Environment and Social Due Diligence Report

May 2015

IND: Accelerating Infrastructure Investment Facility in India
–Dreisatz Mi Mysolar24 Private Limited and Mi Mysolar24 Private Limited

Prepared by

India Infrastructure Finance Company Limited for the Asian Development Bank

Due diligence Report on Environment and Social Safeguards

By

India Infrastructure Finance Company Limited (IIFCL)

(A Govt. of India Enterprise)

Sub Project: 15 x 2 MW Solar PV Power Plants at Village - Fatepura, District- Surendranagar, Gujarat

Sub-Project Developers: MI MYSOLAR24 PRIVATE LIMITED and DREISATZ MY SOLAR 24 PRIVATE LIMITED

India Infrastructure Finance Company Limited

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Sub Project: 15 x 2 MW Solar PV Power Plants at Village – Fatepura, District - Surendranagar, Gujarat

Due Diligence Report on Environment and Social Safeguards

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PROJECT BACKGROUND:

1. SUB-PROJECTS TITLE:

1. The Projects includes construction, operation and maintenance of two 15 MW Solar (Photovoltaic) Power projects at Village – Fatepura, District - Surendranagar, Gujarat.

2. SUB-PROJECTS BACKGROUND:

2. Welspun Energy Private Limited (WEPL), a Welspun Group Company, has setup two solar Photovoltaic power project of 15 MW capacity each, using fixed-tilt polycrystalline technology, in the state of Gujarat. The projects are housed in the company as 'Mi Mysolar24 Private Limited (MMPL)' and 'Dreisatz My Solar 24 Pvt. Ltd (DMPL)'. Mi Mysolar24 Private Limited and Dreisatz My Solar 24 Pvt. Ltd was acquired by WEPL through Welspun Renewable Energy Private Limited (WREPL), a company incorporated to execute and manage the renewable energy portfolio of Welspun group, from their original promoters in December 2011, post which, WREPL is completely responsible for developing and operating these projects.

3. MI Mysolar24 Private Limited (MMPL) and Dreisatz My Solar 24 Pvt. Ltd (DMPL) have signed a 25 year Power Purchase Agreement (PPA) on October 25, 2010 with Gujarat Urja Vikas Nigam Limited (GUVNL), Gujarat's state-owned electricity holding company. The PPA specifies sale of 100% power generated to Government of Gujarat (GoG) on tariff determined in accordance with Gujarat Electricity Regulatory Commission (GERC) norms.

4. Both the projects are located near Village - Fatepura, Taluka – Dasada, District - Surendranagar, Gujarat. This village is at a distance of 22.5 km from the main town in the Taluka – Dasada and 106 kms from Gandhinagar, the capital city of Gujarat. The site falls under the tropical zone having ample sunlight throughout the year. Topological analysis shows the land to be fairly flat which is suitable for the development of a PV power plant. The site is devoid any distinct vegetation or specific landuse.

5. The salient features of the projects and the project costs have been detailed in below as **Table 1**.

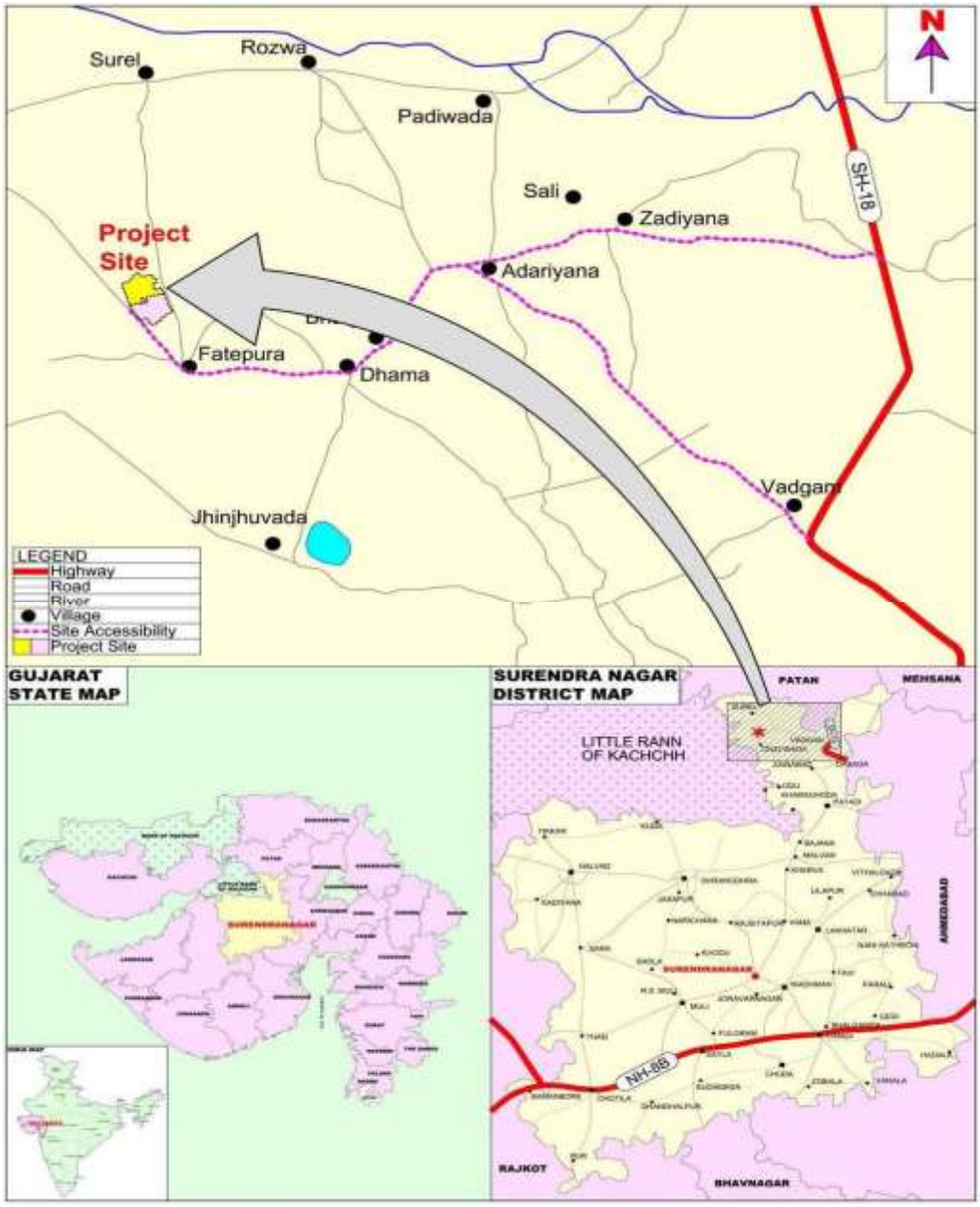
Table 1: Project Salient Features

Sl. No.	Particulars	Details of MI Mysolar24 Private Limited	Details of Dreisatz My Solar 24 Private Limited
1.	Location of Site	Village – Fatepura, Taluka - Dasada District - Surendranagar, Gujarat State.	Village – Fatepura, Taluka - Dasada District - Surendranagar, Gujarat State.
2.	Project Coordinates	Latitude 23° 25' 5.27" North and Longitude 71° 37' 19.61" East.	Latitude 23° 25' 23.25" North and Longitude 71° 37' 0.60" East.

3.	Sensitive area	Little Runn of Kutch at a distance of 3 Kms from the project site in west direction.	Little Runn of Kutch at a distance of 3 Kms from the project site in west direction.
4.	Total cost of the project	Rs. 133.80 crores	Rs. 132.98 crores
5.	Project capacity	15 MW	15 MW
6.	Project operational date	3rd December, 2012	6th December, 2012
7.	Technology	Grid connected based Solar Photovoltaic system.	Grid connected based Solar Photovoltaic system.
8.	Module Type	Polycrystalline PV modules	Polycrystalline PV modules
9.	Available land	130.62 acres	90.55 acres
10.	Type of land	Private land. Mono cropped with agricultural activity only during one season. Rest of the year, the land is fallow.	Private land. Mono cropped with agricultural activity only during one season. Rest of the year, the land is fallow.
11.	Nature of land	Dry land	Dry land
12.	Power Purchase Agreement	By GETCO	By GETCO
13.	Power yield per annum	25.56 Million Units Per Year	25.56 Million Units Per Year

Source: ESIA Report

Figure 1: Project Locations



Source: ESIA report

3. TECHNICAL DESCRIPTION:

6. The main components of the PV plants are solar PV modules, Power Conditioning Units, Module Mounting System, Grid Connect Arrangements, Monitoring Systems Cables, Connectors Control Room and transformers. The technical specifications of these components have been discussed below:

- **Solar Modules:** The Solar PV projects uses fixed polycrystalline PV modules, south facing orientation, tilted 20° from the horizontal to maximise the total annual incident solar irradiation. The 15 MW solar PV plant has been configured into 14 modular plots, out of

which 13 Nos. plot comprises of 1.11 MWp of solar PV and two 500 kW inverters located at the centre of the each plot . There is one plot with only one 500 kW inverter.

- **Inverters:** The inverters have been procured from Bonfiglioli, an Italy based manufacturer. The inverter uses a Maximum Power Point Tracking (MPPT) ensuring maximum power extraction from PV array by tracking the array's maximum power point. The MPPT is based on buck-boost technology ensuring function of inverter in lowest irradiance level too. The inverters have been evaluated by Gensol and have been found to be optimally sized. EPC contractor has deployed total 26 Inverters of capacity 1000 kW which are sufficient. The inverters are IEC and CE certified.

- **Other Equipment*:*** A fixed module mounting system of 25° inclination has been chosen for the PV plant. The mounting structures to be selected shall comply with the appropriate industrial standards and shall be capable of withstanding on-site loading and climatic conditions. The material used to construct the structures shall be hot-dipped galvanized mild steel.

- **Power Evacuation*:*** For the evacuation of power generated from the Project, a 66 KV switchyard has been constructed within the premises of the Projects. As per the PPA executed with GUVNL, the delivery point for the power generated is the switchyard of the Projects and GUVNL shall off take power from this point. Since the off take point is the Project switchyard itself, long term open access for transmission of power is not required for the Project. Power is being evacuated through transmission network of Gujarat Energy Transmission Corporation Limited (GETCO), a Government of Gujarat undertaking, through the substation at Dhama, located at an aerial distance of around 5.5 km from the power plant. The sub-station has transformation capacity of 15 MVA.

4. CONCESSIONAIRE:

7. Mi Mysolar24 Private Limited (MMPL) and Dreisatz My Solar 24 Pvt. Ltd have signed a 25 year Power Purchase Agreement (PPA) on October 25, 2010 with Gujarat Urja Vikas Nigam Limited (GUVNL), Gujarat's state-owned electricity holding company. The PPA specifies sale of 100% power generated to Government of Gujarat (GoG) on tariff determined in accordance with GERC norms.

5. EPC CONTRACT:

8. Engineering, Procurement and Construction ("EPC") work for the Projects has been carried out by WEPL on a turnkey basis. WEPL entered into an EPC agreement for the projects on March 30, 2012.

6. O&M ARRANGEMENT:

9. O&M contract for the projects was entered into with WEPL on March 30, 2012. WEPL shall provide preventive & curative maintenance of the solar PV power plant and related equipment with parts/component and consumables required for avoidance or removal of

breakdown/failure and to ensure timely supply of parts/component consumable for a period of one year.

7. IIFCL FUNDING:

10. The total project cost of MI Mysolar24 Private Limited (MMPL) and Dreisatz My Solar 24 Pvt. Ltd. (DMPL) is Rs. 133.8 crore and Rs. 132.98 crore respectively. MI Mysolar24 Private Limited and Dreisatz My Solar 24 Pvt. Ltd. have signed the Takeout Agreement on 21st October 2014, with India Infrastructure Finance Company Ltd. (IIFCL).

11. The projects has been financed by IIFCL under Takeout Finance Scheme and IIFCL has sanctioned and disbursed an amount of Rs. 37.50 crore to MI Mysolar24 Private Limited and Rs. 37.50 crore to Dreisatz My Solar 24 Pvt. Ltd.

DUE DILIGENCE ON ENVIRONMENTAL SAFEGUARDS

8. ENVIRONMENT SAFEGUARD COMPLIANCE REVIEW:

12. Welspun Energy Private Limited (WEPL), a Welspun Group Company, has setup two solar Photovoltaic Power Projects of 15 MW capacity each, using fixed-tilt polycrystalline technology, in the state of Gujarat. The sub-projects are housed in the company Mi MySolar24 Private Limited (MMPL) and Dreisatz My Solar 24 Pvt. Ltd (DMPL). The said sub-projects were acquired by WEPL through Welspun Renewable Energy Private Limited (WREPL), a company incorporated to execute and manage the renewable energy portfolio of Welspun group. The MMPL and DMPL sub-projects were commissioned in December, 2012. MMPL and DMPL are located in the same area, adjacent to each other.

13. The sub-projects use grid connected based Solar Photovoltaic (PV) technology with Polycrystalline PV modules. Power is being evacuated through transmission network of Gujarat Energy Transmission Corporation Limited (GETCO), a Government of Gujarat undertaking, through the substation at Dhama, located at an aerial distance of around 5.5 km from the power plants.

14. The sub-project company has signed a 25 year Power Purchase Agreement (PPA) on October 25, 2010 with Gujarat Urja Vikas Nigam Limited (GUVNL), Gujarat's state-owned electricity holding company. The PPA specifies sale of 100% power generated to Government of Gujarat (GoG) on tariff determined in accordance with GERC norms. For the evacuation of power generated from the sub project, a 66 KV switchyard has been constructed within the premises of the sub project. As per the PPA executed with GUVNL, the delivery point for the power generated is the switchyard of the sub project and GUVNL shall off take power from this point. Sub-projects are connected to a 66KV substation at Dhama, at an aerial distance of 5.5 Km from the project. The sub-station has sufficient capacity with 16 bays for export of 30 MW of power. The grid availability for Gujarat state has been assumed (for 66KV substation) at 99.72% based upon Gujarat Energy Transmission Corporation Limited (GETCL) tariff order for FY2012.

15. As per MOEF's Office Memorandum dated 13th May 2011, Solar Photovoltaic Power Projects are not covered under the ambit of EIA Notification, 2006 and no environment clearance is required for such projects under the provisions thereof. Although environmental and social impact assessment study was not required for MMPL and DMPL as a statutory requirement, MMPL and DMPL has employed SENES Consultants India Pvt. Ltd. to conduct an Environmental and Social Impact Assessment (ESIA) against the Social and Environmental Performance Standards of IFC and develop an Environment and Social Management Plan for the proposed project. Copy of the ESIA reports of MMPL and DMPL prepared in the year 2012 is given in **Appendix-I**.

16. The environmental safeguard due-diligence study was carried out for the sub-projects on the basis of site visit observations and understanding project scope based on information and documents provided by Concessionaire. A detailed discussion on the Environmental and Social safeguards related issues was also carried out with the E&S team of Welspun Energy Private Limited (WEPL) on 17th March 2015. The meeting was attended by Mr. Suranjan Sarkar, General Manager- EHS, Mr. Harishankar Soni, Deputy General Manager- EHS and Mr. Nitin Mittal, Assistant vice President - Finance.

17. The following documents were referred in order to prepare Environmental Safeguards Due-Diligence Report:
    - Project Information Memorandum (PIM);
    - Environmental and Social Impact Assessment Report (2012) for the Projects;
    - Environment safeguard related permits obtained for the projects;
    - Power Purchase Agreement;
    - Environmental Quality Monitoring Reports;
    - Project/Corporate Safety Management related documents;
    - EMP compliance related documents during operation phase.

9. VISIT TO SUB-PROJECT LOCATION:

18. As part of the preparation of the ESDDR, the sub-projects were visited Environmental and Social safeguard specialists of IIFCL on 12th March, 2015 for field verification of environmental safeguards. Consultation with the O&M team of concessionaire was also done regarding safeguards implementation during the site visit. The sub-projects are currently in operation phase. The site visit photographs are given in Photo Plate-I. The concessionaire, M/s. Welspun Renewable Energy Private Limited (WREPL) is completely responsible for operating these projects.

10. ENVIRONMENTAL SENSITIVITY AND DUE DILIGENCE:

19. The environmental sensitivity of the MI My Solar 24 Pvt. Ltd. and Dreisatz My Solar 24 Pvt. Ltd has been assessed by reviewing the Environmental and Social Impact Assessment study report, compliance monitoring related documents during O&M phase, supplemented by field visit and consultation with the concessionaire. The environmental sensitivity assessment is given below:

- The land acquired for the sub-projects is private land, mono cropped with agricultural activity only during one season. Rest of the year, the land was fallow. The land was acquired by the Concessionaire by private negotiations.
- The sub-project sites are located approximately 3 km from the Wild Ass Sanctuary in Little Runn of Kutch, which is a famous habitat of wild ass (*Equus hemionus khur*). As the sub-projects are located less than 10 km of Wild Ass Sanctuary, necessary NOCs have been obtained from Principal Chief Conservator of Forest (PCCF), Department of Forest, Gujarat (Copy in regional language attached as **Appendix – II**). As per MoEF's guidelines regarding eco-sensitive zone dated 9th February 2011, use of renewable energy sources is a permissible activity in the eco-sensitive zone of a protected area and should be actively promoted in the zone.
- During sight visit and as per discussions with the sub-project staff, it was informed that the wild animals are not sighted in and around the Project area. There was no loss of bio-diversity as there are no fauna species within the project area.
- No notified forestland is involved in the Project Site.

- As per ESIA reports, there are no important cultural heritage sites within 10 Km from the Project site.
- All sewage water being generated at the sub-project premises is disposed in septic tanks/soak pits.
- The sub-project has taken Consent to Establish from the Gujarat Pollution Control Board vide letter No. GPCB/NOC/SRN-523/ID-20401/425 dated 3rd May 2012 for MMPL and GPCB/NOC/SRN-523/ID-28186/424 dated 3rd May 2012 for DMPL, attached as Appendix**-III**.
- Necessary Consent to Operate have been obtained by the sub-projects from Gujarat Pollution Control Board vide Consent order No. W-13203 dated 14.09.2012 for MMPL and No. W-13204 dated 14.09.2012 for DMPL, attached as **Appendix-IV**. Quarterly compliance report for CTO is being submitted to Gujarat Pollution Control Board. The latest compliance report for the period October – December 2014 for both sub-projects is attached as **Appendix – V**.
- Environmental quality monitoring of air, ground water, surface water, noise and soil has been done at the sub-projects, which has been submitted to the Gujarat Pollution Control Board.
- Baseline environmental monitoring for air, water and noise environment indicates good quality of environment at project site as the levels for different environmental parameters are within the prescribed limits of National Environmental Standards.
- WREL has its Corporate Environment, Health, Safety & Sustainability (EHS&S) Policy.
- The concessionaire has undertaken the implementation of safety management system by adopting safety policy for the project.
- In the discussions during the site visit it was informed by the staff that no groundwater is extracted in projects, since the water is saline and cannot be used at the power project. Although permission has been sought from Central Ground Water Board, Ahmedabad for extraction of ground water by the Project. .
- The Storm Water Management Plan (SWMP) has been implemented for the proper management of surface run-off generated during monsoon from the Solar Power Plant area. Drains have been constructed in and around the periphery of the Project for channelizing water outside the Project site.

11. CATEGORIZATION OF SUB-PROJECT:

20. The sub-project can be classified into Category “B” based on ADB’s EA requirements as per their Safeguard Policy Statement (2009) as the project may involve investment of ADB funds through a financial intermediary.

12. STATUS OF REGULATORY CLEARANCES:

21. The applicable statutory clearances from competent authorities were obtained during construction and operation phases of sub-projects. The detailed status of permits/approvals as obtained by Concessionaire is given in **Table-2** below:

Table 2: Status of Regulatory Clearances Obtained

S.No.	Clearances Required	Statutory Authority	Current Status of Clearance
1.	Environmental Clearance	Ministry of Environment, Forests and Climate Change (MoEFCC), New Delhi	Solar Photovoltaic Power Projects are not covered under the ambit of EIA Notification, 2006 and no environment clearance is required for such projects under the provisions thereof. In this regard MOEF has issued Office Memorandum dated 13th May 2011.
2.	Forest Clearance	MoEFCC (Regional Office) and State Forest Dept.	Not applicable as sub-projects do not involve any diversion of forest land.
3.	Wildlife Permission	State Forest/Wildlife Department, Gujarat	The sub-project sites are located within 10 Km from the Wild Ass Sanctuary in Little Runn of Kutch. Necessary NOCs has been obtained from Principal Chief Conservator of Forest (PCCF), Department of Forest, Gujarat (Copy of NOCs in regional language is attached as **Appendix – II**). As per MoEF's guidelines regarding eco-sensitive zone dated 9th February 2011, use of renewable energy sources is a permissible activity and should be actively promoted in the eco-sensitive zone of a protected area.
4.	Consent to Establish	Gujarat State Pollution Control Board	Consent to Establish was taken by the sub-projects under the Water (Prevention and Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, and the Environment (Protection) Act, 1986 (attached as **Appendix-III**)

			Valid till : 26th April 2017
5.	Consent for Operation and Authorization	Gujarat State Pollution Control Board	Necessary Consent to Operate have been obtained by the sub-projects from Gujarat Pollution Control Board under section 25 of the Water (Prevention and Control of Pollution) Act, 1974, under section 21 of Air (Prevention & Control of Pollution) Act, 1981 and authorization under rule 3(c) and 5 (5) of the Hazardous Waste (Management Handling and Trans Boundary Movement) Rules, 2008. (Attached as **Appendix-IV**). This consent authorizes for discharge of effluent and emission due to operation of industrial plant for manufacturing solar energy. Valid Till: 27th August 2017

13. ENVIRONMENT MANAGEMENT PLAN (EMP) IMPLEMENTATION:

22. The environmental management plan as appeared in Section-6 of ESIA reports (Year 2012) is given in **Appendix-I**, which describes the proposed mitigation measures adopted during the operation stage of the project. The following management plans were prepared in the ESIA report and their status of implementation is given below:

13.1 Emergency Preparedness and Response Plan

23. The emergency preparedness and response plan covers the emergency situations that are probable to occur at the solar power projects and the probable causes. This covers fire, diseases due to contaminated water, injury etc.

13.2 Waste Management Plan

24. Domestic waste water generated from toilets/urinals within the plant and associated facilities is being disposed in septic tank / soak pit system. No ground water is utilized for washing / cleaning panels as the ground water is extremely saline. Work order for module cleaning work has been assigned to a local vendor. The copy of work order is enclosed as **Appendix – VI**. The periodicity of module cleaning is once every fortnight. Water for cleaning is also provided by the vendor. Two water tanks of 10,000 litre capacities each are present the project sites and water is brought in tankers to these tanks for utilization.

25. Closed steel containers with concrete platform (02 numbers) have been installed at the project premises to store broken/damaged PV modules.

13.3 Storm Water Management Plan

26. The Storm Water Management Plan (SWMP) refers to the proper management of surface run-off generated during monsoon from the Solar Power Plant area. Cross drainage structures within the site have been constructed to handle rainfall and surface runoff. The peripheral drains are also constructed outside the plant boundary to the storm water pond.

13.4 Occupational Health & Safety Management Plan

27. This plan is prepared to maintain the occupational health & safety (OHS) of the employee and contractual labours during both construction and operation phase. The operating personnel are provided with adequate personal protective equipment (PPEs). Purified water is being provided to the employees at the site. The project has adequate fire alarm and firefighting equipment to handle any fire incident. The work area has first aid kits to manage any injuries occurring in the area.

13.5 Road Safety & Traffic Management Plan

28. All the permanent access roads to main plant sites and the internal roads (within the plants) are black-topped. The speed limit in the internal roads is being restricted to 20 kms/hr.

13.6 Wildlife Management Plan

29. The project sites are properly fenced to avoid straying of any wildlife. During site visit it was informed that no wild animals are sighted near the project areas. Noise levels at the sites are within the prescribed limits of National Standards.

13.7 Decommissioning Plan

30. As per ESIA, no potential significant impacts have been identified as part of the decommissioning activities to be undertaken at the end of the project life cycle adequate environmental safeguards need to be adopted by the project proponent and the contractor to mitigate any short term impact that may arise from such activities. This includes, recycling of solar panels, inverters and related electrical equipment to be carried out in accordance to the provision of E-Waste Management & Handling Rules 2011, recycling of used batteries to be carried out in accordance to the provision of Battery Waste Management & Handling Rules 2001 and heavy equipment to be deployed for decommissioning of civil structures need to be equipped with acoustic controls.

13.7 Environmental Monitoring Plan

31. Environmental Monitoring Plan was formulated to ensure and demonstrate compliance with the Regulatory and Institutional Agency's EHS requirements. The monitoring of

Environmental parameters and compare the same against the benchmark as set by the Regulatory & Institutional Bodies will help MMPL and DMPL assessing the Environmental Performance and identify any gaps or non-conformance for taking immediate actions.

14. IMPLEMENTATION OF EMP DURING OPERATION PHASE:

32. As part of the project, detailed Environment Health and Safety (EHS) measures have been undertaken during Operation phase. The EHS budget for implementing the same at both MMPL and DMPL is attached as **Appendix-VII** which includes the following measures:

- Water Quality Testing
- Ambient air quality monitoring
- Storage of broken/damaged modules in steel container with concrete platform
- Waste Management
- Management of Safety Measures including Fire-fighting equipment.

Environmental Quality Monitoring

33. The Environmental Quality monitoring reports are being submitted to Gujarat State Pollution Control Board. The last monitoring reports are attached as **Appendix – VIII**.

15. IMPLEMENTATION OF SAFETY MANAGEMENT SYSTEM DURING OPERATION PHASE:

34. DMPL and MMPL have a corporate EHS policy. The policy is attached as **Appendix-IX**.

35. An emergency communication system has been prepared and emergency telephone numbers have been displayed at all prime locations at the site. The fire detection and alarm system is inspected and tested on regular basis (the last inspection report is enclosed as **Appendix–X**).

36. Fire extinguishers (72 in numbers) are kept at various locations at the sub-projects site. During site visit, it was informed by the project staff that the nearest primary health centre is approximately 17 km from project site. First aid box with basic medicines including anti venom drugs was present at the site. The necessary training has been given to the employees for first aid. It was informed by the project staff that till date no emergency/injury incident has occurred at the site. RO facility for water purification is present at the project site and its guesthouse. Employees are sent for safety and health related training programmes periodically. Instructions regarding use of fire fighting equipment and action to be taken in case of electric shocks have been displayed at various locations at site.

16. OVERALL INSTITUTIONAL FRAMEWORK FOR ENVIRONMENT AND SAFETY MANAGEMENT PLAN:

37. Environmental Health Safety and Sustainability Department of the Concessionaire headed by Head EHS&S. Head EHS&S is supported by a team of four having sufficient educational and

professional qualification and experience to discharge responsibilities related to environmental management including statutory compliance, pollution prevention, environmental monitoring etc. The engineer in-charge of the O&M projects directly reports to Head O&M and to Head EHS&S for environmental health and safety related issues. The institutional framework for EHS&S is attached under **Appendix-XI**.

Clean Development Mechanism

38. Project Design Document has been prepared for MMPL and DMPL for CDM benefits and Host Country Approval (HCA) has also been granted for the same. Estimated amount of annual average Green House Gas emission reductions as given in the PDD are 23,699 tCO_2e for MMPL and 23,699 tCO_2e for DMPL. Project participant has obtained HCA approval from Designated National Authority of India and it is confirmed by the Authority that the project contributes to sustainable development in India. Carbon credits have not been sold by the sub-project developer due to adverse market conditions.

17. SITE VISIT OBSERVATIONS:

39. A site visit was undertaken by IIFCL's Environmental and Social Safeguard specialists 12th March, 2015 to review the implementation of the sub-project's environmental safeguards. During the site visit, the project O&M team, which included Mr. Bhanwarsin Jadeja, Assistant Manager (O&M) and Mr. Prashant Patel, Senior Engineer (O&M), were consulted regarding environmental and social safeguards related measures implemented at the project site. The site visit photographs are given in **Photo Plate-I**. Based on the discussions with above mentioned officials site observations are given below:

- All sewage water being generated at the sub-projects premises is disposed in septic tanks/soak pits.
- Throughout the MMPL and DMPL premises, proper fire extinguishers (72 in numbers), sand buckets and fire-fighting facilities have been provided.
- First aid boxes have been provided at site, hazard signs have been placed near energized components, provision of sufficient fire extinguishers at site exists to tackle fire hazards, and emergency contact numbers are displayed at various locations at the site.
- Drains have been constructed in and around the periphery of the Project for channelizing storm water /rainwater outside the Project site.
- Two water tanks of 10,000 litre capacities each are present the project site and water is brought in tankers to these tanks for utilization. It was informed by O&M staff that no ground water is being used at the sub-projects.
- Closed steel containers with concrete platform (02 numbers) have been installed at the project premises to store broken/damaged PV modules.
- No oil spillage was seen in the switchyard area.

18. CONCLUSIONS AND RECOMMENDATION:

40. It is concluded from the above impact assessment that the proposed MMPL and DMPL, 15MW each, solar PV power projects in Fatepur village are unlikely to pose any adverse irreversible environmental risks given the nature of the activities and absence of any legally protected areas and cultural heritage sites located within and/or in close proximity to the sub-projects. However, the sub-project activities have reversible environmental impacts which have been managed with structured EMPs in place.

41. Based upon the available documents and site visit, it is concluded that the concessionaire has undertaken adequate environmental safeguard measures. The conclusions for the sub-project are given below:

- The sub-projects have been prepared by the Government of Gujarat along with the Government of India as per the national and state government requirement and not in anticipation to ADB operation.
- The sub-projects are in operation since December 2012.
- The sub-projects have the required national and local level permits and approvals for project implementation.
- Concessionaire has confirmed continuous compliance with the terms and conditions stipulated while according statutory clearances /approvals /consents.
- Safety Management System at MMPL and DMPL has been developed and implemented by keeping in view the requirements of the sub-project.
- The sub-projects will also have a positive GHG emission reduction due to non-emission of pollutants during operation.
- The institutional arrangement available for the implementation of Environment, Health, Safety & Sustainability appears to be adequate.
- During site visit and discussion with the project developer, the implementation of EMP and environmental monitoring were found to be adequate.
- Periodical Environmental/Safety management and monitoring during the projects operation phase is being carried out by the concessionaire.
- Regular field verification as part of audit will be undertaken by IIFCL safeguards team to assess and confirm compliance with the agreed environmental measures by the concessionaire.

42. Based on the site visit and due diligence findings, it can be deduced that the sub-projects have no significant environmental safeguard issues. The sub-projects, therefore, do not appear to involve any kind of reputational risk to ADB funding on environmental safeguards and recommended for funding.

DUE DILIGENCE ON SOCIAL SAFEGUARDS

19. DUE DILIGENCE OF SOCIAL IMPACTS:

43. The Social safeguard due diligence study of MI Mysolar24 Private Limited and Dreisatz My Solar 24 Pvt. Ltd., have been done by reviewing the documents made available by the Concessionaire. The documents reviewed for the due diligence study are as below:

- Environment and Social Impact Assessment (ESIA) Report (attached as **Appendix I**);
- Project Appraisal Memorandum;
- Details of Community development activities provided by the concessionaire;
- Information pertaining to criteria followed for project site identification.

20. VISIT TO PROJECT LOCATIONS AND DISCUSSION WITH CONCESSIONAIRE:

44. A site visit was undertaken by the Environmental and Social safeguard specialists of IIFCL on 12th March, 2015 for field verification of environment and social safeguards related aspects of the projects. During the site visit, the project O&M team, which included Mr. Jadeja, Assistant Manager, Mr. Prashant Patel, Senior Engineer (O&M), were consulted regarding environmental and social safeguards related measures implemented at the project sites. The site visit photographs are given in **Photo Plate-I**.

45. A detailed discussion on the Environmental and Social safeguards related issues for both the projects was also carried out with the E&S team of Welspun Energy Private Limited (WEPL) on 17th March 2015. The meeting was attended by Mr. Suranjan Sarkar, General Manager-EHS, Mr. Harishankar Soni, Deputy General manager- EHS and Mr. Nitin Mittal, Assistant Vice President- Finance.

21. CATEGORIZATION OF SUB-PROJECTS:

46. The sub-projects can be classified into Category FI based on ADB's as per Safeguard Policy Statement (2009) as the project may involve investment of ADB funds through a financial intermediary.

22. MINIMIZATION OF IMPACT:

47. As informed by the concessionaire, comprehensive site selection criterion has been followed towards finalizing the project sites for MI Mysolar24 Private Limited and Dreisatz My Solar 24 Pvt. Ltd. and the site for the projects was identified considering various parameters including social safeguards. Some major criteria considered during the identification of project sites related to social safeguards include number of landowners to be affected landowner, current landuse pattern, and impact on structures and Common Properties at the identified site.

23. PUBLIC CONSULTATION:

48. The projects are located adjacent to each other and only one village is affected due to these projects. Thus public consultations with community members including farmers, school

principal, head of village panchayat, land sellers , etc in affected Fatepura villages were conducted during the ESIA study in April 2012. During the public consultation with the affected landholders, it was also found that only dry land (no wet land or grazing land) was purchased for the projects and the land losers had received monetary compensation against selling of their land. Discussion also revealed that agriculture is the primary livelihood in the area however, due to a mono cropped agricultural pattern; it is not the perennial source of income throughout the year. No grievances were reported during the stakeholder's consultations with the Village Head and locals of Fatepura village, regarding the land transaction and compensation which indicate broad community support for these projects.

24. LAND ACQUISITION IN THE SUB-PROJECTS:

49. As informed by the concessionaire during a meeting on 17th March 2015, the land purchased for MI Mysolar24 Private Limited was 130.62 Acres and 90.55 acres for Dreisatz MySolar 24 Pvt. Ltd.

50. The total land required has already been purchased from private land owners on willing seller-willing buyer basis. The land purchased is shadow free and flat in nature. The land were used for seasonal mono-crop agricultural only.

51. After the identification of the sites, negotiations were carried out with the interested parties. The land title documents and land title clearance certificate was sought for and post satisfactory perusal of the documents, the sale deed were registered in the Company's name and the possession of the land was taken by the Project Team after paying the compensation for the land to the landholder. The Land Acquisition team in conjunction with the Project team handled the mutation process for the land, wherever required.

52. As informed by the developer, the land titles were transferred in the name of the Company after the purchase of land from the titleholders. The Title Deeds in the name of Company is deposited with Security Trustee which is appointed by the lenders and is the custodian of all the securities of the company including the land title, on behalf of the lender. The Company has carried out legal vetting from Legal department internally before acquiring the land. This was followed by preparation of Title search report of the Project land by empaneled lawyer of the Bankers to the Project. At time of registration of sale deed, witnesses have signed on the sale deed which may also be considered as third party confirmation on payment to seller of land on 'willing buyer willing seller' basis.

53. As informed by the concessionaire, Company has acquired the entire land on willing buyer willing seller basis. For the purpose of land ownership, following laws were attracted which were adequately complied with, as clarified in Title search Report prepared by lender's Legal Counsel:
    - Saurashtra Gharkhed Tenancy Settlement and Agricultural Lands Ordinance 1949 amended under Act of 1997 Amendment,
    - The Bombay Land Revenue Code 1879 (now Gujarat Land Revenue Code 1879)

- The Urban Land (Ceiling and regulation) Act 1976 (ULCRA) & rules framed thereunder (same has been repealed in the state of Gujarat from 30th March 1999).

25. RESETTLEMENT IMPACT IN THE SUB-PROJECTS:

54. As mentioned in the ESIA Report, it was reported during consultations with local that there were no inhabitants on the land. Hence relocation of settlements was not required for both the projects.

26. IMPACT ON INDIGENOUS PEOPLE:

55. As mentioned in the ESIA report, the solar power plants are located in Fatepura village and does not involved land acquisition from indigenous people and thus these projects do not have any impact on the indigenous people.

27. COMPENSATION FOR LAND ACQUISTION:

56. The land for the proposed projects is private owned land which was purchased by MMPL and DMPL on willing seller-willing buyer process. The land originally was used for rain fed mono-crop production viz. Cotton, arinda, ground nuts etc. and left as fallow land for rest of the year. The land was acquired by MMPL directly from land owners. As informed by the Concessionaire, the compensation was decided based on the prevailing market rate, in consensus with the land owners. No grievances were reported during the stakeholders consultations with the Village Head and locals of Fatepura village, regarding the land transaction and compensation which indicated broad community support for these projects.

28. GREIVANCE REDRESSAL:

57. As informed by the concessionaire, the grievance register has been maintained for recording the grievances, request, demands etc. of the local community, which is shared by them either verbally or in written at the project sites. The grievances, if received, are addressed by the O&M Head. It has also been informed by the concessionaire that no grievances have been received from the local people for the projects.

29. EMPLOYMENT GENERATION AND INCOME RESTORATION:

58. As mentioned in the ESIA report, discussions with land owners indicated that only dry land (no wet land or grazing land) has been purchased for the projects and the land losers have received monetary compensation against selling of their land. And discussion with the landholders also revealed that agriculture is the primary livelihood in the area however, due to a mono cropped agricultural pattern, it is not the perennial source of income throughout the year.

59. As noted during the site visit, 20 security guards have been employed for both the projects who belong to the local area. It was informed by the concessionaire that local people are also

employed for various unskilled activities like clearing the project sites on a regular basis, cleaning of the solar panels during its maintenance etc.

30. COMMUNITY DEVELOPMENT ACTIVITIES:

60. The concessionaire has carried out various community development activities based on the demands made by the local people of the affected village. These activities are the following:

- **Construction of Community Hall**: There was a request from the Government Primary School, Fatepura, which has strength of 301 students (boys – 158 & girls – 143), for construction of prayer hall as they did not have any close space for the school children for carrying various external activities including daily assembly and prayer. The concessionaire has thus constructed a prayer hall in the school. The cost incurred for construction of the prayer hall was Rs.8,35,000/-.

- **Environment day Celebration**: On the Environmental Day, plantation activity was taken up the staff members involving the villagers at the site.

- **Republic Day celebration in Government Primary School, Fatepura**: On the request of the villagers, sweets were distributed in the government primary school during the Republic Day celebration.

31. SITE VISIT OBSERVATION:

61. The observations made during the site visit are given as below:
    - The projects, MI Mysolar24 Private Limited and Dreisatz My Solar 24 Pvt. Ltd., are in operation and are adjacent to each other inside the same boundary. The projects are operated by the Welspun Renewable Energy Private Limited (WREPL).
    - The concessionaire has constructed the drainage around the project area to carry the storm water/rain water of the project sites to the nearby reservoir.
    - Local people have been employed for various O&M activities for both the projects.
    - The concessionaire has constructed the prayer hall in the government school of the affected village.

32. CONCLUSION AND RECOMMENDATION:

62. Based upon the available documents, observations and discussion with the O&M team and E&S team of WEPL, it is concluded that the concessionaire has undertaken adequate social safeguard measures during the operation of the projects. The conclusions for the sub-projects is given below:

    - The sub-projects have been prepared by the Government of Gujarat as per the national and state government requirement and not in anticipation to ADB operation.

    - MI Mysolar24 Private Limited and Dreisatz My Solar 24 Pvt. Ltd. are in operation from 3rd December 2012 and 6th December 2012 respectively.

- The land for the projects has been purchased by concessionaire as per willing seller-willing buyer basis and the compensation has been paid to the affected landholder.

- The projects did not had any impact on the settlement area and no cultural and community property was affected due to the projects.

- Employment opportunities have been provided to the local people for various O&M activities.

- Concessionaire has undertaken community development activities based on the demands raised by the local people.

63. The Sub-projects, therefore does not appear to involve reputational risk to Asian Development Bank funding on social safeguards and is thus recommended for funding.

FINAL REPORT

Environmental and Social Impact Assessment Report for Proposed 15 MW Solar PV Power Plant at Fatepur Village, Surendranagar District, Gujarat

Submitted to:

Dreisatz My Solar 24 Pvt. Ltd

Prepared by:

SENES Consultants India Pvt. Ltd.

June 2012

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1 Introduction

Dreisatz MySolar24 (P) Limited (DMSPL) is proposing to set up a 15 MW solar PV project in the state of Gujarat. The proposed 15 MW solar power project of Dreisatz MySolar24 (P) Ltd is located near village Fatepur of Dasada Tehsil, in Surendranagar district of Gujarat State. DMSPL is implementing a project in Gujarat under Gujarat state policy. The estimated total cost for setting up the proposed project is Rs. 142 crores. DMSPL has signed PPA with Gujarat Urja Vikas Nigam Limited for supplying power from 15 MW Grid Connected PV based Solar Power Project. The project details are summarised in the Table 1.1.

TABLE 1-1: PROJECT DESCRIPTION IN BRIEF

Project Owner	Dreisatz Mysolar24 (P) Limited
Permissions sought / obtained from concerned authorities such as Panchayat, State Govt, State Pollution Control Board, State Wildlife Department, etc.	Allotment of Solar Power Capacity by Govt of Gujarat Power Purchase Agreement (PPA) IEM Certificate Consent to Establish from GSPCB Approval from Industrial Commissioner Agreement with Land Owners Clearance from State Wildlife Dept.
Location of Site	Fatepur Village, Dasada Tehsil, Surendranagar District, Gujarat State
Project Coordinates	Latitude 23° 25’ 23.25” North and Longitude 71° 37’ 0.60” East
Sensitive area	Little Runn of Kutch at a distance of 3 Km from the site in west direction
Total cost of the project	Rs. 142 crores
Project capacity	15 MW
Expected Project operational date	October, 2012
Technology	Grid connected based Solar Photovoltaic system
Module Type	Polycrystalline PV modules
Available land	Around 135 acres
Type of land	Private land. Mono cropped with agricultural activity only during one season. Rest of the year, the land is fallow
Nature of land	Dry land
Power Purchase Agreement	By GETCO
Power yield per annum	25.56 million units per year

To fulfil the requirements of the funding agency for the project and match international best practices, Dreisatz MySolar24 (P) Limited (DMSPL) is committed to manage the project's social and environmental risks and impacts. So DMSPL has employed SENES Consultants India Pvt. Ltd. to conduct an Environmental and Social Impact Assessment (ESIA) against the Social and Environmental Performance Standards of IFC and develop an Environment and Social Management Plan for the proposed project.

2 Project Description

2.1 SITE LOCATION

The proposed 15 MW solar power project of Dreisatz MySolar24 (P) Ltd is located near village Fatepur of Dasada tehsil, in Surendranagar district of Gujarat State. The coordinates of the site are between latitude 23 ° 25' 23.25" North and 71° 37' 0.60" East. The total area of the proposed project site is around 105 acres with an additional area of 30 acres demarcated for future development. **Figure 2.1** shows the location of the project site.

2.2 SITE SETTING

Administratively, proposed project comes in Surendranagar district and located at a distance of 23.3 km away from Dasada town in Dasada tehsil and 1.5 km away from Fatepur village in northwest direction. Fatepur village is situated 76 km away from the back waters of Arabian Sea. The site is located 42.5 km away from the National highway NH-27. The nearest airport is at Ahmadabad at a distance 112 km from the project site. The Wild Ass Sanctuary in Little Runn of Kutch is located at a distance less than 10 km west of project site. DMSPL has also obtained NOC (vide letter no. – VPS/32/K/140-144/2012-13, dated 9th May 2012) from principal chief conservator of forest (Gujarat) for project execution. Dhama, Bhalgam and Surel are the nearby villages located at a approx. distance of 5.5 km (southeast), 5.5 km (southeast) and 6 km (north) from the proposed project site. The detailed project site accessibility is shown as in **Figure 2.2.**

The proposed site is having almost flat terrain with very gentle slope towards the western side. The site is devoid any distinct vegetation or specific landuse. It was reported during site visits and public consultations that the land was used for seasonal agriculture during the monsoon season and left as fallow land for rest of the year.

The project site is devoid of any major surface water bodies (pond/nala/rivers). It was observed that prominent vegetation at site comprised of bushes and site is principally devoid of large trees. However a few small trees were present at the site. A seasonal drain known as Kharwa ka Nala is passing outside the northern boundary of the project site and opens into little Runn of Kutch. The site is bounded by little Runn of Kutch in west and north west, the Fatepur village in the south and the Dhama village in the southeast.

The site surroundings have been discussed below:

North:	Immediately north of the site lies agricultural fields. Further north, a seasonal water channel exists which drains into the little Runn of Kutch
South:	Immediately south of the site abutting the project boundary lies the agricultural fields beyond which the Fatepur village is located at approx. distance of 1.5 km.
East:	Immediately abutting the project boundary on the eastern side lie agricultural fields
West:	Immediately west of the site abutting the site boundary lie agricultural fields. Further west

	of the fields at a distance of approx. 3-4 km the Little Runn of Kutch starts.

Photographs of the immediate site surroundings are as follows:

Photo 2-1: Photographs of Immediate Site Surrounding

	
East	**West**
	
North	**South**

Other Solar Power Plants Near to the DMSPL Project Site

- A solar power plant of 15 MW capacity is being proposed by MI My Solar 24 Pvt. Ltd., in the south of the proposed DMSPL project site.
- The Solar power plant owned by Amco Pvt. Ltd. already exists on the approaching road to Fatepur village. (Refer Photograph 2.2).

