequate stack height for wider dispersion of gaseous emissions
- Switch off machinery and equipment when not in use;
- Prevent idling of vehicles and equipment; and
- Vehicle engines will be properly maintained and will have a valid Pollution under Control (PUC) to ensure minimization in vehicular emissions.

Residual Impact Significance

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

Impact	Ambient Air quality – Construction phase				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	National	International	
Impact Scale	Project area and vicinity				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large

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

6.2.2.7 Ambient Noise Quality

Context and Receptor Sensitivity

The sources of noise in the construction phase include construction activities, operation of equipment's, machineries, drilling, D.G. sets and movement of vehicles. The construction machinery used for the construction activities could be the major sources of noise at site whereas increased noise levels are also envisaged as a result of increased material movement in the area.

It is to be noted that the proposed project site has habitats in close proximity such as Dehripal, Burlay, Dhatrawada, Updi, Lalupura, Surajpur which may get impacted due to noise generated during construction activities and project related vehicular movement through village roads, especially fence line communities. Therefore receptor sensitivity is considered as **medium**.

Embedded/in-built control

- Normal working hours of the contractor will be defined (preferable 8 am to 6pm). If work needs to be undertaken outside these hours, it would be limited to activities which do not generate noise; and
- Avoid unnecessary honking.

Impact Magnitude

The operation of construction machinery, DG set will generate noise. Construction works are expected to last for 21 months and construction activities will be limited to daytime only. The increase in traffic volumes during construction activities will also increase noise levels in the area.

The baseline noise monitoring results reveals that the equivalent ambient noise level were found to be exceeding the prescribed standards. The day time noise levels were found to be exceeding the prescribed standards (55 dBA) at almost all locations except at Chouma, Gondalmau, Dehripal and Updi villages while the night time levels do not comply with the prescribed standards (45 dBA) at any of the locations except for Dehripal village having marginally less levels.

Hence, the magnitude of impact on ambient noise levels is assessed as **medium** considering the construction period of the project to last for approximately 21 months and proximity to the villages and the construction activities may lead to exceedance of prescribed noise day time limits at receptors.

Impact Significance

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

Additional Mitigation Measures

- Ensure safe distance of project related activities from schools, hospitals, etc.;
- Only well-maintained equipment to be operated on-site;

- If it is noticed that any particular equipment is generating too much noise then lubricating moving parts, tightening loose parts and replacing worn out components to be carried out to bring down the noise. It is to be ensured that such machinery are kept far away from the households;
- Machinery and construction equipment that may be in intermittent use to be shut down or throttled down during non-work periods;
- Low noise equipment shall be used as far as practicable;
- The number of equipment operating simultaneously shall be reduced as far as practicable;
- Install enclosures around construction area, in order to reduce the extent of noise emanating due to project related activities;
- DG set with acoustic enclosures shall be used;
- Vehicular movement through village roads should be planned to avoid traffic jam and inconvenience to local residents;
- Equipment noise should be 85 dB (A) at 1 m from the source in line with WB/IFC EHS guidelines;
- Minimal use of vehicle horns needs to be encouraged;
- Limit construction related activities to day time in order to restrict the noise related nuisance in the evenings, where permissible noise threshold is lesser;
- Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievances pertinent to noise and dust related issues.

Residual Impact Significance

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

Impact	Ambient Noise Quality				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	National	International	
Impact Scale	Project area and vicinity				
Frequency	Construction Stage				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered to be **Moderate**.				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Major
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Moderate to Minor.**				

6.2.2.8 Occupational Health and Safety

Context and Receptor Sensitivity

The proposed Project will involve several higher risk activities as shown below:

- Construction of support structure for PV module would require operation of pile drivers.
- The installation of solar module will involve operation of cranes and other mechanical lifting equipment.
- Laying of interconnecting cable with require digging.
- The commissioning of the inverter rooms and Transmission Line will also involve live power lines.
- Working on live wires carrying power has dangers of electric shock and electrocution.
- Construction and commissioning of PSS and associated structures will involve multiple hazards i.e., working at height, use of cranes and mechanical lifting equipment, working with high voltage power;
- Besides this, there could be slip and trip hazards especially during monsoon season;
- The area experiences extreme winter and summer condition. Working during very high and low temperature could cause health hazards;
- The Project site also needs to implement proper measures for fire safety, structural safety and any for emergency situations;
- Additional safety risk while working in proximity of GAIL pipeline corridor.

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

During construction phase, it is anticipated that on average 150-250 workers will be deployed at site, which could increase upto 500-600 during peak time. The installation of solar panels and associated infrastructure will be done through experienced and trained workers. However, construction of other components will involve local workers who may not have earlier experience. Hence, there will be greater vulnerability for accidents. Therefore, receptor vulnerability is assessed as **Medium**.

Embedded/In-built Controls

- Avoidance measures:
  - The corridor of ~400 m long and 48 m width of GAIL pipeline is excluded from the usable land area of Unit 6, though it is kept in project boundary to maintain continuity of Park. The SPD will not be allowed to do following on this land as per Acquisition of RoU Act No. 50-1962 for the petroleum and mineral pipelines.
    - Construct any building or any other structure;
    - Construct or excavate any tank, well, reservoir; and
    - Plant any tree.
- All construction activities should be carried out during daytime hours and vigilance should be maintained for any potential accidents;
- Project specific Health and Safety Management Plan will be put in place;
- Personal Protective Equipment (PPEs) including safety shoes, helmet, goggles, ear muffs , face shield, insulating (rubber) gloves with leather protectors, insulating sleeves, and flame-resistant (FR) clothing and face masks;
- Use of permit to work system (hot work, electrical, work at height)

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

Impact Magnitude

As mentioned above, the majority of activities such as installation of solar panels and associated infrastructure will be done through experienced and trained workers and unskilled workers will be mainly involved in building construction activities. With above embedded controls, the magnitude of impacts will be **small**.

Impact Significance

As per the impact significant assessment matrix (refer ***Figure 5.2***) a combination of small impact magnitude with medium receptor sensitivity results in impact significance as **minor.**

Additional Mitigation Measures

- A specific SOP shall be prepared for working close to GAIL pipeline. The SPD/ contractor shall coordinate with GAIL officials during construction activities in vicinity of this area;
- Health & safety training to be provided during both construction and operation phase;
- Prior to start of work, workers should be informed about the related safety risks and precautions to be taken through tool box meetings;
- Manual lifting by adult men to be less than 55 kg and for women it should be less than 30 kg;
- Adequate PPEs to be provided for all activities at site including for welding, cutting or similar operations which may cause hazard to eyes;
- All persons performing construction work to wear safety shoes and helmets confirming to national standard;
- Every worker engaged in handling sharp objects which may cause injury to hand shall be provided suitable hand gloves;
- While working in hot conditions, measures such as work break at regular intervals, keeping hydrated by drinking water and liquids, covering face with damp cloth etc. shall be used;
- Obtain and check Contractor's safety method statements;
- Monitor health and safety performance and have an operating audit system;
- Permitting system should be implemented to ensure that cranes and lifting equipment is operated by trained and authorized persons only;
- Appropriate safety harnesses and lowering/raising tools should be used for working at heights;
- All equipment should be turned off and checked when not in use;
- Emergency contact numbers and route to the nearest hospital to be displayed at the construction site;
- The local/ host community to be kept at safe distance from construction site;
- Site specific safety or emergency response plan should be in place to account for natural disasters, accidents and any emergency situations;

- Site specific/ activity specific Hazards Identification and Risk Assessment (HIRA) should be developed prior to start of the activities at site; and
- Provide H&S achievement information to employees.

Residual Impact Significance

After implementation of additional mitigation measures, significance of residual impact will remain **minor.**

Impact	Occupational health and safety				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	National	International	
Frequency	Construction stage				
Impact Scale	The construction work involves construction of Solar Park along with construction of internal cabling and O&M activities				
Impact Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Vulnerability of Receptors	Low	Medium	High		
	The construction of Solar Park and erection of internal cabling will be done through experienced and trained workers. However, construction of other components will involve local workers who may not have earlier experience. Hence, there will be greater vulnerability for accidents.				
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Minor.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Minor.**				

6.2.3 Operation Phase

The list of activities during operation and maintenance phase considered for the assessment of impacts on physical environment includes:

- Routine cleaning of PV modules;
- Control of vegetation viz. weeds, bushes etc. within the site and those immediately surrounding it;
- Routine inspection of all PV modules and associated structures viz. cables, transformers, inverters, mounting structures etc.;
- Operation and maintenance of pooling substation; and
- Inspection and maintenance of internal site pathways/access roads

6.2.3.1 Soil Environment

Context and Receptor Sensitivity

During operation phase 200 employees/workers will be deployed at site. Operation phase will generate small amount of municipal waste from site office and waste such as broken solar panels.

The hazardous waste generated at substation include used/spent oil, oil soaked cotton and filter waste, waste containers/tins of paints, used lead acid batteries, nonferrous scrap, insulated aluminium and copper wires/cables, waste dry chemical residues etc. which needs proper storage and disposal.

During operation phase, the large area of the Project site will remain non concrete (beneath solar panels) and will have soil contamination risk due to improper waste management. Further the agricultural land existing in the surroundings may also get impacted due to random disposal of waste in the surroundings. The receptor sensitivity is assessed as **medium**.

Embedded/In-built Control

- Spill control measures such as the storage and handling of chemicals and fuel in concrete areas with secondary containment will be implemented to minimize impacts in the event of a spill;
- The O&M contractors will have control over the amount and types of waste (hazardous and non-hazardous) produced at the site;
- The hazardous wastes to be stored onsite temporarily at separate designated covered area provided with impervious flooring and secondary containment and to be disposed in accordance with Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016; and
- Workers will be strictly instructed/ trained about random disposal of any waste generated from the O&M activities.

Impact Magnitude

The quantity of waste generation will be negligible and O&M contractors will have proper waste management plan for implementation on site. The municipal waste from the site office will only be routed through proper collection and handover to local municipal body for further disposal. There will be only periodic generation of hazardous wastes during any repair and O&M activity. The waste will be disposed off through approved vendors in accordance to Hazardous Wastes Rules, 2016. The impact magnitude has therefore been assessed as **small**.

Impact Significance

As per the impact significant assessment matrix (refer ***Figure 6.2***) a combination of negligible impact magnitude with medium receptor sensitivity results in impact significance as **minor.**

Additional Mitigation Measures

- SPD shall prepared SOP for storage and disposal of broken solar panels and tie up with an authorized dismantling agency for disposal of panels. MNRE had prepared a concept note for storage and disposal of used solar panels. The recommendations such as recycling of glass, storage of discarded panels in cover shed etc. shall be adopted in the Project; (1)
- The broken solar panels shall not be mixed with normal glass
- RUMSL shall prepare a waste audit checklist as part of their routine site monitoring and auditing plan during operation phase for monitoring of waste management at site.

Residual Impact Significance

After implementation of additional mitigation measures, significance of residual impact will remain **minor.**

(1) http://164.100.94.214/sites/default/files/webform/notices/DraftBluePrintAntimony.pdf

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

6.2.3.2 Water Resources and Availability

Context and Receptor Sensitivity

During operation phase, total water requirement for the Shajapur Solar Park is estimated as below

- 277 KLD for solar panel cleaning;
- 9 KLD domestic water, assuming 200 no. of O&M staff and 45 LPCD;
- 7 KLD for green belt maintenance (as per DPR);
- 30 KL for firefighting and miscellaneous.

The water requirement for the project will be mainly fulfilled through ground water abstraction. As described in ***Section 4.3.7.1***, the resource sensitivity for ground water and surface water resources is assessed as **high**.

Embedded/In-built Controls

Nil

Impact Magnitude

The total domestic water requirement during operation phase is estimated as ~ 9 KLD. It is understood that total domestic water requirement will be met by ground water abstraction and bottled mineral water.

The quantity of ground water required for cleaning of solar panels during operation phase is evaluated to be ~10 ham (assuming 2.5 litre per sq.m and 12 cleaning cycles in a year, as per DPR)..

As per a report of Central Ground Water Board, Ministry of Water Resources 2017 (1), the status of ground water in the district is as below:

Table 6.8 Status of Ground water in Project District

S. No.	Particulars	Details
1.	District	Shajapur
2.	Annual Extractable Ground Water Resources (ham)	55,658.42
3.	Annual Ground Water Draft for all uses (ham)	57,061.03
4.	Projected Demand for Domestic uses upto 2025 (ham)	2,117.11
5.	Ground Water Availability for future use (ham)	3,557.82
6.	Stage of Ground Water Extraction (%)	102.52
8.	Estimated water requirement for solar panel cleaning (ham)	~10

Source: http://cgwb.gov.in/GW-Assessment/GWRA-2017-National-Compilation.pdf

The primary source of water in the area is ground water and reservoirs (Cheelar Dam, Palsavad Son Reservoir. Presently, annual ground water extraction for domestic purposes is ~11690.30 ham, which is assumed to increase upto 3,557.82 ham by 2025. Moman Badodiya Block falls under Overexploited category whereas South Shajapur is under Semi-Critical category.

If ground water is abstracted for Project, there will be additional groundwater abstraction of 253 ham over period of 25 years of operational phase of the Project. As it is evident from the above table, the stage of ground water extraction is on higher side with ~103% in Shajapur district, the utilization of ground water for operation phase of the project may compromise with competitive users (drinking water requirement of villages and irrigation purposes) in the district based on ground water availability. Hence, magnitude of stress on ground water resources is assessed as **high**.

Impact Significance

As per the impact significant assessment matrix (refer ***Figure 6.2***) a combination of medium impact magnitude with high receptor sensitivity results in impact significance as **major.**

Additional Mitigation measures

Conserving Water Resources

- Dry robotic cleaning of modules to be explored as recommended by MNRE (2);
- Alternate sources of water shall be explored
- Ground water abstraction shall be done in accordance to CGWB guidelines.
- Implement rainwater harvesting and/or groundwater recharge and replenishment opportunities within Site premises especially near the low-lying and gently sloping area.
- Optimising water usage in the SCADA building by application of water conservation measures such as sensor based taps, low flush urinals etc.;
- Maintain logbook for water consumption;
- Implement groundwater and wastewater monitoring vis-à-vis quality/quantity;
- Adopt less water consuming module cleaning methods;

(1) http://cgwb.gov.in/GW-Assessment/GWRA-2017-National-Compilation.pdf

(2) MNRE had issued a letter dated 3 June 2019 to Principal Secretaries of States and Solar Association of all States regarding optimal utilization of water and preferably use Robotic technology for cleaning of modules.

- The surface runoff from during solar panel cleaning shall be diverted to a settlement tank for settlement of suspended solids. The overflow shall be treated in water treatment unit and recycled in the Project.
- Use of water from multiple sources to avoid dependency on one particular source (groundwater or surface water). This also includes tapping of rainwater received during the monsoons for the long-term and uninterrupted operations.
- The Project should implement principles of water stewardship to ensure water security not just for the site, but also for other stakeholders within the watershed. Some of the water stewardship frameworks/ standards that can be adopted are UN Global Compact's CEO Water Mandate or AWS Standards.
- Identify stakeholders directly impacted by the groundwater use at the Project site and develop long- term stakeholder engagement plan particularly focused on stakeholders near site to develop positive perception towards Project and its operations.

Rain Water Harvesting

RUMSL shall plan to provide rainwater harvesting provision at site. In addition, in order to comply with CGWB guidelines for ground water abstraction (though this should be avoided), ground water recharge is mandatory in the Project. For this purpose, rainwater harvesting pond shall be provided at site. In addition, groundwater recharge shall be undertaken within the Site to replenish the shallow aquifer zones.

Piezometers to be installed to monitor the groundwater level changes in the aquifer trapped by the abstraction wells at Project site.

Water Quality

- Ensure proper cover and stacking of loose construction material at site to prevent surface runoff and contamination of receiving water body;
- Open defecation and random disposal of sewage will be strictly restricted;
- Planning of toilets, soak pits and septic tanks, waste collection areas away from natural drainage channels;
- Provision of number of toilets across with easily accessible location as the project site is spread across large area of both the Units;
- Use of licensed contractors for management and disposal of waste and sludge;
- Labourers will be given training towards proactive use of designated areas/bins for waste disposal and encouraged for use of toilets;
- Provision for impervious storage area, especially for fuel & lubricant, hazardous waste, etc. will be made onsite; and
- Spill/ leakage clearance plan to be adopted for immediate cleaning of spills and leakages.

Other Management Aspects

Preparing an inventory of water consumption during construction and O&M activities and all pollution sources from the Project activities is essentially the first step towards managing the impacts. The Management Plan will involve preparation of an up to date inventory of all areas of water consumption and wastewater discharge sources based on the latest Project activity related information. This inventory will helps in formulating the following management approaches:

- Source reduction
- Resource recovery options

- Recycle options
- Optimal treatment strategies and technologies
- Post-treatment, resource recovery and recycle options
- Ultimate disposal considering the local environmental sensitivities
- The inventory database of discharge sources shall be kept as a living document and updated as and when any new sources are cited at any point in time of the Project period. Any intermittent water requirement and discharge sources shall also be identified and included in the inventory.
- A Water Management Plan is provided as **Appendix E.**

Residual Impact Significance

Residual significance of impacts during construction phase will be **major to moderate.**

Impact	Water resources				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	National	International	
Impact Scale	Limited to Project areas and surroundings				
Impact Frequency	Operation Stage				
Impact Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Major.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Major
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **major to moderate.**				

6.2.3.3 Occupational Health and Safety

Context and Receptor Vulnerability

During operation phase, it is anticipated that on average ~200 employees/ workers will be deployed at site. The staff will be well experienced and qualified for their work. The pooling substation will be managed by RUMSL/ PGCIL through O&M contractor having Health and safety team, whereas the Solar Project Developer will be responsible for O&M of Solar Park area and have to deploy qualified H&S team. Therefore, receptor vulnerability is assessed as **Low**.

Embedded/In-built Controls

- Project specific Health and Safety Management Plan will be put in place.
- Personal Protective Equipment (PPEs) including safety shoes, helmet, goggles, ear muffs , face shield, insulating (rubber) gloves with leather protectors, insulating sleeves, and flame-resistant (FR) clothing and face masks;

- Use of permit to work system (hot work, electrical, work at height)
- Cranes and other lifting equipment are operated by trained and authorised persons;
- An up-to-date first aid box should be provided at all construction sites and a trained person should be appointed to manage it;
- Electrical and maintenance work should not be carried out during poor weather and during lightning strikes;
- Firefighting measures will be maintained at substation.

Impact Magnitude

As mentioned above, the O&M activities will be carried out by qualified team. With above embedded controls, the magnitude of impacts will be **small**.

Impact Significance

As per the impact significant assessment matrix (refer ***Figure 6.2***) a combination of small impact magnitude with medium receptor sensitivity results in impact significance as **minor.**

Additional Mitigation Measures

- Periodic Health & safety training to be provided to team;
- Activity specific Hazards Identification and Risk Assessment (HIRA) should be conducted and accordingly SOPs shall be prepared for all O&M activities.
- The lock in-lock out system will be followed during maintenance/ repair activities at substation and Transmission Line;
- Records of incident/ accidents shall be maintained;
- Root cause analysis shall be carried out for any incident/ accident
- All persons performing maintenance/repairing work to wear safety shoes and helmets confirming to national standard;
- Appropriate safety harnesses and lowering/raising tools should be used for working at heights;
- All equipment should be turned off and checked when not in use;
- Emergency contact numbers and route to the nearest hospital to be displayed at the construction site;
- The local/ host community to be kept at safe distance from construction site;
- Site specific safety or emergency response plan should be in place to account for natural disasters, accidents and any emergency situations;
- Provide H&S achievement information to employees;
- Specific SOP for any O&M activities in the vicinity of GAIL pipeline.

Residual Impact Significance

Residual significance of impacts during construction phase will be **minor to negligible.**

Impact	Occupational health and safety		
Impact Nature	Negative	Positive	Neutral
Impact Type	Direct	Indirect	Induced

Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
Impact Extent	**Local**	Regional	National	International	
Impact Scale	O&M activities				
Impact Frequency	Operation Stage				
Impact Likelihood	Likely				
Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
Vulnerability of Receptors	Low	**Medium**	High		
	The O&M activities shall be carried out qualified and experienced staff/workers				
Impact Significance	Negligible	**Minor**	Moderate	Major	
	Considering the overall impact magnitude and vulnerability of social receptors, the impact significance is assessed as **Minor**.				
Residual Impact Magnitude	Positive	Negligible	**Small**	Medium	Major
Residual Impact Significance	Negligible	**Minor**	Moderate	Major	
	Significance of impact is considered **Minor to Negligible.**				

6.2.4 *Photovoltaic Heat Island Effect (PVHI)*

The term “heat island” is mostly used with the prefix “urban” and termed as Urban Heat Island Effect (UHI), because it is generally described for the surface structure and overlying atmospheric layers of big cities and metropolitan areas.

PV modules are produced by the electrical assembly of PV cells which provides electricity generation. The most widely-used and commercial PV cells are manufactured from crystalline silicon (c-Si). Because the final products of these cell and module types have the physical and electrical properties that can bring limited conversion efficiencies (15-30%), dark-colored surfaces, packing density and/or arrays with gaps etc., a possible PVHI can be induced in a similar way to UHIs. The large Solar Parks cover the big and untouched areas in a rural environment. After a large-scale deployment, the large number of PV arrays and the corridors between these arrays may disturb the incoming solar radiation and outgoing IR radiation amounts of the previous land surface by landscape albedo change and alteration(1). This land use change may induce a heat island effect and increase the local temperatures which is termed as Photo Voltaic Heat Island Effect (PVHI).

The localized increase in ambient temperature by 3-4°C in Solar Park area could be due to following reasons(2) (3) :

- PV installations shade a portion of the ground and therefore could reduce heat absorption in surface soils;
- PV panels are thin and have little heat capacity per unit area but PV modules emit thermal radiation both up and down, and this is particularly significant during the day when PV modules are often 20 °C warmer than ambient temperatures;
- Vegetation is usually removed from PV power plants, reducing the amount of cooling due to transpiration; and
- PV panels reflect and absorb upwelling longwave radiation, and thus can prevent the soil from cooling as much as it might under a dark sky at night.

(1) https://www.researchgate.net/publication/327838950_Impacts_of_a_PV_Power_Plant_for_Possible_Heat_Island_Effect

(2) Barron-Gafford, G. A. et al. The Photovoltaic Heat Island Effect: Larger solar power plants increase local temperatures. Sci. Rep. 6, 35070; doi: 10.1038/srep35070 (2016); https://www.nature.com/articles/srep35070

(3) https://pvbuzz.com/photovoltaic-heat-island-effect/

The research studies (1) (2) (3) reported that

- The degree of PVHI effect varies depending on the season, likely because of changing sun angles and background temperatures;
- Though the PVHI effect are detectable in the day, the real significant warming occurs in the evening hours, partially because these large photovoltaic installations took longer to cool down in the night time hours;
- The increase in localized temperature may cause discomfort to the habitation and wildlife in the vicinity of Solar Park;
- The heating effect may dissipate after 300 m distance from Solar Park.
- It is to be noted that the PVHI is still a less studied aspect for assessing the impact of large Solar Parks on micro climate change and requires further in depth research. Limited empirical data exists regarding the heat island effect resulting from the installation of large scale Solar Parks.

Recommendations

Based on limited above understanding, following recommendations are proposed:

- The existing ground vegetation in the Solar Park area shall be disturbed to minimum extent;
- Ground vegetation shall be planted in the buffer areas/open areas available in the Solar Park;
- The feasibility of mixed land use development in the Solar Park shall be explored.

6.2.5 Natural Hazards- Flood Likelihood Assessment

ERM has adopted a qualitative risk based categorization to identify potential risks and vulnerabilities associated with flooding, inundation and waterlogging. The risks are defined considering the likelihood of their occurrence and potential severity of the impact broadly following the risk matrix presented in the table below. Refer ***Appendix D*** for detailed Flood Likelihood Assessment.

Risk = Likelihood of an impact occurring x Potential severity of the impact.

		Probability of Occurrence		
		Low	**Medium**	**High**
Potential Impact	Low			
	Medium			
	High			

Note: The study was carried out to evaluate and understand the likelihood of flood impact on the Site only. Risk categorization has been adopted merely for providing broad level perspective on the potential for impact from floods / inundation / water logging on the Site and to emphasize specific areas for further evaluation prior to developing Site specific mitigation measures only.

(1) https://assets.cleanenergycouncil.org.au/documents/events/event-docs-2019/SIF-2019/Presentations/03-Bronte-Nixon.pdf

(2) Barron-Gafford, G. A. et al. The Photovoltaic Heat Island Effect: Larger solar power plants increase local temperatures. Sci. Rep. 6, 35070; doi: 10.1038/srep35070 (2016); https://www.nature.com/articles/srep35070

(3) https://pvbuzz.com/photovoltaic-heat-island-effect/

A likelihood analysis of potential flooding event in and around the Site has been undertaken. The same has been presented in the Table 6.9 below.

Table 6.9 Likelihood of flood evaluation

Attributes	Unit 6 & 7 (Moman Badodiya Site) Likelihood			Unit 8 (South Shajapur Site) Likelihood		
	High	Medium	Low	High	Medium	Low
Site Setting						
■ Shajapur and Moman Badodiya Sites are located ~30 km and ~24 km west from the Kali Sindh River which is the nearest river; ■ Nearest prominent stream is ~1.35 km west of Moman Badodiya Site. This stream is non-perennial in nature.						
Watershed Characteristics						
■ Both Shajapur and Moman Badodiya Sites are located within the Kali Sindh River Basin. Both Sites are located at the ridge in the west-central portion of the basin and ~30 km west from the Kali Sindh River. ■ The Moman Badodiya and Shajapur Sites are located in a rural setting surrounded primarily by scrub land with some agricultural land, forest land, scattered residential settlements, water bodies. ■ Few first order streams originate within Shajapur Site. These are non-perennial streams with shallow depths. ■ Three (3) large artificially created water bodies are located adjoining the Shajapur Site boundary with spread area varying between 21 acres to 260 acres. ■ Several well defined and prominent first order streams originate within Moman Badodiya Site. Few second order streams also pass through Moman Badodiya Site. These streams extend along entire breadth of the Site in the central and southeastern portion. ■ Three (3) large artificially created water bodies are located adjoining the Moman Badodiya Site boundary with spread area varying between 34 acres to 228 acres.						
Hydro-meteorological Data						
■ Average annual rainfall for period of 1980-2019 for Moman Badodiya was ~951 mm with the highest annual rainfall of 1,814 mm recorded in 2019; ■ Average annual rainfall for period of 1980-2019 for Moman Badodiya was ~966 mm with the highest annual rainfall of 1,992 mm recorded in 2019; ■ Maximum daily probable rainfall for 25, 50, and 100 year return periods for Shajapur and Moman Badodiya Sites are <220 mm, <240 mm, and <280 mm respectively;						
Hydrological and Geomorphological Data						
Catchment Analysis						

Attributes	Unit 6 & 7 (Moman Badodiya Site) Likelihood			Unit 8 (South Shajapur Site) Likelihood		
	High	Medium	Low	High	Medium	Low
■ Topography within the watershed of Moman Badodiya Site varies between 375 m and 475 m amsl. ■ Topographic elevation of Moman Badodiya Site was observed to be in the range of 425 m to 475 m amsl. ■ Slope in the Moman Badodiya Site area ranges between 3 to 8 % categorized as gentle slope. ■ Topography within the watershed of Shajapur Site varies between 375 m and 500 m amsl. Topographic elevation of Shajapur Site was observed to be in the range of 425 to 475 m amsl. ■ Slope in the Shajapur Site area ranges between 3 to 8% categorized as gentle slope. ■ Based on the topography and slope maps, the Site area does not appear to have any pockets of 'low lying areas' with potential for water logging and flooding during rainy season.						
Historical Flooding and Inundation Events						
Moman Badodiya Site (Unit 6, 7A, and 7B) ■ Several artificial water bodies have been created within Units 7A and 7B for capturing surface runoff. ■ There are about six (6) artificially constructed non perennial water bodies located within the Unit 7A boundary which were spread over area varying between ~1.5 to ~10 acres. ■ Signs of water logging and inundation were also observed within the Unit 7A boundary based on review of historical satellite imagery. These areas were observed to spread over ~6 to 18 acres area in the south-eastern and central portion. ■ Five (5) artificially created non-perennial water bodies were observed to be located within Unit 7B Site boundary. These were observed to spread over ~1.5 to 8 acres. ■ A low lying area was observed in the north-eastern portion of the Site which was spread across ~7 acres area. ■ Historical satellite imagery of Unit 6 Site did not indicate presence of any significant water feature. Shajapur Site ■ Several well defined and prominent first order streams were observed to originate within the Site boundary or pass through the Site. ■ Two (2) non-perennial water bodies including one (1) artificial water body and one (1) natural pond spread over ~1.5 and 0.5 acres respectively were observed within the Site boundary. ■ Besides these artificially constructed water bodies and non-perennial streams with shallow depths, signs of water logging and inundation were also observed in large expanses (~50						

Attributes	Unit 6 & 7 (Moman Badodiya Site) Likelihood			Unit 8 (South Shajapur Site) Likelihood		
	High	Medium	Low	High	Medium	Low
acres) of low lying area in the central portion of the Site mostly along the streams that pass through the Site.						
Secondary Data Review – Flooding and Inundation						
■ Per the global estimated risk index for flood hazard map developed by UNEP/GRID-Europe, Units 7A and 7B of Moman Badodiya Site are partially located in '*Moderate*' flood risk area. Whereas Unit 6 of Moman Badodiya Site and Shajapur Site are not prone to flooding; ■ Per the global flood hazard map developed by FM Global, both Moman Badodiya Site and Shajapur Site are not prone to high or medium flood risk; ■ Based on Aqueduct's global flood hazard map, both Moman Badodiya Site and Shajapur Site fall in the "Low" river flooding hazard zone; ■ Based on global flood hazard frequency and distribution map developed by Data Basin, the Site and its surroundings at Moman Badodiya and Shajapur are not prone to flooding.						

Based on the observations from the above-mentioned table, it appears that the overall likelihood of flooding event and its impact in and around the Site may be considered as ***'Low' to 'Moderate'***.

Recommendations

Based on the broad level assessment, following measures are recommended to protect the assets at Site from identified 'high probability attributes' and to prevent/mitigate their impact on the Site:

- Carry out a Site specific preliminary Flood Risk Assessment based on inundation and hazard mapping to understand the extent and magnitude of inundation and water logging at Units 7A and 7B of Moman Badodiya Site. This will help in designing and implementing adequate flood mitigtion measures.
- Develop a robust "Storm Water Management Plan (SWMP)" for both Moman Badodiya and Shajapur Sites to effectively and safely manage surface runoff during heavy rainfall events. SWMP must consider protection and development of natural drainage channels and water features within the Site area to prevent localized inundation and safely evacuate surface runoff.
- Enhance structural stability of banks of all seasonal streams which originate within the Site or pass through the Site and provide robust erosion protection to withstand flash flood during heavy downpour.
- Significant area in the central and eastern portion of Shajapur Site is relatively low lying (localized depression) and may be subjected to periodic and intermittent water logging during peak rainy season. Water level data, frequency, duration and extent of inundation or water logging at these seasonal features would not be available from secondary sources. It is recommended to undertake consultations with local communities and carry out physical field assessment to understand maximum potential extent of land submergence and depth of inundation during high rainfall year. This will serve to define 'zones' of concern within the Site, plan the locations of key electrical infrastructure at the Site, assist in designing storm water management plan and structural design of the solar array mounting racks specific to the 'zone of concern'.

6.3 Impacts on Biological Environment

6.3.1 Key Ecological Impacts

Interactions that are likely to lead to significant impacts on ecology and biodiversity in the study area are listed in the following ***Table 6.10*** and will be the focus of the impact assessment.

Table 6.10 Identified interactions that are likely to result in significant impacts

S. No	Potential Impacts	Causes for Impacts
1.	Clearance of vegetation for the construction of access roads, ancillary facilities	■ Loss of Scrub land/Grassland and Agricultural Habitat and associated vegetation that may be used by species commonly found in the rural landscape of the study area. ■ Loss of foraging resources, shelter and shade for resident fauna.
2.	Disturbance and displacement of species due to noise, light, anthropogenic movement and traffic	■ Increased movement of people and vehicles can increase the stress levels of fauna that causes them to spend an increased amount of time in alert mode instead of foraging, nesting, socializing or mating; and ■ Noise, light and uncovered waste can attract or repel fauna to or from the solar site.
3.	Mortality as a result of worker influx and increased hunting, trapping and poaching of wildlife	■ Potential risk to local wildlife due to hunting for "bush meat".

S. No	Potential Impacts	Causes for Impacts
4.	Electrocution risk from increase transmission line laying in the region	■ Roosting on solar panels places avifauna in close proximity to wiring and other electrical components of the solar module.

6.3.2 Ecological Impacts Assessment

6.3.2.1 Assessment Criteria

ERM Impact Assessment Standards define the sensitivity of ecological receptors by determining the significance of effects on species and habitats separately. The significance tables for species and habitats are given in ***Table 6.11*** and ***Table 6.12*** respectively.

Table 6.11 Habitat-Impact Assessment Criteria

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

Table 6.12 Species-Impact Assessment Criteria

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

6.3.3 Impact during Construction Phase

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

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

Impact due to Vegetation Clearance and Construction Activity

Context

The Project sites at Moman Badodiya and South Shajapur are primarily located in scrubland/ grassland area which are parched dried during the winter and summer months and flourish during the monsoon and post monsoon season. The surrounding agricultural lands/scrub vegetation provide habitat for wildlife typically found in the rural agricultural landscape of central India like Northern plains grey langur (*Semnopithecus entellus)*[IUCN(v2020.1)LC], Jungle Cat (*Felis chaus kutas)*[IUCN(v2020.1)LC], Grey Mongoose *(Herpestes edwardsii)*[IUCN(v2020.1)LC] etc. and bird species like Woolly-necked stork (*Ciconia episcopus*), Common Pochard (*Aythya ferina*) and Sarus Crane (*Grus antigone*) listed as Vulnerable as per IUCN v2020.1 and Black-winged kite (*Elanus caeruleus*)[IUCN(v2020.1)LC], Common Myna [IUCN(v2020.1)LC], etc. mentioned in the baseline section are dependent directly or indirectly on these lands for food and shelter. So vegetation clearance and construction activity will result in displacement of these species from the project site.

Embedded/ In-built Controls

- Whenever possible mature large trees will be avoided, along the edge of the project boundary and approach road.

Receptor Sensitivity

Grassland and Agricultural Habitat of the study area is found to sustain Vulnerable and Near Threatened species (IUCN Red List of Threatened Species) having large distribution range. The agricultural habitat is widespread in the study area and beyond study area, so loss of agricultural habitat for project activity will result in negligible loss of such habitat. So based on Species and Habitat Sensitivity Value classification mentioned in ***Table 6.11*** and ***Table 6.12***, both Species and Habitat Sensitivity Values were found to be "**Medium**".

Impact Magnitude

As mentioned earlier in "Receptor Sensitivity" section, agricultural habitat is widespread within the study area and outside it, so loss of such habitat for project related activity will be very small, such that no loss of viability/ function of agricultural habitat in the study area is expected. So magnitude of impact is expected to be "**Small".**

As all species found in the study area have large distribution ranges and found across multiple habitat types, displacement due to project construction related activity is not expected to cause substantial change in the population of the species or other species dependant on it. So magnitude of impact is expected to be "**Small".**

Impact Significance

Based on "Habitat-Impact Assessment Criteria" (as per ***Table 6.11***), as Habitat Sensitivity Value was found to be "**Medium**" and Magnitude of Impact on Habitat was found to be "**Small**", the overall Significance of impact of vegetation clearance and construction activity on habitat is considered to be "**Minor**".

Based on "Species-Impact Assessment Criteria" (as per ***Table 6.12***), as Species Sensitivity Value was found to be "**Medium**" and Magnitude of Impact on Species was found to be "**Small**", the overall Significance of impact of vegetation clearance and construction activity on habitat was also found to be "Minor". The Impact Significance is described below.

Mitigation Measures

- Vegetation clearance should be kept restricted to project site only and should be avoided wherever possible.
- It is recommended that the selected EPC contractor should display and educate labourers not to collect fuel wood from adjacent areas and alternate arrangement for fuel, like LPG must be made available in the labour camps for cooking.
- Provision for identifying grazing areas for the livestock village wise and development of grass plots in 5 acre area with local grass species;
- Sufficient arrangement for identifying water holes based on the terrain gradient to tap the suface water runoff during rains
- Strengthening of existing waterbodies in the study area and development of water channels to connect the surface runoff to them.

Impact	Clearance of vegetation				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to construction area and immediate surroundings				
Frequency	Construction phase				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity (Habitat)	Low	Medium	High		
Resource Sensitivity (Species)	Low	Medium	High		
Impact Significance	Not Significant	Minor	Moderate	Major	
	Significance of impact is considered **Minor** for habitat and species.				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible** for habitats and species.				

Impact due to Influx of Migrant Labour and Labour Camp

Context

Migrant labours are not aware of the local biodiversity values and there is always risk of hunting and trapping of local wildlife by labours for meat as well as for easy source of money by selling products like skin. Apart from impacts like direct hunting or trapping, careless disposal of kitchen waste like discarded vegetable materials and excess food, may attract scavengers like golden jackal etc. This unwanted interaction with wild animals may lead to human-wildlife conflict. Collection of fuel wood for cooking from outside project area, may result in additional habitat degradation.

Embedded/ In-built Controls

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

Impact Significance

As long the labour camp is established within the project area, there will no additional loss of habitat. Moreover agricultural habitat is widespread in the study area and beyond study area, so disturbances due to fuelwood collection will result in negligible loss of such habitat, so as discussed in "Receptor Sensitivity" and "Impact Magnitude" section Habitat Sensitivity Value was found to be "**Medium**" and Magnitude of Impact on Habitat was found to be "**Small**". So the impact significance on habitat, based on "Habitat-Impact Assessment Criteria" (as per ***Table 6.11***) is considered to be "**Negligible**".

Only "Least Concern" species likely to be impacted by worker force presence, are found in the study area so species sensitivity value is "**Low**", and hunting trapping of animals like Chinkara, Grey Mongoose may result in change in abundance and/or reduction in distribution of a population locally over one or more generation, but does not threaten the long term viability/ function of the population, so Magnitude of Impact was found to be "**Medium**". So based on "Species-Impact Assessment Criteria" (as per ***Table 6.12***) the impact significance on species was also found to be "Minor".

Mitigation Measures

- The likelihood of threatened and protected fauna venturing into the Project site is small but proper precautions should be taken to prevent any human-wildlife conflict.
- It is recommended that the selected EPC contractor should display and educate labourers and staff about the hunting, poaching, trapping, injuring or killing of wildlife in the region.
- Any such activity of hunting and poaching should be covered under contractual obligations of the EPC contractor;
- The EPC contractor should in consultation with Forest Department should explore the options to minimize wildlife human interactions in the study area.

Impact	Clearance of vegetation			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Limited to construction area and immediate surroundings			

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

Impact on the ecosystem services

Context

Ecosystem services are the direct and indirect contributions of ecosystems to human well-being. They support directly or indirectly our survival and quality of life. Ecosystem services can be categorized in four main types:

Provisioning services are the products obtained from ecosystems such as food, fresh water, wood, fiber, genetic resources and medicines.

Regulating services are defined as the benefits obtained from the regulation of ecosystem processes such as climate regulation, natural hazard regulation, water purification and waste management, pollination or pest control.

Habitat services highlight the importance of ecosystems to provide habitat for migratory species and to maintain the viability of gene-pools.

Cultural services include non-material benefits that people obtain from ecosystems such as spiritual enrichment, intellectual development, recreation and aesthetic values.

Embedded/ in-built Control

No embedded/in built controls in place

Receptor Sensitivity

The project site (Unit 6 &7) at Moman Badodiya and South Shajapur site comprises of total land area of ~1000 Ha. The land is largely open scrub land to agricultural land at certain patches. The project and surrounding areas are known to be utilized for grazing by the local livestock as well as wild animals such as Nilgai Chinkara, Indian Hare and hunting ground for mammals such as Jackal, Bengal Fox, and Indian Grey Mongoose. The South Shajapur Site (Unit 8) is adjacent to the Palsawad Son dam and there is a likelihood of the roosting of the migratory species on the project site. Post construction this area will be not available for above said activities.

Impact Magnitude

As the similar landscape is available in the study area, they may support these species. Thus, this will affects only a small area of habitat, such that there is no loss of viability/ function of the habitat. Similarly the site and surrounding area bears no CR and EN species and presence of VU species. Hence, the effect does not cause a substantial change in the population of the species or other species dependent on it the project site Hence, the impact on the ecosystem services will be **small**

Impact Significance

The site and surroundings reported presence of IUCN VU species such as Woolly-necked stork (*Ciconia episcopus*), Common Pochard (*Aythya ferina*) and Sarus Crane (*Grus antigone*) listed as Vulnerable as per IUCN v2020.1 hence the resource sensitivity for habitat and species will be **medium**.

In view of the above discussion the impact significance is assessed as **Minor.**

Mitigation Measures

The following mitigation measures can be implemented for the Project site:

- Nesting trees should be avoided to the extent possible when it falls within the Solar Park site.
- Larger mature trees with significant height and girth should be avoided to the extent possible when constructing the Solar Park. Larger trees can be set aside within the Solar Park and avoided as part of the micro-siting of the solar modules..
- Seeding of native plant species outside of the Solar Park especially in areas where the soil layers have been impacted and around water bodies to offset the loss of floral resources and dependent ecosystem services.
- Pollution and spill control mechanisms should be implemented and strictly enforced around Water Bodies to ensure that there is no impact to the water quality or any drainage channels into the water body.

Residual Impact Significance

Post implementation of the mitigation measures, the residual Impact significance will be **Not Significant.**

Impact	Impact on Ecosystem Services				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to project area and immediate surroundings				
Frequency	Construction and Operation phase				
Likelihood	Moderately Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity (Habitats)	Low	Medium	High		

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

6.3.4 Impacts during Operation Phase

Collision and Electrical hazards from Transmission Infrastructure

Context

The power evacuation from the project site from the pooling substation to government substation is considered here. Several species of birds, like Raptors use these transmission lines and poles as perching sites and are under threat of collision and electrocution from the transmission lines. Some birds also utilize the transmission towers for nesting.

Embedded/ in-built Control

Large mature trees will be avoided while finalizing the transmission line route.

Receptor Sensitivity

Grassland and agricultural habitat of the study area is found to sustain Least Concern (IUCN Red List of Threatened Species) having large distribution range. Although migratory birds were recorded for the study area, \no large migratory congregation was recorded from the study area. Woolly-necked stork (*Ciconia episcopus*), Common Pochard (*Aythya ferina*) and Sarus Crane (*Grus antigone*) IUCN (Vulnerable, v2020.1) were also observed.. So based on Species and Habitat Sensitivity Value classification mentioned in ***Table 6.11*** and ***Table 6.12***, both Species and Habitat Sensitivity Values were found to be “Medium”.

Impact Magnitude

Presence of Vulnerable species that have a large distribution range and likelihood of these species getting electrocuted or hit by transmission line is low, so there is not expected to be a substantial change in the population of the species or other species dependent on it. Therefore Impact Magnitude is expected to be “**Medium**”

Impact Significance

As both Sensitivity value for Habitat as well as Species were found to be “medium” and Magnitude of impact for both were also found to be “medium”. Overall Significance of Impact on both Habitat and Species were found to be “**Moderate**”.

Mitigation Measures

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

- If possible transmission line should be aligned away from the waterbody.
- Insulators should be suspended in order to reduce the electrocution of bird species;

- Jump connectors should be insulated of at least 60 cm in length (determined based on the average wing span of common avifauna) to reduce chances of electrocution of species flying through and wing tips coming into contact with the conductors and
- Marking overhead cables using diffractors and avoiding use in areas of high bird concentrations of species vulnerable to collision.

Residual Impact Significance

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

Impact	Electrocution hazards				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to electrical components of the solar farm, transmission lines (internal and external) and transmission poles.				
Frequency	Operation phase				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity (Species)	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is **Moderate** for species.				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Not Significant	Minor	Moderate	Major	
	Significance of impact is considered **Minor.**				

6.4 Impacts on Social Environment

The maximum impacts of the project related activities will be in the Project villages, on the land owners, Patta Land holders and households that are using the land formally and informally as encroachers, agricultural labourers, etc. Specifically, the impacts will be due to use of Government land identified for the project, within which several uses exist, as elaborated in ***Section 4.5.6***. The project design features went through an avoidance exercise to reduce the need for private land and Patta Land for the project to the extent feasible. As part of the avoidance, no *Abadi* area (area with village habitation and residential structures) has been included in the project footprint.

6.4.1 Avoidance and optimisation of the Project footprint

As understood from the project documents, there have been multiple optimization exercises, in order to ensure maximum avoidance of land used for agriculture and habitation in Project villages.

Table 6.13 Land initially identified for Shajapur Solar Park

Villages	Govt Land	Private Land	Patta Land	Horticulture	Seasonal pond
Burlay	23.8	23.7	0	0	0
Jawadi	34	5	0	0	0
Dhatrawada	176.3	11.3	0	0	0
Unit 6 villages	***234.1***	***40***	***0***	***0***	***0***
Parsula	117.2	0.7	9.8	0	0
Dehripal	134.9	13.7	0.2	9.4	0
Bijanakhedi	95.9	37.8	0	0	0
Fawaka	17.1	5.5	0	0	0
Chauma	32.7	9.5	0	0	12.4
Burlay	41.7	0	0	0	0
Unit 7 Villages	**439.5**	**67.2**	**10**	**9.4**	**12.4**
Surajpur	27.5	28.1	0	0	0
Lalpur	62.1	0.1	0	0	0
Khareli	0	59.8	0	0	0
Upadi	49.7	0	0	0	0
Kukdeshwar	6.4	0	0	0	0
Bamaniyakhedi	2.7	0	0	0	0
Boddi	15.3	0	0	0	0
Khakri	18.5	0	0	0	0
Majhaniya	5	0	0	0	0
Rehli	63.8	0	0	0	0
Rulaki	4.1	0	0	0	0
Tanda Pindoniya	2	0	0	0	0
Aakya Chouhani	10.7	0	0	0	0
Palsavad Soun	13.4	0	0	0	0
Besrapur	4.6	0	0	0	0
Khokariya Toak	6.4	0	0	0	0
Hanoti	177.1	18.5	0	0	0
Goyala	3.6	0	0	0	0
Unit 8 Villages	**472.9**	**106.5**	**0**	**0**	**0**
Total	***1146.5.4***	***21.7***	***10***	***9.4***	***12.4***

Source: Land data provided by RUMSL 18th June 2020

The land optimization exercise has resulted in a reduction in the requirement of private land for the project, which has been compensated by the addition of Government land as per the project's requirements, as detailed in ***Section 2.6.2***. The land area considered for the project after the land optimization is as presented in ***Table 6.14.***

Table 6.14 Land considered for the project

S No.	Village Name	Govt. land (NRED allotted)	Govt. Land Identified	Private Land	Patta Land	Total Land Area (Ha) (Govt. Land + Pvt. Land)
1	Burlay*	23.7	0.0	6.4	0.0	30.1
2	Jawadi	32.2	0.0	2.0	0.0	34.2
3	Dhatrawada	172.2	0.0	9.7	0.0	181.9
Sub- Total (Unit 6)		***228.1***	***0.0***	***18.1***	**0.0**	**246.2**
4	Parsula	116.2	0.0	0.0	5.2	121.4
5	Dehripal	111.1	0.0	21.8	0.0	132.9
6	Bijanakhedi	95.4	0.0	22.6	0.0	118.0
7	Fawaka	17.1	0.0	0.2	0.0	17.3
8	Chouma	32.7	0.0	9.5	0.0	42.2
9	Burlay*	41.7	0.0	0.0	0.0	41.7

S No.	Village Name	Govt. land (NRED allotted)	Govt. Land Identified	Private Land	Patta Land	Total Land Area (Ha) (Govt. Land + Pvt. Land)
Sub- Total (Unit 7)		**414.2**	**0**	**54.1**	**5.2**	**473.5**
10	Surajpur	22.7	0.7	18.2	0.0	41.6
11	Lalupura	49.8	0.8	0.0	0.0	50.6
12	Hanoti	131.9	12.5	18.5	0.0	162.9
Sub- Total (Unit 8)		**204.3**	**14.0**	**36.7**	**0.0**	**255.1**
Total (Unit 6, 7,8)		***846.6***	***14.0***	***108.9***	***5.2***	***974.7***

Source: Final DPR, August, 2020

*Land from Burlay village forms a part of both Unit 6 and 7

The impacts of land take on these villages will flow from all categories of land, whether government, patta or private, and will potentially affect livelihoods and easements (traditional access and use) but also the availability of land for future generations. Some impacts may be possible to mitigate or manage while others will need to be compensated. The land remaining after the procurement of identified land for the project is nearly 87% in the Project villages and the village wise details are presented below.

Table 6.15 Extent of Village Land remaining after Project Land Procurement

Sl No.	Village Name	Area as per Census 2011 (ha)	Total Land Area required for the Project (Ha) (Govt. Land+ Pvt. Land)	Balance Land (Ha)	% of Land Remaining
1	Burlay*	948.35	71.8	876.55	92.4
2	Jawadi	304.65	34.2	270.45	88.8
3	Dhatrawada	660.97	181.9	479.07	72.5
4	Parsula	692.98	121.4	571.58	82.5
5	Dehripal	944.49	132.9	811.59	85.9
6	Bijnakhedi	385.56	118	267.56	69.4
7	Fawaka	587.59	17.3	570.29	97.1
8	Chouma	871.31	42.2	816.71	93.7
9	Surajpur	300.83	41.6	259.23	86.2
10	Lalupura	308.61	50.6	258.01	83.6
11	Hanoti	698.25	162.9	535.35	76.7
	Total land for project	**6703.6**	**974.7**	**5716.4**	**87**

Source: Census of India, Village Directory, 2011

6.4.2 Potential impacts from Project activities on stakeholder categories

The private land identified for procurement for the project comprises 108.9 ha and is nearly 11 percent of the total land required, 5.2 ha of Patta Land is (approximately 0.5 percent of the total land required while 860.6 ha of Government Land makes up the largest share, at nearly 88.2 percent of the total land.

The number and profile of the Private land owners and Patta land holders associated with the land that has been identified for the project; will be prepared, based on the RAP survey in the field. These activities have commenced but not completed at the time of compiling this report. Households will also be impacted due to reduction in grazing land in the vicinity or loss of income and/or livelihoods due to impacts on agricultural activity on land parcels encroached/ squatted upon. Households whose members work as agricultural labourers on private, patta and encroached government land that is identified for the Solar Park, will also be affected.

The table below describes the potential impacts that are likely to result from Project activities in various stages of the project, comprising, Planning, Construction and Operation, on various socioeconomic and

community aspects, including from the land requirements of the project (land use change), as noted in the ***Table 6.14***. Additionally, the table below and the subsequent sections describe the embedded controls and mitigation measures for specific impacts, as drawn from the ESMF for the project and enhanced for specific impacts identified.

