Environment and Social Due Diligence Report

February 2016

IND: Accelerating Infrastructure Investment Facility in India
–Uttar Urja Projects 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: 76 MW Wind farm at District Ratlam & Mandsaur in Madhya Pradesh, India

India Infrastructure Finance Company Limited

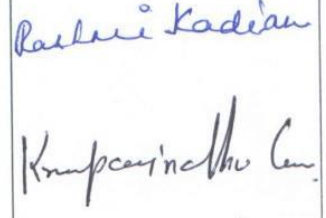
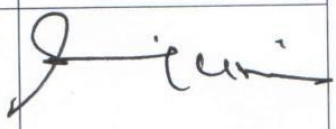
February 2016

ESDDR NO.IIFCL/ESMU/ADB/2016/79-V3

SUB PROJECT: Construction, operation and maintenance of 76 MW Wind Power Project at Ratlam & Mandsaur in Madhya Pradesh, India.

Uttar Urja Projects Private Limited

Environmental and Social Safeguards Due Diligence Report (ESDDR)

Prepared by:	**Dr. Rashmi Kadian** Assistant General Manager (Environment Specialist) ESMU, IIFCL **Mr. Krupsindhu Guru** Assistant General Manager (Social Specialist) ESMU, IIFCL	
Reveiwed by:	**Dr. S.S. Garg** General Manager ESMU, IIFCL	
Approved by:	**Mr. Sanjeev Ghai** Chief General Manager IIFCL	

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PHOTOPLATE

PROJECT BACKGROUND

1. PURPOSE OF THE REPORT:

1. This Environmental and Social Due Diligence Report (ESDDR) has been carried out by India Infrastructure Finance Company Limited (IIFCL) in consultation with the developer, Uttar Urja Projects Private Limited (UUPPL) to assess the adequacy of the project with the applicable national safeguard compliance. The report has been prepared as per the documents/information received from the developer and on the basis of site visit observations. In order to be eligible for funding from the ADB, IIFCL has prepared the Environmental and Social Due Diligence Report (ESDDR) for the sub-project on behalf of UUPPL.

2. SUB-PROJECT TITLE:

2. The sub-project includes construction, operation and maintenance of 76 MW Wind Power project in the Districts Ratlam and Mandsaur of Madhya Pradesh, India.

3. SUB-PROJECT BACKGROUND:

3. Uttar Urja Projects Private Limited (UUPPL) is a wholly owned project company of Continuum Wind Energy Private Limited (CWEPL). CWEPL is setting up a total of 170 MW wind power generation under two Special Purpose Vehicle (SPVs), viz., UUPL (76 MW) and DJ Energy Private Limited (DJEPL) (94 MW) at Ratlam and Mandsaur Districts in the state of Madhya Pradesh, India.

4. SUB-PROJECT LOCATION:

4. The project site of 76 MW wind power project is located in Piploda and Daloada Tehsil of Ratlam and Mandsaur Districts in Madhya Pradesh. Geographically, project site is situated between 23° 64' 18" N & 23° 87' 20" N latitude and 74° 99' 12" E & 75° 09' 89" E longitude. The project site in Ratlam and Mandsaur Districts is surrounded by Rajasthan State in west and north direction. The nearest town of the project site is Jaora in Ratlam district. Sub-project location and accessibility map is presented in Figure 1. The project site is accessible through village roads and National Highway (NH-79). The nearest major railway station is Jaora. The nearest airport is at Indore about 200 km from the sub-project site.