Photos 2-2: Photographs of AMCO Solar Power Plant in Fatepur village

FIGURE 2-1: PROJECT LOCATION

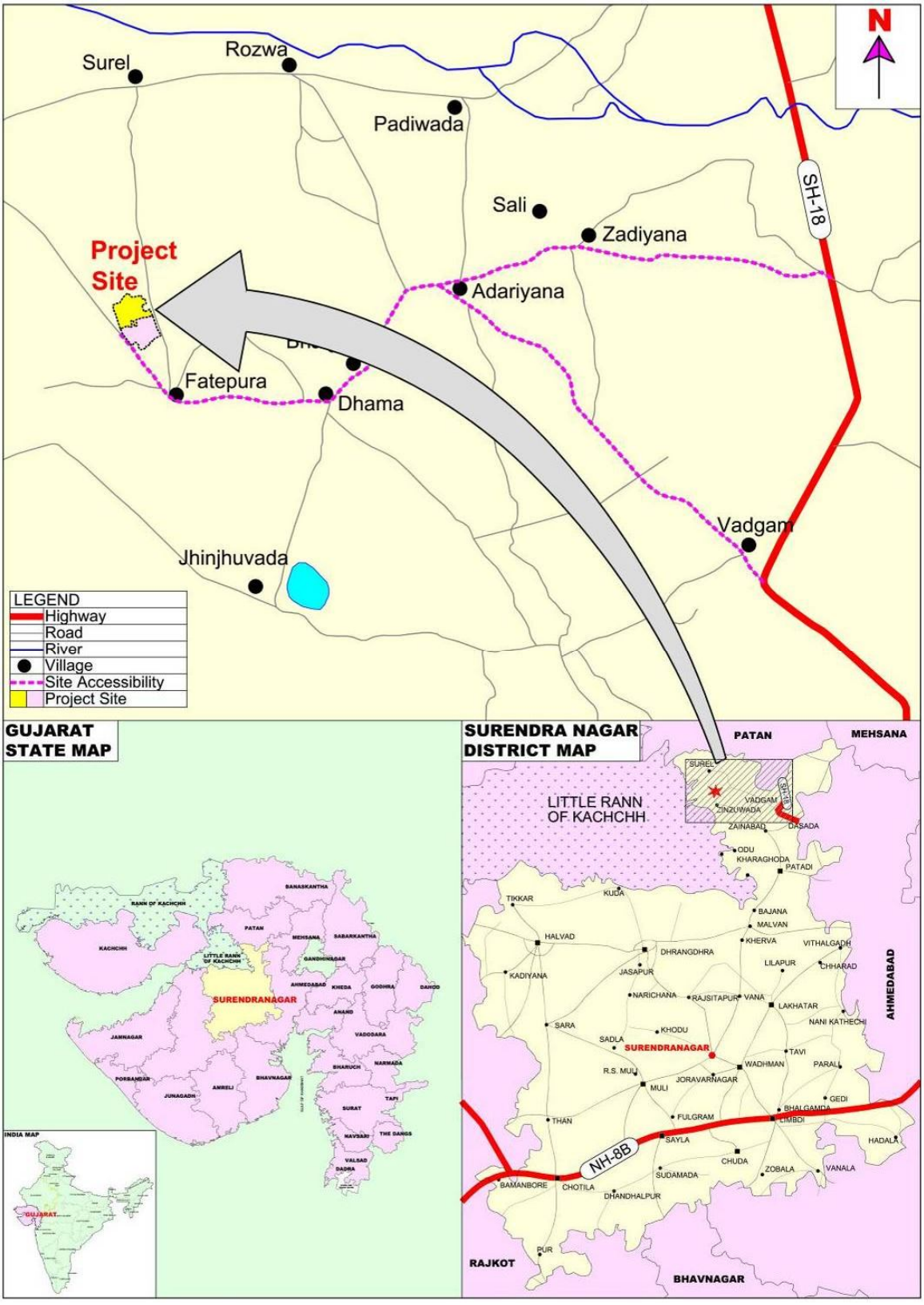


FIGURE 2-2: ACCESSIBILITY OF PROJECT SITE

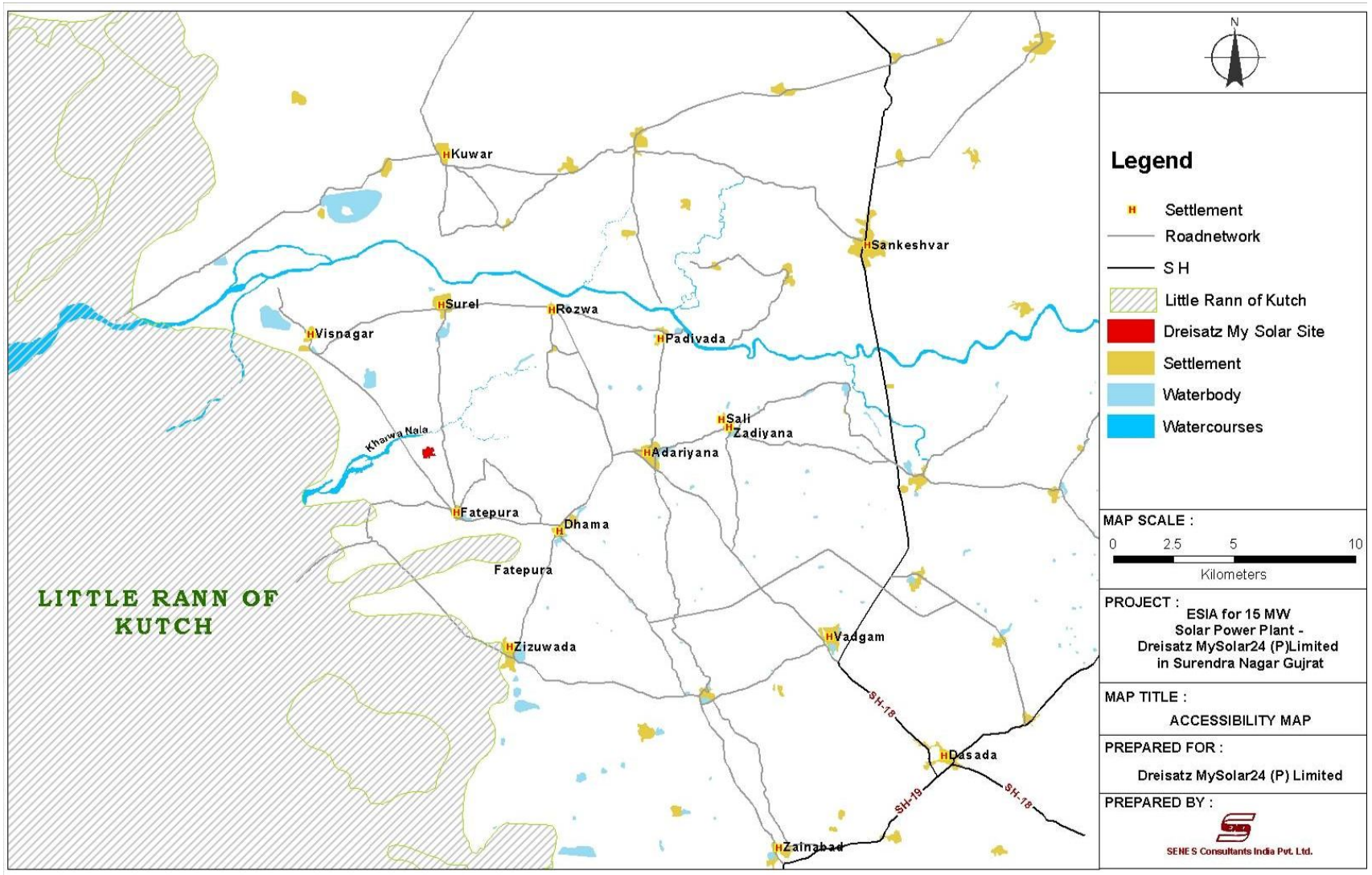
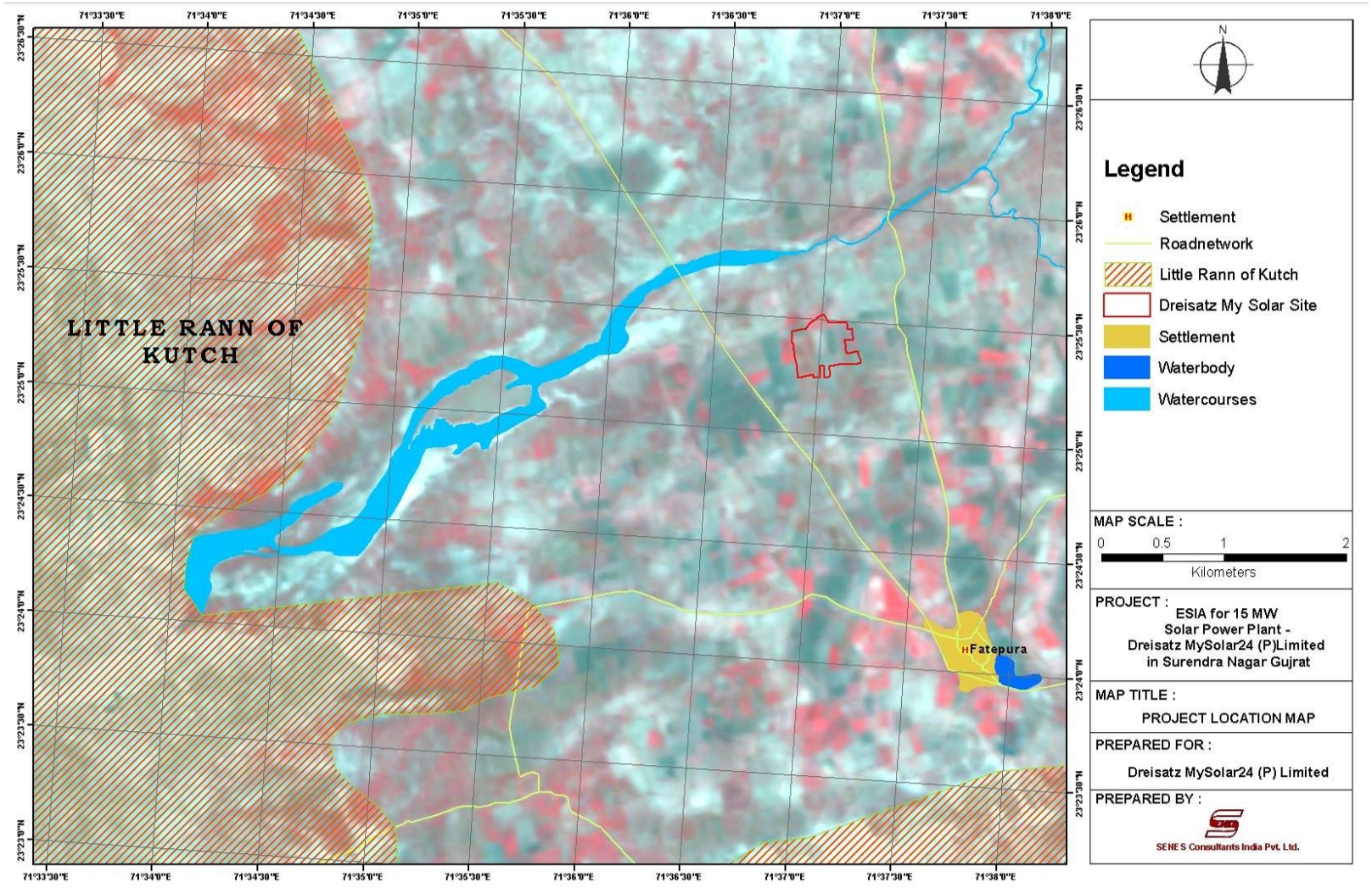


FIGURE 2-3: PROJECT LOCATION ON SATELLITE IMAGERY



2.3 PROJECT BACKGROUND

According to government estimates, the State of Gujarat receives 5.5 to 6.0 kWh/sq. m. /day of solar radiation with 330 sunny days in a year and also has 14.40 million acres of uniquely positioned waste land in the area of high solar radiation. So the State holds immense promise in renewable energy generation for India. The State Government has been actively pursuing the growth of renewable energy sources in the State and has developed a Solar Power Policy in 2009 with the vision of positioning the State as the 'Integrated Solar Generation Hub' for the nation. DMSPL is undertaking the following activities to achieve the objective of speedy establishment and implementation of proposed 15 MW solar power project. According to detailed project report, the overall project activities for the solar photovoltaic (SPV) power plant are listed below:-

- Purchase of land, site preparation, levelling etc. Construction of control room, fencing, peripheral lighting, water supply system, drainage system, approach roads etc. Supply, erection, installation and commissioning of lightning arrestors.
- Supply, erection, installation of solar photovoltaic (SPV) modules on structures. Supply, erection, installation and testing of PCUs. Interconnection of equipments and commissioning of the power plant (deliver 3 Ph, 320 V AC supply and combining the outputs of 27 nos. of PCUs). Completion of earthing system before commissioning. Supply, installation and commissioning of data monitoring system.
- Supply, erection, installation, interconnection and commissioning of power evacuation system consisting of isolators, circuit breakers, transformers and transmission line along with commissioning of metering and protection system.
- Actualize grid feed-in by synchronizing solar photovoltaic (SPV) power supply with 66 kV conventional grid supply at Dhama substation.
- Acceptance test of metering system and energy sale.
- Dreisatz MySolar24 (P) Ltd has signed PPA with Gujarat Urja Vikas Nigam Limited for supplying power from 15 MW Grid Connected PV based Solar Power Project.

2.4 LAND HISTORY AND REQUIREMENT

Land requirement for the installation of proposed 15 MW solar power project in Fatepur village is 105 acres. However, taking into account 30 acres land for future expansion, total land available with Dreisatz MySolar 24 Pvt. Ltd. is 135 acres. The total land required has already been purchased from private land owners on willing seller-willing buyer basis. Purchased land is shadow free and flat in nature. The site was used for seasonal agricultural purposes with mono-crop agricultural pattern. The vegetation at site comprised primarily of shrubs which will be cleared during site preparation activities. It was reported during consultations with local that there were no inhabitants on the land. Hence relocation of settlements was not required here.

Purchased land details and land requirements for setting up the plant is given in **Table 2.1 and Table 2.2** respectively. The layout for the proposed site is shown in **Figure 2.4**

TABLE 2-1: PURCHASED LAND DETAIL

Sl. No	Land Owners Name	Khasra Number	Area (Acres)
1	Sonabhai Thakor	236	6.50
2	Sonabhai Thakor	237	3.02
3	Gajabhai Somabhai Koli	238	7.15
4	Pasabhai Ghamecha	239	8.05
5	Mohanbhai Karsanbhai	240	10.32
6	Mohanbhai Karsanbhai	242	5.30
7	Kamsibhai Somabhai Koli	244	5.57
8	Javerben Savabhai; Lagrabhai Savabhai; Kalubhai Savabhai; Lakhabhai Savabhai; Mewiben Savabhai; Chandubhai Savabhai; Jhulubhai Savabhai; Kanubhai Savabhai; Vailiben Savabhai; Ratanben Savabhai; Jatanben Savabhai; Jemiben Savabhai	245	4.80
9	Liliben Vashrambhai; Bhavnaben Vashrambhai; Geetaben Vashrambhai; Hansaben Vashrambhai;	247	4.40
10	Gandabhai Varvabhai	248	9.05
11	Kesabhai Khodabhai Koli	249	4.50
12	Bhupatbhai Kanabhai; Zainabhai Kanabhai; Gulabhai Kanabhai; Sonaben Kanabhai; Kesarben Kanabhai	250	6.02
13	Rajuba Jhala; Ghanshyamsingh Jhala; Naransingh Jhala; Banesingh Jhala; Janakba Jhala	251	5.47

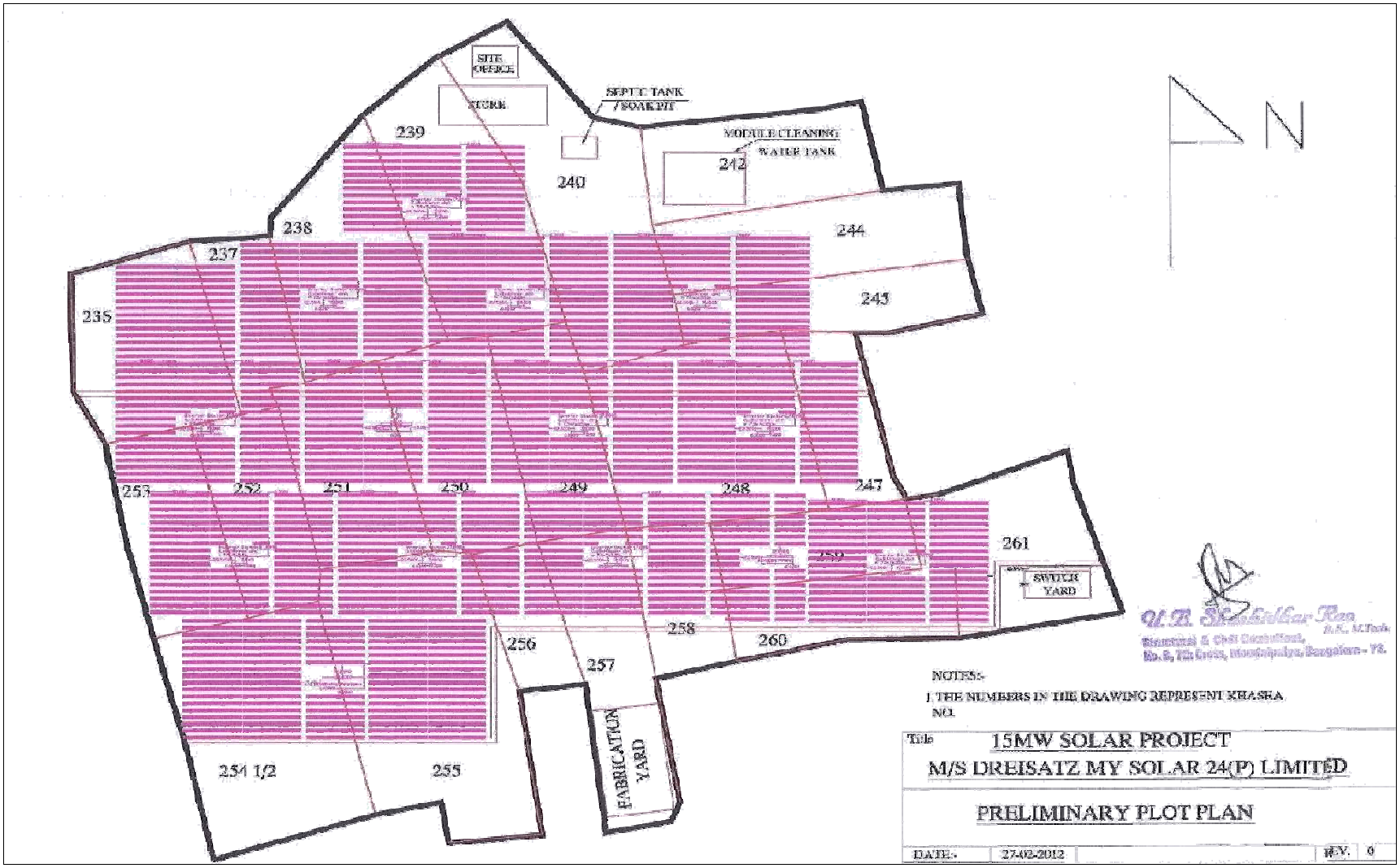
Sl. No	Land Owners Name	Khasra Number	Area (Acres)
14	Panchabhai Rabari	252	3.92
15	Ratanben Vershibhai; Mewabhai Vershibhai; Kalabhai Vershibhai; Dabuben Vershibhai; Jenabhai Vershibhai; Sona Vershibhai; Vasabhai Vershibhai	253	4.52
16	Dhaval Patel; Kishan Patel; Dipak Patel	254/1	4.84
17	Dhaval Patel; Kishan Patel; Dipak Patel	254/2	4.84
18	Dhaval Patel; Kishan Patel; Dipak Patel	255	10.52
19	Paluben Vasabhai Koli; Bagiben Jivabhai Koli; Kalubhai Jivabhai Koli; Dhanabhai Jivabhai Koli; Mewabhai Jivabhai Koli; Shardaben Jivabhai Koli; Rupaben Vasabhai Koli; Javerben Vasabhai Koli;	256	2.50
20	Mafabhai Dayabhai;	257	6.02
21	Jethabhai Motibhai; Vajubhai Motibhai; Chaganbhai Motibhai; Kadvibhai Motibhai; Moghiben Motibhai; Jhaluben Motibhai; Laxmiben Motibhai; Veeraben Motibhai; Ghaniben Motibhai	258	3.25
22	Okhabhai Karshanbhai; Bawabhai Karshanbhai; Shivabhai Karshanbhai; Kaliben Karshanbhai; Santokben Karshanbhai; Babiben Karshanbhai;	259	4.42

Sl. No	Land Owners Name	Khasra Number	Area (Acres)
23	Bababhai Amthubhai	260	3.75
24	Gandabhai Varvabhai; Aalabhai Varvabhai	261	6.25
		Total	135

TABLE 2-2: LAND REQUIREMENT FOR THE PROPOSED PROJECT

Sl. No.	Major Component/ Location	Land Required for One Item	No. of Component in the Plant	Area Required (m^2)
1	Modules in structures including pathways	80 m^2	1360	108,800
2	Pathways	3.6m width 6m width	66930 m length 1680	240,948 10,080
3	Inverter rooms (outer dimensions)	7.5 x 7.5	13	731.25
4	Branch Switch Gear room (outer dimensions)	20.5x 7.5 16 x 6.5	1 1	153.75 104
5	Pooling Switchgear room (outer dimensions)	30.5 x 9.5	1	289.75
6	66 kV Switch yard	30 x 20	1	600
7	Area around control rooms to avoid shading	56 x 24 m	14	18,816
8	Perimeter road	5 x 2700 m	-	13,500
9	Greenery			30878.61
	Total			4,24,901.36
	Total area required in acres (4047 sq.m/acre)			105 acres

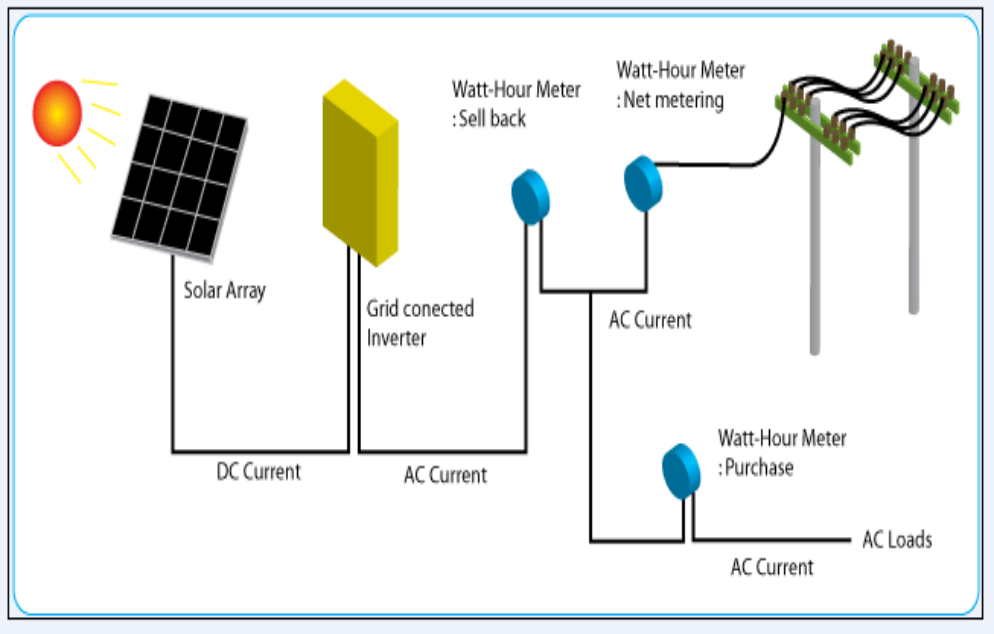
FIGURE 2-4: PROJECT SITE LAYOUT



2.5 TECHNOLOGY & DESIGN

The proposed solar power plant is of Grid connected system type, producing a large quantity of photovoltaic electricity in a single point. Schematic diagram of a Grid connected system is shown as in **Figure 2.5.**

FIGURE 2-5: GRID CONNECTED SYSTEM – BASIC SYSTEM DESIGN



The system consists mainly of the following:

- Solar PV array – which produces DC electricity when solar rays are incident on it.
- Power Conditioning Units (PCU) – These convert DC (Direct Current) electricity into AC (Alternating Current) electricity and facilitate synchronization with the grid power.
- Transformers – which transform the AC output of the Power Conditioning Units to the level required at the grid.

The Maximum Power Point Tracking (MPPT) circuit within the PCU extract the Maximum available power from the solar array and feeds it to the grid. If the grid voltage and / or frequency go out of the window, the PCU immediately isolates from the grid. The PCU will reconnect after a pre-determined time when the grid is back within the window. When the feed-in power is below a pre-determined level or when the solar insolation is below a selected value for a pre-determined period of time the PCU is isolated from the grid and is operated in sleep mode. This minimizes the stand by losses.

The 15 MW power systems circuit typically will consist of 27 numbers of 500 KW PCUs. Advantage of using a central inverter (instead of module oriented inverters) is that the module fields are less sensitive towards partial shading.

The AC power from the PCUs are fed into lower voltage panel and then to the transformers through isolators and circuit breakers. The secondary side of the final transformer is routed through a high voltage panel, fitted with necessary measuring and protection devices, before connecting to the grid.

A grid connected SPV power plant consist mainly of the following components:

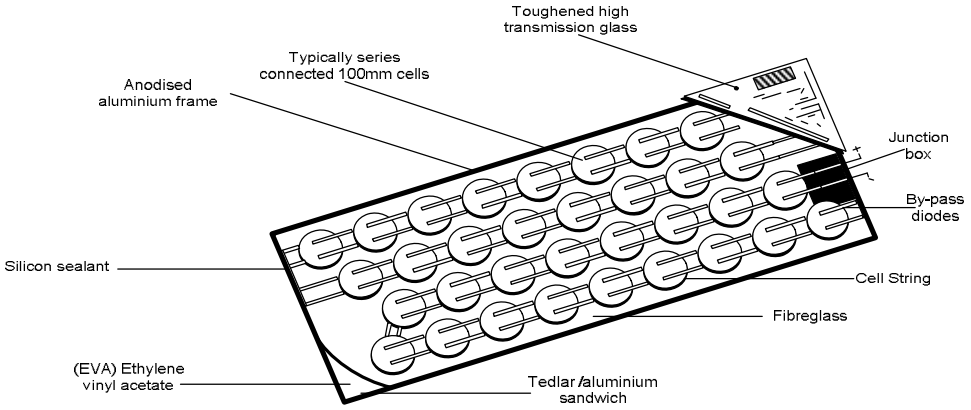
- Solar PV Modules
- Power Conditioning Units
- Module Mounting System
- Grid Connect Arrangements
- Monitoring Systems
- Cables and Connectors
- Control Room

Solar PV modules

The proposed Solar PV project will use fixed polycrystalline PV modules, south facing orientation, tilted 20° from the horizontal to maximise the total annual incident solar irradiation. The 15 MW solar PV plant has been configured into 14 modular plots, out of which 13 Nos. plot will comprise of 1.11 MWp of solar PV and two 500 kW inverters located at the centre of the each plot . There will be one plot with only one 500 kW inverter. The PV plant is designed for 4848 Nos. of modules in 202 strings connected to two 500 kW inverters forming a modular plot of 1.11MWp. Each inverter takes load of 101 strings This configuration is used to give a better system redundancy and economy for upstream project components.

The PV modules are electrically connected with cables sized to minimise DC ohmic losses. The DC electrical output from the PV modules is fed through solar PV grade cables to string monitoring junction boxes to inverters. The inverters convert the DC electrical output to AC.

Structure of PV Module



Advantage of fixed polycrystalline PV modules are given below:

- Reliability- Crystalline more reliable than Thin film
- Area required- Crystalline needs less area in comparison to thin film.
- O&M cost – Cost of maintenance is much more in thin film than crystalline
- The PV module configuration have been discussed below in **Table 2.3**

TABLE 2-3: PV MODULE CONFIGURATION

PV Module Configuration	Values
PV module	BYD 230P6-30
Module peak power	230Wp
Open-circuit voltage, Voc, (V)	36.83
Optimum operating voltage	29
Short-circuit current, Isc (A)	8.52
Optimum operating current	7.93 A
Maximum Power at STC	230 Wp
Operating temperature	-40 to +85 ^{0}C
Maximum system voltage	1000 V DC
System Design Parameters for each MW Plot	
Modules per string	24
Strings per inverter	101
Modules per inverter	2415
Modules per mounting structure	48
Modules in 15 MW plant	64128

Power Conditioning Units

The modules connected in series are known as strings. The strings are connected to the String Monitoring Units (SMUs) and the SMUs are connected to the PCUs which converts DC to AC power supply. The 15 MW power systems circuit typically will consist of 27 numbers of 500 KW PCUs.

Module Mounting System

The mounting structure is designed for holding designed number of modules in series. A fixed module mounting system of 20° inclination has been chosen for the PV plant. Fatepur lies in high damage risk zone with maximum wind speed in the range of 47 m/s. Load withstanding capacity of the PV module is to be verified for the maximum wind suction load on modules at 50 m/s at tilt of 20° and ensure the same is well within limits.

Transformer

The cable routes from inverter leads to the MV transformers stepping up voltage to 11kV. In order to achieve system redundancy at MV level, power output from a set of six modular plots will be combined to form a 11 kV bus bar synchronized panel. Two such combined bus bar panels are planned. The power from the plant shall be evacuated by stepping-up the power from 320 V to 66 kV in two stages, from LT to 11 kV and from 11 kV to 66 kV, through two nos. 11/ 66kV, 7.5 MVA transformers. Proposed 66 kV switchyard in the SPV plant premises will have double bay arrangement with two power transformers of 66 kV level with control and protection equipment.

Control Room

Switch gears in a central control room will receive the incoming feeders from the two 11 kV panels, one feeder from the thirteenth 11 kV panel and the 11 kV feeder from the 750 kV transformer. From the main control room, the 11 kV output is fed to two Nos. 11/66 kV, 7.5 MVA transformers and finally evacuated to the grid of 66kV through 66 kV switch gears/control panels.

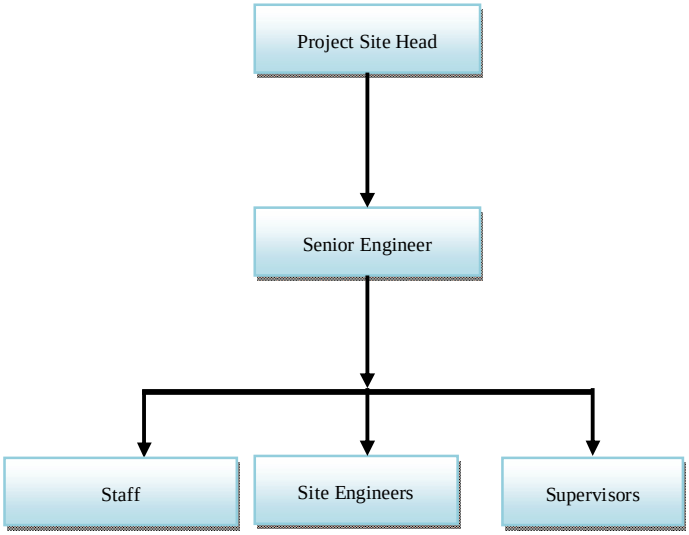
Power Evacuation

Power evacuated from the solar PV plant will be received at Dhama substation which is 5.07 Km away and owned and operated by Gujarat Energy Transmission Corporation Ltd. (GETCO). The point of interconnection and metering for the evacuated power will be within the PV plant premises.

Transmission line between the solar photovoltaic (SPV) plant and the GETCO sub-station shall be of double circuit conductor, and shall be taken through steel lattice towers suitable for double circuit conductors. Foundations, civil works and execution of work shall be in accordance with GETCO norms. The responsibility for the transmission system from the SPV switchyard shall be the responsibility of GETCO, as per their policy.

2.6 OPERATION AND MAINTENANCE

Depending on the O&M requirements the firm will make necessary arrangements for proper implementation of O&M.



During the commissioning of the plant, training will be imparted to the Engineer, Supervisor and Operators. The basis for the training will be according to the plant's O&M manual. This operational training will cover the following:

- The nature, purpose and limitations of all plant and equipment
- The detailed operating instructions on each section and equipment of the plant
- The emergency procedures and all related HSE issues according to the standards

2.7 DECOMMISSIONING PHASE

The proposed 15 MW solar power project includes solar panel, inverters, batteries, and transformer as electrical components along with solar modules foundation, access road, sanitation facilities, site office, and inverter rooms being identified as the civil structures. However with the end of the effective life cycle of the project i.e. 25 years the electrical and civil components will be decommissioned by the proponent to facilitate site restoration for agricultural and green area development.. Decommissioning activities will primarily involve only vehicular movement and operation of workforce limited to the vehicular transportation of solar panels, inverters etc and demolition of concrete structures/foundations.

2.8 MANPOWER

The proposed power plant will create direct employment opportunity for approximately 50 skilled, 4 high profile technical personnel and indirectly for 50 personnel.

2.9 UTILITIES AND INFRASTRUCTURE

Water

Ground water and water supply provided by Gujarat Government are the source of drinking water in Fatepur village. Study area including the proposed project site is water scarce area where ground water table found at approx. 350-400 ftbgl. Solar PV plant is direct conversion

technology so it does not require water during plant operation. Assuming a minimum of three litres of water per module, the water requirement for cleaning of the whole plant (64128 Nos.) and for other needs is estimated as approximately 1,92,384 litres. However, the cleaning of modules will be undertaken once in 4-5 days. In other words, the capacity of tank will be 192 m^3 (considering 4 days storage) which will work out to 48 m^3 (48,000 litres) of water per day.

Power

A minimal LT power is required for the project at the time of plant construction phase. As the installation time is limited, DMSPL use more manpower and machineries for timely completion of project. Estimated power requirement for project is 50 kW with maximum load of 35 KVA.

2.10 COST OF THE PROJECT

The proposed solar power project located at Fatepur village of Dasada tehsil, in Surendranagar district of Gujarat is a high yielding project because it is located in a hot climate with minimum rainfall. The Yield is expected to be around 25.56 million units per year. Based on the current rates of various equipment and construction costs, the approximate cost of a plant is around 9.5 crores per MW. The estimated total cost for setting up the proposed project is Rs. 142 crores. The major cost is for land and equipment which constitutes more than 85% of the cost.

2.11 IMPLEMENTATION SCHEDULE

It is expected that the 15.0 MW solar photovoltaic power plants will be commissioned by October 2012

3 Social and Environmental Compliance Requirements

This section describes the regulations, statutory guidelines and obligatory standards that are applicable to the social and environmental performance of the proposed project.

3.1 NATIONAL REGULATIONS

The environmental and safety related national regulations that are applicable to solar power plants are discussed below.

TABLE 3-1: APPLICABLE ENVIRONMENTAL, HEALTH, SAFETY & SOCIAL REGULATION

Sl. No	National Env., Health & Safety Regulation	Requirement	Applicability
1	The Air (Prevention & Control of Pollution) Act 1981	The Air Act prohibits any person from establishing or operating any industrial plant in an air pollution control area, without previous consent of the State Pollution Control Board. Under the above Act, industries are mandatorily required to apply for Consent to Establish and Consent to Operate from the State Pollution Control Board (also called No Objection Certificates). The State Boards are responsible for granting and renewing the consents and are empowered to revoke such permits and order closure of a project in case of non-compliance with the provisions of these Acts and/or the general or specific consent conditions. Any Establishing or Operating Industrial Plant is required to ensure under the Act, that the emissions from the activities within the plant site comply with the Specific Emissions Standard as laid down by Central Pollution Control Board as part of the Act. As per the Industry Classification published by the Gujarat Pollution Control Board, solar power projects are classified as Other Category industries requiring Consent to Establish from the Pollution Control Board.	During Pre-construction, Construction & Operation Phase. CTE is applicable for the establishing project while CTO is applicable for the Operation Phase of the project. However the project being PV solar projects, no air pollution is anticipated. CTE for the proposed project has been obtained vide letter no. GPCB/NOC/SRN-523/ID-20401/425.dated 3rd May 2012.
2	The Water (Prevention & Control of Pollution) Act 1974	The Water Act prohibits any person from knowingly causing or permitting any poisonous, noxious or polluting matter,	During Pre-construction, Construction &

Sl. No	National Env., Health & Safety Regulation	Requirement	Applicability
		determined in accordance with standards laid down by the State Board, from entering directly or indirectly into any stream or well or sewer or on land; It also prohibits any person from knowingly causing or permitting to enter into any stream any other matter which may tend, either directly or in combination with similar matters, to impede the proper flow of the water of the stream in a manner leading or likely to lead to a substantial aggravation of pollution due to other causes or of its consequences. Under the above Act, industries are mandatorily required to apply for Consent to Establish and Consent to Operate from the State Pollution Control Board (also called No Objection Certificates). The State Boards are responsible for granting and renewing the consents and are empowered to revoke such permits and order closure of a project in case of non-compliance with the provisions of these Acts and/or the general or specific consent conditions. As per the Industry Classification published by the Gujarat Pollution Control Board, solar power projects are classified as Other Category industries requiring Consent to Establish from the Pollution Control Board.	Operation Phase. CTE is applicable for the Construction Phase; while CTO is applicable for the Operation Phase
3	Water (Prevention and Control of Pollution) Cess Rules, 1978	These Rules specify manner of payment of the cess to the Central Government and the time within which it shall be paid respectively in case the water consumption is more than 10 KL/day. These Rules specify places where the meters are to be affixed.	Operation stage.
4	The Environmental (Protection) Act 1986 and Rules	This Act is an umbrella legislation designed to provide a framework for the coordination of Central and State Pollution Control Boards established under the Water (Prevention and Control of Pollution) Act 1974 and Air (Prevention and Control of	Both During Pre-construction, Construction & Operation Phase.

Sl. No	National Env., Health & Safety Regulation	Requirement	Applicability
		Pollution) Act 1981. Under the powers conferred by this Act, the central government has formulated a set of Rules known as the Environment (Protection) Rules and published Notifications directed at the following aspects: • *Restricting and prohibiting new, expansion and modernization projects activities on their potential environmental impacts;* • *Regulating the location of industries and the carrying on of processes and operations in different areas.* • *Setting standards for air emissions, waste water discharges, and hazardous waste management;* • *Setting standards for the ambient air quality and ambient noise levels, and* • *Protection of public health and welfare.*	
5	Environmental Impact Assessment (EIA) Notification 2006, MoEF Office Memorandum dated 13th May 2011 & 30th June 2011	The EIA Notification 2006 and thereafter the MoEF Office Memorandum dtd. 13th May '11 exempts PV solar power projects from obtaining prior Environmental Clearance from the regulatory authorities Hence regulatory Environmental Impact Assessment is not required for solar power projects. Further in accordance to the provisions of MoEF office memorandum dated 30th June 2011 depending upon the extent of land required the project proponent may be required to obtain necessary commitment from competent authority for availability the requisite quantity of the water for the project and no change of land use will be permitted without permission from competent authority.	EIA is not applicable for the project under the provision of the 13th May'11 office memorandum. Under the provision of the MoEF office memorandum dated 30th June'11, requisite commitment/permissio n is required to obtain from competent authority for water and land usage.
6	Environment (Protection) Seventh	The Rules stipulates National Ambient Air Quality Standards (NAAQS) for ambient	Construction phase

Sl. No	National Env., Health & Safety Regulation	Requirement	Applicability
	Amendment Rules 2009 on AAQ standards	concentrations of air pollutants (such as particulate matter, sulphur dioxide, nitrogen oxide, carbon monoxide, hydrocarbon etc.) for industrial, commercial, residential and ecologically sensitive areas	
7	Noise (Regulation and Control) Rules 2000 amended in 2010	The Rules stipulate ambient noise limits during day time and night time for industrial, commercial, residential and ecologically sensitive areas. Under this Rules, Areas/ Zones have been categorized into industrial, commercial, residential or silence areas/zones for the purpose of implementation of noise standards. The ambient air quality standards for noise specified in the Schedule need to be complied with. An area comprising not less than 100 meters around hospitals, educational institutions and courts is declared as silence area/zone for the purpose of these rules.	Construction Phase
8	Wild life (Protection) Act , 1972 & Supreme Court Writ Petition No 460 of 2004 dated 4th Dec'2006	The little Rann of Kachchh is declared as wildlife sanctuary Gujarat State Gazette Notification dated 22nd February 1973 under provisions of the Wild Life Protection Act 1972. The application of the Order of the Hon'ble Supreme Court in W.P 460 of 2004 dated 04.12.2006 in the matter of Goa Foundation v. Union of India and other wherin the Hon'ble Supreme Court has directed that all projects which require environmental clearance and are located within the distance of 10 km of National Park and Sanctuaries must be placed before the Standing Committee of the National Board for Wildlife constituted under the Wildlife (Protection) Act, 1972.	The proposed project is located less than10km of Wild Ass sanctuary for which necessary NOC has been obtained from PCCF, Department of Forest, Gujarat vide letter no. VPS/32/K/145-148/2012 -13, dated 9th May 2012.

Sl. No	National Env., Health & Safety Regulation	Requirement	Applicability
	Forest Conservation Act, 1980	Use of any forest land for non forestry purposes needs to get approval from Government of India, Ministry of Environment & forests	Not applicable as project does not involve any diversion of forest land for project purposes and therefore no Forestry Clearance is required.
9	Hazardous Waste (Management, Handling and Trans-boundary Movement) Rules 2008	These Rules outline the responsibilities of the generator, transporter and recycler/re-processor of the hazardous wastes for handling and management in a manner that is safe and environmentally sound.	Not applicable as no Hazardous Waste generation is expected during operation of the solar PV power plant.
10	The Building and Other Construction Workers' (Regulation of Employment and Conditions of Service) Act 1996	This Act provides for the safety, health and welfare measures of building and construction workers in every establishment which employs or employed during the preceding year ten or more such workers. These measures include fixing hours for normal working day, weekly paid rest day, wages for overtime, provision of basic welfare amenities like drinking water, latrines, urinals, crèches, first aid, canteens, etc. and provision of temporary living accommodation within or near work site. This Act also requires application of the following: • *Building and Other Construction Workers' (Regulation of Employment and Conditions of Service) Central Rules 1998* • *Workmen's Compensation Act, 1923 to building and other construction workers.*	Construction Phase
11	Central Electricity Authority (Safety Requirements for Operation, Construction and	This regulation lays down broad safety requirements for construction, operation and maintenance of electrical plants and electric lines, which includes development and implementation of a safety management	Construction & Operation Phase

Sl. No	National Env., Health & Safety Regulation	Requirement	Applicability
	Maintenance of Electric Plants and Electrical Lines) Regulations 2008	system.	
12	Workmen's Compensation Act, 1923 & Rules 1924	The Act gives requirements related to employer's liability of compensation to any personal injury caused to a workman by accident in the course of his employment. The Act also gives a framework for calculating amount of compensation and wages. Notice of accidents resulting in death or serious bodily injury is required to be given to the government. The Rules give provisions for application and review of compensation after death or serious injury of a workman at site or on duty. The reporting of accidents needs to be done in prescribed forms. The Rules give the procedures for the handling of claims.	Construction & Operation Phase
13	Employers' Liability Act No. 24 of 1938	The employer needs to maintain all the works, machinery or plant connected with or used in his trade or business, in good and safe condition to avoid personal injury to any workman, who may sue for damages in respect of the injury. A contract of service or apprenticeship cannot limit any liability of the employer in respect of personal injuries caused by negligence.	Construction & Operation Phase
14	The Contract Labor (Regulation and Abolition) Rules, 1971	The Contract Labour (Regulation and Abolition) Act, 1970 requires every principal employer of an establishment to make an application to the registering officer in the prescribed manner for registration of the establishment. The Act and its Rules apply to every establishment in which 20 or more workmen are employed or were employed on any day on the preceding 12 months as contract labor and to every contractor who employs or who employed on any day of the preceding 12 months, 20 or more workmen.	Construction Phase

Sl. No	National Env., Health & Safety Regulation	Requirement	Applicability
		It does not apply to establishments where the work performed is of intermittent or seasonal nature. An establishment wherein work is of intermittent nature will be covered by the Act and Rules if the work performed is more than 120 days in a year, and where work is of seasonal nature if the work is performed more than 60 days in a year. Contractors must also be licensed. The Rules specify the manner of making application for registration of establishment and applying for a contractor license. The Rules also make specific provisions mandatory for welfare and health of Contract Labour (such as making a sufficient supply of wholesome drinking water, the minimum number of latrines, washing facilities, and the types of first aid supplies available, and providing rest rooms and canteens at establishments where workers will be living onsite for 3 months or more). The Rules also specify the requirements for maintaining registers, records, and statistics.	

3.2 SOCIAL AND ENVIRONMENTAL PERFORMANCE STANDARDS OF THE INTERNATIONAL FINANCE CORPORATION

The International Finance Corporation has laid down a set of eight Performance Standards that the project developers, who receive debt or equity funding from the agency, need to comply with. The first Performance Standard requires the project developer to conduct a Social and Environmental Assessment of a proposed project at an early stage of project planning to safeguard against the potential risks and impacts described in the Performance Standards. The provisions of the Performance Standards relevant to solar power projects are summarized below:

- ***Performance Standard 1 on Assessment and Management of Environmental and Social Risks and Impacts*:**

  Apart from requiring a Social and Environmental Impact Assessment study for a proposed project to assess potential risks and impacts described in the Performance Standards, this Standard also requires that the project proponent should disclose the details of the project to all the stakeholders and understand their views and concerns regarding the project. This Standard also requires that the project proponent should conduct consultations with focused groups or individual stakeholders if required during any time of the project.

- ***Performance Standard 2 on Labour and Working Conditions:***

  This Performance Standard requires that the project proponent should ensure fair terms of employment and wages for the labours, even when they are hired by sub-contractors, which should comply with the national labour laws. The project proponent should provide the workers with a safe and healthy workplace environment by identifying the physical hazards and safety risks associated with the project activities and by taking steps to completely prevent or minimize the causes, as far as reasonably practicable, of accidents, injury, and disease arising due to such work-related hazards.

- ***Performance Standard 3 on Resource Efficiency and Pollution Prevention:***

  This Performance Standard outlines a project approach to promote sustainable use of resources (including energy and water), pollution prevention and abatement in line with internationally disseminated technologies and practices. It requires that the project proponent should design, construct, operate and decommission a project with adequate consideration of the ambient environmental conditions in the project area and should apply pollution prevention and control technologies and practices that are best suited to avoid or, where avoidance is not feasible, minimize or reduce adverse impacts on human health and the environment while remaining technically and financially feasible and cost-effective.

- ***Performance Standard 4 on Community Health, Safety and Security:***

  This Performance Standard requires that the project proponent should evaluate the risks and impacts to the health and safety of the affected community during the design, construction, operation, and decommissioning of the project and establish preventive or mitigation measures to address them. Where the project poses risks to or adverse impacts on the health and safety of affected communities, the project proponent should disclose the planned preventive or mitigation measures and any other relevant project-related information to enable the affected communities and relevant government agencies to understand these risks and impacts. The project proponent should also avoid or minimize adverse impacts due to project activities on soil, water, and other natural resources in use by the affected communities. When the project proponent directly retains employees or contractors to provide security to safeguard its personnel and property, it should assess risks to those within and outside the project site posed by its security arrangements.

- ***Performance Standard 5 on Land Acquisition and Involuntary Resettlement:***

  This Performance Standard requires that the project proponent should avoid or at least minimize involuntary resettlement wherever feasible by exploring alternative project designs; mitigate adverse social and economic impacts from land acquisition or restrictions on affected persons' use of land by providing compensation for loss of assets at replacement cost; and ensure that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected. The proponent should improve or at least restore the livelihoods and standards of living of displaced persons and improve living conditions among displaced persons.

- ***Performance Standard 6 on Biodiversity Conservation & Sustainable Management of Living Natural Resources:***

  This Performance Standard requires that the project proponent should protect and conserve biodiversity by preventing destruction or damage to wildlife habitats, prevent violation or disturbance of protected areas, and respect the values attached to biodiversity by specific stakeholders.