Table 6.16 Summary of Potential impacts from the project activities

Impact Categories	Impacts	Impacted Stakeholders	Mitigation measure
Planning Phase Impacts			
Private Land (Purchased through MP Mutual Consent Policy, 2014	■ Approx. 108.9 ha. of private land (refer ***Table 2.2*** for village wise break up), is being considered for purchase by the project, which forms nearly 11 percent of the total area identified for the project; ■ The private land parcels that are identified are not being used for residential purposes, thus there is understood to be no physical displacement due to project; however, this is subject to confirmation on site, during the RAP survey ■ It is expected that **economic displacement** will occur affecting livelihoods and incomes for all those employed (seasonally or otherwise) by the private land sellers whose land parcels will be purchased for project related activities; ■ **Landlessness** may potentially result due to purchase of private land parcels in some cases; however, the total land holding and proportion of land remaining with the sellers after the mutual consent based sale, is not known currently, and shall be assessed during the RAP survey; ■ Loss of access or easement for the local community due to diversions/ barricading of areas due to construction phase activities may also occur.	■ Private land owners; ■ Agricultural labourers employed seasonally; ■ Local Community.	■ The consenting private land sellers will be provided with twice the value of land and assets, as per MP Mutual Consent Policy, 2014; ■ After assessing the applicability and need during the RAP Survey, a Resettlement Action Plan-Livelihoods Restoration Plan is required to be formulated to address: - Displacement impacts to people who had encroached/squatted upon government land, based on their status and tenure; - Livelihood impacts on the land owners if the holdings that remain are sub-optimal, or owners are rendered landless; - Additional livelihood assistance to vulnerable households, or women headed households, with skill trainings or entrepreneurship support, etc. under the LRP and other support; - Impacts on land users or regular agricultural labourers affected - The general community being impacted due to access restrictions/easements; - Other displacement impacts on private and patta land owners ■ Preference to members (vulnerable) of the families post selling land to the project for employment opportunities in the

Impact Categories	Impacts	Impacted Stakeholders	Mitigation measure
			Construction/operation phase, award of small contracts; ■ Timely sharing of project related information with all relevant stakeholders, as described in the Stakeholder Engagement Plan; ■ Provision of Grievance Redressal Mechanism to all impacted stakeholders in order to raise and register their grievances.
Patta Land (purchase through MP Mutual Consent Policy)	■ Approximately 5.2 ha. of Patta land from Parsula village is being considered for purchase by the project, which forms approximately 0.5 percent of the total area identified for the project (refer Table 2.2 for details); ■ **Economic displacement** will occur for the Patta Land holders who have invested cost and efforts in the Patta land to make it cultivable and are currently undertaking agricultural activities- it is yet to be determined whether the land value will take these improvements into account for the amount determined as per the Mutual Consent Policy; ■ Typically Patta land owners are likely to be from vulnerable households like SC, ST and other previously landless households and the land purchase for the project may lead to cases of **landlessness, (which is more likely to be in this category than the category of private land holders, as landlessness is a baseline criteria for initial award of pattas)**; ■ It is understood that certain Patta Land parcels have been sold off based on a 'verbal agreement' by the household it was originally allotted to, without a change in records. Although this is not allowed as per the terms of the allotment, it is reported as a practice. In such cases, the households using the Patta lands through this arrangement are also understood to be impacted, in	■ Patta Land Holders; ■ Non-recognised 'patta owners' who have procured the patta based on a verbal agreement with the original (and registered) patta holder ■ Agricultural labourers; ■ Local Community.	■ Patta is being treated at par with ownership, for the land procurement process. Thus, treatment of Patta Land holders will be similar to Private land owners and Patta holders shall be provided with adequate compensation at twice the value of land and assets, as per MP Mutual Consent Policy, 2014; ■ After assessing the applicability and need during the RAP Survey, a Resettlement Action Plan-Livelihoods restoration Plan is required to be formulated to address: - Displacement impacts to people who had encroached/squatted upon government land, based on their status and tenure - Livelihood impacts on the land owners if the holdings that remain are sub-optimal, or owners are rendered landless; - Additional livelihood assistance to vulnerable households, or women headed households, with skill trainings or entrepreneurship support, etc. under the LRP;

Impact Categories	Impacts	Impacted Stakeholders	Mitigation measure
	addition to original owners, who are still on record as 'patta holders' and therefore the legal claimants; ■ Agricultural labourers, if any, working on the Patta land parcels identified for purchase for the project will experience **loss of income/ livelihoods**; ■ **Loss of access or easement** for the local community may occur, due to diversions/ barricading of areas due to construction phase activities.		- Impacts on land users or regular agricultural labourers affected - The general community being impacted due to access restrictions/easements; - Other displacement impacts on private and patta land owners ■ Preference to members (rendered landless or with sub-optimal holdings) of the families post selling land to the project for employment opportunities in the Construction/operation phase, small contracts; ■ Additional safeguards to be addressed through the RAP-LRP for Patta Land owners, and the approach to be taken for those who have informally purchased Patta land; ■ Timely sharing of project related information with all relevant stakeholders ■ Provision of Grievance Redressal Mechanism to all impacted stakeholders in order to raise and register their grievances.
Government Land (LUPA between RUMSL and New and Renewable Energy Department, Government of MP : Used Land (permitted uses): Grazing, easements, cultural heritage sites, water sources, fuel wood	■ Government land being identified for the project from the project villages amounts to 860.6 ha as presented in ***Table 2.2*** which forms nearly 88.2 percent of the total land required for project. ■ This land has different uses for the local community: - Livestock grazing in the open areas; - Collection of firewood for domestic use'; - Easements, access to assets and other resources not within the project boundary, etc. and the change in use and	■ Local Community; ■ Livestock Owners or Graziers whose livestock grazes in the identified land for 8 months in a year (except summers;	■ Provision for alternate grazing land for livestock near the project village, or confirmation of adequacy and ease of access, of the remaining grazing land; ■ Development of a program to include grazing area improvement and fodder intensification (cultivation) in designated areas, as agreed with the Tehsil office and the local dependent community of graziers. This may include the development of community fodder lots under the Livelihood restoration activity in the area as part

Impact Categories	Impacts	Impacted Stakeholders	Mitigation measure
collection and collection of other resources;	ownership of Government land will affect the users in the community to varying degrees. ■ The Impacts on users of this land type comprise the following: – Loss of Grazing land for the livestock in the area; – Loss or severance of access for the community, livestock, etc.; – Loss of cultural resources in terms of religious trees, structures, etc.		of Resettlement Action Plan. This, if feasible, shall serve the purpose of improving the quality of the grazing land, ensuring access and as an income generating activity for people losing land based livelihoods ■ Provision of easements shall be maintained in order to not sever the access to CPRs for the community; ■ The Solar Park Developer is also encouraged to explore identifying unused areas within the solar park boundary and a part of the area with solar panels (10% area), for fodder cultivation, or controlled and managed open grazing of goats, or agriculture (selected crops), to explore the potential of 'mixed land use' areas in solar parks that benefit the local community too. This may be done with the agreement of RUMSL and in partnership with domain specialist agencies and local organisations working in the region. Additional positive effects may include countering the 'heat island effect' described in Section 6.2.4 ■ RAP survey will determine the affected cultural structures/sites and recommend the mitigation based on the community's suggestions ■ Timely sharing of project related information with all relevant stakeholders; ■ Provision of Grievance Redressal Mechanism to all impacted stakeholders in order to raise and register their grievances.

Impact Categories	Impacts	Impacted Stakeholders	Mitigation measure
Government Land (LUPA between RUMSL and New and Renewable Energy Department, Government of MP: Informally occupied Land: Captured/encroached for agriculture or grazing, prohibiting use by other people	■ Several areas of this Government land have been informally (and illegally) encroached by local land owners for cultivation of crops, livestock grazing, etc. ■ Anecdotal evidence suggests that whereas in some villages the encroachment is done by households that are relatively affluent and have the financial means to bring land under cultivation, majorly from Rajput and Patel caste groups, in others, it is done by poorer households that are landless. The extent of each type of occupation will be determined through the RAP survey; ■ Additionally, there are cases where households that were allotted patta lands, which were found unsuitable for cultivation, started cultivating unused parcels of Government land of nearly equivalent area; ■ It was also reported that the encroachers/occupiers pay fines to the Government (revenue department) self-reporting a smaller proportion of land than is actually squatted upon/ encroached. There are no reliable records of the actual extent of government land encroached/occupied for agriculture. ■ Additionally, there are encroachments reported by Bhil community and sharecropping being done by Banjara community residing in Dehripal Chak village; ■ The Government land that is encroached/ squatted upon is also reportedly being sold for agricultural activity by its informal claimants; ■ If encroached/ squatted land is taken for the project it would affect the following groups: – Encroachers/squatters who have occupied (and developed) government land for agriculture (these are reported to be land owners and also some landless households) and belonging to the Project villages, including the Bhil community households from near Parsula and Dehripal villages;	■ Squatters and Encroachers (including Bhil community); ■ Agricultural labourers engaged on the encroached/ squatter land parcels; ■ Sharecroppers from Banjara households cultivating in the area; ■ Buyers of the informal/ encroached/ occupied (undocumented) Government land parcels; ■ Local Community.	■ RUMSL shall serve a three months advance notice to the project affected persons (PAPs) to manage the potential losses to standing crops; ■ In case of crop losses ensuing from project activities, RUMSL shall pay compensation for crops, at full replacement cost, though no compensation for land will be made; ■ Timely sharing of project related information with all relevant stakeholders and/ or in case of crop losses, provision of (i) subsistence allowance; (ii) training allowance; and (iii) temporary employment in project works; ■ Additional entitlements may be determined after completion of the RAP surveys and presented in the RAP-LRP ■ Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievance.

Impact Categories	Impacts	Impacted Stakeholders	Mitigation measure
	– Agricultural labour employed seasonally, to work in these fields; – Sharecroppers (understood to be largely from Banjara community) cultivating the land parcels; – The community at large, using common grazing land is already deprived of these areas as they are no longer available to them for grazing, so, they will not be affected.		
Construction Phase Impacts			
Temporary occupation of land for construction phase activities: ■ Labour Camps; ■ Safety Setbacks; ■ Storage areas; ■ Parking areas; ■ Other construction related temporary land requirements, etc.	■ The land required for temporary activities like setting up of a number of labour camps for the required duration, land for safety setbacks, storage areas, parking areas and other construction related temporary land requirements, if these are located outside the boundary of the Project Area. If all these activities can be accommodated with the Project footprint, the impacts from temporary land lease-rent, will be avoided; ■ COVID 19 related infection risks may persist and may be enhanced for workers, and may need to be especially managed both, within labour camps and in the interactions of workers and the local community	■ Owners of land required for temporary occupation and use ■ Users of land ■ Local Community	■ Adequate lease/ rents to the land owners; ■ Restoration of land to its original state, or better, at the time of handing it back to the owners; ■ Compensation for the loss of livelihoods to the users of the land required for temporary use as this will temporarily economically displace them; ■ Application of all precautions to implement and follow the COVID-19 related safeguards, as relevant and as prescribed by the government, at that time[1]; ■ Timely dissemination of project related information with all relevant stakeholders, in order to serve advance notice and reduce the extent of losses/ impacts; ■ Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievance.
Community Health and Safety including accident risks for animals	■ The movement of material and machinery would pose health and safety risks to the community and livestock as the vehicular movement will increase in the area and may	■ Local Community; ■ Livestock Owners or Graziers;	Stakeholder engagement through the project cycle and an effective Grievance Redressal Mechanism to avoid, mitigate and mange conflicts and disagreements.

[1] A specific set of measures or a protocol will need to be developed, based on the situation and medical advice that is current at that time, since this is a rapidly changing and developing subject

Impact Categories	Impacts	Impacted Stakeholders	Mitigation measure
	result in collision and accident risks, and create additional vehicular and dust pollution, affecting people, animals and potentially affecting crops in the vicinity of the corridor of movement; ■ Labour influx in the area due to construction phase may lead to community health and safety related impacts or risks which may include - Potential spread of communicable diseases (infectious and vector-borne), if external labour will be sourced from outside the region, - The issue of COVID-19 related infections may remain a relevant concern and may need to be especially managed both, within labour camps and in the interactions of workers and the local community - Conflicts with local community resulting from disagreements over other issues and local impacts	■ Workers engaged during construction phase	As part of the stakeholder engagement and information disclosure process, ■ The community will be provided with an understanding of the activities to be undertaken and the precautions taken for safety; ■ The project will also propagate health and safety awareness amongst the community; ■ Special measures will be followed for managing COVID 19 risks and response, with adequate awareness and information dissemination ■ The traffic movement for the project in the area will be regulated to ensure road and pedestrian (including livestock) safety; ■ RUMSL shall maintain safe distance of project components from schools, hospitals, etc. in order to avoid interactions with community hotspots and hence risks of accidents; ■ The Contractor shall be informed of the EHSS practices that are expected from its workers during the construction phase engagement. Obligations like preparation of Traffic Management Plan, Local Procurement Plan, EHSS Plan, etc. shall be communicated to them at the time of selection and appropriate clauses should be included at the time of contract finalization; ■ The contractor shall be required to adhere to IFC's accommodation guidelines, for the labour camps in terms of provisions, sanitation facilities, etc. thus limiting the probability of diseases and infections in the local community on account of improper management of waste;

Impact Categories	Impacts	Impacted Stakeholders	Mitigation measure
			■ The movement of workers from the project site and labour camps should be regulated and similarly the project boundary and labour accommodation to check for unauthorized visitors/ outsiders entering the site in order to avoid any possible tensions between the migrant workforce and host community; ■ RUMSL shall put in place a grievance redressal mechanism to allow for the workers and community members to report any concern or grievance related to project activities.
Stress on Community resources - Water and Forest, Roads	■ Depletion of water resources in the area may take place due to use for project related activities like construction, use for drinking water, cooking and sanitary purposes, etc. potentially affecting water availability for the local population, that depends on the same resources; ■ Potential loss of forest resources due to exploitation triggered by influx of labour in the area, thereby affecting the stock available for the local community; ■ Wear and tear of roads may take place due to movement of heavy machinery on the roads, creating movement problems and risks for local road users.	■ Local Community;	■ There will be a worker Code of Conduct defined by RUMSL that prevents workers and contractors from using the local resources like water, forest. Refer ***Section 6.2.2*** for detailed mitigation measures; ■ An induction session will be organised for the migrant workers where they will be sensitized on the Do's and Don'ts during their stay near project location, which would include aspects on conservation of community's resources; ■ The contractor shall be asked to use Tanker water supply during the summer months, which are dry months in which water scarcity issues are reported by the community. In other months, the contractors will be allowed to use water from local sources, only after agreement with the local communities; ■ Periodic maintenance activities for roads used for transportation of goods for the project shall be the undertaken by RUMSL, through its contractors;

Impact Categories	Impacts	Impacted Stakeholders	Mitigation measure
			■ There will be a set of contractor obligations that require preparation of Traffic Management Plan, Local procurement plan, etc. in order to safeguard community's resources; ■ Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievance on misuse of locally available resources.
Employment and entrepreneurship opportunities during construction	■ The construction phase will provide a boost to the local employment as a higher number is expected to be engaged as construction labour during construction phase; ■ Development of smaller vendors in the area through small shops, petty contractors, etc. providing essential goods and services during the construction phase; ■ There will be an impact on the local food basket due to increased demand for agricultural products and food items.	■ Members of local community that can be engaged as labours for the construction phase; ■ Existing vendors.	**Enhancement measures** ■ The sourcing of local labour wherever possible should be made obligatory through setting of targets, for the Solar Project Developers and sub-contractors and in all major procurement activities; ■ Preference should be given to the land losers and vulnerable population in the Project Villages, to the extent practicable, and based on agreed targets; ■ Employment of members of SC-STs and Women Headed households should be encouraged by the Solar Project Developers through documented agreement with contractors/ sub-contractors and a may be set at a minimum of 20percent of total workers or person-days of employment, building up to 30 percent in the operations phase; ■ Engagement of local vendors, to the extent possible, for the goods and services required for the project during construction phase; ■ The project proponent will establish a mechanism to audit subcontractors and suppliers with respect to compliance of utilizing local labour and resources;

Impact Categories	Impacts	Impacted Stakeholders	Mitigation measure
			■ Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievance with respect to information sharing related to jobs and access to jobs.
Operations Phase Impacts			
Community Health and Safety	The Operations phase would have very limited activity outside the project site as the construction phase would have been over and the scale of activity and workforce at the project footprint area would have reduced significantly. This would lead to far fewer impacts: ■ Less or negligible noise, ■ Fewer workers at site on near project villages, ■ Reduced traffic load (compared to construction phase) from the movement of people and goods.	■ Local Community; ■ Livestock and Livestock Owners	■ Community engagement and sensitization sessions should be re-organised at the beginning of Operations phase, in order to mention about the new developments in the area and provide an understanding of the precautions to be taken for safety; ■ Where community residential clusters are closer to the project boundary, maintain a safety setback (as relevant) to mitigate the heat island effect ■ Additional precautions may be needed to address the COVID-19 related safeguards, as relevant and as prescribed by the government, at that time ■ Project's Grievance Redressal Mechanism for the community shall still be in implementation to deal with any concerns of community health and safety, being raised by the local community.
Impact on Employment	The Operations phase would require much smaller workforce as compared to construction phase and the skillset of the required workforce shall be different. The Operations phase would require Engineers, Technicians to manage the Plant operations and amongst the requirement of semi-skilled workers in limited numbers for housekeeping and Security related jobs, on the payroll of RUMSL. Additionally, there may be some vacancies with the private Solar Project Developers (SPDs) that may have some local employment, if feasible.	■ Local Community	**Enhancement Measures** ■ RUMSL shall ensure that the Solar Project Developers (SPDs) advertise the roles of Technical staff required during operations phases, in the local newspapers to enable hiring of competent people from nearby areas, to the extent feasible; ■ Preference shall be given (to the extent feasible) to hire competent members from PAHs for semi-

Impact Categories	Impacts	Impacted Stakeholders	Mitigation measure
			skilled jobs like housekeeping or Security Guards.
	Impacts on Vulnerable Groups		
Impacts on Indigenous Communities/ Vulnerable Groups	■ Out of the three phases, the Indigenous Communities and vulnerable groups are understood to be impacted the most during Planning phase of the project, on account of loss of livelihoods linked to land being procured for project. ■ Since this group (Bhil tribe) is understood to have encroached land for agriculture (refer ***Section 4.5.6.2*** for details) and work as agricultural workers, they are not documented owners or users of land as per records and the project related land-purchase or compensation measures would not be directly reaching out to this group.	■ SC/ ST communities ■ Vulnerable households	■ To identify and assess the extent of impacts on this group, a review of the scope of FPIC and IPP, in terms of remaining impacts on IP groups, their traditional livelihoods and customary land use; including dependence on natural resources, will be undertaken; ■ Based on this review, the target groups for the FPIC process will be identified in terms of villages and number of households in each village. ■ It should be noted that the exact number of households may be identified only through the RAP survey and resource mapping, as part of the FPIC work. ■ Review the consultation process carried out as part of allotment process of unoccupied government land through discussions with personnel from the Land Division of District Magistrate office to access the Gram Sabha resolutions as part of the land allotment process, will be included in the FPIC work. ■ Relevant details in relation to the Gram Sabha Resolution will be collected to understand implications for any legacy issues. ■ FPIC work will ensure stakeholder engagement, ensure adequate representation of the Indigenous groups and vulnerable groups, and specific engagement activities are undertaken

Impact Categories	Impacts	Impacted Stakeholders	Mitigation measure
			with these groups, however these principles will also be applied at other places where fewer ST members are present and FPIC is not applicable; ■ Ensure that the grievance management mechanism established is accessible to these groups.
	Impacts on Women		
Impact on Women (Construction phase)	■ At this stage, the details of land owners are not known. Therefore, assessment of women land owners and associated impacts on livelihood, income, economic dependability, and significance of these impacts compared to other groups who face similar impacts will be determined and included in the RAP-LRP. Other than this, impacts on women groups can be linked to: ■ Safety and security from the migrant labourers, ■ Loss of livelihood and income; ■ Potential impacts on women within households affected by private and patta land procurement, where women are not land owners: - Women may be potentially affected more severely in such households, if they are being rendered land-less - Risk of gender based violence from delayed payments or other land ownership based conflicts ■ Women Headed households (both Joint as well as independent) may potentially become more vulnerable in cases of sale of land for the project, if land is not in their name, or they do not receive the benefits. ■ Women land owners may face additional risks of not being included in negotiations, or other key meetings due to prevailing	■ Women community members in Project villages; ■ Women Headed households	■ A Gender Action Plan is prepared for the Project where women focussed engagement is detailed (refer **Appendix E;** ■ Provide alternative arrangements for grazing land, and create access for ease of use to collect fuelwood, and fodder; ■ Ensure the participation of women in the grazing area improvement and fodder intensification programme, proposed as part of livelihoods restoration activities but may also be expanded to cover the local population through support from the community development programme of the SPD (as part of CSR). ■ Ensure that the employment of women from vulnerable households is done for the project and efforts are made for development of women owned enterprises in the area, from where procurement for project related needs is undertaken; ■ Undertake a profiling of the various social groups in the Study Area, to understand the individual

Impact Categories	Impacts	Impacted Stakeholders	Mitigation measure
Operations Phase	cultural norms and may not therefore receive the benefits and advantages compared to those who do participate ■ Access to jobs during the construction phases generally skews in favour of males, thus preventing women from availing project benefits. ■ Women and girls are disproportionately at risk in terms of safety (gender based violence, harassment, curtailed movement, reduced access to resources) during the construction phase, with the arrival of migrant labourers in the construction phase and their accommodation being planned near the project villages. ■ The nature of impacts envisaged, affecting women in the Operations phase are likely to be as follows: – The extent of outsiders and migrant population in the area would have reduced along with risk to their safety; – There would be limited requirement of labourers' jobs or vendor-ship opportunities in Operations phase, which might render them in search of livelihood options again.		needs and concerns of the various women belonging to different social groups and design community development, community investment and CSR programmes in light of the same, to ensure that benefits also target women; ■ As part of the stakeholder engagement, RUMSL shall ensure and communicate to the private Solar Project developers, that Women focussed discussions are conducted in order to ensure adequate representation of the Women and their needs and concerns in order to design specific engagement activities. This is especially significant due to prevailing social norms where women do not participate and speak if men from the village are also present in the meeting; ■ Provision of Grievance Redressal Mechanism to all the stakeholders in order to raise and register their grievances.

6.4.3 Assessing significance of impacts

For the assessment of social impacts, the sensitivity and magnitude criteria outlined in ***Section 6.1*** has been used.

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

6.4.4 Planning Phase Impacts

6.4.4.1 Impact due to Private Land Purchase

Context and Receptors

The Private land identified for the Shajapur Solar Park comprises approximately 108.9 ha which has been reduced significantly from the identified land area of nearly 181 ha, through the optimization process. The identified private land is largely used for agricultural activity. Some of the private land parcels that were initially identified that were part of an inhabited settlement and have been carved out from the Project boundary, with the application of avoidance measures. Thus, there is understood to be economic displacement due to project related private land purchase. Although physical displacement was understood to be avoided, this needs to be confirmed during RAP surveys. There is agricultural labour engaged at these private agricultural land parcels which comprise of members of households with marginal or no landholdings, who shall also face loss of income/livelihoods linked to these land parcels; however the estimate of people working as agricultural labour on these land parcels will be assessed through the RAP surveys.

The area surrounding the private identified land for project would still be used for cultivation and livestock grazing in future and the project may restrict access or make accessibility difficult for the local community, livestock, etc. especially during the construction phase. The potential impacts caused due to procurement of private land are detailed in ***Table 6.16.***

Embedded/In built control

- RUMSL shall procure private land based on principles of negotiated settlement, and the amount to be paid for the land sale shall be determined using the principles of MP Mutual Consent Policy 2014. However, RFCTLARR 2013 Act may only be used for land parcels that either do not have clear titles, or have ownership related disputes.
- To clarify, as stated in Section 2, the RAP-LRP will be prepared for all impacted families including the consenting private/patta land owners who are economically displaced wherever negotiated settlement process have been undertaken. The LRP will also cover economic displacement impacts on agricultural labor, working on the procured/purchased private land
- An amount of INR 2 lakhs per MW has been envisaged to be provided to the local district collector to facilitate development activities in the area and these activities may range from skill development, training, to restoration of local water bodies, and other local development works. This may be used to extend the scope of the Livelihoods Restoration Program to achieve greater coverage in the village, over time (as the LRP will be for a limited period and only for those entitled as per the RAP). This recommendation will be included in the LRP.

Impact significance

The impact of change in land ownership and use which imposes restrictions to the identified private land and surrounding agricultural land in the construction phase is evaluated to be **Moderate** as approximately 108.9 ha of private land will be procured for the project across two Tehsils and the nature of change is irreversible.

Additional Mitigation Measures

- The private land owners should be provided with either alternate land parcels with similar nature of productivity and financial assistance to prepare the land for cultivation or adequate payment against land purchase which should be above the prevalent market price, as per the Mutual Consent Policy 2014;
- A Resettlement Action Plan shall be formulated to cover economic displacement categories (subject to the qualifications stated under embedded controls) to address the following:
  - Displacement impacts to people who had encroached/squatted upon government land, based on their status and tenure
  - Livelihood impacts on the land owners if the holdings that remain are sub-optimal, or owners are rendered landless;
  - Additional livelihood assistance to vulnerable households, or women headed households, with skill trainings or entrepreneurship support, etc. under the LRP;
  - Impacts on land users or regular agricultural labourers affected
  - The general community being impacted due to access restrictions/easements;
  - Other impacts on private land owners.
- Preference to members of the families rendered landless or with sub-optimal holdings post selling land to the project for employment opportunities in the Construction/operation phase and/or small contracts;
- Timely sharing of project related information with all relevant stakeholders;
- Provision of Grievance Redressal Mechanism to all impacted stakeholders in order to raise and register their grievances.

Residual Impacts

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

Impact	Impact on private land sellers, agricultural labourers and community due to change in land ownership and use				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
	Project villages				
Frequency	Planning Phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Vulnerability of social Receptors	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Moderate.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	

6.4.4.2 Impact due to Patta Land Purchase

Context and Receptors

The Patta Land identified for the project comprises approximately 5.2 ha from Parsula village. The Patta land in the area is understood to be largely used for agriculture in the area; however, there are reported instances of non-usage of Patta land parcel allotted to the owner due to its limited suitability for agricultural purposes. Additionally, some of these patta owning households are also reported to have squatted upon alternate Government land parcels (of approximately the same area that was allotted at Patta) that were lying unused and were suited for cultivation. As mentioned in ***Section 4.5.6.2*** the Patta holders are typically from SC and ST communities that were granted Pattas by the Government on account of their landlessness and vulnerability. Some Patta holders are using the lands for their own purpose (agriculture or grazing), while some Patta holders have sold of their lands in lieu of economic benefits from the sale, probably in times of distress (refer ***Section 4.5.6.2*** for more details). Thus the impacts of negotiated purchase of Patta Lands shall be on Patta holders, non-recognised Patta owners (those who purchased rights to use Patta land through a verbal agreement without a legally documented sale of land by original and registered Patta holders), agricultural labourers engaged on the identified land parcels and the community affected due to access restriction to their assets or grazing land for livestock. The impacts caused due to procurement of Patta land are detailed in ***Table 6.16.***

Embedded/In built control

- RUMSL shall procure Patta land based on the principles of negotiated settlement, and the amount to be paid for the land sale shall be determined using the principles of MP Mutual Consent Policy 2014. However, RFCTLARR 2013 Act may only be used for land parcels that either do not have clear titles, or have ownership related disputes.
- To clarify, as stated in Chapter 2, the RAP- LRP will be prepared for all impacted families including the consenting private/patta land owners who are economically displaced wherever negotiated settlement process have been undertaken. The LRP will also cover economic displacement impacts on agricultural labor, working on the procured/purchased patta land.
- An amount of INR 2 lakhs per MW has been envisaged to be provided to the local district collector to facilitate development activities in the area and these activities may range for skill development, training, restoration of local water bodies and other local development works. (Recommendations for utilisation stated above).

Impact significance

The impact of change in land ownership and use which imposes restrictions to the identified Patta land and surrounding agricultural land is evaluated to be **Minor** as the quantum of land identified and corresponding number of households directly impacted from the change is understood be small; however it needs to be understood that the nature of change is irreversible.

Additional Mitigation Measures

- Patta is treated at par with ownership, for the land procurement process. Thus treatment of Patta Land holders will be similar to Private land owners and Patta land holders should be provided with either alternate land parcels with similar nature of productivity and financial assistance to prepare the land for cultivation or adequate payment against land purchase which should be above the prevalent market price, as per the Mutual Consent Policy 2014;
- A Resettlement Action Plan-shall be formulated to cover economic displacement categories (subject to the qualifications stated under embedded controls) to address:
    - Displacement impacts to people who had encroached/squatted upon land, based on their status and tenure

- Livelihood impacts on the land owners if the holdings that remain are sub-optimal, or owners are rendered landless;
- Additional livelihood assistance to vulnerable households, or women headed households, with skill trainings or entrepreneurship support, etc. under the LRP;
- Impacts on land users or regular agricultural labourers affected
- The general community being impacted due to access restrictions/easements;
- Other impacts on private land owners.

- Preference to members (rendered landless or with sub-optimal holdings) of the families post selling land to the project for employment opportunities in the Construction/operation phase and/or small contracts;
- Additional safeguards to be addressed through the RAP-LRP for Patta Land owners, including those who may have 'purchased' the patta informally from the original allottees based on a verbal agreement and without documentation;
- Timely sharing of project related information with all relevant stakeholders;
- Provision of Grievance Redressal Mechanism to all impacted stakeholders in order to raise and register their grievances.

Residual Impact Significance

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

Impact	Impact on Patta land owners (formal and informal), agricultural labourers and community due to change in land ownership and use				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
	Project villages				
Frequency	Planning phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Vulnerability of social Receptors	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Minor.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	

6.4.4.3 Impact due to Land Use Permission Agreement (LUPA) of Government Land

Context and Receptors

The proportion of Government land identified for the project is approximately 88.2 percent. The various uses of Government land (discussed in Section 4.5.6) are encroachment and squatting by private and Patta land owners for agriculture, livestock grazing, livestock sheds, firewood collection, etc. Thus, the stakeholders likely to be impacted by long lease of Government land by RUMSL are local community using the land for access to their assets and Common property resources, livestock owners whose livestock grazes on the Government land for approximately 8 months in a year, and squatters and encroachers (including Bhil and Banjara communities), who are not documented users of the land, but their livelihoods will be affected due to

non-availability of the land, that they have prepared by investing cost to make fields suitable for cultivation. The impacts caused due to procurement of Government land are detailed in Table 6.16.

Embedded/ In built control

- There is a provision that a minimum of 2 percent of total agricultural land available in the Project villages is secured for grazing of livestock, after land allotment for the project.
- Grazing rights on areas -Charnoi/charagah- designated in government records are not allotted for projects. However, in some villages, it may be the case that less than 2% land is available for grazing (charnoi/charagah) even before the project allotment. In such cases, the District Collector can designate other government land as charagah and charnoi, for grazing. However, the functional adequacy will be more a function of quality and access
- The adequacy and access (for all users) of this area will need to be confirmed in terms of quality (of grazing land) and ease of access (proximity) for the community of graziers, to confirm if further provisioning support is required.
- An amount of INR 2 lakhs per MW has been envisaged to be provided to the local district collector to facilitate development activities in the area and these activities may range for skill development, training, restoration of local water bodies, etc.

Impact Significance

The impact of long terms lease of Government land by RUMSL will change the current land use and imposes restrictions to the current economic activity, impacts access and easements for the community and affects livestock grazing significantly, as it is a large area (860.6 ha. approximately). Thus the significance of this impact is evaluated to be **Major** as a significant number of households are likely to be impacted from the change and the nature of change is irreversible. Moreover, given that all the households in the project villages own livestock and need land for grazing, the 2% allocation needs to take into account that the land parcel should not significantly increase travel distance for grazing (less than 3 km) to reduce time cost for the graziers, and ensure that it is accessible to all social and caste groups, with safety for women and girls. The grazing land parcels identified for allocation may need land development investments to make them suitable for fodder availability for the open grazing livestock.

Additional Mitigation Measures

- Provision for alternate grazing land for livestock shall be made near the project villages or confirmation of adequacy and quality of remaining grazing land shall be provided through discussion meetings with Sarpanch and Village Secretaries and consultations with the affected community, with representation by all groups- to be confirmed during the RAP survey (including the assessment of access and quality of the remaining area);;
- Development of a program to include grazing area improvement and fodder intensification (cultivation) in designated areas, as agreed with the Tehsil office and the local dependent community of graziers. This may include the development of community fodder lots under the Livelihood restoration activity in the area as part of Resettlement Action Plan. This, if feasible, shall serve the purpose of improving the quality of the grazing land, ensuring access and as an income generating activity for people losing land based livelihoods.
- Provision of easements shall be maintained in order to not sever the access to CPRs for the community;
- The Solar Park Developer is also encouraged to explore identifying unused areas within the solar park boundary and a part of the area with solar panels (10% area), for fodder cultivation, or controlled and managed open grazing of goats, or agriculture (selected crops), to explore the potential of ‘mixed land use’ areas in solar parks that benefit the local community too. This may be done with the agreement of RUMSL and in partnership with domain specialist agencies and local organisations working in the

region. Additional positive effects may include countering the 'heat island effect' described in Section 6.2.4

- Preference of members of Project affected households (PAH) in employment opportunities during construction phase;
- In case of crop losses for Squatters and encroachers, RUMSL shall ensure the provisions of the RAP-LRP, based on the ESMF are followed and loss of standing crops are compensated at full replacement value, though no compensation for land will be made.;
- Compensation for loss of structures shall also be covered as part of RAP report;
- The RAP-LRP will contain mitigation/compensations determined, based on the ESMF and applicable frameworks, for the eligible encroachers/occupiers/squatters on government land, after the RAP survey is concluded.
- Timely sharing of project related information with all relevant stakeholders in order to serve advance notice and reduce the extent of impacts and losses;
- Provision of Grievance Redressal Mechanism to all impacted stakeholders in order to raise and register their grievances.

Residual Impact Significance

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

Impact	Impact due to long lease of Government land and land use change				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
	Project villages				
Frequency	Planning Phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Vulnerability of social Receptors	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Major.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate**	Major	

**If additional enhancement measures are included by the project developer, with RUMSL's consent, it may provide positive benefits to the community over the life of the project, further reducing the residual impact significance to minor.

6.4.5 Construction Phase Impacts

6.4.5.1 Temporary occupation of Land for Construction Phase Activities

Context and Receptors

The construction period for the Shajapur Solar Park is expected to last for about 21 months, during which various construction related activities will be in progress and may require additional land (apart from identified land for project) for the following activities:

- Setting up of Labour Camps;
- Safety Setbacks;
- Storage areas for construction material;

- Parking area for vehicles;
- Other construction related temporary land requirements, etc.

Although the DPR does not identify any additional land requirement, this need may be determined by the contractor, for the construction phase.
The land required for temporary activities like setting up of a number of labour camps for the required duration, land for safety setbacks, storage areas, parking areas and other construction related requirements would be met by renting/ leasing additional land from the local community; however would lead to increased disruptions in access for local community.

If all these activities can be accommodated with the Project footprint, the impacts from temporary land lease-rent, will be avoided.

The impacts caused due to temporary occupation of private land for construction phase activities are detailed in ***Table 6.16.***

Impact Significance

The significance of this impact is evaluated to be **Minor** based on the nature, duration and extent of the activity.

Additional Mitigation Measures

- Provision of adequate lease on rental amounts to the land owners shall be ensured by RUMSL;
- The land leased/ rented shall be restored to its original state (or made better) at the time of handing it back to the owners;
- Provision of compensation for the loss of livelihoods to the users of the land required for temporary use as this will temporarily economically displace them;
- Timely dissemination of project related information with all relevant stakeholders, in order to serve advance notice and reduce the extent of losses/ impacts;
- Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievance.

Residual Impact Significance

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

Impact	Impact due to temporary occupation of land during construction phase				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
	Limited to Project Footprint area and Project villages				
Frequency	Construction Phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Vulnerability of social Receptors	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Minor.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large

Residual Impact Significance	Negligible	Minor	Moderate	Major

6.4.5.2 Community Health and Safety

Context and receptor

The receptors for impacts on community health and safety include the local community within the Study Area who may be present in the vicinity of the project, for grazing purposes or while commuting as well as the workers engaged during construction phase. Additionally, the community uses the land for open defecation which also makes them vulnerable due to safety threats present in the area identified for project due to construction activities and barriers present. The construction phase activities, laying down of transmission line towers and construction of substations and movement of material and personnel may result in impacts on the health and safety of the community. These activities will involve the use of machinery and power transmission lines. Furthermore, the movement of material and personnel via the access roads may result in damage to human life or livestock due to accidents, especially during night time. Review of the project boundary and site assessment shows that existing access roads to villages may be disrupted/blocked, and this will lead to higher time costs associated with accessing markets, schools, and hospitals, for the villages.

Additionally, the establishment of labour camps for workers from outside areas/ states may lead to spread of infections and diseases due to interactions between the migrant workers and local community, improper management of waste and underdeveloped sanitation facilities, etc. The situation of infections due to the spread of COVID19 requires special provisions of safety and sanitisation for engagement and management of migrant labourers for the period that this threat is considered active. All government prescribed safety measures, updated to the most recent and relevant ones, will have to be ensured by the contractors. The Community health and safety impacts in construction phase are detailed in ***Table 6.16.***

The embedded controls, as derived from the ESMF comprise the following:

- Alternate arrangement for fuel wood, heating and cooking should be made to meet fuel wood requirement of the labour ;
- Migrant workforce should be prohibited from disturbing the flora, fauna including hunting of animals, Wildlife hunting, poaching and tree felling or using common resources (wells, forests etc.).
- Treated Water shall be made available at Site for Labour drinking purpose.
- The movement of heavy machinery and equipment's shall be restricted to defined routes and agreed hours during the day, with no night-time activities that will cause disturbance to the community.
- Proper signage's to be displayed at major junctions.

Impact Significance

Based on the above understanding, the impact is assessed to be **Moderate**.

Additional Mitigation Measures

In addition to the embedded measures, the following risk mitigation measures are suggested to minimize the potential risks/hazards to community:

Responsibilities of RUMSL

- Ensuring stakeholder engagement through the project cycle and provision of an effective Grievance Redressal Mechanism to avoid, mitigate and mange conflicts and disagreements;
- As part of the stakeholder engagement and information disclosure process, the community will be provided with an understanding of the activities to be undertaken and the precautions to be taken for safety;

- RUMSL shall maintain safe distance of project components from schools, hospitals, etc. in order to avoid interactions with community hotspots and hence risks of accidents;
- The Contractors to be engaged by RUMSL shall be informed of the EHSS practices that are expected from its workers during the construction phase engagement. Obligations like preparation of Traffic Management Plan, Local Procurement Plan, EHSS Plan (including for managing COVID 19 related risks), etc. shall be communicated to them at the time of selection and appropriate clauses should be included at the time of contract finalization;
- The contractor shall be required to adhere to IFC's accommodation guidelines, for the labour camps in terms of provisions, sanitation facilities, etc. thus limiting the probability of diseases and infections in the local community on account of improper management of waste;
- RUMSL shall put in place a grievance redressal mechanism to allow community members to report any concern or grievance related to project activities. The contractors engaged shall also be contractually required to put in place a similar mechanism to deal with concerns raised by the community (or external stakeholders) and the workers engaged during construction phases.

Responsibilities of Contractors

- The contractor shall induct migrant workers on health and safety awareness and practices to be followed at site during construction phase;
- The contractors shall cordon off areas that are under construction and put relevant safety signs to restrict movement of local community members or workers engaged at site, which may become safety threats;
- The Contractors shall prepare a Traffic Management Plan and traffic movement due to the project in the area will be regulated to ensure road and pedestrian (including livestock) safety;
- Additionally, training on vehicular safety shall be organised for the transport workers.
- The movement of workers from the project site and labour camps shall be regulated and similarly the project boundary and labour accommodation to check for unauthorized visitors/ outsiders entering the site in order to avoid any possible interactions leading to conflicts or tensions between the migrant workforce and host community;
- Contractors shall ensure that regular health check-ups are conducted for the construction phase workers (especially migrant workers staying in temporary labour accommodation) and any major illnesses are reported in the Block level medical authorities at the earliest; The labour accommodation should be clean and hygienic and disposal of kitchen waste and food waste shall be done on a daily basis in an appropriate manner;
- Proper sanitation facilities shall be provided, taking into account the number of labourers that will be using the facilities, both at construction site, as well as labour accommodation.

Residual Impact Significance

The significance of impact will be reduced to **minor** on implementation of mitigation measures.

Impact	Impact on Community Health and Safety				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term		Permanent
Impact Extent	Local		Regional	International	
Impact Scale	Limited to Project Footprint area, Project villages and Study area for transportation related activities				
Frequency	Construction Phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large

Impact	Impact on Community Health and Safety				
Resource/Receptor Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Moderate**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of Residual Impacts is considered **as Minor**				

6.4.5.3 Stress on Community Resources

Context and Receptors

The community resources like water collection and storage areas, forest resources and roads will be the prime receptors for the impact caused by project activities. The project related construction activities are understood to span across 21 months and would require water for drinking, cooking and sanitary purposes. This might affect the water table in the area, especially during the summer months, where water scarcity is reported over the last few years.

Additionally, the impact on forest resource can take place due to labour influx and their unregulated movement around the Project footprint area and project villages.

The roads used by the community would also face wear and tear due to transportation of heavy machinery and material, which shall lead to early damages than their anticipated life span. The Impacts due to stress on community resources in construction phase are detailed in ***Table 6.16.***

Embedded/Built-in Controls

The following embedded controls have been identified:

- Undertaking rain water harvesting activities or development of water bodies to provide more water holding bodies around the villages using the CSR funds as mentioned in the DPR;
- In carving out access spaces to existing water bodies, movement of large livestock needs to be taken into account
- Create water recycling systems that can reduce water use for cleaning the panels of the plants, as covered in the section on Physical Impacts (6.5)

Impact Significance

The significance of impact from the above activities is understood to be **Minor.**

Additional Mitigation Measures

RUMSL responsibilities

- There will be a worker Code of Conduct defined by RUMSL that prevents workers and contractors from using the local resources like water, forest, which will be shared with private SPDs for onward sharing with sub-contractors and its workers;
- An induction session will be organised for the migrant workers where they will be sensitized on the Do's and Don'ts during their stay near project location, which would include aspects on conservation of community's resources;
- The contractor shall be asked to use Tanker water supply during the summer months, which are dry months in which water scarcity issues are reported by the community;

- Periodic maintenance activities for roads used for transportation of goods for the project shall be the undertaken by RUMSL, through its contractors;
- Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievance on misuse of locally available resources.

Residual Impact Significance

The significance of impact will be reduced to **Negligible** on implementation of mitigation measures.

Impact	Impact on Community Resources				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to Project Footprint area, Project villages and Study area for transportation related activities				
Frequency	Construction Phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Minor**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of Residual Impacts is considered **as Negligible**				

6.4.5.4 Impact on Employment and Entrepreneurship Opportunities

Context and Receptors

The social baseline conditions in the Study area suggest that major working population the Project villages are cultivators and agriculture labours. The existing scenario of agriculture in the Study Area as well as the increasingly stressed ground water scenario also indicates that it is not sufficient to meet requirements of the people dependent on agriculture. In absence of any industries and other sources of employment in the Study Area, people dependent on land based livelihoods will face issues with diminished household income and will have to resort to either agriculture or will migrate to other places for work, which may also not be a preferable option during the COVID 19 situation, which is anticipated to prevail for at least another year or so.

The construction phase will provide a boost to the local employment, as approximately 3500-4500 jobs are expected to be created in the period, hiring people from local and distant areas based on the skill set required. A higher number of unskilled labourers is required to be engaged for construction activities, which may be sourced locally Additionally, there would be some skilled labour required that may be available locally now (due to Covid 19 related reverse migration) or would need to be brought in from other states (if not present in local area) that would also lead to spike in economic activity in the area, during construction phase. This would lead to better business opportunities for smaller vendors in the area owning petty shops, petty contractors firms, etc. for providing essential goods and services to the project.

Additionally, there would be increased demand for agricultural products, animal based food products, etc., that may require enhanced production of associated items and opportunities for traders.

Impact Significance

The significance of this impact is understood to be **Moderate**.

Enhancement Measures

- The sourcing of local labour wherever possible should be made obligatory by RUMSL (through contractual provisions) for the Solar Project Developers and sub-contractors and in all major procurement activities;
- Preference should be given to the land losers and vulnerable population in the Project Villages, to the extent practicable;
- Employment of members of SC-STs and Women Headed households should be ensured by the Solar Project Developers through documented agreement with contractors/ sub-contractors;
- Engagement of local vendors, to the extent possible, for the goods and services required for the project during construction phase;
- The project proponent will establish a mechanism to audit subcontractors and suppliers with respect to compliance of utilizing local labour and resources;
- Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievance with respect to information sharing related to jobs and opportunities for vendor-ship.

6.4.6 Operations Phase Impacts

6.4.6.1 Community Health and Safety

Context and Receptors

The Operations phase would have very limited activity at the project site as the construction phase would have been over and the scale of activity and workforce at the project footprint area would have reduced significantly. This would lead to less or negligible noise, lesser workers at site on near project villages, reduced traffic load (compared to construction phase) and the general material supply related traffic would reduce.

However, the community shall still be a receptor of the impacts due to increased traffic, compared to the pre-project phase. There would be additional Transmission lines installed/ erected and may create access issues for community movement, if necessary precautions are not taken by the local residents. The community uses unused land for open defecation which also makes them vulnerable due to safety threats present in the area identified for project due to presence of additional components (like Transmission line towers) in the area.

As discussed in Section 6.2.4, communities that are residing close to the Solar Park may experience the Heat Island Effect due to the expanse of the PV solar panels (based on local conditions, for a few days in the year), but this is understood to dissipate over a 300m distance.

Impact Significance

Based on the above understanding, the impact is assessed to be **Minor**.

Additional Mitigation Measures

In addition to the embedded measures, the following risk mitigation measures are suggested to minimize the risks/hazards of construction activities onsite:

- Community sensitization sessions should be re-organised at the beginning of Operations phase, in order to mention about the new developments in the area and provided an understanding of the precautions to be taken for safety;
- Project's Grievance Redressal Mechanism for the community shall still be in implementation to deal with any concerns of community health and safety, being raised by the local community;

- Where community residential clusters are closer to the project boundary, maintain a safety setback (as relevant) to mitigate the heat island effect.

Residual Impact Significance

The significance of impact will be reduced to **negligible** on implementation of mitigation measures.

Impact	Impact on Community Health and Safety				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to Project Footprint area				
Frequency	Operations Phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Minor**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of Residual Impacts is considered **as Negligible**				

6.4.6.2 Impact on Employment

Context and Receptors

The Operations phase would require much smaller workforce as compared to construction phase and the skillset of the required workforce shall be different. The Operations phase would require Engineers, Technicians to manage the Plant operations and amongst the requirement of semi-skilled workers in limited numbers for housekeeping and Security related jobs, on the payroll of RUMSL. Additionally, there may be some vacancies with the private Solar Project Developers (SPDs) that may have some local employment, if feasible. The Shajapur DPR envisages that nearly 200 personnel will be employed in the Operations phase over a period of 25 years.

Impact Significance

The significance of this impact is understood to be **Minor**.

Enhancement Measures

- The private SPDs shall advertise the roles of Technical staff required during operations phases, in the local newspapers to enable hiring of competent people from nearby areas, to the extent feasible;
- The SPDs shall also designate a dedicated supervisor for management of social and community related aspects at the project site;
- Preference shall be given (to the extent feasible) to hire competent members from PAHs for semi-skilled jobs like housekeeping or Security Guards.

6.4.7 Impact on Indigenous Communities/ Vulnerable Groups

Context and Receptors

Vulnerability in the society is defined on the basis of the economic status of the households, and the difference in access to social, economic and political power between men and women. Thus households

with limited landholdings and resources are relatively vulnerable to changes in the immediate surroundings, affecting their livelihoods.

As discussed in ***Section 4.5.4,*** the project villages are characterised by a SC population of 24 percent and ST[1] population of 1.82 percent. The majority of the ST population consists of Bhils and there are some Banjara households also reportedly involved in share cropping in project villages of Moman Badodiya Tehsil. While there is no caste based distinction reported in terms of habitation patterns, practices, etc., the SC and ST households are generally reported to have lesser land holding than the general population. ST population is present in the villages of Parsula, Dehripal, Chouma and Fawaka villages with the highest proportion present in Parsula (refer Table 4.39 *or details)*.

While the land for the project is a combination of private, Government and Patta Lands, the details of the profile of private and patta land owners, in terms of financial and social profile are presently not available. The land identified for the project is used by the local community for grazing purposes, and does not have any specific SC/ST group usage in terms of grazing, cultivation (through encroachment or sharecropping), water body and cultural/religious property. However, since this is understood from the baseline that SC and ST households on an average has limited landholdings compared to other caste groups, the probability of members of these groups working as agriculture labourers is higher. Additionally, this groups is also understood to possess ownership of a relatively higher number of sheep and goats, compared to other groups in the community. The loss of land under traditional or customary use by Indigenous populations requires the FPIC process to be followed to seek consent for the project. The FPIC approach note (3rd Sept 2020) outlines the process of participation, engagement and information sharing with the identified ST groups, In Village Parsula. The project details along with the IPDP provisions will also be discussed, during the FPIC process.

Embedded/In Built Control

- As part of the Community development activities in the local villages, the Project proponent will identify specific programmes for SC/ST groups and vulnerable groups.
- Implementing the FPIC process in the identified ST settlement/cluster, in village Parsula
- Implementation of an Indigenous People's Development Plan (IPDP/IPP) that will provide livelihood programs specific to these communities;
- One of the assessments undertaken during the RAP survey will be identification of such vulnerable groups and assigning appropriate livelihood measures for them.

Impact Significance

Based on the profile of the stakeholder group, the impact significance is assessed to be **Moderate.**

Additional Mitigation Measures

In addition to the embedded measures, the following additional mitigation measures are identified:

- To identify and assess the extent of impacts on this group, a review of the scope of FPIC and IPP, in terms of remaining impacts on IP groups, their traditional livelihoods and customary land use; including dependence on natural resources, will be undertaken;
- Based on this review, the target groups for the FPIC process will be identified in terms of villages and number of households in each village.
- It should be noted that the exact number of households may be identified only post the site walk through and social mapping.

[1] ST community is considered akin to Indigenous population in India generally; however there are a number of ST groups present in India, some of whom have merged with the mainstream population in terms of habitation and occupational patterns, language, etc., while certain groups continue to follow distinguished cultural practices.

- Review the consultation process carried out as part of allotment process of unoccupied government land through discussions with personnel from the Land Division of District Magistrate office to access the Gram Sabha resolutions as part of the land allotment process.
- Relevant details in relation to the Gram Sabha Resolution will be collected to understand implications for any legacy issues.
- As part of the stakeholder engagement, ensure adequate representation of the Indigenous groups and vulnerable groups, and specific engagement activities are undertaken with these groups;
- Ensure that the grievance management mechanism established is accessible to these groups.

Residual Impact Significance

The significance of impact will be reduced to **minor** after implementation of mitigation measures suggested.

Impact	Indigenous Communities/Vulnerable Groups				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	The SC/ST Community and vulnerable groups may be negatively impacted by the project, in case the economic or developmental opportunities generated by the project are not equally accessible to them in comparison to other social groups.				
Frequency	Planning and Construction Phase				
Likelihood	Possible				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered to be **Moderate**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of Residual Impacts is **Minor**				

6.4.8 Impact on Women

6.4.8.1 Construction Phase

Context and Receptors

At this stage of the Project, the details of land owners are not known. Therefore, assessment of women land owners and associated impacts on livelihood, income, economic dependability, and significance of these impacts compared to other groups who face similar impacts – cannot be determined at this stage. Other than this, impacts on women groups can be assessed as follows:

Land purchase related payments of the private land procurement is likely to be transferred to the men, as most owners are likely to be men. Even as women have participated to improve and cultivate land, tended to livestock and been responsible for household work, they have little decision-making power in the households especially relating to financial matters of land and assets.

During consultations in the Project villages both in Shajapur and Moman Badodiya Tehsil villages, very few women were aware of the total land holding of their household or average income of the household. Therefore, it is highly likely that women may not directly be benefited from the monetary compensation

distributed against purchase of private land for Project. Moreover, they may not be able to take decisions related to how to use the monetary compensation or other benefits extended by the Project to their Project Affected Household. Lack of decision making power makes them vulnerable to loss of income (resulting out of misuse of compensation by other members of their household). This coupled with the loss or reduction in land holding can lower the household's standard of living.

Women's contribution as Main workers is nearly equivalent to men as explained in ***Section 4.5.7***, whereas amongst marginal workers, the contribution of women workers is at 52 percent while for men it is 19 percent.

This indicates that women undertake nearly equivalent main work as men and more women are engaged as marginal workers. In addition to this, household chores are entirely the responsibilities of traditional Indian rural set ups, concluding that women's contributions in household work and responsibilities is nearly equivalent and in most cases more than the men; however is granted lesser status in the households in many cases in terms of economic or other critical decision making, in aspect of sale and purchase of land or assets.

There are certain women headed households in the project area; however, in most cases these Women Headed families are provided financial support and security by other members of the family, as part of the prevalent joint family and living systems. However, certain independent women headed households have to fend for themselves, by working as labourers on agricultural fields.

These Women headed households (both joint as well as independent) face additional risks of not being included in negotiations, or other key meetings due to prevailing cultural norms and may not therefore receive the benefits and advantages compared to those who do participate. Thus they become a little more vulnerable in cases of sale of land for the project, where there is a chance that the proceeds from sale of land do not reach them. Additionally, the probability of access to jobs during the construction phases is also sometimes skewed in the favour of males, thus making these households more vulnerable.