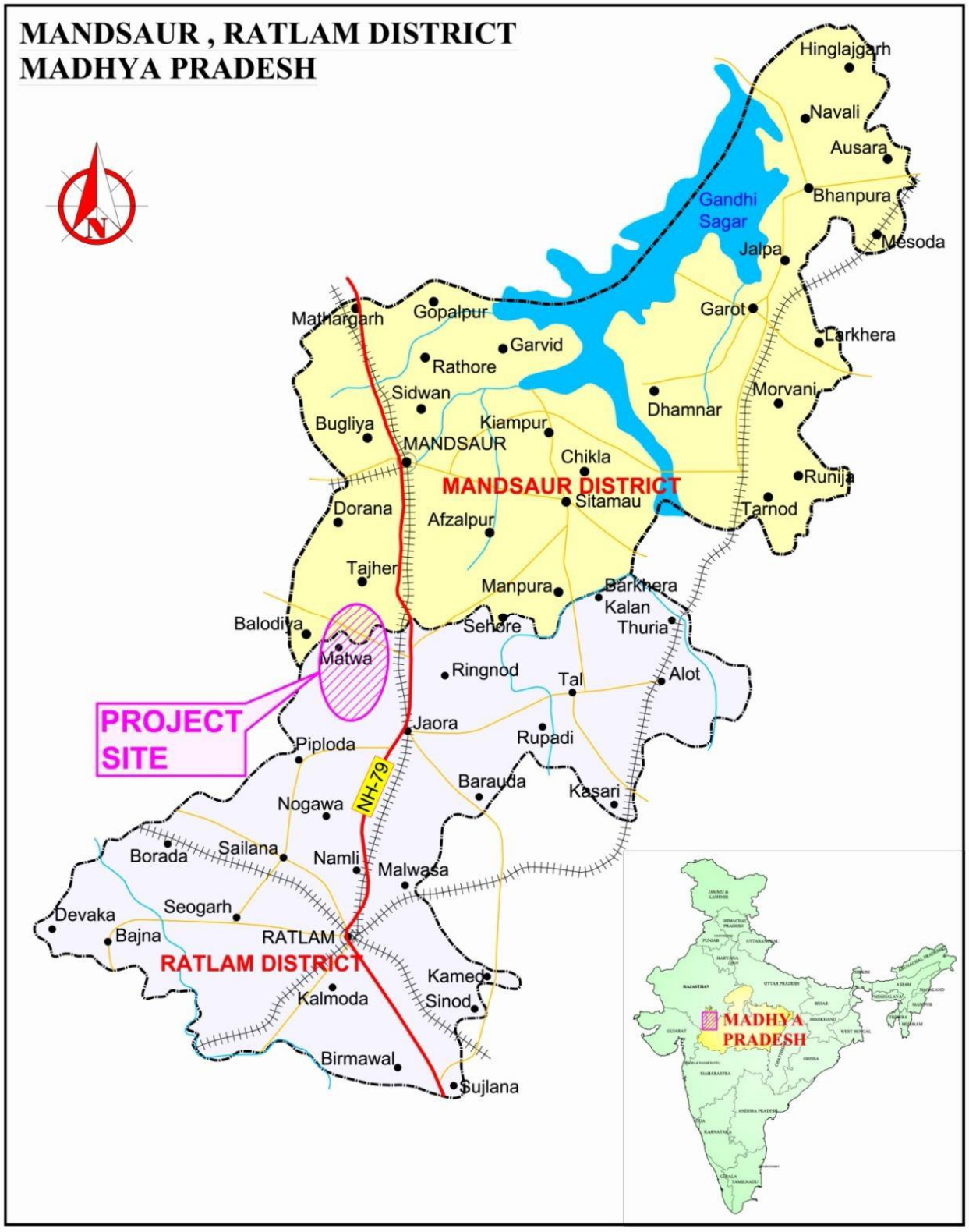


Figure 1: Project Location on District Map

5. SUB-PROJECT TECHNICAL DETAILS:

7. The Project is located over 65.12 hectare revenue land allotted by Madhya Pradesh New and Renewable Energy Department (MPNRED) for a period of 25 years. The Project has been allocated land for WTG locations, 33 kV transmission line and roads.

Table 1: Project Description in Brief

Sub-Project Developer	Uttar Urja Projects Private Limited
Project Site	Taluka: Piploda and Dalauda District: Ratlam and Mandsaur
Project Coordinates	Latitude : 23° 64' 18" N & 23° 87' 20" N Longitude : 74° 99' 12" E & 75° 09' 89" E
Project Capacity	76 MW
Number of WTGs	38
Capacity of each turbine	2 MW each
Model of wind turbine	INOX WT2000DF100
Rotor Diameter	100 m
Hub height	92 m
Total Cost of Project	₹ 527.40 crores
Project Operational Date	25th December 2015
Sensitive area	The sub-project is not located in vicinity of any protected area or ecologically sensitive area
Type of land	Government Revenue land
Nature of land	Barren Government Land
Forest Land Involved	No Forest land involved
Power Purchase Agreement	Madhya Pradesh Power Management Company Limited
Expected generation	181.75 Million Units per annum
Tariff for purchase of power	₹ 5.92 per kWh

6. WIND RESOURCE ASSESSMENT:

8. Wind resource assessment study has been conducted for UUPPL by 3TIER. The wind resource assessment yields a gross capacity factor of 35.7%. Loss factors were considered, leading to a net capacity factor estimate of 29.4%.

7. MAJOR COMPONENTS:

9. **WTGs**: M/s UUPPL has used WTGs of Inox make (Model Inox WT2000DF100) for the project. Inox 2000 DF with 100 m rotor diameter and hub height of 92 m is an evolutionary design. Each WTG has a rated capacity of 2 MW. This has tubular tower with three numbers of blades.

10. **Transformer**: WTG generates power at 690 Volts, hence individual step up transformer of appropriate capacity has been set up with each WTG to step up voltage up to 33 kV.