- ***Performance Standard 7 on Indigenous Peoples***:

  This Performance Standard requires that the project proponent should respect and preserve the culture, knowledge and practices of Indigenous Peoples (known as Scheduled Tribes in India); avoid adverse impacts of projects on communities of Indigenous Peoples or when avoidance is not feasible, should minimize, mitigate, or compensate for such impacts; provide opportunities for development benefits in a culturally appropriate manner; and when projects are to be located on traditional or customary lands under use by the Indigenous Peoples, foster good faith negotiation with them.

- ***Performance Standard 8 on Cultural Heritage:***

  This Performance Standard requires that the project proponent should protect areas and structures of cultural heritage (such as tangible property and sites having archaeological, paleontological, historical, cultural, artistic, and religious values, as well as unique natural environmental features that embody cultural values, such as sacred groves) from the adverse impacts of project activities and extend support in their preservation.

3.3 EQUATOR PRINCIPLES

The Equator Principles comprises of a group of ten principles adopted by the Equator Principle Financial Institutions (EPFIs) in order to ensure that the projects funded by them are developed in a manner that is socially responsible and reflect sound environmental management practices. The Principles strives towards avoidance of negative impacts on project-affected ecosystems and communities where possible, and in case unavoidable, need to be adequately reduced, mitigated and/or compensated. Considering that the proposed project is likely to be financed by EPFIs it is necessary for the proponent to adopt and adhere to these Principles which serve as environmental and social safeguards thereby offering significant benefit to the proponent, financial institutions and the local stakeholders. The applicability of each of the principles with respect to the proposed project has been discussed below:

- ***Principle 1: Review and Categorisation***

When a project is proposed for financing, the EPFI will, as part of its internal social and environmental review and due diligence, categorise such project based on the magnitude of its potential impacts and risks in accordance with the environmental and social screening criteria of the International Finance Corporation (IFC). Based on the IFC environmental and social screening criteria the proposed solar PV project is identified as a "Category B" project with potential limited adverse social or environmental impacts that are few in number, generally site-specific, largely reversible and can be readily addressed through mitigation measures.

- ***Principle 2: Social and Environmental Assessment***

Under the provision of this Principle it is required by the proponent for all Category A and B project to conduct a Social and Environmental Assessment process to address, as appropriate and to the EPFI's satisfaction, the relevant social and environmental impacts and risks of the proposed project. The Assessment should also propose mitigation and management measures relevant and appropriate to the nature and scale of the proposed project. In line with requirement of Principle 2 the proponent of the proposed solar PV project has undertaken an Environmental and Social Impact Assessment study to identify, assess, evaluate and mitigate the potential environmental and social risks.

- ***Principle 3: Applicable Social and Environmental Standards***

This Principle requires the Environment & Social Assessment to refer to the applicable IFC Performance Standards and the then applicable Industry Specific EHS Guidelines including the project's overall compliance with, or justified deviation from, the respective Performance Standards and EHS Guidelines. The Assessment process also needs to address compliance with relevant host country laws, regulations and permits that pertain to social and environmental matters. A similar exercise has been carried out for the proposed solar PV project and has been discussed in detail in section 3.1 and 3.2 of this report.

- ***Principle 4: Action Plan and Management System***

For all Category A and Category B projects an Action Plan (AP) need to be prepared which addresses the relevant findings, and draws on the conclusions of the Assessment. The AP will describe and prioritise the actions needed to implement mitigation measures, corrective actions and monitoring measures necessary to manage the impacts and risks identified in the Assessment. In this regard the borrower /proponent need to maintain or establish a Social and Environmental Management System that addresses the management of these impacts, risks, and corrective actions required to comply with applicable host country social and environmental laws and regulations, and requirements of the applicable Performance Standards and EHS Guidelines, as defined in the AP. Hence in accordance to the provision of this Principle an Environmental & Social Management Plan has been drawn up as part of the ESIA study for the proposed project specifying appropriate plans and procedures which requires to be implemented during various phases in order to prevent, control and mitigate any potential environmental and social risks. For further details please refer to chapter 6 of this document.

- ***Principle 5: Consultation and Disclosure***

According to this Principle it is required that for all Category A and, as appropriate, Category B projects the government, borrower or third party expert has consulted with project affected communities in a structured and culturally appropriate manner. For projects with significant adverse impacts on affected communities, the process will ensure their free, prior and informed consultation and facilitate their informed participation as a means to establish, to the satisfaction of the EPFI, whether a project has adequately incorporated affected communities concern.

Given the proposed project is rated as "Category B" with no potential adverse impacts on communities it does not necessitate the formulation of a Public Consultation & Disclosure Plan. However in consistent with the requirement of this Principle the proponent through an external consultant have undertaken social consultation with land losers and nearby village representatives to establish the socio-economic condition of the area at the same time try to understand any community concern that may be associated with the proposed project

particularly related to loss of land, livelihood, resource requirement etc. For further details please refer to section 5.2 of this document.

- ***Principle 6: Grievance Mechanism***

For all Category A and, as appropriate, Category B projects it need to be ensured by the proponent that consultation, disclosure and community engagement continues throughout construction and operation of the project and community concerns/grievances addressed through establishing a Grievance Redressal Mechanism. In this regard the proponent of the proposed solar PV project need to develop and implement a Grievance Redressal Mechanism (GRM) to receive and facilitate resolution of any concerns and grievances that may be raised by land loser groups and/or nearby village communities during both construction and operation phase of the project. As part of this Principle it is also imperative that the proponent maintains regular dialogue with such communities through implementation of focused CSR programs/initiatives.

- ***Principle 7: Independent Review***

In accordance to the provision of this Principle, an independent social or environmental review need to be undertaken by an external expert of the solar PV project ESIA, ESMP, legal/permit documents (CTE/CTO) and consultation process documentation in order to assist EPFI's due diligence, and in order to assess Equator Principles compliance.

- ***Principle 8: Covenants***

Under this Principle the proponent of the proposed solar PV project is required to covenant in financing documentation to ensure compliance with all applicable national environmental, health, safety and social laws and regulations; demonstrate compliance to environmental and social management plans and procedures drafted as part of the ESIA study; carry out periodic reporting to EPFIs on compliance to the national EHSS regulations and ESMP; and undertake decommissioning of facilities viz. solar panels etc in accordance with an agreed decommissioning plan.

- ***Principle 9: Independent Monitoring and Reporting***

To ensure ongoing monitoring and reporting of the environmental and social performance of the proposed solar PV project over the life of the loan, the EPFIs may require the project proponent to hire an independent environmental and/or social expert or retain qualified and experienced external experts to verify its monitoring information which would be shared with EPFIs.

- ***Principle 10: EPFI Reporting***

This Principle is particularly applicable for EPFIs under which each EPFI is committed to report publicly at least annually about its Equator Principles implementation processes and experience, taking into account appropriate confidentiality considerations.

4 Description of Environment

This chapter describes the existing environmental settings of the project site located in north Surendranagar district and its immediate surroundings. This includes the physical environment comprising air, water and land components, the biological environment, and socio-economic environment.

4.1 THE PHYSICAL ENVIRONMENT

Proposed project site is located in north Surendranagar district (herein referred as area of interest) near little Runn of Kutch and physiographically this region can be categorised into western alluvial plains as shown in **Figure 4.1** *(Source: State Environment Action Plan, Gujarat Ecology Commission).* Based on physiography, Gujarat can be divided into three distinct geographical units namely, mainland of Gujarat, Peninsular Gujarat (Saurashtra) and Kutch. The project area is featuring at the boundary of two physiographic regions – western alluvial plains in the east and the Kutch region on the west.

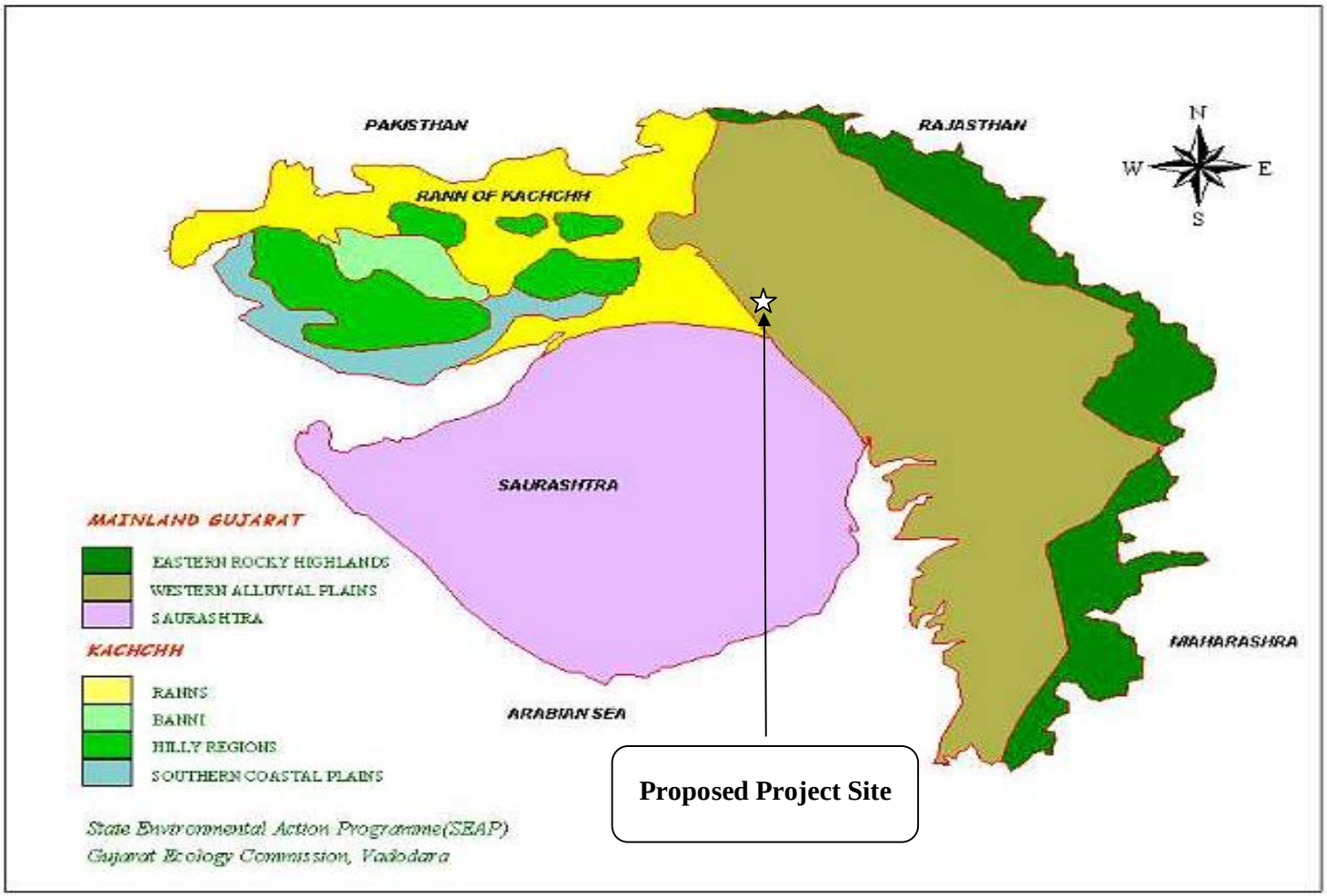
4.2 CLIMATE & METEOROLOGY

Gujarat, being located on the Tropic of Cancer, falls in the sub tropical climatic zone. A large part of the state lies between 35 ^{o}C and 45 ^{o}C isotherms. This state is influenced by three types of climate viz. Arid, semi-arid and sub- humid. Northern part of the state where proposed project site is located is characterized by arid climatic condition. March onwards the temperature starts rising till it reaches the maximum, as high as 45 ^{o}C while January is the coldest month when maximum temperature never exceeds 30 ^{o}C and the minimum temperature remain around 8 ^{o}C to 10 ^{o}C. This region receives maximum of rainfall from southwest monsoon during the period between June and September with its maximum intensity in months of July and August. The rainfall gradually decreases from south to north Gujarat. North Surendranagar, being the location of proposed project site is an area of interest which receives annual rainfall of approx. 300 - 400 mm. The relative humidity in all the part of state is low, although in coastal area it is moderately high. The winds are generally of light to moderate intensity. However, intensity increases from during the late summer and monsoon season. Prevailing wind direction in Gujarat is from west or southwest during the monsoon months and NE to NW from October to April.

As the Radhanpur is the nearest available monitoring station of IMD and located at approx. 45 km North from the proposed project site, secondary meteorology data of Radhanpur has been referred to understand the meteorology profile in the area of interest:

Temperature: Northern part of the Surendranagar district has a hot semi-arid climate along with three main seasons: summer, monsoon, and winter. During the summer (March – June) the average temperature varies from 27 ^{o}C to 41 ^{o}C while in winter (November – February), temperature varies within range of 10 °C – 32 °C.

FIGURE 4-1: PHYSIOGRAPHIC REGION OF GUJARAT



Rainfall: The southwest monsoon in the area brings a humid climate from mid-June to mid-September. The average annual rainfall is about 418 mm, but infrequent heavy torrential rains cause local rivers to flood and it is not uncommon for droughts to occur when the monsoon does not extend.

Wind Speed and Direction: Wind speed and direction data for the Radhanpur has been obtained from Climatological table of Observatories in India (1951-1980) and shown in meteorological summary (refer **Table:4.1**) and **Figure 4.2 – 4.3**

TABLE 4-1: METEOROLOGICAL SUMMARY AT RADHANPUR IMD STATION

Month	Total rainfall (mm)	Predominant wind direction		Mean wind speed (Kmph)	Relative Humidity %		Mean Temp.	
		08:30 hrs IST	*17:30 hrs IST*		*08:30 hrs IST*	*17:30 hrs IST*	*Max (^oC)*	*Min (^oC)*
January	2.3	N	N	6.5	60	37	27.2	10.0
February	0.7	NE	NW	6.3	60	34	30.4	12.5
March	5.3	SW	W/NW	6.6	58	28	35.2	17.0
April	0.1	NW	W	7.4	62	30	39.3	21.9
May	1.7	SW	SW	11.7	70	29	41.6	24.8
June	32.3	SW	SW	15.3	78	46	38.6	26.6
July	152.0	SW	SW	13.5	85	63	34.4	25.3
August	97.2	SW	SW	10.8	86	65	33.1	24.2
September	105.1	SW	SW	7.5	82	58	34.3	23.6
October	4.7	SW	SW	5.0	67	39	36.3	20.7
November	1.2	NE	N	5.3	56	38	32.9	15.9
December	10.1	NE	N	6.1	62	40	29.1	11.7
	418.9	**SW**	**SW**	**8.5**	**69**	**42**	**34.4**	**19.5**

Predominant wind direction during the monitoring period i.e. April in the area of interest was observed as NW (refer **Table 4.1**), which has been further substantiated by meteorology data given above.

Wind Speed: During the study period wind speed was observed as 7.4 kmph, whereas, annual average and highest wind speeds was observed as 8.5 kmph and 15.3 kmph (in the month of June).

FIGURE 4-2: WINDROSE – PREDOMINANT WIND DIRECTION DURING STUDY PERIOD - MORNING (0830 HRS)

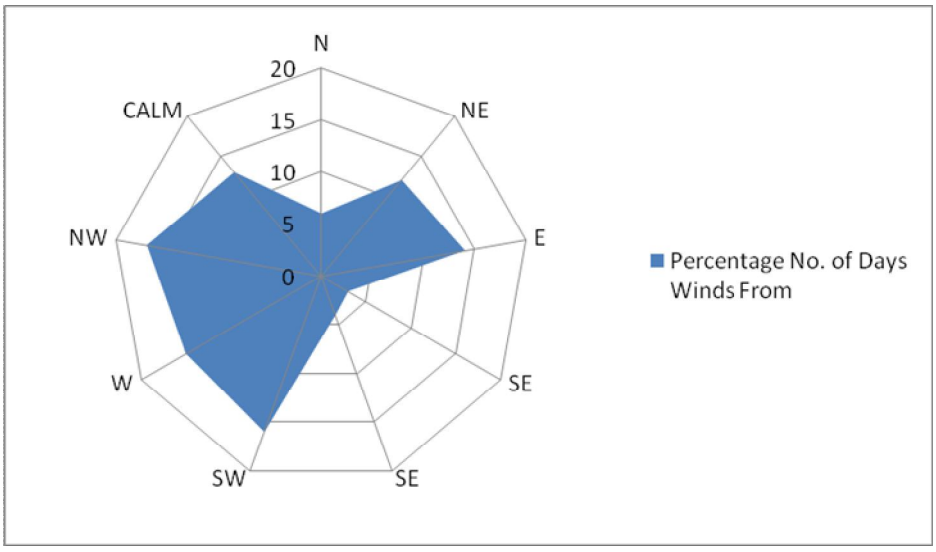
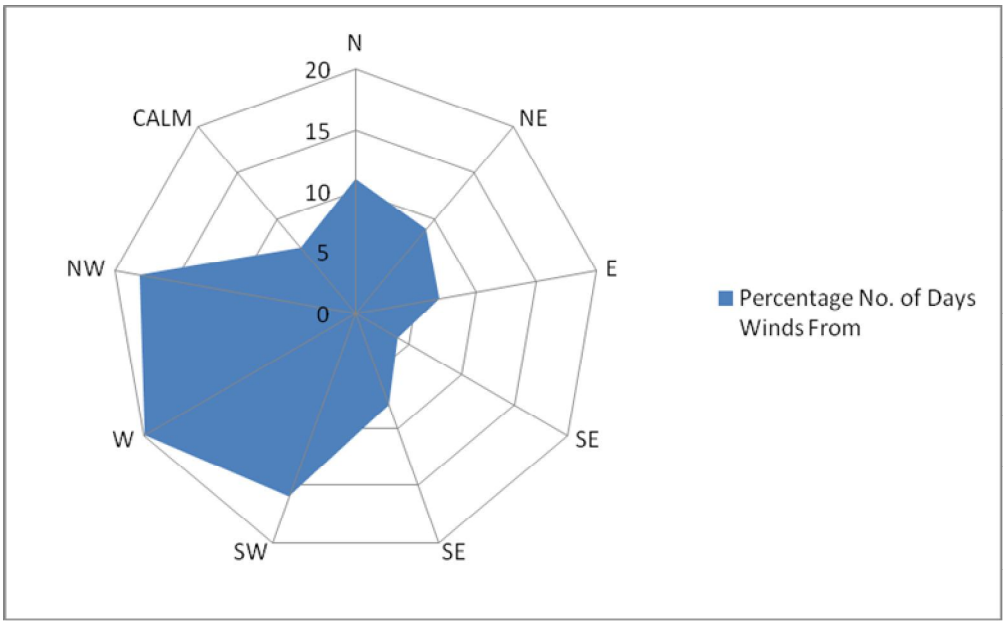


FIGURE 4-3: WINDROSE – PREDOMINANT WIND DIRECTION DURING STUDY PERIOD - EVENING (0830 HRS)



4.3 AMBIENT AIR QUALITY

The objective of the ambient air quality monitoring during an environmental impact assessment study for a solar project is to record the baseline ambient air quality in the area prior to project and identify any current sources of air pollution which could become a liability to the proposed project. Three sites were selected at nearest settlement in Fatepur and Dhama villages for ambient air sampling, monitoring result of which is given in **Table 4.2.** All the monitoring locations are located within the 5 km from the project site in downwind direction (South east). The monitoring locations are provided in **Figure 4.4.**

TABLE 4-2: AMBIENT AIR QUALITY MONITORING RESULT

Locations	Sampling Stations	PM_{10} $\mu g/m^3$	$PM_{2.5}$ $\mu g/m^3$	SO_2 $\mu g/m^3$	NOx $\mu g/m^3$	CO mg/m^3
AQ1	Fatepur Village, Near Primary School's Terrace	53.41	21.42	5.51	23.34	BDL
AQ2	Fatepur Village, Sonabhai's House Terrace	54.18	16.66	BDL	16.36	BDL
AQ3	Dhama Village, Nanjibhai's House	72.29	32.53	6.69	27.62	BDL
NAAQ Standards		**100 (24 hrs)**	**60 (24 hrs)**	**80 (24 hrs)**	**80 (24 hrs)**	**2000 (8 hrs)**

Note: Air Monitoring was conducted between 17/04/2012 to 28/04/2012
BDL-Below Detection Limit

Interpretation of air monitoring results

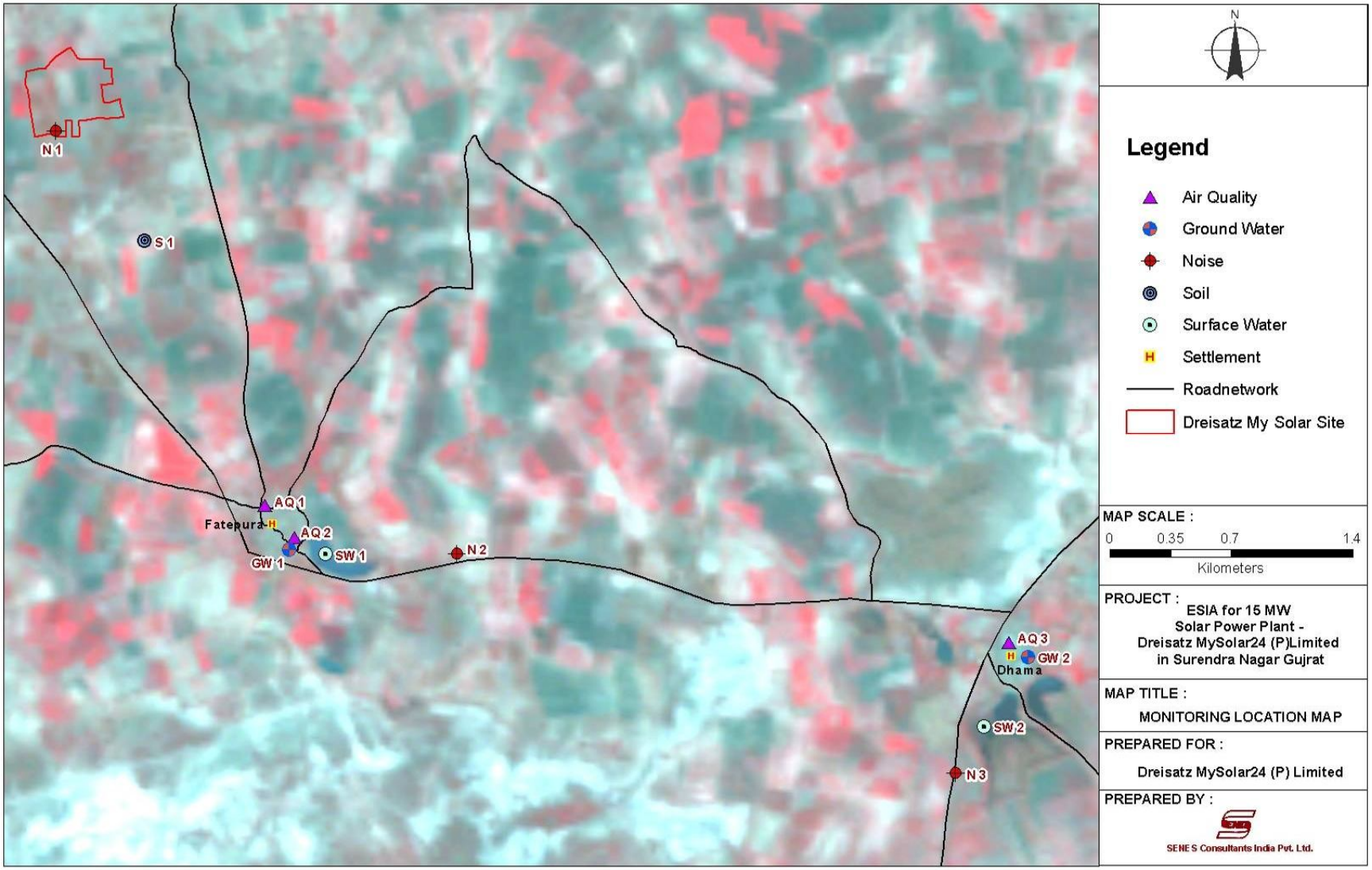
The air sampling data revealed that PM_{10} values at Fatepur and Dhama villages ranged between 53.41 – 72.29 $\mu g/m^3$ whereas PM $_{2.5}$ values falls within the range of 16.66 – 32.53 $\mu g/m^3$. Both PM_{10} and $PM_{2.5}$ values were below the limit of NAAQ standards.

The SO_2 and NOx values for both villages were well within the NAAQ standards, with maximum value of SO_2 recorded as 6.69 $\mu g/m^3$ while the maximum value of NOx was 27.62 $\mu g/m^3$. Low values for SO_2 and NOx can be attributed to the rural setting, low vehicular movements and less industrial activities in the study area.

The CO values for all three locations were found to be below detectable limits.

The air sampling data revealed that values of PM_{10} , PM $_{2.5}$, SOx , NOx and CO parameters at all the monitoring locations i.e. AQ1, AQ2, and AQ3 are well within the limit of NAAQ standards.

FIGURE 4-4: MONITORING LOCATION MAP IN THE STUDY AREA



4.4 AMBIENT NOISE QUALITY

The ambient noise monitoring was carried out in the month of April 2012 (pre-monsoon season) at three locations, out of which two location were in Fatepur village and one location is in Dhama village. The noise monitoring network was established based on the understanding of the project activities during various phases of project and surrounding features including nearby settlement. The location of ambient noise quality station has been represented in the **Figure 4.4.**

Sound pressure level (SPL) measurement in dB (A) were recorded for every hour continuously for 24 hours for the aforesaid monitoring station and equivalent noise levels in the form of Leq day and Leq night were computed. The result so obtained was compared with the standard specified in schedule III, Rule 3 of the Environmental Protection Rules. The equivalent (Leq) day and night noise levels calculated for the monitoring locations is presented in **Table 4.3.**

TABLE 4-3: NOISE QUALITY MONITORING RESULT

Noise Monitoring Locations	Day Time Noise dB (A)		Night Time Noise dB (A)	
	Leq (day)	***Standard***	***Leq (night)***	***Standard***
Project Site (N1)	51.5	55	41.5	45
Way to Fatepur village (N2)	61.5	55	49.9	45
Way to Dhama village (N3)	61.8	55	51.1	45

Interpretation of noise monitoring results

The equivalent noise level for day and night period at monitoring locations N2 and N3 were found to be above the stipulated noise standards specified for the day and night time in residential area. On other side, noise level at project site is below the stipulated standards.

The low noise levels at project site may be typically attributed to rural settings with low vehicular movement. Whereas, high noise level in way to Fatepur village and way to Dhama village may be due to the high vehicular movement on the nearby road.

4.5 TOPOGRAPHY

The proposed project area is characterized by flat terrain (refer Photograph 4.1) with an average elevation of 11 meter above mean sea level. The general slope of the site is from East to West i.e. towards little Runn of Kutch. Although, major river is absent within 5 km from project site, however, a seasonal drain known as Kharwa ka Nala is present in north direction at approximate distance of 500 m from the site which gets filled up during the monsoon season and ends in little Runn of Kutch. Fatepur is the nearest villages from project site, located at approximately 1.5 Km in southwest direction.

Photo 4-1: Topography of the Area

4.6 GEOLOGY AND SOILS

The study area is part of north Gujarat alluvial plain and falls in north Surendranagar district. Geomorphologically, alluvial plains of Gujarat form the median part of mainland Gujarat and extend from Narmada River in south to the Luni River in north. This plane shows a gradual slop from ENE to WSW and falls in altitude range of 150 m to almost sea level. Geologically, alluvial plain are made up of a thick pile of unconsolidated sediments deposited by a combination of fluvial and Aeolian agencies during the Quartnerary period. Rocks in the Gujarat belongs to formations ranging in age from the oldest precambrian to recent. Major geological events of Gujarat are confined to Mesozoic and Cenozoic eras. Geological evolution of Gujarat initiated in the Triassic with the break up of Gondwana land and the subsequent geological history is related to the northward drift of the Indian subcontinent. Surface soil in study area (alluvial plains) belongs to inceptisols order. Inceptisols are derived from balastic, granitic, gneissic and alluvial parents characterized by dark grey to light grey, reddish brown, yellowish red and dark reddish brown color and suitable for the cultivation of cotton, which is the major crop of the area.

According to Geotechnical investigation carried out on the project site, lithological stratification in the study area consist of top sandy clays layer of soft to medium consistency followed by loose to medium dense sand layer of low plasticity. These two layers at depth are again followed by sandy clays/ clayey sands upto depth of investigation. The transition of top sandy clays having moderate plasticity to virtually non plastic sandy layer and then again to clayey sands/sandy clays is gradual.

Soil sample is collected from nearby project site and analyzed during the ESIA study for the project. The soil quality test results are presented in **Table 4.4** and the interpretation of the results are discussed below.

TABLE 4-4: SOIL QUALITY MONITORING RESULT

Sl. No	Parameters	Unit	Result
1	pH	--	8.85
2	Salinity	ppt	0.52
3	Electrical Conductivity	µsm	172
4	Organic Carbon	%	0.13
5	Nitrogen as N	%	0.16
6	Phosphrous as P2O5	%	0.170
7	Potassium as K	mg/kg	42
8	Total Dissolved Solids	mg/kg	600
9	Sodium as Na	mg/kg	384
10	Magnesium as Mg	mg/kg	19.2
11	Calcium as Ca	mg/kg	40
12	Chloride as Cl	mg/kg	129
13	Fluoride as F	mg/kg	ND*
14	**Particle size Distribution**		
14.1	Clay	%	56
14.2	Silt	%	12
14.3	Sand	%	32

Interpretation of soil testing results

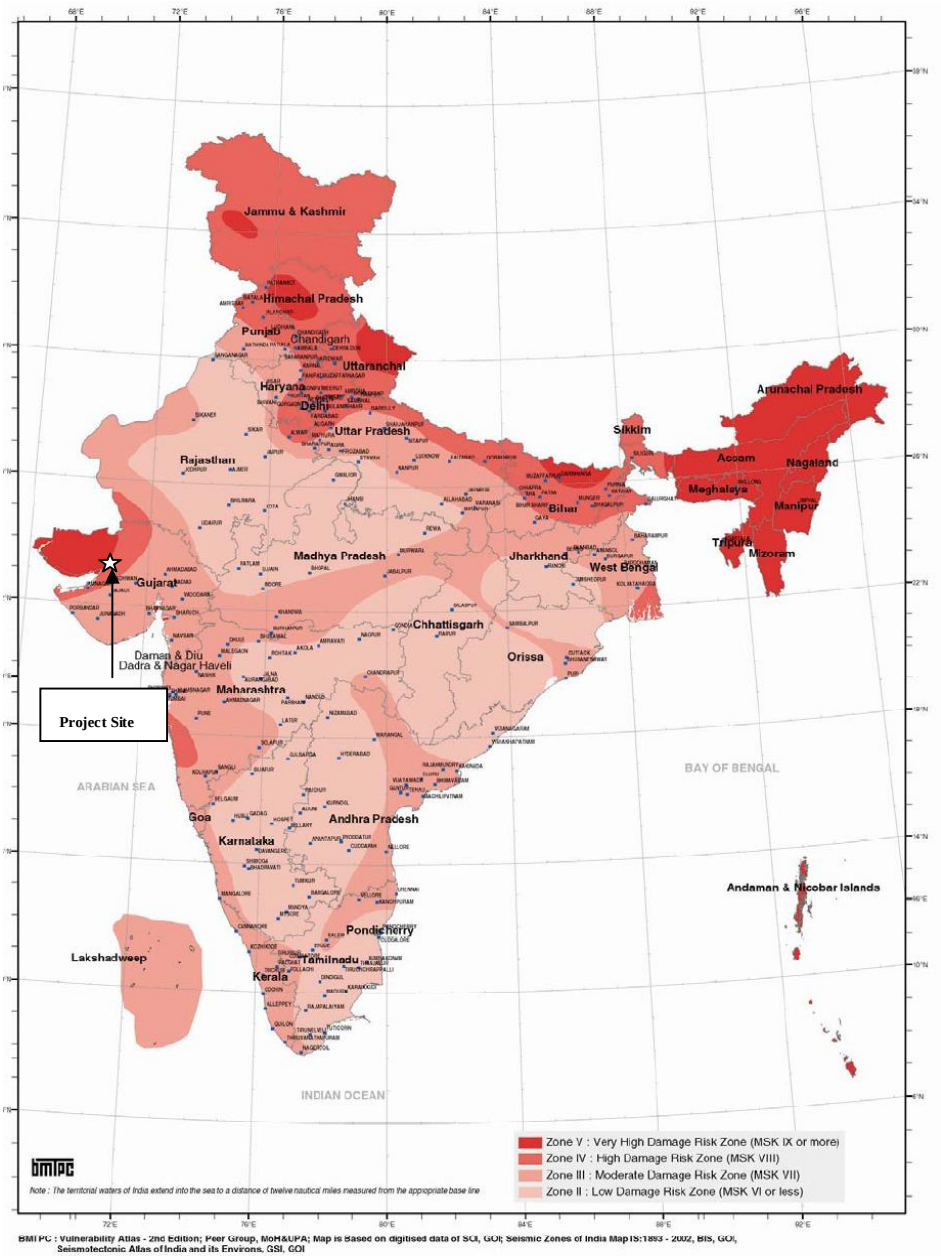
Based on the particle size distribution obtained from the soil analysis, the texture of soil at the project site is clay loam (56%). Soil of the project site is slightly alkaline with a pH value of 8.85. Soil sample contains high concentration of sodium (384 mg/kg) and chloride ions (129 mg/kg). Soil sample also contain high concentration of other minerals like Ca, Mg and show high value of TDS (600 mg/kg), which reflect low nutrient holding and cation exchange capacity and poor fertility of soil. Concentration of organic carbon and nutrient element like nitrogen is also low.

4.7 SEISMIC HAZARD

Seismic hazards include phenomena that occur during or soon after an earthquake, such as primary ground rupture, strong ground shaking, liquefaction and seismically induced

settlement. The seismological map of the project area is as shown in **Figure 4-5**. As per, the Zoning Atlas published by the Ministry of Home and Urban Poverty Alleviation, the project site is located in the Zone IV High Damage Risk Zone with moderate seismicity hazard.

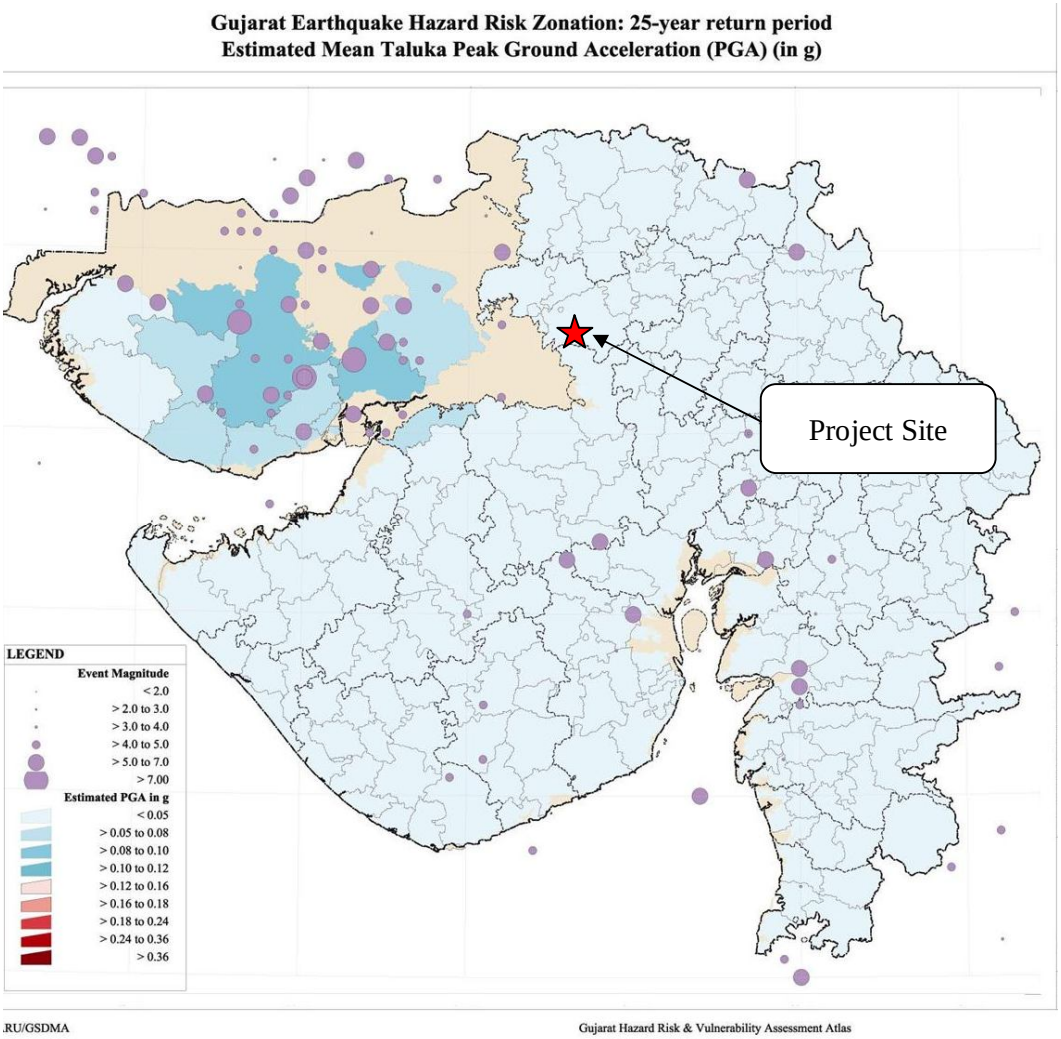
FIGURE 4-5: SEISMOLOGICAL MAP WITH RESPECT TO PROJECT SITE



Although, Saurashtra and Kutch region are seismological active area but proposed project which is in northern Surendranagar district is not very active region (Source: Institute of seismological research). In year 2007, Kutch and Saurashtra experienced 6 & 2 tremors of magnitude >4 (annual report 2007-2008 of Institute of Seismological research). To assess the earthquake hazard in future (25 year return period) with reference to proposed project site, earthquake hazard risk zonation map has been analysed (**refer Figure 4.6**). This map is

prepared by Gujarat state disaster management authority (GSDMA) to provide peak ground acceleration and event magnitude for 25 year return period. According to this map peak ground acceleration (PGA) values falls in the range of 0.05 – 0.08 g which indicates moderate ground shaking and very light potential damage in the proposed project site area.

FIGURE 4-6: EARTHQUAKE HAZARD RISK ZONATION MAP WITH REFERENCE TO PROPOSED PROJECT SITE



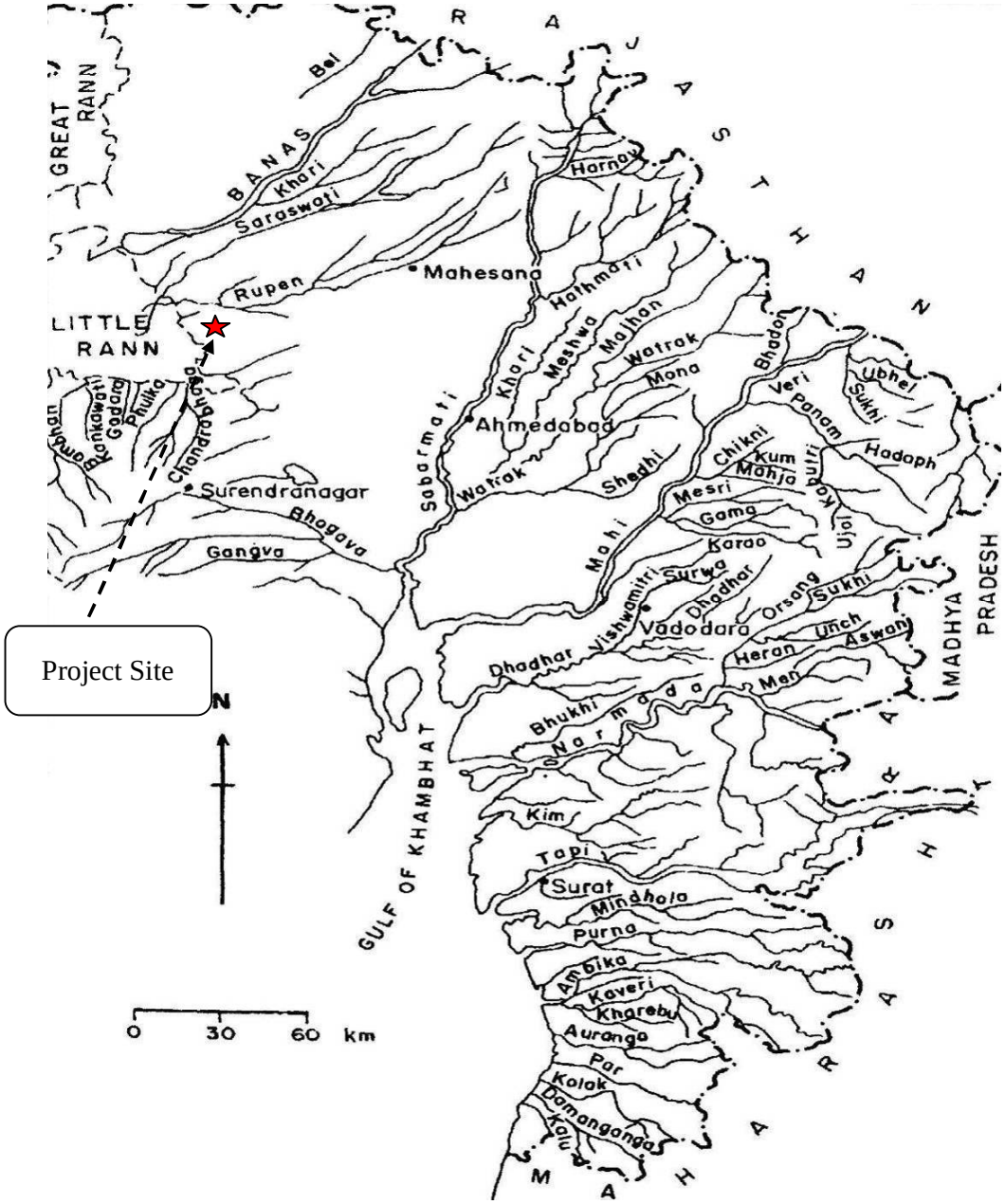
Source:GSDMA

4.8 DRAINAGE

The natural drainage pattern in the region is governed by seasonal surface water channel that typically drain westward into the little Runn of Kutch. Rupen, Saraswati and Banas are the rivers originates from the north-western part of Mainland of Gujarat (refer **Figure 4.7**). These drains originate from Aravalli hills and flow into the Runn of Kutch. These rivers are more or

less seasonal, carrying water only during the monsoon. Although, these rivers are shallow, they have wide sandy channels in their lower reaches.

FIGURE 4-7: DRAINAGE SYSTEM OF ALLUVIAL PLAIN WITH RESPECT TO PROJECT SITE



4.9 SURFACE WATER RESOURCES

During the site visit, study area was found as water scarce with no major rivers. All the natural hydrological features in terms of drains were found to be dry. A seasonal drain was found above the project site at approximate distance of 500 m in north direction draining into little Runn of Kutch during monsoon season.

Water ponds are the only source of surface water, available throughout the year and cater domestic water consumption activities of the surrounding villages. These water ponds can be a source of water to fulfil water requirement at project site during various phases.

4.9.1 Surface Water Quality

Two surface water samples was collected from water ponds in Fatepur villages and Dhama villages for the analysis of physico-chemical and bacteriological parameters.

TABLE 4-5: SURFACE WATER MONITORING RESULT

Sl. No.	Parameters	Unit	Surface Water Quality Result	
			Pond Water from Fatepur Village	Pond Water from Dhama Village
1	Colour	Hazen	< 1.0	< 1.0
2	pH	--	7.47	8.03
3	Total Dissolved Solids	mg/L	924	420
4	Chlorides as Cl	mg/L	345	105
5	Dissolved Oxygen	mg/L	3.25	1.55
6	Oil & Grease	mg/L	ND*	ND*
7	Phenolic Compound	mg/L	ND*	ND*
8	Total Chromium as Cr	mg/L	ND*	ND*
9	Cadmium as Cd	mg/L	ND*	ND*
10	Copper as Cu	mg/L	0.030	0.022
11	Zinc as Zn	mg/L	0.069	0.056
12	Iron as Fe	mg/L	1.021	0.993
12	Iron as Fe	mg/L	1.021	ND*
13	Lead as Pb	mg/L	ND*	< 1.0
14	Selenium as Se	mg/L	ND*	ND*
15	Arsenic as As	mg/L	ND*	ND*
16	Sulphates as SO4	mg/L	58.60	12.74
17	Cyanides as CN	mg/L	ND*	ND*
18	Fluorides as F	mg/L	ND*	ND*
19	BOD (3 days @ 27 ^{o}C)	mg/L	38.12	7.22
20	Nitrate Nitrogen as NO3	mg/L	0.53	0.40
21	Anionic Detergent (MBAS)	mg/L	ND*	ND*
22	Coliform	MPN Index/100 ml	109	120
23	Insectisides	ppm	ND*	ND*

Interpretation of Surface water Quality Results

The collected samples were analysed and results compared with standards mentioned in CPCB surface water class. (Refer **Table 4.5**)

The pH of the surface water sample was 7.47 at Fatepur village and 8.03 at Dhama village, indicating that the water was neutral in nature at Fatepur and slightly alkaline at Dhama village. The DO level in both the water samples were low i.e. 1.55 mg/L at Dhama village and 3.25 mg/L at Fatepur village, while BOD levels were around 38.12 mg/L at Fatepur and 7.22 mg/L at Dhama village, indicating poor water quality with organic loading. High BOD value in pond of Fatepur village is due to its use for cattle bath etc. The coliforms count was 109 MPN/100ml at Fatepur and 120 MPN/100ml at Dhama village, indicating the contamination of pond water.