Women and girls are disproportionately at risk in terms of safety (gender based violence, harassment, curtailed movement, reduced access to resources), with arrival of migrant labourers in the construction phase and their accommodation being planned near the project villages. The land procurement for the project will result impact women due to possible increase in their workload, potential risk of domestic violence if stresses are additionally created due to delayed payments, loss of employment,

Women may also have to cover more distance on foot to work on agricultural fields, for collection of fuel wood, etc. The loss of grazing land nearby will also lead to an increase in stall feeding activities which are solely taken care of by women.

Embedded/In Built Control

- As part of the Community Development Activities in the local villages, the Project proponent will identify specific programmes for women groups and Women Headed households.
- The migrant workforce engaged during construction phase shall be inducted in the initial phases on the Do's and Don'ts during their stay, which shall include limited engagement with local community, not causing disturbances to the community, etc.

Impact Significance

Based on the above the impact after implementing the embedded controls is assessed to be **Moderate.**

Additional Mitigation Measures

In addition to the embedded measures, the following additional mitigation measures are identified:

- A Gender Action Plan is being prepared for the Project where women focussed engagement is detailed in **– Appendix E**;

- Provide alternative arrangements for grazing land, and create access for ease of use to collect fuelwood, and fodder;
- Ensure the participation of women in the grazing area improvement and fodder intensification programme, proposed as part of livelihoods restoration activities but may also be expanded to cover the local population through support from the community development programme of the SPD (as part of CSR).
- Ensure that the employment of women from vulnerable households is done for the project and efforts are made for development of women owned enterprises in the area, from where procurement for project related needs is undertaken;
- Undertake a profiling of the various social groups in the Study Area, to understand the individual needs and concerns of the various women belonging to different social groups and design community development and CSR programmes in light of the same;
- As part of the stakeholder engagement, RUMSL shall ensure and communicate to the private Solar Project developers, that Women focussed discussions are conducted in order to ensure adequate representation of the Women and their needs and concerns in order to design specific engagement activities;
- Include provisions of coverage of women under skill training and Financial literacy training programs, as part of livelihood restoration activities by the project or through developmental programs of SPDs
- Provision of Grievance Redressal Mechanism to all the stakeholders in order to raise and register their grievances.

Residual Impact Significance

The significance of impact will be reduced to **Minor** after implementation of mitigation measures suggested in construction phase.

Impact	Women Groups				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	The women in the Project villages are understood to be impacted during Planning and construction phases				
Frequency	Planning and Construction Phases				
Likelihood	Possible				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered to be **Moderate**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of Residual Impacts is **Minor**				

6.4.8.2 Operations Phase

Context and Receptors

The nature of impacts are envisaged on women in the Operations phase will vary from construction phase as the extent of presence of outsiders and migrant population in the area would have reduced along with risk to their safety. Furthermore, there would be limited requirement of labourers' jobs or vendor-ship opportunities in Operations phase, which might render them in search of livelihood options again.

Embedded / In built Measures

The duration (months) and nature of employment (temporary) shall be communicated in advance to this group in order to manage impacts due job reductions.

Impact Significance

Based on the above the impact after implementing the embedded controls is assessed to be **Minor.**

Additional Mitigation Measures

The SPDs shall ensure appropriate measures for hiring of women, as per required skill set, are put in place, during the Operations phases.

Residual Impact Significance

The significance of impact will be reduced to **Negligible** after implementation of mitigation measures suggested in operations phase.

Impact	Women Groups				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	The women in the Project villages are understood to be impacted during Operations phases				
Frequency	Operations Phase				
Likelihood	Possible				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/Receptor Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered to be **Minor**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	

6.5 Summary of Impact Assessment

The table below presents the summary outcome of the comprehensive assessment of identified impacts pre and post mitigation during various phases of the Project.

Table 6.17 Summary of Impacts

Category	Impact Significance (without mitigation measures)	Impact Significance (post-mitigation)
Planning Phase		
Impact due to private land purchase	Moderate	Minor
Impact due to Patta land purchase	Minor	Negligible
Impact due to long lease of Government Land	Major	Moderate
Construction Phase		
Impacts on Land use and land cover	Moderate	Moderate
Soil Compaction and Erosion	Minor	Negligible
Waste Generation and Soil Contamination	Minor	Minor
Impact on Topography and Drainage	Moderate	Moderate to Minor
Impact on Water Resources	Major	Major to Moderate
Impact on Water Quality	Moderate	Minor
Impact on Air Quality	Minor	Minor
Impact on Noise Quality	Moderate	Moderate to Minor
Occupational Health and Safety	Minor	Minor
Impact due to Vegetation Clearance and Construction Activity	Minor	Negligible
Impact due to Influx of Migrant Labour and Labour Camp	Minor	Negligible
Impact on the ecosystem services	Minor	Not Significant
Impact due to temporary occupation of Land	Minor	Negligible
Community Health and Safety	Moderate	Minor
Impact due to Stress on Community Resources	Minor	Negligible
Impact on Employment and Entrepreneurship Opportunities	Moderate	Moderate (positive benefits)
Operation Phase		
Impact on Soil Environment	Minor	Minor
Impact on Water Resources	Major	Major to Moderate
Occupational Health and Safety	Minor	Minor to Negligible
Collision and Electrical hazards from Transmission Infrastructure	Moderate	Minor
Community Health and Safety	Minor	Negligible
Impact on Employment	Minor	Minor
Impacts on specific stakeholder categories		
Impact on Indigenous Communities (Construction and Operations Phases)	Moderate	Minor
Impact on Women in Construction Phase	Moderate	Minor
Impact on Women in Operations Phase	Minor	Negligible

7. ANALYSIS OF ALTERNATIVES

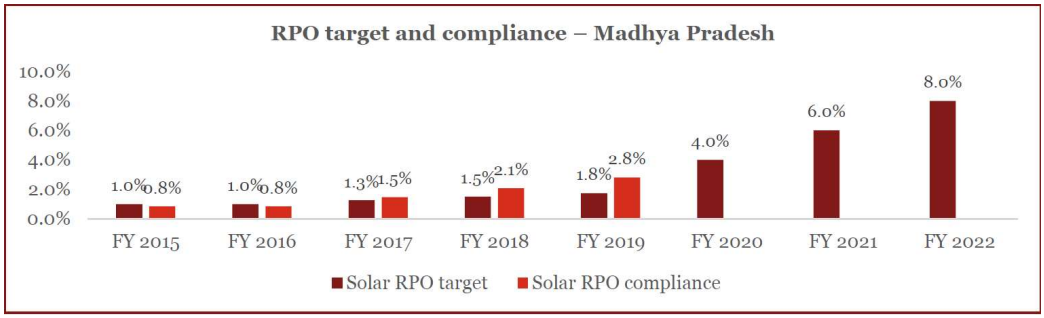
An analysis of probable alternatives for the chosen technology and location of Project site along with other similar factors that contribute to the Project as a whole has been carried out. The following scenarios have been taken into consideration:

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

7.1 Project vs No Project scenario

The state of Madhya Pradesh is endowed with high solar radiation with around 300 days of clear sun. The state offers good sites having potential of more than 5.5 kWh/ sq.m/per day for installation of Solar based power projects. State wise targets by MNRE requires MP to achieve 5,675 MW of Solar power by 2022. As on July 2018, the State has commissioned solar capacity of 1,358 MW and under-construction capacity of 685 MW. Renewable Purchase Obligation (RPO) target and current status for the state of Madhya Pradesh is as presented in Table below.

Figure 7.1 RPO target and compliance status of Madhya Pradesh



Source: Detailed Project Report, 450 MW Shajapur Solar Park, October 2019

The proposed project will enable state to meet their target for solar power and renewable purchase obligations. In addition, the clean power generated by these solar projects play a role for reducing India's carbon footprint, promote high-end technical investments and empower local communities.

7.2 Alternate Source for Power Generation

There are different modes for power generation depending upon the source of energy such as coal energy, natural gas energy, wind energy, solar energy, nuclear energy, geothermal energy and waste to energy. Solar energy is the eco-friendly mode of power generation providing a non-polluting source of energy that can displace greenhouse gas emissions from conventional power. Besides this:

- Negligible emissions from the operation (mainly vehicular emissions);
- No fuel required for operation of the Solar Park;
- The gestation time required for solar energy projects is comparatively less than conventional power generation and requires short lead time to design, install, and start-up.

Manufacturing of parts, related up-stream and downstream activities in a typical solar energy development projects, are associated with emissions due to consumption of fossil fuels which

contributes to Green House Gases (GHGs). The lifecycle emissions from various power sources is shown in ***Table 7.1.***

Table 7.1 Life-cycle Emissions from Power Sources

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

Source: Report on developmental impacts and sustainable governance aspects of renewable energy Projects, Ministry of New and Renewable Energy, 2013

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

The advantages and disadvantages of various power generation systems are shown in table below.

Table 7.2 Environmental Advantages and Disadvantages of Power Generation System

Mode	Disadvantage	Advantage
Thermal Power Plant	■ High fossil fuel consumption. ■ Large quantities of water requirement for cooling ■ High volume of emissions from operation ■ Accumulation of fly ash (in case of coal powered installations) ■ Upstream impact from mining and oil exploration ■ GHG emission estimated as 228gCeq/kWh	■ Large scale production potential ■ Moderate gestation period ■ Relatively inexpensive ■ Wider distribution potential
Hydropower Plant	■ Site specific, dependent on reservoir/river etc. ■ Downstream impact on flow ■ Long gestation period ■ Acute and chronic social and ecological impacts	■ GHG emission estimated as low as 1.1gCeq/kWh for run of river Projects
Nuclear Power	■ Availability of fuel source ■ Hazards associated with radioactive material ■ High cost of Project ■ Long gestation period ■ Risk of fallout and meltdown scenarios and its impacts on the local populace and environment.	■ Cheaper power generation ■ GHG emissions as low as 2.5gCeq/kWh
Wind Power	■ Overall land requirement is large ■ Site specific (associated to wind pattern) ■ Expensive installation	■ Pollution levels are insignificant ■ Inexpensive power generation ■ Inexhaustible source ■ GHG emissions as low as 2.5gCeq/kWh for the Production Chain

Mode	Disadvantage	Advantage
Solar Power	■ Large land requirement ■ Site specific to solar insolation ■ Expensive installation ■ Concrete foundation on larger area	■ Pollution levels are insignificant ■ Inexpensive power generation ■ Inexhaustible source ■ GHG emissions as low as 8.2gCeq/kWh for the Production Chain

Source: International Atomic Energy Agency (IAEA)

Table 7.3 Greenhouse Emissions from Different Electricity Production Chains

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

Source: World Nuclear Association (WNA); http://www.world-nuclear.org/uploadedFiles/org/WNA/Publications/Working_Group_Reports/comparison_of_lifecycle.pdf

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

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

7.2.1 Location for Project Site

7.2.1.1 Availability of Solar Radiation

Solar Projects are non-polluting energy generation Projects, which are site specific and dependent on the availability of solar irradiance resource. Solar irradiance mapping, in India is the responsibility of the Solar Energy Centre (SEC) of India and the National Renewable Energy Laboratory (NREL) of the United States of America as part of the initiatives of the U.S.-India Energy Cooperation /Partnership to Advance Clean Energy (PACE), which is mapped and quantified based on which potential areas that are notified by the SEC, based on hourly data.

Based on the review of data obtained from The US National Aeronautics and Space Administration (NASA), NREL, Meteonorm; the average daily and monthly Global Horizontal Irradiance (GHI) values at Shajapur are presented in Table below.

Table 7.4 Daily and Monthly GHI at Shajapur Solar Park Site

Month	GHI (kWh/m2/ day)			GHI (kWh/m2/ month)		
	NASA	NREL	Meteonorm 7	NASA	NREL	Meteonorm 7
January	4.47	4.43	5.84	139	137	181
February	5.24	5.51	7.71	147	154	216
March	6.09	6.45	8.68	189	200	269
April	6.59	6.96	9.13	198	209	274

Month	GHI (kWh/m2/ day)			GHI (kWh/m2/ month)		
May	6.62	7.00	9.16	205	217	284
June	5.64	6.13	7.97	169	184	239
July	4.25	4.72	6.00	132	146	186
August	3.81	4.49	5.68	118	139	176
September	4.84	5.53	7.13	145	166	214
October	5.12	5.35	7.03	159	166	218
November	4.63	4.62	6.20	139	139	186
December	4.18	4.33	5.52	130	134	171
Annual Average	**5.12**	**5.45**	**7.17**	**155**	**166**	**218**

Source: Detailed Project Report, 450 MW Shajapur Solar Park, August 2020

The site selected has annual GHI of more than 1909 kWh/m^2 at the project site which is appropriate for a Solar PV project development.

8. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

8.1 Introduction

The purpose of an Environmental and Social Management Plan (hereinafter referred as ESMP) is to ensure that social and environmental impacts, risks and liabilities identified during the ESA process are effectively managed during the construction and operation of the proposed project. The ESMP specifies the mitigation and management measures to which the Proponent is committed and shows how the Project will mobilize organizational capacity and resources to implement these measures. The ESMP also shows how mitigation and management measures will be scheduled.

The key objectives of the ESMP are to:

- Formalize and disclose the program for environmental and social management;
- Provide a framework for the implementation of environmental and social management initiatives.

The ESMP describes the mitigation measures for all the identified potential impacts associated with the proposed project during its construction and operation phases. The ESMP delineates the monitoring and management measures to avoid and/or minimize such impacts by allocating management responsibility and suggesting skill requirement for implementation of these measures. Also the ESMP shall ensure a continuous communication process between RUMSL, EPC contractor, workers (including sub-contractors), local community and other stakeholders. RUMSL have an obligation to ensure compliance to all the commitments towards Environment, Social, Health and Safety Standards while executing all the project related activities for the proposed Project.

8.2 Environmental and Social Management Plan

This section outlines the potential impacts, mitigation measures, monitoring and management responsibilities during construction and operation phases of the Project. ESMP measures already embedded/ in-built are not included in the ESMP presented in Table below. As a part of ESMP specific management plans including waste management plan, water management plan, occupational health & safety plan, disaster management and emergency response plan, contractor and labour management, gender action plan and stakeholder engagement plan has also been prepared for the project which are provided in **Appendix E**.

Table 8.1 Planning Phase ESMP

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
Land Procurement	Impacts due to Private land purchase	■ The private land sellers should be provided with either alternate land parcels with similar nature of productivity and financial assistance to prepare the land for cultivation or adequate payment against land purchase which should be above the prevalent market price, as per the Mutual Consent Policy 2014; ■ ; ■ A Resettlement Action Plan shall be formulated to address the following: - Displacement impacts to people who had encroached/squatted upon government land, based on their status and tenure - Livelihood impacts on the land owners if the holdings that remain are sub-optimal, or owners are rendered landless; - Additional livelihood assistance to vulnerable households, or women headed households, with skill trainings or entrepreneurship support, etc. under the LRP; - Impacts on land users or regular agricultural labourers affected - The general community being impacted due to access restrictions/easements; - Other impacts on private land owners. ■ Preference to members of the families rendered landless or with sub-optimal holdings post selling land to	RUMSL	-

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		the project for employment opportunities in the Construction/operation phase and/or small contracts; ■ Timely sharing of project related information with all relevant stakeholders; ■ Provision of Grievance Redressal Mechanism to all impacted stakeholders in order to raise and register their grievances.		
	Impact due to Patta land purchase	■ Patta is being treated at par with ownership, for the land procurement process. Thus treatment of Patta Land holders will be similar to Private land owners and Patta holders shall be provided with either alternate land parcels with similar nature of productivity and financial assistance to prepare the land for cultivation or adequate payment against land purchase which should be above the prevalent market price, as per the Mutual Consent Policy 2014; ■ A Resettlement Action Plan-Livelihoods restoration Plan is required to be formulated to address: - Displacement impacts to people who had encroached/squatted upon government land, based on their status and tenure - Livelihood impacts on the land owners if the holdings that remain are sub-optimal, or owners are rendered landless; - Additional livelihood assistance to vulnerable households, or women headed households, with skill trainings or entrepreneurship support, etc. under the LRP; - Impacts on land users or regular agricultural labourers affected	RUMSL	-

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		- The general community being impacted due to access restrictions/easements; - Other impacts on patta land owners. ■ Preference to members (rendered landless or with sub-optimal holdings) of the families post selling land to the project for employment opportunities in the Construction/operation phase and/or small contracts; ■ Additional safeguards to be addressed through the RAP-LRP for Patta Land owners including those who may have 'purchased' the patta informally from the original allottees based on a verbal agreement and without documentation; ■ Timely sharing of project related information with all relevant stakeholders; ■ Provision of Grievance Redressal Mechanism to all impacted stakeholders in order to raise and register their grievances.		
	Impact due to Land Use Permission Agreement of Government Land	■ Provision for alternate grazing land for livestock shall be made near the project villages or confirmation of adequacy and quality of remaining grazing land shall be provided through discussion meetings with Sarpanch and Village Secretaries and consultations with the affected community, with representation by all groups- to be confirmed during the RAP survey (including the assessment of access and quality of the remaining area); ■ Development of a program to include grazing area improvement and fodder intensification (cultivation) in designated areas, as agreed with the Tehsil office and the local dependent community of graziers. This may include the development of community fodder lots under	RUMSL	-

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		the Livelihood restoration activity in the area as part of Resettlement Action Plan. This, if feasible, shall serve the purpose of improving the quality of the grazing land, ensuring access and as an income generating activity for people losing land based livelihoods. ■ Provision of easements shall be maintained in order to not sever the access to CPRs for the community; ■ The Solar Park Developer is also encouraged to explore identifying unused areas within the solar park boundary and a part of the area with solar panels (10% area), for fodder cultivation, or controlled and managed open grazing of goats, or agriculture (selected crops), to explore the potential of 'mixed land use' areas in solar parks that benefit the local community too. This may be done with the agreement of RUMSL and in partnership with domain specialist agencies and local organisations working in the region. Additional positive effects may include countering the 'heat island effect' described in Section 6.2.4 ■ Preference of members of Project affected households (PAH) in employment opportunities during construction phase; ■ In case of crop losses for Squatters and encroachers, RUMSL shall ensure the provisions of the RAP-LRP, based on the ESMF are followed and loss of standing crops are compensated at full replacement value, though no compensation for land will be made; ■ Compensation for loss of structures shall also be covered as part of RAP report; ■ The RAP-LRP will contain mitigation/compensations determined, based on the ESMF and applicable frameworks, for the eligible		

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		encroachers/occupiers/squatters on government land, after the RAP survey is concluded. ■ Timely sharing of project related information with all relevant stakeholders in order to serve advance notice and reduce the extent of impacts and losses; ■ Provision of Grievance Redressal Mechanism to all impacted stakeholders in order to raise and register their grievances.		
	Impact on Women	■ A Gender Action Plan shall be prepared for the Project where women focussed engagement shall be detailed; ■ Provide alternative arrangements for grazing land, and create access for ease of use to collect fuelwood, and fodder. ■ Ensure the participation of women in the grazing area improvement and fodder intensification programme, proposed as part of livelihoods restoration activities but may also be expanded to cover the local population through support from the community development programme of the SPD (as part of CSR). ■ Ensure that the employment of women from vulnerable households is done for the project and efforts are made for development of women owned enterprises in the area, from where procurement for project related needs is undertaken; ■ Undertake a profiling of the various social groups in the Study Area, to understand the individual needs and concerns of the various women belonging to different social groups and design community development and CSR programmes in light of the same;	RUMSL along with SPDs	Monthly reports on number of women engaged in the project activities

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		■ As part of the stakeholder engagement, RUMSL shall ensure and communicate to the private Solar Project Developers, that Women focussed discussions are conducted in order to ensure adequate representation of the Women and their needs and concerns in order to design specific engagement activities; ■ Provision of Grievance Redressal Mechanism to all the stakeholders in order to raise and register their grievances.		
Water Resources		■ As part of project designing, SPD shall consider the rainwater harvesting ponds in the open area depending on the topography, slope, natural drainage etc. Accordingly infrastructure such as drains/ piping system/ size of pond etc. shall be designed. ■ Similarly, in case water is sourced from surface water bodies, infrastructure requirements shall be identified and planned in project design.	SPD	-

Table 8.2 Construction Phase ESMP

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
Site preparation - Site clearing, excavation and levelling	Change of topography and disturbance to drainage pattern.	■ Project designing shall be done in a way to utilize existing topography to maximum; ■ Project shall ensure to avoid any unnecessary changes in the topography especially during the preconstruction and construction phase; ■ Micro drainage channel should be particularly avoided when constructing access roads or planning the Transmission Line pathway in order to ensure no change to the topography of the area.	EPC Contractor/ Sub-contractor	Monthly Report to RUMSL

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		■ The natural storm water flow pattern towards Nallah in Unit 8 shall be maintained.		
Construction Activities at Site	Change in land use	■ Construction activities should be restricted to designated area; ■ On completion of construction activities, land used for temporary facilities such as Contractor office, batching plant (if any), stockyard, labour camp should be restored to the extent possible ■ The land use in and around permanent Project facilities should not be disturbed; and ■ The land should be restored back to the original state to the extent possible after completion of life cycle of the Project and in case there are plans not to continue further at the site.	EPC Contractor/ Sub-contractor	Monthly Report to RUMSL
	Soil Compaction and Erosion	■ The topsoil present in the construction shall be removed and stock pilled in separate area; ■ The stock pile should be protected from natural elements to prevent from erosion and also degradation; ■ Topsoil to be reused on site for landscaping purpose; ■ Defined routes for transportation and construction vehicles, workers etc. to minimize soil compaction; ■ Good drainage as per the natural slope condition should be provided to reduce surface runoff and associated erosion; ■ Back filling and revegetation of the area disturbed will be undertaken phase wise immediately after the completion; and ■ Site clearance, piling, excavation and access road construction will not be carried out during the monsoon season to minimize erosion and run-off.	EPC Contractor/ Sub-contractor	Monthly Report to RUMSL
	Soil Contamination	■ Construction and Demolition Waste should be stored separately and be periodically collected by an authorized treatment and storage facility; ■ All waste should be stored in a shed that is protected from the elements (wind, rain, storms, etc.) and away from natural drainage channels;	EPC Contractor/ Sub-contractor	Monthly Report to RUMSL

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		■ Designated areas should be provided for Solid Municipal Waste and daily collection and period disposal should be ensured; ■ The hazardous wastes to be stored onsite temporarily at separate designated covered area provided with impervious flooring and secondary containment and to be disposed in accordance with Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016; ■ A log book should be maintained for quantity and type of hazardous waste generated; ■ EPC Contractor should ensure that no unauthorized dumping of used oil and other hazardous waste is undertaken at the site; ■ Hazardous waste to be disposed through MPPCB authorised vendors; ■ In case of accidental/unintended spillage, the contaminated soil should be immediately collected and stored as hazardous waste; and ■ E waste, used discarded batteries shall be disposed off in accordance to e waste management rules and batteries management and handling rules.		
	Impact on Water Resource and Availability	■ No ground water shall be abstracted for construction activities; ■ Construction labour deputed onsite to be sensitised about water conservation and encouraged for optimal use of water; ■ Regular inspection for identification of water leakages and preventing wastage of is necessary for efficient utilisation of water; ■ Maintain logbook for water consumption	EPC Contractor/ Sub-contractor	Monthly Report to RUMSL
	Impact on Water Quality	■ Ensure proper cover and stacking of loose construction material at site to prevent surface runoff and contamination of receiving water body; ■ Open defecation and random disposal of sewage will be strictly restricted;	EPC Contractor/ Sub-contractor	Monthly Report to RUMSL

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		■ Planning of toilets, soak pits and septic tanks, waste collection areas away from natural drainage channels; ■ Provision of number of toilets across with easily accessible location as the project site is spread across large area of 3 units; ■ Use of licensed contractors for management and disposal of waste and sludge; ■ Labourers will be given training towards proactive use of designated areas/bins for waste disposal and encouraged for use of toilets. Open defecation and random disposal of sewage will be strictly restricted; ■ Provision for impervious storage area, especially for fuel & lubricant, hazardous waste, etc. will be made onsite; and ■ Spill/ leakage clearance plan to be adopted for immediate cleaning of spills and leakages.		
	Impact on Air Quality	■ The construction site shall be barricaded; ■ Keeping areas of open excavation to a minimum; ■ Minimising stockpiling by coordinating excavations, spreading, re-grading, compaction activities; ■ Cease or phase down work if excess fugitive dust is observed, investigate source and take suppression measures; ■ Speed of vehicles on site to be limited to 10-15 km/hr; ■ The emissions from diesel generator shall be by optimised operations, orientation at the site and providing adequate stack height for wider dispersion of gaseous emissions ■ Switch off machinery and equipment when not in use; ■ Prevent idling of vehicles and equipment; and ■ Vehicle engines will be properly maintained and will have a valid Pollution under Control (PUC) to ensure minimization in vehicular emissions.	EPC Contractor/ Sub-contractor	Monthly Report to RUMSL
	Impact on Noise Quality	■ Only well-maintained equipment to be operated on-site; ■ If it is noticed that any particular equipment is generating too much noise then lubricating moving parts, tightening loose parts and replacing worn out components to be carried out to	EPC Contractor/ Sub-contractor	Monthly Report to RUMSL

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		bring down the noise. It is to be ensured that such machinery are kept far away from the households; ■ Machinery and construction equipment that may be in intermittent use to be shut down or throttled down during non-work periods; ■ Low noise equipment shall be used as far as practicable; ■ The number of equipment operating simultaneously shall be reduced as far as practicable; ■ DG set with acoustic enclosures shall be used; ■ Vehicular movement through village roads should be planned to avoid traffic jam and inconvenience to local residents; ■ Equipment noise should be 85 dB (A) at 1 m from the source in line with WB/IFC EHS guidelines; and ■ Minimal use of vehicle horns needs to be encouraged through induction training and periodic toolbox training sessions.		
	Impacts due to vegetation clearance and construction activities	■ Vegetation clearance should be kept restricted to project site only and should be avoided wherever possible. ■ No hunting, trapping or injuring of local fauna should be communicated to labourers through a workshop or formal training exercise. The training should also communicate presence of species protected under Wildlife Protection Act, 1972 Schedule I and the penalties associated with contravention on the identified law; ■ Noise control measures such as acoustic enclosures for DG sets, noise attenuation barriers in areas near sensitive habitat and proper maintenance of the vehicles used for the Project site should be implemented to reduce the effect of construction noise on local ecology; ■ Set routes, consolidation of trips and no off-roading policies should be introduced by the EPC contractor to reduce the impact from noise and human-wildlife conflict; ■ Adequate toilets, gas/firewood and space should be provided in any anticipated labour accommodation and the labourers should be informed not to enter or utilize any resources from	EPC Contractor/Sub-contractor	Report to RUMSL Construction Team

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		surrounding forest land over the course of the construction period; ■ Local semi-skilled and unskilled labourers should be used to the extent possible to reduce demography influx into the Project site and therefore reduce the risk of disturbance to local fauna; ■ Waste that is generated from the Solar Park during construction and operation should be stored in covered containers within the site premises. Uncovered waste may attract fauna to the Solar Park; ■ Excavated areas should be adequately fenced and security should be deployed to prevent wildlife intrusion into these areas; ■ Construction work and anthropogenic movement should be restricted near any major water bodies to reduce the impact on aquatic bird species (resident or migratory); ■ Construction activities and transportation should be avoided during peak ecological activity i.e. dawn (5:30 am to 7:30 am) and dusk (5:00 pm to 7:00 pm). Night-time activities should be kept to a minimum and if essential, should be done with prior intimation to the neighbouring communities; ■ Areas with pre-existing nests, ground-roosting sites and burrows should be avoided for construction related work to reduce the impact on local fauna; and ■ Hazardous materials and waste should not be stored near any drainage channels or cliff-sides to prevent contamination of the surrounding environment and impact on local flora/fauna. ■ The area around the reservoirs and lakes should be avoided for the siting of any ancillary facilities including access roads, contractor facilities or labour accommodation and even temporary siting of equipment (e.g. DG set, waste storage area and material storage area) should not be undertaken adjacent to the water body or its drainage channels. ■ It is recommended that the selected EPC contractor should display and educate labourers not to collect fuel wood from		

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		adjacent areas and alternate arrangement for fuel, like LPG must be made available in the labour camps for cooking. ■ Provision for identifying grazing areas for the livestock village wise and development of grass plots in 5 acre area with local grass species; ■ Sufficient arrangement for identifying water holes based on the terrain gradient to tap the surface water runoff during rains ■ Strengthening of existing waterbodies in the study area and development of water channels to connect the surface runoff to them.		
	Loss of Ecosystem Services	■ Nesting trees should be avoided to the extent possible when it falls within the Solar Park site. ■ Natural drain passing through project site should be unaffected by the Project construction. Similar seasonal drainage pathways should not be blocked during the Project construction. ■ Seeding of native plant species outside of the Solar Park especially in areas where the soil layers have been impacted and around water bodies to offset the loss of floral resources and dependent ecosystem services. ■ Pollution and spill control mechanisms should be implemented and strictly enforced around surface water bodies to ensure that there is no impact to the water quality or any drainage channels into the water body. ■ Larger mature trees with significant height and girth should be avoided to the extent possible when construction the solar compound. Larger trees can be set aside within the Solar Park and avoided as part of the micro-siting of the solar modules.	EPC Contractor	Report to RUMSL Construction Team
	Occupational Health & Safety	■ A specific SOP shall be prepared for working close to GAIL pipeline. The SPD/ contractor shall coordinate with GAIL officials during construction activities in vicinity of this area; ■ Health & safety training to be provided;	EPC Contractor/ Sub-contractor	Monthly Report to RUMSL

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		■ Prior to start of work, workers should be informed about the related safety risks and precautions to be taken through tool box meetings; ■ Manual lifting by adult men to be less than 55 kg and for women it should be less than 30 kg; ■ Adequate PPEs to be provided for all activities at site including but not limited to welding, cutting or similar operations which may cause hazard to eyes; ■ All persons performing construction work to wear safety shoes and helmets confirming to national standard; ■ Every worker engaged in handling sharp objects which may cause injury to hand shall be provided suitable hand gloves; ■ While working in hot conditions, measures such as work break at regular intervals, keeping hydrated by drinking water and liquids, covering face with damp cloth etc. shall be used; ■ Obtain and check Contractor's safety method statements; ■ Permitting system should be implemented to ensure that cranes and lifting equipment is operated by trained and authorized persons only; ■ Appropriate safety harnesses and lowering/raising tools should be used for working at heights; ■ All equipment should be turned off and checked when not in use; ■ Emergency contact numbers and route to the nearest hospital to be displayed at the construction site; ■ The local/ host community to be kept at safe distance from construction site; ■ At a minimum, implement all COVID-19 related safety and emergency response measures, as relevant and as prescribed by the government ■ A Site specific safety or emergency response plan should be in place to account for natural disasters, accidents and any emergency situations; ■ Site specific/ activity specific Hazards Identification and Risk Assessment (HIRA) should be developed prior to start of the activities at site; and		

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		■ Provide H&S achievement information to employees.		
	Photovoltaic Heat Island Effect	■ The existing ground vegetation in the Solar Park area shall be disturbed to minimum extent; ■ Ground vegetation shall be planted in the buffer areas/open areas available in the Solar Park; ■ The feasibility of mixed land use development in the Solar Park shall be explored	SPD and RUMSL	
	Flood Risks	■ Carry out a Site specific preliminary Flood Risk Assessment based on inundation and hazard mapping to understand the extent and magnitude of inundation and water logging at Units 7A and 7B of Moman Badodiya Site. This will help in designing and implementing adequate flood mitigtion measures. ■ Develop a robust "Storm Water Management Plan (SWMP)" for both Moman Badodiya and Shajapur Sites to effectively and safely manage surface runoff during heavy rainfall events. SWMP must consider protection and development of natural drainage channels and water features within the Site area to prevent localized inundation and safely evacuate surface runoff. ■ Enhance structural stability of banks of all seasonal streams which originate within the Site or pass through the Site and provide robust erosion protection to withstand flash flood during heavy downpour. ■ Significant area in the central and eastern portion of Shajapur Site is relatively low lying (localized depression) and may be subjected to periodic and intermittent water logging during peak rainy season. Water level data,		

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		frequency, duration and extent of inundation or water logging at these seasonal features would not be available from secondary sources. It is recommended to undertake consultations with local communities and carry out physical field assessment to understand maximum potential extent of land submergence and depth of inundation during high rainfall year. This will serve to define 'zones' of concern within the Site, plan the locations of key electrical infrastructure at the Site, assist in designing storm water management plan and structural design of the solar array mounting racks specific to the 'zone of concern'		
Social impacts due to ongoing construction activities	Temporary occupation of land for construction phase activities	■ Provision of adequate lease on rental amounts to the land owners shall be ensured by RUMSL; ■ The land leased/ rented shall be restored to its original state (or made better) at the time of handing it back to the owners; ■ Provision of compensation for the loss of livelihoods to the users of the land required for temporary use as this will temporarily economically displace them; ■ Timely dissemination of project related information with all relevant stakeholders, in order to serve advance notice and reduce the extent of losses/ impacts; ■ Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievance.	RUMSL	-
	Impact on Community Health and Safety	*Responsibilities of RUMSL* ■ Ensuring stakeholder engagement through the project cycle and provision of an effective Grievance Redressal Mechanism to avoid, mitigate and mange conflicts and disagreements;	RUMSL along with Contractors	Monthly reports to RUMSL from EPC contractors

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		■ As part of the stakeholder engagement and information disclosure process, the community will be provided with an understanding of the activities to be undertaken and the precautions to be taken for safety; ■ RUMSL shall maintain safe distance of project components from schools, hospitals, etc. in order to avoid interactions with community hotspots and hence risks of accidents; ■ The Contractors to be engaged by RUMSL shall be informed of the EHSS practices that are expected from its workers during the construction phase engagement. Obligations like preparation of Traffic Management Plan, Local Procurement Plan, EHSS Plan, etc. shall be communicated to them at the time of selection and appropriate clauses should be included at the time of contract finalization; ■ The contractor shall be required to adhere to IFC's accommodation guidelines, for the labour camps in terms of provisions, sanitation facilities, etc. thus limiting the probability of diseases and infections in the local community on account of improper management of waste, special measures may be required to additionally manage the risk of the COVID-19 related infections and emergency response; ■ RUMSL shall put in place a grievance redressal mechanism to allow community members to report any concern or grievance related to project activities. The contractors shall also be contractually required to put in place a similar mechanism to deal with concerns raised by the community (or external stakeholders) and the workers engaged during construction phases. *Contractors*		

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		■ The contractor shall induct migrant workers on health and safety awareness and practices to be followed at site during construction phase; ■ The contractors shall cordon off areas that are under construction and put relevant safety signs to restrict movement of local community members or workers engaged at site, which may become safety threats; ■ The Contractors shall prepare a Traffic Management Plan and traffic movement due to the project in the area will be regulated to ensure road and pedestrian (including livestock) safety; ■ Additionally, training on vehicular safety shall be organised for the transport workers. ■ The movement of workers from the project site and labour camps shall be regulated and similarly the project boundary and labour accommodation to check for unauthorized visitors/ outsiders entering the site in order to avoid any possible interactions leading to conflicts or tensions between the migrant workforce and host community; ■ Contractors shall ensure that regular health check-ups are conducted for the construction phase workers (especially migrant workers staying in temporary labour accommodation) and any major illnesses are reported in the Block level medical authorities at the earliest; ■ The labour accommodation should be clean and hygienic and disposal of kitchen waste and food waste shall be done on a daily basis in an appropriate manner; ■ Proper sanitation facilities shall be provided, taking into account the number of labourers that will be using the		

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		facilities, both at construction site, as well as labour accommodation.		
	Stress on Community Resources	■ There will be a worker Code of Conduct defined by RUMSL that prevents workers and contractors from using the local resources like water, forest, which will be shared with private SPDs for onward sharing with sub-contractors and its workers; ■ An induction session will be organised for the migrant workers where they will be sensitized on the Do's and Don'ts during their stay near project location, which would include aspects on conservation of community's resources; ■ The contractor shall be asked to use Tanker water supply during the summer months, which are dry months in which water scarcity issues are reported by the community; ■ Periodic maintenance activities for roads used for transportation of goods for the project shall be the undertaken by RUMSL, through its contractors; ■ Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievance on misuse of locally available resources.	RUMSL along with contractors	Monthly reporting by contractors
	Impact on Employment and Entrepreneurship opportunities	**Enhancement Measures** ■ The sourcing of local labour wherever possible should be made obligatory by RUMSL (through contractual provisions) for the Solar Project Developers and sub-contractors and in all major procurement activities; ■ Preference should be given to the land losers and vulnerable population in the Project Villages, to the extent practicable;	RUMSL	-

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		■ Employment of members of SC-STs and Women Headed households should be ensured by the Solar Project Developers through documented agreement with contractors/ sub-contractors; ■ Engagement of local vendors, to the extent possible, for the goods and services required for the project during construction phase; ■ The project proponent will establish a mechanism to audit subcontractors and suppliers with respect to compliance of utilizing local labour and resources; ■ Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievance with respect to information sharing related to jobs and opportunities for vendor-ship.		
	Impact on Women	■ Include provisions of coverage of women under skill training and Financial literacy training programs, as part of livelihood restoration activities by the project or through developmental programs of SPDs; ■ Ensure that the employment of women from vulnerable households is done for the project and efforts are made for development of women owned enterprises in the area, from where procurement for project related needs is undertaken; ■ Undertake a profiling of the various social groups in the Study Area, to understand the individual needs and concerns of the various women belonging to different social groups and design community development and CSR programmes in light of the same;	RUMSL along with SPDs	Monthly reports on number of women engaged in the project activities

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		■ Provision of Grievance Redressal Mechanism to all the stakeholders in order to raise and register their grievances.		

Table 8.3 Operation Phase ESMP

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
Solar Park operation leading to use of water	Water Resource	**Conserving Water Resources** ■ Dry robotic cleaning of modules to be explored as recommended by MNRE (1); ■ Alternate sources of water shall be explored ■ Ground water abstraction, if required shall be done in accordance to CGWB guidelines. ■ Implement rainwater harvesting and/or groundwater recharge and replenishment opportunities within Site premises especially near the low-lying and gently sloping area. ■ Optimising water usage in the SCADA building by application of water conservation measures such as sensor based taps, low flush urinals etc.; ■ Maintain logbook for water consumption; ■ Implement groundwater and wastewater monitoring vis-à-vis quality/quantity; ■ Adopt less water consuming module cleaning methods;	O&M Contractor	Annual Report to RUMSL

(1) MNRE had issued a letter dated 3 June 2019 to Principal Secretaries of States and Solar Association of all States regarding optimal utilization of water and preferably use Robotic technology for cleaning of modules.

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		■ The surface runoff from during solar panel cleaning shall be diverted to a settlement tank for settlement of suspended solids. The overflow shall be treated in water treatment unit and recycled in the Project. ■ Use of water from multiple sources to avoid dependency on one particular source (groundwater or surface water). This also includes tapping of rainwater received during the monsoons for the long-term and uninterrupted operations. ■ The Project should implement principles of water stewardship to ensure water security not just for the site, but also for other stakeholders within the watershed. Some of the water stewardship frameworks/ standards that can be adopted are UN Global Compact's CEO Water Mandate or AWS Standards. ■ Identify stakeholders directly impacted by the groundwater use at the Project site and develop long- term stakeholder engagement plan particularly focused on stakeholders near site to develop positive perception towards Project and its operations. **Rain Water Harvesting** Rainwater harvesting pond shall be provided at site. In addition, groundwater recharge shall be undertaken within the Site to replenish the shallow aquifer zones. Piezometers to be installed to monitor the groundwater level changes in the aquifer trapped by the abstraction wells at Project site.		

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		Water Quality ■ Ensure proper cover and stacking of loose construction material at site to prevent surface runoff and contamination of receiving water body; ■ Open defecation and random disposal of sewage will be strictly restricted; ■ Planning of toilets, soak pits and septic tanks, waste collection areas away from natural drainage channels; ■ Provision of number of toilets across with easily accessible location as the project site is spread across large area of both the Units; ■ Use of licensed contractors for management and disposal of waste and sludge; ■ Labourers will be given training towards proactive use of designated areas/bins for waste disposal and encouraged for use of toilets; ■ Provision for impervious storage area, especially for fuel & lubricant, hazardous waste, etc. will be made onsite; and ■ Spill/ leakage clearance plan to be adopted for immediate cleaning of spills and leakages. **Other Management Aspects** ■ Preparing an inventory of water consumption during construction and O&M activities.		
Solar Park operation leading to waste generation and leaks & spill	Soil contamination	■ Designated areas should be provided for Solid Municipal Waste and daily collection and period disposal should be ensured;	O&M Contractor	Annual Report to RUMSL

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		■ The hazardous wastes to be stored onsite temporarily at separate designated covered area provided with impervious flooring and secondary containment and to be disposed in accordance with Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016; ■ A log book should be maintained for quantity and type of hazardous waste generated; ■ O&M Contractor should ensure that no unauthorized dumping of used oil and other hazardous waste is undertaken at the site; ■ Hazardous waste to be disposed through MPPCB authorised vendors; ■ In case of accidental/unintended spillage, the contaminated soil should be immediately collected and stored as hazardous waste; ■ The guidelines and procedures shall be prepared and followed for immediate clean-up actions following any spillages; ■ Damaged/ discarded solar panels to be disposed with the help of authorised recycling vendors/ module installation contractors; ■ A SOP shall be prepared for storage and disposal of broken solar panels. MNRE had prepared a concept note for storage and disposal of used solar panels. The recommendations such as recycling of glass, storage of discarded panels in cover shed etc. shall be adopted in the Project; (1); ■ The broken panels shall not be mixed with normal glass and kept separately in accordance to HW Rules; and ■ Other wastes such as e-waste, used discarded batteries shall be disposed off in accordance to E-waste Rules and batteries management Rules.		
Solar Park operations	Occupational Health and Safety	■ At Substation, SOPs will be prepared for all O&M activities; ■ Specific SOP for any O&M activities in the vicinity of GAIL pipeline.		

(1) http://164.100.94.214/sites/default/files/webform/notices/DraftBluePrintAntimony.pdf

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		■ H&S training to be imparted; ■ Work permit system to be developed and implemented; ■ Appropriate PPEs for electrical work and other O&M work to be provided; ■ First aid kit to be provided; ■ Records of incident/ accidents shall be maintained; ■ Root cause analysis shall be carried out for any incident/ accident; ■ Emergency contact numbers and route to the nearest hospital to be displayed at the construction site; ■ A safety or emergency management plan should be in place to account for natural disasters, accidents and any emergency situations; and ■ Provide H&S achievement information to employees.		
	Collision and Electrocution risk	■ If possible transmission line should be aligned away from the waterbody. ■ Insulators should be suspended in order to reduce the electrocution of bird species; ■ Jump connectors should insulated and of at least 60 cm in length (determined based on the average wing span of common avifauna) to reduce chances of electrocution of species flying through and wing tips coming into contact with the conductors and ■ Marking overhead cables using diffractors and avoiding use in areas of high bird concentrations of species vulnerable to collision.	Solar Project Developers (SPDs)	Quarterly
Social Impacts during Operations Phase	Community Health and Safety	■ Community sensitization sessions should be re-organised at the beginning of Operations phase, in order to mention about the new developments in the area and provided an understanding of the precautions to be taken for safety;	Solar Project Developers (SPDs)	Monthly

Activity	Potential Impacts	Mitigation Measures	Responsibility	Reporting to RUMSL
		■ Project's Grievance Redressal Mechanism for the community shall still be in implementation to deal with any concerns of community health and safety, being raised by the local community. ■ Where community residential clusters are closer to the project boundary, maintain a safety setback (as relevant) to mitigate the heat island effect.		
	Impact on Employment (General, Vulnerable and Indigenous groups and women)	**Enhancement Measures:** ■ The private SPDs shall advertise the roles of Technical staff required during operations phases, in the local newspapers to enable hiring of competent people from nearby areas, to the extent feasible; ■ SPD shall appoint a dedicated supervisor for management of social and community related aspects at the project site; ■ Preference shall be given (to the extent feasible) to hire competent members from PAHs for semi-skilled jobs like housekeeping or Security Guards; ■ Preference to Indigenous and Vulnerable groups shall be provided to the extent possible for semi-skilled jobs, like housekeeping, security guards, etc., and as Technicians and more, if there is a skill set match; ■ The SPDs shall ensure appropriate measures for hiring of women, as per required skill set, are put in place, during the Operations phases.		

8.3 Institutional Structure for Implementation

To ensure the efficacy of Environmental and social management plan, certain institutional mechanism with well-defined roles and responsibilities is essential for effective implementation of identified mitigation measures both during construction and operation phases.

8.3.1 Project Implementation- SPPD and SPD

The proposed Solar Park project will be owned by RUMSL and will be established jointly by Solar Power Park Developer (SPPD), i.e. RUMSL and Solar Project Developers (SPD). SPDs will be selected through bidding process. RUMSL had appointed PGCIL as PMC to oversee the project development. Presently, bidding process for selection of SPD is in planning stage.

8.3.1.1 Responsibilities of SPPD and SPD

The scope of SPPD and SPD is given in ***Table 8.4*** below.

Table 8.4 Responsibilities of SPPD and SPD

Project Phase/Scope	SPPD	SPD
Name of Agency	RUMSL	To be selected through bidding process
Permissions	■ Land Acquisition, Gram Panchayat NOC, ■ NA Conversion ■ Support in obtaining permissions such as ■ Geology & Mining NOC ■ PTCC Approval ■ CEIG Approval ■ Commissioning Certificate ■ Open Access Approval ■ Approval from Irrigation department ■ Registrations/ permissions required for work (to be executed by RUMSL)	■ Registrations/ permissions required for work to be executed by SPD such as CTO for batching plant, Registration under Contract Labour Act and other labour laws (as applicable), NOC from Gram Panchayat, Geology & Mining NOC etc. ■ PTCC Approval ■ CEIG Approval ■ Commissioning Certificate ■ Open Access Approval ■ Approval from Irrigation department
Solar Park	■ Common facilities ■ Access roads, roads within Solar Park to provide access to individual plots and other common facilities ■ lightening to the common area such as utility area, street lighting of the roads ■ The Fire Fighting & Protection System for common infrastructure such as the Pooling Substation	■ Site levelling activities for individual units ■ Development of three units ■ Development of internal roads within each unit ■ Labour camps
Substation and Transmission Line	■ Development of internal evacuation infrastructure ■ Erection of Transmission Line from Unit substations to PGCIL ISTS substation at Agar; ■ O&M of Transmission system and switching/pooling substation	■ 33 kV cable circuit to evacuate the generated power from each unit to Unit substation. ■ O&M of Unit substation ■
Water Requirement	■ RUMSL shall make available the construction water by way of water tankers including facilitating required necessary approvals	■ Payment of construction water cost. ■ Arrangement of water requirement during operation phase.

Project Phase/Scope	SPPD	SPD
Construction power	■ Infrastructure for construction of power through DG set or temporary supply from Distribution Company	■ Cost of construction power to be paid by SPD.
Operation and Maintenance	■ O&M of common facilities provided like pooling substation, shall be undertaken by RUMSL	■ O&M of each unit

Source: DPR, August 2020

RUMSL will appoint EPC contractor for their scope of work such as construction of external roads, substations, common facilities etc. PGCIL will be responsible to oversee the EPC contractor activities.

8.3.1.2 Power Grid Corporation India Limited (PGCIL)

PGCIL will be responsible for providing grid connectivity to the Solar Park for power evacuation. For this purpose PGCIL will construct a 220kV /400 kV ISTS substation at Pachora village, Agar.

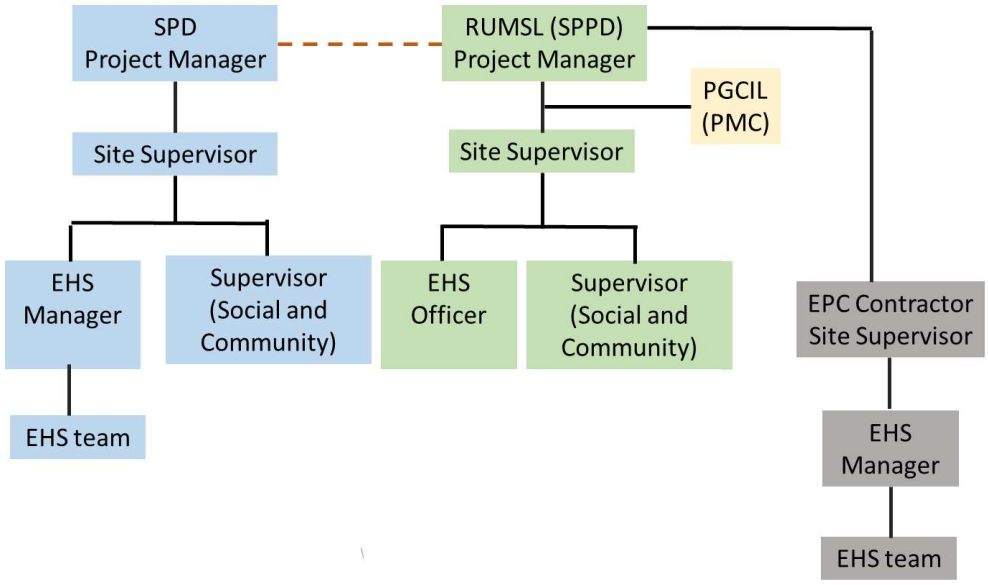
RUMSL has appointed PGCIL as Project Management Consultant. Under this role, the responsibilities of the PGCIL includes supervision of EPC contractor to be hired by RUMSL for construction of common infrastructure of Solar Park such as roads, control room etc. and construction of internal evacuation infrastructure, i.e. 33kV/220 kV Pooling substations at each Unit and 220 kV Transmission Line connecting Pooling substations to ISTS substation

8.3.2 Implementation of ESMP

RUMSL will have ultimate responsibility for implementing the provisions of the ESMP. This role will include the on-going management of environmental and social impacts, monitoring of contractor performance as well as development of mechanisms for dealing with environmental and social problems. RUMSL will also ensure that the activities of its contractors are conducted in accordance with good practice measures, implementation of which will be required through contractual documentation.

The organizational structure of RUMSL with respect to management of EHSS issues across the project life cycle is shown in ***Figure 8.1*** below. The overall management and coordination of the Project will be the responsibility of Project Manager of RUMSL. RUMSL will engage EPC contractors to undertake construction activities for pooling substation and common infrastructure at all the three Units, i.e. Unit 6, Unit 7 and Unit 8. The project level activities will be managed at the Site by Site Supervisor(s) of respective Units. At project level, implementation of management plans and corrective actions are the responsibilities of Site Supervisor in coordination with EHS Manager, hired by the respective Unit EPC contractor. In construction and operational phase, EHS Manager of each respective Unit will supervise the Contractor HSE Engineer's performance to implement the management action plans in coordination with Site Supervisor.

Figure 8.1 Proposed Organisation Structure for ESMP Implementation



As the project is being developed on some private land also; it is envisaged that SPD need to appoint an onsite social/admin officer to manage social (including labour and community) issues. The name and contact number of the appointed person should be displayed at the site office.

8.3.2.1 Roles and Responsibilities

This section describes the roles and responsibilities of the key persons responsible for management of onsite activities for the proposed project:

Project Manager /Site In charge

The Project Manager of RUMSL will be responsible for overall management of the project and ESMP implementation during construction and operation phase. The following tasks will fall within his/her responsibilities:

- Monitor site activities on a daily basis for compliance during construction phase and weekly during operation phase;
- Conduct internal audits of the construction site against the ESMP;
- Confine the construction site to the demarcated area;
- Reporting EHSS related issues & incidents to Chairman of RUMSL;
- Conducting meetings with Site Supervisor of Unit Developers regarding EHSS issues;
- Oversee activities of Site Supervisor and will coordinate with him for updates on the project; and
- Reviewing and updating of ESMP for its effective implementation.

Site Supervisor

Site Supervisor will be appointed by the SPD/EPC Contractor and will be responsible for the following scope of work:

- Meet the labour requirements during construction phase;
- Hiring and management of different contractors for civil, mechanical and electrical works;

- Supervise the daily activities occurring on the site during construction and operation phase; and
- Plan the traffic route for movement of material and solar panels and will communicate the same to RUMSL officials.

EHS Manager

EHS Manager as appointed by SPD/EPC Contractor shall be responsible for checking compliance of the contractor(s) with the requirements of this EMP and any other relevant environmental legislation for all activities associated with the contract. The general duties of the EHS Manager are as follows:

- Be familiar with the environmental management requirements contained in this ESMP;
- Regular auditing of the contractor(s) with the view of ensuring that all activities on the site are undertaken in accordance with the ESMP;
- Issuing regular audit reports to the Site Supervisor and contractor(s)regarding compliance with this EMP with help of Safety Officers; and
- Advising on environmental legal requirements regarding issues that may arise during the project to the Site Supervisor and the contractor(s).