11. **Internal Transmission lines of 33 kV:** 33 kV lines radiate from different WTGs locations up to the 220 kV sub-station at Village Bhatkhera to further step up from 33 kV to 220 kV.

8. POWER EVACUATION ARRANGEMENT:

12. For power evacuation arrangement, a separate 33/220 kV sub station near the site at Bathkhera village has been built which joins the existing 220/132/33 kV substation at Dalauda through 19.87 kms by 220 kV Double Circuit transmission line. All the permissions for sub-station and 220 kV Transmission Line is in the name of DJEPL, another SPV of CWEPL at the same location. NOC has been given by Madhya Pradesh Power Transmission Company Limited (enclosed as **Appendix I**) to UUPPL for use of 220 kV transmission line and substation at Bhatkhera.

13. The Project has a dedicated power evacuation system and approvals to evacuate power via 19.87 km long 220 kV transmission line to MPPTCL substation at Dalouda, District Mandsaur, Madhya Pradesh. The brief details of evacuation arrangement are as below:
    - 220/33 kV substation with 2 nos. of 100 MVA transformer established at Bhatkhedka, District Ratlam, Madhya Pradesh at the land parcel allotted by MPNRED for DJEPL.
    - 33 kV lines radiate from different WTGs locations up to the 220 kV Project Substation to further step up from 33 kV to 220 kV.
    - From 220 kV Project Substation a dedicated 220 kV double circuit line has been laid up to MPPTCL's Dalouda Substation. There are 62 towers in this line.

14. The contract for the external transmission line was allotted to M/s Kailash Dev Build (India) Pvt. Ltd and construction commenced in September 2013. The transmission line work was completed in May 2015.

9. CONCESSIONAIRE:

15. Uttar Urja Projects Private Limited (UUPPL) is a Special Purpose Vehicle (SPV) established for the development of 76 MW Greenfield wind power Project at Ratlam and Mandsaur Districts in Madhya Pradesh.

16. Madhya Pradesh Power Management Company Limited (MPPMCL) has signed a Power Purchase Agreement (PPA) with M/s UUPPL on 6th August, 2014 for a period of 25 years from the date of commissioning. The PPA specifies sale of power generated to Government of Madhya Pradesh at a fixed tariff of ₹ 5.92 per KWh.

10. E&C CONTRACT:

17. The Project is being developed on a self-development model. UUPPL has entered into a contract with INOX Wind Infrastructure Services Ltd. for the supply of wind turbine generators, erection & commissioning and WTG operation & maintenance. Responsibility for remaining project development activities remains with UUPPL including wind data collection, project approvals, internal roads, WTG foundations, evacuation infrastructure, transmission lines and other civil works.

11. IIFCL FUNDING:

18. The total project cost of UUPPL is ₹ 527.40 crores. The project is financed by IIFCL under Direct Finance Scheme. IIFCL has sanctioned an amount of ₹ 107 crore towards UUPPL and has disbursed ₹ 95 crores in June 2015.

12. STATUS OF PROJECT IMPLEMENTATION:

19. The sub-project has been commissioned on 25th December 2015.

DUE DILIGENCE ON ENVIRONMENTAL SAFEGUARDS

13. ENVIRONMENT SAFEGUARDS COMPLIANCE REVIEW:

20. Continuum Wind Energy Private Limited (CWEPL) is setting up a total of 170 MW wind power generation under two Special Purpose Vehicles (SPVs), DJ Energy Private Limited (DJEPL) and Uttar Urja Projects Private Limited (UUPPL) at Ratlam and Mandsaur Districts in the state of Madhya Pradesh, India.

21. UUPPL is the project company owned by CWEPL having a capacity of 76 MW. There are total 38 WTGs having 2 MW capacity each.

22. The Project is located over the Revenue Land allotted by Madhya Pradesh New and Renewable Energy Department (MPNRED) for a period of 25 years.

14. APPLICABILITY OF ENVIRONMENTAL IMPACT ASSESSMENT NOTIFICATION

23. It is required that the project meets the applicable national guidelines / regulations relating to the environment, occupational health and safety and social issues. The project should have necessary clearances as well as permits and approvals for project implementation and suitable environmental management plans.

24. Wind Power Projects are not covered under the ambit of Environmental Impact Assessment Notification, 2006 of Government of India and no environment clearance is required for such projects under the provisions thereof. Wind Projects do not require conducting an Environmental & Social Impact Assessment (ESIA) as a statutory requirement.