4.10 GROUND WATER QUALITY AND RESOURCES

During the site visit, it was observed that tube wells were used for the extraction of ground water in agricultural fields. Although water supply line of Gujarat Government was present in the villages, bore holes were also used for the drinking purpose. Depth of ground water in Fatepur villages was reported as 350 – 400 ft below the ground level. Samples for the ground water quality assessment were collected from the Fatepur and Dhama villages, monitoring results for which are described in **Table 4.6.**

TABLE 4-6: GROUND WATER QUALITY DATA

S. No.	Test Parameters	Units	As per: IS 10500: 1993		Ground Water Quality	
			Desirable Limits	Permissible Limit	Fatepur Village	Dhama Village
1	Colour	Co-pt	Max 5	25	< 1.0	< 1.0
2	Odour	--	Unobjectionable	-	Unobjectionable	Unobjectionable
3	Taste	--	Agreeable	-	Agreeable	Agreeable
4	Turbidity	NTU	Max 5	10	0.31	0.26
5	pH Value	--	6.5 to 8.5	No Relaxation	7.96	8.21
6	Total Hardness as $CaCO_3$	mg/L	Max 300	600	78	74
7	Iron as Fe	mg/L	Max 0.3	1	0.152	0.131
8	Chloride as Cl	mg/L	Max 250	1000	714	724
9	Residual Free Chlorine	mg/L	Min 0.2	-	< 0.1	< 0.1
10	Fluoride as F	mg/L	Max 1.0	1.5	ND*	ND*
11	Total Dissolved Solids	mg/L	Max 500	2000	1776	**1812**
12	Calcium as Ca	mg/L	Max 75	200	20.8	12.0
13	Magnesium as Mg	mg/L	Max 30	100	6.24	10.56

14	Copper as Cu	mg/L	Max 0.05	1.5	ND*	ND*
15	Manganese as Mn	mg/L	Max 0.1	0.3	0.025	0.025
16	Sulphate as SO_4	mg/L	Max 200	400	84.28	29.10
17	Nitrate as NO_3	mg/L	Max 45	100	0.44	0.35
18	Phenolic Compounds as C_6H_5OH	mg/L	Max 0.001	0.002	ND*	ND*
19	Mercury as Hg	mg/L	Max 0.001	No Relaxation	ND*	ND*
20	Cadmium as Cd	mg/L	Max 0.01	No Relaxation	ND*	ND*
21	Selenium as Se	mg/L	Max 0.01	No Relaxation	ND*	ND*
22	Arsenic as As	mg/L	Max 0.01	No Relaxation	ND*	ND*
23	Cyanide as CN	mg/L	Max 0.05	No Relaxation	ND*	ND*
24	Lead as Pb	mg/L	Max 0.05	No Relaxation	ND*	ND*
25	Zinc as Zn	mg/L	Max 5	15	0.087	0.033
26	Anionic Detergents as MBAS	mg/L	Max 0.2	1	ND*	ND*
27	Chromium as Cr_{+6}	mg/L	Max 0.05	No Relaxation	ND*	ND*
28	Oil & Grease (Mineral Oil)	mg/L	Max 0.01	0.03	ND*	ND*
29	Alkalinity	mg/L	Max 200	**600**	**250**	**244**
30	Aluminum as Al	mg/L	Max 0.03	0.2	ND*	ND*
31	Boron as B	mg/L	Max 1	5	0.048	0.40
32	Pesticides	mg/L	Absent	0.001	ND*	ND*
	Microbiological Parameters					
33	Coliform	/100 ml	Absent		**Present**	**Present**
34	E-Coli	/100 ml	Absent		Absent	Absent
35	Polynuclear aroimic hydrocarbons as PAH	ppm	NS*		ND*	ND*

Interpretation of Ground Water Quality Results

Ground water was analyzed for physico-chemical and bacteriological parameters and results compared with IS: 10500 drinking water standards.

pH and Turbidity: The pH (7.96) and turbidity (0.31 NTU) at Fatepur village and pH (78.21) and turbidity (0.26 NTU) at Dhama village of ground water sample collected from bore wells

at Fatepur and Dhama village were found within the desirable limit of IS: 10500 drinking water standards.

Chlorides and Total Dissolved Solids: The chloride and TDS concentrations in the ground water sample collected from Fatepur village (Chloride-714 mg/L & TDS-1776 mg/L) and Dhama village (Chloride-724 mg/L & TDS-1812 mg/L) was found to be exceeding the desirable limit of 250 mg/L and 500 mg/L respectively. High value of TDS and chlorides attribute to sediments characteristic of the area resulting in leaching of salts during percolation of water upto considerable depth (350 – 400 ft depth). High value of chloride in the ground water of Surendranagar district is further substantiated by CGWB ground water monitoring report.

Total Hardness: Hardness of water is considered to be an important parameter in determining the suitability of water for domestic uses particularly washing. Total hardness for Fatepur village (78 mg/L) and for Dhama village (74 mg/L) in the ground water samples were found to be conforming within the desirable limit of 300 mg/L specified under IS: 10500.

Iron and Fluoride:. The concentration of iron in ground water sample at Fatepur village (0.15 mg/L) and at Dhama village (0.13 mg/L) were found to be in compliance with the desirable limits specified in the IS standards. Fluoride content in the same samples were not detected and thus found to be complying with the desirable limit for fluorides in potable drinking water standard (1.0 mg/L).

Heavy Metals: The concentration of heavy metals like lead, selenium, mercury, arsenic, copper, chromium, cadmium, etc in the ground water samples were not detected.

Micro-organism: Coliforms were detected at both the monitoring locations but E-coli was absent in ground water sample collected from Dhama and Fatepur village.

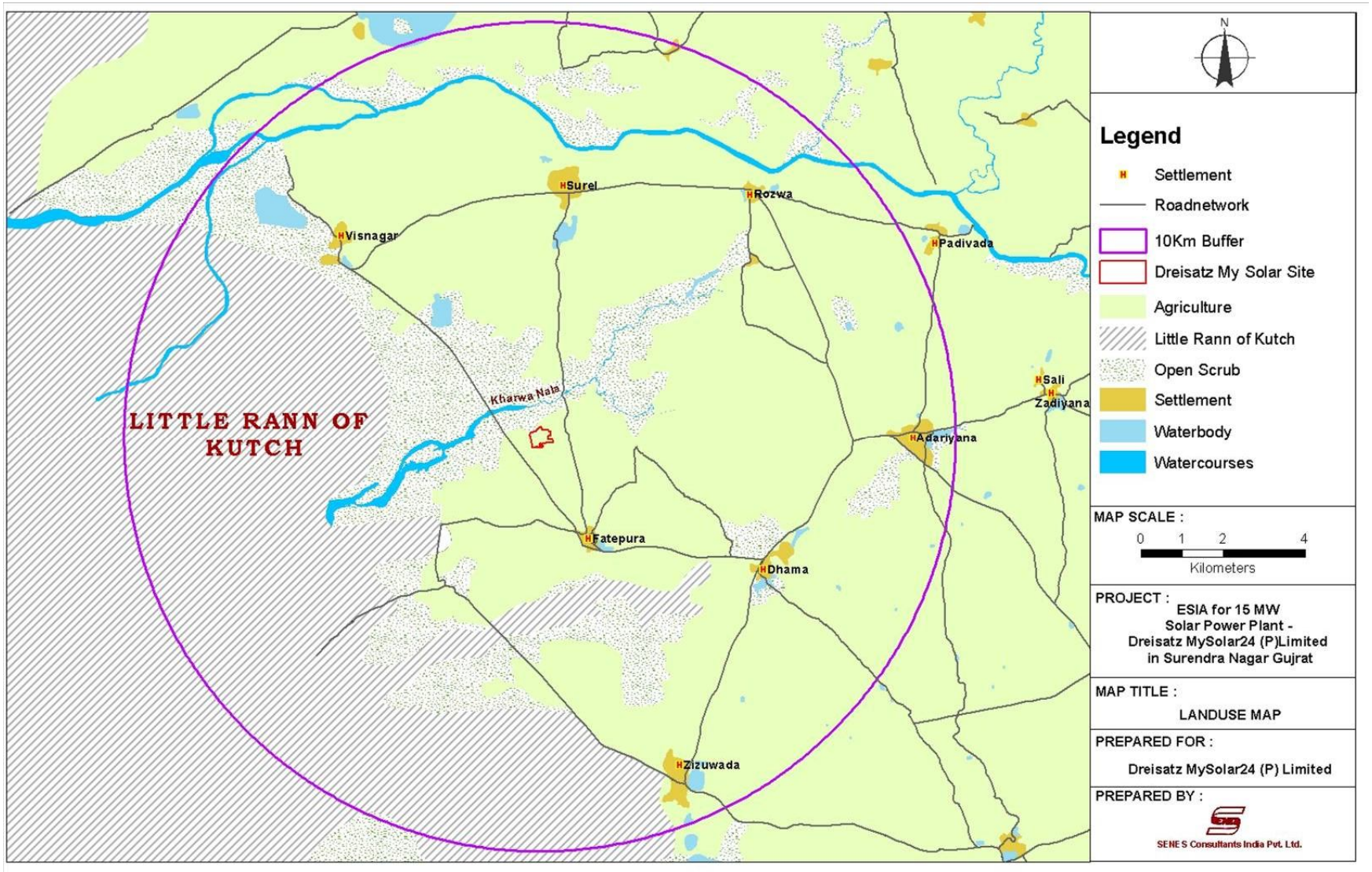
4.11 LAND USE AND LAND COVER

Land-use of the project area is highly influenced by the arid climate of the region. A study of the land-use and land-cover in a 10 km area around the project site shows that major portion (approx. 54%) of the area is agricultural lands. Salty marsh lands of the little Runn of Kutch accounts for 29 %. Approximately 14% of the land is in the category of open scrub land. No significant tree cover was seen in this area. Approximately 1 % of the area is used for settlements and roads. Water bodies and water courses constitute only around 2% of the land-use. **Figure 4.8** shows the land-use patterns in the study area.

TABLE 4-7: LANDUSE OF THE STUDY AREA

Landuse Category	**Area in Sq. Km**	**Percentage**
Agriculture	170.33	54.22
Little Rann of Kutch	89.32	28.43
Open Scrub	44.79	14.26
Road	1.10	0.35
Settlement	2.89	0.92
Water body	2.51	0.80
Water courses	3.21	1.02
Total	**314.16**	**100.0**

FIGURE 4-8: LAND USE PATTERN IN PROJECT AREA



4.12 ECOLOGY

Flora

Study area falls in arid cum dry zone of north Saurashtra agro climatic region having primarily black cotton-fine-loamy-mixed-hyperthermic type of soil and supports vegetation growth in the area. The vegetation in the Runn and its environs is largely xerophytic dominated by the thorny exotic shrub species *Prosopis juliflora,* which has spread and taken over most beyts and fringes. Major floral species found in the study area including project sites are specified below:

Flora

Common Name	Scientific Name
Babul	Acacia nilotica
Black locust	Acacia Senegal
Khadira	Acacia catechu
	Acacia leucophiila
Ber	Zizyphus spp.
Neem	Azadirachta indica
Peepal	Ficus religiosa
Shami	Prosopis cineraria

Fauna

The proposed project site is located within 10 Km from the Wild Ass Sanctuary in Little Runn of Kutch, which is a famous habitat of wild ass (*Equus hemionus khur*) (refer **Figure 4.9**). As per IUCN protected area categories, this sanctuary falls in IUCN IV category[1]. During sight visit and as per discussion with local people in Fatepur villages, sighting/reporting of faunal species viz. Wild Ass, Nilgai, Chinkara etc. were not confirmed in the nearby area of project site. However, due to close proximity of wild ass sanctuary occasional presence of these faunal species in search of food and water in nearby area of the project site cannot be ruled out. The Wild Ass Sanctuary is also a habitat to many species of animals and birds According to the data submitted to the UNESCO World Heritage Centre, the sanctuary has about 93 species of invertebrates, 4 species of amphibians, 29 species of

[1] *IUCN category IV represents habitat/species management area and focuses on conservation of species or habitat that requires continuous protection rather than that of natural features.*

reptiles, *Metapenaeus kutchensis* – a type of prawn, 70,000-75000 birds nests, 9 mammalians orders with 33 speceis/subspecies – including the world's last population of the Khur sub-species of Wild Ass. Details about the faunal species found in the sanctuary are as follows:

Wild mammals

Indian Wild Ass	Desert Cat
Blackbuck	Indian Fox
Chinkara	Striped Hyena
Nilgai	Indian Pangolin
Wolf	Small Indian Mongoose
Caracal	Indian Desert Gerbil
Blue bull	Hare
Jackal	Hyena
Wildboar	

Reptiles

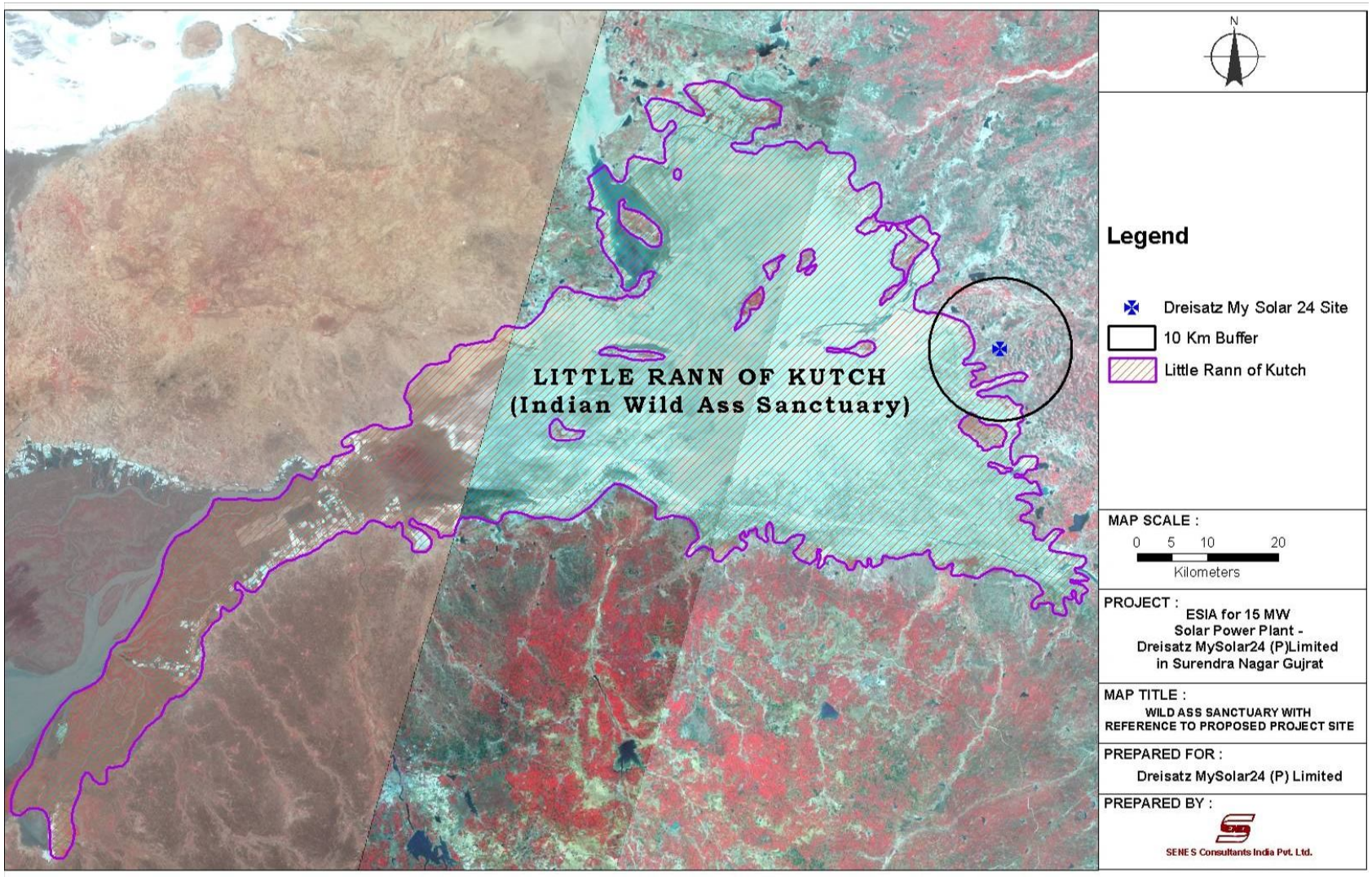
Spiny-tailed Lizard	Yellow Monitor
Black Cobra	Sand Boa

Aves

Bustard	Short Toed Snake Eagle
Long Legged Buzzard	Steppe Eagle
Imperial Eagle	Lagger Falcon
Short Cared Owl	Lesser Flamingo
Greater Flamingo	Asian Openbill
Woolly Necked Stork	White Stork
Eurasian Spoonbill	Great Crested Grebe
Great White Pelican	Dalmatian Pelican
Demoiselle Crane	Common Crane
Spotbill Duck	Gadwall
Northern Shoveler	Common Pochard
Tufted Duck	Caspian Tern
Pale Harrier	Houbara Bustard
Black Shouldered Kite	Pelican
Herons	Spoonbill

This area with the Wild Ass Sanctuary comprises of vast desiccated unbroken bare surface of dark silt which has been encrusted with salts and transforms into spectacular coastal wetland immediately after the rains.

FIGURE 4-9: WILD ASS SANCTUARY WITH REFERENCE TO PROPOSED PROJECT SITE



4.13 SOCIOECONOMIC ENVIRONMENT

This section discusses the baseline socio-economic environment of the study area defined for the proposed solar power project. Based on the assessment of the socio-economic conditions of the rural and urban settlements identified within the study area ESIA will later attempt to predict and evaluate the future impacts of the project on the local people, their physical and psychological health and well-being, economic facilities, heritage and culture, lifestyle and other value systems. The issues under focus are demographic structure, economic activity, education, literacy profile, infrastructure facilities, etc. The assessment and evaluation of potential socio-economic impacts will thereby assist in the formulation of necessary guidelines for impact mitigation and management of human environment.

The information provided in the following sections has been primarily derived from secondary sources (Census of India 2001, District Information Centre, District Statistical Handbook etc). The village-wise secondary data (as obtained from Census, 2001) has been taken into consideration for analyzing the socio-economic profile in a comparative manner.

4.13.1 General Socioeconomic Profile

Considering the scale and nature of the solar power plant project, a study area of 5 km from the project site has been identified for profiling of socio-economic environment of villages. Identification of the study area is primarily based on reconnaissance surveys, understanding of the project and professional judgment. Detail of the villages identified for socioeconomic profiling is presented in **Table 4-8** below.

TABLE 4-8 : LIST OF VILLAGES SELECTED FOR SOCIO-ECONOMIC PROFILING

State & District	Tehsil	Villages	Approx. distance from the project site
Gujarat, Surendranagar	Dasada	Fatepur	1.69 km
		Dhama	5.0 km

Surendranagar district

According to census, 2001, total population of the *Surendranagar* district is 15, 15,148 out of which rural population is 11, 12,700 while urban population is 4, 02,448. The sex ratio of the district is 924, having 7, 87,650 no. of male and 7, 27,498 no. of female population. Surendranagar district is situated between 22°00' to 23°05' North altitude and 69°45' to 72°15' East longitudes.

4.13.2 Demographic Profile

The demographic profile in terms of total population, household size, sex-ratio and scheduled population of the selected villages in the study area of district with respect to the proposed solar plant has been discussed in section below and presented in **Table 4-9**

Of the study area villages, *Dhama* has the highest population (2,029). The household size for both the study area villages was found to be about 5.2. The sex ratio within the study area is almost similar with percentage of male population. The highest SC population was recorded for Dhama village (266) while ST population are absent in both the study area villages.

TABLE 4-9 : DEMOGRAPHIC PROFILE OF THE STUDY AREA VILLAGES

Village Name	HH No	Total Pop.	HH Size	Male Pop.	% M	F Pop	% F	Sex Ratio	SC Pop	% SC	ST Pop	% ST
Fatepur	382	1991	5.2	1024	51.4	967	48.6	944.3	210	10.5	0.0	0.0
Dhama	391	2029	5.2	1050	51.7	979	48.3	932.4	266	13.1	0.0	0.0

HH-Household

4.13.3 Education & Literacy

The study of the education and literacy profile in the region is relevant in order to have an understanding whether the proposed project can utilize the skilled human resources available within the individual study area. The village-wise male and female literacy status as obtained from Census 2001 is presented in **Table 4-10.**

According to the 2001 census data, crude literacy levels in *Surendranagar* district is 61.6 %. The highest crude literacy rate was observed in *Dhama village* (45.3%) while average male and female crude literacy rate in Dhama village was recorded at 65.2% and 34.8 % respectively.

TABLE 4-10 : LITERACY PROFILE OF THE STUDY AREA VILLAGES

Villages	Total population	Total Literates	% Literates	Illiterates	%	Male Literates	%	Female Literates	%
Fatepur	1991	596	29.9	1395	70.1	414	69.5	182	30.5
Dhama	2029	920	45.3	1109	54.7	600	65.2	320	34.8

4.13.4 Economic Activity & Livelihood Pattern

The relevance of economic activity and livelihood pattern is important in the context of the study since depending on the existing situation one can predict the impact of the project activity on the economy of the villages and the region. The village-wise workforce participation as obtained from Census 2001 is presented in **Table 4-11.**

The workforce participation rate in the study area villages of *Surendranagar* varies from 0.3% to 59.7%.Majority of inhabitants (about 59.7%) in the study area villages are employed in the category of Agricultural labours. Cultivators comprise the second most important work category in the study area constituting about 24.55% of the total workforce. Employments in other workers category (15.45%) as well as workers working in household industries (0.3 %) are low in number.

TABLE 4-11 : WORKFORCE PARTICIPATION OF STUDY AREA VILLAGES

Villages	Total Worker	Total Non workers	% Cultivator	% Agriculture Labour	% Household Worker	% Other Worker
Fatepur	656.0	1335	19.4	72.1	0.0	8.5
Dhama	827.0	1202	29.7	47.3	0.6	22.4

4.13.5 Socioeconomic Infrastructure

Educational Facilities

There are 943 primary, 153 secondary and higher secondary schools in the Surendranagar district. Only primary education facilities were observed in both the villages within the study area, no secondary schools have been recorded in Fatepur and Dhama village. Village wise educational facility in the study area is given in **Table 4-12**.

Drinking Water Facilities

It was observed that both the villages in study area have fair access to drinking water through village tube wells, open wells and tanked water supply. Village wise drinking water facility in the study area is given in **Table 4-12**.

Medical Facilities

Surendranagar has several private specialised hospitals to provide a comprehensive range of tertiary and secondary care services backed by state-of-the-art technology and trained medicos but medical facilities within the study area villages are not satisfactory. There is no medical facility in Fatepur village while in Dhama only one primary health sub centre is present. However, Government of Gujarat is providing on call medical facility to the caller within an hour. Village wise medical facility in the study area is given in **Table 4-12.**

TABLE 4-12 : BASIC AMENITIES IN THE STUDY AREA

Village	Education Facility	Medical Facility	Drinking Water Source	Post & Telegraph	Approach to Village	Power Supply	communication facilities
Fatepur	P_SCH (1)	Not available	T,TK	PO(1) PH(1)	PR Nearest town-	EA	Bus services

Village	Education Facility	Medical Facility	Drinking Water Source	Post & Telegraph	Approach to Village	Power Supply	communication facilities
					Kharaghoda (44km)		
Dhama	P_SCH (1)	PHSC_1	T, W, TW	PO(1) PH(8)	PR Nearest town-Kharaghoda (42km)	EA	Bus services

[Source: Census of India 2001]

Education Facility: *P_SCH = Primary School; S_SCH = Secondary School*

Medical Facility: *FWC-Family welfare centre; PMC-Number of registered private medical practiotioners; PHSC-Primary heath sub centre; PHC-Primary Health centre; MCWC-Maternity and child welfare centre*

Drinking Water Facility*: T = TAP; W = WELL; TK = TANK; TW= TUBEWELL;*

Post & Telegraph*: PO = Post Office, PH= Phone Connection*

Approach Road to Village*: PR = Paved Road; MR= Mud Road*

Power Supply*: EA = Electricity for all purposes, ED = Electricity for domestic use, EAG= Electricity for Agriculture use, EO = Electricity for other purposes,*

5 Social & Environmental Impact Assessment

5.1.1 Approach and Methodology

An assessment was done in order to understand the potential risks and impacts of the proposed project on the physical, biological and economic environment in which it proposes to operate. The basis of the assessment was the applicable national regulations, IFC Performance Standards on Social and Environmental Sustainability and the IFC General EHS Guidelines.

- The study team carried out the following steps to complete the impact assessment process:-
- Detailed discussion with project proponent to understand project schedule, technical features, and plans/procedures for construction and operation;
- Desk study of the socio-environmental profile of the project area; and
- Field surveys and consultations with the villagers
- Study of the layout, design and plans for the solar power project as provided by the Project proponent.

5.2 SOCIAL CONSULTATION

The study team conducted a consultation exercise within the project area in April 2012, where they met and interacted with community members including farmers, school principal, head of village panchayat, land sellers , etc in Fatepur villages (please refer Photo 5.1). The objective of the consultation was to understand the following:

- Socio-economic condition of the people of Fatepur and nearby villages
- General perception about the proposed project and other solar energy projects proposed among the local community
- Previous dependent of the villagers, if any, on the land taken up for the project site;
- To understand environmental and social concerns of the local community with respect to the proposed project

A brief account of the various discussions is summarized below:

5.2.1 Public Consultation with land loosers

From the discussion, it came out that the community is well aware of the solar power project coming up in the proposed area and they are in support of the proposed project. It was also found that only dry land (no wet land or grazing land) has been purchased for the proposed project and the land losers have received monetary compensation against selling of their land.

(refer the details given in section 2.4). They are now planning to purchase other plots of land for agricultural activities. Discussion also revealed that agriculture is the primary livelihood in the area however, due to a mono cropped agricultural pattern, it is not the perennial source of income throughout the year. In the dry season (non agricultural season) they are jobless therefore there is a growing tendency among the youth to migrate to nearby cities like Ahmedabad, Gandhinagar, Mehsana, etc for permanent employment opportunities.

5.2.2 Public consultation with villagers

During discussion with villagers, it was found that some of the villagers are already employed as labourers in the existing solar power plant (owned by AMCO Pvt. Ltd), in the Fatepur village and they are also expecting employment opportunities for casual labourers (unskilled) from the upcoming proposed project.

Discussions with principal of primary school in Fatepur village revealed that, there is need for renovation and development of school building and prayer hall in the school. He is hopeful that socio-economic conditions along with infrastructural facilities like primary medical facilities and approach roads will improve due to the upcoming solar power projects.

During public consultation it was also noted that no land or properties of cultural, community and religious importance or affecting their sentiments has been purchased for the proposed project. It was also observed that drinking water was supplied in the villages through government water supply line. However, water from the ponds was also used by villagers for domestic activities.

Overall different sections of the community comprising of residents, school teachers, farmers, etc. are aware that the land will be utilized for the development of solar power plant and they are looking for associated benefits like employment generation as casual labourers in the non-farming season. In addition to this, renovation and development of school building was another expectation from the proposed project.

The list of the stakeholders consulted during the ESIA study is presented in the following table:

TABLE 5-1: STAKEHOLDERS CONSULTED DURING THE ESIA STUDY

Sl. No.	Name of Participant	Occupation	Village
1	Sh. Sonabhai	Village Head, land seller	Fatepur Village
2	Sh. Laxmanbhai	Gram Sewak	Fatepur Village
3	Sh. Punjabhai	Land seller	Fatepur Village
4	Sh. Chunda Bhai	Farmer	Fatepura Village
5	Sh. Goyaleshwar	Principal, Govt. Primary School	Dhama Village
6	Sh. Goyabhai	Land seller	Fatepur village

Photo 5-1: Public Consultation with Villagers for the proposed Project

Public Consultation with Group of People including Villlagers and Land Loosers

5.3 IMPACT ASSESSMENT

Potential social and environmental risk and impacts from the proposed project have been described in relation with IFC performance standards in **Table 5-2** below. Column (a) of the table denotes the title of the IFC Performance Standard, column (b) denotes the fundamental requirements of the Performance Standard and column (c) describes the assessment of the risks and impacts arising from the different phases of the project life-cycle in comparison with the Performance Standards. A Social and Environmental Management Plan has been developed based on the impact assessment and is presented in the next section.

TABLE 5-2: IMPACT ASSESSMENT

Sl. No.	(a) Title of Performance Standard	(b) Performance Standard Requirements	(c) Assessment of Risks
1	PS 1: Social and Environmental Assessment and Management Systems	When local communities are affected by risks or adverse impacts from a project, the project proponent must ensure adequate engagement with the communities to build and maintain a constructive relationship over time. Project proponent should disclose project-related information to help affected communities understand the risks, impacts and opportunities of the project.	Dreisatz My Solar (24) Pvt. Ltd. (DMSPL) has carried out a detailed Environmental & Social Risk Assessment study for the proposed power plant at Fatepur to identify & assess the social and environmental impacts arising from the project activities. Typically construction or operation of a solar power project does not generate emissions and effluent or involve handling or generation of hazardous materials. With regard to use of natural resources, while demand for water during construction and operation phases is low given the requirement of land per MW need to be optimised while designing. Hence, adverse environmental and related social impacts on the local community are not envisaged from project activities other than from project siting and land requirement. Approximately, 135 acres of land is being acquired by DMSPL for development of their 15 MW solar power project. Private land is being purchased on willing seller willing buyer method through mutual consent. Originally, the land was seasonally cultivated for crops such as cotton, arinda, groundnuts etc. due to its poor fertility levels. The land was acquired directly from the land owners; however, process was facilitated by mediators. Concerns of the local people regarding siting/design of the solar power project generally related to change in local drainage patterns and topography, sharing of community resources especially those which are in short supply (e.g., water) and restricted access to public infrastructure such as roads. There are no local drainage or public roads passing through the site. Local people expect support to the School in the village from DMSPL in terms of development and

Sl. No.	(a) Title of Performance Standard	(b) Performance Standard Requirements	(c) Assessment of Risks
			renovation of primary school building and the same can be taken up by DMSPL as one of their CSR activities.
2	PS 2: Labour and Working Conditions	The project proponent should provide the workers with a safe and healthy work environment, taking into account inherent risks in its particular sector and specific classes of hazards in the client's work areas. The proponent should take steps to prevent accidents, injury, and disease arising from, associated with, or occurring in the course of work by minimizing, so far as reasonably practicable, the causes of hazards. In a manner consistent with good international industry practice, the client will identify potential hazards to workers, particularly those that may be life-threatening; provide preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances; train workers; document and report of occupational accidents, diseases, and incidents; and be prepared for preventing and responding to	During the site visit it was found that proposed project is at very initial stage where land acquisition is in process. During discussion with DMSPL officials, it was found that for construction phase, water will be provided by EPC contractor through water tanker. DMSPL shall also ensure that drinking water for staff and the labour during construction and operational phase must be meeting IS: 10500 quality standards. Different kinds of safety hazards will be associated with construction, operation and maintenance activities. For e.g. manual excavation can cause cut hazards, loading and unloading of materials can cause physical strain and injuries, work on electrical equipments can lead to electrocution hazard to cite a few. Safety-related risks are minimised by incorporating safety measures in plant design, developing safety culture in project site working. preparation safety manuals and including safety-related instructions in work procedures, imparting training and awareness to contracted labour and employees, providing adequate Personal Protective Equipments (PPEs) and ensuring their use, and carrying out supervision on a regular basis. Design-in safety measures include circuit breakers and fuses to isolate energized plants components during repair and maintenance work. Lock-Out-Tag-Out methods can also be employed for preventing re-energization of electrical equipments. However, systematic adequate training and supervision needs to be ensured by the company to ensure that electrocution hazards are avoided and safety controls are used effectively. Fires are expected to be managed using fire

Sl. No.	(a) Title of Performance Standard	(b) Performance Standard Requirements	(c) Assessment of Risks
		emergencies. The proponent should also ensure that child labour is not used during any stage of the project.	extinguishers maintained at the project site. The company will need to ensure the health and safety of workers as required by Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and the Central Electricity Authority (Safety Requirements for Operation, Construction and Maintenance of Electric Plants and Electrical Lines) Regulations 2008. In case the construction workers require temporary shelters at site during the construction period the same will have to be managed as per the guideline published jointly by International Finance Corporation (IFC) and the European Bank for Reconstruction and Development (EBRD)[2] and relevant provisions of the above-mentioned regulations. Any encroachment upon adjoining lands for providing temporary shelter to workers must be avoided. Emergency preparedness and response plan will be developed and communicated to all workers to increase their preparedness to handle emergency events.
3	PS 3: Pollution Prevention and Abatement	The project proponent should ensure that adequate control techniques are provided to minimize emissions or achieve a pre-established performance	Operating solar photovoltaic power plants have no significant point or fugitive sources of air emission. However, fugitive dust generated during excavation work and materials handling during construction phase can temporary increase particulate levels at the project site. DMSPL will ensure that dust

[2] *"Workers accommodation: process and standards" guideline published by IFC and EBRD. It addresses the processes and standards that should be applied to the provision of workers' accommodation in relation to projects funded by the EBRD or IFC.*

Sl. No.	(a) Title of Performance Standard	(b) Performance Standard Requirements	(c) Assessment of Risks
		level. The proponent should ensure that generation of hazardous wastes are minimized and handling, storage and disposal are managed properly to prevent any adverse social and environmental impacts. Reasonable inquiry about the location of the final disposal of their waste, even if the disposal is conducted by the third party and especially if the waste is considered to be hazardous to human health and the environment should be carried out.	suppressing procedures should be followed during construction period. Operation of construction and earth-moving machines and equipments and temporary diesel-based generator sets will also result in an increase in ambient concentrations of SO_2, NO_x, CO and HC and ambient noise levels. Inverters can be the only source of noise but, being housed inside control rooms, their impact on the ambient noise levels are not expected. The increase in air pollutant concentration and noise levels caused by the proposed project during its construction phase is expected to be short-lived and insignificant. However, cumulative air and noise quality impacts though intermittent are anticipated from area development activities by other solar power plant operating in the area. Very low volumes of sanitary waste water will be generated during construction (maximum 1 KLD) and operation phases (maximum 200 LPD). Soak pit and septic tank will be used on-site for the treatment of sanitary waste water. No chemicals will be used in the panel wash water. Mopping techniques will be employed to reduce water demand. DMSPL will need to ensure transformer oil used in transformer is free of Polychlorinated Bi-Phenyls. Hazardous wastes such as empty paint containers (generated when the control room buildings or the module mounting structures are painted) will be handled and disposed in a manner that contamination of soil or groundwater is avoided. During decommissioning phase temporary impacts are envisaged due to noise and fugitive emissions generated from vehicles involved in the transportation

Sl. No.	(a) Title of Performance Standard	(b) Performance Standard Requirements	(c) Assessment of Risks
			of solar panels, transformers, demolition waste etc. However these impacts are likely to be short terms and localized in nature and can be mitigated through implementation of appropriate mitigation measures as outlined in the "Decommissioning Plan"
4	PS 4: Community Health, Safety and Security	The project proponent should avoid or minimize risks to and impacts on the health and safety of the local community during the project life-cycle from both routine and non-routine circumstances. The proponent should also ensure that the safeguarding of personnel and property is carried out in a legitimate manner that avoids or minimizes risks to the community's safety and security. The proponent should avoid or minimize the exacerbation of impacts caused by natural hazards, such as, landslides or floods that could arise from land use changes due to project activities.	Generation of air pollutants and high noise due to operation of construction equipments/machineries is short-lived and not expected to cause any significant impact on settlements located more than 1 km away from the project site. Movement of heavy vehicles carrying materials and machines during construction phase of a solar power plant is not expected to disturb the local communities, Prior information of such activities.in case of significant vehicular movement in the area of the solar plant is expected. However Road Safety & Traffic Management Plan shall be in place. The nearby area of project site is low-lying which may get water logged during rains. As part of area developmental activities, DMSPL needs to develop the drainage system to eliminate the water stagnation from the site and facilitate surface runoff into seasonal drain. Adverse impacts on local surface drainage patterns are not expected. The project will offer employment opportunities to the local people, especially as semi-skilled and unskilled labour.
5	PS 5: Land Acquisition and Involuntary Resettlement	The project proponent should preferably acquire land for project by negotiated settlement and should avoid expropriation.	The lands for the proposed project are private owned land which is being purchased by DMSPL on willing seller willing buyer process. The land originally was used for rain fed mono-crop production viz. Cotton, arinda, ground nuts etc. and left as fallow land for rest of the year. The land was

Sl. No.	(a) Title of Performance Standard	(b) Performance Standard Requirements	(c) Assessment of Risks
			acquired by DMSPL directly from land owners. No grievances are reported during the stake holders consultations with the Village Head and locals of Fatepur village, regarding the land transaction and compensation which indicate broad community support (BCS) for this project.
6	PS 6: Biodiversity Conservation and Sustainable Natural Resource Management	The project proponent should protect and conserve biodiversity.	The project site was originally a rain fed agricultural land and was used for cultivation of crops such as cotton, arinda, groundnut, etc during the monsoons. Vegetation at project site was observed as bushes, shrubs and few trees. Considering that major vegetation on site comprised of bushes and shrubs, no major impact is envisaged due to clearing of site. Further, the project site is not a part of animal habitat. Consultations with community members and forest officials revealed that the habitat of animals such as Nilgai, Wild Ass, etc is quite far from the site and within the sanctuary area. Their occasional sighting in the project area could be in search of food (from surrounding agricultural fields) and water. This is quite common in the entire Kutch region where herbivores such as Nilgai, Wild Ass are frequent visitors to agricultural fields. Initiation of site activity is likely to discourage such animals from visiting the agricultural fields close to the project site. Support from DMSPL to the Forest Department to strengthen the habitat in the sanctuary to ensure safety to these animals is recommended. Considering that the Wild Ass Sanctuary is located within 10 KM. from the project site, noise related disturbances to the animals from movement of construction machineries, interface with project vehicles etc are envisaged particularly during the construction phase

Sl. No.	(a) Title of Performance Standard	(b) Performance Standard Requirements	(c) Assessment of Risks
7	PS 7: Indigenous People	The project proponent should minimize, mitigate or compensate for adverse impacts on scheduled tribe due to project activities and provide them opportunities for development benefits.	The solar power plant is located in Fatepur village and does not involved land acquisition from indigenous people. Hence, it is not expected that proposed project will have adversely impact on indigenous people. This Performance Standard is not applicable for the proposed project.
8	PS 8: Cultural Heritage	The project proponent should ensure there are no adverse impacts on the cultural heritage in the project area.	There are no important cultural heritage sites within 10 Km from the proposed project site. No significant area or building of cultural heritage is existing near the project site. Hence, this Performance Standard is not applicable.

5.4 CONCLUSION

It is concluded from the above impact assessment that the proposed DMSPL 15MW solar PV power project in Fatepur village is unlikely to pose any adverse irreversible social and environmental risks given the intermittent nature of the proposed activities and absence of any legally protected areas and cultural heritage sites located within and/or in close proximity to the project. However it may have reversible environmental & social impacts which can be managed with a structured ESMP in place.

It is understood through our visits and consultation that appropriate plans and procedures viz. Emergency Response & Preparedness Plan, Labour Working Conditions Management Procedure, Occupational Health & Safety Management Plan, etc need to be formulated and implemented by DMSPL in coordination with the EPC contractor engaged by them to meet relevant IFC PS and regulatory requirements.

Community consultations indicate broad community support for the project taking into account the provision of both direct and indirect employment opportunities being generated. However in line with PS requirements it is recommended that DMSPL develops and implement a community engagement plan to maintain continued dialogue with the Fatepur Panchayat to address any community related issues/grievances. Further it is also anticipated that such continued engagement will enable DMSPL to enhance project level awareness in neighbouring villages and effectively plan community development initiatives in consensus with the local communities.

6 Environment and Social Management Plan

The outcomes of the Social and Environmental Impact Assessment of the proposed project have been used to formulate specific Management & Monitoring Plans for the project, presented in **Table 6.1** and discussed in subsequent section. The Plan specifies the following:

- measures for safeguarding the health and safety of workers;
- good industry practices for ensuring that the project's environmental impacts are minimized to the maximum extent; and
- the requisite legal compliances are met.
- In addition, organizational capacity and training requirements, required to check and ensure effectiveness of the plan throughout the lifecycle of the project, have also been discussed.

Dreisatz My Solar24 (P) Limited (DMSPL), has a corporate EHS policy. The policy envisions:

- Promoting a safe and healthy work culture by actively working towards prevention of environmental pollution, occupational health and safety hazard.
- Complying with applicable legislation and regulations and other requirements pertaining to environmental protection, occupational health and safety.
- Ensuring involvement of employees at all levels and applicable customers/ suppliers by providing training & awareness with effective communication
- Minimizing the wastes through efficient use of resources
- Communicating EHS policy to all employees and interested parties including contractual work force at site
- Focusing on continual improvement of its applicable processes and performances to ensure its suitability, adequacy and effectiveness
- The Environment and Social Management Plan follows the foot print of the Corporate EHS policy.

TABLE 6-1: ENVIRONMENT AND SOCIAL MANAGEMENT & MONITORING PLAN

Sl. No.	Aspect	Action	Timeframe	Responsibility
1	Preservation of natural area drainage systems	• The site preparation activities like excavation, elevation, filling work, boundary demarcation by DMSPL's EPC Contractor shall ensure that the natural drainage pattern of the area is not altered. The formation of stagnant water pools shall be avoided through proper site leveling and filling in order to prevent potential health impacts of the workers onsite from transmission of vector-borne diseases • Measure shall be taken to ensure that construction activities in no way affect the natural drainage pattern of the seasonal drain known as *Kharwa ka Nala* present in north direction at approx distance of 500 m from the site • Temporary peripheral drains shall be provided with small check dams all around the proposed site or short temporary bunds shall be constructed all around the site (until permanent plant boundary wall is constructed) to prevent passage of silt laden surface run-off from site . • During operation phase surface run-off from internal drains within the site shall be channelized outside the plant site. Provision of sediment traps/interceptors to be ensured for the internal drainage network at run-off discharge location. • Proper storm water drainage network need to be developed on site.	During construction and operation phase	EPC contractor and O&M contractor under the supervision of DMSPL's Personnel

Sl. No.	Aspect	Action	Timeframe	Responsibility
2	Safeguard of occupational health of the workers onsite	• Water purification systems shall be provided to ensure that drinking water for the staff and workers meet the IS 10500 quality standards for potable water. • Periodic monitoring of potable water supply shall be carried out to check conformance IS 10500 standards. • Temporary shelters to be provided at workplace for resting of workers at periodic intervals, adequate drinking water dispenser and toilets shall be provided at site to facilitate proper sanitation of the staff and worker.	Before use Before use Construction and Operation phase	EPC contractor and O&M contractor under the supervision of DMSPL's Personnel
3	Proper handling and disposal of wastes and protection of local environment	• A Waste Management Plan for both non-hazardous & hazardous waste has been prepared & given in section 6.3. Based on the above mentioned plan, DMSPL should manage site specific waste storage and handling practices. • Construction debris after completion of major construction phase shall be reused in paving on site approach road or filling of low lying areas. • Waste water during operation phase should be collected and treated properly. Suitability of soak pits of the project site shall be assessed. • Dry sewage sludge generated from septic tank shall be reused in the green belt development along site periphery. • Local waste recyclers shall be identified for disposal of recyclables viz. packaging materials, metal scrap	During construction and operation	EPC contractor and O&M contractor under the supervision of DMSPL's Personnel

Sl. No.	Aspect	Action	Timeframe	Responsibility
		generated primarily during construction phase. • Hazardous wastes generated only during construction phase shall be managed in accordance to the provision of Hazardous Waste Management & Handling Rules, 2008.		
4	Health and safety of workers	• First aid boxes shall be provided at site; hazard signs to be placed near energized components; provision of sufficient fire extinguishers at site to tackle fire hazards; adequate use of personal protective equipments during work to be ensured; ensure implementation of proper occupational health and safety programs/procedures viz. Job Safety Analysis, Permit to Work, Lock-Out & Tag-Out etc and safety inductions and training to prevent safety hazards at work prior to commencement of any operation and maintenance activities. • Construction workers shall be provided with requisite shelter, drinking water and sanitation in accordance with the requirements of the Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996, the Central Electricity Authority (Safety Requirements for Operation, Construction and Maintenance of Electric Plants and Electrical Lines) Regulations 2008 and the guidelines published jointly by International Finance Corporation (IFC) and the European Bank for Reconstruction and Development (EBRD).	During operational stage	O&M contractor under the supervision of DMSPL's Personnel

Sl. No.	Aspect	Action	Timeframe	Responsibility
5	Emergency response and preparedness	• Potential emergencies viz. natural disasters, fire and community protests, accidents/injuries etc will be addressed in accordance with the Emergency Preparedness and Response Plan as discussed in 6.2 of this report. DMSPL will be responsible for periodic upgradation of this plan to ensure it effectiveness.	During construction and operation phase	EPC contractor and O&M contractor under the supervision of DMSPL's Personnel
6	Develop positive perception among local communities about project	• Open dialogues shall be maintained with the community members and all other local stakeholders of the project to communicate details of the project, its utility in a national and sectoral perspective, extent of benefits and opportunities the project can present to the local communities and plans/measures the project proponent is taking to address the community concerns about social and environmental impacts. • Planned use of public infrastructure such as road and community resources such as water shall be discussed with the community members, especially the competing users. • Ensure maximum employment to local people, especially as construction workers and security guards. • A Community Development Plan shall be prepared to address community needs viz. strengthening of village access roads, enhance livelihood opportunities etc	During construction and operation	DMSPL Management and EPC Contractor
7	Safeguard of community safety	• Community health and safety risks identified with respect to the movement of heavy vehicles and equipments during construction and operations will be	During construction and operation stage	EPC contractor and O&M contractor under the supervision of

Sl. No.	Aspect	Action	Timeframe	Responsibility
		addressed through development and implementation of Road Safety & Traffic Management Plan as discussed later in this chapter.		DMSPL's Personnel
8	Prevent any disturbance to wildlife	• Approval from forest & wildlife department for construction of project strict compliance with conditions of the NOC given by the Forest & wildlife department. • Temporary nature of construction phase (approx. 6-9 month) would not likely to create significant impact. However, impacts can be managed through implementation of appropriate mitigation measures viz. avoiding construction activity and traffic movement at night time and during early hours in the mornings. Also proper fencing around the site will deter the animals from entering the site and getting hurt.	Before construction During construction and operations	DMSPL Personnel during both construction & operational phase
9	Legal compliance	• Consent to Establish (CTE) and Consent to Operate (CTO) to be obtained from Gujarat Pollution Control Board (GPCB) before commencement of construction and operation respectively. • Compliance with the conditions of the CTE and CTO shall be ensured and the compliance shall be reported to the Pollution Control Board periodically as mentioned in the aforesaid permits/consents.	Before construction and prior to operation During operations	DMSPL Personnel during both construction & operational phase
10	Prevention of soil and groundwater	• Spillage of materials e.g. paints, solvents and diesel oil on soil shall be prevented, by placing these materials in	During construction and operation	EPC contractor and O&M contractor under

Sl. No.	Aspect	Action	Timeframe	Responsibility
	contamination	safe places with impermeable liners during storage, handling and use. • Adequate spill control arrangements viz. sand bucket etc to be provided onsite to address any accidental spills.		the supervision of DMSPL's Personnel

6.1 ENVIRONMENTAL MANAGEMENT ACTION PLANS

The ESMP is comprises of some site specific management plans viz. Emergency Management Plan, Waste Management Plan, Storm Water Management Plan, Wild life Management Plan, Environmental Monitoring Plan, Traffic Management Plan and Social Development Plan for the DMSPL's 15 MW Solar PV Power Plant in Fatepur village, in the Surendra Nagar District of Gujarat. However, detailed CSR initiatives and operational activity specific Standard Operating Procedures (SOPs) shall be prepared at a later stage.