Safety Officer

Safety Officers appointed by SPD/EPC Contractor will also be responsible for conducting an EHS audit during the construction phase of the project on a weekly basis according to the provisions of the Environmental and Social Management Plan. The major responsibilities will be:

- Stay at ground levels on daily basis and will coordinate with Contractor's representatives for all construction activities;
- Provide tool box trainings to labour and will also issue relevant PPEs to them;
- Develop formats for work permit system and will ensure its implementation;
- Conduct independent environmental audits; and
- Submit audit reports to the EHS Manager and Site Supervisor of respective Units.

Supervisor (Social and Community aspects)

A supervisor shall be appointed by RUMSL to manage social and community aspects on site

- The Supervisor (S&C) shall be responsible for maintaining category wise records of those eligible for priority hiring of labourers by the contractors at the time of Construction activity initiation, based on the lists provided based on RAP-LRP eligibility for priority employment.
- Additionally, the Supervisor (S&C) shall be responsible for maintenance and upkeep of records related to liaison with local community including awareness and communications on construction phase activities by the project personnel, on various topics, and also be responsible for maintaining stakeholder engagement records.
- The Supervisor (S&C) shall also be designated as the Grievance Officer for the project, who is liable to maintain records of all incoming grievances (including but not limited to RAP and LRP implementation or linked to compensation payments), maintain grievance trackers and drive the communication to the aggrieved on receipt and resolution of grievances and also in cases of any delays that are anticipated in resolution of grievances

HSE Engineer

The SPD/EPC Contractor's HSE officer shall be responsible for implementation of the ESMP and any other environmental requirements that may be identified by the Site Supervisor during the course of the contract. The Contractor(s) HSE officer shall have received basic HSE training either as part of the contract or previously. In addition to any other responsibilities, the general duties of the Contractor's HSE officer shall be:

- Ensure that all personnel (including sub-contractors) are duly informed of the requirements contained in this ESMP, and the associated responsibilities and implications of this ESMP;
- Consult with the Safety Officer of SPD/EPC Contractor regarding interpretation of the EMP and any other aspects of the contract that may impact significantly on the environment; and
- Ensure that all records needed to demonstrate compliance with the EMP requirements are obtained, filed and readily available for inspection by the Site Supervisor of Module or the Project Manager of RUMSL.

8.3.3 Monitoring and Reporting

RUMSL through the respective PMC will monitor the project to ensure conformity to the requirements of the ESMF. The monitoring will cover construction and operation phases. The list of performance indicators as provided in Table 8.5 will be used to monitor project objectives.

The monitoring will be carried out through the environmental and social safeguard compliance reports that will form a part of Monthly Progress Reports (MPR) for the project during construction phase and monthly and annual reports during operation phase. Besides this, regular visits by the EHS Manager shall also be carried out for monitoring of ESMP implementation on site. Delegated personnel shall require to fully complying with the reporting programme in terms of both timely submissions of reports as per acceptable level of detail.

Reporting: Reporting is the process of measuring actual performance or how well the mitigation measures have been implemented, including the format, timing and responsibility for reporting of the monitoring results. This needs to be undertaken in form of environmental, health, safety and social check list, incident record register, environmental, health, safety and social performance reports. RUMSL shall develop and implement a programme of reporting through all stages of the project construction and commissioning, operation and maintenance.

8.3.3.1 Monitoring Indicators

Regular monitoring of critical environmental parameters is of immense importance to assess the status of environment during construction and operation stage. The monitored data can serve as an indicator for any change in environmental quality due to the Solar Park with respect to baseline environmental conditions, so that suitable mitigatory steps could be taken in time to safeguard the environment.

The monitoring action plan covering various performance indicators, frequency and institutional arrangements of the project in the construction and operation stages is given in have been presented in the following ***Table 8.5.***

Table 8.5 Monitoring Action Plan

No.	Parameter	Performance Indicator	Implementing Agency	Monitoring Agency	Frequency
A	**Construction Phase**				

No.	Parameter	Performance Indicator	Implementing Agency	Monitoring Agency	Frequency
1	Compliance to Statutory Norms	Permission for borrow area/ stone query/ explosive permit Availability of required regulatory permissions; Compliance to applicable environmental and labour laws	SPD and EPC Contractor	RUMSL	Quarterly
2	Air Quality	PM10, PM2.5, SOx, NOx, CO at 3 locations covering all the 3 Units	SPD and EPC Contractor through Approved Environmental Laboratory	RUMSL	Quarterly
3	Noise Quality	Leq Day and Night at 5 locations	SPD and EPC Contractor through Approved Environmental Laboratory	RUMSL	Quarterly
4	Water Quality	Suspended Solids (SS), Total dissolved solids (TDS), oil, grease, Heavy metals (Fe, Cr, Pb, etc.) Biological Oxygen Demand (BOD), Total coliforms, Faecal coliforms at 2 locations	SPD and EPC Contractor through Approved Environmental Laboratory	RUMSL	Quarterly
5	Soil Quality	Oil and grease, Heavy metals (Pb, Cr, Ni, Mn, Fe, etc.), N.P.K. at 2 to 3 locations covering all the 3 Units	SPD and EPC Contractor through Approved Environmental Laboratory	RUMSL	Quarterly
6	Personnel Safety	Total supply of PPEs vs number of workers working Number of workers working using PPEs Safe access Safe working platform for work site Incident investigation Number of near misses Number of incidents	SPD and EPC Contractor	RUMSL	Daily
7	Site Restoration	Visual Observation of sites including plant site, borrow area, camp site	SPD and EPC Contractor	RUMSL	After completion of works & before demobilization of the contractor
8	Debris Management	Removal of debris from site (visual Observation)	SPD and EPC Contractor	RUMSL	After completion of works & before issuing completion certificate

No.	Parameter	Performance Indicator	Implementing Agency	Monitoring Agency	Frequency
9	Habitat Modification and Loss	Visual observation of Project site to ensure that any mature trees that are set aside and vegetation around water bodies is being avoided by construction team	SPD and EPC Contractor	RUMSL	Monthly visits during the construction phase to ensure documented information is being followed.
10	Labour Camp	■ Availability of adequate potable water in labour camp and at construction site ■ Adequate toilet and bathing facilities and their maintenance ■ Adequacy of process of waste water disposal ■ Source of cooking fuel ■ Use of wood as a cooking fuel ■ Adequate lighting and ventilation in labour camo ■ Is an emergency response plan in place for the site and are the emergency contact details displayed in the camp ■ Number of first aid kit available and required first aid medicine filled ■ Key Health (Malaria/ dengue/fever/ any other) issues reported during the last month	SPD and EPC Contractor	RUMSL	Monthly
11	Social	■ Implementation of GAP, SEP, GRM	SPD and SPPD	RUMSL	Quarterly
B	**Operation Phase**				
1	Regulatory Compliances	Availability of the regulatory permissions and its compliance	O&M contractor	RUMSL	Annual
2	Waste generation	Quantity of hazardous waste generated and its disposal	O&M contractor	RUMSL	Quarterly
3	Water reuse and recycling	Water consumption reports and wash water reuse and recycling	O&M contractor	RUMSL	Monthly
4	Disposal of Batteries	Number of batteries disposed	O&M contractor	RUMSL	Annual

No.	Parameter	Performance Indicator	Implementing Agency	Monitoring Agency	Frequency
5	Ground water level	Monitoring of ground water level fluctuation	RUMSL through External Agency	RUMSL	Half Yearly
6	Soil Quality	Oil and grease, Heavy metals (Pb, Cr, Ni, Mn, Fe, etc.), N.P.K.	Contractor through Approved Environmental Laboratory	RUMSL	Half yearly
7	Health & Safety	■ Availability of PPEs; ■ Availability of procedures for preventive maintenance along Transmission Line and substation; ■ Records of incident/ accidents and their root cause analysis; ■ Display of emergency contact numbers; ■ Availability of firefighting equipment at substation.	Contractor	RUMSL	Monthly
8	Biodiversity	Maintenance of carcass registry and records of any bird nesting/roosting along Transmission Line Infrastructure	O&M Contractor	RUMSL	Half-yearly visits to check register and records and confirm the findings with local communities who can comment on presence/absence of carcasses in the area.
9	Community health and safety	The implementation of the SEP and GRM formulated for the project and monitoring against the indicators identified in it	O&M Contractor	RUMSL	Monthly

External Reporting and Communication

EHS Manager shall be responsible for ensuring that communication with government agencies and stakeholders are maintained as per the requirement. All complaints and enquiries to be appropriately dealt with and records be maintained in a Complaint/Enquiry Register.

The reporting to external agencies on Environmental and social performance of the project shall be done as agreed in contract.

8.3.3.2 Indicative Environmental Monitoring Budget

Indicative cost of environmental monitoring for the project have been presented in Table below.

Table 8.6 Environmental Monitoring Budget

Component	Item	Unit	Approx.. Unit Cost (Rs.)	Quantity
Construction Phase				

Component	Item	Unit	Approx.. Unit Cost (Rs.)	Quantity
Ambient Air Quality	Quarterly monitoring of AAQ comprising of PM10, PM2.5, SOx, NOx, CO at nearby villages	Per sample	4000	3 locations covering all the three Units
Ambient Noise Level	Quarterly ambient noise level monitoring near D.G. sets/ batching plant/ nearest receptors	Per sample	3000	5 locations covering all the three Units
Surface Water Quality	Quarterly monitoring of surface water quality Parameters as per CPCB Use-class	Per sample	7000	2 locations (nearby water bodies)
Soil Quality	Oil and grease, Heavy metals (Pb, Cr, Ni, Mn, Fe, etc.), N.P.K.	Per sample	8000	2 to 3 locations covering all the 3 Units
Operation Phase				
Ambient Noise Level	Leq Day and Night to be monitored on six monthly basis	Per sample	3000	3 locations comprising to nearest receptors to all the three Units
Surface Water Quality	Six monthly monitoring of surface water quality Parameters as per CPCB Use-class	Per sample	7000	2 locations (nearby water bodies/lakes)
Soil Quality	Six monthly monitoring of Oil and grease, Heavy metals (Pb, Cr, Ni, Mn, Fe, etc.), N.P.K.	Per sample	8000	3 locations (near storage area of all the three units)
Ground Water Level Monitoring	Ground water level to be monitored once in a year	Per sample	200000	One per Unit

8.4 ESMP Budget

The project will have its own budget for implementation of ESMP and RAP. The budget heads for Construction and O&M stage will include cost towards

- Dust Control (Construction Phase)
- Wastewater treatment;
- Waste management;
- Personal protective equipment;
- Health & Safety; and
- Hazardous material transportation & disposal

An indicative budgetary allocation for ESMP implementation during construction and O& M stage is provided in Table below.

Table 8.7 Indicative Budgetary allocation for ESMP Implementation

S. N.	Particular	Capital Cost (INR in lakhs)	Recurring Cost (INR in lakhs) per annum
A.	**Construction Phase**		

S. N.	Particular	Capital Cost (INR in lakhs)	Recurring Cost (INR in lakhs) per annum
1	Dust Suppression with sprinkling of water, covers of the vehicles transporting construction material. (During moderate operations 10-20 tankers will be required on daily basis depending on the season of the year)		10
2	Wastewater treatment - septic tank and soak pits	8	2.5
3	Waste Management - Construction of suitable masonry bins with concrete floors for waste collection and for further disposal as per applicable norms	8	5
4	Environment, health and safety and EMP implementation	50	10
5	Environmental monitoring		3
6	Landscaping	10	
7	Labour camp cleanliness		5
8	RAP, LRP, FPIC measures etc.	To be decided after completion of these studies	
	Subtotal A	**76**	**35.5**
B.	**Operation and Maintenance Phase**		
1	Wastewater treatment- septic tank and soak pits	10	2.5
2	Rainwater harvesting (for roof top at pooling substation) The cost of rainwater harvesting pond in the open area shall be determined on land available, topography, slope, piping system required etc.)	20	2.0
3	Waste Management - Municipal solid waste and hazardous waste storage area sheds (impervious shed for hazardous waste storage)	5	1.5
4	Environment, health and safety training and ESMP evaluation	25	4.0
5	Dry Robotic cleaning	depends on Robot make and capacity	depends on Robot make and capacity
6	Horticulture and landscaping (including seeding of native plants around the Solar Park and adjacent to water bodies)	20	2
7	RAP, LRP, FPIC measures etc.	To be decided after completion of these studies	
	Subtotal B	**80**	**12**
	Total (Subtotal A+ Subtotal B)	**156**	**47.5**

Note: The above cost does not include cost of manpower needed for the EMP implementation

8.5 Training and Capacity Building

Successful implementation of the Project will depend on the effective implementation of the environmental and social management measures outlined in the ESMPs, RAPs, etc. Training and capacity building will be necessary for the key stakeholders in order to ensure effective implementation of the Environmental and Social Management Framework (ESMF).

Project Manager will ensure that the training needs are identified and conducted.

Training needs will be identified based on the specific requirements of ESMP and existing capacity of site and project personnel (including the EPC Contractors and Sub-contractors) to undertake the required ESMP management actions and monitoring activities.

Also general environmental awareness will be created among the project's team to encourage the implementation of environmentally sound practices and compliance requirements of the project activities. This will help in minimising adverse environmental impacts, compliance with the applicable regulations and standards, and achieving performance beyond compliance.

RUMSL in coordination with the educational / research institutions in the country who have substantial experience in the environmental and social management sector including a good understanding of the WB/IFC safeguard requirements, shall conduct classroom training sessions for all staff likely to be involved in sub-project planning & implementation. The EH&S officer can also be one of the resource persons for conducting such training programs.

An environmental management training programme will be conducted for project related activities. This will ensure capacity building for effective implementation of the management and control measures on various project activities. The training shall focus on the environmental, health and safety and social issues. The contents will basically focus on the ESMF concept, regulatory requirements, Environment and Social priority issues, project cycle, outline of Environmental Assessment / Social Assessment and report formats in respect of the Environmental aspects.

The typical training modules for formal class room training could cover the following:

- *Module 1* - ESMF Profile (Concept, regulatory requirements, ESA, reports and formats)
- *Module 2* - Environmental Assessment Process (Environmental Laws & Regulations, EIA process, Identification of Environmental Impacts, Impact Identification Methods, Identification Mitigation Measures, Formulation of Environmental Management Plan, Implementation and Monitoring, Institutional Mechanism)
- *Module 3* - Social Assessment Process (Description of R&R, tribal and gender frameworks and procedures and National requirements, LA process, Necessity for RAP and its preparation process)
- *Module 4* – List of protected and threatened species found in and around the Project site and the provisions of no hunting, trapping and injuring of the species in accordance to the Wildlife Protection Act, 1972.

The program should be structured in such a way that it clearly brings out the value addition and enhancement benefits of proper management of environmental and social issues.

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

9. GRIEVANCE REDRESSAL MECHANISM

Grievance management is an important component of any project's implementation. Over the duration of a project lifecycle, it encounters numerous instances of conflicts, allegations and dissatisfaction within the working and associated human capital and their interactions. Some of the areas of grievances for the project may include issues regarding land procurement, payment of compensation for land or wages to the workers, issues arising due to allotment of alternate land parcels with diminished productivity or higher upfront costs required for making it fit for cultivation, failure to fulfil commitments, poor management of construction activities, accidents due to inappropriate planning of vehicle movement, etc.

Presently, RUMSL does not have a formal grievance redressal mechanism in place for external stakeholders. In order to manage these risks, it needs an internal mechanism to allow the aggrieved party/s to lodge their complaints and get them amicably settled prior to approaching the formal legal mode of solutions.

However, according to the consultations undertaken with the local community and the project team, it was understood that the public meetings were used by the local community to voice their concerns and there have been agitations and demonstrations by the community at the Tehsil and district level Government offices. The local community representatives are also reported to have access to the contact information of the project team; however, this is an informal process and no records of such communication are maintained. For the remaining project lifecycle, a formal grievance redressal mechanism has been put in place for the project.

9.1 Objectives of the Grievance Redressal Mechanism

The primary objective of the GRM shall be to provide an accessible mechanism to the stakeholders of the project and resolve any social and environmental related grievances. For this purpose, a Grievance Redressal Cell (GRC) shall be established, to resolve non-judicial disputes arising out of various matters related to the implementation of the ESMP, as well as other aspects of the project, as deemed fit to be raised before the GRC.

9.2 Composition of the GRC

The GRC will be driven internally by the Project team and shall have representation from the following teams to ensure fair and timely solution to the grievances:

- Site Manager/Project Manager;
- EHS Officer;
- Community Relations Officer;
- Senior representation on behalf of the Project Company; and
- Any other concerned person with decision making authority in relevance to the grievance or aggrieved party.

The GRC shall be led by a Grievance Officer, who can either be the site EHS officer or Community Relations Officer. The aggrieved party shall register their grievances with the GRC. The GRC shall be empowered to take a decision which is to be considered final and binding on the Project. However, the decision of the GRC is not binding on the aggrieved person and he or she may take the grievance to the administrative setup in case any grievance channel is available at that level or take a legal course, in case not satisfied with the outcome of GRC decision.

9.2.1 Functioning of the GRC for Grievance Redress

The GRC meetings will be held on a regular basis (at least monthly) at the Project's site office. The key responsibilities of the GRC shall be as follows:

- Receive, review, consider and resolve grievances related to the social and environmental aspects of the project;
- Entertain grievances of indirectly affected persons and/or persons affected during project implementation;
- Resolve grievances within a period of two weeks at the GRC level and communication of the resolution to the aggrieved party;
- The GRC shall not engage in any review of the legal standing of an "awardee" nor shall deal with any matters pending in the court of law;
- Arrive at decisions through consensus, failing which resolution will be based on majority vote. Any decision made by the GRC must be within the purview of Environmental Management Plan, Corporate EHS and Social Policies or any such documents of relevance of that matter;
- In case the grievance relates to environmental monitoring results or engineering matters, the GRC will validate the information available to it, as provided by the Project Company's Project management team/ environmental monitoring team. However, GRC will not be in a position to question the validity of the data provided to it.
- If needed, may undertake field visits to verify and review the issues, disputes or other relevant matters.

9.3 External Grievance Redressal Mechanism of RUMSL

The medium of receiving Grievances from external stakeholders, comprising fence line community, private and patta land sellers, encroachers and squatters, etc., shall be documented and displayed at relevant locations outside the Solar Park, near entrances, on the boundary walls, etc. The external grievances may be submitted through various mediums, comprising the following:

- Face to face/Walk in;
- In written form to the address displayed by RUMSL;
- Through a toll free phone line or through direct calls to concerned officials, as set up by RUMSL; and
- Online – through website.

The Social and Community Supervisor in the SPPD team shall be responsible for coordination of grievance/complaints received. The person in-charge, based on nature of complaint, will forward the same to the concerned official. A ticket or a unique number will be generated for all such calls and messages based complaints. The complainant will follow up based on that unique number.

9.3.1 Grievance Receipt and Recording

An acknowledgement shall be sent to the aggrieved, either on the spot, or through mail. RUMSL shall maintain records of all grievances received as part of Grievance management process, in the form of a tracker, along with date of receipt of Grievance, nature and details of Grievance, concerned department or personnel linked to Grievances, resolution details and date of closure. Additionally provision of communication of resolution to the aggrieved shall also be maintained by RUMSL, during project lifecycle. The format to be used for recording of grievances is presented below.

GRIEVANCE REGISTRATION FOR EXTERNAL STAKEHOLDERS		
Case No.:	Date:	
Name:		
District:	Village:	
Contact number:		
Details of grievance:		
Name of person recording the grievance:		
Designation of recording person:		
Proposed date of response:		
Signature of the recording person	Signature of complainant	
Date of Resolution :		
Decision of the GRC (give full details):		
Complainant accepts the outcome:	Accepted	Not accepted
Signature of the complainant		
Signature of the S&C Supervisor		

Additionally, the format to be used for an external Grievance Tracker is provided below.

Table 9.1 Format for Grievance Tracker

S. No	Date	Individual Name	Department/ Village	Medium of Communication	Details of Issue	Grievance within Scope	Investigation Requirement	Concerned Department	Timeline for Closing Grievance	Present Status	Remarks

9.3.2 Grievance Resolution and Communication

All grievances lodged by the aggrieved, shall be responded within two weeks. If response is not received within 15 days, the complaint will be escalated to next level. The staffing of GRC will include Social and Community Supervisor of SPPD; and two representatives from community / beneficiary / affected persons. The head of the cell will be a person of repute but not continuing in the government service.

Any project affected person however is free to approach judiciary system of the country if he or she is not satisfied with the verdict given by GRC.

9.4 Internal Grievance Redressal Mechanism

The grievances that shall be treated as "Internal Grievances" by RUMSL, may arise from private Solar Project developers, staff, contractors and contractual workers or RUMSL, staff and workers of private Solar Project Developers, etc.

The mode of receipt of grievances coming from internal stakeholder of RUMSL shall be the following:

- Face to face/Walk in;
- In written form through suggestion boxes set up within Solar Park premises by RUMSL; and
- Through a toll free phone line or through direct calls to concerned officials, as set up by RUMSL.

9.4.1 Grievance Receipt and Recording

An acknowledgement shall be sent to the aggrieved, either on the spot, or through mail. RUMSL shall maintain records of all grievances received as part of Grievance management process, in the form of a tracker, along with date of receipt of Grievance, nature and details of Grievance, concerned department or personnel linked to Grievances, resolution details and date of closure. Additionally provision of communication of resolution to the aggrieved shall also be maintained by RUMSL, during project lifecycle. The format to be used for recording of grievances is presented below.

GRIEVANCE REGISTRATION FOR EXTERNAL STAKEHOLDERS		
Case No.:	Date:	
Name:		
District:	Village:	
Contact number:		
Details of grievance:		
Name of person recording the grievance:		
Designation of recording person:		
Proposed date of response:		
Signature of the recording person	Signature of complainant	
Date of Resolution :		
Decision of the GRC (give full details):		
Complainant accepts the outcome:	Accepted	Not accepted
Signature of the complainant		
Signature of the S&C Supervisor		

Additionally, the format to be used for an external Grievance Tracker is provided below.

Table 9.2 Format for Grievance Tracker

S. No	Date	Individual Name	Department/ SPD/ Contractor	Medium of Communication	Details of Issue	Grievance within Scope	Investigation Requirement	Concerned Department	Timeline for Closing Grievance	Present Status	Remarks

9.4.2 Grievance Resolution and Closure

The GRC will organize an inspection/review of the grievance received, to check the validity and severity of the grievance. The inspection will be undertaken in no later than seven days of receiving the grievance. The assigned individual will work with immediate supervisors/ managers of the concerned department or contractors to investigate the problem and identify measures to resolve the grievance as appropriate, within 15 days. This could involve provision of information to clarify the situation, undertaking measures to remedy actual problems or compensate for any damage that has been caused. Where a grievance is found to be not a real problem a clear explanation will be provided to the complainant.

A formal response detailing how the grievance has been resolved shall be provided to each complainant once a resolution is reached. Where resolution is delayed the complainant will be provided with regular updates on progress.

Once a resolution is decided and agreed upon internally, it is communicated to the aggrieved. If the GRC along with the concerned department head are not able to resolve the grievance adequately within 15 days, the same may be escalated.

9.5 Monitoring and Evaluation

Like the other project components, the GRM shall be regularly monitored to ensure that the stakeholders are having no or limited issues with the project and in case there are concerns, they are being adequately addressed as per the mandate. In order to keep track on the effectiveness of GRM, it is the responsibility of the Project Company's Environment and Social team to compile and maintain database on grievances for periodic review. The mechanism shall be based on two components, internal monitoring and reporting and external monitoring and reporting which shall run simultaneously. Mostly this shall be aligned with simultaneous process monitoring rather than doing it separately all the time.

9.6 Budgeting

RUMSL shall ensure adequate budgeting and resource allocation for implementing the GRM.

10. CONCLUSION

The ESIA has assessed the overall acceptability of environmental and social impacts likely to arise as a result of construction and operation of Shajapur Solar Park.
To summarize,

- Project's potential environmental impacts will be mostly confined to construction phase and site-specific. These impacts include change in land use, stress on ground water resources, increase noise & vibration and air quality, etc. during the site preparation of Solar Park, pooling substations and community health and safety during material transportation.
- The proposed project will require water for cleaning of solar modules during operation phase. The Unit 6 & 7 (Moman Badodiya) and Unit 8 (South Shajapur) falls under Over Exploited and Semi Critical category respectively in terms of ground water availability. Water requirement for the project will be met mainly through ground water. Project will require to explore the dry cleaning method or alternate sources of water.
- The usable land area for the project is ~1000 hectares for Solar Park. Potential social impacts due to loss of access to land for farming, grazing, loss of land-based livelihood sources for the households in the PFA can be mitigated through the RAP-LRP for the Project. Impact on common property resources will be limited and can be avoided by providing access to the villagers to continue their existing use of such occupied land parcels/water bodies, etc.
- The impact on community resources and community health and safety is limited to construction phase, while on the other hand, short term employment will also be generated.

The Environmental and Social Management Plan (ESMP) describes mitigation measures for impacts specific to Project activities and also discuss implementation mechanism. Project specific management plans are also provided for certain Project activities such as waste management, occupational health & safety, contractor and labour management plan, gender action plan, stakeholder management plan, grievance redressal, etc. This ESIA study together with mitigation measures and follow up of recommendations on management actions will help RUMSL in complying with the environmental standards.

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APPENDIX A PHOTO DOCUMENTATION

View of project site

View of project site

View of project site

Disclosure of Project to community

Disclosure of Project to community

Disclosure of Project to community

Water sampling in study area

Soil sampling in study area

APPENDIX B DETAILS OF CONSULTATIONS UNDERTAKEN DURING SHAJAPUR SOLAR PARK ESIA PREPARATION

S. No	Date	Location	Meeting with	Details of Consultations
1.	29th January 2020	Surajpur village	Mixed Group and Women's group consultations	■ Discussions were held regarding the general land holding patterns in the village, social group wise, and share of landless households in the village; ■ The villagers shared details regarding the process of encroachment of government land or leased land (patta land) for residential structures, and grazing activities; ■ Concerns were raised regarding the amount of land parcel to be utilized for the project and whether it will affect the area of grazing land; ■ The villagers differentiated between *atikraman ()* and *kabza*, where the former is defined as the extension of private land boundary while the latter refers to the government land for livestock grazing; ■ Discussions also focussed on agricultural activity, farm output and water availability; ■ It was informed that there is not sufficient water for irrigation and water level is at around 400-500 feet; ■ It was reported that most of the agricultural crops are rain fed and it is understood that farmers has installed the borewell in their field for the irrigation purpose .However, the consultation revealed that the ■ Crops grown in the area include soyabean, wheat, chana, etc. along with other vegetables like onions and Orange cultivations scaling up ■ Landless households and household with less 2-3 bighas of holding work as daily wage agricultural labour ■ Nearly 50 % HHs have livestock in the village, with an average holding of 2-3 livestock/ HH and a maximum holding of 20-25 livestock/ HH ■ The village has had a history of encroachment, where the process is a primary right of those households with sufficient land holdings
2.		Lalupura village	Mixed Group and Women's group consultations	■ There are ~70-80 households in village and have a total population of ~600. ■ Out of ~80 HHs there are Balai/ Harijan (SC) community and Gurjar community (OBC) ■ All the community stay together in village, no discrimination is done on the basis of the caste

S. No	Date	Location	Meeting with	Details of Consultations
				■ Discussions were held regarding the general land holding patterns in the village, social group wise, and share of landless households in the village ■ It is understood that no one in Lalpur village is landless, either villager has their own land or were given the land on patta. ■ The encroachment is the villages is usually done for agriculture, for making livestock shed and storing fodder; ■ Villagers are carrying out the process of encroachment for the past 20 years. There is no major encroachment for agricultural purposes, only the private landowner extends his boundary to around ½ - 1 bigha for every 5- 10 bigha of private land-holding; ■ The Government land and common grazing lands are used for grazing by animals; ■ Migrants from Rajasthan (shepherd community) also come to this village once or twice a year. and reside in nearby Government land ■ There are no land improvement activities undertaken by respective Gram Panchayat or watershed Dept. for the village; however, during consultation with local community, which were mostly farmers, it was informed that the land productivity and irrigation has increased in last 10 years due to water availability in the area;
3.	30th January 2020	Parsula village	Men's Group and Women's group consultations	■ The total number of households in the village is ~175 and Out of 175 households, ~45 % HHs are below poverty lines (BPL) ■ It is understood that most of the villager were not aware about gram Sabha meeting which was held on 26th Jan. additionally, the consultation indicates that villager has never been to the Panchayat ghar and have very limited awareness about the government notification which is displayed on the notice board of Panchayat ghar. The local community get information regarding any schemes or Yojna is through television, newspaper or from Patwari. ■ The average land holding in village ~2-510 bighas; ■ The current rate of 1 Bigha is ~ 2- 2.5 Lakh; ■ Nearly 15- 20 households from SC & ST community had got land on patta nearly 20 years ago ■ The Bhil and Thakurs community has the land on patta

S. No	Date	Location	Meeting with	Details of Consultations
				■ Government land is mostly used as grazing land for their livestock, apart from that there is some area which has been encroached by local community for agriculture or any other purposes ■ There is a local market at Kanad (12 km) from village, where people sell their livestock. Cow @INR ~2500, buffalo INR ~20,000- 50,000 and goats INR ~ 5000- 10,000 ■ The crop residues are mostly used by farmers as fodder for livestock and when stored fodder is consumed they purchase it from someone in village (who has a stock) or from nearby villages at the rate of 2000- 3000 Rs/ trolley, khalli @ of 2000-2500 Rs/ 60 Kg. ■ Reportedly, there are no women headed households in the village, also there are no households in village whose head is a handicapped. ■ Women are responsible for collecting and carrying water and based on information, the women travel approximately 2km to fetch water for domestic chores. ■ The majority of girls drop school after class, 8th because the distance of High school, which is in Chouma village is approximately 7km and due to limited facility of transportation, the number of dropout increase. ■ Women are responsible for the livestock rearing as well.
4.		Fawaka Village	Nearly 15- 20 people including 5-6 women were present in village level consultation	■ Nearly 300 households in the village; and total population is 800 ■ Nearly 200 households are of OBC (Sondiya Thakur) and General (Rajputs & Brahmins) community; ■ There are nearly 90 households of SC community and rest HHs are of ST (Bhilala) community; ■ The average land holding in village is 8- 10 bigha/ household; and approximately 10hh doesn't have any land holding ■ Nearly 30 HHs from SC community got patta land, out of which only 5-7 households got land for cultivation. ■ The nearby government land and grazing land is used as grazing land for livestock by local community; ■ In addition, there are almost every households in the village, who have encroached upon 1 – ½ bighas of government land. Such encroached land parcels are not barricaded however, there are temporary culverts made on land boundary and is used only during cropping season. The cropping area is extended to revenue land;

S. No	Date	Location	Meeting with	Details of Consultations
				■ A fine of INR ~ 400 – 500 is levied on encroachers of Government land, which is paid by farmers, however they do not remove the encroachment, neither are they forced by revenue department to remove it; ■ Local community informed that no fodder is purchased, as farmers store and have sufficient fodder for their livestock. Also fodder is collected from nearby areas (grass, leaves etc.) ■ The crop residues, i.e. husk from wheat, mustard residues etc. are stored by farmers and used as fodder throughout the year;
5.	31st January 2020	Tehsildar – Shajapur tehsil	Maksi	■ Discussion about the process of patta land ■ All patta cases dealt with by the collector's office, not at tehsildar's level. They are only asked to investigate the case and prepare a report of the status ■ He has not seen any case of patta land being relocated but collector can do it ■ In a case where a person's land was taken for road construction, he sent in an application for patta to be allotted to him on government land ■ Collector can give permission for a patta holder, based on circumstances, to sell land. Usually when the patta is more than 30 years old. ■ Tehsildar thinks that the collector could give approval for RUMSL to take the patta land, if the patta holder agrees, and provide compensation ■ Collector could also cancel allotment of plots to RUMSL if pattas found and if the people do not want to move or be compensated ■ The fine has to be paid by the Farmer to Tehsildar, who has encroached the government land. It was informed that the fine is paid by the same person every year, there is no change ■ In case any villagers has the requirement of the patta land, the permission need to be taken from the district collector. the proper inspection is undertaken before allotting the patta land to any villager

S. No	Date	Location	Meeting with	Details of Consultations
6.		Chouma Village	Community groups like SC, OBC, general	■ There are ~ 160- 170 HHs in the village; ■ The total population of the village is ~ 1200; ■ During consultation with local community present at the meeting, it was informed that there are ~ 40 HHs of SC community (Malviya), ~ 40 HHs of OBC community (Dhobi, Luhar, Khati, Patidar, Sunar and Sondiya Thakur), no ST population ■ There are 4 HHs of Jain community, 20 HHs of Rajput community and 2 HHs of Brahmin community; ■ There ~ 80 HHs that come Below Poverty Line, the BPL category has people from every community; The BPL card were made in 2004-05, however, no cross checking has been done by the official regarding the upgradation of BPL into non BPL . The BPL is applicable to all the community. ■ Primarily local community are engaged in agricultural activity ■ It was informed by local community that there are ~ 10 HHs in village who do not have agricultural land and are landless; and none of them has been given the land on patta. ■ Usually HHs from SC community have less land holding, i.e. between 1-2 bighas and maximum up to 3- 4 bigha; ■ Local community present during consultation informed that nearly every household have encroached land; ■ Where Government land encroached by any land owner is approximately double the private land owned by him, however encroachment depends on the availability of land in the proximity; ■ Since the land given on patta is unirrigated land so mostly every patta holder has left their patta land and encroached a new parcel of revenue land for cultivation; ■ It was informed that there is one family from Malviya community (SC) who does not cultivate on his patta land and cultivates over another revenue land parcel of ~ 4 bigha, as a squatter; ■ It is understood that the local community is aware about the project and they had a discussion among themselves regarding their concerns. Furthermore, they have written a letter regarding the stay order in 2017-18 , but have not received any response

S. No	Date	Location	Meeting with	Details of Consultations
7.		Jawadi Village	Men's group consultation	■ ~ 70 Households and having a Population of ~ 700, out of which there are ~550 voters; ■ Patta land has been given to ~15 SC HHs; as they don't own any land. ■ However, it was noted that SC community don't do any agricultural practice on their patta land because the land has been allotted by the Patwari for Gaushala Current market rate is INR 2.5- 3 Lakh/ Bigha; ■ Nearly 15 HHs from village have left main settlement of the village and settled to Jawadi Khedi ~500 meters from village. These HHs still do not have patta of their residential plot. There is one Rajput community and rest OBC communities among these HHs. ■ Patta holders cultivate on another available government land in their area as it is used as grazing land by villagers; ■ The proposed project and the land given patta to villager, is under the same khasra number, where the government has not provided any provision of pipeline, the villagers has laid their own pipe line for agricultural practice, as the ground water level is low. ■ It was reported that the water is clean and it doesn't lead to any diseases.
8.		Dehripal Village	Mixed groups	■ There are nearly 600 Households in village. The village has a population of ~2000, people out of which ~1200 are people above 18 years of age/ voting population. ■ Nearby revenue and allotted grazing land is used grazing field for livestock, especially in rainy season, as there is much grass. During other seasons/ dry seasons, people collect fodder from nearby agricultural field; ■ Farmers use crop residues of wheat, mustard etc. as fodder. Where crop residues are stored and usually lasts for approximately 8- 12 months. In case of shortage of fodder for livestock, people also purchase fodder like grass @ 3-4/ per pc, husk @ 2- 2.5 thousand/ trolley etc.; ■ The major crops grown in the village are, soyabean, wheat, chana, masoor and mustard; ■ Nearly 12 HHs cultivate orange in their agricultural land; ■ Nearly 50% of the land remains uncultivated due to scarcity of water

S. No	Date	Location	Meeting with	Details of Consultations
9.	31st January 2020	Bijnakhedi	Men and Women's Group Consultation	■ There are nearly 150 HHs in village which has a population of ~1200 people; ■ There are nearly 550 voters out of 1200 people ■ Village has people from different communities, like 50 HHs from Rajput community, 50 HHs from Sondiya Thakur (OBC) community, ~15 HHs of Gurjar (OBC) community, ~25 HHs of SC community, ~4 HHs of Brahmin community, one HH of Barber community (OBC), ~five HHs of Lohar community (OBC) and ~six HHs of Banjara community (OBC). ■ Primarily engaged in agricultural practices ■ Women are organised into SHGs and 7 SHG, out of which 2 are not functioning, the money which is collected by the SHG is used for those, who have the requirement of money. For example the money is utilized for paying the school fees, to buy medicine, any kind of requirement in agricultural practice. ■ It is understood, that utility of the SHG borrowed money is usually concentrated in the hands of male members; however, the views of women is also acknowledged, for the utility of money. ■ People having no agricultural land or are marginal farmers, work as daily wager agricultural in fields of other farmers or farmers from nearby villages.
10.		Burlay village	Men's and Women's Group consultations	■ People during consultation informed that people usually encroach land, which is used for livestock shed, grazing and agriculture. ■ Patta holders usually do not cultivate on their patta land as it is un-irrigated land; they usually encroach around 5-20 bighas of revenue land for agriculture; ■ it is understood that the villagers who got the land on patta , have 5 bighas patta land which is used for 1 crop cultivation during the rainy season and rest 20 bigha of land has been encroached , which is used as grazing land, ■ Families having livestock usually store crop residues as fodder which usually lasts for 8-12 months; ■ In case of further requirement of fodder they purchase it from farmers having extra fodder stored or from nearby villages. One trolley of fodder (husk) costs around 1000 INR.

S. No	Date	Location	Meeting with	Details of Consultations
				■ It was reported that, the villager who don't have water availability for irrigation, ask for the supply of water from other framers. It is understood, 1part of the agricultural production is given in return of water supply. ■ Village residents informed that when household with less land are not working on their agricultural farm, they work as wage labour at construction site as well as an agricultural labourer in nearby area.
11.		Dhatravada village	Mixed Group consultation	■ There are nearly 250-275 HHs in village; ■ The current population of village is around 1800 out of which 800 is the voting population.
12.				■ There are nearly 175 HHs of Pal Rajput (General), ~10 HHs of Brahmin community, ~6 HHs of Sutar (OBC) community, ~5 HHs of Kumhar (OBC), ~50 HHs of Chamar (SC) community and ~50 HHs of Malviya (OBC) community. ■ The village has ~50 % population below poverty line; ■ Most SC population stays in a different hamlet, a little away from the village; ■ People informed that ~ INR 400- 500 was levied on farmers who encroached nearby revenue or grazing land and were using it for agricultural purposes; ■ People informed that every farmer who has encroached revenue land paid the fine but have not removed their encroached land and are still cultivating on that encroached land parcel; ■ Nearly 10% of the total village population living in Chhapri part of the village have encroached revenue land for agriculture purpose. On an average every encroacher farmer is cultivating over ~2-3 to ~7 bigha of government land;
13.	1st February 2020	Moman Badodiya tehsil office	Moman Badodiya Tehsildar	■ There is a condition with every patta land, that if needed by Government, Patta holder have to return it; ■ In case of giving patta land to any project, another land is allotted on patta to patta holders. It entirely depends on Collector's decision; ■ Conditions of Patta include no selling; no gifting; no exchange of property, when needed by Govt. they have to return it back to Government;

S. No	Date	Location	Meeting with	Details of Consultations
				■ Usually patta land is avoided during proceedings/ transactions; ■ Crop compensation is given to patta holder during replacement of patta; ■ Land on patta is given to landless usually SC/ST, previously it was given to landless people from general community also; ■ In case of eligibility of getting compensation: if any patta (un-irrigated) land is given to patta holder and he is cultivating another land (and not the land parcel given on patta), he will not be given compensation; ■ In case of this project no crop compensation will be given as they are aware of project and yet chose to cultivate on that land parcel; ■ ■ Discussion on understanding of the Process of land take by Government for projects. ■ It was informed during consultation that when land is allotted by Collector for project, then even Collector can't take it back; ■ Only project proponent/ developer has the authority to return back the allotted/ remaining land; ■ In case of any structure on allotted land, no compensation will be given; ■ Nistar Patrak: Special power given to Collector/ GP to identify and reserve/ segregate any land parcel for some special purpose/ for future development; ■ Depends on GP/ Collector/ authority on how much land he wants to keep in reserve; ■ 2 % of total Government land is provisioned to be kept as reserve for grazing land; ■ In case, the land has to be undertaken from Schedule Tribe person, the permission has to be granted by the district collector.

APPENDIX C ENVIRONMENTAL MONITORING RESULTS

Location : Gondal Mau

Sr. No.	Date of Monitoring	Parameters					Sample Code
		PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	SO_2 (µg/m³)	NO_x (µg/m³)	HC (ppm)	
1	14-12-2019	60.3	22.2	6.9	20.4	9.5	NIL/AA/12/19/282
2	15-12-2019	61.3	19.5	7.2	17.5	14.3	NIL/AA/12/19/284
CPCB Limits		**100**	**60**	**80**	**80**	**---**	
Minimum		**60.3**	**19.5**	**6.9**	**17.5**	**9.5**	
Maximum		**61.3**	**22.2**	**7.2**	**20.4**	**14.3**	
Average		**60.80**	**20.85**	**7.05**	**18.95**	**11.90**	
90th Percentile		**61.20**	**21.93**	**7.19**	**20.11**	**13.82**	
95th Percentile		**61.25**	**22.07**	**7.21**	**20.26**	**14.06**	
98th Percentile		**61.28**	**22.15**	**7.22**	**20.34**	**14.20**	

Location : Khareli

Sr. No.	Date of Monitoring	Parameters					Sample Code
		PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	SO_2 (µg/m³)	NO_x (µg/m³)	HC (ppm)	
1	14-12-2019	58.0	17.0	6.7	20.4	19.2	NIL/AA/12/19/278
2	20-12-2019	62.3	17.8	7.9	19.1	15.1	NIL/AA/12/19/280
CPCB Limits		**100**	**60**	**80**	**80**	**---**	
Minimum		**58.0**	**17.0**	**6.7**	**19.1**	**15.1**	
Maximum		**62.3**	**17.8**	**7.9**	**20.4**	**19.2**	
Average		**60.15**	**17.40**	**7.28**	**19.75**	**17.15**	
90th Percentile		**61.87**	**17.72**	**7.75**	**20.27**	**18.79**	
95th Percentile		**62.09**	**17.76**	**7.81**	**20.34**	**19.00**	
98th Percentile		**62.21**	**17.78**	**7.85**	**20.37**	**19.12**	

Location : Hanoti

Sr. No.	Date of Monitoring	Parameters					Sample Code
		PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	SO_2 (µg/m³)	NO_x (µg/m³)	HC (ppm)	
1	14-12-2019	60.6	22.2	7.5	18.2	10.8	NIL/AA/12/19/279
2	20-12-2019	55.7	20.4	6.9	17.4	14.9	NIL/AA/12/19/281
CPCB Limits		**100**	**60**	**80**	**80**	**---**	
Minimum		**55.7**	**20.4**	**6.9**	**17.4**	**10.8**	
Maximum		**60.6**	**22.2**	**7.5**	**18.2**	**14.9**	
Average		**58.15**	**21.30**	**7.22**	**17.80**	**12.85**	
90th Percentile		**60.11**	**22.02**	**7.45**	**18.12**	**14.49**	
95th Percentile		**60.36**	**22.11**	**7.48**	**18.16**	**14.70**	
98th Percentile		**60.50**	**22.16**	**7.50**	**18.18**	**14.82**	

Location : Burlay

Sr. No.	Date of Monitoring	Parameters					Sample Code
		PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	SO_2 (µg/m³)	NO_x (µg/m³)	HC (ppm)	
1	14-12-2019	63.0	24.8	7.3	18.2	7.5	NIL/AA/12/19/283
2	15-12-2019	62.1	20.4	7.8	22.1	6.4	NIL/AA/12/19/285
CPCB Limits		**100**	**60**	**80**	**80**	**---**	

Minimum	**62.1**	**20.4**	**7.3**	**18.2**	**6.4**	
Maximum	**63.0**	**24.8**	**7.8**	**22.1**	**7.5**	
Average	**62.55**	**22.60**	**7.57**	**20.15**	**6.95**	
90th Percentile	**62.91**	**24.36**	**7.75**	**21.71**	**7.39**	
95th Percentile	**62.96**	**24.58**	**7.78**	**21.91**	**7.45**	
98th Percentile	**62.98**	**24.71**	**7.79**	**22.02**	**7.48**	

Location :Agar to Sarangpur Road
Date of monitoring : 19.12.2019

Location :Sarangpur Road to Agar
Date of monitoring : 19.12.2019

TIME	NO. OF VEHICALS IN 24 Hrs, (Hourly Data)					TIME	NO. OF VEHICALS IN 24 Hrs, (Hourly Data)				
	TWO WHEELERS	THREE WHEELERS	LCV,S	HCV,S	NON MOTORISED		TWO WHEELERS	THREE WHEELERS	LCV,S	HCV,S	NON MOTORISED
06:00 - 07:00	5	0	2	3	0	06:00 - 07:00	10	0	10	11	0
07:00 - 08:00	7	7	4	11	0	07:00 - 08:00	17	2	13	24	0
08:00 - 09:00	49	5	12	1	0	08:00 - 09:00	7	4	37	8	0
09:00 - 10:00	37	0	23	3	0	09:00 - 10:00	16	8	16	10	0
10:00 - 11:00	20	4	11	4	0	10:00 - 11:00	21	1	21	29	0
11:00 - 12:00	35	6	9	1	0	11:00 - 12:00	29	3	11	7	0
12:00 - 13:00	31	0	14	23	0	12:00 - 13:00	23	5	16	21	0
13:00 - 14:00	14	0	19	31	0	13:00 - 14:00	9	0	8	24	0
14:00 - 15:00	29	2	29	17	0	14:00 - 15:00	15	0	22	37	0
15:00 - 16:00	23	3	6	12	0	15:00 - 16:00	39	1	16	25	0
16:00 - 17:00	44	4	24	16	0	16:00 - 17:00	8	0	13	19	0
17:00 - 18:00	13	0	16	15	0	17:00 - 18:00	26	2	34	24	0
18:00 - 19:00	37	2	11	2	0	18:00 - 19:00	28	6	10	10	0
19:00 - 20:00	19	7	19	1	0	19:00 - 20:00	37	4	36	27	0
20:00 - 21:00	10	0	13	1	0	20:00 - 21:00	13	0	1	15	0
21:00 - 22:00	13	0	8	9	0	21:00 - 22:00	16	0	8	9	0
22:00 - 23:00	4	0	7	9	0	22:00 - 23:00	12	0	6	13	0
23:00 - 00:00	1	0	5	6	0	23:00 - 00:00	5	0	5	15	0
00:00 - 01:00	7	0	3	12	0	00:00 - 01:00	15	0	1	28	0
01:00 - 02:00	0	0	13	10	0	01:00 - 02:00	7	0	2	9	0
02:00 - 03:00	1	0	8	11	0	02:00 - 03:00	8	0	4	8	0
03:00 - 04:00	0	0	1	7	0	03:00 - 04:00	0	0	8	11	0
04:00 - 05:00	0	0	0	1	0	04:00 - 05:00	1	0	7	8	0
05:00 - 06:00	0	0	1	10	0	05:00 - 06:00	9	0	8	12	0

Location :Jhonkar To Palsavad Road
Date of monitoring : 15.12.2019

Location :Palsavad Road to Jhonkar
Date of monitoring : 15.12.2019

TIME	NO. OF VEHICALS IN 24 Hrs, (Hourly Data)					TIME	NO. OF VEHICALS IN 24 Hrs, (Hourly Data)				
	TWO WHEELERS	THREE WHEELERS	LCV,S	HCV,S	NON MOTORISED		TWO WHEELERS	THREE WHEELERS	LCV,S	HCV,S	NON MOTORISED
06:00 - 07:00	1	0	0	4	0	06:00 - 07:00	4	0	0	1	0
07:00 - 08:00	5	0	2	0	0	07:00 - 08:00	7	0	0	4	1
08:00 - 09:00	12	1	5	8	2	08:00 - 09:00	5	2	6	4	3
09:00 - 10:00	27	0	9	2	1	09:00 - 10:00	16	3	10	6	0
10:00 - 11:00	25	1	13	3	6	10:00 - 11:00	31	0	4	2	2
11:00 - 12:00	31	0	8	4	0	11:00 - 12:00	50	0	11	9	0
12:00 - 13:00	30	1	5	9	1	12:00 - 13:00	39	1	4	7	2
13:00 - 14:00	16	0	9	5	0	13:00 - 14:00	18	0	14	11	0
14:00 - 15:00	48	0	13	2	1	14:00 - 15:00	45	0	9	4	0
15:00 - 16:00	11	0	12	9	0	15:00 - 16:00	27	1	16	11	0
16:00 - 17:00	13	0	5	13	0	16:00 - 17:00	10	0	10	16	0
17:00 - 18:00	12	2	18	4	0	17:00 - 18:00	24	0	8	18	1
18:00 - 19:00	8	1	2	3	1	18:00 - 19:00	13	0	3	9	0
19:00 - 20:00	16	0	11	2	0	19:00 - 20:00	20	1	9	4	4
20:00 - 21:00	5	2	4	1	1	20:00 - 21:00	18	0	2	1	1
21:00 - 22:00	13	0	1	1	2	21:00 - 22:00	12	2	1	5	1
22:00 - 23:00	2	0	7	0	0	22:00 - 23:00	5	0	4	1	0
23:00 - 00:00	1	0	2	1	0	23:00 - 00:00	9	0	0	2	0
00:00 - 01:00	0	0	3	2	0	00:00 - 01:00	0	0	2	3	0
01:00 - 02:00	0	0	1	1	0	01:00 - 02:00	0	0	1	4	0
02:00 - 03:00	0	0	4	1	0	02:00 - 03:00	0	0	7	1	0
03:00 - 04:00	0	0	2	2	0	03:00 - 04:00	0	0	0	4	0
04:00 - 05:00	0	0	1	0	0	04:00 - 05:00	0	0	3	1	0
05:00 - 06:00	2	0	1	0	0	05:00 - 06:00	3	0	1	2	0

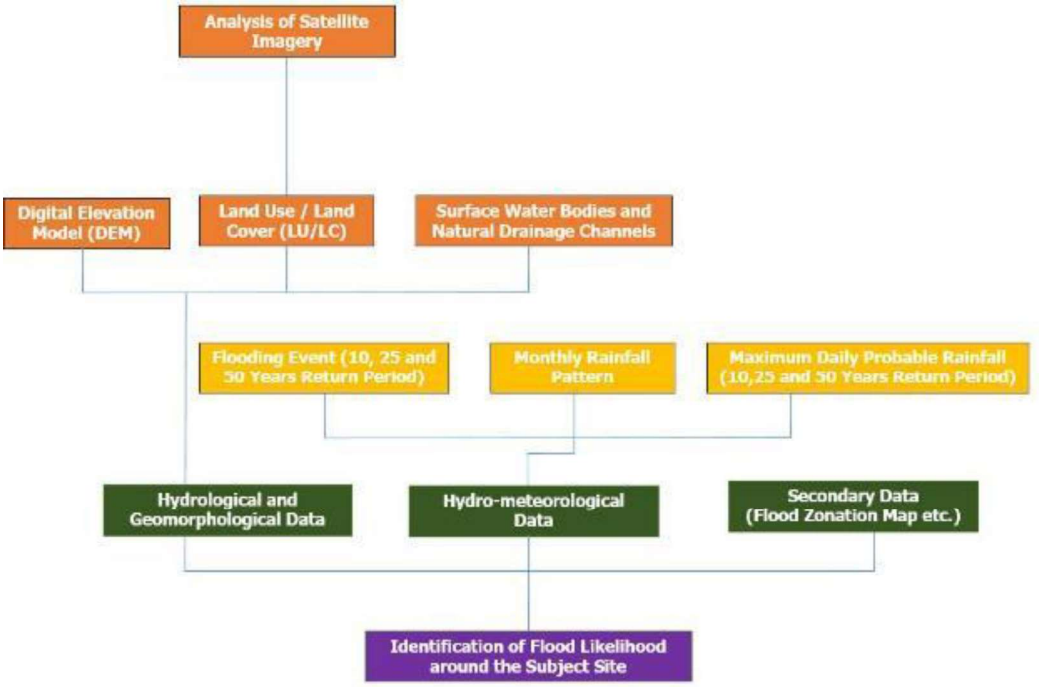
APPENDIX D FLOOD LIKELIHOOD ASSESSMENT

FLOOD LIKELIHOOD ASSESSMENT (FLA)

Approach and Methodology

The study includes a high-level review of the hydrology and flooding characteristics of the Site and the surrounding areas. The assessment was done using Site Level assessment and desktop analysis. The Site level assessment was conducted by reviewing the data collected during the Site visit and community consultation. Desktop analysis include review of satellite data, geospatial data analysis, thematic mapping based on ArcGIS, and review of secondary available in public domain. Based on this review, a flood likelihood matrix will be developed with the various attributes to which the Site and area is likely to be sensitive to inundation and flooding. Figure D.0.1 illustrates the methodology to perform FLA.