25. An ESIA study for UUPPL and DJEPL was conducted with an objective to understand the project activities followed by identifying environmental and social risks associated with the project. Based on the findings the mitigation measures have been derived. The ESIA report is enclosed as **Appendix II.**

15. APPROACH TO THE ENVIRONMENT SAFEGUARDS DUE DILIGENCE REPORT:

26. The Environmental Due Diligence Report reviews the available documents and assesses the compliance of the sub-project with the respect to environmental safeguards, regulatory clearances, environmental impacts and management measures, Health, Safety and Environment (HSE) measures, public consultations & information disclosure.

27. The following documents were referred in order to prepare Environmental Safeguards Due-Diligence Report:
    - Project Information Memorandum (PIM)
    - Detailed Project Report

- Power Purchase Agreement
- Lender's Independent Engineer Reports
- Project Statutory Approvals/Permits
- Project HSE Documents
- Labour License
- Contract Documents

28. The environmental safeguard due-diligence study was carried out for the sub-project 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 team of the sub-project at site.

16. POLICY, LEGAL AND REGULATORY REQUIREMENT:

29. Wind power projects are not listed in Schedule I of the EIA Notification, 2006 that lists projects or activities requiring prior environmental clearance and hence these are exempt from obtaining Environmental Clearance.

30. As per the categorization of industries by the Central Pollution Control Board and its Office Memorandum to all State Pollution Control Boards, wind power generation comes under green category of industry.

31. UUPPL is required to comply with the applicable guidelines relating to the environment, occupational health and safety in addition to complying with local laws and regulations. The statutory clearances related to environmental aspects obtained/to be obtained from regulatory authorities as part of the UUPPL development were assessed and current status of availability of such clearances are given in **Table 2** below:

Table 2: Status of Regulatory Clearances Obtained related to Environmental Safeguards

S.No.	Clearances	Statutory Authority	Current Status of Clearance
1.	Environmental Clearance	Ministry of Environment, Forests & Climate Change (MoEF&CC), New Delhi	Not Applicable. As Wind Power project development is not listed in Schedule I of the MoEF&CC's EIA Notification 2006, that lists projects or activities requiring prior environmental clearance and hence this is exempted from obtaining the same. However, an EIA study has been done for UUPPL.

2.	Forest Clearance	MoEF&CC and State Forest Department	The sub-project does not involve any forest land.
3.	Wildlife Clearance	MoEF&CC	The Project area does not lie within an Ecologically Sensitive Area and is not located within 10 km of any National Park/Wildlife Sanctuary. The location of Project does not contravene any international biodiversity or ecosystem conservation conventions. Therefore, it does not require wildlife clearance or permission.
4.	Consent to Establish	Madhya Pradesh Pollution Control Board (MPPCB), Madhya Pradesh State	Consent to Establish under Water Act, 1974 and Air Act, 1981 was obtained from Madhya Pradesh Pollution Control Board during construction phase (**Appendix III**).
5.	Consent to Operate	Madhya Pradesh Pollution Control Board, Madhya Pradesh State	Consent to Operate under Water Act, 1974 and Air Act, 1981 and Hazardous Waste (Management, Handling & Transportation) Rules, 2008 has been obtained from Madhya Pradesh Pollution Control Board for operation phase on 10.12.2015 (**Appendix IV**).
6.	Land use related permission	Madhya Pradesh State Government	The project is being implemented on revenue land allotted to it. The Commissioner, New and Renewable Energy Department, Bhopal, Government of Madhya Pradesh has allotted 65.12 ha revenue land to UUPPL for implementation of wind power project vide letter dated 22.7.2013 (**Appendix V)**.
7.	The Contract Labor (Regulation and Abolition) Rules, 1970	Licensing Officer & Assistant Commissioner of Labour, Govt. of India	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 establishment is registered under the provisions of the Contract Labour (Regulation and Abolition) Act, 1970 and labour license has been obtained for the project under the

			said Act and is enclosed as **Appendix VI**.
8.	Civil Aviation Clearance	Airport Authority of India	The sub-project is located at a distance of more than 200 km from nearest airport at Indore, therefore "No Objection Certificate" is not required for the same.
9.	Permissions for Transmission Lines	Power Telecommunication Coordination Committee (PTCC), Government of India	Divisional Engineer Telecom (PTCC) accorded route approval for 220 kV Double Circuit Transmission Line from 220 kV Dalauda sub-station to 220/33 kV sub-station of DJEPL vide letter dated 24.7.2014 (**Appendix VII**). Profile approval for the 220 kV line with 62 towers was accorded by Madhya Pradesh Power Transmission Company Limited vide letter dated 4.1.2014 (**Appendix VIII**).

17. PUBLIC CONSULTATION & INFORMATION DISCLOSURE:

32. A Project Information Booklet attached as **Appendix- XVIII**, was prepared and distributed to the project affected villages and explained in local language to make the local people aware about the project coming up in the area.