6.2 POLLUTION PREVENTION AND ABATEMENT PLAN

The purpose of the plan is to manage the potential impacts on environmental components that may result from both construction and operation phase activities viz. operation of construction equipments & machineries, vehicular movement, storage and handling of sub-soil, fuel and chemicals etc. The mitigation measures identified as part of the plan has been outlined below:

- Vehicles delivering raw materials like soil and fine aggregates shall be covered to prevent fugitive emissions.
- Storage and handling of raw material and debris to be carefully managed to prevent generation of fugitive dust.
- Sprinkling of water on earthworks, material haulage and transportation routes on a regular basis during dry season.
- All vehicles, equipment and machinery used for construction will be subjected to preventive maintenance as per manufacturer norms.
- All vehicles utilized in transportation of raw material and personnel will have valid Pollution under Control Certificate (PUC). Vehicular exhaust will be complying with the CPCB specified emission norms for heavy diesel vehicles.
- Exhausts of DG sets will be positioned at a sufficient height to ensure dispersal of exhaust emissions; engines will not be left running unnecessarily.
- Preventive maintenance of DG sets to be undertaken as per manufacturers schedule to ensure compliance with CPCB specified generator exhaust.
- Selection and use of low noise generating equipment equipped with engineering controls viz. mufflers, silencers etc
- All vehicles utilized in transportation of raw material and personnel will have valid Pollution under Control Certificate (PUC)
- Periodic preventive maintenance of vehicles as per manufacturer's schedule to ensure compliance with the vehicular noise limits specified by CPCB

- All high noise generating equipments will be identified and subjected to periodic preventive maintenance.
- No night time operation of vehicles and construction activities will be undertaken.
- Engines of vehicles and construction equipment to be turned off when not in use for long periods.
- Installing acoustic enclosures and muffler on engine exhaust of DG sets to ensure compliance with generator noise limits specified by CPCB.
- Debris and excavated material generated during construction activities to be stockpiled in designated areas onsite. No material to be disposed in adjacent land surrounding the site boundary.
- Fuel and chemical storage areas will be paved and properly bunded. Bunded areas will be designed to accommodate 110% of the volume of spilled material.
- Spill kits will be made available at all fuel and chemical storage areas. All spills/leaks contained, reported and cleaned up immediately.

6.3 EMERGENCY PREPAREDNESS & RESPONSE PLAN

Purpose

DMSPL's has prepared a site specific Emergency Management Plan for implementation at the project site in the event of an emergency situation so that the loss of life and damage to the properties & natural resources are minimized. This plan will outline a series of emergency actions that will be executed by the DMSPL & its Contractors to ensure preparedness and response to emergency situations throughout the life-cycle of the project.

Definition

Emergency - Any unplanned situation, which presents a threat to the safety of workers and/or damage to the properties and other natural resources deemed valuable at the project site

Emergencies

The emergency situations that are probable to occur at the solar power site and the probable causes are listed below:

- Fire resulting from electrical short circuit at the plant and equipment during both construction & operation phase.
- Outbreak of endemic disease among construction workers due to contaminated drinking water, unhygienic conditions that have developed at workplace etc;
- Protests by the local community or other stakeholders at any point of the project lifecycle due to conflict with project activities;

- Flood and earthquake in the region; and
- Serious injury or death of employee or sub-contracted worker at work, due to non-work related illness or work-related accident.

Emergency Management

The following steps shall be taken to ensure proper management of emergency or crisis situations:

- An Emergency Management team during operation phase of the proposed Solar PV Power Plant; shall be formed to combat any emergency situation arising at site and ensure safety of the life and property at site. The team shall be headed by Project Head/ Emergency Coordinator.
- An emergency communication system will be prepared and informed to all concerned. The nearest civil hospitals, private health care centers or practitioner clinic shall be identified and a agreements shall be made with the aforesaid medical centers/practitioners to provide prompt health care services (including ambulance services) in the event of an emergency situation at site.
- A list of important telephone numbers such as fire brigade, health care facility/practitioner, police station, EHS and Social Coordinator, project office, head offices etc shall be displayed at all the prime locations at site
- Regular liaisoning with the police, Gram Panchayat, district administration shall be carried out to ensure that prompt assistance is readily available in the event of an emergency.
- Development and implementation of a grievance redressal procedure to deal with village level issues/concerns at preliminary stage to prevent fall out of any major emergencies.
- Emergency Response Team (ERT) to be trained on Emergency scenarios and their management measures including their roles and responsibilities in case of an emergency situation.
- Emergency evacuation plan to be developed and keep for ready reference

In case of an emergency, all site personnel shall be trained to follow the communication lines given below:

  - Personnel at site affected by the emergency situations immediately inform the project office and the external agencies (such as police, fire brigade, ambulance services); In case, project office cannot be reached, the Coordinator will be informed directly;

- The Emergency Management Coordinator on being informed about the emergency by project offices or by the employee directly; reaches site if necessary, and also follows-up with the aforesaid external agencies for aid;
- The Coordinator takes charge of the emergency response and direct further action and co-ordination, including escalating the matter to the project management as required.

Responsibilities

The Project Head will be responsible for implementing this procedure, which includes (a) ensuring that the emergency preparedness measures are in place; (b) providing training to the personnel at site regarding reporting of the emergencies, and to site office personnel regarding response to emergency calls from the site personnel and (c) direct action-and co-ordination at the time of an emergency.

6.4 WASTE MANAGEMENT PLAN

Scope

The Waste Management Plan (WMP) shall be applicable to the wastes arising during commissioning and operation of the proposed Solar Power Plant of DMSPL. The major waste streams from the project include non-hazardous solid waste, wash water, generated from panel washing and sewage.

Purpose

WMP is intended to serve as a guideline for DMSPL & the contractor(s) to manage wastes effectively during the project life cycle. The WMP describes how wastes will be managed during the project life cycle and how the project will:

- Minimize the potential to cause harm to human health and the environment.
- Comply with Indian Environmental Regulation & IFC Performance Standards.
- Reduce operational costs and reduce any potential liabilities which may arise from waste handling operations.
- This plan also ensures that every waste stream and solid waste materials from the main plant site and the associated facilities will be managed effectively.

6.4.1 Solid Waste Management

Management of Solid Waste & Hazardous Waste during Construction & Operation Phase

The EPC contractor should manage the waste generated during construction phase like construction debris, packing material, paint containers and filters.

The management measures of the aforementioned solid wastes and the hazardous wastes are discussed in details below:

- The recyclable and non-recyclable non-hazardous solid waste generated onsite should be collected and stored in a temporary waste storage facility from where all the wastes shall be sent for recycling and disposal to appropriate facilities.
- The reusable waste like wooden waste and cardboards from packing material, empty cement bags, construction debris etc can also be given to locals for their use or give it back to original equipment manufacturer (OEM)

6.4.2 Liquid Waste Management

Liquid Waste Management during Operation Phase

The liquid wastes likely to be generated during the operation phase include:

Domestic Waste Water – Domestic Waste Water likely to be generated from toilets/urinals within the proposed plant and associated facilities shall be treated in combined septic tank-soak pit system.

Wash water from Panel Washing & Floor Washing – The wash water generated from periodic cleaning of panels, equipment within the solar power plant can be reused for greenery development within the main plant, as it may not contain any pollutants requiring treatment.

6.5 STORM WATER MANAGEMENT PLAN

The Storm Water Management Plan (SWMP) refers to the proper management of surface run-off generated during monsoon from the Solar Power Plant area. The purpose of Storm Water Management Plan (SWMP) is to ensure prevention and control of any adverse impact due to un-regulated storm water runoff from the main plant to the nearby natural drainage channels, surface water bodies, public and private properties. Following measures shall be undertaken as part of the Storm Water Management Plan:

- All cross drainage structures within the site shall be designed and constructed to handle maximum rainfall.
- The existing peripheral drains shall not be altered until the completion of construction of permanent plant boundary. This will prevent the silt contaminated surface run-off from site to enter into the adjoining lands.
- Storm water from all longitudinal and cross drainage works within the main plant shall be connected to a detention pond to be constructed within the main plant.
- No surface run-off from within the solar power plant site shall be directly discharged into any nallah/water body.
- Water from the storm water detention pond shall be reused for non-potable purposes

- Periodic cleaning of drainage shall be undertaken before monsoon set in to maintain uninterrupted storm water flow.

6.6 OCCUPATION HEALTH & SAFETY MANAGEMENT PLAN

The occupational health & safety (OHS) of the employee and contractual labours shall be maintained at the work sites during both construction and operation phase. The OHS Management measures shall comply with the Indian Regulatory requirements under OHSAS and the Factories Act. Since construction phase is almost completed this plan only deals with the OHS issues of operational phase of the Solar Power Plant.

Construction Phase

The following occupation health & safety measures shall be adopted during the construction phase:

- The workers shall be provided with proper personal protective equipment (PPEs) i.e. safety shoes & goggle, helmet, coverall, gloves, ear plugs etc. during construction related activities to ensure health and safety of the workers at workplace.
- Ensure provision and maintenance of drinking water and sanitation facilitation for construction workers in accordance to the provision of Contract Labour Act and Building & Other Construction Workers Act.
- Periodic cleaning of work areas shall be undertaken to ensure hygienic conditions at site.
- The workers shall stop working in extreme natural climatic conditions i.e. heat wave, heavy rain, flood, etc.
- All the work places shall have adequate fire alarm and fire fighting equipment to handle any fire incident.
- Adequate drinking water shall be supplied at workplace for the workers onsite and the water quality shall meet the drinking water quality standards.
- Sufficient light and ventilation shall be provided for the workers working in confined space.
- Periodic health check up camps for the workers onsite shall be organized to ensure prevention of occupational health hazards.
- All the work areas shall have first aid kits to manage any injuries occurring in the area.

Operational Phase

Although no significant occupational health and safety risks have been identified during operations however the following mitigation measures need to be adopted:

- The operating personnel are provided with adequate PPEs depending upon the nature of the operation and the occupation health & safety risks associated with it viz. electrical maintenance activities, replacement of solar panels etc
- Special emphasis on electrical safety and all employees shall be trained in respect of electrical safety & first aid
- Standard Operation Procedures (SOPs) shall be developed for operational activities likely to have potential occupational health and safety risks
- All enclosed spaces shall have adequate light and ventilation arrangements and potable water & sanitation facilities.
- Periodic medical examination will be undertaken for workers of the plant.
- Periodic inspections shall be carried out to ensure all the above are implemented and any non-conformances shall be recorded along with any grievance related to OHS issues.
- An EHS coordinator shall effectively implement and monitor the OHS Management System and ESMP.

6.7 ROAD SAFETY & TRAFFIC MANAGEMENT PLAN

The solar power plant will involve vehicular movements across the main plant site and the access roads, which may lead to impacts on existing road users and sensitive receptors located close to the site & approach road. This Road Safety & Traffic Management Plan identifies the potential impacts and their appropriate mitigation measures to avoid any unforeseen traffic accident and other disturbance to local communities during construction and operation phases of the project.

Traffic and Road Safety Measures during Construction Phase*:* The key issues addressed by TMP in terms of management measures include:

- The temporary access roads to construction sites shall be sprinkled with water for dust suppression to reduce emission of dust , if required
- Restrict use of horns when the vehicles ply with in village and habitat areas.
- Communicate to Local villagers on the peak vehicular movement.
- Proper warning signage shall be provided during movement of Heavy vehicles carrying equipment and machinery; all the vehicles entering the access road shall have Pollution under Control (PUC) certificates.
- The contractor shall comply with all statutory vehicle limits (width, height, loading, gross weight) and any other statutory requirements.

- Speed-arresters shall be provided to restrict the speed of the vehicle.
- Use of seat belts for both drivers and passengers shall be made compulsory to minimize death & injuries in the event of an accident.
- Periodic Road Safety campaigns and awareness sessions shall be carried out among the villagers and the site workers/personnel
- Regular inspection of the vehicles and the drivers shall be conducted to ensure minimum HSE risks.
- The site shall frame and implement a "No Tobacco No Alcohol" Policy to prevent road accidents/incidents.

Traffic and Road Safety Measures during Operational Phase*:* The key issues addressed in terms of management measures include:

- All the permanent access roads to main plant site and the internal roads (within the plant) shall be black-topped with road dividers.
- Reduce the use of horns near the villages, main plant and internal roads All the vehicles entering the access roads and plant shall have Pollution under Control (PUC) certificates.
- The speed limit in the internal roads shall be restricted to 20 km/hr.
- Proper warning signs and road safety awareness posters shall be displayed to create road safety awareness among the personnel accessing the solar power plant.
- Periodic Road Safety and Traffic Management campaigns and awareness sessions shall be carried out among the villagers and the plant workers/personnel to develop road safety awareness among the people likely to be impacted by the project.
- An emergency road safety plan shall be framed by the Proponent to combat any emergency conditions/accidents along the highways, access roads and within plant area.
- There must be "No Tobacco No Alcohol" Policy to prevent accidents/incidents.
- Use of seat belts for both drivers and passengers shall be made compulsory to all company travellers in cars and other vehicles.

6.8 WILD LIFE MANAGEMENT PLAN

Purpose

The purpose of Wildlife Management Plan is to minimize the impact on the faunal resources in the Rann Biosphere Reserve area which is located within 10 Km from the northern boundary of the proposed plant. This plan details out the measures and strategies to be

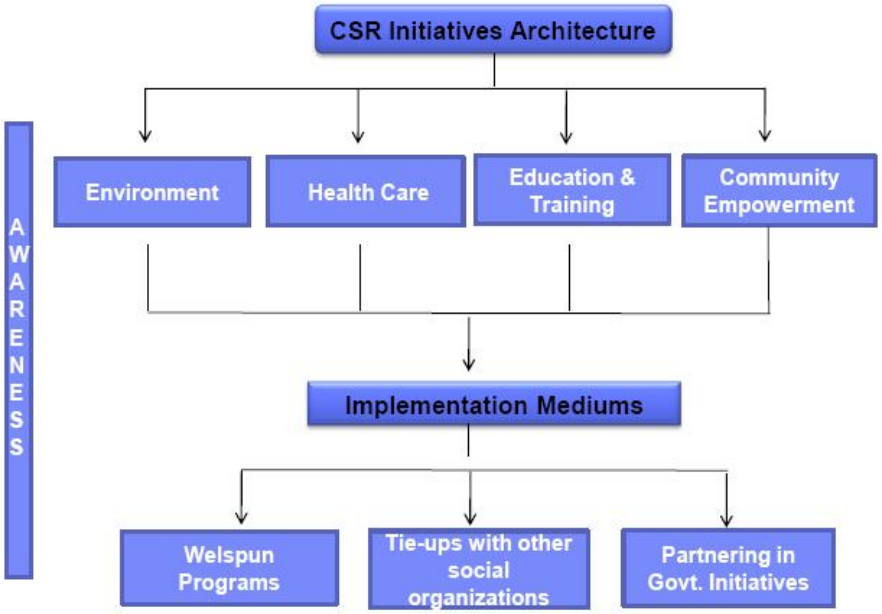
adopted by DMSPL and the Contractors during each phase of the project, to reduce impact on wildlife, if any.

Suggested measures

- The project site will be properly fenced (chain-linked) during construction to avoid straying of any wildlife;
- Proper electric supply connection line from the grid will be laid for the proposed project activity. Noise Levels at the construction site will be controlled through selection of low noise generating equipment and noisy work will be avoided during night time. Movement of the heavy vehicles will be restricted in the night time especially near to sanctuary area. Construction labor camps at site shall be avoided so that procurement of fuel wood and other resources from little Rann of kutch by workers during construction phase can be prevented.
- Care would be taken while disposal of construction and other wastes.
- Any animal if trapped during site development or operation of would be released into the original habitat;
- Seek a Veterinary Doctor's help In case of any emergency.
- All sightings of wildlife in and around the project site must be reported and adequate steps will be taken with the help of forest personnel to reduce man animal conflict Signage would be provided in areas of wildlife sightings and crossings along the defined vehicular movement route
- The EHS Coordinator will hold training program for all the DMSPL project personnel and contractors on the applicable practice and mitigation measures outlined in this plan.

6.9 SOCIAL ENVIRONMENT MANAGEMENT PLAN

The solar power project has positive socio-economic impact in its each stage right from hiring the unskilled labour during site preparation activities. The project has generated local employment of around 50 temporary jobs during construction and will also generate 5-10 unskilled jobs during the operation. DMSPL has been actively engaged in CSR activities in Gujarat. This project area will also be covered in future programs. The CSR activities are being undertaken by DMSPL in collaboration with local administration, gram panchayat, block development office etc. The CSR activity revolves around EEE (Environment, Education & Empowerment) as provided below. Keeping in view of the above and based on outcome of the public consultations DMSPL need to develop and implement a targeted "*Community Development Plan & CSR Program*" in continued engagement with the Fatepur Panchayat and village communities.



6.10 DECOMMISSIONING PLAN

Although no potential significant impacts have been identified as part of the decommissioning activities to be undertaken at the end of the project life cycle adequate environmental safeguards need to be adopted by the project proponent and the contractor to mitigate any short term impact that may arise from such activities. This includes:

- Recycling of solar panels, inverters and related electrical equipment to be carried out in accordance to the provision of E-Waste Management & Handling Rules 2011.
- Recycling of used batteries to be carried out in accordance to the provision of Battery Waste Management & Handling Rules 2001.
- Vehicles deployed by contractors need to have valid PUC and subjected to periodic preventive maintenance.
- Possible options for reuse/disposal of demolition waste/debris generated from decommissioning need to be assessed and evaluated in consultation with the local communities.
- Adequate care need to be taken during decommissioning of septic tank-soak pit system to prevent any ground water contamination and generation of unpleasant odour.
- Heavy equipments to be deployed for decommissioning of civil structures need to be equipped with acoustic controls.

6.11 ENVIRONMENTAL MONITORING PLAN

The Environmental Monitoring Plan has been formulated to ensure and demonstrate compliance with the Regulatory and Institutional Agency's EHS requirements. The monitoring of Environmental and Social parameters and compare the same against the benchmark as set by the Regulatory & Institutional Bodies will help DMSPL assessing the Environmental Performance and identify any gaps or non-conformance for taking immediate actions. The following environmental parameters shall be monitored continuously during project operational phase for compliance. The same has been provided in **Table 6.2.**

TABLE 6-2: ENVIRONMENT MONITORING PLAN

Activity	Parameter	Frequency	Roles & Responsibility	Location
Ambient Air Quality Monitoring (if applicable as per consent conditions)	SOx, NOx, PM_{10}, $PM_{2.5}$, CO	As and when required during operations as specified in the consent condition	DMSPL through an external monitoring agency	Project site and near Fatepur village
Ambient Noise Quality	Measurement of Noise Pressure Level in dB(A)	As and when required during operations as specified in the consent condition	DMSPL through an external monitoring agency	Project site and near Fatepur Village
Ground Water Quality Monitoring	IS 10500 Parameter	As and when required during operations as specified in the consent condition	DMSPL through an external monitoring agency	Plant is not consuming any ground water for plant activity. However ground water from the village hand pump will be monitored (if required)
Storm Water Quality	CPCB General Discharge Standards	Prior to discharge (if any) to natural drainage channels or reuse in green belt development	DMSPL through an external monitoring agency	Drainage discharge outlets/ Retention structures

The company should designate Head – Plant supported by EHS coordinator, as in charge for implementation of the Social & Environment Management and Monitoring Plans. The responsibilities are as follows:

- Implement the Social and Environmental Management Plan
- Conducting and coordinate meetings as required with local communities
- Conduct and facilitate EHS awareness and management trainings to the project and operations teams
- Liaison with the Gujarat State Pollution Control Board for obtaining and/or renewing consent with the support of corporate EHS
- Facilitate external reporting to the Fund at periodic interval as required

FINAL REPORT

Environmental and Social Impact Assessment Report for Proposed 15 MW Solar PV Power Plant at Fatepur Village, Surendranagar District, Gujarat

Submitted to:

MI My Solar 24 Pvt. Ltd

Prepared by:

SENES Consultants India Pvt. Ltd.

June 2012

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1 Introduction

MI MySolar24 (P) Limited (MMSPL) is proposing to set up a 15 MW solar PV project in the state of Gujarat. The proposed 15 MW solar power project of MI MySolar24 (P) Ltd is located near village Fatepur of Dasada Tehsil, in Surendranagar district of Gujarat State. MMSPL is implementing a project in Gujarat under Gujarat state policy. The estimated total cost for setting up the proposed project is Rs. 142 crores. MMSPL has signed PPA with Gujarat Urja Vikas Nigam Limited for supplying power from 15 MW Grid Connected PV based Solar Power Project. The project details are summarised in the Table 1.1.

TABLE 1-1: PROJECT DESCRIPTION IN BRIEF

Project Owner	MI Mysolar24 (P) Limited
Permissions sought / obtained from concerned authorities such as Panchayat, State Govt, State Pollution Control Board, State Wildlife Department, etc.	Allotment of Solar Power Capacity by Govt of Gujarat Power Purchase Agreement (PPA) IEM Certificate Consent to Establish from GSPCB Approval from Industrial Commissioner Agreement with Land Owners Clearance from State Wildlife Dept.
Location of Site	Fatepur Village, Dasada Tehsil, Surendranagar District, Gujarat State
Project Coordinates	Latitude 23° 25’ 5.27” North and Longitude 71° 37’ 19.61” East
Sensitive area	Little Runn of Kutch at a distance of 3 Km from the site in west direction
Total cost of the project	Rs. 142 crores
Project capacity	15 MW
Expected Project operational date	October, 2012
Technology	Grid connected based Solar Photovoltaic system
Module Type	Polycrystalline PV modules
Available land	Around 152 acres
Type of land	Private land. Mono cropped with agricultural activity only during one season. Rest of the year, the land is fallow
Nature of land	Dry land
Power Purchase Agreement	By GETCO
Power yield per annum	25.56 million units per year

To fulfil the requirements of the funding agency for the project and match international best practices, MI MySolar24 (P) Limited (MMSPL) is committed to manage the project's social and environmental risks and impacts. So MMSPL has employed SENES Consultants India Pvt. Ltd. to conduct an Environmental and Social Impact Assessment (ESIA) against the Social and Environmental Performance Standards of IFC and develop an Environment and Social Management Plan for the proposed project.

2 Project Description

2.1 SITE LOCATION

The proposed 15 MW solar power project of MI MySolar24 (P) Ltd is located near village Fatepur of Dasada tehsil, in Surendranagar district of Gujarat State. The coordinates of the site are between latitude 23 ° 25' 5.27" North and 71° 37' 19.61" East. The total area for the proposed project is 105 acres with an additional area of 47 acres demarcated for future project development. **Figure 2.1** shows the location of the project site.

2.2 SITE SETTING

Administratively, proposed project comes in Surendranagar district and located at a distance of 23.3 km away from Dasada town in Dasada tehsil and 1.5 km away from Fatepur village in northwest direction. Fatepur village is situated 76 km away from the back waters of Arabian Sea. The site is located 42.5 km away from the National highway NH-27. The nearest airport is at Ahmadabad at a distance 112 km from the project site. The Wild Ass Sanctuary in Little Runn of Kutch is located at a distance less than 10 km west of project site. MMSPL has also obtained NOC (vide letter no. – VPS/32/K/145-148/2012-13, dated 9th May 2012) from principal chief conservator of forest (Gujarat) for project execution. Dhama, Bhalgam and Surel are the nearby villages located at a approx. distance of 5.5 km (southeast), 5.5 km (southeast) and 6 km (north) from the proposed project site. The detailed project site accessibility is shown as in **Figure 2.2.**

The proposed site is having almost flat terrain with very gentle slope towards the western side. The site is devoid any distinct vegetation or specific landuse. It was reported during site visits and public consultations that the land was used for seasonal agriculture during the monsoon season and left as fallow land for rest of the year.

The project site is devoid of any major surface water bodies (pond/nala/rivers). It was observed that prominent vegetation at site comprised of bushes and site is principally devoid of large trees. However a few small trees were present at the site. A seasonal drain known as Kharwa ka Nala is passing outside the northern boundary of the project site and opens into little Runn of Kutch. The site is bounded by little Runn of Kutch in west and north west, the Fatepur village in the south and the Dhama village in the southeast.

The site surroundings have been discussed below:

North:	Immediately north of the site lies agricultural fields. Further north, a seasonal water channel exists which drains into the little Runn of Kutch
South:	Immediately south of the site abutting the project boundary lies the agricultural fields beyond which the Fatepur village is located at approx. distance of 1.5 km.
East:	Immediately abutting the project boundary on the eastern side lie agricultural fields
West:	Immediately west of the site abutting the site boundary lie agricultural fields. Further west of the fields at a distance of approx. 3-4 km the Little Runn of Kutch starts.

Photographs of the immediate site surroundings are as follows:

Photo 2-1: Photographs of Immediate Site Surrounding

	
East	**West**
	
North	**South**

Other Solar Power Plants Near to the MMSPL Project Site

- A solar power plant of 15 MW capacity is being proposed by Dreisatz My Solar 24 Pvt. Ltd., in the north of the proposed MMSPL project site.
- The Solar power plant owned by Amco Pvt. Ltd. already exists on the approaching road to Fatepur village. (Refer Photograph 2.2).

Photos 2-2: Photographs of AMCO Solar Power Plant in Fatepur village

FIGURE 2-1: PROJECT LOCATION

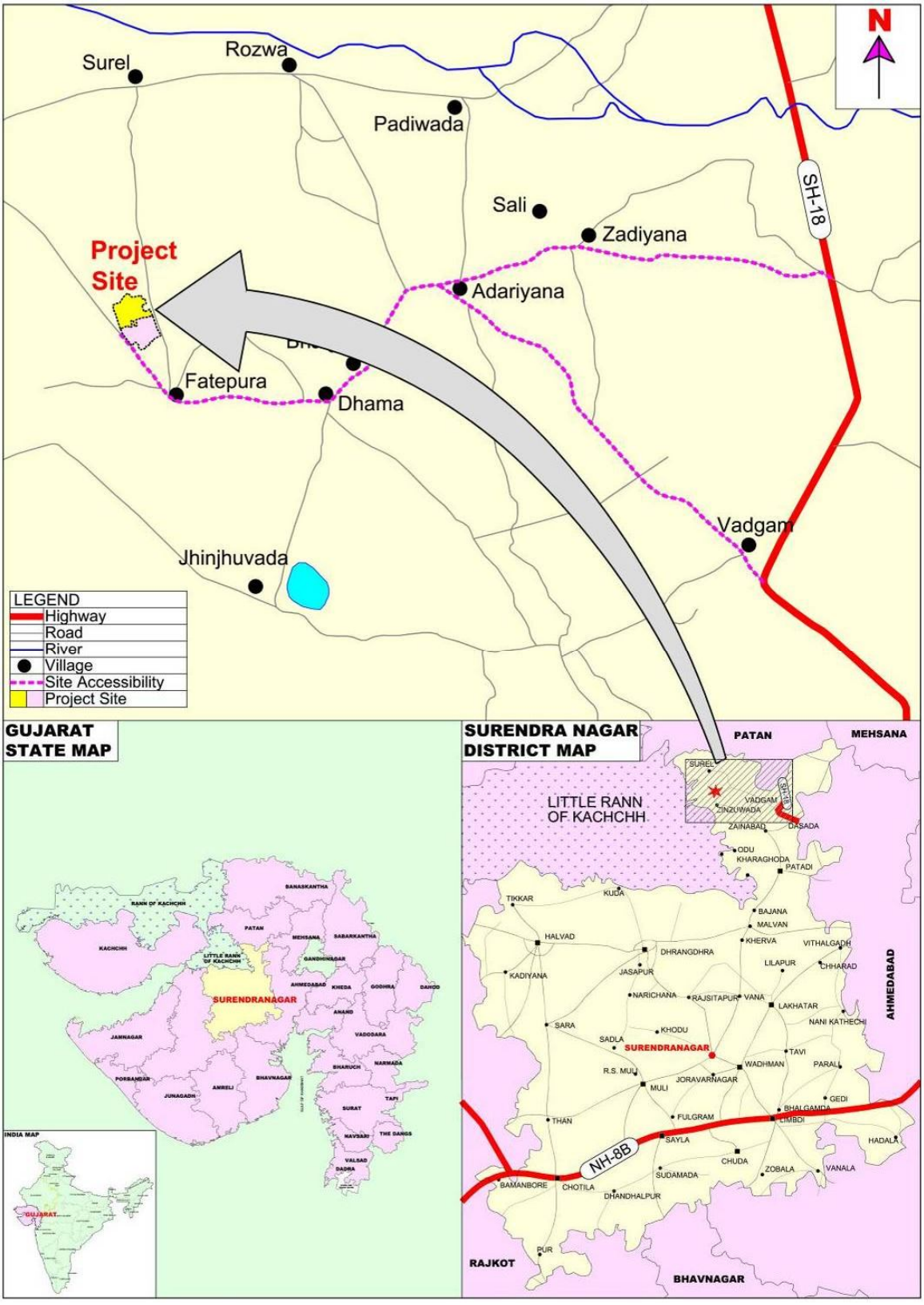


FIGURE 2-2: ACCESSIBILITY OF PROJECT SITE

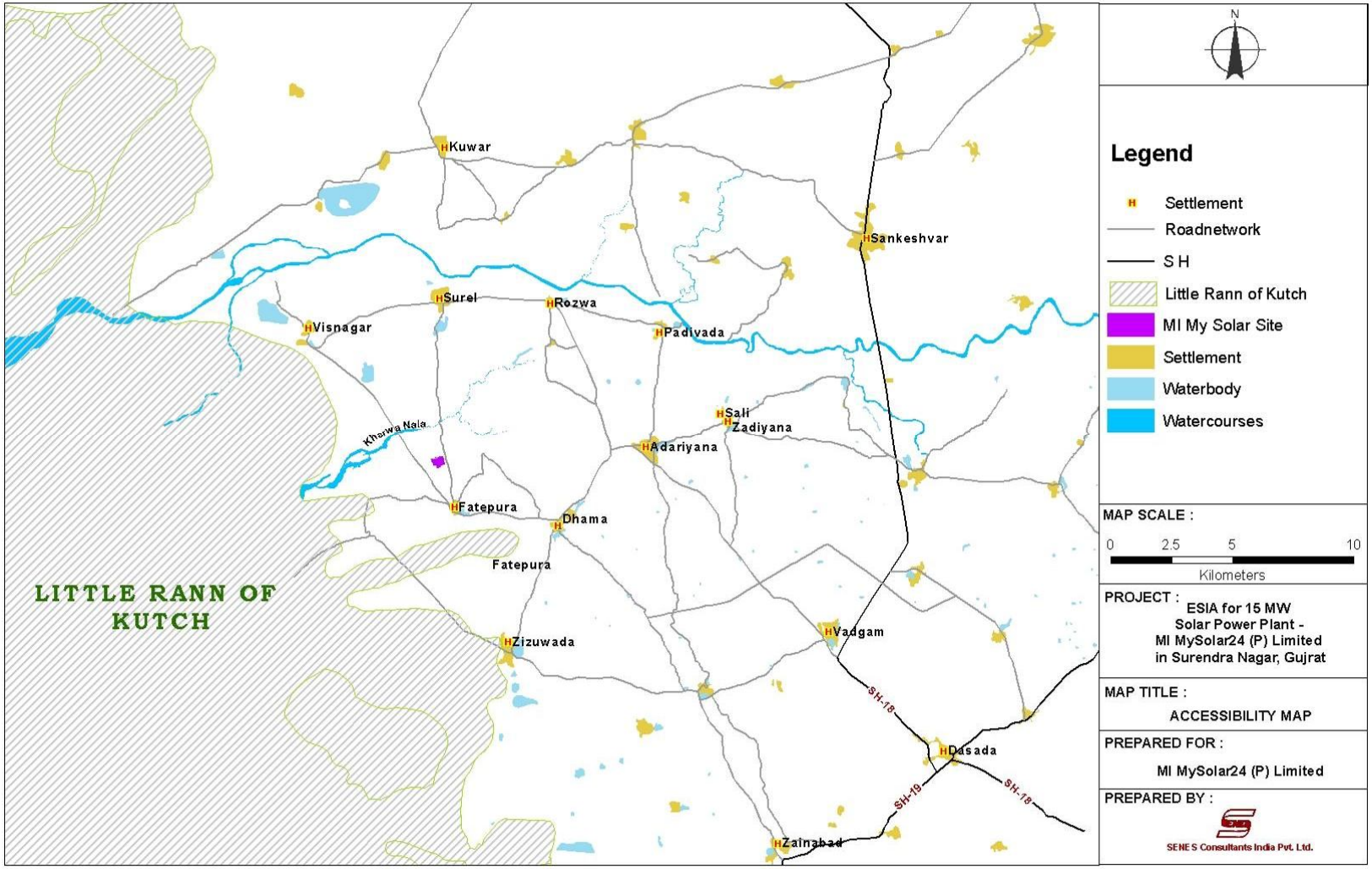
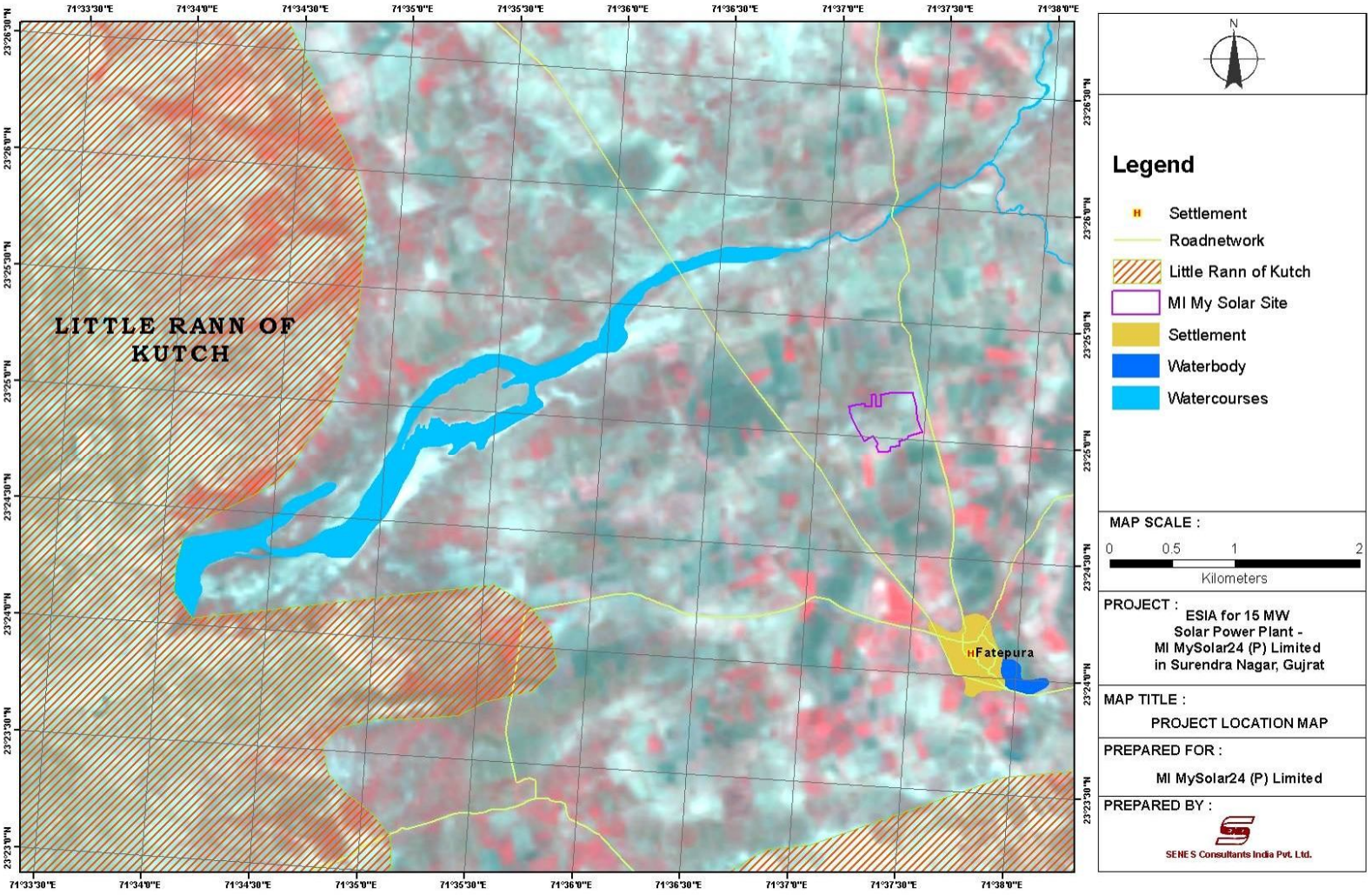


FIGURE 2-3: PROJECT LOCATION ON SATELLITE IMAGERY



2.3 PROJECT BACKGROUND

According to government estimates, the State of Gujarat receives 5.5 to 6.0 kWh/sq. m. /day of solar radiation with 330 sunny days in a year and also has 14.40 million acres of uniquely positioned waste land in the area of high solar radiation. So the State holds immense promise in renewable energy generation for India. The State Government has been actively pursuing the growth of renewable energy sources in the State and has developed a Solar Power Policy in 2009 with the vision of positioning the State as the 'Integrated Solar Generation Hub' for the nation. MMSPL is undertaking the following activities to achieve the objective of speedy establishment and implementation of proposed 15 MW solar power project. According to detailed project report, the overall project activities for the solar photovoltaic (SPV) power plant are listed below:-

- Purchase of land, site preparation, levelling etc. Construction of control room, fencing, peripheral lighting, water supply system, drainage system, approach roads etc. Supply, erection, installation and commissioning of lightning arrestors.
- Supply, erection, installation of solar photovoltaic (SPV) modules on structures. Supply, erection, installation and testing of PCUs. Interconnection of equipments and commissioning of the power plant (deliver 3 Ph, 320 V AC supply and combining the outputs of 27 nos. of PCUs). Completion of earthing system before commissioning. Supply, installation and commissioning of data monitoring system.
- Supply, erection, installation, interconnection and commissioning of power evacuation system consisting of isolators, circuit breakers, transformers and transmission line along with commissioning of metering and protection system.
- Actualize grid feed-in by synchronizing solar photovoltaic (SPV) power supply with 66 kV conventional grid supply at Dhama substation.
- Acceptance test of metering system and energy sale.
- MI MySolar24 (P) Ltd has signed PPA with Gujarat Urja Vikas Nigam Limited for supplying power from 15 MW Grid Connected PV based Solar Power Project.

2.4 LAND HISTORY AND REQUIREMENT

Land requirement for the installation of proposed 15 MW solar power project in Fatepur village is 105 acres. However, taking into account 47 acres land for future expansion, total land available with MI MySolar 24 Pvt. Ltd. is 152 acres. The total land required has already been purchased from private land owners on willing seller-willing buyer basis. The land purchased is shadow free and flat in nature. The site was used for seasonal agricultural purposes with mono-crop agricultural pattern. The vegetation at site comprised primarily of shrubs which will be cleared during site preparation activities. It was reported during consultations with local that there were no inhabitants on the land. Hence relocation of settlements was not required here.

Available land details and land requirements for setting up the plant is given in **Table 2.1 and Table 2.2** respectively. The layout for the proposed site is shown in **Figure 2.4**

TABLE 2-1: PURCHASED LAND

Sl. No	Land Owners Name	Khasra Number	Area (Acres)
1	Gandabhai Varvabhai	262	3.28
2	Mohanbhai Patel	263/1	3.38
3	Mohanbhai Patel	263/2	5.72
4	Jaisinghbhai Talshibhai; Lakhuben Talshibhai	264	7.32
5	Hirabhai Kalabhai Bhangi	265	8.12
6	Bhaghabhai Kuberbhai Bhangi; Ajuben Kuberbhai Bhangi; Laxmiben Kuberbhai Bhangi; Koliben Kuberbhai Bhangi; Kankuben Kuberbhai Bhangi;	266	6.10
7	Ajmalbhai Jerambhai; Raghubhai Jerambhai; Melabhai Jerambhai; Mafabhai Jerambhai; Chothabhai Jerambhai; Shankuben Jerambhai;	267	6.97
8	Pushotamdas Patel	268	7.95
9	Punjabhai Somabhai	269	5.57
10	Punjabhai Somabhai	270	6.22
11	Soni Aartibhai Harshbhai	271	8.37
12	Dhirajbhai Shivlal Soni	272	4.77
13	Dhaval Patel; Kishan Patel; Dipak Patel	273	5.15
14	Dhaval Patel; Kishan Patel; Dipak Patel	274	6.67
15	Kaisabhai Khodabhai Koli	275	5.80
16	Govabhai Rupabhai Harijan	276	7.65
17	Sonabhai Thakor	277	4.92
18	Varsanghbhai Devjibhai	278	6.00

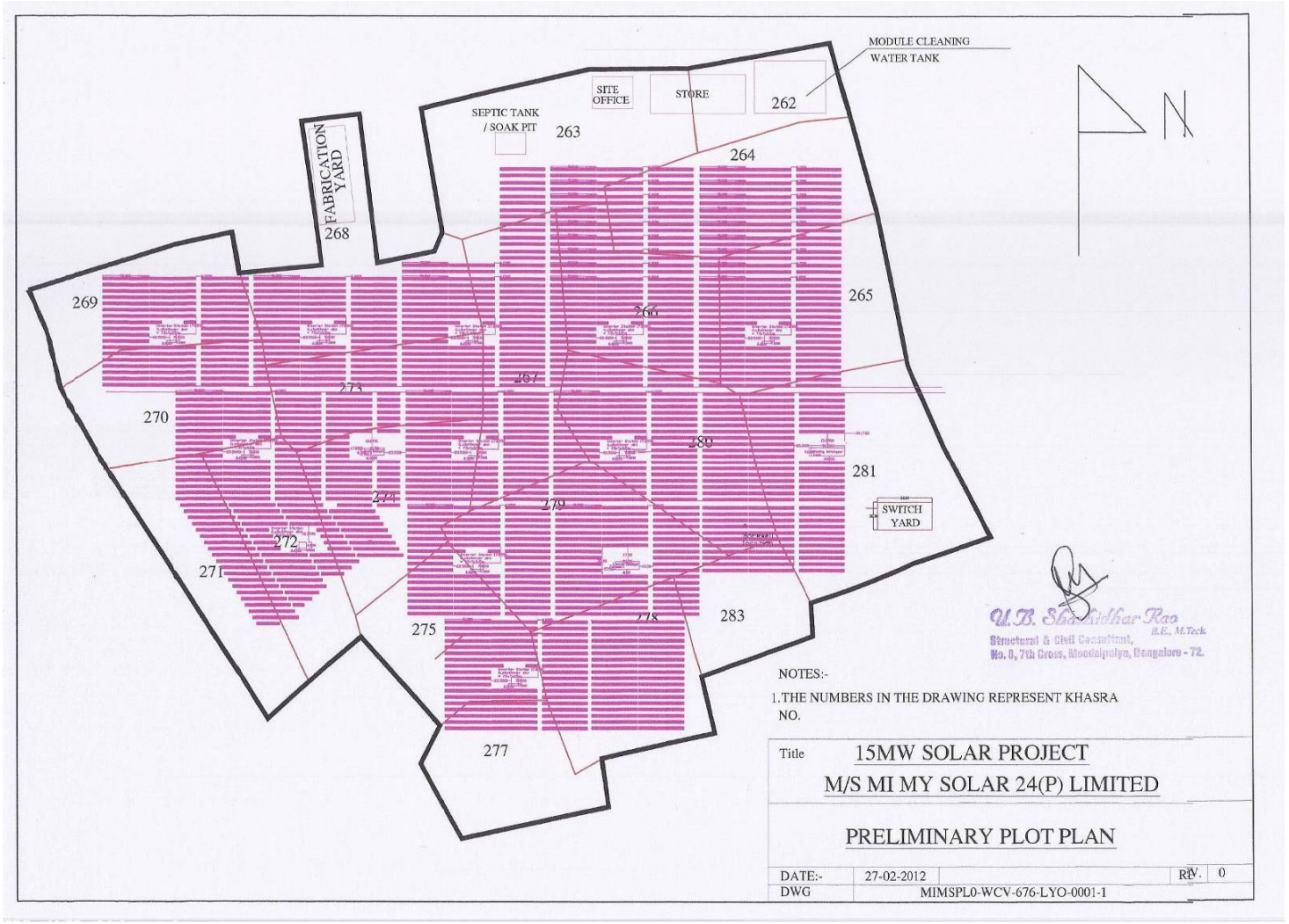
Sl. No	Land Owners Name	Khasra Number	Area (Acres)
19	Dhaval Patel; Kishan Patel; Dipak Patel	279	8.15
20	Gangarambhai Koli	280/1	4.61
21	Dhaval Patel; Kishan Patel; Dipak Patel	280/2	2.97
22	Dineshbhai Kantilal; Chandrakant Kantilal	281	12.15
23	Bhaghabhai Kuberbhai Bhangi; Ajuben Kuberbhai Bhangi; Laxmiben Kuberbhai Bhangi; Koliben Kuberbhai Bhangi; Kankuben Kuberbhai Bhangi;	283	3.82
24	Kalubhai Punabhai; Labhubhai Punabhai; Dudabhai Punabhai; Kantiben Punabhai; Amarben Punabhai; Panchabhai Punabhai; Prahladbhai Punabhai; Keshiben Punabhai; Naniben Punabhai; Pashiben Punabhai; Bhopabhai Punabhai;	296	10.90
		Total	**152.56**

TABLE 2-2: LAND REQUIREMENT FOR THE PROPOSED PROJECT

Sl. No.	Major Component/ Location	Land Required for One Item	No. of Component in the Plant	Area Required (m^2)
1	Modules in structures including pathways	80 m^2	1360	108,800
2	Pathways	3.6m width 6m width	66930 m length 1680	240,948 10,080
3	Inverter rooms (outer dimensions)	7.5 x 7.5	13	731.25
4	Branch Switch Gear	20.5x 7.5	1	153.75

Sl. No.	Major Component/ Location	Land Required for One Item	No. of Component in the Plant	Area Required (m^2)
	room (outer dimensions)	16 x 6.5	1	104
5	Pooling Switchgear room (outer dimensions)	30.5 x 9.5	1	289.75
6	66 kV Switch yard	30 x 20	1	600
7	Area around control rooms to avoid shading	56 x 24 m	14	18,816
8	Perimeter road	6 x 2700 m	-	13,500
9	Greenery			30878.61
	Total			4,24,901.36
	Total area required in acres (4047 sq.m/acre)			**105 acres**

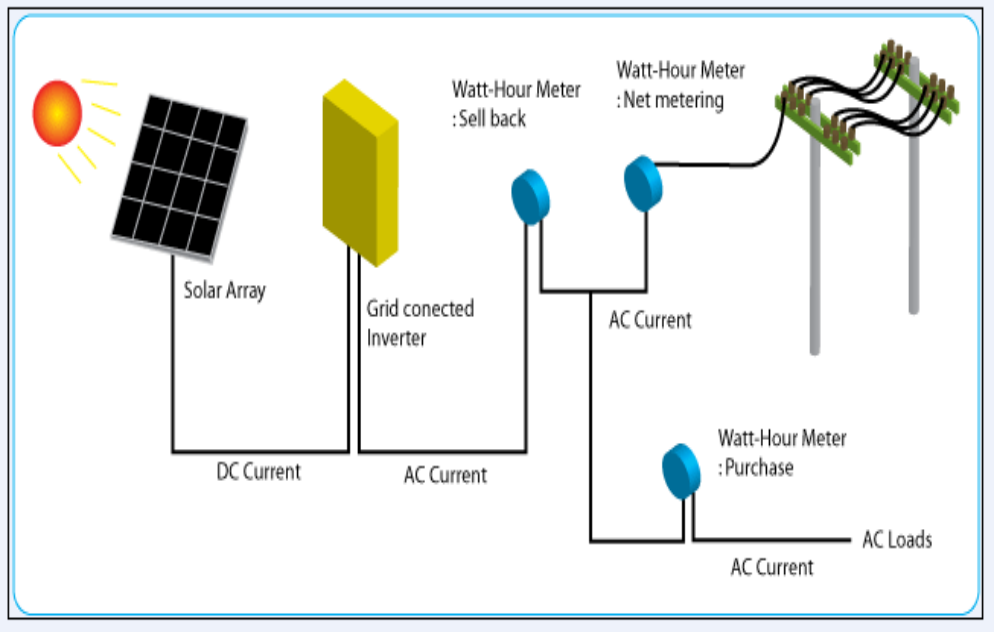
FIGURE 2-4: PROJECT SITE LAYOUT



2.5 TECHNOLOGY & DESIGN

The proposed solar power plant is of Grid connected system type, producing a large quantity of photovoltaic electricity in a single point. Schematic diagram of a Grid connected system is shown as in **Figure 2.5.**

FIGURE 2-5: GRID CONNECTED SYSTEM – BASIC SYSTEM DESIGN



The system consists mainly of the following:

- Solar PV array – which produces DC electricity when solar rays are incident on it.
- Power Conditioning Units (PCU) – These convert DC (Direct Current) electricity into AC (Alternating Current) electricity and facilitate synchronization with the grid power.
- Transformers – which transform the AC output of the Power Conditioning Units to the level required at the grid.