Figure D.0.1: Methodology of flood likelihood assessment



Risk Categorization

ERM has adopted a qualitative risk based categorization to identify potential risks and vulnerabilities associated with flooding, inundation and waterlogging. The risks are defined considering the likelihood of their occurrence and potential severity of the impact broadly following the risk matrix presented in the table below.

Risk = Likelihood of an impact occurring x Potential severity of the impact.

		Probability of Occurrence		
		Low	Medium	High
Potential Impact	Low			
	Medium			
	High			

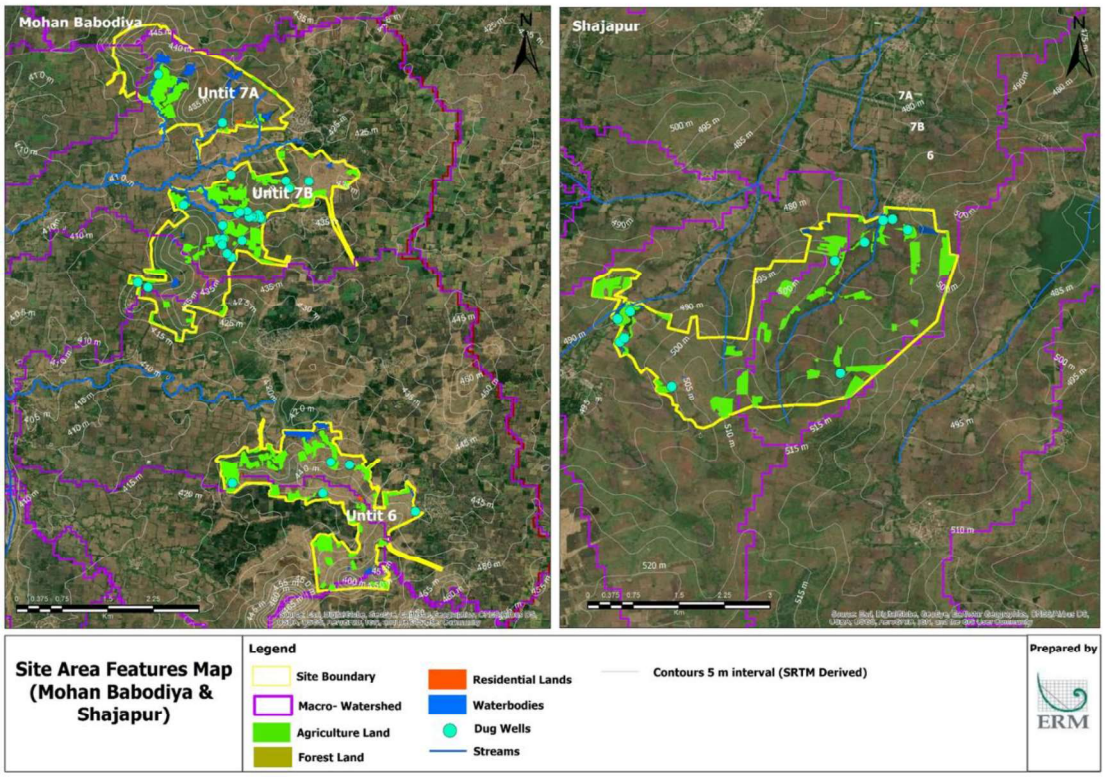
Note: The study was carried out to evaluate and understand the qualitative likelihood of flood impact on the Site only. Risk categorization has been adopted merely for providing broad level perspective on the potential for impact from floods / inundation / water logging on the Site and to emphasize specific areas for further evaluation prior to developing Site specific mitigation measures only.

Hydrological Setup

The natural waterbodies and Site area setting of Moman Badodiya and Shajapur is presented in Figure D0.2. Moman Badodiya has three clusters namely Unit 7A, Unit 7B and Unit 6, whereas Shajapur has one cluster. Some of the salient features of both the Sites are described below:

- The core zone (2 km radius) around the Sites is largely occupied by open lands; scrubland; agricultural land along the stream and low lying areas; forest land; scattered residential settlements; and river channels of the Kali Sindh River and its tributaries.
- A tributary (major stream) of Kali Sindh River is located in the west at distances of ~2.5 to 3.0 km parallel to the three clusters of the Moman Badodiya, flowing from south to north. No major streams were found in the vicinity of these clusters except few local streams which originate at the Site ridge and flow from east to west during the rains. One (1) village pond was observed at northern boundary of the Unit 6 Site in Moman Badodiya.
- The major stream which flows parallel to both Sites at a distance of 2.5 to 3 km in the west has an elevation around 400 m, amsl, whereas three (3) clusters of Moman Badodiya are located at an elevation range of approximately 425- 450 m, amsl. This indicates towards a potentially significant elevation difference between the Sites and the stream.
- A tributary (major stream) of Kali Sindh River flows at distance of ~2.0 km north to the Shajapur Site, flowing along south – north direction. This major stream stretches in northward vector. Moman Badodiya Sites are located ~2.5 to 3.5 km east of the major stream and within the catchment of the major stream. No major streams were observed in the vicinity of Shajapur Site, though few first order (seasonal) streams originate at the Site ridge and flow along east-west direction. One village pond found at northern boundary of the Shajapur Site.
- The major stream is located at a distance of 2 km north to the Site and has an elevation around 475 m amsl, whereas Shajapur site situated at an elevation range of approximately 475- 525 m, amsl. Further, a small scale reservoir located at Palswad Son habitation located adjacent to the Site in the north- east but falls in other micro-watershed.
- All the streams are seasonal in nature and eventually drain into the Kali Sindh River.

Figure D0.2: Natural Waterbodies and Site Area Setting for Moman Badodiya and Shajapur



Topography and Drainage of Site

The catchment level topography and drainage patterns were discussed in Section 2. This section will mainly cover the topography and drainage patterns at the Sites and their immediate surroundings.

Topography Map

Figure D0.3 presents the topographic map of the Moman Badodiya Sites (Unit 6, Unit 7A and Unit 7B) along with the micro-catchments of the Site. The Moman Badodiya Site was observed to comprise of five (5) different sub-catchments or micro-watershed labelled as Cat-1 through Cat-5. The general topography within the Moman Badodiya Sites varies between 400 and 475 m, amsl. Topographic highs were mainly observed along the eastern part of all the Sites while topographic lows were mainly observed in patches along the western part of the Sites. The narrow topography contours at the Site indicate relatively steeper slopes which are conducive to facilitate drainage of the surface water from east/ north- east to west/ south- west of the Site.

Figure D0.3: Topographic Map of the Moman Badodiya Site

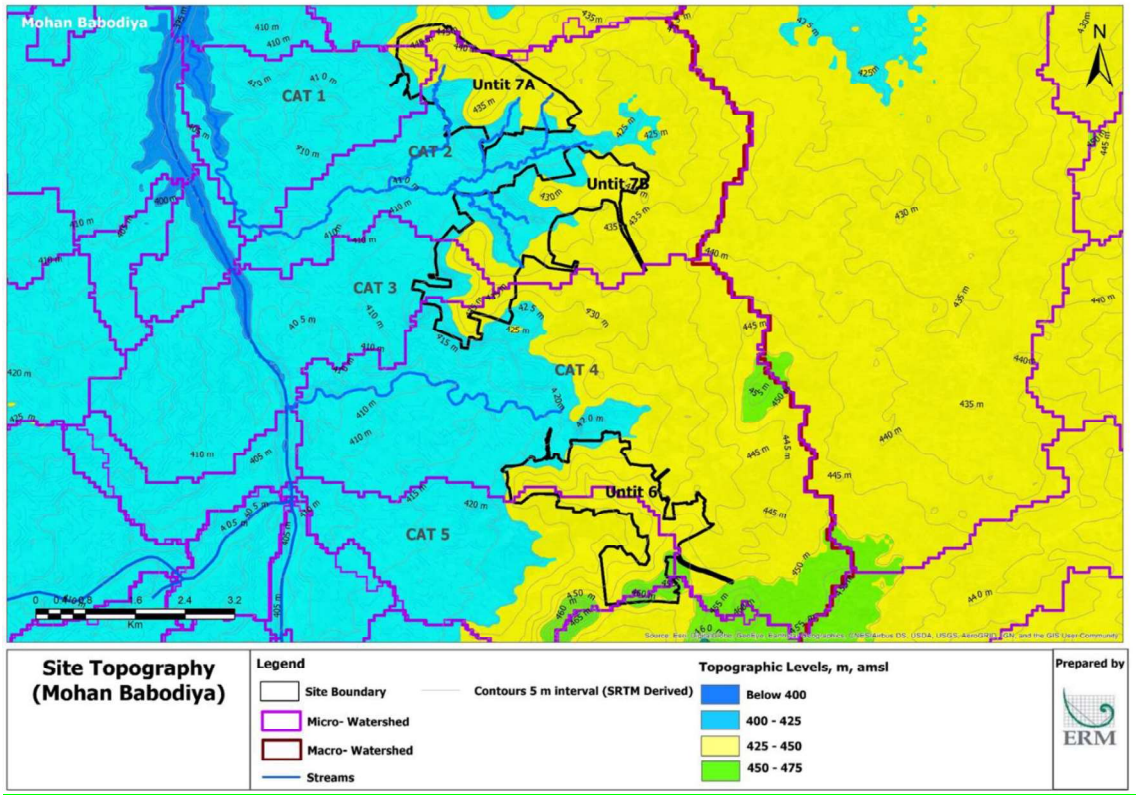
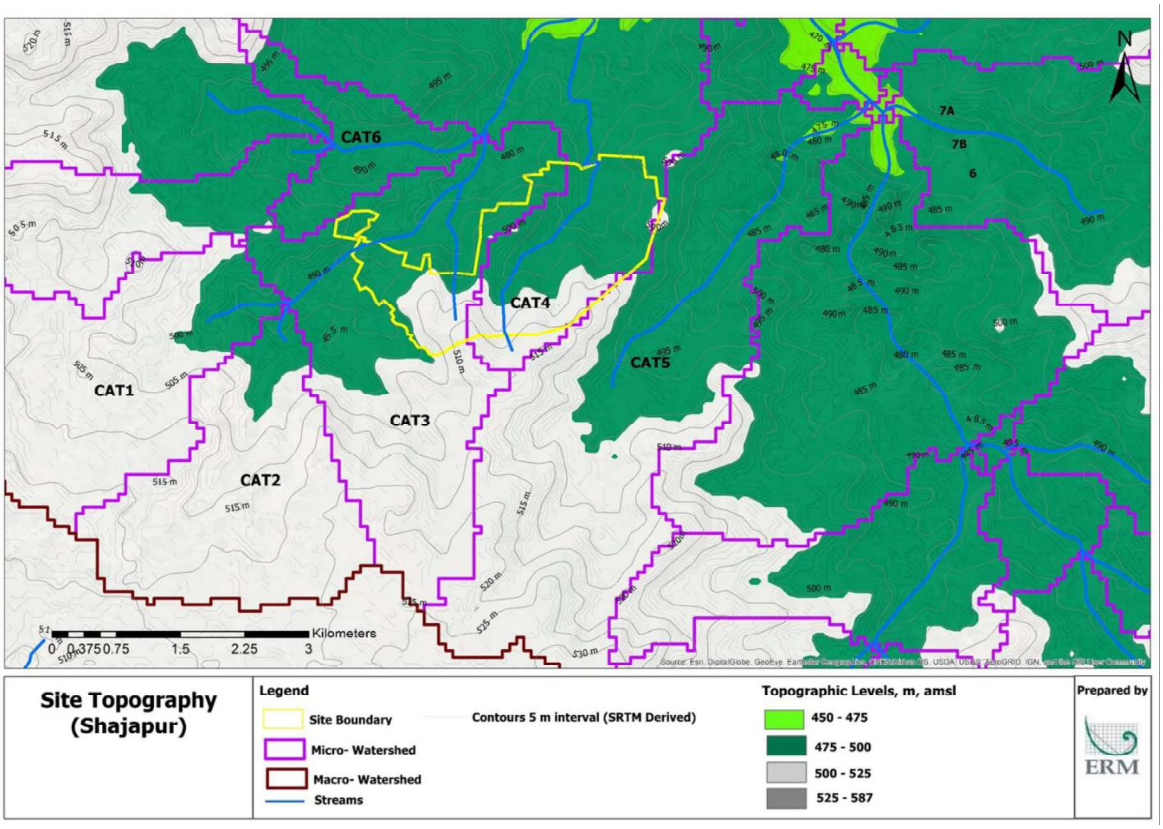


Figure D0.4 presents the topographic map of the Shajapur Site along with the micro-catchments of the Site. The Shajapur Site was observed to comprise of two (2) different sub-catchments or micro-watershed labelled as Cat-3 and Cat-4. The general topography within the Shajapur Site varies between 475 and 525 m, amsl. Topographic highs were mainly observed in the southern part of the Site which is responsible for draining surface water towards north, north-west and north-east within the Site indicating high likelihood of drainage of surface water in different directions from the Site in general during rainy season. The Site topography indicates likely facilitation of drainage of the surface water from the Site and hence reduces the likelihood of surface water stagnation/ inundation during the rainy season.

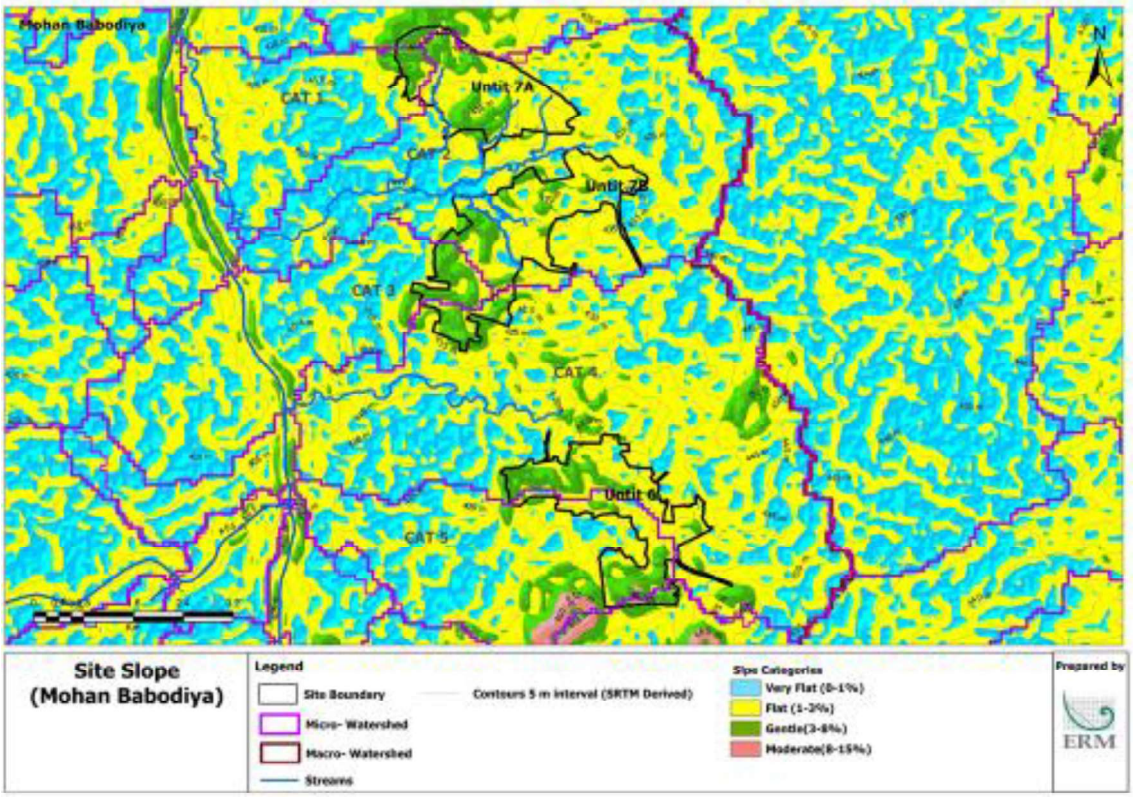
Figure D.0.4: Topographic Map of the Shajapur Site



Slope Map

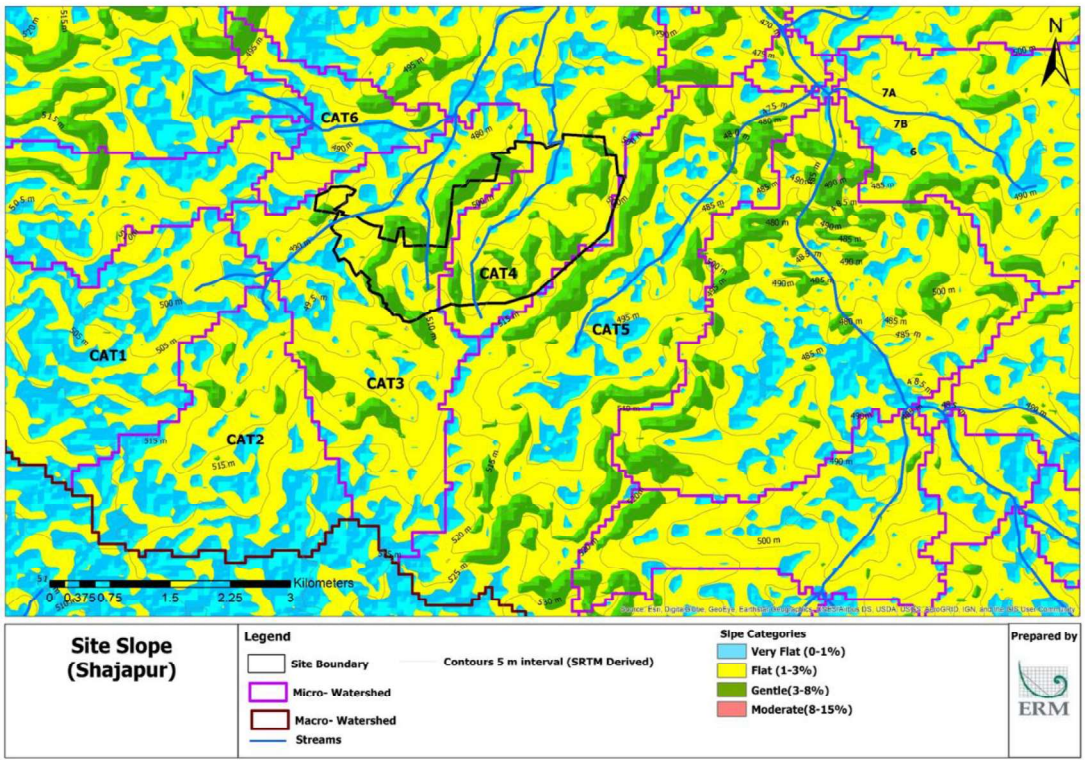
The slope map for the Moman Badodiya Sites is presented in Figure 1.5. The slope at Site and its surrounding ranges from very flat (0-1 %) to moderate (8- 15 %). Moderate slope was observed only in patches particularly outside the Sites. Slope at the Moman Badodiya Site varies from flat (1-3 %) to gentle (3-8 %) with only few patches of very flat (0- 1%) slope. Moderate slope was only observed in a single patch at the southern periphery of Unit 6. Discontinuous areas of gentle slope at Unit 6 (western and eastern boundary), Unit 7A (northern and south-western boundary) and Unit 7B (western and southern boundary) followed by relative continuous areas of flat slope at all the Sites is indicative of potential for surface water drainage from gentle slope to flat slope regions during rainy season. However, the presence of continuous areas of flat slope at all Sites may lead to stagnation/ water logging/ inundation during storm events. This may increase the likelihood of flood in certain parts of the Sites (central and south-eastern in Unit 7A; northern and eastern parts in Unit 7B; and eastern and western parts in Unit 6) which have relatively flat slope.

Figure D.0.5: Slope Map of the Moman Badodiya Site



The slope map for the Shajapur Site is presented in Figure 4.6. The slope at Site and its surrounding ranges from very flat (0-1 %) to gentle (3- 8 %). Slope at the Moman Badodiya Site varies from flat (1-3 %) to moderate (8- 15 %). Flat slope was only observed primarily outside the Site. Slope at the Site was observed to vary from flat to gentle. The presence ridge with gentle slope along the boundary of the Site may facilitate in the drainage of surface water in different directions within and outside the Site. However, the presence of flat slope areas in the central parts of the Site surrounded by ridges is likely to facilitate the stagnation/ water logging/ inundation of Site during rain events.

Figure D0.6: Slope Map of the Shajapur Site



Analysis of Historical Satellite Imagery

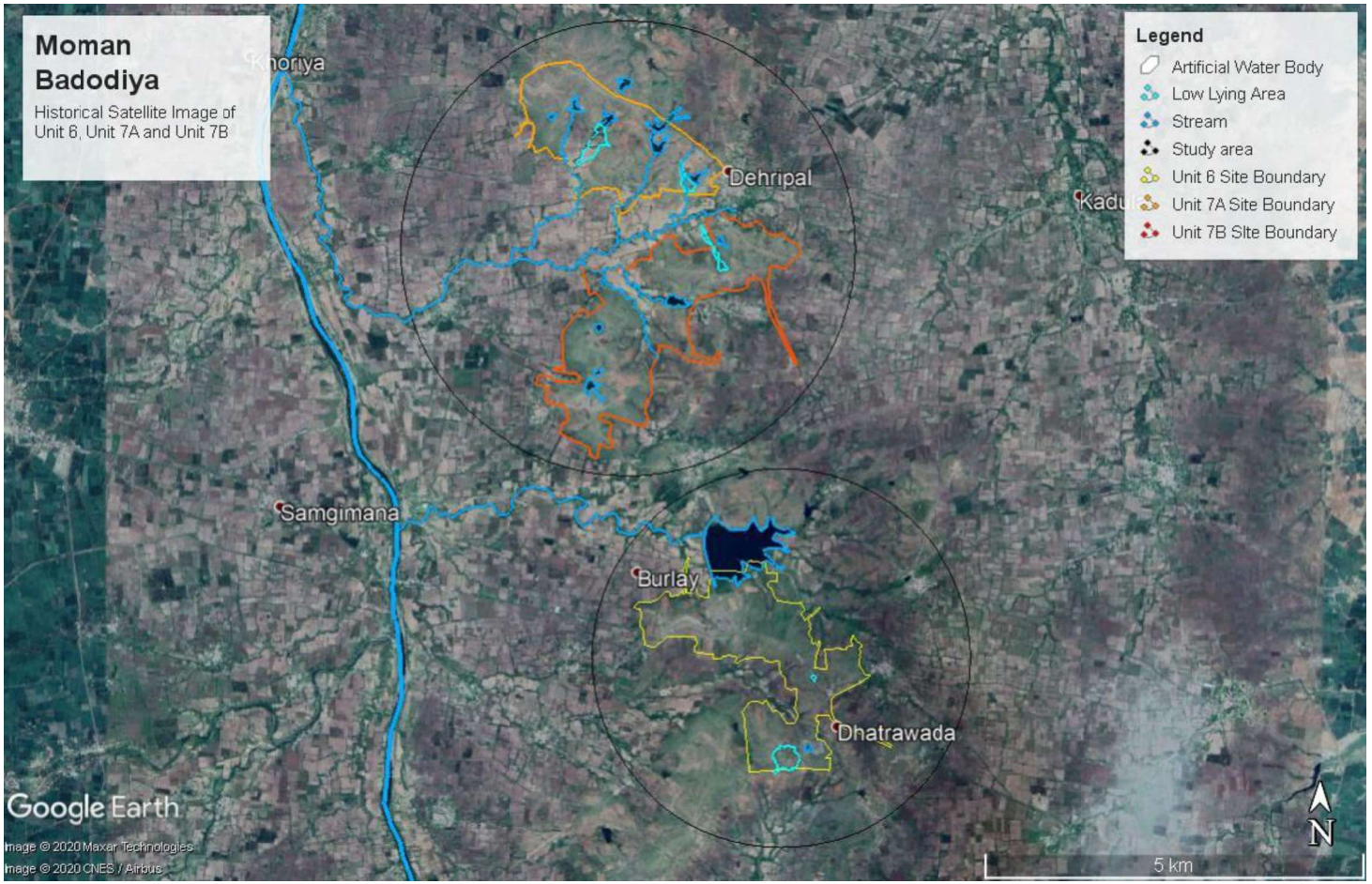
ERM analysed the historical satellite imagery of the Sites and surrounding areas to identify any events of flooding or inundations. For this, ERM reviewed satellite imageries available from GoogleEarth Pro from 2005 till present. Review of historical satellite imagery do not indicate any major developmental activity or significant change in land use.

Historical satellite imageries of Moman Badodiya and Shajapur Sites are presented in Figure D0.7 and Figure D0.8. Clear and high resolution satellite images were not available for monsoon and post-monsoon season. Hence, extent of submergence areas and low lying areas within both Sites could not be clearly defined. However, based on certain evidential observations such as erosion pattern, water marks, and artificially built structures relatively low lying areas and potential extent of submergence area were delineated as presented in Figure D0.7 and Figure D0.8.

Moman Badodiya Site

In Unit 7A and 7B of Moman Badodiya Site, few first order streams were observed to originate within the Site boundary. Several artificial water retaining structures were observed across some of these streams. As observed, there are about six (6) artificially constructed non perennial water bodies located within the Unit 7A boundary which were spread over area varying between ~1.5 to ~10 acres. Actual extent of land submergence from these water bodies could vary depending on peak flows from heavy downpour and storages. Besides these artificially constructed water bodies and minor non-perennial streams with shallow depths, signs of water logging and inundation were also observed within the Unit 7A boundary based on review of historical satellite imagery. These areas were observed to spread over ~6 to 18 acres area in the south-eastern and central portion.

Figure D0.7: Historical Satellite Imagery for Moman Badodiya Site: Unit 6, Unit 7A and 7B



Five (5) artificially created seasonal water bodies were observed within Unit 7B Site boundary. The spatial extent of these was observed to be ~1.5 to 8 in post-monsoon period. Besides these, a low lying area was observed in the north-eastern portion of the Site which was spread across ~7 acres area. About half of this low lying area extends beyond the Site boundary.

Review of historical satellite imagery of Unit 6 Site did not indicate presence of any significant water body or feature. A seasonal natural water body (pond) was observed in the southern portion of the Site, spread over ~1.6 acres. Besides this, a low lying area was observed in the southern portion of the Site, spread over ~21 acres, and which may be subjected to inundation during storm event. A large ~145 acre artificially created lake is located adjoining the northern boundary of the Site. Backwaters / submergence area of this lake may extend up to 200 m inside the Site boundary.

Besides the on-Site water features, nearest significant water body is a seasonal stream located ~4 km southwest of the Sites. Based on review of historical satellite imagery, riverine flooding from this stream was not observed to extend beyond the natural course of the stream.

Based on review of historical satellite imagery, risk associated with flooding and inundation at the Site may be limited to flows and inundation in natural drainage channels, and artificially created water bodies and the low lying areas adjoining these features during monsoon period. Considering the extent of these water features within the Unit 7A and 7B, risk associated with flooding and inundation may be considered as '*Moderate*', whereas risk associated with flooding and inundation may be considered as '*Low*' for Unit 6.

Considering large number of water features in Unit 7A and 7B and their spread area, a Site level flood risk assessment is recommended to further understand the extent and magnitude of inundation in these water features under various climatic conditions. This would assist in achieving two (2) key objectives:

- to develop a Site specific "Storm Water Management Plan" to effectively drain the Site area; and
- plan mitigation measures to protect key components of the electrical infrastructure within the Site.

Shajapur Site

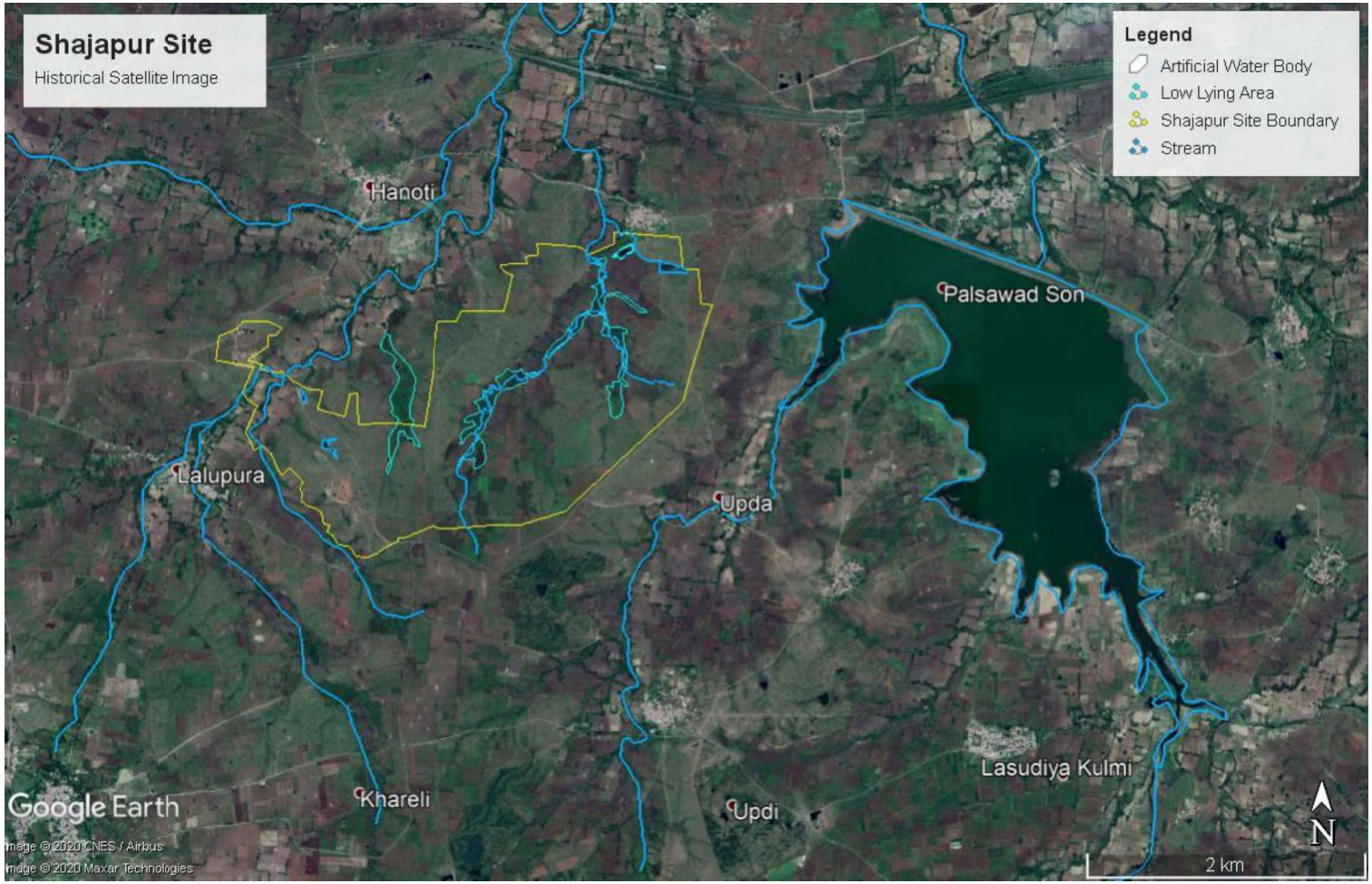
Several well defined and prominent first order streams were observed to originate within the Site boundary or pass through the Site which may be indicative of significant flow typically during rainfall. These streams extend along the entire breadth of the Site in the central and far western portions.

Two (2) seasonal water bodies including one (1) artificial water body and one (1) natural pond spread over ~1.5 and 0.5 acres respectively were observed within the Site boundary in the western portion. Besides these artificially constructed water bodies and seasonal streams with shallow depths, signs of water logging and inundation were also observed in large expanses (~50 acres) of low lying area in the central portion of the Site, mostly along the streams that pass through the Site (based on review of historical satellite imagery). Water logging or inundation in these low lying areas are typically limited to monsoon period. Extent and duration of the inundation or water logging may be defined by storm intensity and duration.

Besides the on-Site water features, nearest significant water body is a artificially constructed lake spread over ~900 acres located ~500m east of the Site. This lake is located cross gradient from the Site and its submergence area does not appear to impact the Site.

Considering the extent of these water features within the Unit 7A and 7B, risks associated with flooding and inundation may be considered as '*Moderate*'. A Site level flood risk assessment is recommended to further understand the extent and magnitude of inundation in these water features under various climatic conditions.

Figure D0.8: Historical Satellite Imagery for Shajapur Site



Hydro-meteorology

The sites Moman Badodiya and Shajapur are located in the district, Shajapur in Madhya Pradesh. The CGWB published the groundwater report for the entire Shajapur district in 2013, and the data reported in this section is based on this report.

The climate of Shajapur district is generally dry, except during the southwest monsoon season. The annual climate can be divided into four (4) seasons:

- Winter commences from December and lasts till the end of February.
- The period from March to middle of June is the summer season with May being the hottest month of the year.
- The southwest monsoon starts from middle of June and lasts till end of September.
- October and November constitutes the post monsoon.

The normal maximum temperature recorded during the month of May is 39.90 °C, while the minimum during the month of January is 9.60 °C. The normal annual mean maximum and minimum temperatures are reported to be 35.50 °C and 31.3 °C respectively. Summer is the driest period of the year. The relative humidity generally exceeds 88% in the month of July/August.

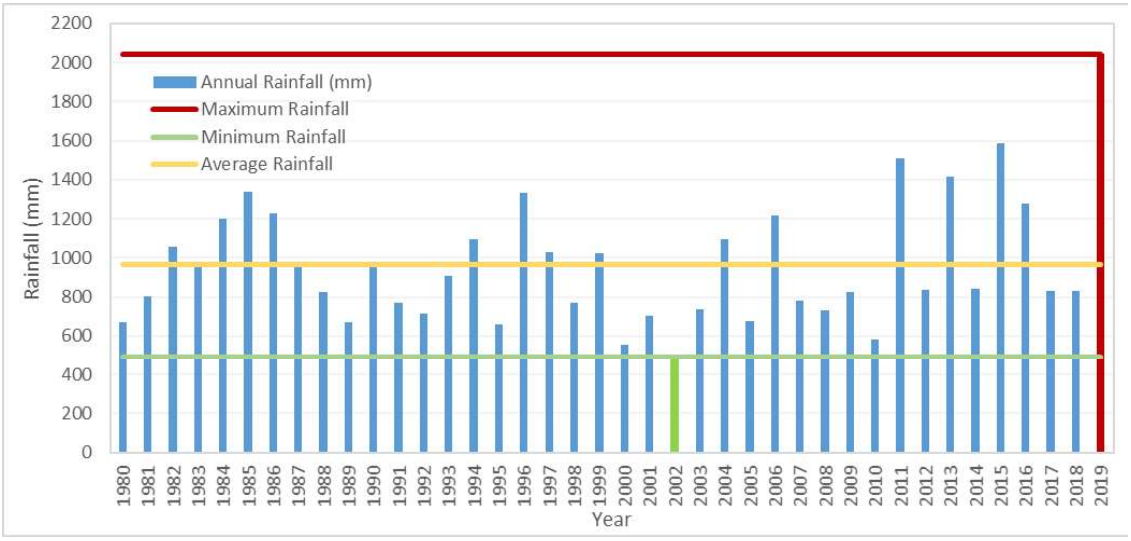
Rainfall Pattern - Moman Badodiya

Annual Rainfall Pattern

Southwest monsoon (i.e. June to September) is considered to be the most predominant and important climatic feature in Shajapur district and about 92.3% of the annual rainfall received during the monsoon season. As per the CGWB publication, the normal annual rainfall of the Shajapur district is reported to be ~1020 mm.

For the Sites near Moman Badodiya, the long- term average annual rainfall during 1980-2019 was reported as ~ 964 mm. The lowest annual rainfall of ~491 mm was received in year 2002 and maximum rainfall of ~2043 mm was received in year 2019. The annual rainfall pattern in Moman Badodiya during 1980-2019 is illustrated in Figure D0.9.

Figure D0.9: Annual Rainfall at Site near Moman Badodiya (1980-2019)



Source: India Meteorological Department (IMD)

Monthly Rainfall Pattern

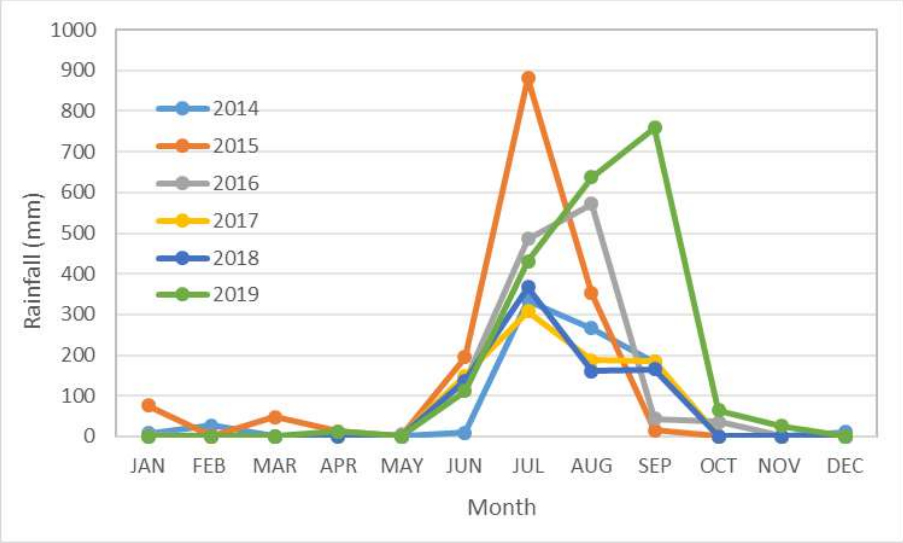
The monthly variation of the rainfall for the Site near Momanbabodiya in Shajapur District was studied for the period of 2014-2019 using the India Meteorological Department gridded total monthly rainfall data. Details are provided in Table D.1. The monthly variation of the rainfall for the Site near Moman Badodiya in Shajapur District was studied for the period of 2014-2019 using the India Meteorological Department gridded total monthly rainfall data. The data is summarised in Table D.1 and illustrated in Figure D0.10. It is evident that May-September months receive substantial monsoon rains.

Table D.1: Monthly Rainfall Pattern at Moman Badodiya for 2014-2019

Year	Month												Annual
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2014	7.1	27.3	0	2.7	2.5	9.4	334	266	183	0.3	0	10.3	842.6
2015	75.8	1.6	47.6	12.3	0.4	195.6	881.4	352.9	15.9	0.4	0	0	1583.9
2016	2.8	0	0	0	5.2	134.7	485.8	571.4	43.1	35.6	0	0	1278.6
2017	0	0	0	0	0.4	149.1	308	187	185.2	0	0	0.5	830.2
2018	0	0	0.4	0.5	0	136.9	367.8	161.1	165.8	0	0	0	832.5
2019	0	0	0	11.9	0	112.2	431.6	638.1	758.5	64.1	25.6	0.8	2042.8

Source: IMD, All values in mm.

Figure D0.10: Monthly Variation of Rainfall at Moman Badodiya for 2014-2019



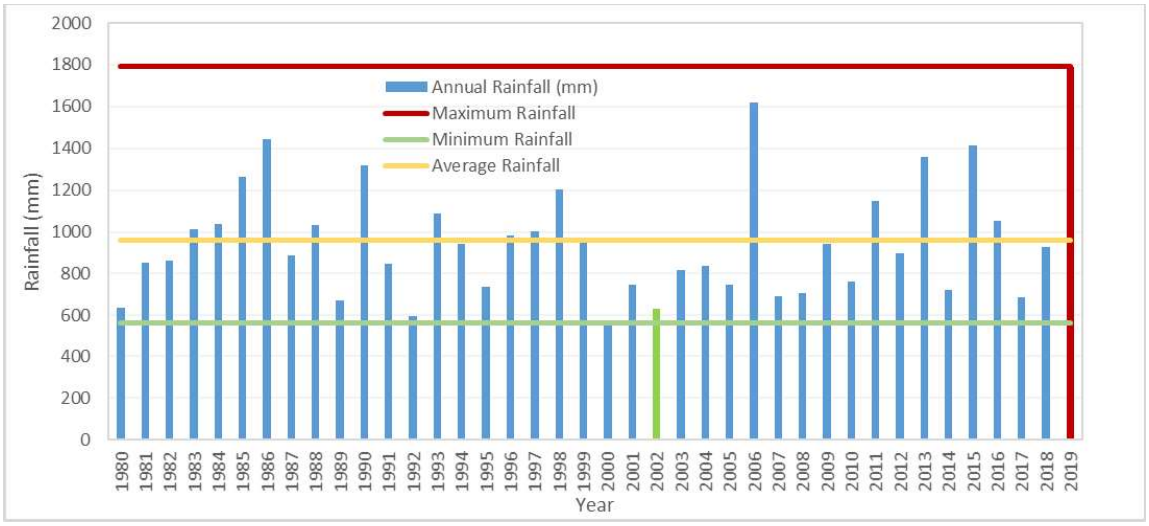
Source: IMD, All values in mm

Rainfall Pattern- Shajapur

Annual Rainfall Pattern

For the Site near Shajapur, the long- term average annual rainfall during the period 1980-2019 was reported as ~961 mm. The lowest annual rainfall of ~564 mm was received in year 2000 and maximum rainfall of ~1791 mm was received in year 2019. The annual rainfall pattern near Shajapur Site during 1980-2019 is illustrated in Figure D0.11.

Figure D0.11: Annual Rainfall at Site near Shajapur (1980-2019)



Source: India Meteorological Department (IMD)

Monthly Rainfall Pattern

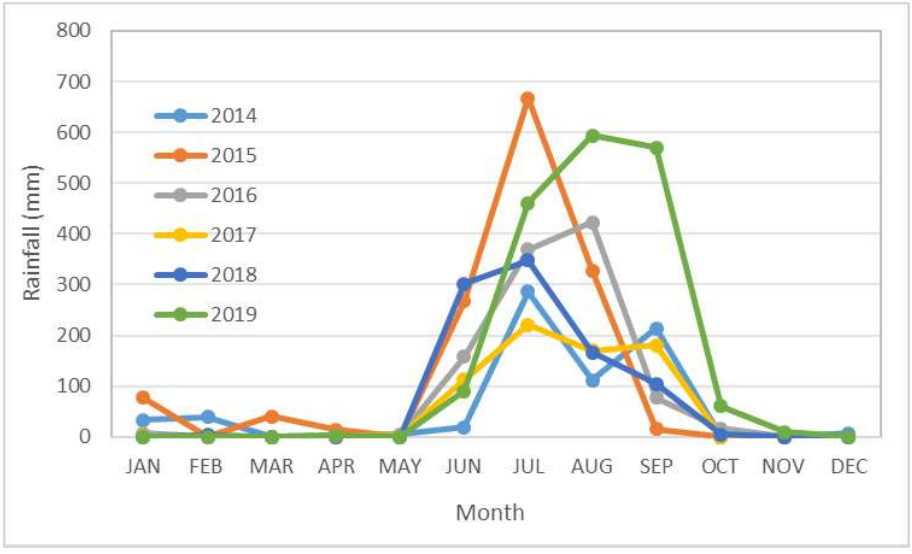
The monthly variation of the rainfall for the Site near Shajapur in Shajapur District was studied for the period of 2014-2019 using the India Meteorological Department gridded total monthly rainfall data. The monthly rainfall variation observed for the Site for the period (1980-2019) is summarised in Table D.2 and illustrated in Figure D0.12. It is evident that May-September months receive substantial monsoon rains.

Table D.2: Monthly Rainfall Pattern at Shajapur for 2014-2019

Year	Month												Annual
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2014	34	38.9	0	2.4	5.2	19.1	286.1	112.1	214.1	0	0	7.8	719.7
2015	77.2	0	40.4	14.6	0.7	267.5	667.4	327.4	16	0.4	0	0	1411.6
2016	7.1	0	0	0	2.2	158	369.3	422.9	77.6	17	0	0	1054.1
2017	0.8	0	0	0	2.5	112.6	221	169.5	180.7	0.2	0	0.2	687.5
2018	0	4.1	0	0	0	302.2	347.5	166.7	104.7	4.4	0	0	929.6
2019	0	0	0	2.8	0	90.8	461.3	594.2	570.5	60.7	10.2	0.2	1790.7

Source: IMD, All values in mm.

Figure D0.12: Monthly Variation of Rainfall at Shajapur (2014-2019)



Source: IMD, All values in mm

11.1.1 Maximum Daily Probable Rainfall (25, 50 and 100 Year Return Period)

As per the Central Water Commission's (CWC) report titled 'Flood Estimation Report for Chambal Sub-Zone -1(b)'[73], maximum daily probable rainfall for different return periods for the watershed of Moman Badodiya and Shajapur Sites is presented in Table D.3.

Table D.3: Maximum Daily Probable Rainfall at Moman Badodiya and Shajapur Sites

Return period in years	Maximum daily probable rainfall in mm
25	< 220
50	< 240
100	< 280

Source: CWC (http://cwc.gov.in/sites/default/files/chambal20subzone201b.pdf)

11.2 Flood Review Based on Secondary Sources

Several secondary data sources and maps were reviewed to understand the vulnerability of the Site to flooding due to various storm events and scenarios. These are presented below:

11.2.1 Secondary Data Analysis of Flood Risk Map - WRI Aqueduct

As part of the assessment, Aqueduct's riverine flood risk map[74] developed by World Resources Institute (WRI) in collaboration with several research partners[75] was used to ascertain the flooding risk calculated using 50 years of data spanning from 1960 to 2014 for the study region. WRI Aqueduct defines riverine flood risk as the percentage of population expected to be affected by riverine flooding in an average year, accounting for existing flood protection standards. Higher values indicate greater proportion of the population is expected to be impacted by riverine floods. Riverine flood risk are classified into five (5) categories based on probability of flooding as:

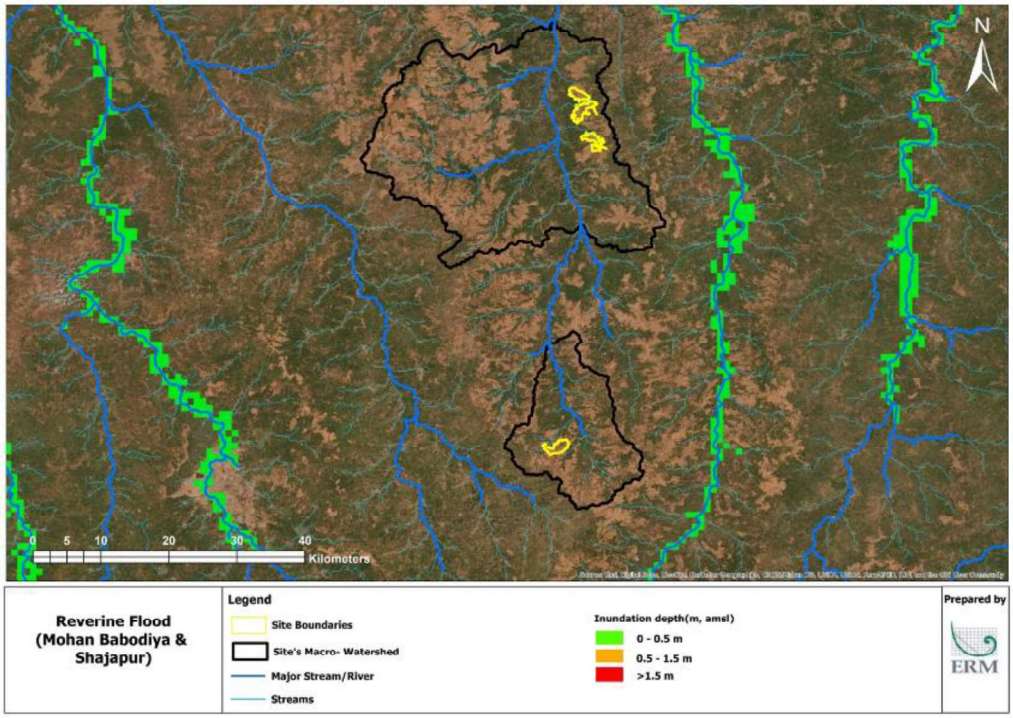
- Low: flooding probability is 0 to 1 in 1000;
- Low-Medium: flooding probability is 1 in 1000 to 2 in 1000;
- Medium-High: flooding probability is 2 in 1000 to 6 in 1000;
- High: flooding probability is 6 in 1000 to 1 in 100; and
- Extremely High: flooding probability is more than 1 in 100.

[73] http://cwc.gov.in/sites/default/files/chambal20subzone201b.pdf

[74] https://www.wri.org/resources/data-sets/aqueduct-global-maps-30-data

[75] Delft University of Technology, Deltares, Utrecht University, Institute for Environmental Studies (IVM), International Food Policy Research Institute (IFPRI), PBL Netherlands Environmental Agency, and RepRisk.

Figure D0.13: Flood Hazard Map of River Basin (WRI Aqueduct): Moman Badodiya Site and Shajapur Site



Source: WRI-Aqueduct Water Risk Atlas 3.0 (https://www.wri.org/resources/data-sets/aqueduct-global-maps-30-data)

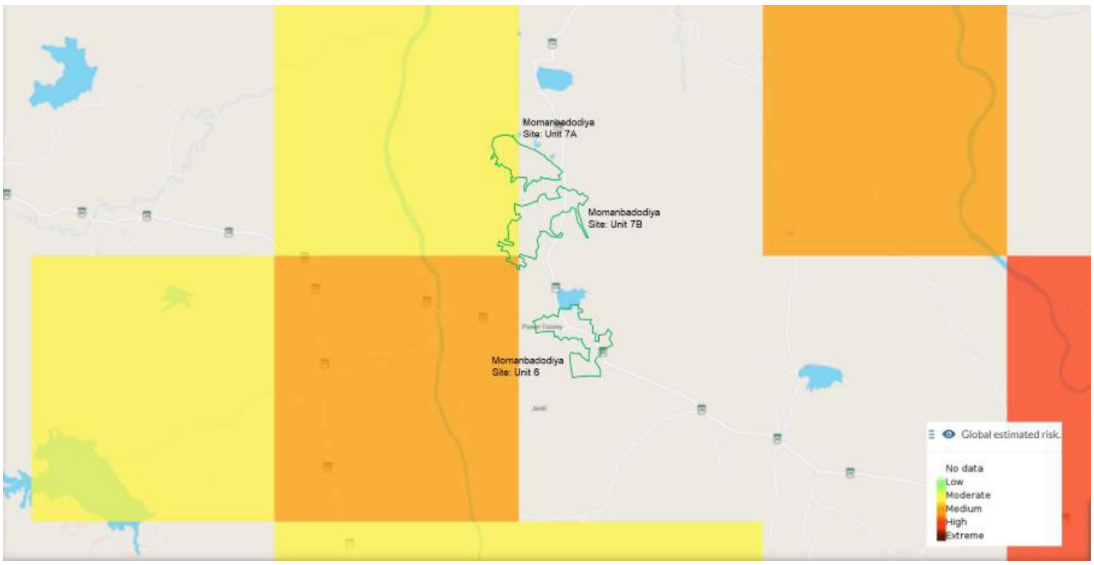
Figure D0.13 presents the Site boundary and River Basin superimposed over WRI's Aqueduct's riverine flood risk map. Per the map, riverine flood hazard is not observed within the Site or within the Site's catchment. Nearest riverine flood hazard observed is located ~15 km east of both Moman Badodiya and Shajapur Site. Based on review of riverine flood hazard map from WRI Aqueduct, flooding risk at the both Moman Badodiya Site and Shajapur Site is considered *'**Low**'*.

11.2.2 Secondary Data Analysis of Flood Hazard Map - UNEP/GRID-Europe

For the purpose of this assessment, Global estimated risk index for flood hazard dataset[76] developed by United Nations Environmental Programme (UNEP) was reviewed. As the name suggest, this dataset includes an estimate of the global risk induced by flood hazard. Unit is estimated risk index from 1 (low) to 4 (extreme). This product was designed by UNEP/GRID-Europe for the Global Assessment Report on Risk Reduction (GAR). It was modelled using global data.