33. The project was discussed with Gram Panchayat and NOC was also obtained for setting up of UUPPL. Copy one such NOC is enclosed as **Appendix IX**.

34. The sub-project developer displayed the ESIA report of the project at the Gram Panchayat Village Bhatkhera (where the sub-station is located) for a week and apprised the local people about the project. The Project development Officer of UUPPL was all the time present there to answer the queries of local people.

35. The Gazette Notification regarding 220 kV line from sub-station at Village Bhatkhera to Dalauda sub-station was published on 11th November 2011 (**Appendix X**).

36. A public notice was given in vernacular language in the newspaper Dainik Avantika, Ujjain edition on 16th April 2015 before charging of 220 kV transmission line from sub-station Bhatkhera to sub-station Dalauda (**Appendix XI**).

18. IMPLEMENTATION OF ENVIRONMENTAL MANAGEMENT PLANS:

37. The status of various EMPs is elaborated in the subsequent sections on the basis of information received from the developer and site visit.

38. **Pollution Prevention and Abatement Plan:** The vehicles at the site are checked for valid Pollution under Control Certificate (PUC). The developer has informed that water sprinkling was done during construction phase on regular basis for controlling fugitive emissions.

39. **Solid Waste Management:** Solid waste generated onsite was stored in the storage facility near the sub-station. It was informed that the collected and stored waste will be sent for recycling and disposal to appropriate facilities. The pit excavation for WTG erection was 16.5 m in diameter and 3 m deep. The excavated soil was used in backfilling.

40. **Liquid Waste Management:** The liquid wastes likely to be generated during the operational phase include domestic waste water generated from toilets/urinals within the site. Septic tank / soak pit system has already been constructed at the sub-station. The project office is located at Jaora, the nearest town about 20 km from the project site, in a rented accommodation. Currently there are no labour camps at site since the construction work is over. Portable toilets are being provided for security staff to be deployed at the project during operation phase.

41. **Storm Water Management Plan:** All the roads constructed in the project area are unpaved roads. Temporary storm water drains are constructed at appropriate locations. Rainwater harvesting pit has been constructed at the sub-station.

42. **Occupational Health & Safety Management Plan:** Safety at site is being given utmost importance for UUPPL staff as well as Contractor's staff. The details on health and safety are given in Section 19.

43. **Road Safety & Traffic Management Plan:** Road safety will be managed during operation phase of the project.

44. **Emergency Preparedness Plan:** UUPPL has developed emergency preparedness plan for implementation at the site in the event of an emergency situation so that the loss of life and damage to the properties & natural resources is minimized. The plan is a part of the Safety Manual of UUPPL. Regular trainings for staff are conducted for the same. This plan includes preparation to tackle civil unrest & terrorism, fire emergency, natural disaster, emergency preparedness plan, personal accident & emergency preparedness plan and emergency evacuation plan. The telephone numbers to be contacted in case of emergency are displayed at appropriate locations at the sub-project sites.

45. **Environmental Monitoring Plan:** The sub-project staff during discussions informed that noise monitoring system will be established during operation phase. Noise monitoring will be done at approximately 10 representative locations twice a month.

19. HEALTH AND SAFETY:

46. UUPPL has its own Safety Manual which is enclosed as **Appendix XII.** The manual defines clear procedures for wind farm safety and emergency preparedness plan.

47. UUPPL follows the Safety Manual and conducts safety training programmes as defined in the procedures. Records for the following are maintained at the sub-project site:

    (i) Safety Prayer & Tool Box Talk (TBT)
    (ii) Total Man Power, Safe Man Hours & Safe Day Worked
    (iii) Site Safety Committee Meeting MOM Points
    (iv) Labor Camp inspection
    (v) Unsafe act Before & After – Implement
    (vi) Accident Free Days
    (vii) Near Miss Incident Status
    (viii) Fire Incident Status
    (ix) Accident Status
    (x) Work Permit Issue Status
    (xi) Fire, Safety Induction Training Status
    (xii) Fire Extinguisher Inspection Status
    (xiii) First Aid Box Inspection Status
    (xiv) Vehicle Inspection/Accident Status

48. The Clause 10 of the Erection & Commissioning (E&C) contract between UUPPL and Inox Wind Infrastructure Services Limited deals with the Health, Safety and Environmental Requirements. The copy of the E&C Contract is enclosed as **Appendix XIII.**

49. Inox Wind Infrastructure Services Limited has its own Health Safety & Environment Manual which is enclosed as **Appendix XIV.** Developer has informed that the manual has been followed in full spirit.