The Maximum Power Point Tracking (MPPT) circuit within the PCU extract the Maximum available power from the solar array and feeds it to the grid. If the grid voltage and / or frequency go out of the window, the PCU immediately isolates from the grid. The PCU will reconnect after a pre-determined time when the grid is back within the window. When the feed-in power is below a pre-determined level or when the solar insolation is below a selected value for a pre-determined period of time the PCU is isolated from the grid and is operated in sleep mode. This minimizes the stand by losses.

The 15 MW power systems circuit typically will consist of 27 numbers of 500 KW PCUs. Advantage of using a central inverter (instead of module oriented inverters) is that the module fields are less sensitive towards partial shading.

The AC power from the PCUs are fed into lower voltage panel and then to the transformers through isolators and circuit breakers. The secondary side of the final transformer is routed through a high voltage panel, fitted with necessary measuring and protection devices, before connecting to the grid.

A grid connected SPV power plant consist mainly of the following components:

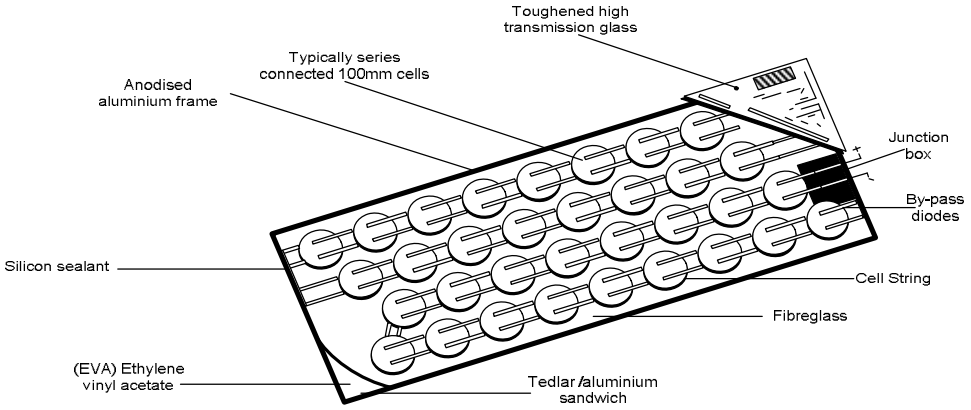
- Solar PV Modules
- Power Conditioning Units
- Module Mounting System
- Grid Connect Arrangements
- Monitoring Systems
- Cables and Connectors
- Control Room

Solar PV modules

The proposed Solar PV project will use fixed polycrystalline PV modules, south facing orientation, tilted 20° from the horizontal to maximise the total annual incident solar irradiation. The 15 MW solar PV plant has been configured into 14 modular plots, out of which 13 Nos. plot will comprise of 1.11 MWp of solar PV and two 500 kW inverters located at the centre of the each plot . There will be one plot with only one 500 kW inverter. The PV plant is designed for 4848 Nos. of modules in 202 strings connected to two 500 kW inverters forming a modular plot of 1.11MWp. Each inverter takes load of 101 strings This configuration is used to give a better system redundancy and economy for upstream project components.

The PV modules are electrically connected with cables sized to minimise DC ohmic losses. The DC electrical output from the PV modules is fed through solar PV grade cables to string monitoring junction boxes to inverters. The inverters convert the DC electrical output to AC.

Structure of PV Module



Advantages of fixed polycrystalline PV modules are given below:

- Reliability- Crystalline more reliable than Thin film
- Area required- Crystalline needs less area in comparison to thin film.
- O&M cost – Cost of maintenance is much more in thin film than crystalline
- The PV module configuration have been discussed below in **Table 2.3**

TABLE 2-3: PV MODULE CONFIGURATION

PV Module Configuration	Values
PV module	BYD 230P6-30
Module peak power	230Wp
Open-circuit voltage, Voc, (V)	36.83
Optimum operating voltage	29
Short-circuit current, Isc (A)	8.52
Optimum operating current	7.93 A
Maximum Power at STC	230 Wp
Operating temperature	-40 to +85 ^{0}C
Maximum system voltage	1000 V DC
System Design Parameters for each MW Plot	
Modules per string	24
Strings per inverter	101
Modules per inverter	2415
Modules per mounting structure	48
Modules in 15 MW plant	64128

Source: Detailed Project Report

Power Conditioning Units

The modules connected in series are known as strings. The strings are connected to the String Monitoring Units (SMUs) and the SMUs are connected to PCUs which converts DC to AC power supply. The 15 MW power systems circuit typically will consist of 27 numbers of 500 KW PCUs.

Module Mounting System

The mounting structure is designed for holding designed number of modules in series. A fixed module mounting system of 20° inclination has been chosen for the PV plant. Fatepur lies in high damage risk zone with maximum wind speed in the range of 47 m/s. Load withstanding capacity of the PV module is to be verified for the maximum wind suction load on modules at 50 m/s at tilt of 20° and ensure the same is well within limits.

Transformer

The cable routes from inverter leads to the MV transformers stepping up voltage to 11kV. In order to achieve system redundancy at MV level, power output from a set of six modular plots will be combined to form a 11 kV bus bar synchronized panel. Two such combined bus bar panels are planned. The power from the plant shall be evacuated by stepping-up the power from 320 V to 66 kV in two stages, from LT to 11 kV and from 11 kV to 66 kV, through two nos. 11/ 66kV, 7.5 MVA transformers. The proposed 66 kV switchyard in the SPV plant premises will have double bay arrangement with two power transformers of 66 kV level with control and protection equipment.

Control Room

Switch gears in a central control room will receive the incoming feeders from the two 11 kV panels, one feeder from the thirteenth 11 kV panel and the 11 kV feeder from the 750 kV transformer. From the main control room, the 11 kV output is fed to two Nos. 11/66 kV, 7.5 MVA transformers and finally evacuated to the grid of 66kV through 66 kV switch gears/control panels.

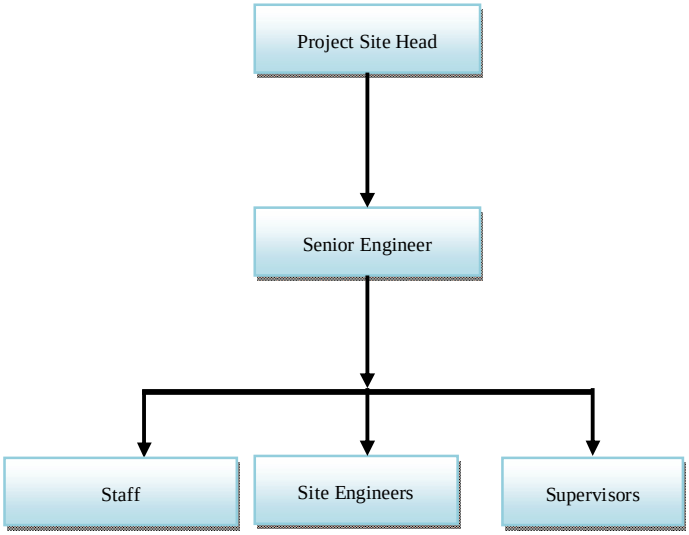
Power Evacuation

Power evacuated from the solar PV plant will be received at Dhama substation which is 5.07 Km away and owned and operated by Gujarat Energy Transmission Corporation Ltd. (GETCO). The point of interconnection and metering for the evacuated power will be within the PV plant premises.

Transmission line between the solar photovoltaic (SPV) plant and the GETCO sub-station shall be of double circuit conductor, and shall be taken through steel lattice towers suitable for double circuit conductors. Foundations, civil works and execution of work shall be in accordance with GETCO norms. The responsibility for the transmission system from the SPV switchyard shall be the responsibility of GETCO, as per their policy.

2.6 OPERATION AND MAINTENANCE

Depending on the O&M requirements the firm will make necessary arrangements for proper implementation of O&M.



During the commissioning of the plant, training will be imparted to the Engineer, Supervisor and Operators. The basis for the training will be according to the plant's O&M manual. This operational training will cover the following:

- The nature, purpose and limitations of all plant and equipment
- The detailed operating instructions on each section and equipment of the plant
- The emergency procedures and all related HSE issues according to the standards

2.7 DECOMMISSIONING PHASE

The proposed 15 MW solar power project includes solar panel, inverters, batteries, and transformer as electrical components along with solar modules foundation, access road, sanitation facilities, site office, and inverter rooms being identified as the civil structures. However with the end of the effective life cycle of the project i.e. 25 years the electrical and civil components will be decommissioned by the proponent to facilitate site restoration for agricultural and green area development. Decommissioning activities will primarily involve only vehicular movement and operation of workforce limited to the vehicular transportation of solar panels, inverters etc and demolition of concrete structures/foundations.

2.8 MANPOWER

The proposed power plant will create direct employment opportunity for approximately 50 skilled, 4 high profile technical personnel and indirectly for 50 personnel.

2.9 UTILITIES AND INFRASTRUCTURE

Water

Ground water and water supply provided by Gujarat Government are the source of drinking water in Fatepur village. Study area including the proposed project site is water scarce area where ground water table found at approx. 350-400 ftbgl. Solar PV plant is direct conversion technology so it does not require water during plant operation. Assuming a minimum of three

litres of water per module, the water requirement for cleaning of the whole plant (64128 Nos.) and for other needs is estimated at approximately 1,92,384 litres. However, the cleaning of modules will be undertaken once in 4-5 days. In other words, the capacity of tank will be 192 m^3 (considering 4 days storage) which will work out to 48 m^3 (48,000 litres) of water per day.

Power

A minimal LT power is required for the project at the time of plant construction phase. As the installation time is limited, MMSPL use more manpower and machineries for timely completion of project. Estimated power requirement for project is 50 kW with maximum load of 35 KVA.

2.10 COST OF THE PROJECT

The proposed solar power project located at Fatepur village of Dasada tehsil, in Surendranagar district of Gujarat is a high yielding project because it is located in a hot climate with minimum rainfall. The Yield is expected to be around 25.56 million units per year. Based on the current rates of various equipment and construction costs, the approximate cost of a plant is around 9.5 crores per MW. The estimated total cost for setting up the proposed project is Rs. 142 crores. The major cost is for land and equipment which constitutes more than 85% of the cost.

2.11 IMPLEMENTATION SCHEDULE

It is expected that the 15.0 MW solar photovoltaic power plants will be commissioned by October 2012

3 Social and Environmental Compliance Requirements

This section describes the regulations, statutory guidelines and obligatory standards that are applicable to the social and environmental performance of the proposed project.

3.1 NATIONAL REGULATIONS

The environmental and safety related national regulations that are applicable to solar power plants are discussed below.

TABLE 3-1: APPLICABLE ENVIRONMENTAL, HEALTH, SAFETY & SOCIAL REGULATION

Sl. No	National Env., Health & Safety Regulation	Requirement	Applicability
1	The Air (Prevention & Control of Pollution) Act 1981	The Air Act prohibits any person from establishing or operating any industrial plant in an air pollution control area, without previous consent of the State Pollution Control Board. Under the above Act, industries are mandatorily required to apply for Consent to Establish and Consent to Operate from the State Pollution Control Board (also called No Objection Certificates). The State Boards are responsible for granting and renewing the consents and are empowered to revoke such permits and order closure of a project in case of non-compliance with the provisions of these Acts and/or the general or specific consent conditions. Any Establishing or Operating Industrial Plant is required to ensure under the Act, that the emissions from the activities within the plant site comply with the Specific Emissions Standard as laid down by Central Pollution Control Board as part of the Act. As per the Industry Classification published by the Gujarat Pollution Control Board, solar power projects are classified as Other Category industries requiring Consent to Establish from the Pollution Control Board.	During Pre-construction, Construction & Operation Phase. CTE is applicable for the establishing project while CTO is applicable for the Operation Phase of the project. However the project being PV solar project, no significant air pollution is anticipated due to plant operations. CTE for the proposed project has been obtained vide letter no. GPCB/NOC/SRN-523/ID-20401/425.dated 3rd May 2012.
2	The Water (Prevention & Control of Pollution) Act 1974	The Water Act prohibits any person from knowingly causing or permitting any poisonous, noxious or polluting matter, determined in accordance with standards laid	During Pre-construction, Construction & Operation Phase. CTE

Sl. No	National Env., Health & Safety Regulation	Requirement	Applicability
		down by the State Board, from entering directly or indirectly into any stream or well or sewer or on land; It also prohibits any person from knowingly causing or permitting to enter into any stream any other matter which may tend, either directly or in combination with similar matters, to impede the proper flow of the water of the stream in a manner leading or likely to lead to a substantial aggravation of pollution due to other causes or of its consequences. Under the above Act, industries are mandatorily required to apply for Consent to Establish and Consent to Operate from the State Pollution Control Board (also called No Objection Certificates). The State Boards are responsible for granting and renewing the consents and are empowered to revoke such permits and order closure of a project in case of non-compliance with the provisions of these Acts and/or the general or specific consent conditions. As per the Industry Classification published by the Gujarat Pollution Control Board, solar power projects are classified as Other Category industries requiring Consent to Establish from the Pollution Control Board.	is applicable for the Construction Phase; while CTO is applicable for the Operation Phase
3	Water (Prevention and Control of Pollution) Cess Rules, 1978	These Rules specify manner of payment of the cess to the Central Government and the time within which it shall be paid respectively in case the water consumption is more than 10 KL/day. These Rules specify places where the meters are to be affixed.	Operation stage.
4	The Environmental (Protection) Act 1986 and Rules	This Act is an umbrella legislation designed to provide a framework for the coordination of Central and State Pollution Control Boards established under the Water (Prevention and Control of Pollution) Act 1974 and Air (Prevention and Control of Pollution) Act 1981. Under the powers	Both During Pre-construction, Construction & Operation Phase.

Sl. No	National Env., Health & Safety Regulation	Requirement	Applicability
		conferred by this Act, the central government has formulated a set of Rules known as the Environment (Protection) Rules and published Notifications directed at the following aspects: • *Restricting and prohibiting new, expansion and modernization projects activities on their potential environmental impacts;* • *Regulating the location of industries and the carrying on of processes and operations in different areas.* • *Setting standards for air emissions, waste water discharges, and hazardous waste management;* • *Setting standards for the ambient air quality and ambient noise levels, and* • *Protection of public health and welfare.*	
5	Environmental Impact Assessment (EIA) Notification 2006, MoEF Office Memorandum dated 13th May 2011 & 30th June 2011	The EIA Notification 2006 and thereafter the MoEF Office Memorandum dtd. 13th May '11 exempts PV solar power projects from obtaining prior Environmental Clearance from the regulatory authorities Hence regulatory Environmental Impact Assessment is not required for solar power projects. Further in accordance to the provisions of MoEF office memorandum dated 30th June 2011 depending upon the extent of land required the project proponent may be required to obtain necessary commitment from competent authority for availability the requisite quantity of the water for the project and no change of land use will be permitted without permission from competent authority.	EIA is not applicable for the project under the provision of the 13th May'11 office memorandum. Under the provision of the MoEF office memorandum dated 30th June'11, requisite commitment/permissio n is required to obtain from competent authority for water and land usage.
6	Environment (Protection) Seventh Amendment Rules	The Rules stipulates National Ambient Air Quality Standards (NAAQS) for ambient concentrations of air pollutants (such as	Construction phase

Sl. No	National Env., Health & Safety Regulation	Requirement	Applicability
	2009 on AAQ standards	particulate matter, sulphur dioxide, nitrogen oxide, carbon monoxide, hydrocarbon etc.) for industrial, commercial, residential and ecologically sensitive areas	
7	Noise (Regulation and Control) Rules 2000 amended in 2010	The Rules stipulate ambient noise limits during day time and night time for industrial, commercial, residential and ecologically sensitive areas. Under this Rules, Areas/ Zones have been categorized into industrial, commercial, residential or silence areas/zones for the purpose of implementation of noise standards. The ambient air quality standards for noise specified in the Schedule need to be complied with. An area comprising not less than 100 meters around hospitals, educational institutions and courts is declared as silence area/zone for the purpose of these rules.	Construction Phase
8	Wild life (Protection) Act , 1972 & Supreme Court Writ Petition No 460 of 2004 dated 4th Dec'2006	The little Rann of Kachchh is declared as wildlife sanctuary vide Gujarat State Gazette Notification dated 22nd February 1973 under provisions of the Wild Life Protection Act 1972. The application of the Order of the Hon'ble Supreme Court in W.P 460 of 2004 dated 04.12.2006 in the matter of Goa Foundation vs. Union of India and others wherein the Hon'ble Supreme Court has directed that all projects which require environmental clearance and are located within the distance of 10 km of National Park and Sanctuaries must be placed before the Standing Committee of the National Board for Wildlife constituted under the Wildlife (Protection) Act, 1972.	The proposed project is located less than10km of Wild Ass sanctuary for which necessary NOC has been obtained from PCCF, Department of Forest, Gujarat vide letter no. VPS/32/K/145-148/2012 -13, dated 9th May 2012.
	Forest Conservation Act, 1980	Use of any forest land for non forestry purposes needs to get approval from Government of India, Ministry of	Not applicable as project does not involve any diversion of forest land for project

Sl. No	National Env., Health & Safety Regulation	Requirement	Applicability
		Environment & forests	purposes and therefore no Forestry Clearance is required.
9	Hazardous Waste (Management, Handling and Trans-boundary Movement) Rules 2008	These Rules outline the responsibilities of the generator, transporter and recycler/re-processor of the hazardous wastes for handling and management in a manner that is safe and environmentally sound.	Not applicable as no Hazardous Waste generation is expected during operation of the solar PV power plant.
10	The Building and Other Construction Workers' (Regulation of Employment and Conditions of Service) Act 1996	This Act provides for the safety, health and welfare measures of building and construction workers in every establishment which employs or employed during the preceding year ten or more such workers. These measures include fixing hours for normal working day, weekly paid rest day, wages for overtime, provision of basic welfare amenities like drinking water, latrines, urinals, crèches, first aid, canteens, etc. and provision of temporary living accommodation within or near work site. This Act also requires application of the following: • *Building and Other Construction Workers' (Regulation of Employment and Conditions of Service) Central Rules 1998* • *Workmen's Compensation Act, 1923 to building and other construction workers.*	Construction Phase
11	Central Electricity Authority (Safety Requirements for Operation, Construction and Maintenance of Electric Plants and Electrical Lines) Regulations 2008	This regulation lays down broad safety requirements for construction, operation and maintenance of electrical plants and electric lines, which includes development and implementation of a safety management system.	Construction & Operation Phase

Sl. No	National Env., Health & Safety Regulation	Requirement	Applicability
12	Workmen's Compensation Act, 1923 & Rules 1924	The Act gives requirements related to employer's liability of compensation to any personal injury caused to a workman by accident in the course of his employment. The Act also gives a framework for calculating amount of compensation and wages. Notice of accidents resulting in death or serious bodily injury is required to be given to the government. The Rules give provisions for application and review of compensation after death or serious injury of a workman at site or on duty. The reporting of accidents needs to be done in prescribed forms. The Rules give the procedures for the handling of claims.	Construction & Operation Phase
13	Employers' Liability Act No. 24 of 1938	The employer needs to maintain all the works, machinery or plant connected with or used in his trade or business, in good and safe condition to avoid personal injury to any workman, who may sue for damages in respect of the injury. A contract of service or apprenticeship cannot limit any liability of the employer in respect of personal injuries caused by negligence.	Construction & Operation Phase
14	The Contract Labor (Regulation and Abolition) Rules, 1971	The Contract Labour (Regulation and Abolition) Act, 1970 requires every principal employer of an establishment to make an application to the registering officer in the prescribed manner for registration of the establishment. The Act and its Rules apply to every establishment in which 20 or more workmen are employed or were employed on any day on the preceding 12 months as contract labor and to every contractor who employs or who employed on any day of the preceding 12 months, 20 or more workmen. It does not apply to establishments where the work performed is of intermittent or seasonal nature. An establishment wherein work is of intermittent nature will be covered by the	Construction Phase

Sl. No	National Env., Health & Safety Regulation	Requirement	Applicability
		Act and Rules if the work performed is more than 120 days in a year, and where work is of seasonal nature if the work is performed more than 60 days in a year. Contractors must also be licensed. The Rules specify the manner of making application for registration of establishment and applying for a contractor license. The Rules also make specific provisions mandatory for welfare and health of Contract Labour (such as making a sufficient supply of wholesome drinking water, the minimum number of latrines, washing facilities, and the types of first aid supplies available, and providing rest rooms and canteens at establishments where workers will be living onsite for 3 months or more). The Rules also specify the requirements for maintaining registers, records, and statistics.	

3.2 SOCIAL AND ENVIRONMENTAL PERFORMANCE STANDARDS OF THE INTERNATIONAL FINANCE CORPORATION

The International Finance Corporation has laid down a set of eight Performance Standards that the project developers, who receive debt or equity funding from the agency, need to comply with. The first Performance Standard requires the project developer to conduct a Social and Environmental Assessment of a proposed project at an early stage of project planning to safeguard against the potential risks and impacts described in the Performance Standards. The provisions of the Performance Standards relevant to solar power projects are summarized below:

- ***Performance Standard 1 on Assessment and Management of Environmental and Social Risks and Impacts*:**

  Apart from requiring a Social and Environmental Impact Assessment study for a proposed project to assess potential risks and impacts described in the Performance Standards, this Standard also requires that the project proponent should disclose the details of the project to all the stakeholders and understand their views and concerns regarding the project. This Standard also requires that the project proponent should conduct consultations with focused groups or individual stakeholders if required during any time of the project.

- ***Performance Standard 2 on Labour and Working Conditions:***

  This Performance Standard requires that the project proponent should ensure fair terms of employment and wages for the labours, even when they are hired by sub-contractors, which should comply with the national labour laws. The project proponent should provide the workers with a safe and healthy workplace environment by identifying the physical hazards and safety risks associated with the project activities and by taking steps to completely prevent or minimize the causes, as far as reasonably practicable, of accidents, injury, and disease arising due to such work-related hazards.

- ***Performance Standard 3 on Resource Efficiency and Pollution Prevention:***

  This Performance Standard outlines a project approach to promote sustainable use of resources (including energy and water), pollution prevention and abatement in line with internationally disseminated technologies and practices. It requires that the project proponent should design, construct, operate and decommission a project with adequate consideration of the ambient environmental conditions in the project area and should apply pollution prevention and control technologies and practices that are best suited to avoid or, where avoidance is not feasible, minimize or reduce adverse impacts on human health and the environment while remaining technically and financially feasible and cost-effective.

- ***Performance Standard 4 on Community Health, Safety and Security:***

  This Performance Standard requires that the project proponent should evaluate the risks and impacts to the health and safety of the affected community during the design, construction, operation, and decommissioning of the project and establish preventive or mitigation measures to address them. Where the project poses risks to or adverse impacts on the health and safety of affected communities, the project proponent should disclose the planned preventive or mitigation measures and any other relevant project-related information to enable the affected communities and relevant government agencies to understand these risks and impacts. The project proponent should also avoid or minimize adverse impacts due to project activities on soil, water, and other natural resources in use by the affected communities. When the project proponent directly retains employees or contractors to provide security to safeguard its personnel and property, it should assess risks to those within and outside the project site posed by its security arrangements.

- ***Performance Standard 5 on Land Acquisition and Involuntary Resettlement:***

  This Performance Standard requires that the project proponent should avoid or at least minimize involuntary resettlement wherever feasible by exploring alternative project designs; mitigate adverse social and economic impacts from land acquisition or restrictions on affected persons' use of land by providing compensation for loss of assets at replacement cost; and ensure that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected. The proponent should improve or at least restore the livelihoods and standards of living of displaced persons and improve living conditions among displaced persons.

- ***Performance Standard 6 on Biodiversity Conservation & Sustainable Management of Living Natural Resources:***

  This Performance Standard requires that the project proponent should protect and conserve biodiversity by preventing destruction or damage to wildlife habitats, prevent violation or disturbance of protected areas, and respect the values attached to biodiversity by specific stakeholders.

- ***Performance Standard 7 on Indigenous Peoples***:

  This Performance Standard requires that the project proponent should respect and preserve the culture, knowledge and practices of Indigenous Peoples (known as Scheduled Tribes in India); avoid adverse impacts of projects on communities of Indigenous Peoples or when avoidance is not feasible, should minimize, mitigate, or compensate for such impacts; provide opportunities for development benefits in a culturally appropriate manner; and when projects are to be located on traditional or customary lands under use by the Indigenous Peoples, foster good faith negotiation with them.

- ***Performance Standard 8 on Cultural Heritage:***

  This Performance Standard requires that the project proponent should protect areas and structures of cultural heritage (such as tangible property and sites having archaeological, paleontological, historical, cultural, artistic, and religious values, as well as unique natural environmental features that embody cultural values, such as sacred groves) from the adverse impacts of project activities and extend support in their preservation.

3.3 EQUATOR PRINCIPLES

The Equator Principles comprises of a group of ten principles adopted by the Equator Principle Financial Institutions (EPFIs) in order to ensure that the projects funded by them are developed in a manner that is socially responsible and reflect sound environmental management practices. The Principles strives towards avoidance of negative impacts on project-affected ecosystems and communities where possible, and in case unavoidable, need to be adequately reduced, mitigated and/or compensated. Considering that the proposed project is likely to be financed by EPFIs it is necessary for the proponent to adopt and adhere to these Principles which serve as environmental and social safeguards thereby offering significant benefit to the proponent, financial institutions and the local stakeholders. The applicability of each of the principles with respect to the proposed project has been discussed below:

- ***Principle 1: Review and Categorisation***

When a project is proposed for financing, the EPFI will, as part of its internal social and environmental review and due diligence, categorise such project based on the magnitude of its potential impacts and risks in accordance with the environmental and social screening criteria of the International Finance Corporation (IFC). Based on the IFC environmental and social screening criteria the proposed solar PV project is identified as a "Category B" project with potential limited adverse social or environmental impacts that are few in number, generally site-specific, largely reversible and can be readily addressed through mitigation measures.

- ***Principle 2: Social and Environmental Assessment***

Under the provision of this Principle it is required by the proponent for all Category A and B project to conduct a Social and Environmental Assessment process to address, as appropriate and to the EPFI's satisfaction, the relevant social and environmental impacts and risks of the proposed project. The Assessment should also propose mitigation and management measures relevant and appropriate to the nature and scale of the proposed project. In line with requirement of Principle 2 the proponent of the proposed solar PV project has undertaken an Environmental and Social Impact Assessment study to identify, assess, evaluate and mitigate the potential environmental and social risks.

- ***Principle 3: Applicable Social and Environmental Standards***

This Principle requires the Environment & Social Assessment to refer to the applicable IFC Performance Standards and the then applicable Industry Specific EHS Guidelines including the project's overall compliance with, or justified deviation from, the respective Performance Standards and EHS Guidelines. The Assessment process also needs to address compliance with relevant host country laws, regulations and permits that pertain to social and environmental matters. A similar exercise has been carried out for the proposed solar PV project and has been discussed in detail in section 3.1 and 3.2 of this report.

- ***Principle 4: Action Plan and Management System***

For all Category A and Category B projects an Action Plan (AP) need to be prepared which addresses the relevant findings, and draws on the conclusions of the Assessment. The AP will describe and prioritise the actions needed to implement mitigation measures, corrective actions and monitoring measures necessary to manage the impacts and risks identified in the Assessment. In this regard the borrower /proponent need to maintain or establish a Social and Environmental Management System that addresses the management of these impacts, risks, and corrective actions required to comply with applicable host country social and environmental laws and regulations, and requirements of the applicable Performance Standards and EHS Guidelines, as defined in the AP. Hence in accordance to the provision of this Principle an Environmental & Social Management Plan has been drawn up as part of the ESIA study for the proposed project specifying appropriate plans and procedures which requires to be implemented during various phases in order to prevent, control and mitigate any potential environmental and social risks. For further details please refer to chapter 6 of this document.

- ***Principle 5: Consultation and Disclosure***

According to this Principle it is required that for all Category A and, as appropriate, Category B projects the government, borrower or third party expert has consulted with project affected communities in a structured and culturally appropriate manner. For projects with significant adverse impacts on affected communities, the process will ensure their free, prior and informed consultation and facilitate their informed participation as a means to establish, to the satisfaction of the EPFI, whether a project has adequately incorporated affected communities concern.

Given the proposed project is rated as "Category B" with no potential adverse impacts on communities it does not necessitate the formulation of a Public Consultation & Disclosure Plan. However in consistent with the requirement of this Principle the proponent through an external consultant have undertaken social consultations with land losers and nearby village representatives to establish the socio-economic condition of the area and at the same time try to understand any community concern that may be associated with the proposed project

particularly related to loss of land, livelihood, resource requirement etc. For further details please refer to section 5.2 of this document.

- ***Principle 6: Grievance Mechanism***

For all Category A and, as appropriate, Category B projects it need to be ensured by the proponent that consultation, disclosure and community engagement continues throughout construction and operation of the project and community concerns/grievances addressed through establishing a Grievance Redressal Mechanism. In this regard the proponent of the proposed solar PV project need to develop and implement a Grievance Redressal Mechanism (GRM) to receive and facilitate resolution of any concerns and grievances that may be raised by land loser groups and/or nearby village communities during both construction and operation phase of the project. As part of this Principle it is also imperative that the proponent maintains regular dialogue with such communities through implementation of focused CSR programs/initiatives.

- ***Principle 7: Independent Review***

In accordance to the provision of this Principle, an independent social or environmental review need to be undertaken by an external expert of the solar PV project's ESIA, ESMP, legal/permit documents (CTE/CTO) and consultation process documentation in order to assist EPFI's due diligence, and in order to assess Equator Principles compliance.

- ***Principle 8: Covenants***

Under this Principle the proponent of the proposed solar PV project is required to covenant in financing documentation to ensure compliance with all applicable national environmental, health, safety and social laws and regulations; demonstrate compliance to environmental and social management plans and procedures drafted as part of the ESIA study; carry out periodic reporting to EPFIs on compliance to the national EHSS regulations and ESMP; and undertake decommissioning of facilities viz. solar panels etc in accordance with an agreed decommissioning plan.

- ***Principle 9: Independent Monitoring and Reporting***

To ensure ongoing monitoring and reporting of the environmental and social performance of the proposed solar PV project over the life of the loan, the EPFIs may require the project proponent to hire an independent environmental and/or social expert or retain qualified and experienced external experts to verify its monitoring information which would be shared with EPFIs.

- ***Principle 10: EPFI Reporting***

This Principle is particularly applicable for EPFIs under which each EPFI is committed to report publicly at least annually about its Equator Principles implementation processes and experience, taking into account appropriate confidentiality considerations.

4 Description of Environment

This chapter describes the existing environmental settings of the project site located in north Surendranagar district and its immediate surroundings. This includes the physical environment comprising air, water and land components, the biological environment, and socio-economic environment.

4.1 THE PHYSICAL ENVIRONMENT

Proposed project site is located in north Surendranagar district (herein referred as area of interest) near little Runn of Kutch and physiographically this region can be categorised into western alluvial plains as shown in **Figure 4.1** *(Source: State Environment Action Plan, Gujarat Ecology Commission).* Based on physiography, Gujarat can be divided into three distinct geographical units namely, mainland of Gujarat, Peninsular Gujarat (Saurashtra) and Kutch. The project area is featuring at the boundary of two physiographic regions – western alluvial plains in the east and the Kutch region on the west.

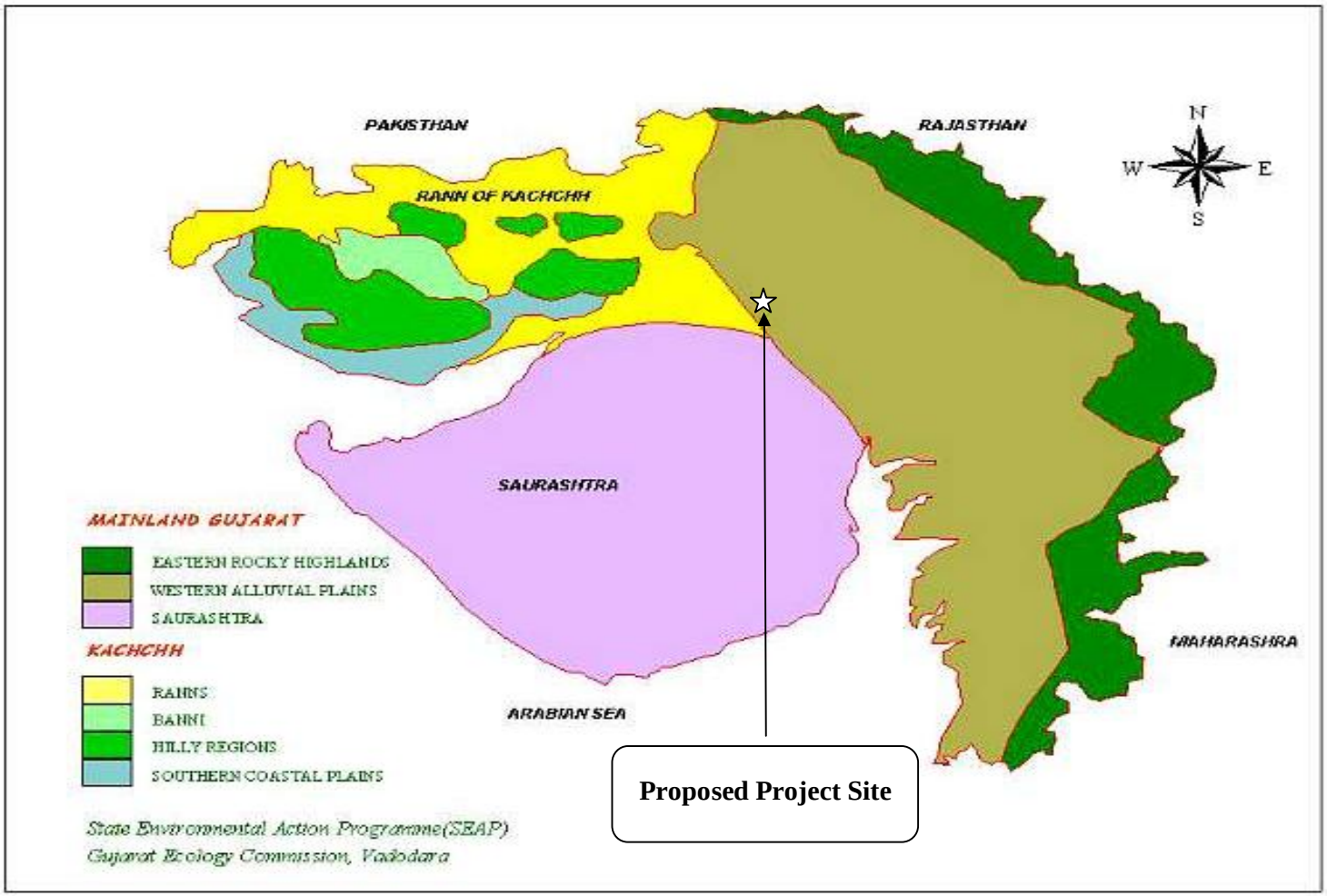
4.2 CLIMATE & METEOROLOGY

Gujarat, being located on the Tropic of Cancer, falls in the sub tropical climatic zone. A large part of the state lies between 35 ^{o}C and 45 ^{o}C isotherms. This state is influenced by three types of climate viz. Arid, semi-arid and sub- humid. Northern part of the state where proposed project site is located is characterized by arid climatic condition. March onwards the temperature starts rising till it reaches the maximum, as high as 45 ^{o}C while January is the coldest month when maximum temperature never exceeds 30 ^{o}C and the minimum temperature remain around 8 ^{o}C to 10 ^{o}C. This region receives maximum of rainfall from southwest monsoon during the period between June and September with its maximum intensity in months of July and August. The rainfall gradually decreases from south to north Gujarat. North Surendranagar, being the location of proposed project site is an area of interest which receives annual rainfall of approx. 300 - 400 mm. The relative humidity in all the part of state is low, although in coastal area it is moderately high. The winds are generally of light to moderate intensity. However, intensity increases from during the late summer and monsoon season. Prevailing wind direction in Gujarat is from west or southwest during the monsoon months and NE to NW from October to April.

As the Radhanpur is the nearest available monitoring station of IMD and located at approx. 45 km North from the proposed project site, secondary meteorology data of Radhanpur has been referred to understand the meteorology profile in the area of interest:

Temperature: Northern part of the Surendranagar district has a hot semi-arid climate along with three main seasons: summer, monsoon, and winter. During the summer (March – June) the average temperature varies from 27 ^{o}C to 41 ^{o}C while in winter (November – February), temperature varies within range of 10 °C – 32 °C.

FIGURE 4-1: PHYSIOGRAPHIC REGION OF GUJARAT



Rainfall: The southwest monsoon in the area brings a humid climate from mid-June to mid-September. The average annual rainfall is about 418 mm, but infrequent heavy torrential rains cause local rivers to flood and it is not uncommon for droughts to occur when the monsoon does not extend.

Wind Speed and Direction: Wind speed and direction data for the Radhanpur has been obtained from Climatological table of Observatories in India (1951-1980) and shown in meteorological summary (refer **Table:4.1**) and **Figure 4.2 – 4.3**

TABLE 4-1: METEOROLOGICAL SUMMARY AT RADHANPUR IMD STATION

Month	Total rainfall (mm)	Predominant wind direction		Mean wind speed (Kmph)	Relative Humidity %		Mean Temp.	
		08:30 hrs IST	*17:30 hrs IST*		*08:30 hrs IST*	*17:30 hrs IST*	*Max (^oC)*	*Min (^oC)*
January	2.3	N	N	6.5	60	37	27.2	10.0
February	0.7	NE	NW	6.3	60	34	30.4	12.5
March	5.3	SW	W/NW	6.6	58	28	35.2	17.0
April	0.1	NW	W	7.4	62	30	39.3	21.9
May	1.7	SW	SW	11.7	70	29	41.6	24.8
June	32.3	SW	SW	15.3	78	46	38.6	26.6
July	152.0	SW	SW	13.5	85	63	34.4	25.3
August	97.2	SW	SW	10.8	86	65	33.1	24.2
September	105.1	SW	SW	7.5	82	58	34.3	23.6
October	4.7	SW	SW	5.0	67	39	36.3	20.7
November	1.2	NE	N	5.3	56	38	32.9	15.9
December	10.1	NE	N	6.1	62	40	29.1	11.7
	418.9	**SW**	**SW**	**8.5**	**69**	**42**	**34.4**	**19.5**

Predominant wind direction during the monitoring period i.e. April in the area of interest was observed as NW (refer **Table 4.1**), which has been further substantiated by meteorology data given above.

Wind Speed: During the study period wind speed was observed as 7.4 kmph, whereas, annual average and highest wind speeds was observed as 8.5 kmph and 15.3 kmph (in the month of June).

FIGURE 4-2: WINDROSE – PREDOMINANT WIND DIRECTION DURING STUDY PERIOD - MORNING (0830 HRS)

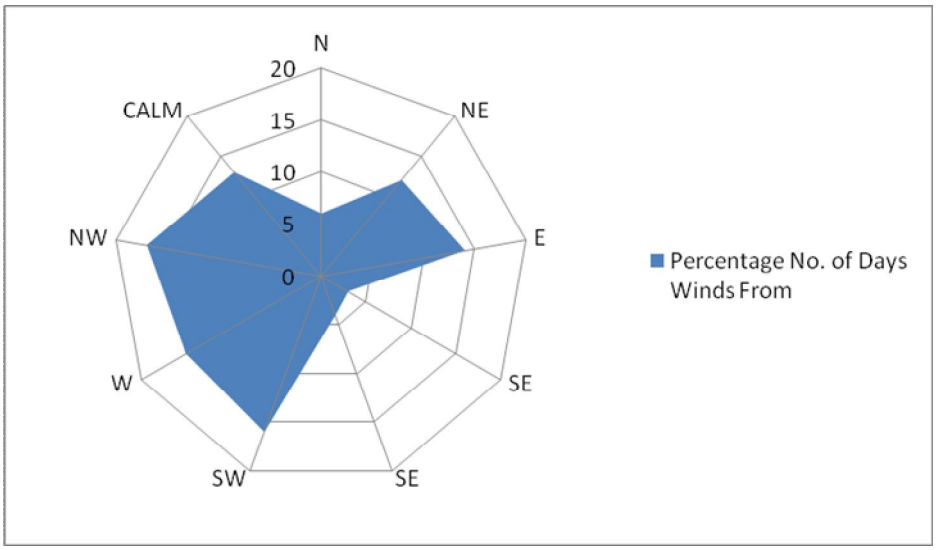
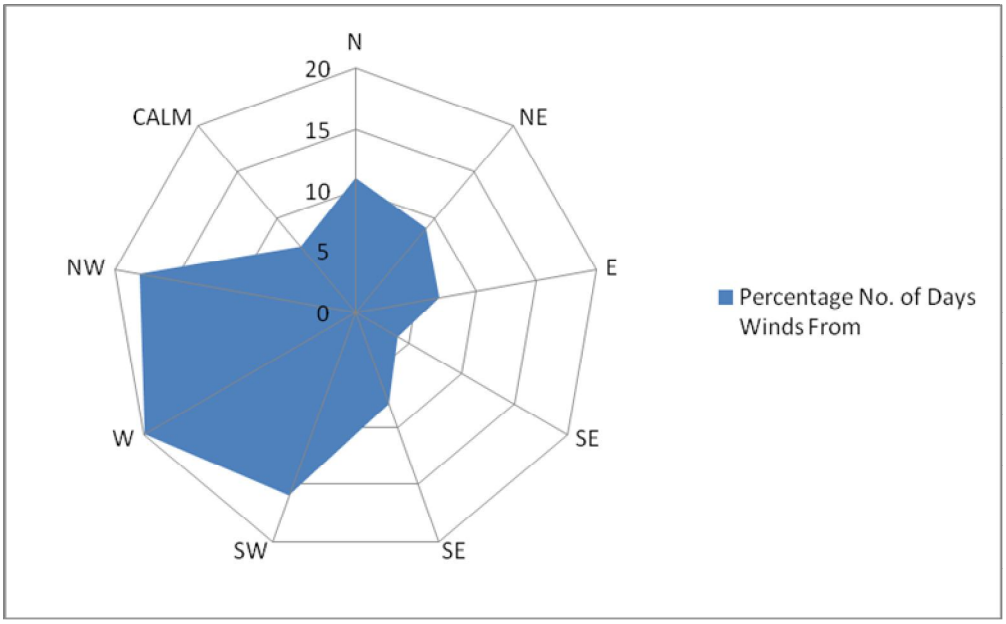


FIGURE 4-3: WINDROSE – PREDOMINANT WIND DIRECTION DURING STUDY PERIOD - EVENING (0830 HRS)



4.3 AMBIENT AIR QUALITY

The objective of the ambient air quality monitoring during an environmental impact assessment study for a solar project is to record the baseline ambient air quality in the area prior to project and identify any current sources of air pollution which could become a liability to the proposed project. Three sites were selected at nearest settlement in Fatepur and Dhama villages for ambient air sampling, monitoring result of which is given in **Table 4.2.** All the monitoring locations are located within the 5 km from the project site in downwind direction (South east). The monitoring locations are provided in **Figure 4.4.**

TABLE 4-2: AMBIENT AIR QUALITY MONITORING RESULT

Locations	Sampling Stations	PM_{10} $\mu g/m^3$	$PM_{2.5}$ $\mu g/m^3$	SO_2 $\mu g/m^3$	NOx $\mu g/m^3$	CO mg/m^3
AQ1	Fatepur Village, Near Primary School's Terrace	53.41	21.42	5.51	23.34	BDL
AQ2	Fatepur Village, Sonabhai's House Terrace	54.18	16.66	BDL	16.36	BDL
AQ3	Dhama Village, Nanjibhai's House	72.29	32.53	6.69	27.62	BDL
NAAQ Standards		**100 (24 hrs)**	**60 (24 hrs)**	**80 (24 hrs)**	**80 (24 hrs)**	**2000 (8 hrs)**

Note: Air Monitoring was conducted between 17/04/2012 to 28/04/2012

BDL-Below Detection Limit

Interpretation of air monitoring results

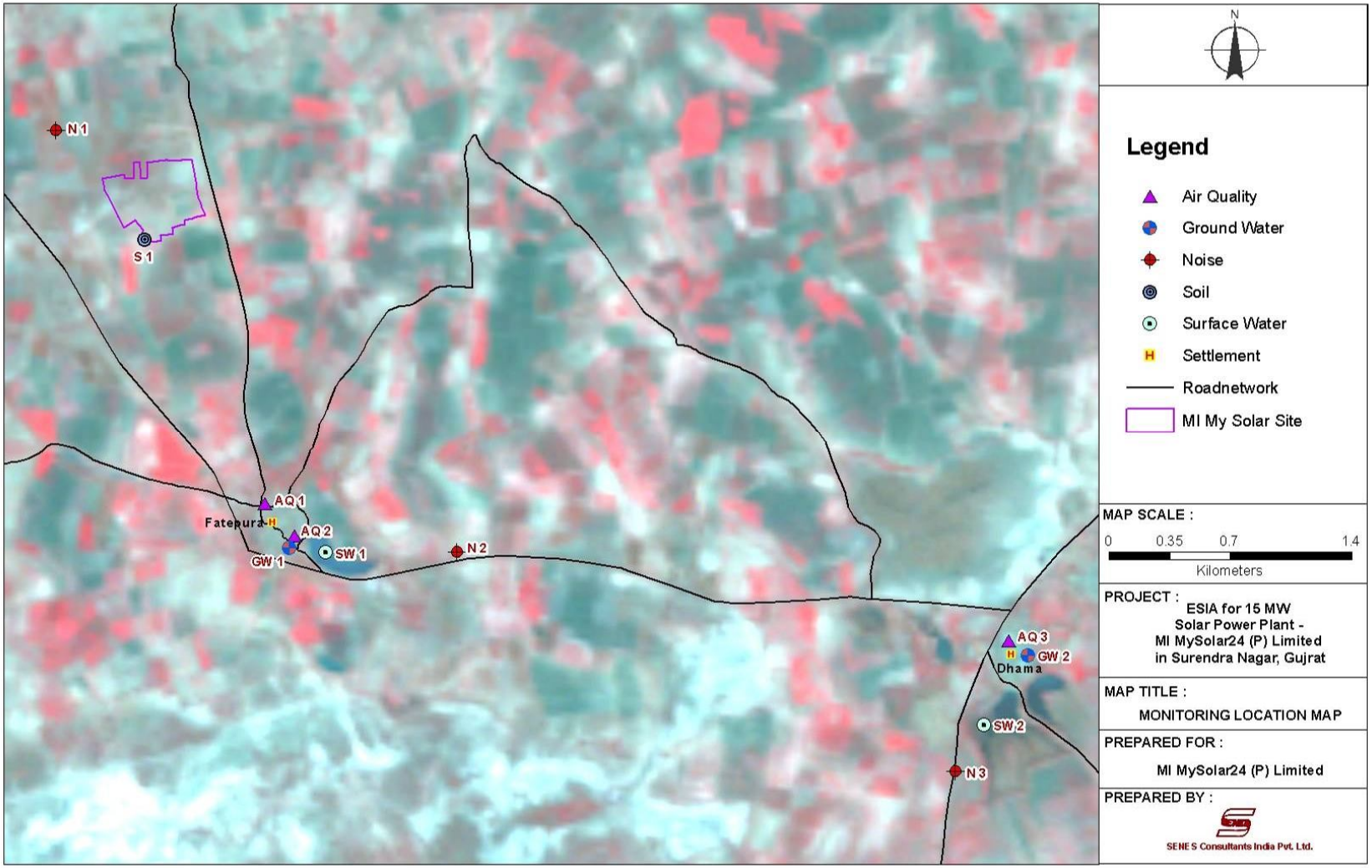
The air sampling data revealed that PM_{10} values at Fatepur and Dhama villages ranged between 53.41 – 72.29 $\mu g/m^3$ whereas $PM_{2.5}$ values falls within the range of 16.66 – 32.53 $\mu g/m^3$. Both PM_{10} and $PM_{2.5}$ values were below the limit of NAAQ standards.