[76] https://preview.grid.unep.ch/index.php?preview=dataandevents=floodsandevcat=5andlang=eng

Figure D0.14: Global Estimated Risk Index for Flood Hazard Map – UNEP: Moman Badodiya Site

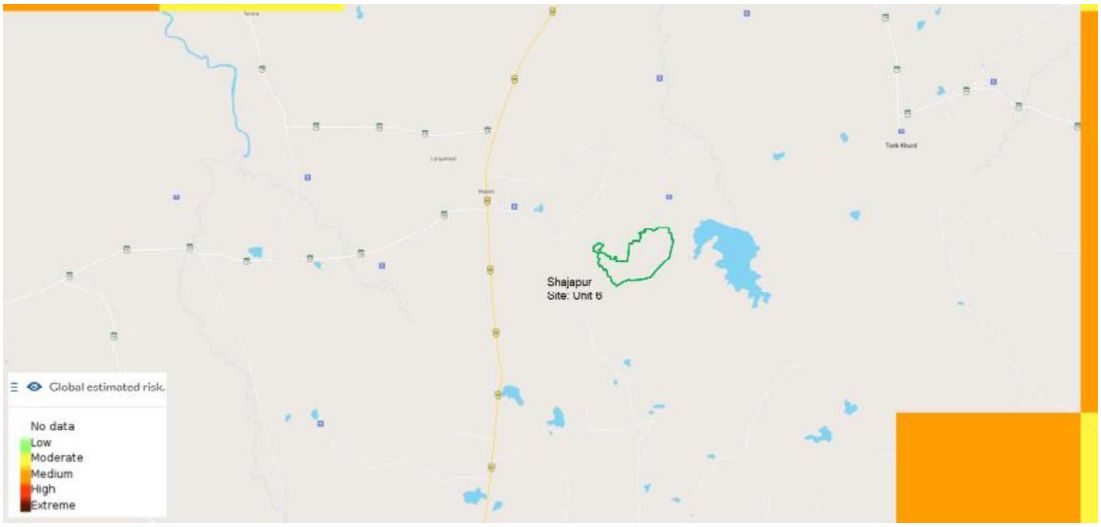


Source: UNEP/GRID Europe (http://ihp-wins.unesco.org/layers/geonode:fl1010irmt)

Figure D0.14 presents the Moman Badodiya Site boundary (Units 6, 7A, and 7B) superimposed over UNEP's flood hazard map. Patches of flood hazard risk ranging from medium to extremely high were observed along the periphery of major watershed particularly in east. Further, eastern portions of Unit 7A and 7B were observed to be located in an area categorized as '*Moderate*' risk. Therefore, flood risk for Unit 6 of Moman Badodiya Site may be considered as '***Low***' and flood risk for Units 7A and 7B may be considered as '***Moderate***'.

Figure D0.14 presents the Shajapur Site boundary superimposed over UNEP's flood hazard map. Patches of flood hazard risk ranging from medium to extremely high were observed along the periphery of major watershed particularly in east. However, Site is not located in an area categorized as at risk. Therefore, flood risk for Shajapur Site may be considered as '***Low***'.

Figure D0.15: Global Estimated Risk Index for Flood Hazard Map – UNEP: Shajapur Site



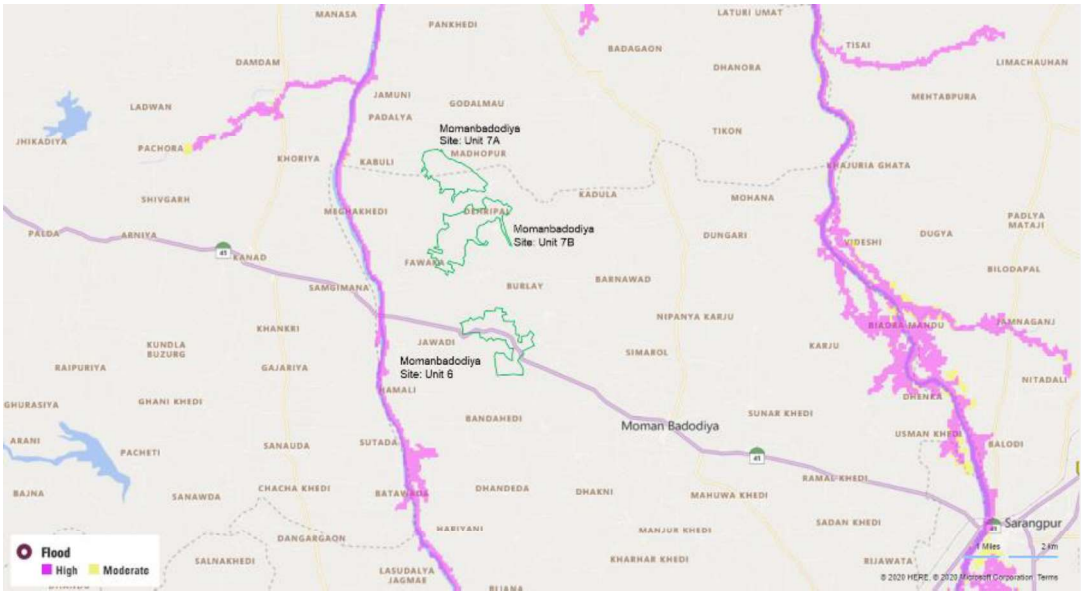
Secondary Data Analysis of Flood Hazard Map - FM Global

The Global Flood Map is prepared by FM Global[77] using historical data, hydrology and hydraulic scientific data accounting for variable external factors such as rainfall, evaporation, snowmelt and terrain. The Global Flood Map currently displays two (2) hazard flood zones via a 90 x 90 meter grid namely:

- High Hazard (Pink): Locations in a 100-year flood zone have at least a 1 percent chance of experiencing a flood each year; and
- Moderate Hazard (Yellow): Locations in a 500-year flood zone have at least a 0.2 percent chance of experiencing a flood each year.

Figure D0.16 and Figure D0.17 presents the approximate location of Moman Badodiya Site and Shajapur Sites respectively superimposed over the FM Global's flood hazard map. Per the map, all units of Moman Badodiya Site and Shajapur Site are ***not prone to*** '*High*' or '*Moderate*' flood risk.

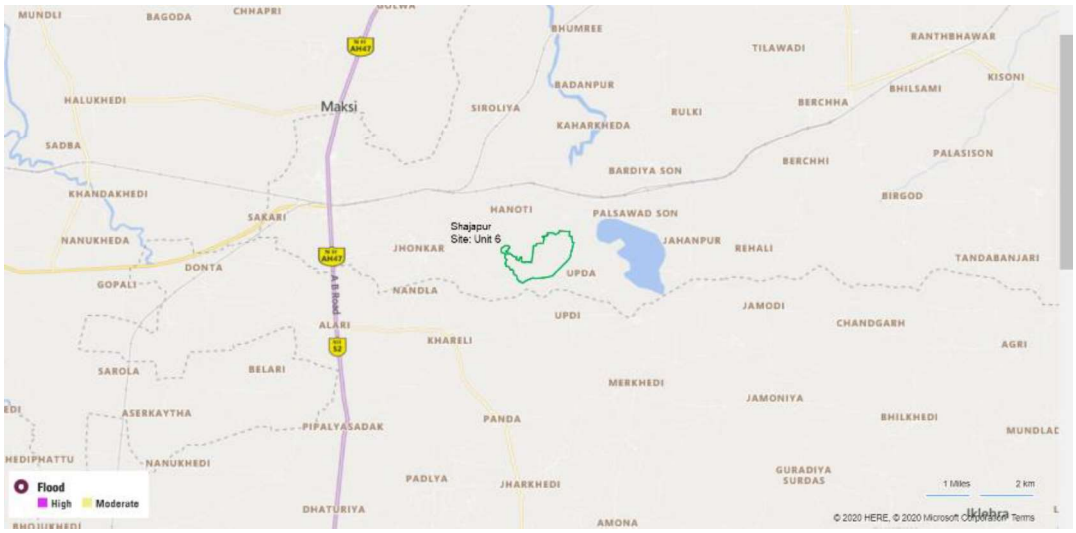
Figure D0.16: Flood Hazard Map (FM Global): Moman Badodiya Site



Source: FM-Global Flood Hazard Map (https://www.fmglobal.com/research-and-resources/nathaz-toolkit-and-map/flood-map)

[77] https://www.fmglobal.com/research-and-resources/nathaz-toolkit/about-global-flood-map

Figure D0.17: Flood Hazard Map (FM Global): Shajapur Site

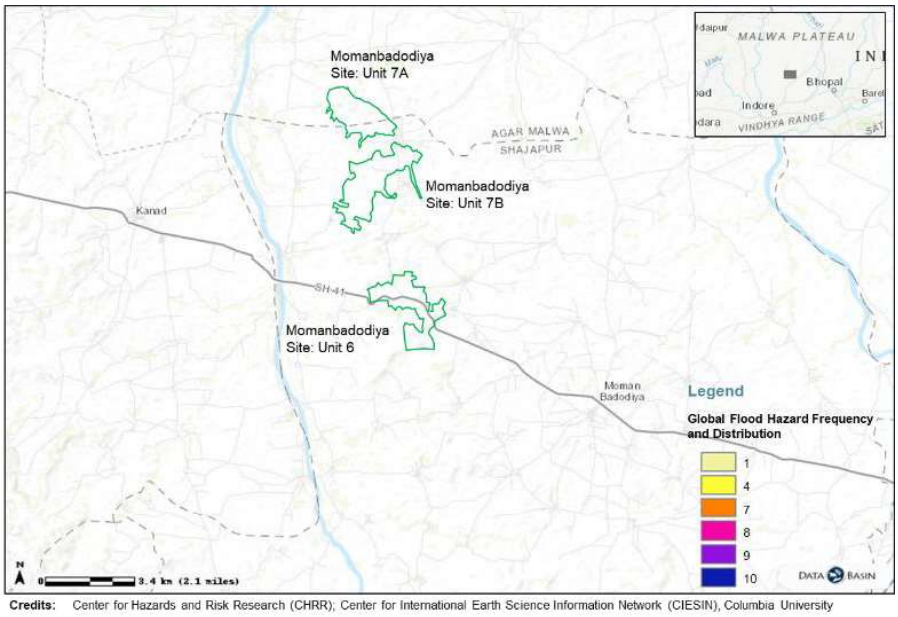


Source: FM-Global Flood Hazard Map (https://www.fmglobal.com/research-and-resources/nathaz-toolkit-and-map/flood-map)

Secondary Data Analysis of Flood Hazard Frequency and Distribution Map – Data Basin

Global Flood Hazard Frequency and Distribution is a 2.5 by 2.5 minute grid derived from a global listing of extreme flood events between 1985 and 2003 (poor or missing data in the early/mid 1990s) compiled by Dartmouth Flood Observatory and georeferenced to the nearest degree. The resultant flood frequency grid was then classified into 10 classes of approximately equal number of grid cells. The greater the grid cell value in the final data set, the higher the relative frequency of flood occurrence.

Figure D0.18: Flood Hazard Frequency and Distribution Map (Data Basin): Moman Badodiya Site

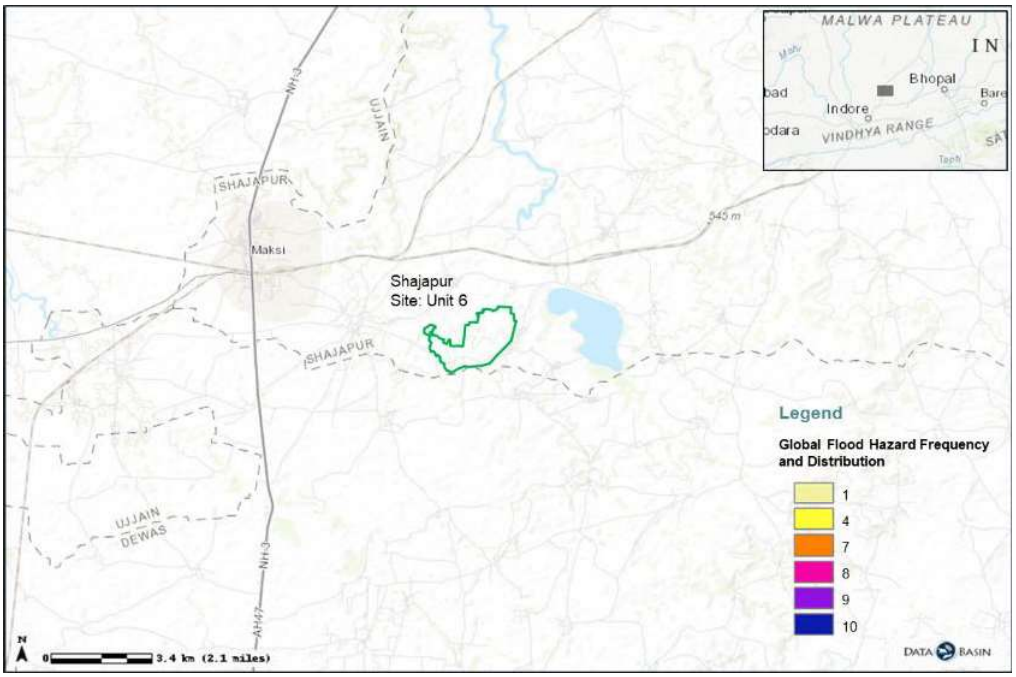


Source: Data Basin Global Flood Hazard Frequency and Distribution
(https://databasin.org/datasets/e5190023c8194691b5b233df41955417)

Figure D0.18 illustrates the approximate location of Moman Badodiya Site superimposed on the flood hazard frequency and distribution map developed by Data Basin. Per the map, none of the Units of Moman Badodiya Site are prone to flooding hazard. As such flood hazard risk may be considered as '***Low***'.

Figure D0.19 illustrates the approximate location of Shajapur Site superimposed on the flood hazard frequency and distribution map developed by Data Basin. Per the map, Shajapur Site is not prone to flooding hazard. As such flood hazard risk may be considered as '***Low***'.

Figure D0.19: Flood Hazard Frequency and Distribution Map (Data Basin): Shajapur Site



Source: Data Basin Global Flood Hazard Frequency and Distribution (https://databasin.org/datasets/e5190023c8194691b5b233df41955417)

Likelihood of a Flooding Event

Based on the above-mentioned findings, a likelihood analysis of potential flooding event in and around the Site has been undertaken. The same has been presented in the Table D.4 below.

Table D.4: Likelihood of flood evaluation

Attributes	Moman Badodiya Site Likelihood			Shajapur Site Likelihood		
	High	Medium	Low	High	Medium	Low
Site Setting						
■ Shajapur and Moman Badodiya Sites are located ~30 km and ~24 km west from the Kali Sindh River which is the nearest river; ■ Nearest prominent stream is ~1.35 km west of Moman Badodiya Site. This stream is non-perennial in nature.			■			■
Watershed Characteristics						
■ Both Shajapur and Moman Badodiya Sites are located within the Kali Sindh River Basin. Both Sites are located at the ridge in the west-central portion of the basin and ~30 km west from the Kali Sindh River. ■ The Moman Badodiya and Shajapur Sites are located in a rural setting surrounded primarily by scrub land with some agricultural land, forest land, scattered residential settlements, water bodies. ■ Few first order streams originate within Shajapur Site. These are non-perennial streams with shallow depths. ■ Three (3) large artificially created water bodies are located adjoining the Shajapur Site boundary with spread area varying between 21 acres to 260 acres. ■ Several well defined and prominent first order streams originate within Moman Badodiya Site. Few second order streams also pass through Moman Badodiya Site. These streams extend along entire breadth of the Site in the central and southeastern portion. ■ Three (3) large artificially created water bodies are located adjoining the Moman Badodiya Site boundary with spread area varying between 34 acres to 228 acres.			■		■	
Hydro-meteorological Data						
■ Average annual rainfall for period of 1980-2019 for Moman Badodiya was ~951 mm with the highest annual rainfall of 1,814 mm recorded in 2019; ■ Average annual rainfall for period of 1980-2019 for Moman Badodiya was ~966 mm with the highest annual rainfall of 1,992 mm recorded in 2019;		■			■	

Attributes	Moman Badodiya Site Likelihood			Shajapur Site Likelihood		
	High	Medium	Low	High	Medium	Low
■ Maximum daily probable rainfall for 25, 50, and 100 year return periods for Shajapur and Moman Badodiya Sites are <220 mm, <240 mm, and <280 mm respectively;						
Hydrological and Geomorphological Data						
Catchment Analysis						
■ Topography within the watershed of Moman Badodiya Site varies between 375 m and 475 m amsl. ■ Topographic elevation of Moman Badodiya Site was observed to be in the range of 425 m to 475 m amsl. ■ Slope in the Moman Badodiya Site area ranges between 3 to 8 % categorized as gentle slope. ■ Topography within the watershed of Shajapur Site varies between 375 m and 500 m amsl. Topographic elevation of Shajapur Site was observed to be in the range of 425 to 475 m amsl. ■ Slope in the Shajapur Site area ranges between 3 to 8% categorized as gentle slope. ■ Based on the topography and slope maps, the Site area does not appear to have any pockets of 'low lying areas' with potential for water logging and flooding during rainy season.						
Historical Flooding and Inundation Events						
Moman Badodiya Site (Unit 6, 7A, and 7B) ■ Several artificial water bodies have been created within Units 7A and 7B for capturing surface runoff. ■ There are about six (6) artificially constructed non perennial water bodies located within the Unit 7A boundary which were spread over area varying between ~1.5 to ~10 acres. ■ Signs of water logging and inundation were also observed within the Unit 7A boundary based on review of historical satellite imagery. These areas were observed to spread over ~6 to 18 acres area in the south-eastern and central portion. ■ Five (5) artificially created non-perennial water bodies were observed to be located within Unit 7B Site boundary. These were observed to spread over ~1.5 to 8 acres. ■ A low lying area was observed in the north-eastern portion of the Site which was spread across ~7 acres area. ■ Historical satellite imagery of Unit 6 Site did not indicate presence of any significant water feature. Shajapur Site						

Attributes	Moman Badodiya Site Likelihood			Shajapur Site Likelihood		
	High	Medium	Low	High	Medium	Low
■ Several well defined and prominent first order streams were observed to originate within the Site boundary or pass through the Site. ■ Two (2) non-perennial water bodies including one (1) artificial water body and one (1) natural pond spread over ~1.5 and 0.5 acres respectively were observed within the Site boundary. ■ Besides these artificially constructed water bodies and non-perennial streams with shallow depths, signs of water logging and inundation were also observed in large expanses (~50 acres) of low lying area in the central portion of the Site mostly along the streams that pass through the Site.						
Secondary Data Review – Flooding and Inundation						
■ Per the global estimated risk index for flood hazard map developed by UNEP/GRID-Europe, Units 7A and 7B of Moman Badodiya Site are partially located in '*Moderate*' flood risk area. Whereas Unit 6 of Moman Badodiya Site and Shajapur Site are not prone to flooding; ■ Per the global flood hazard map developed by FM Global, both Moman Badodiya Site and Shajapur Site are not prone to high or medium flood risk; ■ Based on Aqueduct's global flood hazard map, both Moman Badodiya Site and Shajapur Site fall in the "Low" river flooding hazard zone; ■ Based on global flood hazard frequency and distribution map developed by Data Basin, the Site and its surroundings at Moman Badodiya and Shajapur are not prone to flooding.						

Based on the observations from the above-mentioned table, it appears that the overall likelihood of flooding event and its impact in and around the Site may be considered as ***'Low' to 'Moderate'***.

Conclusions

Based on the observations from the above-mentioned table, it appears that the overall likelihood of flooding event and its impact in and around the Site can be considered to be *'Medium'*. The main high probability attributes are as follows:

Moman Badodiya Site (Unit 6, 7A, and 7B)

- Several artificial water bodies have been created within Units 7A and 7B for capturing surface runoff.
- There are about six (6) artificially constructed non perennial water bodies located within the Unit 7A boundary which were spread over area varying between ~1.5 to ~10 acres.
- Signs of water logging and inundation were also observed within the Unit 7A boundary based on review of historical satellite imagery. These areas were observed to spread over ~6 to 18 acres area in the south-eastern and central portion.
- Five (5) artificially created non-perennial water bodies were observed to be located within Unit 7B Site boundary. These were observed to spread over ~1.5 to 8 acres.
- A low lying area was observed in the north-eastern portion of the Site which was spread across ~7 acres area.
- Historical satellite imagery of Unit 6 Site did not indicate presence of any significant water feature.

Shajapur Site

- Several well defined and prominent first order streams were observed to originate within the Site boundary or pass through the Site.
- Two (2) non-perennial water bodies including one (1) artificial water body and one (1) natural pond spread over ~1.5 and 0.5 acres respectively were observed within the Site boundary.
- Besides these artificially constructed water bodies and non-perennial streams with shallow depths, signs of water logging and inundation were also observed in large expanses (~50 acres) of low lying area in the central portion of the Site mostly along the streams that pass through the Site.

Summary of Secondary Risk Tools

- Per the global estimated risk index for flood hazard map developed by UNEP/GRID-Europe, Units 7A and 7B of Moman Badodiya Site are partially located in '***Moderate***' flood risk area. Whereas Unit 6 of Moman Badodiya Site and Shajapur Site are not prone to flooding;
- Per the global flood hazard map developed by FM Global, both Moman Badodiya Site and Shajapur Site are **not prone** to high or medium flood risk;
- Based on Aqueduct's global flood hazard map, both Moman Badodiya Site and Shajapur Site fall in the "**Low**" river flooding hazard zone;
- Based on global flood hazard frequency and distribution map developed by Data Basin, the Site and its surroundings at Moman Badodiya and Shajapur are **not prone** to flooding.

Considering the above mentioned attributes, the Site is '***Low***' to '***Moderately***' *susceptible* to flooding, inundation and/or water logging.

Recommendations

Based on the broad level assessment, following measures are recommended to protect the assets at Site from identified 'high probability attributes' and to prevent/mitigate their impact on the Site:

- Carry out a Site specific preliminary Flood Risk Assessment based on inundation and hazard mapping to understand the extent and magnitude of inundation and water logging at Units 7A and 7B of Moman Badodiya Site. This will help in designing and implementing adequate flood mitigtion measures.
- Develop a robust "Storm Water Management Plan (SWMP)" for both Moman Badodiya and Shajapur Sites to effectively and safely manage surface runoff during heavy rainfall events. SWMP must consider protection and development of natural drainage channels and water features within the Site area to prevent localized inundation and safely evacuate surface runoff.
- Enhance structural stability of banks of all seasonal streams which originate within the Site or pass through the Site and provide robust erosion protection to withstand flash flood during heavy downpour.
- Significant area in the central and eastern portion of Shajapur Site is relatively low lying (localized depression) and may be subjected to periodic and intermittent water logging during peak rainy season. Water level data, frequency, duration and extent of inundation or water logging at these seasonal features would not be available from secondary sources. It is recommended to undertake consultations with local communities and carry out physical field assessment to understand maximum potential extent of land submergence and depth of inundation during high rainfall year. This will serve to define 'zones' of concern within the Site, plan the locations of key electrical infrastructure at the Site, assist in designing storm water management plan and structural design of the solar array mounting racks specific to the 'zone of concern'.

APPENDIX E ESMP- MANAGEMENT PLANS

1. Waste Management Plan
2. Water Management Plan
3. Occupational health and Safety Plan
4. Disaster Management and Emergency Response Plan
5. Construction and Labour Management Plan
6. Gender Action Plan
7. Stakeholder Engagement Plan

WASTE MANAGEMENT PLAN

All project generated wastes will need to be managed and disposed of in a manner to prevent potential impacts on the environment and risks to human health. A Waste Management Plan for the proposed Project has been developed. This has to be updated by the Solar Project Developer (SPD)/EPC contractor before start of activity.

Objectives

The construction and operation of the proposed project will generate various type of waste which will need appropriate collection, transportation, primary treatment and disposal. Hence, to serve the purpose, a Waste Management Plan has been formulated to demonstrate:

- Inventorisation of waste in different type of categories like garbage, rubbish, hazardous, waste etc.;
- Maintain the site in a clean and tidy state to reduce the attraction of pest species, impacts on the local environment and negative impacts on visual amenity;
- Suggestion of options for waste handling and disposal during construction and operation phase of the project
- Establish compliance to various national waste management related regulations
- Establish an appropriate training programme for contractors, workers and other stakeholders
- Define the roles and responsibilities for implementing the measures

Scope

This plan shall be applicable to the Solar Project Developers or EPC contractors engaged by RUMSL for the construction and operation and maintenance phase of the proposed project. The elements of the plan will be directly implemented by the Developers and contractors hired by the Developers while overall management and responsibility will lie with RUMSL. The Plan also identifies the individuals currently assigned to the various roles designated in this Plan.

Type of Waste and Source

The table below provides the list of type of waste likely to generate at site during construction and O&M phases.

Table E.1 Details of Type of Waste

S. No	Waste Type	Source
Construction Phase		
	Non Hazardous Waste	
1.	Domestic solid waste	Temporary site office, storage area, labour activities
2.	Construction debris	Construction activities within Solar Park including construction of access road, substation, storage yard etc.
3.	Packaging waste containing wood, cardboard and other recyclables.	Packaging material from solar panels, cables and accessories
4.	Sludge from Septic Tank	Site Office and labour camp
5.	All non-recyclables waste	Construction activities

S. No	Waste Type	Source
6.	Plastic waste	Packaging material
7.	Biomedical waste	First aid kits kept at construction site and site office
8.	Broken solar panels and other electronics waste (E waste)	Solar Park, PSS and Site Office
9.	Batteries	Solar Park, PSS and Site Office
	Hazardous Waste	
1.	Used oil/waste oil, lubricants and oil contaminated rags	DG set, construction machinery
2.	Bio medical waste	First aid centre
Operation Phase		
	Non Hazardous Waste	
1.	Domestic solid waste and office waste	Site Office
2.	Metal Scrap	Site Office and PSS
3.	Damaged PPEs	Site Office and PSS
	Hazardous Waste	
1.	Used oil/waste oil, lubricants and oil contaminated rags	Maintenance activities at site
2.	Broken solar panels, batteries (dry type or wet type), electronics	Site office and PSS

Regulatory Context

The regulatory context for waste management in India has been provided in ***Table E***.2***.***

Table E.2 National Regulations for Waste management

Waste Stream	Regulation	Requirements for the waste generator(s)- (SPD/EPC Contractor)
Construction and Demolition Waste	Construction and Demolition Waste Rules, 2016	■ Waste generator shall be responsible for collection, segregation of concrete, soil and others and storage of construction and demolition waste generated, as directed or notified by the concerned local authority in consonance with these rules; ■ Waste generator shall ensure that other waste (such as solid waste) does not get mixed with this waste and is stored and disposed separately; ■ Waste generator shall keep the construction and demolition waste within the premise or get the waste deposited at collection centre so made by the local body or handover it to the authorised processing facilities of construction and demolition waste; ■ Waste generator shall ensure that there is no littering or deposition of construction and demolition waste so as to prevent obstruction to the traffic or the public or drains;

Waste Stream	Regulation	Requirements for the waste generator(s)- (SPD/EPC Contractor)
		■ In case, quantum of C&D waste generating at site is estimated 20 tons or more in one day or 300 tons per project in a month, the Waste Generator shall segregate the waste into four streams such as concrete, soil, steel, wood and plastics, bricks and mortar and shall submit waste management plan and get appropriate approvals from the local authority before starting activities.
Solid Municipal Waste	Solid Waste Management Rules, 2016, as amended	■ Waste generated at the site should be segregated into biodegradable and non-biodegradable wastes; ■ Horticulture and garden waste generated within site should be stored separately and disposed as per the directions of the local body; and ■ Waste should not be thrown, burned or buried on streets, open spaces, outside the site premises or in drains/water bodies.
Hazardous Waste	Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, as amended	■ Waste generator should be responsible for safe and environmentally sound management of hazardous waste; ■ Hazardous and other wastes should be sold to an authorised actual user or disposed authorized disposal facility; ■ Waste generator should take steps while managing hazardous and other wastes to contain contaminants, prevent accidents and limit consequences to human beings and the environment; ■ Waste generator should provide persons working in the site with appropriate training, equipment and information necessary to ensure their safety; ■ Waste generator should make an application to the State Pollution Control Board to obtain an authorization for managing hazardous and other wastes; ■ Waste generator should maintain a record of hazardous and other wastes managed by him/her in Form 3 of the HW Rules; ■ An annual return containing the details of the waste generated should be submitted through Form 4 of the HW Rules on or before the 30th day of June following the financial year to which the return related; ■ Waste generator may store the waste for a period not exceeding ninety days; ■ During transportation of hazardous waste, the waste generator should provide the relevant information as shown in Form 9 of the HW rules; ■ If waste has to be transported across state borders for disposal then an NoC is required from both State Pollution Control Boards; ■ The waste generator should prepare copies of the manifest of hazardous and other wastes before transportation and as given in Form 10 and provide a copy to the transporter, State Pollution Control Board and retain a copy; and ■ When an accident occurs at a facility handling hazardous waste, the operator should intimate the State Pollution Control Board through

Waste Stream	Regulation	Requirements for the waste generator(s)- (SPD/EPC Contractor)
		telephone or email about the accident and subsequently send a report.
Electronic Waste	E-waste (Management) Rules, 2016, as amended	■ Bulk consumers of electrical equipment should be channelized through collection centers or dealers of authorized producer or dismantler or recycler or through a designated take back service provider; ■ Bulk consumers should maintain records of e-waste generated and make these records available to the State Pollution Control Board; ■ E-waste containing radioactive material should not be mixed; and ■ Bulk consumers should provide annual returns to the State Pollution Control Board before the 30th day of June following the financial year to which the return relates.
Plastic Waste	Plastic Waste Management Rules, 2016, as amended	■ Waste generator should take steps to minimize generation of plastic waste and if generated, then segregate plastic waste from municipal solid waste; and ■ Plastic waste should not be littered and handed over to urban local body or gram panchayat or approved agencies, registered recyclers or waste collection agencies.
Battery Waste	Batteries (Management and Handling) Rules, 2001, as amended	■ Batteries should not be disposed in any manner other than depositing with dealer, manufacturer, importer, assembler, registered recycler, reconditioner or at designated collection centres; and ■ Bulk consumers should file half-year return to the State Pollution Control Board.
Bio-medical waste	Bio-Medical Waste Management Rules, 2016	■ The bio-medical waste shall be segregated into containers or bags at the point of generation in accordance with Schedule I prior to its storage, transportation, treatment and disposal. ■ Obtain (one time) authorisation from the prescribed authority under BMWM Rules, 2016 ■ Maintain record pertains to quantum of category wise bio-medical waste generated and treated

Waste Handling, Management & Disposal

Construction Phase

All wastes produced from the Project activities on site will be temporarily stored in designated waste storage areas. All wastes that cannot be reused or recycled will be collected by approved waste contractors and transferred to an appropriately licensed waste management facility for treatment and disposal. Following steps will be taken to manage the waste generation during construction phase:

- Fuel will be stored on site in temporary aboveground storage tanks and will be stored in a locked container within a fenced and secure temporary staging area;
- Trucks and construction vehicles will be serviced off site;

- All concrete mixing be undertaken on impermeable plastic lining to prevent contamination of the soils and surrounding areas;
- Food waste and other refuse are to be adequately deposited in sealable containers and removed from the kitchen frequently to avoid accumulation;
- The use, storage, transport and disposal of hazardous materials used for the project will be carried out in accordance with all applicable regulations;
- All hazardous waste to be disposed off to MPPCB approved vendors;
- Material Safety Data Sheets (MSDS) for all applicable materials present on site will be readily available to on-site personnel;
- The construction debris will be placed in appropriate on-site storage containers and periodically disposed of by a licensed waste contractor;
- The construction contractor will remove refuse collected from the designated waste storage areas at the site at least once a week; and
- Empty fuel containers will also be stored at a secured area designated for scrap and sold to authorized vendors. All packaging material will also be collected at the storage area and sold to scrap dealers.

Operation Phase

Damaged cells would need to be characterized and managed as hazardous waste. Following measures to be taken for management of waste:

- Developers need to have buy back agreements for defunct solar panels;
- A designated area needs to be demarcated within the premises for storage of defunct and broken solar panels with restricted access and on impervious surface;
- MNRE had prepared a concept note for storage and disposal of used solar panels. The recommendations such as recycling of glass, storage of discarded panels in cover shed etc. shall be adopted in the Project; (78);
- All fuel storage should be equipped with secondary containment and spillage trays;
- All used oil is required to send off to MPPCB approved vendors and recyclers; and
- Transportation of defunct solar panels is required to be undertaken as per the procedures specified by the Manufacture of Solar Panels.

Handling of Broken Solar Modules generated due to cleaning and other maintenance activities

Impact	Mitigation Measure
Land Contamination (Soil Quality)	■ Broken or damaged solar panels are required to be shifted to a designated area in scrap yard to avoid any type of land contamination. ■ The designated area should be isolated and to be established on an impervious surface. ■ A photograph is to be taken of the broken panel at the site to cater to Insurance settlement claims
Risk on Health of Workers	■ Proper PPE are provided to the workers handling the broken solar panels. ■ The workers at site are also on regular basis apprised about the potential health risks associated with handling of solar panels.

(78) http://164.100.94.214/sites/default/files/webform/notices/DraftBluePrintAntimony.pdf

Roles and Responsibilities

Site Supervisor (SPD/ EPC Contractor)

Site Supervisor will be responsible for the following activities

- Management of onsite waste generation associated with construction works to help avoid excessive generation where practicable;
- Maintaining all records of waste type which are construction waste and debris, hazardous waste;
- Liaising with Madhya Pradesh Pollution Control Board (MPPCB) approved vendors for disposal of hazardous waste generated;
- Renewal and Management of Buy Back Agreements for defunct solar panels with the Manufacturers;

EHS Manager (SPD/ EPC Contractor)

The following responsibilities are entrusted to the EHS Manager:

- Demarcation of area within the module area for keeping of segregated wastes;
- Labelling of the drums containing hazardous wastes like used oil;
- Maintaining of receipts for hazardous waste management records;
- Notifying the Site Supervisor of any activity that may generate a large amount of waste to allow appropriate controls to be put in place to manage waste generated; and
- Ensure safe transportation of defunct solar panels as per specified procedures.

WATER MANGEMENT PLAN

The construction and operation & maintenance activities will require water. A Water Management Plan has been prepared for the Project to support the ESIA process. The Plan was developed to meet the objectives of water management during the construction and operation of the Solar Park. Plan is based on the assessment of impacts on water resources, quality, which would occur during the site preparation and operation phase of the Project.

Objectives

The Water Management Plan aims to ensure that water consumption during the project life cycle do not result in unacceptable impacts on the water resources and surrounding community. It focuses on the strategies to be used to monitor the water quantity, conservation measures, and recycling of water within the Project. The objective of this Water Management Plan (WMP) is

- Monitoring water consumption in the Project during construction and O&M activities;
- Delineate mitigation/management measures to be implemented during construction and O&M phases;
- Establish compliance of National Standard for Discharges
- Establish an appropriate training programme for contractors, workers and other stakeholders
- Define the roles and responsibilities for implementing the measures

Scope

This plan shall be applicable to the Solar Project Developers or EPC contractors engaged by RUMSL for the construction and operation and maintenance phase of the proposed project. The elements of the plan will be directly implemented by the Developers and contractors hired by the Developers while overall management and responsibility will lie with RUMSL. The Plan also identifies the individuals currently assigned to the various roles designated in this Plan.

Water Resources

Surface Water

The natural waterbodies and Site area setting of Moman Badodiya and South Shajapur is described below:

- Both Shajapur and Moman Badodiya Sites are located within the Kali Sindh River Basin. Both Sites are located at the ridge in the west-central portion of the basin and ~30 km west from the Kali Sindh River.
- Few first order streams originate within Shajapur Site. These are non-perennial streams with shallow depths.
- Three (3) large artificially created water bodies are located adjoining the Shajapur Site boundary with spread area varying between 21 acres to 260 acres.
- Several well defined and prominent first order streams originate within Moman Badodiya Site. Few second order streams also pass through Moman Badodiya Site. These streams extend along entire breadth of the Site in the central and southeastern portion.
- Three (3) large artificially created water bodies are located adjoining the Moman Badodiya Site boundary with spread area varying between 34 acres to 228 acres

Ground Water

Groundwater was reported as the primary source of water in Shajapur Solar Park and its surrounding area with some seasonal streams contributing for domestic use as secondary source of water.

Water Requirement

The tables below provides details with respect to water requirement at site during construction and O&M phases.

Table E.1 Details of Water Requirement for the Project

S. No	Particulars	Water Requirement
Construction Phase		
1.	Domestic Purposes	80-90 KLD
2.	Construction Activities	200-300 KLD
Operation Phase		
1.	Cleaning of Solar Panels	277 KLD
2.	Domestic Purposes	9 KLD
3.	Landscaping	7 KLD
4.	Firefighting and Miscellaneous	30 KL

The water requirement for the Project will be met through tanker water supply during construction phase. Whereas, during O&M phase, ground water will be used for domestic purposes and solar panel cleaning activities.

Waste water Generation

Wastewater will be generated from the following sources:

- Construction Phase
  - Sewage: site office, labour camp.
  - Surface runoff from site
- Operation Phase
  - Sewage: site office
  - Wastewater from solar panel cleaning activities

The domestic wastewater generated from the site will be collected through septic tank and followed by soak pit.

Regulatory Context

The regulatory context for water management in India has been provided in table below.

Table E.2 National Regulations for Water management

Regulation	Requirements
The Water (Prevention and Control of Pollution) Act, 1974 and its amendment, 1988	■ This Act provides for the prevention and control of water pollution and maintaining or restoring good water quality for any establishment. ■ Any waste water discharge shall be within the discharges limits prescribed by CPCB.
Guidelines/Criteria for evaluation of proposals/ requests for ground water abstraction by CGWB	Permission from CWGB shall be taken prior to any ground water abstraction for construction and O&M activities. The Unit 6 & 7 (Moman Badodiya) and Unit 8 (South Shajapur) falls under Over Exploited and Semi Critical category. As per guidelines, groundwater withdrawal may be permitted subject to ■ Undertaking of ground water recharge measures. The withdrawal should not exceed 100% of the recharged quantity. ■ The recharge should be implemented within the premises and/or same water shed/assessment unit. Detail project proposal shall be included along with the application for NOC.

Impact Avoidance and Impact Mitigation

Conserving Water Resources

- Construction Phase
  - Optimum use of water during sprinkling on roads for dust settlement, washing of vehicles, concrete mixing for foundation etc.;
  - Regular inspection for identification of water leakages and preventing wastage of water from water supply tankers, camp area.
  - Construction labour deputed onsite to be sensitized about water conservation and encouraged for optimal use of water;
  - Minimum use of water in cleaning/washing of equipment's and vehicles;
- Operation Phase
  - Feasibility of dry cleaning of solar panels shall be examined;
  - Use of water-efficient technologies for cleaning the solar panels and domestic consumption nodes;
  - The surface runoff from during solar panel cleaning shall be diverted to a settlement tank for settlement of suspended solids. The overflow shall be treated in water treatment unit and recycled in the Project.
  - Optimising water usage in the SCADA building by application of water conservation measures such as sensor based taps, low flush urinals etc.;
  - Maintain logbook for water consumption;
  - Use of water from multiple sources to avoid dependency on one particular source (groundwater or surface water). This also includes tapping of rainwater received during the monsoons for the long-term and uninterrupted operations.

- The Project should implement principles of water stewardship to ensure water security not just for the site, but also for other stakeholders within the watershed. Some of the water stewardship frameworks/ standards that can be adopted are UN Global Compact's CEO Water Mandate or AWS Standards.
- Identify stakeholders directly impacted by the groundwater use at the Project site and develop long- term stakeholder engagement plan particularly focused on stakeholders near site to develop positive perception towards Project and its operations.

Rain Water Harvesting

In order to comply with CGWB guidelines for ground water abstraction, ground water recharge is mandatory in the Project. RUMSL shall plan to provide rainwater harvesting provision at site. For this purpose, rainwater harvesting pond shall be provided at site. In addition, groundwater recharge shall be undertaken within the Site to replenish the shallow aquifer zones.

Piezometers to be installed to monitor the groundwater level changes in the aquifer trapped by the abstraction wells at Project site.

Water Quality

- Ensure proper cover and stacking of loose construction material at site to prevent surface runoff and contamination of receiving water body;
- Open defecation and random disposal of sewage will be strictly restricted;
- Planning of toilets, soak pits and septic tanks, waste collection areas away from natural drainage channels;
- Provision of number of toilets across with easily accessible location as the project site is spread across large area of both the Units;
- Use of licensed contractors for management and disposal of waste and sludge;
- Labourers will be given training towards proactive use of designated areas/bins for waste disposal and encouraged for use of toilets;
- Provision for impervious storage area, especially for fuel & lubricant, hazardous waste, etc. will be made onsite; and
- Spill/ leakage clearance plan to be adopted for immediate cleaning of spills and leakages.

Other Management Aspects

Inventory of Water Consumption and Pollution Sources

Preparing an inventory of water consumption during construction and O&M activities and all pollution sources from the Project activities is essentially the first step towards managing the impacts. The Management Plan will involve preparation of an up to date inventory of all areas of water consumption and wastewater discharge sources based on the latest Project activity related information. This inventory will helps in formulating the following management approaches:

- Source reduction
- Resource recovery options
- Recycle options
- Optimal treatment strategies and technologies
- Post-treatment, resource recovery and recycle options

- Ultimate disposal considering the local environmental sensitivities

The inventory database of discharge sources shall be kept as a living document and updated as and when any new sources are cited at any point in time of the Project period. Any intermittent water requirement and discharge sources shall also be identified and included in the inventory.

Responsibilities and Accountabilities

EHS Manager

The EHS Manager of SPD/EPC contractor will be responsible for:

- Implementing the mitigation measures mentioned in this management plan;
- Maintain a database which will record the water consumption quantities and waste water generation at different locations;
- Monthly review of water consumption and waste water generation in the project;
- Conducting regular audits around the Project site to inspect water management practices;
- Conducting regular audits for rainwater harvesting;
- Review conditions of storage location and records related to hazardous wastes as per the conditions of authorization

All employees and sub-contractors will be provided with environmental awareness training through a site induction process. All employees and contractors will have a responsibility to manage operations in an environmentally responsible manner and report any visible emission/ discharge/ accidental spillage. All pollution related environmental incidents will be reported to the EHS manager.

OCCUPATIONAL HEALTH AND SAFETY PLAN

The section below presents an overview of the potential occupational health and safety risks on the proposed project. It defines the various risks involved during the construction and operation phase of the project. The occupational health and safety plan (OHSP) will address the following:

- Evaluation and Identification of hazards;
- Elimination and removal of hazards;
- Control of Hazards which cannot be eliminated; and
- Recovery from accidents.

Purpose and Scope

This plan provides guidance with respect to occupational risks (for both construction and operation stage) and aims to achieve the following:

- Identification of hazards, associated risks and control measures for each activity;
- Defining responsibilities to ensure effective implementation of health and safety (H&S) risk control measures;
- Avoid and/or minimise the impacts on workers and local communities' health due to various project activities;
- Provide and maintain safe working procedures and operations for workers; and
- Reduce human injury and damage to property and environment in case of an emergency.

Definitions

Competent Person: any person having the knowledge, training and experience specific to the work or task being performed.

Confined Space: "Confined space" means a compartment of small size and limited access which by its small size and confined nature can readily create or aggravate a hazardous exposure.

Emergency: An unforeseen occurrence, a sudden and urgent occasion for action

First aider: A person who has received training and who holds a current first aid certificate from an organization or employer whose training and qualification for first aiders are approved by authority.

Hazard: A source, situation or act with a potential for harm in terms of:

- ill Health
- damage to property, plant, ships etc.
- production losses or increased liabilities

Hazardous Substance: The term "hazardous substance" means a substance which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritant, or otherwise harmful is likely to cause injury.

Health and Safety Plan: A documented plan which addresses hazards identified and includes safe work procedures to mitigate, reduce or control the hazards identified.

Hot Work: The term "hot work" means riveting, welding, burning or other fire or spark producing operations.

Incident: An event or occurrence occurring at work or arising out of or in connection with the activities of persons at work, or in connection with the use of plant or machinery.

Risk: the probability that injury or damage will occur

Safe: free from any hazard

Roles and Responsibilities

Site Supervisor (SPD/EPC Contractor)

Following tasks will fall within his/her responsibilities:

- Monitor site activities on weekly basis for compliance;
- Supervise the performance of the work being carried out within the project boundary;
- Conduct internal audits of the construction site against the ESMP;
- Confine the construction site to the demarcated area; and
- Keeping a check on operation and maintenance services of solar project components required during operation phase.

EHS Manager (SPD/EPC Contractor)

Responsibilities of an EHS Manager shall include the following:

- Ensure that the operations are in compliance with EHS requirements at all times;
- Conducting HS&E Audits on regular basis & advice management for necessary action;
- Maintaining first aid facilities and personal protective equipment as demanded by the nature of the work/Material Safety Data Sheets;
- Review of investigation of all type of accidents & reporting to Site Supervisor;
- Training of workers and ensuring that they are issued with adequate instructions and creating awareness of safe work practice among them;
- Carrying out Job Safety Analysis to determine “Hazards of the operations/activity” and facilitating suitable solutions; and
- Participate in the preparation of, all Safety instructions, procedures and activities.

Safety Officer(s)

The developer shall ensure appointment of safety officer(s) for employees and workers working at site, to:

- Review the effectiveness of health and safety measures;
- Identify potential hazards and potential major incidents;
- Examine the causes of incidents in collaboration with his employer,;
- Investigate complaints by any employee /workers relating to that their health or safety on the site;
- Inspect the site with a view to, the health and safety of employees, at regular intervals;
- Participate in any internal health or safety audit.

First Aider

- Initial emergency response resuscitation and stabilization of critically ill or injured personnel;
- First Aid of non-emergency medical conditions;
- Implementation of site health plans and preventive medicine activities including first aid training of employees and workers; and
- Undertake regular health and hygiene inspections.

Workers

- Use the correct tools and equipment for the job;
- Use Safety equipment and protective equipment/clothing supplied, e.g. Safety helmets, shoes, harness, goggles, etc.; and
- Report all defects in plant or equipment to health and safety representatives.

Risk Assessment

Contractor shall before the commencement of any work on site and during construction work, ensure to undertake risk assessment by a competent person. Such an assessment shall as a minimum :

- Identify the risks and hazards to which persons may be exposed to;
- Analyse and evaluate the identified risks and hazards;
- Document a plan of safe work procedures, including the use of any personal protective equipment or clothing and the undertaking of periodic “tool box talks” or inductions before undertaking hazardous work, to mitigate, reduce or control the risks and hazards that have been identified;
- provide a monitoring plan; and
- Provide a review plan.

Risk assessment is an important step in protecting workers. It helps to focus on the potential risks in a particular workplace. Workers and others have a right to be protected from harm caused by a failure to take reasonable control measures.

Training

Site Supervisor shall ensure that every employee/worker (direct or contractual) is aware of the EHS risks associated with the work being carried out at the site and is trained and competent in the relevant work practices and maintenance procedures.

Procedures to identify training needs to be established and adequate safety training to be provided to all the employees/ workers on site. The safety training should provide staff with the knowledge and skills necessary for organising and managing occupational safety and health programmes; team leaders with leadership skills and knowledge to lead, implement and apply occupational safety and health activities; and workers with the knowledge, skills and right attitudes to enable them to work safely.

HSE trainings proposed for the project to include:

- Induction training on HSE
- Tool Box Training or pre-task briefings, highlighting hazards and the method of dealing with them

- Special Job Hazard Training including entry into confined space and other hazardous environment
- Hot work;
- Working at height;
- Electrical safety;
- Fire Safety
- First Aid
- Emergency Response
- Use of PPEs

Documentation and Record Keeping

Site Supervisor should maintain data and records concerning the identification of hazards, assessment and control of risks of the ongoing activities. The document should establish and maintain procedures for controlling all relevant EHS documents and data. Such documents can include but not limited to:

- Hazard Identification Record;
- Risk Register;
- Legal Register;
- Licenses, Certificates, Permits;
- Control Methods including process control and machine design, safe work procedures, in-house work rules;
- Work Permit System;
- Training Reports;
- Drill Reports;
- MoM of HSE meetings;
- Inspection and Audit Records; and
- Medical and Health Surveillance Records

Communication and Information Dissemination

Supervisor(s) should communicate and inform any persons affected by the risks about:

- The nature of the risks involved; and
- The control measures or safe work procedures to be taken to address the risks involved.

Safe Work Practices

Construction and operation of the Solar Park involves many on job hazards which needs to be identified and eliminated or minimised to an expectable level in order to achieve a safe and healthy work environment. Following safe working practices should be established for site works (not limited to):

- Lockout/Tagout (LOTO)
- Crane and Hoist Safety

- Electrical
- Heat Stress
- Personal Protective Equipment

Lockout/Tagout (LOTO)

LOTO refers to specific practices and procedures to safeguard employees from start-up of machinery and equipment, or the release of hazardous energy during service or maintenance activities. Many workers face the greatest risk of injury if lockout/tagout is not properly implemented. Solar energy equipment can generate electrical energy and may be connected to electrical circuits. Workers may be exposed to electrical hazards from solar panels, PSS/ SCADA inverter room activities and from electrical circuits. LOTO is required to be implemented while working in PSS, SCADA and inverter room. While installing or servicing solar panels, employers should assure that workers cover the solar panels, in addition to protecting workers from electrical circuits. Workers performing servicing or maintenance of solar panels may be exposed to injuries from the unexpected energization or release of stored energy in the equipment.

The following are some of the significant requirements of a Lockout/Tagout procedure required under a Lockout/Tagout program.

- Only authorized employees may lockout or tagout machines or equipment in order to perform servicing or maintenance;
- Lockout devices (locks) and tagout devices (tags) shall not be used for any other purposes and must be used only for controlling energy;
- Lockout and Tagout devices (locks and tags) must identify the name of the worker applying the device;
- All energy sources to equipment must be identified and isolated;
- After the energy is isolated from the machine or equipment, the isolating device(s) must be locked out or tagged out in safe or off position only by the authorized employees;
- Following the application of the lockout or tagout devices to the energy isolating devices, the stored or residual energy must be safely discharged or relieved;
- Prior to starting work on the equipment, the authorized employee shall verify that the equipment is isolated from the energy source, for example, by operating the on/off switch on the machine or equipment;
- Lock and tag should not be removed from the machine until the work is completed; and
- Only the authorized employee who placed the lock and tag must remove his/her lock or tag.

Electrical

Solar energy workers while working in PSS, SCADA and inverter room are exposed to potential electrical hazards present in their work environment, which makes them more vulnerable to the danger of electrocution and arc flash hazards. Workers may be exposed to electric shocks and burns when hooking up the solar panels to an electric circuit.

Workers must pay attention to overhead power lines and stay at least 10 feet away because they carry extremely high voltage. Fatal electrocution is the main hazard, but burns and falls from elevations can occur while installing solar panels. Another hazard is from using tools and equipment that can contact power lines.

Heat Stress

Solar energy workers often work in very hot weather where hazards include dehydration, heat exhaustion, heat stroke, and death. Employers should monitor employees and workers should be trained to identify and report early symptoms of any heat-related illness.

Heat Stroke occurs when the body's system of temperature regulation fails and body temperature becomes abnormally high. If a worker shows signs of possible heat stroke, medical treatment should be obtained immediately.

Workers suffering from heat exhaustion should be removed from the hot environment and given fluid replacement. They should also be encouraged to get adequate rest.

Personal Protective Equipment (PPE)

Using personal protective equipment is often essential, but it is generally the last line of defence after engineering controls, work practices, and administrative controls. Solar energy employers must assess their workplace to determine if hazards are present that require the use of protective equipment. Solar energy workers can be exposed to many hazards that may require the use of safety glasses, hard hats, gloves, respirators, or other personal protective equipment used to protect against injuries and illnesses. Workers exposed to potential electrical hazards must be provided with appropriate electrical protective equipment, and workers must use them. Electrical protective equipment must be maintained in a safe and reliable condition. They must be periodically inspected or tested for their workability.

General Working Conditions

Housekeeping

- Work areas should be maintained in a neat and orderly condition;
- Scrap material, such as rags, bolts and wedges should not be allowed to accumulate in the site area; Spills of oil, grease, paint and other slippery substances should be cleaned up immediately;
- Walkways should be kept clear of tripping hazards at all times;
- All personal protective equipment required for a procedure must be worn;
- Maintain a free access to all safety equipment including firefighting equipment, electrical panels and boxes, etc.;
- Proper barricades, safety rings and safety wires should be used. Barricades must be properly lighted for visibility;
- Operating equipment, tools or machinery without proper guards and/or signalling devices is prohibited;
- Observe all warning signs in the yard; and
- Before leaving the job, always check the area for any sparks or smouldering materials.