50. First aid boxes and fire fighting systems are maintained at WTGs and sub-station.

51. Saint John's Ambulance service is always available at the site.

52. Engineers are certified for 3 years for first aid training by Red Cross Society.

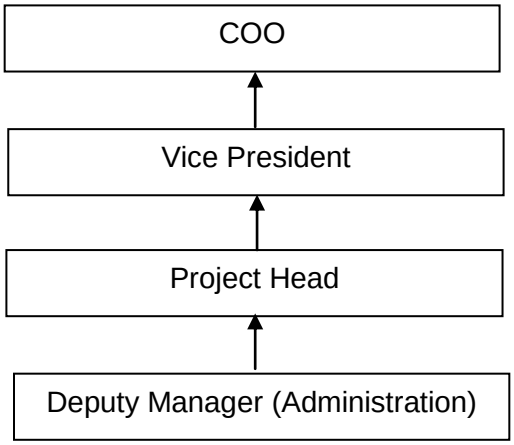
53. There are three Safety Officers available at the site, one Manager (Safety) and two Officers (Safety).

20. INSTITUTIONAL FRAMEWORK & GRIEVANCE REDRESSAL

54. The Head of Project is responsible for the following:

- Ensuring availability of resources and appropriate institutional arrangements for implementation health & safety;
- Compliance of legislative requirements and contractual terms; and communication with the regulatory agencies;
- Overall implementation of the health & safety by contractors, sub-contractors, workforce deputed at the project;
- Conduct audits and inspection of all the project activities;
- Preparation of necessary documents and record keeping system.

55. The organizational structure in place for handling grievances is as follows:



56. Record of any grievance or demand received from locals is maintained at the site office.

21. ENVIRONMENTAL SENSITIVITY:

57. The environmental sensitivity of UUPPL has been assessed by reviewing various documents, supplemented by field visit and consultation with the developer.

58. The environmental sensitivity assessment is given below:

- The land available for the sub-project is revenue waste land. The land was allotted to the sub-project by Government of Madhya Pradesh.
- The sub-project sites are not located in any protected area like wildlife sanctuary / national park or in close proximity of any eco-sensitive area.

- During site visit and as per discussions with the sub-project staff, it was informed that no wild animals are sighted in and around the sub-project area.
- No forest area is getting affected due to the sub-project.
- The developer has informed and confirmed that no tree has been cut for the sub-project and transmission lines.
- As informed by the concessionaire, no important cultural or heritage sites are getting affected due to the sub-project.
- The sub-project has the necessary approvals and permits from regulatory authorities.
- The sub-project has taken Consent to Establish and Operate from the Madhya Pradesh Pollution Control Board.
- The impacts of the sub-project are temporary in nature.

22. PROJECT AGAINST THE PROHIBITED INVESTMENT ACTIVITIES LIST:

59. The sub - project does not involve any prohibited activity as per the Prohibited Investment Activities List (PIAL) of ADB.

23. CATEGORIZATION OF SUB-PROJECT:

60. The sub-project can be classified as category B based upon ADB's EA requirements as per their Safeguard Policy Statement (2009). This classification is based on the review of the available documents and site visit with respect to the environmental sensitivity due to project activities.

24. SITE VISIT OBSERVATIONS:

61. A site visit was undertaken by IIFCL's Environmental and Social Safeguard Specialists on 11th December 2015. The site visit was undertaken to review the implementation of the project's environmental and social safeguards. The sub-project at the time of site visit was in the last phase of construction. During the site visit, following staff were mainly consulted regarding environmental safeguards related measures implemented at the project site:

    (a) Mr. Rakesh Vishwakarma, Senior Manager – Projects (Project Head), DJEPL & UUPPL, Continuum Windfarm Development Private Limited
    (b) Mr. Sachin Bhambre, Civil Head
    (c) Mr. Pramodh Singh, Deputy Manager (Administration)
    (d) Mr. Wasim Siddiqui, Assistant Manager (Power Evacuation)

(e) Mr. Saurabh Vyas, Safety In-Charge

62. The sub-project was in the last phase of construction at the time of site visit and has been commissioned on 25th December 2015. Based on the discussions with above mentioned officials and visit, the site observations are given below:

- The area is generally devoid of vegetation and trees.
- The area has agricultural fields in the vicinity.
- Crop compensation has been paid wherever private land has been used for ROW for transmission lines.
- No tree has been cut at the project site and in the ROW of transmission line.
- All sewage water being generated at the sub-project premises is disposed in septic tanks/soak pits.
- It was informed by the developer during site visit that no groundwater is being utilized at site. Water requirement for various activities is being taken care by the private tankers.
- It was observed during the site visit, the single poles for 33 kV transmission line have temporary impacts and the impacts on vegetation are minimal.
- Safety engineers were present at the site and understood their commitments.
- On discussions with the site staff, it was observed that tool box talk is done for labour as well as staff.
- Safety induction training was done for workers as well as staff.
- Monthly safety reports are generated at the site.
- Mock drills on fire safety are conducted regularly.
- Vehicle movement in the premises was very limited.
- No oil spillage was observed at the site.
- The permits and NOCs required for the project are in place.
- Portable toilets are being provided for security staff to be deployed at the project during operation phase.
- UUPPL has its own Safety Manual. The concessionaire has undertaken the implementation of safety management system by adopting safety policy for the sub-project.
- Developer has informed that SF_6, a potential greenhouse gas, has not been used in the 33 kV transmission line as insulator or in circuit break.