The SO_2 and NOx values for both villages were well within the NAAQ standards, with maximum value of SO_2 recorded as 6.69 $\mu g/m^3$ while the maximum value of NOx was 27.62 $\mu g/m^3$. Low values for SO_2 and NOx can be attributed to the rural setting, low vehicular movements and less industrial activities in the study area.

The CO values for all three locations were found to be below detectable limits.

The air sampling data revealed that values of PM_{10} , $PM_{2.5}$, SOx , NOx and CO parameters at all the monitoring locations i.e. AQ1, AQ2, and AQ3 are well within the limit of NAAQ standards.

FIGURE 4-4: MONITORING LOCATION MAP IN THE STUDY AREA



4.4 AMBIENT NOISE QUALITY

The ambient noise monitoring was carried out in the month of April 2012 (pre-monsoon season) at three locations, out of which two location were in Fatepur village and one location is in Dhama village. The noise monitoring network was established based on the understanding of the project activities during various phases of project and surrounding features including nearby settlement. The location of ambient noise quality station has been represented in the **Figure 4.4.**

Sound pressure level (SPL) measurement in dB (A) were recorded for every hour continuously for 24 hours for the aforesaid monitoring station and equivalent noise levels in the form of Leq day and Leq night were computed. The result so obtained was compared with the standard specified in schedule III, Rule 3 of the Environmental Protection Rules. The equivalent (Leq) day and night noise levels calculated for the monitoring locations is presented in **Table 4.3.**

TABLE 4-3: NOISE QUALITY MONITORING RESULT

Noise Monitoring Locations	Day Time Noise dB (A)		Night Time Noise dB (A)	
	Leq (day)	***Standard***	***Leq (night)***	***Standard***
Project Site (N1)	51.5	55	41.5	45
Way to Fatepur village (N2)	61.5	55	49.9	45
Way to Dhama village (N3)	61.8	55	51.1	45

Interpretation of noise monitoring results

The equivalent noise level for day and night period at monitoring locations N2 and N3 were found to be above the stipulated noise standards specified for the day and night time in residential area. On other side, noise level at project site is below the stipulated standards.

The low noise levels at project site may be typically attributed to rural settings with low vehicular movement. Whereas, high noise level in way to Fatepur village and way to Dhama village may be due to the high vehicular movement on the nearby road.

4.5 TOPOGRAPHY

The proposed project area is characterized by flat terrain (refer Photograph 4.1) with an average elevation of 11 meter above mean sea level. The general slope of the site is from East to West i.e. towards little Runn of Kutch. Although, major river is absent within 5 km from project site, however, a seasonal drain known as Kharwa ka Nala is present in north direction at approximate distance of 500 m from the site which gets filled up during the monsoon season and ends in little Runn of Kutch. Fatepur is the nearest villages from project site, located at approximately 1.5 Km in southwest direction.

Photo 4-1: Topography of the Area

4.6 GEOLOGY AND SOILS

The study area is part of north Gujarat alluvial plain and falls in north Surendranagar district. Geomorphologically, alluvial plains of Gujarat form the median part of mainland Gujarat and extend from Narmada River in south to the Luni River in north. This plane shows a gradual slop from ENE to WSW and falls in altitude range of 150 m to almost sea level. Geologically, alluvial plain are made up of a thick pile of unconsolidated sediments deposited by a combination of fluvial and Aeolian agencies during the Quartnerary period. Rocks in the Gujarat belongs to formations ranging in age from the oldest precambrian to recent. Major geological events of Gujarat are confined to Mesozoic and Cenozoic eras. Geological evolution of Gujarat initiated in the Triassic with the break up of Gondwana land and the subsequent geological history is related to the northward drift of the Indian subcontinent. Surface soil in study area (alluvial plains) belongs to inceptisols order. Inceptisols are derived from balastic, granitic, gneissic and alluvial parents characterized by dark grey to light grey, reddish brown, yellowish red and dark reddish brown color and suitable for the cultivation of cotton, which is the major crop of the area.

According to Geotechnical investigation carried out on the project site, lithological stratification in the study area consist of top sandy clays layer of soft to medium consistency followed by loose to medium dense sand layer of low plasticity. These two layers at depth are again followed by sandy clays/ clayey sands upto depth of investigation. The transition of top sandy clays having moderate plasticity to virtually non plastic sandy layer and then again to clayey sands/sandy clays is gradual.

Soil sample is collected from nearby project site and analyzed during the ESIA study for the project. The soil quality test results are presented in **Table 4.4** and the interpretation of the results are discussed below.

TABLE 4-4: SOIL QUALITY MONITORING RESULT

Sl. No	Parameters	Unit	Result
1	pH	--	8.85
2	Salinity	ppt	0.52
3	Electrical Conductivity	µsm	172
4	Organic Carbon	%	0.13
5	Nitrogen as N	%	0.16
6	Phosphrous as P2O5	%	0.170
7	Potassium as K	mg/kg	42
8	Total Dissolved Solids	mg/kg	600
9	Sodium as Na	mg/kg	384
10	Magnesium as Mg	mg/kg	19.2
11	Calcium as Ca	mg/kg	40
12	Chloride as Cl	mg/kg	129
13	Fluoride as F	mg/kg	ND*
14	**Particle size Distribution**		
14.1	Clay	%	56
14.2	Silt	%	12
14.3	Sand	%	32

Interpretation of soil testing results

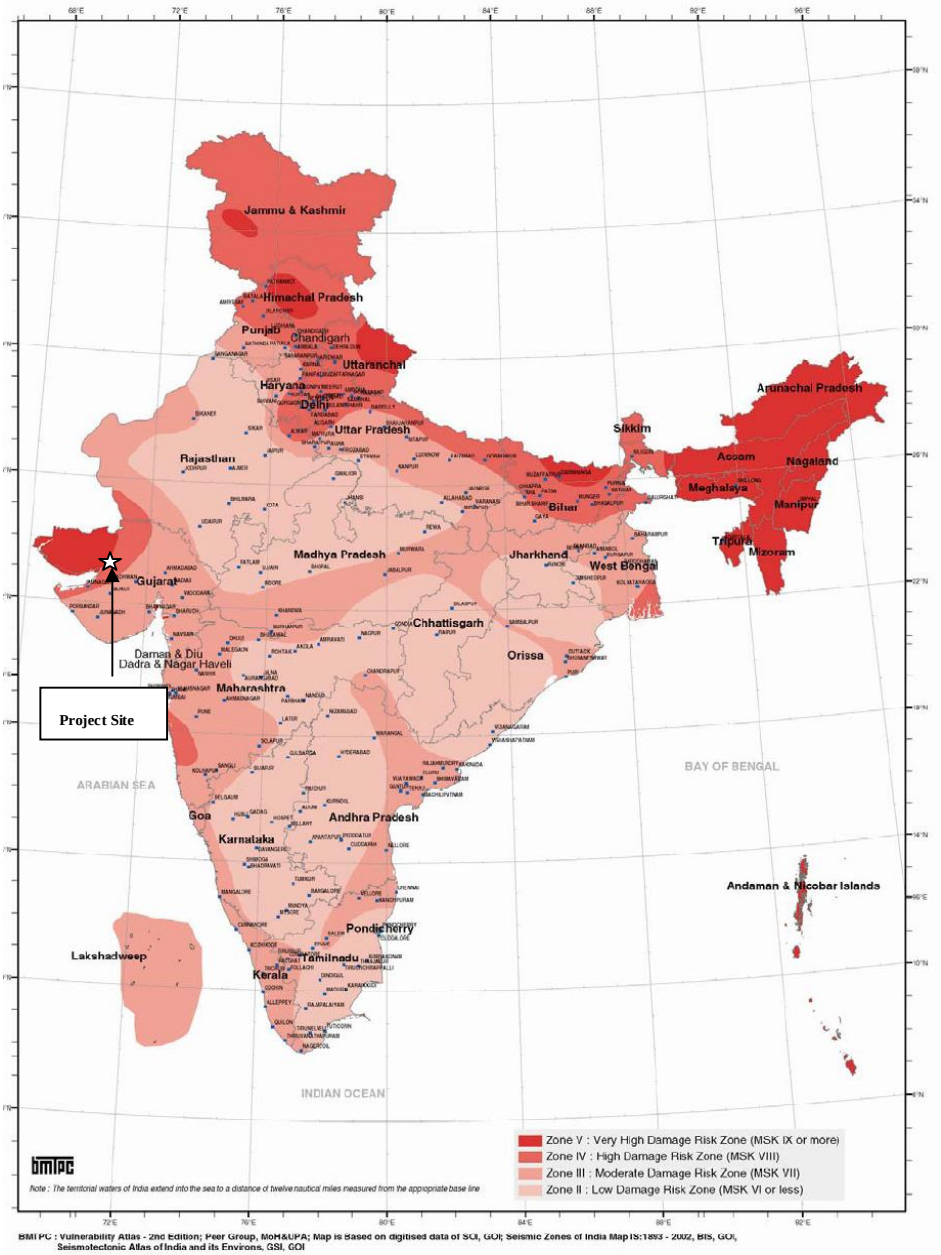
Based on the particle size distribution obtained from the soil analysis, the texture of soil at the project site is clay loam (56%). Soil of the project site is slightly alkaline with a pH value of 8.85. Soil sample contains high concentration of sodium (384 mg/kg) and chloride ions (129 mg/kg). Soil sample also contain high concentration of other minerals like Ca, Mg and show high value of TDS (600 mg/kg), which reflect low nutrient holding and cation exchange capacity and poor fertility of soil. Concentration of organic carbon and nutrient element like nitrogen is also low.

4.7 SEISMIC HAZARD

Seismic hazards include phenomena that occur during or soon after an earthquake, such as primary ground rupture, strong ground shaking, liquefaction and seismically induced settlement. The seismological map of the project area is as shown in **Figure 4-5**. As per, the

Zoning Atlas published by the Ministry of Home and Urban Poverty Alleviation, the project site is located in the Zone IV High Damage Risk Zone with moderate seismicity hazard.

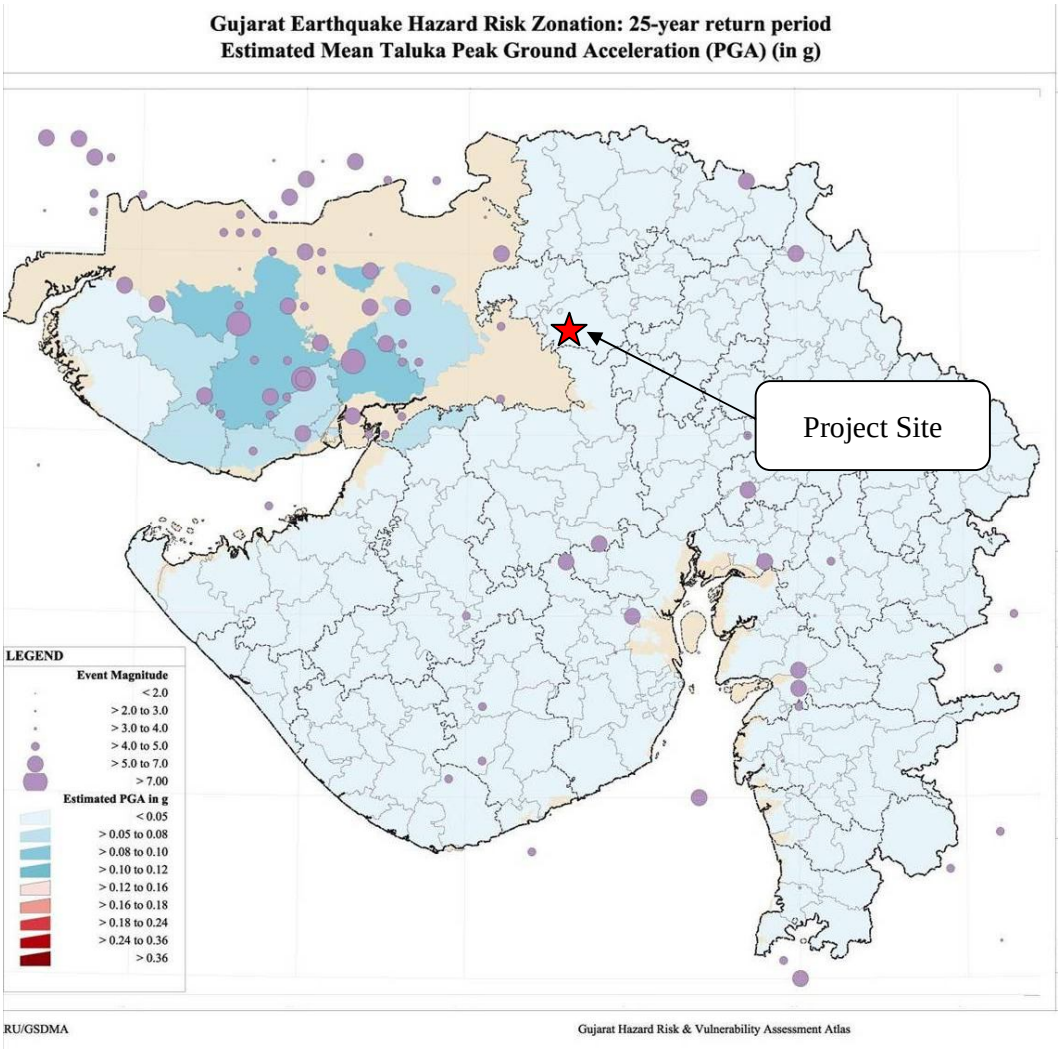
FIGURE 4-5: SEISMOLOGICAL MAP WITH RESPECT TO PROJECT SITE



Although, Saurashtra and Kutch region are seismological active areas but proposed project which is in northern Surendranagar district is in not very active region (Source: Institute of seismological research). In year 2007, Kutch and Saurashtra experienced 6 & 2 tremors of magnitude >4 (annual report 2007-2008 of Institute of Seismological research). To assess the earthquake hazard in future (25 year return period) with reference to proposed project site, earthquake hazard risk zonation map has been analysed (**refer Figure 4.6**). This map is prepared by Gujarat state disaster management authority (GSDMA) to provide peak ground

acceleration and event magnitude for 25 year return period. According to this map peak ground acceleration (PGA) values falls in the range of 0.05 – 0.08 g which indicates moderate ground shaking and very light potential damage in the proposed project site area.

FIGURE 4-6: EARTHQUAKE HAZARD RISK ZONATION MAP WITH REFERENCE TO PROPOSED PROJECT SITE

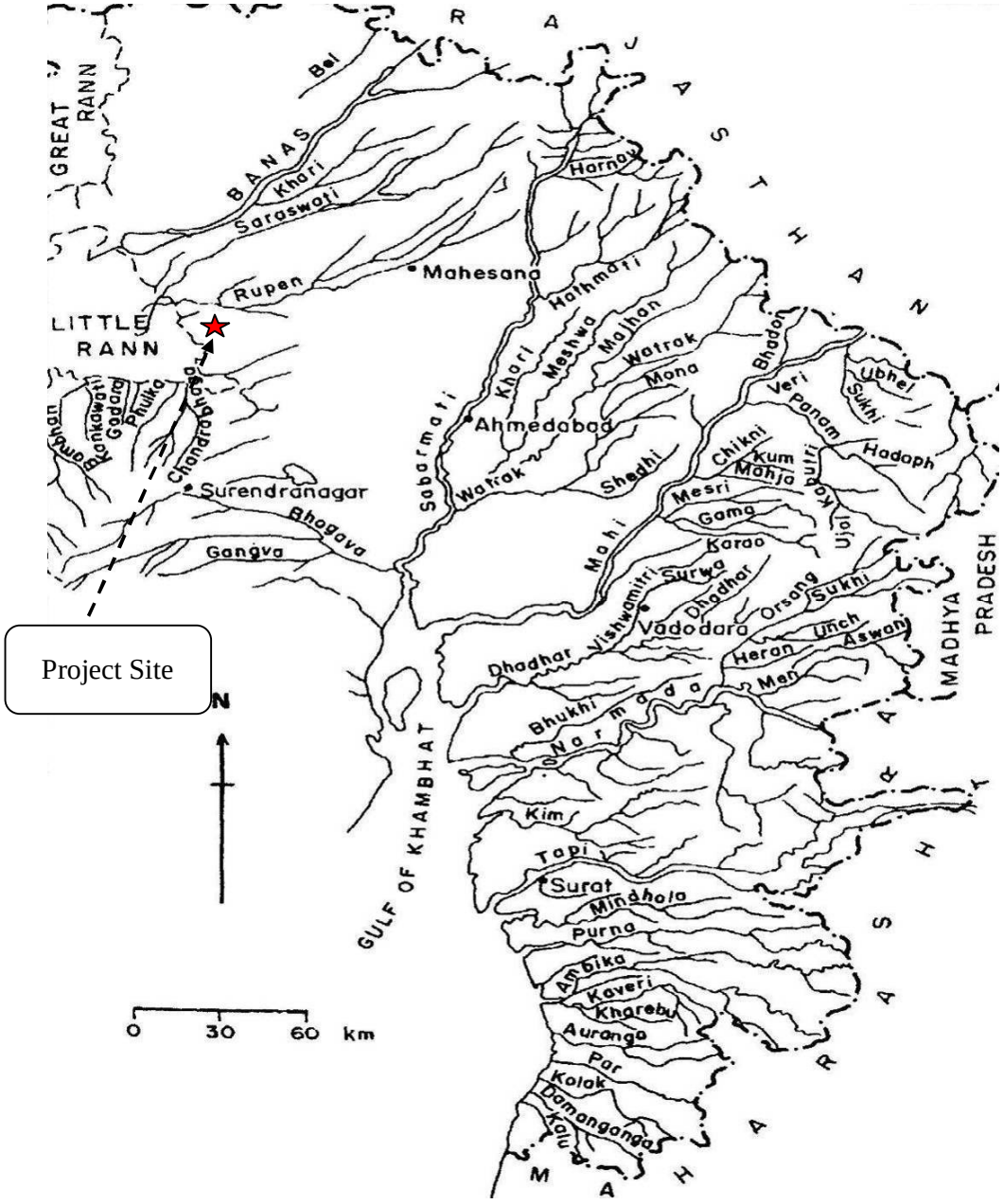


Source:GSDMA

4.8 DRAINAGE

The natural drainage pattern in the region is governed by seasonal surface water channel that typically drain westward into the little Runn of Kutch. Rupen, Saraswati and Banas are the rivers originates from the north-western part of Mainland of Gujarat (refer **Figure 4.7**). These drains originate from Aravalli hills and flow into the Runn of Kutch. These rivers are more or less seasonal, carrying water only during the monsoon. Although, these rivers are shallow, they have wide sandy channels in their lower reaches.

FIGURE 4-7: DRAINAGE SYSTEM OF ALLUVIAL PLAIN WITH RESPECT TO PROJECT SITE



4.9 SURFACE WATER RESOURCES

During the site visit, study area was found as water scarce with no major rivers. All the natural hydrological features in terms of drains were found to be dry. A seasonal drain was found above the project site at approximate distance of 500 m in north direction draining into little Runn of Kutch during monsoon season.

Water ponds are the only source of surface water, available throughout the year and cater domestic water consumption activities of the surrounding villages. These water ponds can be a source of water to fulfil water requirement at project site during various phases.

4.9.1 Surface Water Quality

Two surface water samples was collected from water ponds in Fatepur villages and Dhama villages for the analysis of physico-chemical and bacteriological parameters.

TABLE 4-5: SURFACE WATER MONITORING RESULT

Sl. No.	Parameters	Unit	Surface Water Quality Result	
			Pond Water from Fatepur Village	Pond Water from Dhama Village
1	Colour	Hazen	< 1.0	< 1.0
2	pH	--	7.47	8.03
3	Total Dissolved Solids	mg/L	924	420
4	Chlorides as Cl	mg/L	345	105
5	Dissolved Oxygen	mg/L	3.25	1.55
6	Oil & Grease	mg/L	ND*	ND*
7	Phenolic Compound	mg/L	ND*	ND*
8	Total Chromium as Cr	mg/L	ND*	ND*
9	Cadmium as Cd	mg/L	ND*	ND*
10	Copper as Cu	mg/L	0.030	0.022
11	Zinc as Zn	mg/L	0.069	0.056
12	Iron as Fe	mg/L	1.021	0.993
12	Iron as Fe	mg/L	1.021	ND*
13	Lead as Pb	mg/L	ND*	< 1.0
14	Selenium as Se	mg/L	ND*	ND*
15	Arsenic as As	mg/L	ND*	ND*
16	Sulphates as SO4	mg/L	58.60	12.74
17	Cyanides as CN	mg/L	ND*	ND*
18	Fluorides as F	mg/L	ND*	ND*
19	BOD (3 days @ 27 ^{o}C)	mg/L	38.12	7.22
20	Nitrate Nitrogen as NO3	mg/L	0.53	0.40
21	Anionic Detergent (MBAS)	mg/L	ND*	ND*
22	Coliform	MPN Index/100 ml	109	120
23	Insectisides	ppm	ND*	ND*

Interpretation of Surface water Quality Results

The collected samples were analysed and results compared with standards mentioned in CPCB surface water class. (Refer **Table 4.5**)

The pH of the surface water sample was 7.47 at Fatepur village and 8.03 at Dhama village, indicating that the water was neutral in nature at Fatepur and slightly alkaline at Dhama village. The DO level in both the water samples were low i.e. 1.55 mg/L at Dhama village and 3.25 mg/L at Fatepur village, while BOD levels were around 38.12 mg/L at Fatepur and

7.22 mg/L at Dhama village, indicating poor water quality with organic loading. High BOD value in pond of Fatepur village is due to its use for domestic activities such as cloth washing cattle bath, etc. . The coliforms count was 109 MPN/100ml at Fatepur and 120 MPN/100ml at Dhama village, indicating the contamination of pond water.

4.10 GROUND WATER QUALITY AND RESOURCES

During the site visit, it was observed that tube wells were used for the extraction of ground water in agricultural fields. Although water supply line of Gujarat Government was present in the villages, bore holes were also used for the drinking purpose. Depth of ground water in Fatepur villages was reported as 350 – 400 ft below the ground level. Samples for the ground water quality assessment were collected from the Fatepur and Dhama villages, monitoring results for which are described in **Table 4.6.**

TABLE 4-6: GROUND WATER QUALITY DATA

S. No.	Test Parameters	Units	As per: IS 10500: 1993		Ground Water Quality	
			Desirable Limits	Permissible Limit	Fatepur Village	Dhama Village
1	Colour	Co-pt	Max 5	25	< 1.0	< 1.0
2	Odour	--	Unobjectionable	-	Unobjectionable	Unobjectionable
3	Taste	--	Agreeable	-	Agreeable	Agreeable
4	Turbidity	NTU	Max 5	10	0.31	0.26
5	pH Value	--	6.5 to 8.5	No Relaxation	7.96	8.21
6	Total Hardness as $CaCO_3$	mg/L	Max 300	600	78	74
7	Iron as Fe	mg/L	Max 0.3	1	0.152	0.131
8	Chloride as Cl	mg/L	Max 250	1000	714	724
9	Residual Free Chlorine	mg/L	Min 0.2	-	< 0.1	< 0.1
10	Fluoride as F	mg/L	Max 1.0	1.5	ND*	ND*
11	Total Dissolved Solids	mg/L	Max 500	2000	1776	**1812**
12	Calcium as Ca	mg/L	Max 75	200	20.8	12.0
13	Magnesium as Mg	mg/L	Max 30	100	6.24	10.56
14	Copper as Cu	mg/L	Max 0.05	1.5	ND*	ND*
15	Manganese as Mn	mg/L	Max 0.1	0.3	0.025	0.025
16	Sulphate as SO_4	mg/L	Max 200	400	84.28	29.10

17	Nitrate as NO_3	mg/L	Max 45	100	0.44	0.35
18	Phenolic Compounds as C_6H_5OH	mg/L	Max 0.001	0.002	ND*	ND*
19	Mercury as Hg	mg/L	Max 0.001	No Relaxation	ND*	ND*
20	Cadmium as Cd	mg/L	Max 0.01	No Relaxation	ND*	ND*
21	Selenium as Se	mg/L	Max 0.01	No Relaxation	ND*	ND*
22	Arsenic as As	mg/L	Max 0.01	No Relaxation	ND*	ND*
23	Cyanide as CN	mg/L	Max 0.05	No Relaxation	ND*	ND*
24	Lead as Pb	mg/L	Max 0.05	No Relaxation	ND*	ND*
25	Zinc as Zn	mg/L	Max 5	15	0.087	0.033
26	Anionic Detergents as MBAS	mg/L	Max 0.2	1	ND*	ND*
27	Chromium as Cr_{+6}	mg/L	Max 0.05	No Relaxation	ND*	ND*
28	Oil & Grease (Mineral Oil)	mg/L	Max 0.01	0.03	ND*	ND*
29	Alkalinity	mg/L	Max 200	**600**	**250**	**244**
30	Aluminum as Al	mg/L	Max 0.03	0.2	ND*	ND*
31	Boron as B	mg/L	Max 1	5	0.048	0.40
32	Pesticides	mg/L	Absent	0.001	ND*	ND*
	Microbiological Parameters					
33	Coliform	/100 ml	Absent		**Present**	**Present**
34	E-Coli	/100 ml	Absent		Absent	Absent
35	Polynuclear aroimic hydrocarbons as PAH	ppm	NS*		ND*	ND*

Interpretation of Ground Water Quality Results

Ground water was analyzed for physico-chemical and bacteriological parameters and results compared with IS: 10500 drinking water standards.

pH and Turbidity: The pH (7.96) and turbidity (0.31 NTU) at Fatepur village and pH (78.21) and turbidity (0.26 NTU) at Dhama village of ground water sample collected from bore wells at Fatepur and Dhama village were found within the desirable limit of IS: 10500 drinking water standards.

Chlorides and Total Dissolved Solids: The chloride and TDS concentrations in the ground water sample collected from Fatepur village (Chloride-714 mg/L & TDS-1776 mg/L) and Dhama village (Chloride-724 mg/L & TDS-1812 mg/L) was found to be exceeding the desirable limit of 250 mg/L and 500 mg/L respectively. High value of TDS and chlorides attribute to sediments characteristic of the area resulting in leaching of salts during percolation of water upto considerable depth (350 – 400 ft depth). High value of chloride in the ground water of Surendranagar district is further substantiated by CGWB ground water monitoring report.

Total Hardness: Hardness of water is considered to be an important parameter in determining the suitability of water for domestic uses particularly washing. Total hardness for Fatepur village (78 mg/L) and for Dhama village (74 mg/L) in the ground water samples were found to be conforming within the desirable limit of 300 mg/L specified under IS: 10500.

Iron and Fluoride: The concentration of iron in ground water sample at Fatepur village (0.15 mg/L) and at Dhama village (0.13 mg/L) were found to be in compliance with the desirable limits specified in the IS standards. Fluoride content in the same samples were not detected and thus found to be complying with the desirable limit for fluorides in potable drinking water standard (1.0 mg/L).

Heavy Metals: The concentration of heavy metals like lead, selenium, mercury, arsenic, copper, chromium, cadmium, etc in the ground water samples were not detected.

Micro-organism: Coliforms were detected at both the monitoring locations but E-coli was absent in ground water sample collected from Dhama and Fatepur village.

4.11 LAND USE AND LAND COVER

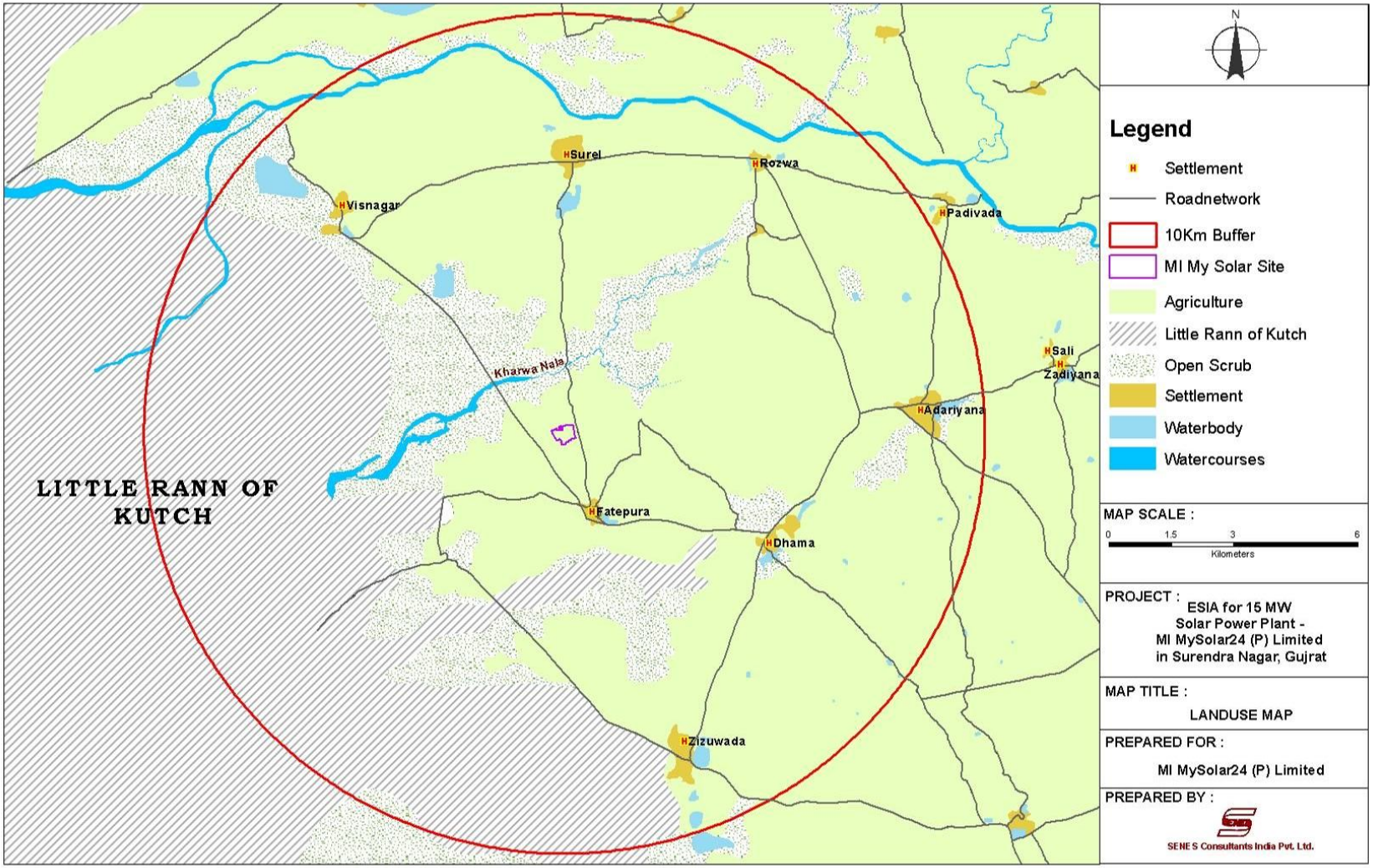
Land-use of the project area is highly influenced by the arid climate of the region. A study of the land-use and land-cover in a 10 km area around the project site shows that major portion (approx. 54%) of the area is agricultural lands. Salty marsh lands of the little Runn of Kutch accounts for 29 %. Approximately 14% of the land is in the category of open scrub land. No significant tree cover was seen in this area. Approximately 1 % of the area is used for settlements and roads. Water bodies and water courses constitute only around 2% of the land-use. **Figure 4.8** shows the land-use patterns in the study area.

TABLE 4-7: LANDUSE OF THE STUDY AREA

Landuse Category	Area in Sq. Km	Percentage
Agriculture	170.33	54.22
Little Rann of Kutch	89.32	28.43
Open Scrub	44.79	14.26
Road	1.10	0.35
Settlement	2.89	0.92
Water body	2.51	0.80

Water courses	3.21	1.02
Total	**314.16**	**100.0**

FIGURE 4-8: LAND USE PATTERN IN PROJECT AREA



4.12 ECOLOGY

Flora

Study area falls in arid cum dry zone of north Saurashtra agro climatic region having primarily black cotton-fine-loamy-mixed-hyperthermic type of soil and supports vegetation growth in the area. The vegetation in the Runn and its environs is largely xerophytic dominated by the thorny exotic shrub species *Prosopis juliflora*, which has spread and taken over most beyts and fringes. Major floral species found in the study area including project sites are specified below:

Flora

Common Name	Scientific Name
Babul	Acacia nilotica
Black locust	Acacia Senegal
Khadira	Acacia catechu
	Acacia leucophiila
Ber	Zizyphus spp.
Neem	Azadirachta indica
Peepal	Ficus religiosa
Shami	Prosopis cineraria

Fauna

The proposed project site is located within 10 Km from the Wild Ass Sanctuary in Little Runn of Kutch, which is a famous habitat of wild ass (*Equus hemionus khur*) (refer **Figure 4.9**). As per IUCN protected area categories, this sanctuary falls in IUCN IV category[1]. During sight visit and as per discussion with local people in Fatepur villages, sighting/reporting of faunal species viz. Wild Ass, Nilgai, Chinkara etc. were not confirmed in the nearby area of project site. However, due to close proximity of wild ass sanctuary occasional presence of these faunal species in search of food and water in nearby area of the project site cannot be ruled out. The Wild Ass Sanctuary is also a habitat to many species of animals and birds According to the data submitted to the UNESCO World Heritage Centre, the sanctuary has about 93 species of invertebrates, 4 species of amphibians, 29 species of reptiles, *Metapenaeus kutchensis* – a type of prawn, 70,000-75000 birds nests, 9 mammalians

[1] *IUCN category IV represents habitat/species management area and focuses on conservation of species or habitat that requires continuous protection rather than that of natural features.*

orders with 33 speceis/subspecies – including the world's last population of the Khur sub-species of Wild Ass. Details about the faunal species found in the sanctuary are as follows:

Wild mammals

Indian Wild Ass	Desert Cat
Blackbuck	Indian Fox
Chinkara	Striped Hyena
Nilgai	Indian Pangolin
Wolf	Small Indian Mongoose
Caracal	Indian Desert Gerbil
Blue bull	Hare
Jackal	Hyena
Wildboar	

Reptiles

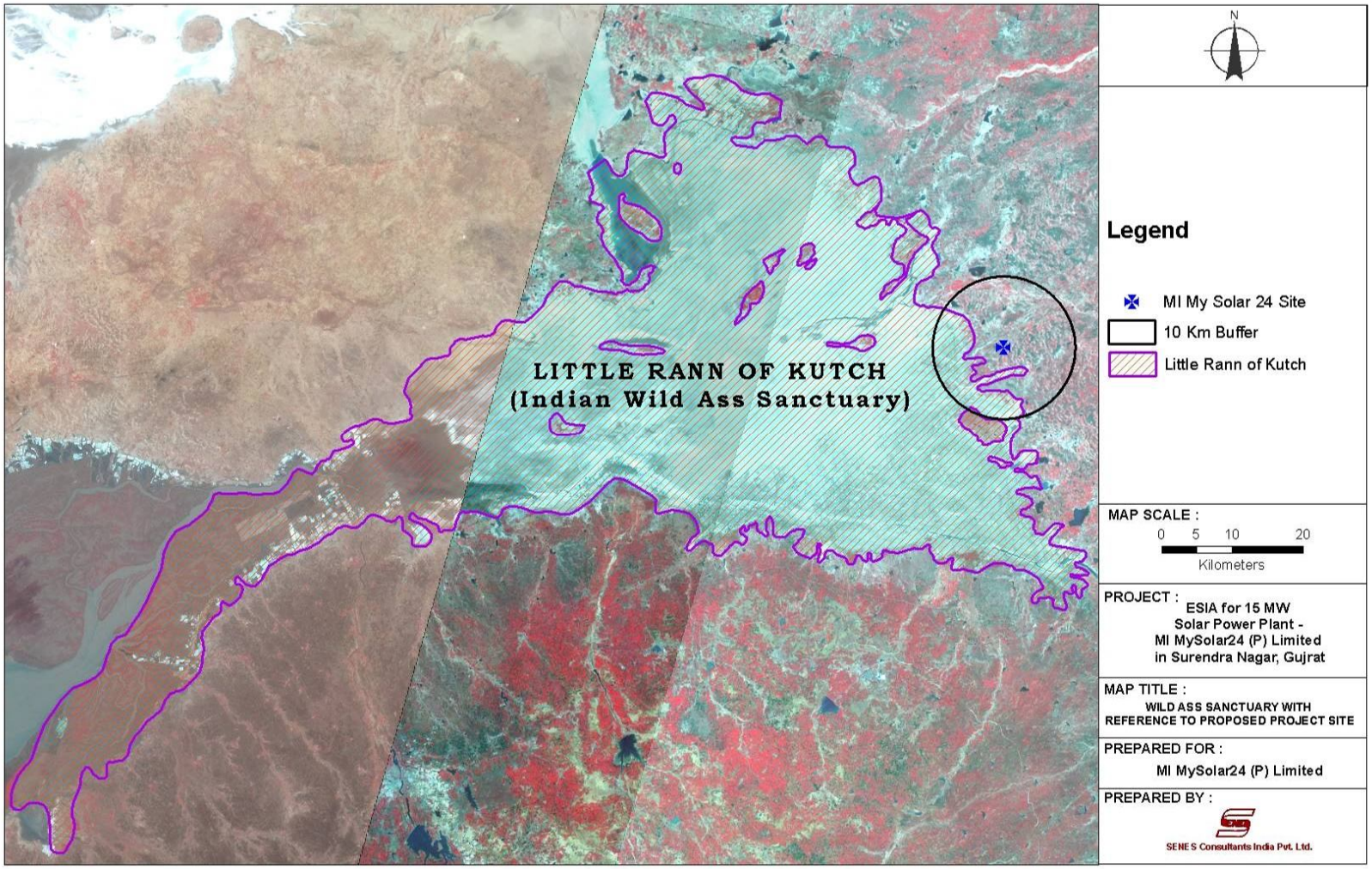
Spiny-tailed Lizard	Yellow Monitor
Black Cobra	Sand Boa

Aves

Bustard	Short Toed Snake Eagle
Long Legged Buzzard	Steppe Eagle
Imperial Eagle	Lagger Falcon
Short Cared Owl	Lesser Flamingo
Greater Flamingo	Asian Openbill
Woolly Necked Stork	White Stork
Eurasian Spoonbill	Great Crested Grebe
Great White Pelican	Dalmatian Pelican
Demoiselle Crane	Common Crane
Spotbill Duck	Gadwall
Northern Shoveler	Common Pochard
Tufted Duck	Caspian Tern
Pale Harrier	Houbara Bustard
Black Shouldered Kite	Pelican
Herons	Spoonbill

This area with the Wild Ass Sanctuary comprises of vast desiccated unbroken bare surface of dark silt which has been encrusted with salts and transforms into spectacular coastal wetland immediately after the rains.

FIGURE 4-9: WILD ASS SANCTUARY WITH REFERENCE TO PROPOSED PROJECT SITE



4.13 SOCIOECONOMIC ENVIRONMENT

This section discusses the baseline socio-economic environment of the study area defined for the proposed solar power project. Based on the assessment of the socio-economic conditions of the rural and urban settlements identified within the study area ESIA will later attempt to predict and evaluate the future impacts of the project on the local people, their physical and psychological health and well-being, economic facilities, heritage and culture, lifestyle and other value systems. The issues under focus are demographic structure, economic activity, education, literacy profile, infrastructure facilities, etc. The assessment and evaluation of potential socio-economic impacts will thereby assist in the formulation of necessary guidelines for impact mitigation and management of human environment.

The information provided in the following sections has been primarily derived from secondary sources (Census of India 2001, District Information Centre, District Statistical Handbook etc). The village-wise secondary data (as obtained from Census, 2001) has been taken into consideration for analyzing the socio-economic profile in a comparative manner.

4.13.1 General Socioeconomic Profile

Considering the scale and nature of the solar power plant project, a study area of 5 km from the project site has been identified for profiling of socio-economic environment of villages. Identification of the study area is primarily based on reconnaissance surveys, understanding of the project and professional judgment. Detail of the villages identified for socioeconomic profiling is presented in **Table 4-8** below.

TABLE 4-8 : LIST OF VILLAGES SELECTED FOR SOCIO-ECONOMIC PROFILING

State & District	Tehsil	Villages	Approx. distance from the project site
Gujarat, Surendranagar	Dasada	Fatepur	1.69 km
		Dhama	5.0 km

Surendranagar district

According to census, 2001, total population of the *Surendranagar* district is 15, 15,148 out of which rural population is 11, 12,700 while urban population is 4, 02,448. The sex ratio of the district is 924, having 7, 87,650 no. of male and 7, 27,498 no. of female population. Surendranagar district is situated between 22°00' to 23°05' North altitude and 69°45' to 72°15' East longitudes.

4.13.2 Demographic Profile

The demographic profile in terms of total population, household size, sex-ratio and scheduled population of the selected villages in the study area of district with respect to the proposed solar plant has been discussed in section below and presented in **Table 4-9**

Of the study area villages, *Dhama* has the highest population (2,029). The household size for both the study area villages was found to be about 5.2. The sex ratio within the study area is almost similar with percentage of male population. The highest SC population was recorded for Dhama village (266) while ST population are absent in both the study area villages.

TABLE 4-9 : DEMOGRAPHIC PROFILE OF THE STUDY AREA VILLAGES

Village Name	HH No	Total Pop.	HH Size	Male Pop.	% M	F Pop	% F	Sex Ratio	SC Pop	% SC	ST Pop	% ST
Fatepur	382	1991	5.2	1024	51.4	967	48.6	944.3	210	10.5	0.0	0.0
Dhama	391	2029	5.2	1050	51.7	979	48.3	932.4	266	13.1	0.0	0.0

HH-Household

4.13.3 Education & Literacy

The study of the education and literacy profile in the region is relevant in order to have an understanding whether the proposed project can utilize the skilled human resources available within the individual study area. The village-wise male and female literacy status as obtained from Census 2001 is presented in **Table 4-10.**

According to the 2001 census data, crude literacy levels in *Surendranagar* district is 61.6 %. The highest crude literacy rate was observed in *Dhama village* (45.3%) while average male and female crude literacy rate in Dhama village was recorded at 65.2% and 34.8 % respectively.