First Aid

- All work areas must be provided with adequate first aid facilities with a trained first aider during working hours; and
- Developer(s) must provide or ensure that there is provision of adequate and appropriate facilities for enabling first aid to be rendered to their employees if they are injured or become ill at work.

EMERGENCY RESPONSE AND DISASTER MANAGEMENT PLAN

The primary objective of formulating Emergency Response and Disaster Management Plan (ERDMP) is to undertake immediate rescue and relief operations and stabilize the mitigation process as quickly as possible. A site specific ERDMP shall be prepared by SPD/EPC Controller for the site.

The basic concept of the plan is to allow for smooth coordination of activities during an emergency. All employees and contractors shall be familiar with the plan. This plan shall be reviewed and amended when needed to ensure that all parties concerned are furnished with up-to-date information. The site supervisor with support of EHS team shall carry out exercises of part of the emergency plan at a regular interval as deemed necessary. The lesson learnt from these exercises shall be documented and used during the updating of this emergency response plan.

Objectives

The key objectives of the Plan are to:

- To localize the emergency and if possible eliminate it;
- To avoid confusion, panic and to handle the emergency with clearly defined actions;
- To reduce the incidence and severity of injury during mining operations;
- Identify the designated personnel and responsibilities for dealing with emergencies on and off-site;
- To take remedial measures in a quickest possible time to contain the incident and control it with minimum damage; and
- To mobilize the internal resources and utilize them in the most effective way.

Identification of Hazards and Emergency Categorization

Identification of all the hazards and risks associated with each activity which may lead to an emergency and anticipate the actions to be taken before or after the emergency arises. This section identifies the hazardous areas and activities in both construction and operation phases. Probable emergencies that might arise due to these hazards for the duration of the project have been listed below.

Hazardous Areas

Following potentially hazardous areas and activities have been identified at the construction site:

- Fuel storage areas
- Kitchen arrangement in labour camps
- Electrical installations – improper laying of cables
- Scaffolds

Emergency Situations

The possible emergency situations identified for the construction and operation phases of the Project are as listed below:

Fire and Explosion

- Leakage of fuel from storage areas; and
- Short-circuit at campsite/Project site.

Mechanical and Electrical Hazards

- Structural Collapse;
- Accidentally dropped object;
- Loss of stability; and
- Electrocution.

Occupational Hazards

- Outbreak of Disease / Illness/injury;
- Handling of chemicals;
- Accidents due to vehicle movement/ vehicle collision; and
- Vandalism.

Other emergencies

- Flooding;
- Earthquake;
- Cultural Conflict;
- Terrorism;
- Bomb Threat.

Categorization of Emergencies

Level 1 (Minor Emergencies)

All events with no escalation potential and which can be controlled and contained by the action of Safety Officer at the site will be considered as Level 1. In such cases of local alert, EHS Manager of RUMSL will be notified. Some typical incidents are:

- Vehicle collision (involving no loss of life);
- Medical Evacuation (not very serious cases);
- Minor localized fires.

Level 2 (Serious Emergencies)

All events with escalation potential, depending on the effectiveness of the local response will be considered as Level 2. These incidents may impact the entire construction activity/ project operations or have cascading effect. For such type of incidents Site Supervisor will take the lead. Some typical incidents are:

- Substantial security incident / Vandalism;
- Structural collapse;
- Minor Flooding;
- Serious damage to structures;
- Substantial fire; and
- Cultural conflict.

Level 3 (Major Emergency)

The crisis that requires assistance from external resources in order to save lives, minimize damage and to bring the abnormal situation back under control are Level 3 emergencies. These incidents have the potential to impact beyond the project footprints and affect the community. In such cases

appropriate government / regulatory authorities will be informed and involved. Some typical Level 3 incidents are:

- Major fire/explosion;
- Fatality;
- Severe flooding;
- Terrorism;
- Bomb Threat

Personnel on site will know that a Major Emergency has been declared if the site fire alarm siren and /or the local fire alarm systems are activated. The Emergency Siren Modes will be demonstrated and shared with all workers to identify with them.

Level 2 and level 3 will be declared using emergency siren and evacuation shall be done.

Codification of Sirens

Following codes of siren are proposed during emergencies:

- ON SITE EMERGENCY (ALERT) for evacuation - 120 seconds Continuous Whelming Sound
- EMERGENCY CONTROLLED - 30 + 30 + 30 seconds sound with an interval of 5 seconds each

Emergency Facilities

Emergency Control Centre (ECC)

For the purpose of handling emergency, separate emergency control centre should be established. All communications to and from should originate from this control centre. The site office has been identified for establishment of ECC. All the key personnel such as Site Controller/ Incident Controller Officers, Senior Personnel would be located here or have access to the ECC. The ECC will also coordinate with offsite District Emergency Operation Centre (DEOC).

Infrastructure at Emergency Control Centre

Emergency control centre should therefore contain the following:

- A copy of on-site emergency plan;
- A copy of evacuation plan;
- An adequate number of internal and external telephones lines;
- Layout of fire-fighting system including locations of fire extinguishers with their type,
- Location of assembly points;
- Information on additional sources of water;
- List of important telephone numbers such as Police, Fire Brigade, Hospitals, and other outside Emergency Services, etc.;
- List of key Personnel with addresses and telephone numbers;
- List of Personal Protective Equipment;
- First Aid box;
- Alarm Control system.

Assembly Areas and Evacuation Routes

Safe assembly areas shall be identified and marked and employees to be instructed to gather at the assembly area during emergencies. The evacuation routes/plans shall be displayed at all strategic locations across the site.

Emergency Equipment

The following should be implemented to tackle emergency situations:

- Onsite emergency equipment such as first aid boxes, firefighting equipment, PPEs etc. shall be maintained at project site;
- The adequacy and availability of emergency equipment shall be assessed at periodic intervals by the EHS Manager;
- Inventory and locations of respective emergency equipment shall be displayed at project office building, construction areas and other work areas;
- It is to be ensured that the site staff is trained on usage of each type of emergency equipment.

First Aid Boxes

First aid boxes shall be provided at identified locations within the Project premises. A first aid box shall contain, but not limited to the following articles:

- Cotton wool
- Sterile gauze
- Antiseptic lotion
- Box of adhesive dressing (Plasters) for small wounds
- Blunt-ended scissors
- Tweezers for removing splinters
- Triangular bandages (for making a sling or emergency bandage)
- Safety pins
- Sterile eye dressings
- Crepe bandages
- Skin creams for treating burns
- Anti-histamine cream for insect bites and stings

Fire Fighting Equipment

The fire extinguishers and sand buckets will be provided at critical areas such as fuel storage area, waste storage area, labour camps, kitchens, areas with electrical installations and project office.

Other firefighting systems to be installed should include:

- Heavy-duty ABC powder type fire extinguishers kept at important electrical equipment areas;
- Portable CO2 extinguishers provided throughout the plant;

Provision of Personal Protective Equipment (PPE)

Onsite workers and site staff should be provided with adequate number of personal protective equipment (PPEs) to deal with emergency situations. The PPEs shall be stored at the designated Emergency Control Centre (ECC) in the site premises and will be easily accessible during times of

emergency. Training of proper use of PPEs shall be provided to all working personnel on periodic basis.

Stretchers, and general first aid materials for dealing with burns, burns, fractures etc. would be maintained in the Medical Centre as well as in the ECC. A range of medicines should be maintained in the ECC/ Medical Centre. Other emergency medical equipment as suggested by local administration for COVID pandemic should be provided and maintained. Apart from first aid facilities, external facilities would be augmented. Checklist of name of medical personnel, medical facilities available in the surrounding area to be prepared and updated.

Incident Management System

Emergency Response Team

The Emergency Response Team (ERT) shall be set up for construction phase and shall be revised for commencement of plant operations.

Each personnel identified as part of the ERT shall be designated specific roles and responsibilities for handling emergency situations.

The ERT at the operating site under its control will have following role:

- Control the emergency and render the facility premises safe by the application of local resources; and
- Support the local response effort by co-ordinating additional equipment, personnel, and other external resources for the direct response effort.

Following Emergency Response Team (ERT) is proposed:

- **Site Controller**: The site supervisor would be designated as site controller during emergency.
- **Incident Controllers/Disaster response coordinator**: Health and safety team responsible for different activities would be designated as incident controller/disaster response coordinator. All incident controllers shall report to site controller.
- **Emergency Coordinators**: Emergency coordinators would be appointed who would undertake the responsibilities like fire fighting, rescue, rehabilitation, transport and support services. For this purposes, security in-charge, personal department, essential services personnel would be engaged.

Site Supervisor

The Site Supervisor or personnel nominated by him shall be the Site Controller and responsible for overall management. The following tasks will fall within his/her responsibilities:

- Assess the magnitude of the situation
- Maintain a continuous review of possible development and assess in consultation with Incident Controller and other Key personnel
- Review monthly and annual incident reporting
- Review disaster response drill outcomes and work with EHS Manager and safety officers to identify necessary improvements
- Appoint a Disaster Response Coordinator tasked with responding to emergencies
- Overall coordination during emergency

- Communication with the District Disaster Management Authority and other external agencies
- Issue authorised statements to news media, and ensure that evidence is preserved for inquiries to be conducted by statutory authorities

EHS Manager

EHS Manager will be part of Incident Controller team. The duties of an EHS Manager shall include the following:

- Direct all operations within the affected areas with the priorities for safety of personnel, minimise damage to the property and loss of materials
- Pending arrival of Site Controller, assume the duties of his post and, in particular
- Direct the shutting down and evacuation of areas likely to be adversely affected by the emergency
- Provide advice and information to the Fire squad & Security Officer and the local fire service as and when they arrive
- Ensure that all non-essential workers/staff of the areas affected are evacuated to the appropriate assembly points, and the areas are searched for casualties
- To set up communication point and establish contact with Emergency Control Centre
- Distribution of the DMP to all parties with responsibilities in implementing the plan (including contractors);
- Review monthly and quarterly reports of accidents/incidents and reviews of contractor practices;
- Training and Planning mock drills;
- Receive all notifications of incidents/accidents and ensure proper response is being followed including reporting and review.

Safety Officer

Safety officer will be part of Incident Controller team. Responsibility of Safety Officer includes:

- Support the EHS Manager as required in disaster response planning and in development of training and management plans to ensure environmental concerns are addressed;
- Provide regular incident reporting;
- Schedule monthly inspections and audits and resolve issues identified;
- Schedule emergency response training sessions for relevant staff;
- Prepare monthly incident reports.

Emergency Coordinators

- Ensure they are easily recognizable to their colleagues/visitors and the emergency services during any evacuation;
- Responsible for all occupants' safety during evacuation and to ensure the safety for personnel to re-enter the site;
- Keep an updated list of employees and visitors on site and carry the name list with them during evacuation;
- Ensure all occupants have evacuated the area where the incident has taken place (including people in rest rooms, site office rooms etc.);

- To be fully trained in the provision of first aid.

Employees/Workers

- All persons employed or under service contract (e.g. contractor, transporter etc.), who witnesses or cause an incident are responsible for immediate reporting of the incident to his/her supervisor.

Emergency Response Procedure

Effective command and control starts with a clear definition of the overall command and control structure, and description of the duties of key personnel with specific responsibilities for emergency response. The control of emergencies will consider the minimum number of persons required to provide an adequate response to emergencies.

All emergencies occurring as a result of project activities shall be managed according to the following order of priorities:

- Preservation of Life (self, team, community);
- Protection of the Environment;
- Protection or Property/assets; and,
- Preservation of Evidence.

Emergency procedure to be followed in the event of any emergency are provided below:

Emergency	Procedure
Medical Emergencies	■ If a person finds someone injured, he shall immediately tell his shift In charge about the accident; ■ The shift In charge shall inform the ECC and First Aid Team about the injury and location of accident. ■ On receiving the information, First Aid Team should go to the accident site immediately; ■ First Aid team shall provide the first aid to the injured person and make necessary arrangements for taking him to the hospital, if required; ■ After this, First Aid Team shall report the ECC and make entries in the register about the incident, it's cause and measures taken ■ Medical emergencies can be classified as life threatening or non-life threatening. If there is any doubt, assume that the emergency is life threatening.
Fire	■ The Incident controller must be notified; ■ Personnel in the immediate vicinity of the fire, including the designated Evacuation personnel must be immediately notified; ■ All persons located in the area in which the fire is located must be evacuated. Evacuation must be carried out as per the Evacuation Procedure; ■ The fire must be contained with the correct extinguisher only by those trained to do so; ■ Those requiring assistance must be assisted and first aid must be rendered only by those trained to do so; ■ Those confined to an area where there is smoke, must move under the level of the smoke and cover their nose/mouth.
Building Collapse	■ The Incident Controller must be notified; ■ Personnel in the immediate vicinity of the collapsed building move away from the building to a safe location - there could be a secondary collapse; ■ Enter and rescue others only by those trained to do so;

Emergency	Procedure
	■ If you know the identity or location of someone who is trapped, notify emergency personnel; ■ All persons located in the area must be evacuated. Evacuation must be carried out as per the Evacuation Procedure.
Earthquake	Actions during earthquake ■ Keep self and other calm; ■ Do not rush to doors or exit; ■ Keep away from loose articles/ furniture; and ■ Protect yourself by staying under the rental of an inner door, in the corner of a room, under a table. Action after an earthquake ■ Keep calm; ■ Expect aftershocks; ■ If there is a fire, try to put it out. If required call the fire brigade; ■ If people are seriously injured, do not move them unless they are in danger; ■ Do not enter badly damaged buildings; and ■ Do not go near damaged structures. Further Action ■ All person to assemble at assembly area; ■ Attendance of everyone present including direct and non-direct staff and visitors; ■ Rescue management to be initiated, if required additional help to be sought from authorities; and ■ RUMSL management to be briefed about the situation.
Flooding	■ The Incident Controller must be notified; ■ All personnel onsite, including the designated Evacuation Personnel must be immediately notified; ■ All equipment must be safely shutdown and all electrical equipment must be isolated. ■ During monsoon season, all emergency supplies to be kept handy at ECC and assembly point, such as flashlights, portable battery operated radios, extra batteries, emergency food and water, essential medicines, first aid kits etc.; ■ ECC should keep track on rainfall intensity and local weather forecast during the monsoon season; ■ The site controller should get into communication with DEOC and informing about the current situation at the site; ■ The onsite Emergency Response Team to help the Government Relief team in guiding them about the site and rescuing the people in the affected areas
Terrorism	Actions to be taken in response to terrorism include: ■ Run to a safe place, if there is nowhere to go; ■ Turn your phone to silent and turn off vibrate. Barricade yourself in if you can ■ Call for police help, when it is safe to do so. Further actions: ■ Help others with first aid, if it is safe to do so; ■ Tell the police what all you saw.
Bomb Threat	Actions taken in response to such a threat should be prompt and assure the safety of all. While a bomb threat may be a hoax, all such threats should be treated seriously. Procedure is as follows: ■ Do not touch anything electrical equipment including turning lights on or off. ■ Do not take a phone off the hook or replace it. ■ Do not use radios or cellular telephones. ■ Do not move anything that looks out of place. If a suspected bomb device is found, take note of the location, but do not touch it. Notify the police regarding the whereabouts of suspected bomb device. Once it is determined

Emergency	Procedure
	that a bomb threat has been made, the Safety Office will coordinate evacuation of the area.

Evacuation Procedure

All staff must be aware of the possible escape routes prior to the emergency situation. Always assure safety of the assembly point prior to evacuation. The procedure associated with an evacuation event is detailed below:

- The Disaster Response Coordinator will give instruction or the alarm sound to evacuate specific assembly areas;
- All staff appointed as Evacuation Officers must assist with the evacuation;
- All personnel onsite must follow the instructions of the Evacuation Officer;
- Personnel must follow the directional pointers to the nearest assembly points;
- Evacuation must be undertaken in accordance to the emergency lay out plan;
- Mobile employees must be the first to be evacuated followed by the frail and the injured;
- Evacuation personnel must work in pairs where possible to assist one another lifting injured employee (if any);
- Mobile employees who are struggling or appear unsure must be assisted;
- Personnel must evacuate by walking briskly and must not run;
- Evacuating personnel must stay calm and must not panic. Panic can spread and cause unnecessary chaos;
- Evacuating personnel must always keep left along the evacuation routes;
- In the case where the emergency situation results in fire or smoke, evacuating personnel must consider crawling, as this may be better than walking;
- Visitors that are not familiar with the evacuation procedure must be assisted;
- A daily record of staff and visitors must be kept;
- The task of the professional Emergency Services must not be obstructed;
- If necessary, a search / check for all unaccounted personnel must be undertaken before leaving the area;
- The evacuation officer must be the last one to leave the area;
- All personnel onsite must report directly to the allocated assembly point;
- Personnel must not leave the assembly point until it has been deemed safe to do so.

Post Emergency Analysis and Evaluation

When the emergency is over, the Emergency Response Team will carry out a detailed analysis of the causes of the accident, evaluate the influence of various factors and minimize them for future. At the same time, the adequacy of the Disaster Preparedness Plan will be evaluated and shortcomings will be rectified for subsequent improvement of the plan.

Reporting and Documentation

The following aspects need to be communicated for the emergency reporting:

- While witnessing or receiving notification of an emergency, as much information as possible should be taken and/or conveyed to the relevant emergency activation authority;
- Where possible, all information should be logged in written form with time and date included and provided to EHS Manager;
- Personnel working on the site may, at any time, be exposed to an emergency which could take many forms, for example (but not limited to):
  - Injuries and/or fatalities
  - Fires and/or explosions
  - Extreme weather
- When an emergency occurs, an appropriate and prompt response is required, providing precise action to control, correct and return the site to a safe condition. Timely action will also be required to protect people, the environment and property from damage;
- All near misses and unsafe acts will be written in logbooks / reported in the 'near miss, unsafe acts, hazards and sub-standard conditions report' and verbally communicated to the concerned Site Supervisor within a reasonable time. All accidents and incidents will be immediately reported to the EHS Manager, and requisite forms completed.

Co-ordination with External Agencies

Site Supervisor shall coordinate with the following departments:

- Fire brigade;
- Police department;
- Hospitals/ Ambulance Services;
- Utility departments (electricity and water);
- Technical departments such as Madhya Pradesh State Pollution Control Board, Factory Inspectorate etc.
- Local Authorities and District Administration
- District Disaster Control Room

Training and Education

Major emergency procedure should be laid down clearly and convincingly to everyone on site particularly Key Personnel. For this purpose, on site training and mock drills should be conducted periodically and documented. The duties and responsibilities of each person and the emergency procedure to be followed by him should be very clear.

Procedure for Mock Rehearsal

Mock drills on Disaster Management shall be conducted twice in a year as preparedness exercise.

- Inform all the employees about mock drill;
- Fix the date for mock drill;
- Observers (senior personnel) will not be involved in the exercise. They will monitor the Mock drill;

- Emergency Siren / alarm will be raised;
- After hearing the Siren /alarm, Emergency procedure will be followed as mentioned in the Onsite Emergency Plan;
- Observer will note down the activities with respect to the time and identify any gap

Verification and Monitoring

The EHS Manager has been tasked with the responsibility for auditing the project and implementation of emergency response procedures associated with all phases of the project.

Reporting and monitoring requirements for the ERDMP will include:

- Monthly inspections and audits;
- Quarterly report of accidents/incidents;
- Reporting at the time of any incidents;
- Bi-annual disaster response drills; and
- Annual reporting on trainings.

Disaster response drills and reporting maintained by the EHS Managers will provide information regarding required revisions to training or the disaster response actions. Each incident reported will be reviewed and investigated upon occurring. Actions will be identified where possible to improve the site's overall response to disasters.

Training

All employees and contractors will be trained in disaster response procedures within one month of their start-date. The EHS Manager shall distribute the ERDMP (together with the associated Evacuation Plan) to all parties in charge of ensuring the plans implementation. All relevant information in the DMP shall be communicated to employees and contractors. This information shall include information on potential emergency risks/threats, appropriate first person response/contact to incidents/emergencies and notification procedures.

All site personnel, including contractors, are to be trained in the appropriate responses for possible disasters. The training is mandatory and is to be conducted on a regular basis. The frequency and timing of training is to take place at least quarterly.

Awareness programs for community should also be arranged to apprise them about the potential emergencies that can arise in construction and operation phase.

Training is to include, but not limited to the following:

- Basic Fire Safety and Rescue;
- Basic Life Safety and First Aid;
- Emergency Evacuation and Response; and
- Medical Emergencies

CONTRACTOR AND LABOUR MANAGEMENT PLAN

Objective

The contractor and labour management plan has been developed with the objective of defining the procedures to manage and regulate the standards of labour and working conditions for the labourers hired through Solar Plant Developer or contractors (and in case they are being hired directly by RUMSL).

The Shajapur Solar Park will be developed by RUMSL and Independent Power developers will develop individual Solar Plants within the park. These Solar Plant developers will hire contractors and sub-contractors, who will be held responsible for all on-ground activities for the project; however Project proponent will monitor the progress of the project on regular basis and will be responsible to oversee that the labour conditions.

In the context of the project, Shajapur Solar Park requires a management plan that could provide guidance and become monitoring tool to assess and align the labour and working conditions of the contractors with the applicable regulatory as well as World Bank OP requirements.

Scope

This plan applies to all the three phases of the project, i.e. Construction, Operations & Decommissioning phase. This plan will be applicable for all the contractors and their workers that are going to be engaged in the above-mentioned three phases of the project. The scope of the present labour management plan has been broadly categorised into two components:

Aspects for ensuring proper Labour Management Contractor and Labour Management Plan

There shall be a well-documented set of policies defined for the project and the workforce to be engaged for it. The indicative set of policies to be developed have been enlisted below.

- Human resources Policy
- Working Relationship Policy
- Working Conditions & Terms of Employment Policy
- Workers' Organizations
- Non-Discrimination & Equal Opportunity
- Retrenchment
- Grievance Mechanism
- Child Labour
- Forced Labour
- Occupational Health & Safety
- Non-Employee Workers

Setting up and management of labour camp

Setting up and management of labour camp has been dealt with separately as they are considered an integral part of any construction project involving influx of migrant workers travelling alone or with their families including the children in some of the cases. Following are the major steps in the process:

- Site Selection and construction

- Facilities at the labour camp including safety, amenities etc.
- Usage and maintenance;
- Dismantling and reinstatement of labour camp occupied land.

Applicable legislations

There is a wide range of Central and State level regulations, that cover almost every aspect of the labour related issues. In addition to the Acts & Regulations, there are rules, notifications and standing orders of state government. Some of the aspects like the minimum wage rates are also updated from time to time and shall need to be tracked for recent and most updated developments. Acts and regulations pertaining to the migrant workers assume much more importance especially in the Indian context, wherein migrant workers (especially from certain states like UP, Bihar, west Bengal & Odisha etc.) constitute a huge section of the building and construction industry, or for that matter any form of labour intensive industry. The plan therefore, captures almost all the existing laws and regulations pertaining to the management of labour issues in the country.

National & State legislations regarding Contractor- Labour relationship

There are several laws and rules governing labour issues in India. The local legislations likely to get triggered for the contractor labour relationship are:

- The contract labour (Regulation and abolition) Act, 1970 and Rules
- The child labour (Prohibition and Regulation) Act, 1986
- The Bonded Labour (Abolition) Act 1976:
- The Trade Union Act, 1926:
- Workmen's Compensation Act 1923.
- Minimum Wages Act, 1948
- The Payment of Wages Act, 1936, amended in 2005.
- The E.P.F. and Miscellaneous Provisions act, 1952
- Public Provident Fund Act, 1968
- Payment of Gratuity Act, 1972
- Employees State Insurance Act, 1948 (ESI)
- Employer's Liability Act, 1938 (as amended).
- The Industrial Employment (Standing Orders) Act, 1946 (as amended).
- The Industrial Disputes Act, 1947 (as amended).
- Payment of Bonus Act, 1965 and Amendment Act No.43 of 1977 and No.48 of 1978 and amendments
- The Personal Injuries (Compensation Insurance) Act, 1963 (as amended).
- The Factories Act 1948;
- Shops and Establishment Act
- Interstate Migrant Workers Act 1979
- Maternity Benefit Act 1961
- Equal Remuneration Act 1976

- Building and Other Construction Workers Act 1996

Rules include:

- Industrial Disputes (Central) Rules, 1957
- Minimum Wages (Central) Rules, 1950
- Payment of Bonus Rules, 1975
- The Personal Injuries (Compensation Insurance) Rules, 1972
- Standing Orders Rules 1946.

References & Recommended further Readings

For detailed reading on best practices related to the labour management, some of the regulations/ guidance notes that could be further referred are:

- The Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and Central Rules, 1998 made thereunder stipulates that all establishments employing more than ten (10) workers will have to meet the provisions of the act and rules made thereunder;
- For engaging twenty or more labour on contract on any day, the Contractor shall also abide by the provisions laid down in the Contract Labour (Regulation & Abolition) Act, 1970. Under this Act, the Contractor shall secure a license from the Labour Commissioner after certification from the Employer (RUMSL). The contractor shall maintain all wage, attendance, PF, leave registers as applicable under the Act and shall keep them available for any inspection by the Employer;
- Similarly the provisions of Interstate Migrant Workmen Act 1979 shall become applicable in case 5 or more interstate migrant workmen are engaged by the Contractor;
- Child labour prohibition Act shall be universally applicable to the Contractor, which prohibits employing of any workmen/labour below the age of 14 years. In addition compliance to labour laws like payment of wages, payment of PF, equal remuneration, hours of work, overtime, weekly holiday etc. shall be observed by the contractor as per applicable laws; and
- *Chapter 6* of The Building and other Construction Workers Act and Chapter 28 of Central rules stipulate the basic welfare measures that are to be provided by the employer or establishment. Similarly, Chapter 5 of Contract Labour Act stipulates the basic welfare measures. The stipulations shall be reviewed and followed

Contractor & Labour Management- Specific issues

The challenges that the project is likely to encounter during construction and operational phases regarding the maintenance of labour standards could be:

- Lack of defined terms of employment for some worker or labour by sub-contractors might be possible;
- Likelihood of child labour at varying scale, particularly during development/ construction phase on account of migrant labour;
- Discrimination in remuneration between male and female labour or between local & outside labour; and
- Inappropriate living arrangement in labour colony or workers colony;
- Conflict with local population.

The section below describes in detail the challenges as well as the suitable measures to manage these challenges. However, the contractors would not be expected to limit their action plan against the suggestive measures.

Defined Human Resource Policy, working conditions and terms of employment

Management Plan

The contractors will be required to take following mentioned measures to regulate and manage the workforce engaged during construction as well as the operational phase of the project.

- Adequately cover the contract labourers that will be engaged in the construction phase of the project within the HR policy;
- Maintain consistency with the applicable labour laws;
- The Policy should be commensurate with the size and type of workforce;
- Policy should be clear and in a language understandable to workers;
- Procedure to make provisions of the policy very clear to each worker at the outset of joining;
- Working condition(79) and terms of employment(80) should be documented and communicated properly to all workers;
- Wages and benefits must be clearly communicated and understood by the workers;
- Provide all workers with a contract in a language understood by them;
- Routinely provide workers with a clear record of wage calculation and deduction;
- Ongoing internal verification that all workers are receiving wages and benefits as prescribed by law;
- Ongoing communication and training on legal labour rights and company personnel policies;
- Worker representatives meets regularly with HR and company management;
- Training on minimum legal benefits for all workers, including contractors, and employment agencies;
- Cooperation with local labour ministries.

(79) Working condition is defined as the conditions in the workplace and treatment of workers. Condition in workplace includes the physical environment, health and safety precautions, and access to sanitary facilities. Treatment of workers includes disciplinary practices, reason and process for termination of workers and respect for workers personal dignity.

(80) Terms of employment includes wages and benefits, wage deduction, hours of work, rest days, overtime arrangements, overtime compensation, medical insurance, pension, leave for illness, vacation, maternity and so on.

Table E.1 Aspects for Ensuring Proper Contractor and Labour Management

SN.	Guiding principles	Desired Actions	Special Remarks and Suggestions	Monitoring Indicators
1	**Human resource Policy**			
	■ RUMSL & its contractors will have a documented policy and procedure related to Human resources. ■ RUMSL & its contractors will inform workers of their rights under national labour and employment law ■ Policy must be clear and understandable to all workers	■ Centrally organize all policies and procedures; ■ Identify and record responsible person and last date modified; ■ Conduct an annual review of all policies and procedures; ■ Prominently display policies and procedures in all local languages, especially which the staffs and workers understand; ■ Appoint a person responsible for monitoring policies and procedures related to labour law implementation; ■ Implement standardized routine training	■ The contractors will be required to put in place a well-defined and documented Human Resource policy at the outset of the project in order to ensure efficient and fair management of workers engaged in the overall process of work. In case the contractor has existing HR policy, the same can be made applicable for the workers to be engaged for the project.	■ Complete review of all policies and procedures ■ Review of management-worker committee meeting minutes ■ Communications (memos, letters, etc.) to workers, suppliers, contractors and multi-stakeholder groups ■ Interviews with management and workers ■ Interviews with external stakeholders ■ Budgets related to implementing labour policy ■ Training curricula and logs
2	**Working Relationship Policy**			
	■ RUMSL & its contractors will document and communicate working conditions and terms of employment to all workers ■ Wages and benefits must be clearly communicated and understood by all workers	■ Provide all workers with a contract in their native language ■ Provide documented training on contracts, wages, benefits and deductions for all workers ■ Routinely provide workers with a clear record of pay calculations in the form of wage slips	■ The working relationship policy can be a separate document or it can be integrated with the HR policy. The working relationship policy will essentially ensure ■ Coverage of each category of workers including direct workers, contract workers and supply chain workers who will be engaged in operation; ■ Consistent with regulatory requirements on labour as per	■ Contracts for all workers ■ Policies and procedures related to worker contracts and wages ■ Communication and training on wage calculation, including local laws ■ Payroll records, time sheets ■ Piece rate or performance pay calculations verified against minimum wage ■ Worker interviews

SN.	Guiding principles	Desired Actions	Special Remarks and Suggestions	Monitoring Indicators
			the national and state labour regulations:	
3	**Working Conditions & Terms of Employment Policy**			
	■ If there is a collective bargaining agreement, RUMSL & its contractors will respect its terms ■ RUMSL & its contractors must provide reasonable working conditions and terms of employment, at a minimum complying with the various local laws as described in this plan	■ On-going internal verification that all workers are receiving wages and benefits as prescribed by law ■ On-going communication and training on legal labour rights and company personnel policies ■ Worker representatives meets regularly with HR and company management ■ Training on minimum legal benefits for all workers, including contractors, and employment agencies	■ Defined Terms of Employment and procedure for sharing the same with each new worker in a transparent manner; and ■ Procedure for establishing and updating records of employment relationship conditions.	■ Collective bargaining agreement (if one exists) ■ Worker contracts ■ Policies and procedures related to wages, benefits, hours and leave ■ Wage calculations as they relate to local laws ■ Worker and external stakeholder interviews ■ National law as it relates to wage and benefit minimums ■ Employment and termination records
4	**Workers' Organizations**			
	■ RUMSL & its contractors will recognize worker's right to form and to join workers' organizations ■ RUMSL & its contractors cannot interfere with or discriminate against workers who choose to organize ■ Worker representatives must have access to management ■ Worker organizations are expected to fairly represent the workforce	■ Clear communication to workers on their rights to collective bargaining ■ Allow workers to raise workplace related issues; ■ Regular training on worker-manager communications ■ Regular meetings of management and worker representatives ■ Periodic documented communication with local unions and NGOs	■ The purpose of forming a trade union/workers organisation is to create a platform for collective bargaining to protect the interest and rights of the workers with regard to working conditions and the terms of employment. The contractors will have to abide by the Indian regulations on provision for trade union and the contractors to form trade union, if they wish should not restrict the workers. ■ The construction phase is likely to engage migrant labour and is expected to be over in one-two	■ Documented policy regarding collective bargaining ■ Minutes and records from collective bargaining sessions, reviews or other actions ■ Procedure for workers to select worker representative without management interference ■ Interviews with workers, NGOs and trade unions ■ Collective bargaining agreements ■ Grievance mechanism

SN.	Guiding principles	Desired Actions	Special Remarks and Suggestions	Monitoring Indicators
			years after getting started. During this phase, the labourers should be provided a suitable mechanism to raise their grievances and genuine work related issues, alternatively allow them to create a platform for collective bargaining. ■ During operational phase of the project, contractors will be required to consider following mentioned measures to ensure freedom of association for workers and provide them an alternate grievance mechanism ■ The contractors shall have clear communication with the workers on their right to form trade union and collective bargaining; ■ There will be regular trainings on worker-manager communications ■ There will be regular meetings of the contractor's management and their workers	
5	**Non-Discrimination & Equal Opportunity**			
	■ People should be hired, promoted and compensated solely based on their ability to do the job ■ All workers should have equal access to training, tools and opportunities for advancement	■ Clearly define anti-discrimination policy in hiring, training, promotions and compensation ■ Regularly review worker and manager demographics	■ The contractors will be required to make employment decisions on the principle of equal opportunity and fair treatment and will not discriminate with respect to aspect of the employment relationship like	■ Discrimination policy and related employment policies and procedures ■ Company policy and procedure to address and manage discrimination issues when found ■ Comparative demographics of workers and managers

SN.	Guiding principles	Desired Actions	Special Remarks and Suggestions	Monitoring Indicators
	■ All workers should be free from harassment by management or other workers ■ Positive discrimination may be allowable in cases where it protects disadvantaged or excluded groups and provides them special opportunities	■ Develop long term remediation plan to address past discrimination ■ Provide regular training to workers and managers ■ Establish confidential and secure communication channels for workers to reach managers ■ Actively promote a harassment-free workplace	recruitment and hiring, compensation, working conditions and terms of employment, promotion etc. ■ Contractors however will have to give preference to the project affected people during the recruitment process as part of the R&R policy, which has a provision for employment to one member of each affected family.	■ Documentation of handled discrimination cases ■ Diversity training curriculum and attendance log ■ Interviews with workers and managers, including those who may be likely to be discriminated against ■ Interviews with local NGOs and trade unions ■ Hiring, promotion and termination records ■ Local laws related to discrimination ■ Hiring of the local residents/ PAFs in the various jobs
6	**Retrenchment**			
	■ RUMSL and its Solar Plant developers will develop and implement a plan to mitigate the adverse impact of retrenchment if it anticipates a large number of layoffs ■ The plan will incorporate non-discrimination principles and include the input of workers, their organizations, where appropriate, the government	■ Policy and procedure for workforce reduction, including worker selection ■ Analysis of alternatives to workforce reduction ■ Engage workers in discussions with workers related to workforce reduction as early as possible ■ Communication to all workers about why and how the reduction will take place ■ Discussions with local NGOs about how the community impact of workforce reduction could be minimized	■ The contractors may be asked to prepare such a lay off plan especially if the local community is engaged as labourers, as most of the migrant labourers are shifted to other sites for work by the contractor itself.	■ Policy and procedure related to workforce reduction, severance and transition ■ Analysis of alternatives employed for workforce reduction. ■ Procedures for selecting workers impacted by workforce reduction ■ Documentation of prior instances of workforce reductions ■ Minutes from management meetings and discussions ■ Communications with workers related to workforce reduction ■ Communications with external stakeholders and community groups
7	**Grievance Mechanism**			

SN.	Guiding principles	Desired Actions	Special Remarks and Suggestions	Monitoring Indicators
	■ RUMSL & its contractors will establish a transparent process for workers to express concerns and file grievances ■ There will be no retaliation or discrimination against those that express grievances ■ RUMSL & its contractors will treat the grievances seriously and take appropriate action ■ RUMSL & its contractors grievance mechanism does not replace other channels as defined by law or collective bargaining agreements	■ Establish clear policies and procedures for grievances ■ Communicate the grievance process to all workers in a clear, understandable manner ■ Provide on-going training to all workers ■ Document all grievances and the resulting actions ■ Make worker representatives a key part of the process	■ For a healthy work environment, contractors should create an atmosphere where workers feel safe expressing their concerns and the grievances are settled mostly through informal channel and workers don't feel the need to lodge the complaint. However there should be a formal grievance redress mechanism which is simple and secure; free from fear of retaliation; responsive and fair, and allow workers to file anonymous complaints as well. The grievance mechanism system should not impede the aggrieved to access to court in case he/she is not satisfied with the outcome derived from the formal system. ■ For an effective grievance redress system, the contractors will have to ■ Establish clear policies and procedures for grievances based on above outlined principles; ■ Communicate the grievance process to all workers in a clear, understandable manner; ■ Document all grievances and the resulting actions; and	■ Documented policy and procedure for worker grievances ■ Worker and manager interviews ■ Training curriculum and log on grievance handling ■ Communications to workers, supervisors and managers ■ Records of complaints lodged and actions taken on grievances ■ Employment and termination records

SN.	Guiding principles	Desired Actions	Special Remarks and Suggestions	Monitoring Indicators
			■ Make worker representatives a key part of the grievance redressal process.	
8	**Child Labour**			
	■ RUMSL & its contractors will not employ workers under the minimum age for employment as defined by national law (.i.e. below 18 years of age) ■ Workers between the minimum age and 18 will not be employed in dangerous work or work that interferes with their education or development ■ The Indian regulation recognises a person as a child who has not completed his/ her 14 years of age. The World Bank OP requirements say that company cannot employ workers under the minimum age (completed 14 years in Indian context) and workers between the prescribed minimum age and 18 years may be employed in non-hazardous working conditions with certain terms and conditions.	■ Write clearly defined policies and procedures for age verification – make them publicly available ■ Develop remediation plan for use in cases where children are unknowingly employed despite RUMSL's Anti Child Labour policies and procedures (ex: child presents false ID) ■ Engage with local stakeholders to develop proactive plans to address child labour issues ■ Communicate child labour policies to RUMSL's suppliers and contractors – and provide them with the training and tools to address the issue	■ The migrant contract labourers may be expected to bring their family along during the construction phase of the project. The family might also accompany the labourer to their workplace thus enhances the possibility of child labour at varying scale. Further during the operational phase of the project, the possibility of adolescent workers (between 14 to 18 years) entering into hazardous working conditions cannot be ruled out. ■ The contractors will need to adopt suitable proactive mechanisms to prevent child labour in any form. Some of the measures in this regard could be as follows; ■ Identify the types of activities during the entire project operation that could have a possibility of child labour; ■ Clearly defined policies and procedures for age verification; ■ Visual observation and verification thereupon;	■ Policies and procedures for age verification in hiring ■ Interviews with workers, local children, trade unions and NGOs ■ Visual observation ■ Pay records, medical records, birth certificates, panchayat certificate

SN.	Guiding principles	Desired Actions	Special Remarks and Suggestions	Monitoring Indicators
			■ Develop remediation plan for use in cases where children are unknowingly employed despite the clear policy and procedure of contractors on no-child labour.	
9	**Forced Labour**			
	■ RUMSL & its contractors will not employ forced labour ■ Workers have the right to retain their personal documents and money ■ Workers are free to leave the workplace after work ■ Workers have the right to resign	■ Clearly define worker's freedom in employment contract ■ Provide employment contracts to all workers in their language - direct or contracted ■ Define and enforce policy regarding use of employment agencies and expectations ■ If employment agencies are used, audit relationship between the agency and the workers ■ Provide training for all workers to explain their rights ■ Pay all job related training and equipment expenses	■ Any involuntary work, which is performed under threat of force or penalty, is considered as forced labour. It can be in form of bonded labour, indentured labour or similar labour arrangement, slavery or slavery like situation. There can be a possibility of forced labour by sub-contractors or petty contractors during the construction or operational phase of the project; however, the likelihood of forced labour is expected to be negligible for the regular workers during operational phase in view of hiring system structures in place and an adequate HR management department.	■ Employment contracts in all appropriate languages ■ Contracts with employment or recruitment agencies ■ Payroll records, timesheets and wage deduction calculations ■ List of permanent workers and contracted workers at RUMSL facility ■ Worker IDs ■ Interviews with all workers, employment agencies and external stakeholders ■ Interviews with security guards
10	**Occupational Health & Safety**			
	■ RUMSL & its contractors will take all reasonable precaution actions to protect the health and safety of workers	■ Structuring an OHS team and an OHS accountability framework (including production area) ■ Conducting a comprehensive job safety or job hazard analyses	■ RUMSL and its Solar Plant developers is expected to have its own system. Either the MDO/ contractor will have to completely follow RUMSL's OHS system or in case it has its	■ Visual observation ■ Exposure to hazardous agents monitoring log ■ Manager and worker interviews ■ Accident and medical treatment logs

SN.	Guiding principles	Desired Actions	Special Remarks and Suggestions	Monitoring Indicators
	■ Ensure that workers are not exposed to unnecessary or unreasonable risks at the workplace, dormitories etc. ■ Implement an OHS management system consistent with international standards such as OHSAS 18001. ■ Systematically assess all of the OHS risks, conducting a comprehensive job safety or job hazard analyses. ■ Implement preventive and protective measures according to the order of priority: Eliminating the hazard, Controlling the hazard at its source, Minimizing the hazard, Providing appropriate personal protective equipment ■ Document, investigate and report all accidents and occupational diseases. ■ Investigate and identify the root causes of all accidents with working time loss, and implement appropriate corrective actions ■ Note: This can be done through the involved contractors also.	■ Developing a Corrective OHS Action Plan based on the likelihood and severity of the consequence of exposure to the identified hazards ■ Proper equipment design, maintenance and procedures, such as: Designing machines and equipment's like stairs, to eliminate trap hazards ■ Turning off, disconnecting, isolating, and de-energizing (Locked Out and Tagged Out) machinery with exposed or guarded moving parts or being serviced ■ Marking and checking all energized electrical devices, cords and lines with warning signs ■ Implementing proper monitoring systems of hazardous agents and proper control measures (eliminating risk, PPC, PPE)	own, it needs to be reviewed by RUMSL, before the starting of the work during construction or operations. ■ ■ Some examples of things to be done include: ■ Integrity of Workplace Structures – reachable, easy to clean, fore resistant, floors ■ Workspace and exits – unobstructed, clearly marked, consider disabilities ■ Fire Precautions ■ Amenities- toilets, potable water, lighting ■ Safe Access –even pathways, falling objects, railings ■ First Aid- training ■ Fresh air supply ■ Physical Hazards- Working at heights, Vibrations, Electrical, Ergonomics, illumination ■ PPEs ■ Communication- Induction orientation, training	■ Equipment maintenance logs ■ Fire and safety drill logs ■ Health and safety risk analysis ■ Health and safety inspection logs with test results ■ Government health inspection reports ■ Training curriculum and logs
11	**Non-Employee Workers of RUMSL**			

SN.	Guiding principles	Desired Actions	Special Remarks and Suggestions	Monitoring Indicators
	■ RUMSL will extend the previously discussed indicators to contractors hired directly or through employment agencies. ■ RUMSL will not use contracting as a means of circumventing labour rights and laws. ■ Employment and recruitment agencies will be monitored to verify their adherence to labour rights and laws.	■ Provide employment contracts to all workers in their language - direct or contracted ■ If employment agencies are used, audit relationship between the agency and the workers ■ Provide training for all contracted workers to explain their rights ■ Include contracted workers in grievance process access and training		■ Contracted labour contracts in all appropriate languages ■ Contracts with employment or recruitment agencies ■ Payment records, timesheets and wage deduction calculations for contracted workers ■ Listing of direct employees and contracted workers at RUMSL's Solar Park site ■ Interviews with managers, employment agencies and external stakeholders ■ Interviews with contracted workers - directly contracted and through agencies

Worker's Accommodation

The requirement of workers accommodation would entirely depend on the type of workforce that will be engaged during construction and operations phase of the project.

RUMSL & its contractors are recommended to adopt the following approach to handle the issues of workers accommodation and it should be dealt systematically in following manner:

- Assessment of the type and number of workers who will be requiring accommodation facility;
- Impact assessment of workers accommodation on local community and accordingly plan mitigation measures;
- Identify applicable regulatory requirements on establishment of workers colony; and
- Determining the standards to apply to the location of facilities, the construction of housing and provision of facilities
- Managing accommodation.

Apparently local working population of the project area cannot meet total project workforce requirement, as the project would need skilled workers for construction, module installations, electric work etc., therefore it is likely that workers from outside will need to be recruited. Given the remote location of the project, the outside workers will require adequate accommodation arrangements. Types of workers requiring accommodation arrangement can be classified in the following categories:

- Migrant labourers during construction phase;
- Supervisors and executives of the contractors engaged in construction phase;
- Regular workers, supervisors and executives during operational phase.

Housing standards for workers accommodation

Labour Colony:

The contractors would be recommended to prepare temporary accommodation facilities for the construction labourers preferably within the lease boundary, away from existing local community to leave minimum possible adverse impact upon local community. The standards that are to be maintained for labour colonies will be:

- Allocation of minimum space per person or per family;
- Supply of safe water in the workers' dwelling in sufficient quantity;
- Adequate sewage and garbage disposal systems;
- Adequate sanitary and washing facilities, ventilation, cooking and storage facilities and natural and artificial lighting;

If the contractors are required to provide accommodation for single labour or labours with their families, following standards should be suitably applied;

- A separate bed for each worker;
- Separate accommodation for families and bachelors;
- Adequate sanitary conveniences;
- Common dining rooms, canteens, rest and recreation rooms and health facilities, where not otherwise available in the community.

Further, as per the Building and Other Construction Workers (Regulation of Employment and Conditions of Services) Act 1996; the contractors will have to provide temporary accommodation facilities to the construction labourers free of cost. Also, after the construction work is over, the employer at his own cost will remove/ destroy the temporary structures and restore ground in good level and clean conditions.

Workers Colony

The contractors will have to abide by all applicable rules and regulations pertaining to the design and construction of the building as well as facilities to be provided therein while planning for the accommodation arrangements for the workers. In addition, a suggestive guideline for workers accommodation arrangement based on international standards has been prescribed below.

Table E.2 Standards for Workers Colony

Standards Parameter	Requirements as well as Monitoring indicators
Location	■ Reasonable distance from Project Site ■ Adequate Transportation arrangement
Drainage	■ Proper drainage system ■ Avoid accumulation of stagnant water
Ventilation	■ Adequate ventilation and air conditioning system ■ Natural lighting available ■ Artificial lighting available
Water	■ Adequate and convenient water supply ■ Drinking water meeting national and WHO standards ■ Regular monitoring of drinking water
Waste water and solid waste	■ Proper discharge of waste water and sewage ■ Establish Sewage Treatment Plant (STP) if required ■ Solid waste management system ■ Pest control mechanism
Bachelor Accommodation	■ Separate bed for each worker ■ Minimum space available ■ Storage for personal belongings ■ Separate storage for PPEs
Family Accommodation	■ Adequate space ■ Other suitable housing facilities described in this table
Toilet facilities	■ Adequate number of toilets ■ Convenient location ■ Constructed of good materials ■ Easily cleanable ■ Kept in working condition ■ Separate for male and female except for family accommodation
Bathrooms and other sanitary facilities	■ Made of anti-slip hard washable materials ■ Adequate number of bathroom and hand wash facilities ■ Kept in working condition ■ Convenient location. Separate for male and female except for family accommodation ■ Adequate supply of cold and hot running water

Standards Parameter	Requirements as well as Monitoring indicators
Canteen and cooking arrangement	■ Adequate space ■ Constructed of good and easy to clean material ■ Option for separate cooking ■ Adequate space for separate cooking ■ Hygiene in canteen/dining halls and cooking facilities ■ Adequate facilities for cleaning, disinfecting and storage of cooking utensils and equipment ■ Adequate food waste disposal
Laundry	■ Provide laundry facility
Nutrition and food safety	■ Appropriate level of nutrition value ■ Consideration of religious and cultural background of workers in food selection ■ Workers could have choice of food
Medical facilities	■ First aid facility ■ Own dispensary
Recreational, social and market facilities	■ Community centre for social gathering ■ Market complex ■ Provide possible recreational facilities like tennis court, swimming, park etc.

Considering the current pandemic situation, RUMSL is recommended to follow the SOPs on CoVID 19 below. The Site team and EHS personnel shall closely monitor and take the responsibility of proper implementation of the given below SOP.

Box E.1 SOP on CoVID 19 Pandemic

CoVid 19 SOP to be followed in Labour Camps

The speed of CoVid 19's spread, and the nature of virus, has given rise to concerns with respect to safety of workers as well as that of members of the public with whom workers may come into contact.
To better understand physical & economic risks to workers, RUSML should ensure that these considerations are properly integrated into the emergency response plan. A brief and non-exhaustive overview of prevention and response measure has been provided below though the understanding and medical advice is being updated frequently, and the measures must be updated to the most recent advice, including central, state and district level guidelines:

- Providing information about CoVid 19 to engaged staff & workers at site level

This process will include awareness campaigns, training or the establishment of specific communication channels. No practice of discrimination against or stigmatization of person affected, or his family;

- Encourage workers to stay at home, in-case they report symptoms of CoVid 19.
  - In this case, a RUMSL shall ensure a separate accommodation facility for the affected/ or CoVid symptomatic person;
- Awareness about proper cough hygiene should be given, also a proper use of soap, frequent hand wash, sanitizers should be given;
- Staff & workers to strictly follow social distancing at work place;
  - Shall ensure that workers maintain a safe distance of 2 meters at workplace, limit gatherings and work in shifts, up to large extent;
- Cleaning and dis-infecting protocols should be extended to food preparation facilities, kitchen staff should be strictly prohibited if they discover any symptoms of CoVid;
  - Shall improve ventilation or air- filtration, when not in open space. The accommodation facilities provided, should be ensured to have proper ventilation and air-filtration facility;
- Usage of PPEs at workplace;
  - This involves usage of gloves, mask, facemask etc. at workplace. Especially when they are working in a large number during construction phase. Proper disposal of PPE kits at daily basis should be monitored;

Responsibilities & Accountabilities

The overall responsibility of the aligning the contractor labour relationship as well as maintaining labour standards as per the regulatory and international standards would be vested with the Human Resource department of the key contractors. These key contractors would also be held responsible for regulating labour issues of their sub-contractors or petty contractors.

The role of RUMSL will be limited to periodic monitoring and provide direction in case of any deviation from the standards. RUMSL will also be empowered to take strict steps against contractors in case any serious violation of labour issues like child labour, bonded labour and so on, is identified in monitoring process.

However, the overall responsibility of ensuring the compliance to the standards will be on RUMSL, also RUMSL will have to ensure that contractors are abiding by the same.

RUMSL will therefore need to put especially some staffs dedicated to the labour management and OHS issues:

- Supervisor (S&C);
- EHS specialist;
- EHS supervisors

Contractors of RUMSL will put in similar corresponding staff for the direct implementation of the labour management plan:

- Dedicated Health & Safety supervisors
- Dedicated labour officer
- Dedicated supervisor for HR, HR policy and working conditions, wages & labour related issues.

Contractor's responsibility
Within 30 days from the appointed date, the Contractor shall prepare and submit 4 hard copies and 1 soft copy of Labour Influx and Worker's Camp Management Plan to the concerned PEA that addresses specific activities that will be undertaken to minimize the impact on the local community, including elements such as worker codes of conduct, training programs on HIV/AIDS, etc. A Workers' Camp Management Plan addresses specific aspects of the establishment and operation of workers' camps. This Labour Influx and Worker's Camp Management Plan will include:

- mandatory and repeated training and awareness raising for the workforce about refraining from unacceptable conduct toward local community members, specifically women;
- informing workers about national laws that make sexual harassment and gender-based violence a punishable offence which is prosecuted;
- introducing a Worker Code of Conduct as part of the employment contract and including sanctions for non-compliance (e.g., termination), manual scavenging, engagement with local residents, child labour, non-discrimination, harassment of co-workers including women and those belonging to SC and STs and other minority social groups;
- contractors adopting a policy to cooperate with law enforcement agencies in investigating complaints about gender-based violence;
- training programs on HIV/AIDS and other communicable diseases;

- workers' Camp Management Plan addressing specific aspects of the establishment and operation of workers' camps provided the Local Body/ Executing Agency is unable to cater to the demand for affordable housing for this additional workforce in terms of rentals, hostels, apartments, etc.; and
- complaint handling Mechanism at the project level.