- Developer informed that 15-20 workforce is currently available at the site, who are residing in rented accommodations.
- Currently there are no labour camps at the site as construction was almost complete.
- The sub-project staff is staying in rented accommodation at Jaora town about 20 km from sub-project site.
- Fire extinguishers and first aid kits are available at all WTGs and sub-station.
- Transformer explosion prevention and fire extinguishing system is at place at the sub-station.
- Emergency contact numbers have been displayed at appropriate locations.
- The workers and staff at the site were seen wearing personal protective equipment such as helmets, jackets, boots, gloves etc.
- Records of safety trainings, mock drills and various inspections/audits are maintained at site office.
- The sub-project has a proper grievance handling mechanism and records are maintained at site.
- Good housekeeping was maintained at the site.

63. The site visit photographs are given in **Photoplate - I.**

25. CONCLUSIONS AND RECOMMENDATIONS:

64. It is concluded from the above environmental examination that the proposed UUPPL, 76 MW wind power project in the Districts Mandsaur and Ratlam of Madhya Pradesh is 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-project. However, the sub-project activities have reversible environmental impacts which have been managed.

65. 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-project has been planned as per the National and State Government requirement and not in anticipation to ADB operation.
- The sub-project has achieved Commercial Operation on 25th December 2015.
- The project site is not located in an ecologically sensitive area.

- The land for the project development has been allotted to the developer by Madhya Pradesh State Government.
- The project does not involve diversion of forest land.
- Developer has informed that no vegetation clearing was required for the sub-project, as the revenue land allotted for the project is generally devoid of vegetation and utmost care has been taken by the developer to avoid cutting of trees.
- The sub-project has 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.
- The sub-project 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 appears to be adequate.
- The main impacts were on land environment, water resources and waste management. However, most of the associated impacts were limited to the extent of construction phase and are temporary in nature. The EMPs are undertaken to minimize any significant negative impact.
- During site visit and discussion with the project developer, the implementation of EMP was found to be adequate.
- This nature of the project site coupled with the clean nature of wind power generation ensures that the Project will not cause any significant adverse environmental impacts during construction and operation. The same is evident from the site visit.
- After approval from the Bank the ESDDR will be uploaded for public disclosure.

66. Based on the site visit and due diligence findings, it can be deduced that the sub-project has no significant environmental safeguard issues. The sub-project, therefore, does not appear to involve any kind of reputational risk to ADB funding on environmental safeguards.

DUE DILIGENCE ON SOCIAL SAFEGUARDS

26. OBJECTIVE OF SOCIAL SAFEGUARDS DUE DILIGENCE:

67. Social Safeguards due diligence study is carried out to assess the social monitoring compliance status of the project as per the applicable National policies/procedures as observed during the site visit as well as the information received. The main objective of this Social Safeguard Due Diligence Report (SSDDR) is,

- To assess the likely social impacts and its minimization/mitigation majors adopted of the project with respect to land acquisition, compensation and involuntary resettlement, common properties, if any, in terms of displacement, loss of incomes, and community links:

- To ascertain, in case of any adverse impact, if appropriate mitigation measures have been taken during the project planning, designing and frameworks established for carrying out safeguard measures during the implementation stage to minimize and mitigate if any adverse impacts;

27. APPROACH AND METHODOLOGY:

68. The Social safeguard due diligence study for Uttar Urja Projects Pvt. Ltd. (UUPL) has been carried out after reviewing the documents made available by the Concessionaire. On site visit to the project location by Environmental and Social Safeguards Specialist, discussion with the project developer UUPL and various permits and approvals relating to the project to understand the salient features of the project and social concerns. The following documents/Reports/Licenses/permits and notifications were referred in order to prepare the Social Safeguard Due Diligence Report:

- Environmental and Social Impact Assessment (ESIA)

- Information Memorandum (IM);

- Detail Project Report (DPR);

- Lenders Independents Engineers Report (LIE) (May 2015);

- Gazette Notification;

28. INFORMATION DISCLOSURE

69. Gazette Notifications, regarding 220 kV line from sub-station at Village Bhatkhera to Dalauda sub-station which was published dated 11th of November 2011, this substation comes under the

DJ Energy Private Limited (DJEPL) and not in the scope of UUPL, The Gazette notification regarding the sub-station has given in the **Appendix- X**. Further, a public notification for the transmission line have also been disclosed for the local people which were published in the Vernacular language in the regional daily in Hindi language newspaper "Dainik Avantika", Ujjain edition on 16th April 2015 before charging of 220 kV transmission line from sus-station Bhatkhera to sub-station Dalauda, the details of the public notice has given in the **Appendix-XI**.