TABLE 4-10 : LITERACY PROFILE OF THE STUDY AREA VILLAGES

Villages	Total population	Total Literates	% Literates	Illiterates	%	Male Literates	%	Female Literates	%
Fatepur	1991	596	29.9	1395	70.1	414	69.5	182	30.5
Dhama	2029	920	45.3	1109	54.7	600	65.2	320	34.8

4.13.4 Economic Activity & Livelihood Pattern

The relevance of economic activity and livelihood pattern is important in the context of the study since depending on the existing situation one can predict the impact of the project activity on the economy of the villages and the region. The village-wise workforce participation as obtained from Census 2001 is presented in **Table 4-11.**

The workforce participation rate in the study area villages of *Surendranagar* varies from 0.3% to 59.7%.Majority of inhabitants (about 59.7%) in the study area villages are employed in the category of Agricultural labours. Cultivators comprise the second most important work category in the study area constituting about 24.55% of the total workforce. Employments in other workers category (15.45%) as well as workers working in household industries (0.3 %) are low in number.

TABLE 4-11 : WORKFORCE PARTICIPATION OF STUDY AREA VILLAGES

Villages	Total Worker	Total Non workers	% Cultivator	% Agriculture Labour	% Household Worker	% Other Worker
Fatepur	656.0	1335	19.4	72.1	0.0	8.5
Dhama	827.0	1202	29.7	47.3	0.6	22.4

4.13.5 Socioeconomic Infrastructure

Educational Facilities

There are 943 primary, 153 secondary and higher secondary schools in the Surendranagar district. Only primary education facilities were observed in both the villages within the study area, no secondary schools have been recorded in Fatepur and Dhama village. Village wise educational facility in the study area is given in **Table 4-12**.

Drinking Water Facilities

It was observed that both the villages in study area have fair access to drinking water through village tube wells, open wells and tanked water supply. Village wise drinking water facility in the study area is given in **Table 4-12**.

Medical Facilities

Surendranagar has several private specialised hospitals to provide a comprehensive range of tertiary and secondary care services backed by state-of-the-art technology and trained medicos but medical facilities within the study area villages are not satisfactory. There is no medical facility in Fatepur village while in Dhama only one primary health sub centre is present. However, Government of Gujarat is providing on call medical facility to the caller within an hour. Village wise medical facility in the study area is given in **Table 4-12.**

TABLE 4-12 : BASIC AMENITIES IN THE STUDY AREA

Village	Education Facility	Medical Facility	Drinking Water Source	Post & Telegraph	Approach to Village	Power Supply	communication facilities
Fatepur	P_SCH (1)	Not available	T,TK	PO(1) PH(1)	PR Nearest town-	EA	Bus services

Village	Education Facility	Medical Facility	Drinking Water Source	Post & Telegraph	Approach to Village	Power Supply	communication facilities
					Kharaghoda (44km)		
Dhama	P_SCH (1)	PHSC_1	T, W, TW	PO(1) PH(8)	PR Nearest town-Kharaghoda (42km)	EA	Bus services

[Source: Census of India 2001]

Education Facility: *P_SCH = Primary School; S_SCH = Secondary School*

Medical Facility: *FWC-Family welfare centre; PMC-Number of registered private medical practiotioners; PHSC-Primary heath sub centre; PHC-Primary Health centre; MCWC-Maternity and child welfare centre*

Drinking Water Facility*: T = TAP; W = WELL; TK = TANK; TW= TUBEWELL;*

Post & Telegraph*: PO = Post Office, PH= Phone Connection*

Approach Road to Village*: PR = Paved Road; MR= Mud Road*

Power Supply*: EA = Electricity for all purposes, ED = Electricity for domestic use, EAG= Electricity for Agriculture use, EO = Electricity for other purposes,*

5 Social & Environmental Impact Assessment

5.1.1 Approach and Methodology

An assessment was done in order to understand the potential risks and impacts of the proposed project on the physical, biological and economic environment in which it proposes to operate. The basis of the assessment was the applicable national regulations, IFC Performance Standards on Social and Environmental Sustainability and the IFC General EHS Guidelines.

- The study team carried out the following steps to complete the impact assessment process:-
- Detailed discussion with project proponent to understand project schedule, technical features, and plans/procedures for construction and operation;
- Desk study of the socio-environmental profile of the project area; and
- Field surveys and consultations with the villagers
- Study of the layout, design and plans for the solar power project as provided by the Project proponent.

5.2 SOCIAL CONSULTATION

The study team conducted a consultation exercise within the project area in April 2012, where they met and interacted with community members including farmers, school principal, head of village panchayat, land sellers , etc in Fatepur villages (please refer Photo 5.1). The objective of the consultation was to understand the following:

- Socio-economic condition of the people of Fatepur and nearby villages
- General perception about the proposed project and other solar energy projects proposed among the local community
- Previous dependent of the villagers, if any, on the land taken up for the project site;
- To understand environmental and social concerns of the local community with respect to the proposed project

A brief account of the various discussions is summarized below:

5.2.1 Public Consultation with land loosers

From the discussion, it came out that the community is well aware of the solar power project coming up in the proposed area and they are in support of the proposed project. It was also found that only dry land (no wet land or grazing land) has been purchased for the proposed project and the land losers have received monetary compensation against selling of their land. (refer the details given in section 2.4 of this report). They are now planning to purchase other

plots of land for agricultural activities. Discussion also revealed that agriculture is the primary livelihood in the area however, due to a mono cropped agricultural pattern, it is not the perennial source of income throughout the year. In the dry season (non agricultural season) they are jobless therefore there is a growing tendency among the youth to migrate to nearby cities like Ahmedabad, Gandhinagar, Mehsana, etc for permanent employment opportunities.

5.2.2 Public consultation with villagers

During discussion with villagers, it was found that some of the villagers are already employed as labourers in the existing solar power plant (owned by AMCO Pvt. Ltd), in the Fatepur village and they are also expecting employment opportunities for casual labourers (unskilled) from the upcoming proposed project.

Discussions with principal of primary school in Fatepur village revealed that, there is need for renovation and development of school building and prayer hall in the school. He is hopeful that socio-economic conditions along with infrastructural facilities like primary medical facilities and approach roads will improve due to the upcoming solar power projects.

During public consultation it was also noted that no land or properties of cultural, community and religious importance or affecting their sentiments has been purchased for the proposed project. It was also observed that drinking water was supplied in the villages through government water supply line. However, water from the ponds was also used by villagers for domestic activities.

Overall different sections of the community comprising of residents, school teachers, farmers, etc. are aware that the land will be utilized for the development of solar power plant and they are looking for associated benefits like employment generation as casual labourers in the non-farming season. In addition to this, renovation and development of school building was another expectation from the proposed project.

The list of the stakeholders consulted during the ESIA study is presented in the following table:

TABLE 5-1: STAKEHOLDERS CONSULTED DURING THE ESIA STUDY

Sl. No.	Name of Participant	Occupation	Village
1	Sh. Sonabhai	Village Head, land seller	Fatepur Village
2	Sh. Laxmanbhai	Gram Sewak	Fatepur Village
3	Sh. Punjabhai	Land seller	Fatepur Village
4	Sh. Chunda Bhai	Farmer	Fatepur Village
5	Sh. Goyaleshwar	Principal, Govt. Primary School	Dhama Village
6	Sh. Goyabhai	Land seller	Fatepur village

Photo 5-1: Public Consultation with Villagers for the proposed Project

Public Consultation with Group of People including Villlagers and Land Loosers

5.3 IMPACT ASSESSMENT

Potential social and environmental risk and impacts from the proposed project have been described in relation with IFC performance standards in **Table 5-2** below. Column (a) of the table denotes the title of the IFC Performance Standard, column (b) denotes the fundamental requirements of the Performance Standard and column (c) describes the assessment of the risks and impacts arising from the different phases of the project life-cycle in comparison with the Performance Standards. A Social and Environmental Management Plan has been developed based on the impact assessment and is presented in the next section.

TABLE 5-2: IMPACT ASSESSMENT

Sl. No.	(a) Title of Performance Standard	(b) Performance Standard Requirements	(c) Assessment of Risks
1	PS 1: Social and Environmental Assessment and Management Systems	When local communities are affected by risks or adverse impacts from a project, the project proponent must ensure adequate engagement with the communities to build and maintain a constructive relationship over time. Project proponent should disclose project-related information to help affected communities understand the risks, impacts and opportunities of the project.	MI My Solar (24) Pvt. Ltd. (MMSPL) has carried out a detailed Environmental & Social Risk Assessment study for the proposed power plant at Fatepur to identify & assess the social and environmental impacts arising from the project activities. Typically construction or operation of a solar power project does not generate emissions and effluent or involve handling or generation of hazardous materials. With regard to use of natural resources, while demand for water during construction and operation phases is low given the requirement of land per MW need to be optimised while designing. Hence, adverse environmental and related social impacts on the local community are not envisaged from project activities other than from project siting and land requirement. Approximately, 152 acres of land is being acquired by MMSPL for development of their 15 MW solar power project. Private land is being purchased on willing seller willing buyer method through mutual consent. Originally, the land was seasonally cultivated for crops such as cotton, arinda, groundnuts etc. due to its poor fertility levels. The land was acquired directly from the land owners; however, process was facilitated by mediators. Concerns of the local people regarding siting/design of the solar power project generally related to change in local drainage patterns and topography, sharing of community resources especially those which are in short supply (e.g., water) and restricted access to public infrastructure such as roads. There are no local drainages or public roads passing through the site. Local people expect support to the School in the village from MMSPL in terms of development and renovation of primary school building and the same can be

Sl. No.	(a) Title of Performance Standard	(b) Performance Standard Requirements	(c) Assessment of Risks
			taken up by MMSPL as one of their CSR activities.
2	PS 2: Labour and Working Conditions	The project proponent should provide the workers with a safe and healthy work environment, taking into account inherent risks in its particular sector and specific classes of hazards in the client's work areas. The proponent should take steps to prevent accidents, injury, and disease arising from, associated with, or occurring in the course of work by minimizing, so far as reasonably practicable, the causes of hazards. In a manner consistent with good international industry practice, the client will identify potential hazards to workers, particularly those that may be life-threatening; provide preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances; train workers; document and report of occupational accidents, diseases, and incidents; and be prepared for preventing and responding to emergencies. The proponent should also ensure that child labour is not used	During the site visit it was found that proposed project is at very initial stage where land acquisition is in process. During discussion with MMSPL officials, it was found that for construction phase, water will be provided by EPC contractor through water tanker. MMSPL shall also ensure that drinking water for staff and the labour during construction and operational phase must be meeting IS: 10500 quality standards. Different kinds of safety hazards will be associated with construction, operation and maintenance activities. For e.g. manual excavation can cause cut hazards, loading and unloading of materials can cause physical strain and injuries and work on electrical equipments can lead to electrocution hazard to cite a few. Safety-related risks are minimised by incorporating safety measures in plant design, developing safety culture in project site working, preparation safety manuals and including safety-related instructions in work procedures, imparting training and awareness to contracted labour and employees, providing adequate Personal Protective Equipments (PPEs) and ensuring their use, and carrying out supervision on a regular basis. Design-in safety measures include circuit breakers and fuses to isolate energized plants components during repair and maintenance work. Lock-Out-Tag-Out methods can also be employed for preventing re-energization of electrical equipments. However, systematic adequate training and supervision needs to be ensured by the company to ensure that electrocution hazards are avoided and safety controls are used effectively. Fires are expected to be managed using fire extinguishers maintained at the project site. The company will need to ensure the health and safety of workers as required

Sl. No.	(a) Title of Performance Standard	(b) Performance Standard Requirements	(c) Assessment of Risks
		during any stage of the project.	by Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and the Central Electricity Authority (Safety Requirements for Operation, Construction and Maintenance of Electric Plants and Electrical Lines) Regulations 2008. In case the construction workers require temporary shelters at site during the construction period the same will have to be managed as per the guideline published jointly by International Finance Corporation (IFC) and the European Bank for Reconstruction and Development (EBRD)[2] and relevant provisions of the above-mentioned regulations. Any encroachment upon adjoining lands for providing temporary shelter to workers must be avoided. Emergency preparedness and response plan will be developed and communicated to all workers to increase their preparedness to handle emergency events.
3	PS 3: Pollution Prevention and Abatement	The project proponent should ensure that adequate control techniques are provided to minimize emissions or achieve a pre-established performance level. The proponent should ensure that generation of hazardous wastes are minimized and handling, storage and	Operating solar photovoltaic power plants have no significant point or fugitive sources of air emission. However, fugitive dust generated during excavation work and materials handling during construction phase can temporary increase particulate levels at the project site. MMSPL will ensure that dust suppressing procedures should be followed during construction period. Operation of construction and earth-moving machines and equipments and temporary diesel-based generator sets will also result in an increase in

[2] *"Workers accommodation: process and standards" guideline published by IFC and EBRD. It addresses the processes and standards that should be applied to the provision of workers' accommodation in relation to projects funded by the EBRD or IFC.*

Sl. No.	(a) Title of Performance Standard	(b) Performance Standard Requirements	(c) Assessment of Risks
		disposal are managed properly to prevent any adverse social and environmental impacts. Reasonable inquiry about the location of the final disposal of their waste, even if the disposal is conducted by the third party and especially if the waste is considered to be hazardous to human health and the environment should be carried out.	ambient concentrations of SO_2, NO_x, CO and HC and ambient noise levels. Inverters can be the only source of noise but, being housed inside control rooms, their impact on the ambient noise levels are not expected. The increase in air pollutant concentration and noise levels caused by the proposed project during its construction phase is expected to be short-lived and insignificant. However, cumulative air and noise quality impacts though intermittent are anticipated from area development activities by other solar power plant operating in the area. Very low volumes of sanitary waste water will be generated during construction (maximum 1 KLD) and operation phases (maximum 200 LPD). Soak pit and septic tank will be used on-site for the treatment of sanitary waste water. No chemicals will be used in the panel wash water. Mopping techniques will be employed to reduce water demand. MMSPL will need to ensure that transformer oil used in transformer is free of Polychlorinated Bi-Phenyls. Hazardous wastes such as empty paint containers (generated when the control room buildings or the module mounting structures are painted) will be handled and disposed in a manner that contamination of soil or groundwater is avoided. During decommissioning phase temporary impacts are envisaged due to noise and fugitive emissions generated from vehicles involved in the transportation of solar panels, transformers, demolition waste etc. However these impacts are likely to be short terms and localized in nature and can be mitigated through implementation of appropriate mitigation measures as outlined in the

Sl. No.	(a) Title of Performance Standard	(b) Performance Standard Requirements	(c) Assessment of Risks
			"Decommissioning Plan"
4	PS 4: Community Health, Safety and Security	The project proponent should avoid or minimize risks to and impacts on the health and safety of the local community during the project life-cycle from both routine and non-routine circumstances. The proponent should also ensure that the safeguarding of personnel and property is carried out in a legitimate manner that avoids or minimizes risks to the community's safety and security. The proponent should avoid or minimize the exacerbation of impacts caused by natural hazards, such as, landslides or floods that could arise from land use changes due to project activities.	Generation of air pollutants and high noise due to operation of construction equipments/machineries is short-lived and not expected to cause any significant impact on settlements located more than 1 km away from the project site. Movement of heavy vehicles carrying materials and machines during construction phase of a solar power plant is not expected to disturb the local communities. Prior information of such activities will be provided to the locals in case of significant vehicular movement in the area of the solar plant is expected. However Road Safety & Traffic Management Plan shall be in place. The nearby area of project site is low-lying which may get water logged during rains. As part of area developmental activities, MMSPL needs to develop the drainage system to eliminate the water stagnation from the site and facilitate surface runoff into seasonal drain. Adverse impacts on local surface drainage patterns are not expected. The project will offer employment opportunities to the local people, especially as semi-skilled and unskilled labour.
5	PS 5: Land Acquisition and Involuntary Resettlement	The project proponent should preferably acquire land for project by negotiated settlement and should avoid expropriation.	The lands for the proposed project are private owned land which is being purchased by MMSPL on willing seller willing buyer process. The land originally was used for rain fed mono-crop production viz. Cotton, arinda, ground nuts etc. and left as fallow land for rest of the year. The land was acquired by MMSPL directly from land owners. No grievances are reported during the stake holders consultations with the Village Head and locals of Fatepur village, regarding the land transaction and compensation which

Sl. No.	(a) Title of Performance Standard	(b) Performance Standard Requirements	(c) Assessment of Risks
			indicate broad community support (BCS) for this project.
6	PS 6: Biodiversity Conservation and Sustainable Natural Resource Management	The project proponent should protect and conserve biodiversity.	The project site was originally a rain fed agricultural land and was used for cultivation of crops such as cotton, arinda, groundnut, etc during the monsoons. Vegetation at project site was observed as bushes, shrubs and few trees. Considering that major vegetation on site comprised of bushes and shrubs, no major impact is envisaged due to clearing of site. Further, the project site is not a part of animal habitat. Consultations with community members and forest officials revealed that the habitat of animals such as Nilgai, Wild Ass, etc is quite far from the site and within the sanctuary area. Their occasional sighting in the project area could be in search of food (from surrounding agricultural fields) and water. This is quite common in the entire Kutch region where herbivores such as Nilgai, Wild Ass are frequent visitors to agricultural fields. Initiation of site activity is likely to discourage such animals from visiting the agricultural fields close to the project site. Support from MMSPL to the Forest Department to strengthen the habitat in the sanctuary to ensure safety to these animals is recommended. Considering that the Wild Ass Sanctuary is located within 10 KM. from the project site, noise related disturbances to the animals from movement of construction machineries, interface with project vehicles etc are envisaged particularly during the construction phase
7	PS 7: Indigenous People	The project proponent should minimize, mitigate or compensate for adverse impacts on scheduled tribe due to project activities and provide them	The solar power plant is located in Fatepur village and does not involved land acquisition from indigenous people. Hence, it is not expected that proposed project will have adversely impact on indigenous people. This Performance Standard is not applicable for the proposed project.

Sl. No.	(a) Title of Performance Standard	(b) Performance Standard Requirements	(c) Assessment of Risks
		opportunities for development benefits.	
8	PS 8: Cultural Heritage	The project proponent should ensure there are no adverse impacts on the cultural heritage in the project area.	There are no important cultural heritage sites within 10 Km from the proposed project site. No significant area or building of cultural heritage is existing near the project site. Hence, this Performance Standard is not applicable.

5.4 CONCLUSION

It is concluded from the above impact assessment that the proposed MMSPL 15MW solar PV power project in Fatepur village is unlikely to pose any adverse irreversible social and environmental risks given the intermittent nature of the proposed activities and absence of any legally protected areas and cultural heritage sites located within and/or in close proximity to the project. However it may have reversible environmental & social impacts which can be managed with a structured ESMP in place.

It is understood through our visits and consultation that appropriate plans and procedures viz. Emergency Response & Preparedness Plan, Labour Working Conditions Management Procedure, Occupational Health & Safety Management Plan, etc need to be formulated and implemented by MMSPL in coordination with the EPC contractor engaged by them to meet relevant IFC PS and regulatory requirements.

Community consultations indicate broad community support for the project taking into account the provision of both direct and indirect employment opportunities being generated. However in line with PS requirements it is recommended that MMSPL develops and implement a community engagement plan to maintain continued dialogue with the Fatepur Panchayat to address any community related issues/grievances. Further it is also anticipated that such continued engagement will enable MMSPL to enhance project level awareness in neighbouring villages and effectively plan community development initiatives in consensus with the local communities.

6 Environment and Social Management Plan

The outcomes of the Social and Environmental Impact Assessment of the proposed project have been used to formulate specific Management & Monitoring Plans for the project, presented in **Table 6.1** and discussed in subsequent section. The Plan specifies the following:

- measures for safeguarding the health and safety of workers;
- good industry practices for ensuring that the project's environmental impacts are minimized to the maximum extent; and
- the requisite legal compliances are met.
- In addition, organizational capacity and training requirements, required to check and ensure effectiveness of the plan throughout the lifecycle of the project, have also been discussed.

MI MySolar24 (P) Limited (MMSPL), has a corporate EHS policy. The policy envisions:

- Promoting a safe and healthy work culture by actively working towards prevention of environmental pollution, occupational health and safety hazard.
- Complying with applicable legislation and regulations and other requirements pertaining to environmental protection, occupational health and safety.
- Ensuring involvement of employees at all levels and applicable customers/ suppliers by providing training & awareness with effective communication
- Minimizing the wastes through efficient use of resources
- Communicating EHS policy to all employees and interested parties including contractual work force at site
- Focusing on continual improvement of its applicable processes and performances to ensure its suitability, adequacy and effectiveness
- The Environment and Social Management Plan follows the foot print of the Corporate EHS policy.

TABLE 6-1: ENVIRONMENT AND SOCIAL MANAGEMENT & MONITORING PLAN

Sl. No.	Aspect	Action	Timeframe	Responsibility
1	Preservation of natural area drainage systems	• The site preparation activities like excavation, elevation, filling work, boundary demarcation by MMSPL's EPC Contractor shall ensure that the natural drainage pattern of the area is not altered. The formation of stagnant water pools shall be avoided through proper site leveling and filling in order to prevent potential health impacts of the workers onsite from transmission of vector-borne diseases • Measure shall be taken to ensure that construction activities in no way affect the natural drainage pattern of the seasonal drain known as *Kharwa ka Nala* present in north direction at approx distance of 500 m from the site • Temporary peripheral drains shall be provided with small check dams all around the proposed site or short temporary bunds shall be constructed all around the site (until permanent plant boundary wall is constructed) to prevent passage of silt laden surface run-off from site . • During operation phase surface run-off from internal drains within the site shall be channelized outside the plant site. Provision of sediment traps/interceptors to be ensured for the internal drainage network at run-off discharge location. • Proper storm water drainage network need to be developed on site.	During construction and operation phase	EPC contractor and O&M contractor under the supervision of MMSPL's Personnel

Sl. No.	Aspect	Action	Timeframe	Responsibility
2	Safeguard of occupational health of the workers onsite	• Water purification systems shall be provided to ensure that drinking water for the staff and workers meet the IS 10500 quality standards for potable water. • Periodic monitoring of potable water supply shall be carried out to check conformance IS 10500 standards. • Temporary shelters to be provided at workplace for resting of workers at periodic intervals, adequate drinking water dispenser and toilets shall be provided at site to facilitate proper sanitation of the staff and worker.	Before use Before use Construction and Operation phase	EPC contractor and O&M contractor under the supervision of MMSPL's Personnel
3	Proper handling and disposal of wastes and protection of local environment	• A Waste Management Plan for both non-hazardous & hazardous waste has been prepared & given in section 6.3. Based on the above mentioned plan, MMSPL should manage site specific waste storage and handling practices. • Construction debris after completion of major construction phase shall be reused in paving on site approach road or filling of low lying areas. • Waste water during operation phase should be collected and treated properly. Suitability of soak pits of the project site shall be assessed. • Dry sewage sludge generated from septic tank shall be reused in the green belt development along site periphery. • Local waste recyclers shall be identified for disposal of recyclables viz. packaging materials, metal scrap	During construction and operation	EPC contractor and O&M contractor under the supervision of MMSPL's Personnel

Sl. No.	Aspect	Action	Timeframe	Responsibility
		generated primarily during construction phase. • Hazardous wastes generated only during construction phase shall be managed in accordance to the provision of Hazardous Waste Management & Handling Rules, 2008.		
4	Health and safety of workers	• First aid boxes shall be provided at site; hazard signs to be placed near energized components; provision of sufficient fire extinguishers at site to tackle fire hazards; adequate use of personal protective equipments during work to be ensured; ensure implementation of proper occupational health and safety programs/procedures viz. Job Safety Analysis, Permit to Work, Lock-Out & Tag-Out etc and safety inductions and training to prevent safety hazards at work prior to commencement of any operation and maintenance activities. • Construction workers shall be provided with requisite shelter, drinking water and sanitation in accordance with the requirements of the Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996, the Central Electricity Authority (Safety Requirements for Operation, Construction and Maintenance of Electric Plants and Electrical Lines) Regulations 2008 and the guidelines published jointly by International Finance Corporation (IFC) and the European Bank for Reconstruction and Development (EBRD).	During operational stage	O&M contractor under the supervision of MMSPL's Personnel

Sl. No.	Aspect	Action	Timeframe	Responsibility
5	Emergency response and preparedness	• Potential emergencies viz. natural disasters, fire and community protests, accidents/injuries etc will be addressed in accordance with the Emergency Preparedness and Response Plan as discussed in 6.2 of this report. MMSPL will be responsible for periodic up gradation of this plan to ensure it effectiveness.	During construction and operation phase	EPC contractor and O&M contractor under the supervision of MMSPL's Personnel
6	Develop positive perception among local communities about project	• Open dialogues shall be maintained with the community members and all other local stakeholders of the project to communicate details of the project, its utility in a national and sectoral perspective, extent of benefits and opportunities the project can present to the local communities and plans/measures the project proponent is taking to address the community concerns about social and environmental impacts. • Planned use of public infrastructure such as road and community resources such as water shall be discussed with the community members, especially the competing users. • Ensure maximum employment to local people, especially as construction workers and security guards. • A Community Development Plan shall be prepared to address community needs viz. strengthening of village access roads, enhance livelihood opportunities etc	During construction and operation	MMSPL Management and EPC Contractor
7	Safeguard of community safety	• Community health and safety risks identified with respect to the movement of heavy vehicles and equipments during construction and operations will be	During construction and operation stage	EPC contractor and O&M contractor under the supervision of

Sl. No.	Aspect	Action	Timeframe	Responsibility
		addressed through development and implementation of Road Safety & Traffic Management Plan as discussed later in this chapter.		MMSPL's Personnel
8	Prevent any disturbance to wildlife	• Approval from forest & wildlife department for construction of project and strict compliance with conditions of the NOC given by the Forest & wildlife department. • Temporary nature of construction phase (approx. 6-9 month) would not likely to create significant impact. However, impacts can be managed through implementation of appropriate mitigation measures viz. avoiding construction activity and traffic movement at night time and during early hours in the mornings. Also proper fencing around the site will deter the animals from entering the site and getting hurt.	Before construction During construction and operations	MMSPL Personnel during both construction & operational phase
9	Legal compliance	• Consent to Establish (CTE) and Consent to Operate (CTO) to be obtained from Gujarat Pollution Control Board (GPCB) before commencement of construction and operation respectively. • Compliance with the conditions of the CTE and CTO shall be ensured and the compliance shall be reported to the Pollution Control Board periodically as mentioned in the aforesaid permits/consents.	Before construction and prior to operation During operations	MMSPL Personnel during both construction & operational phase
10	Prevention of soil and	• Spillage of materials e.g. paints, solvents and diesel oil	During construction	EPC contractor and

Sl. No.	Aspect	Action	Timeframe	Responsibility
	groundwater contamination	on soil shall be prevented, by placing these materials in safe places with impermeable liners during storage, handling and use. • Adequate spill control arrangements viz. sand bucket etc to be provided onsite to address any accidental spills.	and operation	O&M contractor under the supervision of MMSPL's Personnel

6.1 ENVIRONMENTAL MANAGEMENT ACTION PLANS

The ESMP is comprises of some site specific management plans viz. Emergency Management Plan, Waste Management Plan, Storm Water Management Plan, Wild life Management Plan, Environmental Monitoring Plan, Traffic Management Plan and Social Development Plan for the MMSPL's 15 MW Solar PV Power Plant in Fatepur village, in the Surendra Nagar District of Gujarat. However, detailed CSR initiatives and operational activity specific Standard Operating Procedures (SOPs) shall be prepared at a later stage.

6.2 POLLUTION PREVENTION AND ABATEMENT PLAN

The purpose of the plan is to manage the potential impacts on environmental components that may result from both construction and operation phase activities viz. operation of construction equipments & machineries, vehicular movement, storage and handling of sub-soil, fuel and chemicals etc. The mitigation measures identified as part of the plan has been outlined below:

- Vehicles delivering raw materials like soil and fine aggregates shall be covered to prevent fugitive emissions.
- Storage and handling of raw material and debris to be carefully managed to prevent generation of fugitive dust.
- Sprinkling of water on earthworks, material haulage and transportation routes on a regular basis during dry season.
- All vehicles, equipment and machinery used for construction will be subjected to preventive maintenance as per manufacturer norms.
- All vehicles utilized in transportation of raw material and personnel will have valid Pollution under Control Certificate (PUC). Vehicular exhaust will be complying with the CPCB specified emission norms for heavy diesel vehicles.
- Exhausts of DG sets will be positioned at a sufficient height to ensure dispersal of exhaust emissions; engines will not be left running unnecessarily.
- Preventive maintenance of DG sets to be undertaken as per manufacturers schedule to ensure compliance with CPCB specified generator exhaust.
- Selection and use of low noise generating equipment equipped with engineering controls viz. mufflers, silencers etc
- All vehicles utilized in transportation of raw material and personnel will have valid Pollution under Control Certificate (PUC)
- Periodic preventive maintenance of vehicles as per manufacturer's schedule to ensure compliance with the vehicular noise limits specified by CPCB

- All high noise generating equipments will be identified and subjected to periodic preventive maintenance.
- No night time operation of vehicles and construction activities will be undertaken.
- Engines of vehicles and construction equipment to be turned off when not in use for long periods.
- Installing acoustic enclosures and muffler on engine exhaust of DG sets to ensure compliance with generator noise limits specified by CPCB.
- Debris and excavated material generated during construction activities to be stockpiled in designated areas onsite. No material to be disposed in adjacent land surrounding the site boundary.
- Fuel and chemical storage areas will be paved and properly bunded. Bunded areas will be designed to accommodate 110% of the volume of spilled material.
- Spill kits will be made available at all fuel and chemical storage areas. All spills/leaks contained, reported and cleaned up immediately.

6.3 EMERGENCY PREPAREDNESS & RESPONSE PLAN

Purpose

MMSPL's has prepared a site specific Emergency Management Plan for implementation at the project site in the event of an emergency situation so that the loss of life and damage to the properties & natural resources are minimized. This plan will outline a series of emergency actions that will be executed by the MMSPL & its Contractors to ensure preparedness and response to emergency situations throughout the life-cycle of the project.

Definition

Emergency - Any unplanned situation, which presents a threat to the safety of workers and/or damage to the properties and other natural resources deemed valuable at the project site

Emergencies

The emergency situations that are probable to occur at the solar power site and the probable causes are listed below:

- Fire resulting from electrical short circuit at the plant and equipment during both construction & operation phase.
- Outbreak of endemic disease among construction workers due to contaminated drinking water, unhygienic conditions that have developed at workplace etc;
- Protests by the local community or other stakeholders at any point of the project lifecycle due to conflict with project activities;
- Flood and earthquake in the region; and

- Serious injury or death of employee or sub-contracted worker at work, due to non-work related illness or work-related accident.

Emergency Management

The following steps shall be taken to ensure proper management of emergency or crisis situations:

- An Emergency Management team during operation phase of the proposed Solar PV Power Plant shall be formed to combat any emergency situation arising at site and ensure safety of the life and property at site. The team shall be headed by Project Head/ Emergency Coordinator.
- An emergency communication system will be prepared and informed to all concerned. The nearest civil hospitals, private health care centers or practitioner clinic shall be identified and a agreements shall be made with the aforesaid medical centers/practitioners to provide prompt health care services (including ambulance services) in the event of an emergency situation at site.
- A list of important telephone numbers such as fire brigade, health care facility/practitioner, police station, EHS and Social Coordinator, project office, head offices etc shall be displayed at all the prime locations at site
- Regular liaisoning with the police, Gram Panchayat, district administration shall be carried out to ensure that prompt assistance is readily available in the event of an emergency.
- Development and implementation of a grievance redressal procedure to deal with village level issues/concerns at preliminary stage to prevent fall out of any major emergencies.
- Emergency Response Team (ERT) to be trained on Emergency scenarios and their management measures including their roles and responsibilities in case of an emergency situation.
- Emergency evacuation plan to be developed and keep for ready reference

In case of an emergency, all site personnel shall be trained to follow the communication lines given below:

  - Personnel at site affected by the emergency situations immediately inform the project office and the external agencies (such as police, fire brigade, ambulance services); In case, project office cannot be reached, the Coordinator will be informed directly;
  - The Emergency Management Coordinator on being informed about the emergency by project offices or by the employee directly; reaches site if necessary, and also follows-up with the aforesaid external agencies for aid;

- The Coordinator takes charge of the emergency response and direct further action and co-ordination, including escalating the matter to the project management as required.

Responsibilities

The Project Head will be responsible for implementing this procedure, which includes (a) ensuring that the emergency preparedness measures are in place; (b) providing training to the personnel at site regarding reporting of the emergencies, and to site office personnel regarding response to emergency calls from the site personnel and (c) direct action-and co-ordination at the time of an emergency.

6.4 WASTE MANAGEMENT PLAN

Scope

The Waste Management Plan (WMP) shall be applicable to the wastes arising during commissioning and operation of the proposed Solar Power Plant of MMSPL. The major waste streams from the project include non-hazardous solid waste, wash waters generated from panel washing and sewage.

Purpose

WMP is intended to serve as a guideline for MMSPL & the contractor(s) to manage wastes effectively during the project life cycle. The WMP describes how wastes will be managed during the project life cycle and how the project will:

- Minimize the potential to cause harm to human health and the environment.
- Comply with Indian Environmental Regulation & IFC Performance Standards.
- Reduce operational costs and reduce any potential liabilities which may arise from waste handling operations.
- This plan also ensures that every waste stream and solid waste materials from the main plant site and the associated facilities will be managed effectively.

6.4.1 Solid Waste Management

Management of Solid Waste & Hazardous Waste during Construction & Operation Phase

The EPC contractor should manage the waste generated during construction phase like construction debris, packing material, paint containers and filters.

The management measures of the aforementioned solid wastes and the hazardous wastes are discussed in details below:

- The recyclable and non-recyclable non-hazardous solid waste generated onsite should be collected and stored in a temporary waste storage facility from where all the wastes shall be sent for recycling and disposal to appropriate facilities.

- The reusable waste like wooden waste and cardboards from packing material, empty cement bags, construction debris etc can also be given to locals for their use or give it back to original equipment manufacturer (OEM)

6.4.2 Liquid Waste Management

Liquid Waste Management during Operation Phase

The liquid wastes likely to be generated during the operation phase include:

Domestic Waste Water – Domestic Waste Water likely to be generated from toilets/urinals within the proposed plant and associated facilities shall be treated in combined septic tank-soak pit system.

Wash water from Panel Washing & Floor Washing – The wash waters generated from periodic cleaning of panels, equipment within the solar power plant can be reused for greenery development within the main plant, as it may not contain any pollutants requiring treatment.

6.5 STORM WATER MANAGEMENT PLAN

The Storm Water Management Plan (SWMP) refers to the proper management of surface run-off generated during monsoon from the Solar Power Plant area. The purpose of Storm Water Management Plan (SWMP) is to ensure prevention and control of any adverse impact due to un-regulated storm water runoff from the main plant to the nearby natural drainage channels, surface water bodies, public and private properties. Following measures shall be undertaken as part of the Storm Water Management Plan:

- All cross drainage structures within the site shall be designed and constructed to handle maximum rainfall.
- The existing peripheral drains shall not be altered until the completion of construction of permanent plant boundary. This will prevent the silt contaminated surface run-off from site to enter into the adjoining lands.
- Storm water from all longitudinal and cross drainage works within the main plant shall be connected to a detention pond to be constructed within the main plant.
- No surface run-off from within the solar power plant site shall be directly discharged into any nallah/water body.
- Water from the storm water detention pond shall be reused for non-potable purposes
- Periodic cleaning of drainage shall be undertaken before monsoon set in to maintain uninterrupted storm water flow.

6.6 OCCUPATION HEALTH & SAFETY MANAGEMENT PLAN

The occupational health & safety (OHS) of the employee and contractual labours shall be maintained at the work sites during both construction and operation phase. The OHS Management measures shall comply with the Indian Regulatory requirements under OHSAS and the Factories Act. Since construction phase is almost completed this plan only deals with the OHS issues of operational phase of the Solar Power Plant.

Construction Phase

The following occupation health & safety measures shall be adopted during the construction phase:

- The workers shall be provided with proper personal protective equipment (PPEs) i.e. safety shoes & goggle, helmet, coverall, gloves, ear plugs etc. during construction related activities to ensure health and safety of the workers at workplace.
- Ensure provision and maintenance of drinking water and sanitation facilitation for construction workers in accordance to the provision of Contract Labour Act and Building & Other Construction Workers Act.
- Periodic cleaning of work areas shall be undertaken to ensure hygienic conditions at site.
- The workers shall stop working in extreme natural climatic conditions i.e. heat wave, heavy rain, flood, etc.
- All the work places shall have adequate fire alarm and fire fighting equipment to handle any fire incident.
- Adequate drinking water shall be supplied at workplace for the workers onsite and the water quality shall meet the drinking water quality standards.
- Sufficient light and ventilation shall be provided for the workers working in confined space.
- Periodic health check up camps for the workers onsite shall be organized to ensure prevention of occupational health hazards.
- All the work areas shall have first aid kits to manage any injuries occurring in the area.

Operational Phase

Although no significant occupational health and safety risks have been identified during operations however the following mitigation measures need to be adopted:

- The operating personnel are provided with adequate PPEs depending upon the nature of the operation and the occupation health & safety risks associated with it viz. electrical maintenance activities, replacement of solar panels etc
- Special emphasis will be laid on electrical safety and all employees shall be trained in respect of electrical safety & first aid
- Standard Operation Procedures (SOPs) shall be developed for operational activities likely to have potential occupational health and safety risks
- All enclosed spaces shall have adequate light and ventilation arrangements and potable water & sanitation facilities.
- Periodic medical examination will be undertaken for workers of the plant.
- Periodic inspections shall be carried out to ensure all the above are implemented and any non-conformances shall be recorded along with any grievance related to OHS issues.
- An EHS coordinator shall effectively implement and monitor the OHS Management System and ESMP.

6.7 ROAD SAFETY & TRAFFIC MANAGEMENT PLAN

The solar power plant will involve vehicular movements across the main plant site and the access roads, which may lead to impacts on existing road users and sensitive receptors located close to the site & approach road. This Road Safety & Traffic Management Plan identifies the potential impacts and their appropriate mitigation measures to avoid any unforeseen traffic accident and other disturbance to local communities during construction and operation phases of the project.

Traffic and Road Safety Measures during Construction Phase*:* The key issues addressed by TMP in terms of management measures include:

- The temporary access roads to construction sites shall be sprinkled with water for dust suppression to reduce emission of dust , if required
- Restrict use of horns when the vehicles ply with in village and habitat areas.
- Communicate to Local villagers on the peak vehicular movement.
- Proper warning signage shall be provided during movement of Heavy vehicles carrying equipment and machinery; all the vehicles entering the access road shall have Pollution under Control (PUC) certificates.
- The contractor shall comply with all statutory vehicle limits (width, height, loading, gross weight) and any other statutory requirements.
- Speed-arresters shall be provided to restrict the speed of the vehicle.

- Use of seat belts for both drivers and passengers shall be made compulsory to minimize death & injuries in the event of an accident.
- Periodic Road Safety campaigns and awareness sessions shall be carried out among the villagers and the site workers/personnel
- Regular inspection of the vehicles and the drivers shall be conducted to ensure minimum HSE risks.
- The site shall frame and implement a "No Tobacco No Alcohol" Policy to prevent road accidents/incidents.

***Traffic and Road Safety Measures during Operational Phase**:* The key issues addressed in terms of management measures include:

- All the permanent access roads to main plant site and the internal roads (within the plant) shall be black-topped with road dividers.
- Reduce the use of horns near the villages, main plant and internal roads.
- All the vehicles entering the access roads and plant shall have Pollution under Control (PUC) certificates.
- The speed limit in the internal roads shall be restricted to 20 km/hr.
- Proper warning signs and road safety awareness posters shall be displayed to create road safety awareness among the personnel accessing the solar power plant.
- Periodic Road Safety and Traffic Management campaigns and awareness sessions shall be carried out among the villagers and the plant workers/personnel to develop road safety awareness among the people likely to be impacted by the project.
- An emergency road safety plan shall be framed by the Proponent to combat any emergency conditions/accidents along the highways, access roads and within plant area.
- There must be "No Tobacco No Alcohol" Policy to prevent accidents/incidents.
- Use of seat belts for both drivers and passengers shall be made compulsory to all company travellers in cars and other vehicles.

6.8 WILD LIFE MANAGEMENT PLAN

Purpose

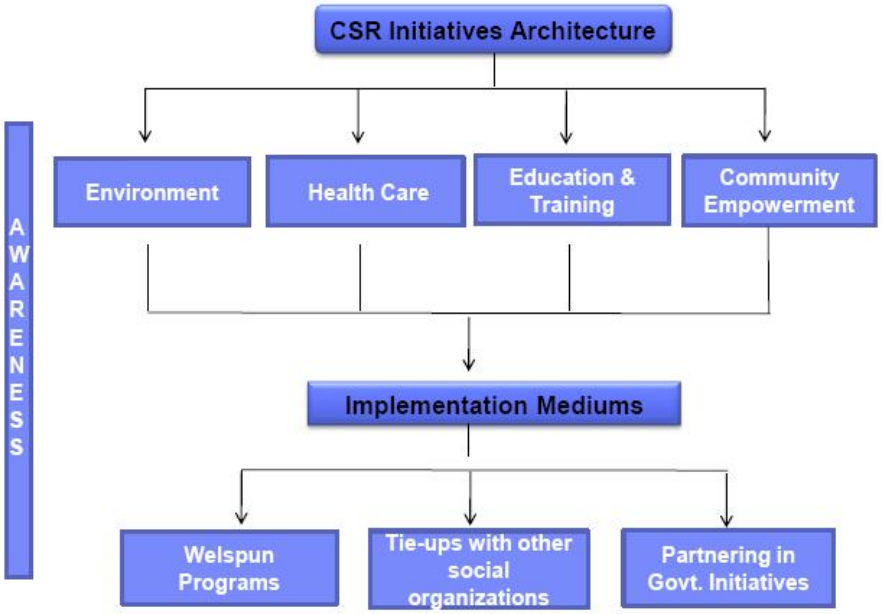
The purpose of Wildlife Management Plan is to minimize the impact on the faunal resources in the Rann Biosphere Reserve area which is located within 10 Km from the northern boundary of the proposed plant. This plan details out the measures and strategies to be adopted by MMSPL and the Contractors during each phase of the project, to reduce impact on wildlife, if any.

Suggested measures

- The project site will be properly fenced (chain-linked) during construction to avoid straying of any wildlife;
- Proper electric supply connection line from the grid will be laid for the proposed project activity. Noise Levels at the construction site will be controlled through selection of low noise generating equipment and noisy work will be avoided during night time. Movement of the heavy vehicles will be restricted in the night time especially near to sanctuary area. Construction labor camps at site shall be avoided so that procurement of fuel wood and other resources from little Rann of kutch by workers during construction phase can be prevented.
- Care would be taken while disposal of construction and other wastes.
- Any animal if trapped during site development or operation of would be released into its original habitat;
- Seek a Veterinary Doctor's help in case of any emergency.
- All sightings of wildlife in and around the project site must be reported and adequate steps will be taken with the help of forest personnel to reduce man animal conflict Signage would be provided in areas of wildlife sightings and crossings along the defined vehicular movement route
- The EHS Coordinator will hold training program for all the MMSPL project personnel and contractors on the applicable practice and mitigation measures outlined in this plan.

6.9 SOCIAL ENVIRONMENT MANAGEMENT PLAN

The solar power project has positive socio-economic impact in its each stage right from hiring the unskilled labour during site preparation activities. The project has generated local employment of around 50 temporary jobs during construction and will also generate 5-10 unskilled jobs during the operation. MMSPL has been actively engaged in CSR activities in Gujarat. This project area will also be covered in future programs. The CSR activities are being undertaken by MMSPL in collaboration with local administration, gram panchayat, block development office etc. The CSR activity revolves around EEE (Environment, Education & Empowerment) as provided below. Keeping in view of the above and based on outcome of the public consultations MMSPL need to develop and implement a targeted "*Community Development Plan & CSR Program*" in continued engagement with the Fatepur Panchayat and village communities.



6.10 DECOMMISSIONING PLAN

Although no potential significant impacts have been identified as part of the decommissioning activities to be undertaken at the end of the project life cycle adequate environmental safeguards need to be adopted by the project proponent and the contractor to mitigate any short term impact that may arise from such activities. This includes:

- Recycling of solar panels, inverters and related electrical equipment to be carried out in accordance to the provision of E-Waste Management & Handling Rules 2011.
- Recycling of used batteries to be carried out in accordance to the provision of Battery Waste Management & Handling Rules 2001.
- Vehicles deployed by contractors need to have valid PUC and subjected to periodic preventive maintenance.
- Possible options for reuse/disposal of demolition waste/debris generated from decommissioning need to be assessed and evaluated in consultation with the local communities.
- Adequate care need to be taken during decommissioning of septic tank-soak pit system to prevent any ground water contamination and generation of unpleasant odour..
- Heavy equipments to be deployed for decommissioning of civil structures need to be equipped with acoustic controls.

6.11 ENVIRONMENTAL MONITORING PLAN

The Environmental Monitoring Plan has been formulated to ensure and demonstrate compliance with the Regulatory and Institutional Agency's EHS requirements. The monitoring of Environmental and Social parameters and compare the same against the benchmark as set by the Regulatory & Institutional Bodies will help MMSPL assessing the Environmental Performance and identify any gaps or non-conformance for taking immediate actions. The following environmental parameters shall be monitored continuously during project operational phase for compliance. The same has been provided in **Table 6.2.**

TABLE 6-2: ENVIRONMENT MONITORING PLAN

Activity	Parameter	Frequency	Roles & Responsibility	Location
Ambient Air Quality Monitoring (if applicable as per consent conditions)	SOx, NOx, PM_{10}, $PM_{2.5}$, CO	As and when required during operations as specified in the consent condition	MMSPL through an external monitoring agency	Project site and near Fatepur village
Ambient Noise Quality	Measurement of Noise Pressure Level in dB(A)	As and when required during operations as specified in the consent condition	MMSPL through an external monitoring agency	Project site and near Fatepur Village
Ground Water Quality Monitoring	IS 10500 Parameter	As and when required during operations as specified in the consent condition	MMSPL through an external monitoring agency	Plant is not consuming any ground water for plant activity. However ground water from the village hand pump will be monitored (if required)
Storm Water Quality	CPCB General Discharge Standards	Prior to discharge (if any) to natural drainage channels or reuse in green belt development	MMSPL through an external monitoring agency	Drainage discharge outlets/ Retention structures

The company should designate Head – Plant supported by EHS coordinator, as in charge for implementation of the Social & Environment Management and Monitoring Plans. The responsibilities are as follows:

- Implement the Social and Environmental Management Plan
- Conducting and coordinate meetings as required with local communities
- Conduct and facilitate EHS awareness and management trainings to the project and operations teams
- Liaison with the Gujarat State Pollution Control Board for obtaining and/or renewing consent with the support of corporate EHS
- Facilitate external reporting to the Fund at periodic interval as required