Monitoring & Evaluation

RUMSL will put in place a robust mechanism for the purpose of monitoring and evaluation of the Labour management practices for its project. The monitoring would not only help keeping track of labour related management practices on ground, but also to improve the existing identified gaps which will require to be addressed while meeting the need to comply with the regulatory and International standards. RUMSL will ensure setting up of both internal and external monitoring systems to assess the progress and evaluate the performance on the labour management practices.

Internal Monitoring

The Social and Community Supervisor of RUMSL will do internal monitoring of the labour management implementation in case the labour officer is not appointed; however preferably a labour officer will be appointed. The labour officer will coordinate with the EHS officer and representatives from the sub coordinator part to conduct internal monitoring from time to time. Internal monitoring will also be done through regular submission of the reports from the sub-contractor side on various monitoring indicators as mentioned in tables above.

Apart from daily or weekly reporting, monitoring will also be carried out on quarterly basis to assess the performance on the various labour related issues. The findings of these internal monitoring and will be documented and brought before the advisory committee for review and guidance.

External Monitoring/ Evaluation

A third party will do external monitoring of the labour management practices carried out under the project, independently at the end of each financial year to monitor the labour management practices. External monitoring will also be based on various monitoring indicators as mentioned earlier.

Allocation of Finances

The sub-contractor will be responsible for the financial allocation of resources to implement the contractor and labour management plan. Sub-contractors for the various aspects of the project will be responsible for incorporating the cost of implementing the construction and labour management plan at the bidding stages itself. RUMSL and is contractors in their quotation request from the contractors will be responsible for putting up the requirements from its contractor regarding the labour management plan. The cost of the labour management plan will therefore be already included in the bidding document, especially with regard to provision of the health and safety PPEs, safety managers and construction of the labour camp as required.

GENDER IMPACT ASSESSMENT AND ACTION PLAN

Background

This gender assessment intends to outline the gender situation in the Study Area and specifically in the Project villages. It also aims to identify the socio-cultural factors contributing to the gender issues that are relevant to the project, to analyse and evaluate the potential gender mainstreaming opportunities that can be adopted by the project during the course of its operation. This gender assessment is largely based upon the stakeholder consultations conducted by ERM during site visit in the month of January 2020, supported by Census 2011, which assists in presenting the current social context in the area.

There are various constitutional and legal provisions for gender equality and women's empowerment that the Government of India has charted. Some of the key such initiatives are enlisted below.

- Principles of Gender Equality are enshrined in the Indian Constitution;
- The Indian Constitution not only grants equality to women but also empowers the State to adopt positive discrimination in favour of women;
- In terms of Legal Provisions, the crimes directed specifically against women are characterised as Crimes against women and identified under Indian Penal Code.

Legal Regulations supporting Gender Mainstreaming

The Indian regulations focussing on Gender aspects in India, have been given below:

- **Equal Remuneration Act, 1973** provides for payment of equal remuneration to men and women workers for the same work of similar nature without any discrimination. In order to ensure social security to the workers including women in the unorganised sector, the Government has enacted the Unorganised Workers' Social Security Act 2008.
- **The Maternity Benefit Act, 1961** and **The Maternity Benefit** (**Amendment**) **Act**, **2017** regulate employment of women in certain establishments for a certain period (26 weeks) before and after childbirth and provides for maternity and other benefits.
- **The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act (POSH), 2013** has been enacted, which covers all women, irrespective of their age or employment status and protect them against sexual harassment at all workplaces in both public and private sector, whether organised or unorganised.

Additionally, India has also ratified various international conventions and human rights instruments committing to secure equal rights of women. Key among them is the ratification of the Convention on Elimination of All Forms of Discrimination against Women (CEDAW) in 1993.

Understanding Gender roles in society

Gender roles in Household activities

The consultations suggest that in a household, women from most social and caste groups, take equal ownership and responsibilities of working on agricultural fields owned by the household, taking care of domestic chores of cooking, cleaning, fetching water from community water points to their respective houses, caretaking of children and elderly as well as tending to livestock owned by the family. Men are largely responsible for management of financial resources, sale and purchase of goods, etc. and their contribution to domestic chores of cleaning, cooking, caretaking is limited. Consultations with SHG members reports that several of groups that were previously active are now dormant, due to lack of any income generating activities being undertaken. Gender roles in livelihood & economic activities

The occupational profile of the community is detailed in ***Section 4.5.7***, where men's employment options comprise working as cultivators, agricultural labours, construction labours, etc. The men are also understood to migrate for employment to nearby cities and town for work, either alone or with families. There have not been any cases reported for women working as construction labourers or in any enterprise outside their respective villages and are largely engaged as agricultural labourers in the fields owned by their families (unpaid labour work) and in agricultural fields of other against payment of daily wages. According to the discussions undertaken during the ESIA consultations and as detailed in ***4.5.11,*** it women make significant contributions in terms of time and effort within the household and in economic activities, especially agriculture, taking care of livestock, and domestic responsibilities linked to livestock management comprising staff feeding, cleaning of livestock and their sheds, milking, cow dung cakes preparation, etc. These activities undertaken by women comprise unpaid labour rendering women with less economic independence and participation in financial decision making.

On the agricultural fields, women are involved in cutting, sowing, threshing, watering, and collecting fuel wood. The women engaged as agricultural laborers are paid an amount of INR 100-200 per day where as men are paid INR 200-300. The tasks that are taken care of by men include sale and purchase of agricultural inputs, sale of crops in markets and Mandis and other farm based activities Gender Asset ownership profile

The exposure of women outside the realms of their villages is understood to be limited in general. The ownership of land and assets by women is also understood to be minimal and in cases where women own land legally, the management of the same in terms of sale, purchase or usage is largely decided by men, with limited or no consultations with women. The proceeds from sale of land and its usage is also usually discussed within households but the final decision on usage of money is taken by male members of the household.

The men have more social exposure, access to cash and linkage to banking services, understanding of financial and legal instruments, etc. which makes them the natural decision making authority in a household on aspects linked to assets or financial matters. Women are restricted in their movement outside villages due to socio-cultural practices and safety issues and in spite of being equal contributors to the household and agricultural fields (which largely forms unpaid work); have less access to cash and resources for discretionary spending. The societal norms also play a role in this scenario where education of male child is given importance over female, thereby limiting their exposure and role to caregivers and in charge of domestic responsibilities.

Women Headed Household

There are certain women headed households in the project villages; however in most cases these Women Headed families are provided financial support and security by other members of the family, as part of the prevalent joint family and living systems. However, certain independent women headed households have to fend for themselves, by working as labourers on agricultural fields.

These Women headed households (both joint as well as independent) face additional risks of not being included in negotiations, or other key meetings due to prevailing cultural norms and may not therefore receive the benefits and advantages compared to those who do participate. Thus they become a little more vulnerable in cases of sale of land for the project, where there is a chance that the proceeds from sale of land do not reach them.

Role in Decision-making

The men lead in the decision making process at the household and community level, although the participation of women is understood to be crucial, especially at the household level, for matters relating to the family. According to the consultations undertaken, the women are reported to have limited say in the financial decision making or land transactions; however, in aspects such as

education of the children or purchase of goods of domestic uses, women are reported to take more decisions than men.

With the constitutional amendments, women are being elected as Sarpanch at village level; however;; they do not actively participate in any community or village level meetings as their interactions with the community, and village at large, is still subject to societal and cultural norms combined with their inherent inhibitions. Even after being elected to leadership roles that require interaction with the community members, addressing large gatherings, and undertaking administrative work, women tend to remain in the background, as male members from their household take over these tasks and assume this authority. During consultation held in village Chouma and Dhatrawada, women Sarpanch did not participate; rather their husbands participated in the meetings with ERM team. The (Sarpanch pati/ Husband of Sarpanch) further informed that all the Panchayat related decisions and activities, are being taken by him on behalf of the formally elected Sarpanch, as is common practise for villages where the seat (of Sarpanch) is reserved for women, in the region.

Gender lensing of Socio-economic impacts of the project

The detailed social-economic baseline for the project has been in ***Section 4*** (Social- Environment) of the ESIA report. The further understanding of the same in project's context has led to assessment of potential impacts of the project.

The potential social impacts that can be caused by the project on the receptors can be broadly categorized as the following.

- Reduction of Land-holdings and loss of agricultural income to the Private and Patta Land Holders, agricultural labourers, etc.
- Reduced availability of Government land that is currently being used by the community as Common resources like grazing land for livestock, collection of firewood by women, for access and easements to their assets, religious trees or structures, etc.;
- Increased domestic workload on women in absence of grazing land nearby leading to increased stall feeding of livestock;
- Reduction in/absence of income from the Government land that is encroached/ squatted upon by local residents for agriculture, fodder lots, etc.
- Community Health and Safety related impacts;
- Impacts on Community Resources like Water, Roads, Forests and temporary use of land during construction phase; and
- Positive Impact due to short term availability of Employment Opportunities (largely during construction stage) and some new employment creation during Operations phase.

The receptors of these socio-economic impacts comprise both of male and female residents in the project area, whereas in the general nature of operations, the mitigations are implemented in a gender-agnostic manner.

In cases where the land from Women Headed households are procured, there is a chance that the household becomes landless and thus special assessment of the situation needs to be done. The impact on Women due to project activities is detailed in ***Section 6.4.8,*** which comprises the mitigation measures as well as assesses the Impact significance.

The detailed Gender Action Plan has been devised for implementation of the action items identified, which is presented in ***Table E***.1***.***

This Gender Action Plan shall, also guide the mitigation measures that will be derived on Gender aspects during RAP and LRP surveys.

Table E.1 Gender Action Plan

Action Items	Timeline	Responsibility	Means of Verification for achievement of Targets	Potential Risk in achievement of Targets	Risk Mitigating Measures
Loss of Land Related Impacts					
Ensure that the land sellers inform and disclose the sale of land parcels for the project to their household, including women	Ongoing till completion of land procurement	RUMSL along with Tehsil Administration	Review of Sale Deed	NA	Public disclosure of the timelines, with a focussed women's meeting at the village level to disclose land procurement activities and time lines
It is recommended that the proceeds from the sale of land should get deposited in a joint bank account with the spouse, if feasible	Ongoing till completion of land procurement	RUMSL along with Tehsil Administration	Review of Bank account ownership documents prior to release of payments	There might be an existing bank account with single user's name and the key member of the family will be reluctant to make the changes	■ Put across this requirement during the initial stages of land related discussion. ■ Require the presence of the spouse at the time of hand-over of the cheque or sale agreement papers.
If the land is purchased from a Woman Headed household, then special provision for confirming the bank account use (by the women and not other family member) needs to be done to ensure against fraud	Within 6 months of initiation of construction	RUMSL	Review of Sale Deeds and bank account name and access by actual holder.	NA	Liaise with the bank branch to ensure against misuse. Financial literacy training programs should be conducted for women in the project area and specifically for the ones belonging to PAHs.
■ Ensure the participation of women in the grazing area improvement and fodder intensification programme, proposed as part of livelihoods restoration activities but may also be	Within 6 months of initiation of construction	RUMSL	Allocation of grazing land parcels and providing demarcated access routes to the same; disclosure of the same to women groups	Lack of use due to distance issue of the parcel and power relations in the village may prevent women from "lower" castes in accessing such land	Assist in creation of a village level committee with representation from project, for smooth functioning and decision making over access and control of such collective/common resources

Action Items	Timeline	Responsibility	Means of Verification for achievement of Targets	Potential Risk in achievement of Targets	Risk Mitigating Measures
expanded to cover the local population through support from the community development programme of the SPD (as part of CSR).					
Employment related impacts					
During planning and construction phases, all community consultations shall have a target of at least 50% female participation, or, women only consultations in all the Project Villages of Gram Panchayats Surajpur for Surajpur & Lalupura village, Fawaka for Parsula & Fawaka village, Bijanakhedi for Chouma village, Sangadiya for Jawadi village, Dehripal, Burlay and Dhatrawada to ensure that women are not only involved and aware but also have the opportunity to participate in decision-making. ■ Organize separate women consultations or FGD with women's groups to understand their perspective, if the women do not express opinions as part of larger groups	Ongoing till construction phase	RUMSL, EPC contractor representative (during the construction phase) Project operator (operations phase)	■ Sex disaggregated data of attendees shall be documented in records of Stakeholder Consultations; ■ Photo documentation and signatures of attendees	■ Reduced participation of women due to socio cultural norms; ■ Silent presence of women during consultations due to cultural norms of women not speaking up in a village gathering in front of men.	■ Organize separate women consultations or FGD with women's groups to understand their perspective and provide project related updates ■ Require sign-off on key information disclosure, and community decisions through the construction phase

Action Items	Timeline	Responsibility	Means of Verification for achievement of Targets	Potential Risk in achievement of Targets	Risk Mitigating Measures
■ Ensure that the contract agreements with contractors contains clauses on requirement for contractors to hire at least 20% women as staff and workers for the project and ensure equal pay for women for same nature of work as added as clauses in the contract agreements for the contractors.	Within 3 months from Plan implementation, upto completion of construction related activities	RUMSL	■ Review of sex disaggregated pay sheet records of each month; ■ Cross verification of the select workers on periodic basis.	Contractor considers it is hard to source women	■ Advertisements for job vacancies for women should be posted at key locations near the project area, comprising bus stops, Government schools, Government hospitals, dispensaries, etc.; ■ Talk about the potential job opportunities for women during community consultations and get a feedback on the women with required key skills that are interested.
■ Undertake a profiling of the various social groups in the Study Area, to understand the individual needs and concerns of the various women belonging to different social groups and design community development, community investment and CSR programmes in light of the same, to ensure that benefits also target women	Within 6 months of initiation of construction related activities	RUMSL along with SPDs	■ Need Assessment Report; ■ Monitoring of progress of action plan	Sustainability of the CSR programs might be an issue, in terms of long term benefits	■ Clear communication on objective and duration of CSR programs; ■ Selection of Implementation partners that can provide linkages to livelihood programs that are sustainable.
Contractor shall provide safety gear and protective equipment to keep both men and women workers safe on the job	Ongoing completion of construction activities	RUMSL along with Contractors	Visual observations/ audits	Contractor may site financial constraints	■ Include these provisions as part of contract agreements with contractors to set expectations initially
Provide segregated toilet and sanitation facilities for men and women with reliable water supply, proper lock and lighting.	Ongoing	RUMSL along with Contractors	Site visits and site maps should include separate male and female toilets	Contractor may site financial or logistical constraints	■ Include these provisions as part of contract agreements with contractors to set expectations initially

Action Items	Timeline	Responsibility	Means of Verification for achievement of Targets	Potential Risk in achievement of Targets	Risk Mitigating Measures
Ensure that a crèche is established if the women engaged at the project are 50 or more, as per provisions of Maternity Benefit (Amendment) Act, 2017	Prior to commencement of construction activities and ongoing till completion of construction	RUMSL along with Contractors	Physical verification	Contractor may site financial or logistical constraints	■ Include these provisions as part of contract agreements with contractors to set expectations initially
The staff and workers recruited for the project, including the EPC and O&M contractors and their sub-contractors shall undergo periodic trainings on Prevention of Sexual Harassment as per the corporate POSH policy of the project (developed by RUMSL), which will be applicable for the project. Additionally train the staff and workers on provisions of GRM that are applicable for them and ways to use the GRM for the project	Start of Construction phase activities and ongoing on monthly basis	RUMSL	■ Records of Trainings in terms of number of staff and workers trained in each session; ■ Photo documentation of training session	None foreseen	NA

STAKEHOLDER ENGAGEMENT PLAN

Background

Rewa Ultra Mega Solar Limited (RUMSL) is a Public Undertaking Company incorporated on 10th July 2015 as a 50:50 joint venture (JV) company between Solar Energy Corporation of India Limited (SECI) and Madhya Pradesh Urja Vikas Nigam Limited (MPUVNL). Its primary objective is to develop and facilitate development of large scale solar power projects in the state of Madhya Pradesh.

RUMSL is planning to develop three Solar Parks in Madhya Pradesh and their associated internal evacuation infrastructure and transmission lines. This Stakeholder engagement plan is developed as part of the Environmental and Social Impact Assessment report for proposed 450 MW Shajapur Solar Park.

The proposed 500 MW Solar Park is proposed to be developed on allotted 974.7 Ha of land area spread across 11 villages of Moman Badodiya and Shajapur tehsils of Shajapur District in the state of Madhya Pradesh. The Solar Park is divided into three units (Unit 6, Unit 7 and Unit 8).

An ESIA has been prepared for this site (Units 6, 7 and 8) and this document, is a management plan for stakeholder engagement activities.

Objective and Scope of SEP

This document presents the Stakeholder Engagement Plan, which is applicable all activities proposed to be undertaken for the RUMSL Shajapur Solar Park, as well as other stakeholder engagement that is conducted by the project proponent (RUMSL), the private Solar Project Developers (SPD) or other parties contracted by RUMSL, that engage with the key stakeholders identified as part of this Plan.

The main objective of this document is to guide stakeholder consultations across various stages of the project, while meeting the requirements of the applicable reference framework for the Project. Overall, this SEP will enable stakeholder engagement to be undertaken in a systematic and meaningful manner, where the various stakeholder groups are able to express their individual views, opinions and concerns, while allowing the Project to appropriately respond to them.

The objective of the Stakeholder Engagement Plan are as follows:

- Identification of the stakeholder groups in the project location and analysis of their profiles, interests, issues/impacts and concerns relevant to the project;
- Identification of specific measures to allow meaningful engagement with different stakeholder groups identified in a manner that is transparent and accessible and using culturally appropriate communication methods with a specific focus on the stakeholders with high influence/impact ;
- Facilitate adequate and timely dissemination of information to the stakeholder groups in a culturally appropriate manner;
- Provide systems for prior disclosure/dissemination of information and consultation including seeking inputs from affected persons, incorporation of inputs, as applicable, providing feedback to affected persons/groups on whether and how the input has been incorporated; and
- Providing a mechanism for documentation of the activities undertaken and the reporting and monitoring of the same.

Scope

The Stakeholder Engagement Plan document applies to the entire project lifecycle (planning or pre-construction, construction and operations phases) and shall be considered as a live document that shall be updated regularly, as required. This stakeholder engagement plan (SEP) will be used and updated by the project proponents and its various teams (internal as well as contracted), performing

various tasks linked to the project, comprising ESIA, RAP and FPIC processes, through interactions with various stakeholder groups like Tehsil level officials, Revenue Inspector, Patwari, officials from RUMSL, etc.

Methodology

The stakeholder engagement plan is guided by the Stakeholder Engagement strategy developed for internal use at ERM, to ensure consistency in the message and communication being undertaken with the identified stakeholders, by all teams that are involved in ESIA, RAP and FPIC/IPDP preparation.

During the environmental and social impact assessment consultations process, ERM conducted various activities as part of the development of the public consultation program to determine the relevant stakeholders. From the ESIA field-consultations, ERM has identified approximately key stakeholders groups and categorised them as Primary and Secondary stakeholders, based on the nature and extent of impact of project and influence of stakeholders on the project, as presented in table 7.1**.**

There may be cases where additional stakeholder categories are identified during the RAP-LRP and FPIC/IPDP survey processes, and/ or the profile of these stakeholder groups (Primary or Secondary) altered based on detailed assessment from impacted entities by the project.

The details of these engagement activities and key points of discussion are captured in **Appendix B** of the document.

Furthermore, the surveys for the Resettlement Action Plan and Livelihoods Restoration Plan (RAP-LRP) and FPIC/IPDP preparation started in early August 2020 and are ongoing till compilation of this report. These will comprise the following stakeholder categories. Separate meetings with women and men may be help, as required:

- Private Land Owners;
- Patta Holders;
- Users of the affected land categories, including agricultural labour, encroachers etc.;
- Indigenous Groups present in the Project villages;
- Other groups or institutional entities that are identified at the time of detailed RAP surveys.

Applicable Reference Framework

This Stakeholder Engagement Plan is prepared as per the requirements of the following regulations and standards:

- Relevant environmental, land labour and other relevant policies, laws, regulations and rules of the state of MP, and the Government of India;
- World Bank Environmental and Social Management Framework for Solar PV Park, February 2017;
- IFC Performance Standards, 2012;

Stakeholder Mapping

Stakeholder Identification and Categorisation

A stakeholder is defined as "any identifiable group or individual who can affect the achievement of an organization's objectives or who is affected by the achievement of an organization's objectives". Stakeholders thus vary in terms of degree of interest, influence and control they have over the project. While those stakeholders who have a direct impact on or are directly impacted by the project are known as **Primary Stakeholders,** those who have an indirect impact or are indirectly impacted are known as **Secondary Stakeholders**.

During the ESIA process, a stakeholder identification and prioritization was conducted for identifying the key stakeholders of the project, while keeping in mind the nature of the project and its setting. Furthermore, consultations were conducted with these identified stakeholders through a participatory approach. The table below presents the key stakeholders of the project.

Table E.1 Stakeholder Group Categorisation

Stakeholder Groups	Primary Stakeholders	Secondary Stakeholders
Community	■ Private land owners from project villages; ■ Patta holders (i.e. ~10-15 HHs in each village from SC & ST community) including those who are not cultivating on their allotted patta land parcel and have squatted upon a separate/ new land parcel, in the nearby areas; ■ Non recognized Patta owners who have purchased land from registered Patta holders, based on the verbal agreement. ■ Agricultural labours; ■ People/ farmers utilizing nearby Government land or fallow land for their livestock grazing, i.e. Graziers; ■ Vulnerable Social Groups (i.e. women headed households, handicapped and households of SC and ST community) from project villages and surrounding areas; ■ EPC/ Construction Contractors, sub-contractors; ■ Potential unskilled labours to be engaged for the construction phase of the project; ■ Owners of land required for temporary occupation or use ■ Squatters on the Government land parcels identified for project ■ Banjara households	■ Fence line community
Institutional Stakeholders	■ Gram Panchayats (GPs) – Surajpur for Surajpur and Lalupura villages – Fawaka for Parsula and Fawaka villages – Bijanakhedi for Chouma village,	■ Local Political Groups ■ Civil Society/ Local NGOs

Stakeholder Groups	Primary Stakeholders	Secondary Stakeholders
	– Sangadiya for Jawadi village, – Dehripal, Burlay and Dhatrawada; ■ Zila Panchayat/ Janpad Panchayat of Moman Badodiya & Shajapur; ■ Tehsil Officials,	
Government Bodies/Regulatory Authorities	■ District Administration ■ Regulatory Authorities – MP Urja Vikas Nigam Ltd. – MP Pollution Control Board; – Central Pollution Control Board (CPCB) – Ministry of Environment Forest and Climate Change (MoEFCC) – Local Fire Authority; – Ministry of Road Transport and Highways – State Transport Authority; – District Collector and Revenue Department; – Block Development Officer & Patwari – Central Electrical Authority through C.E(P&D) Jabalpur; – Department of Telegraph – Communication, Govt. of Madhya Pradesh; – Department of Panchayat Raj, Madhya Pradesh; – Labour Department; – Wildlife Warden, State Forest Department; – District and State Forest Department, MoEFCC.	

Stakeholder Analysis

The significance of a stakeholder group is categorized considering the magnitude of impact (type, extent, duration, scale and frequency) or degree of influence (power and proximity) of stakeholder group and urgency/ likelihood of the impact associated with the particular stakeholder group in the project context.

The magnitude of stakeholder impact/influence is assessed taking the power/responsibility and proximity of the stakeholder group and the group is consequently categorized as negligible, small, medium or large. The urgency or likelihood of the impact on/influence by the stakeholder is assessed on a scale of low, medium and high. The overall significance of the stakeholder group is assessed as per the matrix provided in table below.

Table E.2 Stakeholder Significance and Engagement Requirement

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

The influence and priority have both been primarily rated as:

- High Influence: This implies a high degree of influence of the stakeholder on the project in terms of participation and decision making or high priority to engage with the stakeholder;
- Medium Influence: Which implies a moderate level of influence and participation of the stakeholder in the project as well as a priority level to engage the stakeholder which is neither highly critical nor are insignificant in terms of influence; and
- Low Influence: This implies a low degree of influence of the stakeholder on the project in terms of participation and decision making or low priority to engage that stakeholder.
- The intermediary categories of low to medium or medium to high primarily imply that their influence and importance could vary in that particular range subject to context specific conditions or also based on the responses of the project towards the community
- The coverage of stakeholders as stated above includes any person, group, institution or organization that is likely to be impacted (directly or indirectly) or may have interest/ influence over project. Keeping this wide scope of inclusion in stakeholder category and the long life of project, it is difficult to identify all potential stakeholders and gauge their level of influence over project at the outset of the project. Therefore the project proponent is advised to consider this stakeholder mapping as a live document which should be revised in a timely manner so as to make it comprehensive for any given period of time. The Figure 7.1 below is for the for the consultations held in project villages

Figure E.1 Stakeholder Consultations undertaken in the project villages

Source: ERM Site visit January 2020

Table E.3 Stakeholder Analysis

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
Primary Stakeholder					
Private land owners and Patta Holders from project villages This includes people who have 'purchased patta land' based on verbal agreements with the original patta holders	■ Private landowners, whose land parcels fall within the project footprint area (footprint area identified for project) ■ Patta holders comprises of households who were landless in past and were provided Government land on Patta, around 20 years ago by then District Collector; ■ As stated during consultations, these landless households (largely from SC & ST groups) were given 5 bighas of Patta land nearly 20-30 years ago, at different points of time and under different circumstances. The 5 bigha patta land allotted then, has now reduced to only 2-3 bighas per household due to family growth and sub-division among families in the decades since the allotment; ■ Based on the consultation with Tehsildars it was understood that land was given to any landless households by the District Collector, irrespective of their caste; however the specific criteria for allotting land to Patta Holders is not known as reportedly these documents were lost over time and are not available;	■ The dependence on land for agriculture and livestock in the area is high, as evident in the Census data and as reported during consultations; ■ The procurement of private and patta land for the project will affect this stakeholder group leading to reduced land holdings or landlessness, in some cases; ■ Provision of alternate land as a land-for-land exchange has not been stated by RUMSL However, if this were to be considered, at a later stage, the quality of alternate land parcels and the effort and investment required to make it fit for cultivation, is likely to be a key concern, as there are several rocky patches of land in and around the project area;	■ The stakeholder groups' influence on the project is directly linked to their agreement to a Mutual Consent agreement to sell their land (MP Mutual Consent Policy 2014). ■ Their ongoing support will also be key to the smooth functioning of the construction phase activities, and the timely completion of the project activities; ■ Ongoing support in the operations phase will also be useful, through their influence at that stage may be significantly lower	■ The major concern of the landowners from the project is to get adequate payment as per the MP Mutual Consent Policy, (twice the) and get timely payment of the amount; ■ Adequate compensation for their land, even if it is without any formal recognized rights including who may have 'bought' patta land based on a verbal agreement; ■ Potential employment opportunities that the project will generate, both in construction and operational stage. ■ Minimal disturbance to the community with regards to access issues, pollution, health and safety risks and influx of migrant workers	High (especially in the planning and construction phase of the project) Medium-low in the operations phase

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	■ This group is dependent on their land parcels for livelihood; ■ The exact number of private and patta-land owners, whose land may be impacted by the project, is not currently known but will be assessed during the RAP survey				
Encroachers and Squatters for agricultural purposes and for livestock shed, fodder storage etc.	■ This stakeholder group comprises of households that have illegally encroached Government Land, adjoining the private lands and was lying unused, in the project area and around; ■ Encroachment of Government land is a common practice in Project villages; where households having government land adjoining their private lands extend their cultivation area in the government land and encroach it even without any legal ownership of the land parcel; ■ During consultation it was informed by local communities that people with large land-holdings have more tendency to encroach government land. Usually the encroachers having large land-holding belong to Rajput and Patel communities; ■ Consultations with Bhil community highlighted that they have encroached/ squatted upon Government land parcels,	■ The project would be set up on the encroached/ squatted land and would lead to disruption of livelihood activities and incomes to these households. ■ As understood, at least some of these stakeholder groups have been using the land for livelihood activities, as they are either landless or have marginal land-holdings. These stakeholder groups do not have any legal claims/ ownership over the encroached or squatted land parcel and are well aware of their illegal status;	■ The influence of this stakeholder group on the project is minimal at an individual level, considering they do not have legal rights on the land; however there is major dependence of farmers/ encroachers on these government land as they use it for cultivation, livestock shed, for fodder storage and even structure etc. ■ Since they have had the use of this land for a long period of time (usually more than 10 years) and have spent time, money and effort in making agriculture viable or making sheds for livestock; ■ There may be reasons for these individuals to lobby as a group, in which	■ The key concern of this stakeholder group is of losing the land parcels which they have been using for agriculture and as livestock sheds; ■ This group reports that they have spent considerable amount of effort and money to make the land cultivable and all this effort will be wasted after the project comes on this land; ■ The concern of farmers/ encroachers is more for the land parcels that have been encroached by them and is used for cultivation, rather than entire government land parcels; ■ The land identification/ mapping carried out for the project entirely have not distinguished government land parcels encroached.	Medium

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	especially near Dehri pal and Parsula villages; ■ Furthermore, there have been land transactions reported on the encroached Government land by the community; ■ When the encroachment related practices are identified by the Government officials, a fine/ penalty is charge on them; in response encroachers pay the fine/ penalty charged on them and continue cultivating the encroached land. The assessment of the encroachment for the fine will usually not reflect the actual extent of encroachment		case their influence on the Project may increase ■ Construction phase and implementation phase impacts will be the same as the earlier category.	Thus raising a concern among encroachers that they may not be considered for compensation; ■ This Stakeholder group may expect income generating activities or employment as construction labourers, masons, drivers, security etc. during the construction phase of the Project.	
Graziers	■ Out of the total project footprint area, nearly 846.6 ha. is Government land., which, in addition to squatting and encroachment, is used as grazing land by local communities; ■ The livestock ownership in the Project villages is higher amongst communities, like Sondhiya Thakur, Rajputs, Gurjars etc. The household from SC and ST groups also possess livestock, though not as many in number; ■ The grazing activity increases more during rainy season thus limiting the amount of fodder to be purchased from the market.	■ The procurement of Government land that is being used shall reduce the amount of land available for grazing near the project villages; ■ The project boundaries may also impose a restriction on the left over/ available Govt. land to be used for grazing purposes; ■ The project construction work, movement of frequent vehicles, labour crowd etc. will also lead to disruption of livestock grazing activities and loss of vegetation cover in the nearby fields.	■ The influence of graziers on the project would be very low as individuals but given the numbers and the near universal dependence of all village households on grazing areas, they would gain significance and strength from lobbying together; ■ Restrictions on accessibility, lack of vegetation layer etc. during construction stage may lead to lack of fodder availability	■ The key expectations of this stakeholder group is to allow for the provision of adequate and accessible (2 percent to be confirmed) grazing land for livestock grazing, after taking the project area; ■ Easements shall be retained or replaced /provided through project design to have minimal impact on this stakeholder groups' ease of activities;	High-medium

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
			for livestock, thus leading to low bi-product (i.e. milk, meat) and/ or increased household spend on purchasing fodder from market.		
Agricultural Labourers	■ This stakeholder group comprises of those households that have marginal or limited land holdings and members of their families work as Agricultural labourers in the land parcels falling in the area identified for project across all three categories- private land, patta land (that is being cultivated), and encroached land under agriculture ■ As per consultation, people from SC and ST communities are largely landless and work as agricultural labours;	■ The land procurement for the project will be impacting their income sources, thereby leading to a deterioration of the household income.	■ The influence of this group on the project is limited, given that they do not have any legal claims on the land; ■ This group can be utilised during the construction phase of the project as unskilled labour with priority hiring and may additionally be included in Livelihood Restoration initiatives;	■ This Stakeholder group may expect employment as construction labourers, masons, drivers, etc. during the construction phase of the Project.	Low
Indigenous People	■ While the project is not located in a Schedule V area, the local community also has ST households, largely belonging to the Bhil tribe. ■ Nearly 1.8 percent of the total population belongs to ST group and is found in Parsula, Dehripal, Chouma and Fawaka villages; ■ This stakeholder group has also been understood to be engaged in encroachment and squatting of Government land for cultivation.	■ The influence of project on this group is similar in nature as the entire fence line community, as it is a subset of the same.	■ The involvement of this stakeholder group is expected to be as part of the larger local community; ■ In keeping with the requirements of the IFC PS 7, the project will require to obtain Free Prior Informed Consent from this stakeholder group prior to the initiation of project activities.	■ Priority in economic benefits and development opportunities created by the project; ■ Minimal disturbance to the community in regards to access issues, grazing land, pollution and influx of migrant workers.	High

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
Banjara households	■ There are certain pockets of Banjara settlements in the project footprint area; ■ These groups largely reside near Dehri pal Chak village, are landless, and are engaged in share-cropping on many patta and government land parcels and are potential users of the government land identified for the project; ■ These groups are also understood to have squatted upon some patta land parcels belonging to other households; however the status of these patta land parcels in land identified for project i needs to be confirmed during the RAP survey.	■ The project would lead loss of income for this stakeholder group, and also force them to shift to non-farm labour;	■ The influence of this group is similar to encroachers/squatters and their concerns are of similar nature. ■ Although this group forms part of the larger category of encroachers/squatters their concerns and impacts are to be treated separately as their livelihood profile and location profile is relatively unique compared to the overall profile of the village	■ The key concern of this stakeholder group is of losing the land parcels which they have been using for agriculture and as livestock sheds; ■ This Stakeholder group may expect alternate sites for income generating activities or employment as construction labourers, masons, drivers, security etc. during the construction phase of the Project.	Medium
EPC/ Construction Contractors, sub-contractors	■ This stakeholder group comprises of the EPC contractors and other contractors/ sub-contractors involved in the Project for various tasks, like access roads construction, laying down of Transmission Line towers, civil and electric works for the Solar Park, etc.	■ The project provides this group contractor-ship opportunities and steady flow of income.	■ This stakeholder group is critical for the smooth functioning and timely implementation of the Project; ■ This group may also play an important role in the formation of public opinion towards the project	■ Continued economic opportunities and work generation; ■ Clarity in terms of scope of work, expectations, key performance indicators, responsibilities and timelines for the project; ■ Timely and adequate disclosure of information to allow the	High

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
				project activities to be carried out; ■ Fair business opportunities and contract closure; ■ Undertake project activities in keeping with the contractual agreements and applicable regulations in place.	
Unskilled labourers to be engaged for the construction phase of the project	■ This group is comprised of skilled and semi-skilled workers, who will be involved in the project on a contractual basis. ■ Labour may be local, regional or migrant (from other regions) and is likely to be comprised of skilled worker and any number of semi-skilled or unskilled workers This decision will be the contractors', depending on their requirements.	■ If local labour is used, it will help create goodwill locally and the project related opportunities would be shared with the local population. ■ If migrant labour is used in the persistent context of COVID 19, there may be local concerns from a community health and infectious disease perspective, putting this group at greater risk, and under greater local scrutiny	■ This stakeholder group will be critical for the smooth functioning and timely implementation of the project; ■ If migrant labour is used, their conduct may influence local support for the project, as in the COVID 19, context, they may be viewed with suspicion ■ This group may also play an important role in the formation of public opinion towards the project.	■ Concerns pertaining to wages, benefits, working hours and working conditions, etc.; ■ Health and safety measures relating to COVID 19 ■ Health and safety involved with the construction phase ■ Working hours at the construction site ■ Timely disbursement of wages; ■ Access to the GRM established for the project	Medium
Owners of land required for temporary occupation or use	■ Some of the project components may require short term leasing of land available, largely from Private and/ or Patta land owners; ■ This requirement would be better understood during the	■ The short term leasing/rent of land by the project may bring in additional income from lease, if the land is not being used for any other commercial purposes;	■ This stakeholder group is critical for availability of land parcels that are conveniently located from the project footprint (based on the needs) and are	■ The expectations of this stakeholder group is clear communication of lease terms and amount and timely payments, as necessary;	low

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	planning of the construction activity.	■ The project related activities on these land parcels may be for purposes of storage, set up of labour camps, etc. and may result in change in land use due to construction or storage activities, contamination issues, etc.	available without disturbances or issues during the lease period.	■ Restoration of land to its original state, or better, at the time of handing it back to the owners.	
Gram Panchayats (GPs)	■ This stakeholder group is comprised of Sarpanch, ward member and Gram Sewak of Panchayats of project villages, as detailed in ***Table 7.1.***	■ The influence of project on this stakeholder group is limited in terms of administrative control, however, this group may gain significance around the time of local elections, and if they decide to support local stakeholder groups/ specific concerns linked to the project.	■ This group has the ability to influence the perception of the community and specific stakeholder groups in regards to the Project and its activities	■ Involvement of this group in decision making process for the project, especially related to the land purchase process ■ Involvement in the formulation and implementation of the community development activities for the project; ■ Village and area level benefits from the local area development related investments of the project ■ Adequate communication of project information, in terms of timelines of key activities and their potential impacts.	Medium-Low
Tehsil Moman Badodiya & Shajapur/ District Shajapur officials	■ This group is comprised of the regulatory authorities at the tehsil and district level that are responsible for land demarcation for the project and	■ The project should be in compliance with the requirements stated and the processes governed by this stakeholder group.	■ This stakeholder group is high in priority as this group provides the land demarcation and	■ Developmental activities in the project area; ■ Smooth operations of the project related	High

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	for various permits and licenses pertaining to the project. ■ The authorities at tehsil level with whom the consultations were carried out by ERM team are: ○ Tehsildar of Shajapur; ○ Tehsildar of Moman Badodiya; ■ The local administration in this regard refers to the district and block level administration comprising of the offices of the Taluka Development Officer, District Collectors, and Revenue officer etc. The revenue department is responsible for allotment of Govt. land, mutation, updating and records and transfer of land; ■ The allotment of Government land for project purpose is provided by the District Collector on the basis of which the lease land will be granted.	■ Their involvement for resolution of patta land related issues, encroachment and informal use and occupation of government land, will be essential ■ They will be required to provide support for law and order for the smooth and peaceable functioning, of construction activities, and to resolve grievance that may be escalated to them	permits and licenses essential for the functioning of the project; ■ They also hold all official land records, including a record of violations, fines, relating to encroachment, special permissions, and documents pertaining to easements, grazing areas, and community use (Nistar Patrak, Wajib-ul-arz) ■ Noncompliance to conditions laid down in permits issued by this group stakeholders group can result in penalties and fines being levied on the Project.	activities by causing minimal impacts on the community; ■ Adherence to regulations ■ Maintaining law and order	
Regulatory Authorities	■ This stakeholder group is comprised of the central, state and district level regulatory authorities; ■ MP Urja Vikas Nigam Ltd. is the Nodal agency for renewable energy projects in state; ■ These authorities influence the project in terms of establishing	■ The main concerns of the Regulatory Authorities from the Project Proponents is abidance to all applicable guidelines, policies and laws.	■ The ability of the project to comply with the various applicable rules and regulations may play a role in the timely implementation of the project.	■ Project's compliance to the regulatory requirements; ■ Timely disclosure of information and provisioning of updated through the life of the project ■ This stakeholder group is also critical for	High

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	policy, granting permits and approvals for the project, monitoring and enforcing compliance with the applicable rules and regulations; ■ These groups include the labour department, pollution control board, forest department, district collector office etc.			various permits/clearances required for the commissioning of the project	
Secondary Stakeholders					
Fence Line Community	■ This stakeholder group is comprised of the local population in eleven project villages, coming under the project boundaries; ■ This stakeholder group has been using the land identified for the Project for grazing of their livestock, accessing their agricultural fields or using the land for other common activities. ■ Some sub-categories of the community are directly impacted by the project and are discussed above; while this stakeholder group is important on account of its presence near project and associated impacts.	■ The project will use land which is currently being used by this stakeholder group as grazing land for their livestock, for agricultural purposes (patta holders of SC and ST community) and other community purposes, etc.; ■ Some of the community members also use this land for cultivation (through encroachments) or work on the farm lands as agricultural labourers, etc. These activities will be disrupted after the project related activities commence on the identified land	■ This stakeholder group shall play a critical role in the smooth functioning of the Project.	■ Adequate provisions of easements while designing various project features in order to ensure minimal access restriction for this group; ■ Minimum disturbance to this group due to various activities of construction, operation and decommissioning phases.	High
Indigenous People	■ The project villages are not located in scheduled V area and the total population of ST community in Project villages is just 1.8 percent , which is very low;	■ There will be more impact on ST community compared to other communities in the Project villages, considering that they have very limited	■ The involvement of this stakeholder group is expected to be as part of the larger local community;	■ Avoidance of procuring any patta land for the given project; ■ In case the patta land is procured and can't be avoided, a separate	High

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	■ Only village Parsula has the highest ST population of 17.7 percent in the entire Project villages; ■	private land ownership and have got land mostly on patta for cultivation; ■ The Patta land have a clause that it cannot be transferred, sold, exchanged etc. but it can be taken back or transferred to any private or government project on District Collectors order. The land for this project has been granted on District Collectors order;	■ In keeping with the requirements of the IFC PS 7, the project will require to obtain Free Prior Informed Consent from this stakeholder group prior to the initiation of project activities.	land parcel will be allotted by District Collector to every patta holder; ■ Priority in economic benefits and development opportunities created by the project; ■ Minimal disturbance to the community in regards to access issues, grazing land, pollution and influx of migrant workers.	
Local Political Groups	■ This stakeholder group is comprised of the political parties and local politicians active in the region; ■ This group might be active in the area and may play an important role in influencing of public opinion towards the Project, especially before elections.	■ The project will have minimal or no influence on this stakeholder group	■ This stakeholder group is expected to play a critical role in the development of the public opinion towards the project, especially in light of the current political environment, whether to do with local, project specific-issues, or to do with other regional/state/national issues.	■ The main expectation and concern of the stakeholder group from the project includes the project's role in the development of the area in keeping with the broader agenda of the projects and keeping the constituents and loyalists of the parties at the forefront.	Medium-High
Civil Society/Local NGOs	This stakeholder group comprises of NGOs and Civil Society Organizations of a national, state and local level who may be active in the area. Most of the NGOs and CSOs working in the region are state level NGOs, involved in literacy,	The level of influence of project on this stakeholder group is limited as it does not affect the functioning of this group.	■ The stakeholder group may play an important role in the development of public opinion for the project; ■ This stakeholder group may also be	■ The main expectations and concerns of the stakeholder group from the project is likely to include the development of the project, in keeping with	Medium

Relevant Stakeholders	Profile/ Status	Impact/Influence of the project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the project	Expectations, Opinions Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
	water management, WASH and gender equality some of the key NGOs and CSOs working in the region include the following: ■ Water Aid ■ Madhya Bharat Social welfare & education society ■ Grask Gramin Rojgar Evam Samaj Kalyan Samiti Samiti Dewas ■ Samaj Pragati Sahayog ■ Jan Shree Foundation ■ Guru Shaheb Public Education Society		involved in the implementation of the community development plans	the applicable regulations and with minimal impacts on the local population, while contributing towards the overall development of the area ■ The interest of this stakeholder group primarily pertains to the roles of the project in implementing community development activities in the area; ■ Involvement in the formulation and implementation of the community development activities for the project; and ■ Timely disclosure of information pertaining to the project.	

Detailed Stakeholder Engagement Plan

Some of the most common tools of engagement are discussions, consultations and meetings. These modes of engagement can be undertaken in the forms of groups or at individual levels. These serve the purpose of allowing the project proponents to gain an understanding of the viewpoint of the other stakeholders involved in regards to the functioning of the Unit/project, the implementation of various provisions in the Project.

Based on the stakeholder identification and analysis undertaken, a detailed plan is prepared that guides the engagement process with each stakeholder group, as identified in table below**.** The Social and Community Supervisor shall be responsible for maintenance of the records of along with the members that engage with stakeholders during construction and operations phase, along with addition of addition of any new categories identified.

Table E.4 Stakeholder Engagement Plan

Stakeholder Group	Objective	Method/time of Engagement	Teams
Planning Phase:			
Private Land Owners	■ Information sharing regarding the project, including the background of the project and capacity of the project; ■ To understand the key concerns related to the projects; ■ Understand the socio-economic profile of land owners and the details of income generated through agricultural activities in order to arrive at details for compensation for crop damage, etc. ■ Effort required by the land owners to make the land cultivable; and ■ Understanding expectation from the project.	■ Face to face discussion and/or Focus Group Discussion; ■ RAP-LRP surveys and consultations	■ ESIA ■ RAP ■ RUMSL ■ FPIC/IPDP
Squatters and Encroachers	■ Understanding the extent of land encroached and legally possessed by the group; ■ Understanding other sources of livelihoods of the household, and dependence of their households and others; ■ Understand the duration that the land is encroached for and improvements made to it; ■ Understanding expectation from the project.	■ Face to face discussion and/or Focus Group Discussion during RAP-LRP and FPIC consultations	■ ESIA ■ RAP ■ FPIC/IPDP
Patta Holders along Patta holders who have sold their land based on verbal agreement	■ Information sharing regarding the project, including the background of the project and capacity of the project; ■ To understand the key concerns related to the projects; ■ Understand the socio-economic profile of Patta land holders, any alternate land parcels or alternate occupational profile of household and the details of income generated through agricultural activities in order to arrive at details for compensation for crop damage, etc. ■ Effort required by the Patta land holders to make the land cultivable; ■ Any informal land transaction executed on the Patta land identified for project; and ■ Understanding expectation from the project	■ Face to face discussion and/or Focus Group Discussion ■ RAP-LRP surveys and consultations ■	■ ESIA ■ RAP ■ RUMSL ■ FPIC/IPDP
Indigenous Groups – ST community	■ To understand existing rights, dependence and use ■ To understand the nature and extent of impacts; ■ To ascertain if FPIC is required ■ If FPIC is requires, the process to be followed will be contained in the FPIC document and must be applied;	■ Face to face discussion and/or Focus Group Discussions ■ Separate discussions with women, if required	■ RAP ■ FPIC/IPDP ■ RUMSL
Agricultural Labourers and Graziers	■ Understanding the dependence on identified private, patta and Government land parcels for labour work and livestock grazing activities; ■ Evaluation of alternate grazing land – proximity and adequacy ■ Access routes and easements ■ Other sources of livelihoods, if any;	■ Open Meetings; ■ Separate discussions with women, if required ■	■ RAP; ■ FPIC/IPDP ■ RUMSL and Solar Power Developers

Stakeholder Group	Objective	Method/time of Engagement	Teams
	■ Engagement in community development activities; ■ Understanding of expectations from the project.		
Gram Panchayat	■ Discussion on the Bhil community, regarding the socio-economic status, legal documents of the community, migration of the community, encroachment on the nearby land done by the community and the voting rights of the community; ■ Information given regarding the project, including the background of the project and capacity of the project; ■ To understand the key concerns related to the projects; ■ Understand the socio-economic profile of land owners ■ Understanding the potential impact of the project on the stakeholder; and ■ Expectation from the project.	■ Consultations, meetings (FGD and individual interview) and Discussions; ■ Sharing of documents as part of the disclosure mechanism; ■ Grievances Redressal Mechanism (GRM); ■ For issues concerning Grievances Redressal Mechanism (GRM)	■ ESIA; ■ RAP; ■ RUMSL; ■
Local Community from project villages	■ Information given regarding the project, including the background of the project and capacity of the project; ■ To understand the key concerns related to the projects; ■ Understanding the potential impact of the project on the stakeholder; and ■ Expectation from the project; ■ Engagement in developmental activities	Focus Group Discussion and/or Open Public Meetings	■ ESIA; ■ RAP; ■ FPIC/IPDP ■ RUMSL/SPD along with EPC contractors and subcontractors
Tehsil Officials (Revenue Inspectors and Tehsildar)	■ Understand the working of revenue department; ■ The process adopted for demarcation of land; ■ The land transfer process from Revenue department to RUMSL; ■ Discussion over the Patta Land and the ownership of Patta land; and ■ Different type of land present which are coming under the project footprint. ■ Minimum Support Price for the crops given to the land owners and to the encroachers ■ Encroachment in the area ■	■ Face to face discussion	■ ESIA; ■ RAP; ■ IPDP ■ RUMSL along with EPC contractors and subcontractors
Regulatory Authorities	■ On land allocation for Government land by RUMSL; ■ On understanding of land procurement process followed, by ERM ESIA Team; ■ On maintaining compliance to regulatory requirements; ■	■ Face to face discussion; ■ Through applications, letters, etc.	■ RUMSL along with EPC contractors and subcontractors; ■ SPD
Construction Phase			

Stakeholder Group	Objective	Method/time of Engagement	Teams
Contractors	■ Information dissemination, including information regarding labour laws, local employment opportunities, safety measures and discussion on grievances; ■ For negotiation on contract clauses as per requirements stated in ESIA and Management plans for the project; ■ EHSS Audits by project proponents	■ Signed contracts with requirement to implement the ESMP ■ Meetings and monthly reporting in the operations phase; ■ Documentation as agreed in the contract	■ RUMSL
Potential unskilled labour to be used for construction phase of the project	■ Advertising of job vacancies for the project at village level; ■ During screening of applicants by contractors of RUMSL, in coordination with RUMSL on list of project affected households; ■ Induction on Code of Conduct and Grievances Redressal Mechanism (GRM)	■ Through face to face discussion at the time of hiring for construction phase	■ RUMSL oversight ■ SPD and their contractors and subcontractors
Local Community from project villages	■ To identify labour class in the village and site area; ■ To identify their skill set and adequacy for engaging them in the on-going construction activity, i.e. as construction worker, security guard, cook, technician etc.; ■ To understand more about their expectation from project; ■	■ Focus Group Discussion and/or Open Public Meetings	■ RUMSL and ■ EPC contractor and other Sub-contractors engaged for construction phase
Gram Panchayat	■ To seek permission for labour camps and carry out construction activities; ■ To understand their expectation from then ongoing construction activity; ■ To identify and document, if there is any grievance, query or recommendation of Gram Panchayat or local community	■ Individual/ Group consultations with Gram Panchayat members	■ RUMSL ■ EPC Contractor
Operations Phase			
Gram Panchayat (for Community Development Activities and other Project related Grievances)	■ Discussion with Gram Panchayat regarding community development activities; ■ Engagement of Gram Panchayat & local community in identifying the much needed skills to be developed in youth and local community; ■ To identify the vulnerable community/ family and synchronizing their demand and need with project activities; ■ To seek cooperation of local community and Gram Panchayat members for smooth and timely execution of development activities; ■ Also, to liaison with Gram Panchayat regarding any query, grievance from then ongoing project activities and staff/ security guards.	■ Consultations, meetings with Gram Panchayat members and local community, individual meeting/ discussion; ■ Sharing of documents, ideas pertaining to development activities; ■ Grievances Redressal Mechanism (GRM);	■ RUMSL; ■ SPDs; ■ O&M Contractor ■

Stakeholder Group	Objective	Method/time of Engagement	Teams
		■ For issues concerning Grievances Redressal Mechanism (GRM)	
Local community & Youth	■ To identify the occupational pattern of the village; ■ Understand the role and engagement of women in the workforce; ■ Understanding the livelihood/ employment opportunities at village level; ■ To understand, if there is any need based demand from youth especially women/ girls, regarding skill development, typology of skill development etc.	■ Consultation with local community especially youth; ■ Separate consultations with school and college going girls and adult women regarding skill development demand.	■ RUMSL; ■ SPDs; ■ O&M Contractor ■

There is a Grievance Redresaal Mechanism that is developed to receive, record, resolve and track grievances raised by both internal and external stakeholders, as part of the ESIA report. The provision of SEP and GRM are also referenced as mitigation measures in the relevant sections of the Environmental and Social Management Plan.

Implementation Arrangements

Monitoring and Evaluation

Like the other project components, the SEP shall be regularly monitored to ensure that the engagement with various stakeholders are getting properly documented, in order to ensure transparency in communication and decision making processes, wherever applicable.

A Social and Community Supervisor shall be appointed by RUMSL, who will be responsible for implementation of the SEP, along with other related plans like Gender Action Plan, Grievance Redressal Mechanism of the project, and identified roles in monitoring of labourers during construction and operations phases of the project. The S&C Supervisor shall play a key role in implementation of the SEP and other plans in construction and operations phases of the project.

The S&C Supervisor shall coordinate with other relevant team members of RUMSL and its contractors, SPDs, etc., on maintaining and update of documentation of stakeholder engagement details, across the construction and operations phases.

The S&C Supervisor shall additionally be responsible for identifying and tracking training needs, maintenance and update of documentation, reporting and monitoring requirements for the effective implementation of SEP.

Budgeting

RUMSL shall ensure that proper budgetary allocations are made for the activities related to stakeholder engagement, like meetings, trainings, addressing o needs identified and found reasonable through the stakeholder engagement process.

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ERM India Private Limited

Building 10A
4th Floor, DLF Cyber City
Gurgaon, NCR – 122002

Tel: 91 124 417 0300
Fax: 91 124 417 0301

www.erm.com

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