29. PUBLIC CONSULTATION & STAKEHOLDERS ENGAGEMENT:

70. UUPL has invited stakeholders in the project region to explain about the proposed project activity and benefits associated with the project. Project authority has discussed with the Gram Panchayats and NoC was also obtained for setting up of the UUPL. Consultations were held at the villages and Panchayat level, one of the sample copy regarding the NoC received from Sarsod village given in the **Appendix-IX.** The stakeholders identified for the project activity were villagers, Local Gram Panchayat Sarpanchs, Employees of UUPL. During the discussion, it was explained to them that no major social impacts is expected from the operation of the project activity and the project is planned over a total area of 65.12 hectares that has been allotted by the state government specifically for this project. The details of the stakeholder's consultation were given in the stakeholder engagement programme attached as **Appendix-XV.**

30. LAND ACQUISITION IN THE SUB-PROJECT AND COMPENSATION FOR THE LOSS OF ASSETS:

71. UUPL wind farm is located mainly over the Revenue Land granted by the Government of Madhya Pradesh allotted by Madhya Pradesh New and Renewable Energy Department (MPNRED) for a period of 25 years. All the 38 WTG have been erected on uninhabited land measuring 65.12 Ha. of land falls under the villages of Jalineer, Jathana, Panchaba, Bagia, Richadbeda, Khedana, Bakhedi, Pingrala, Kachanara, Sarosad, Chandakhedi, Kalukhedi, Mabata and Mamatkheda. The detail of land use permission is given in the **Appendix- V.** There is no forest land.

72. Individual Land Owner- The transmission line and substation comes under another project being implemented by the DJ Energy Private Limited (DJEPL) and not in the scope of Uttar Urja Project Pvt. Ltd. (UUPL). requires small patches of private land for ROW at some places. Owners of these land parcels has been identified through the help of district administration and one to one mutual negotiation between the company and the land owners for compensation of use of ROW and smooth project operation. After mutual agreement the compensation has been paid to the land owners for use of Right of Way (RoW). However, it was also needs to be noted that these developed land parcels is being used by the local communities for their use in post installation phase.

73. UUPPL involves 38 numbers of WTGs, however 220 Kv transmission line from substation at Bhatkheda to substation at Dalauda comes under the scope of DJEPL for which NoC has been granted for use by UUPPL (attached as Appendix-I)

74. During the discussion with the subproject developer it was told that the WTG locations were identified in such a way that the impact upon the private owners has been avoided and all the locations towers were installed in government land.

31. IMPACT ON STRUCTURES

75. The Project is being constructed on revenue land (allocated by the government of Madhya Pradesh). No physical or economic displacement is expected/envisaged due to the Project. The access roads constructed for the sub-project are also being used by the local communities for their use in post installation phase.

32. IMPACT ON SCHEDULE TRIBE PEOPLE:

76. The 38 WTG locations have been erected on the government land and thus, do not have any impact on indigenous people.

33. IMPACT ON RELIGIOUS PROPERTIES:

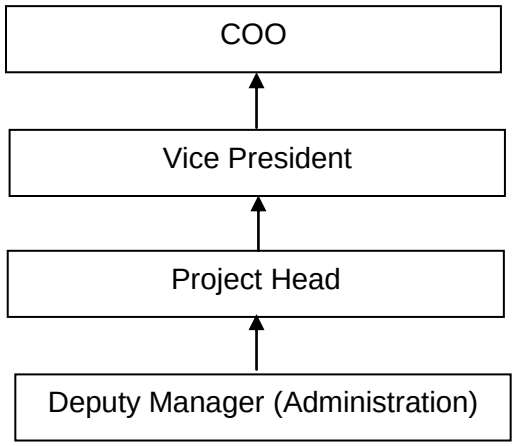
77. It was observed during the site visit that all the 38 WTG locations has been so identified that there is no religious property are going to be affected.

34. GREIVANCE REDRESSAL MECHANISM FOR THE SUB-PROJECT:

78. During the site visit it was observed that the project authority has formed their own institutional arrangements to deal with any issues/concerns in the site. Grievance Redressal Mechanism with the help of project site official has in place which comprises of the following members:
    - Project Head
    - Deputy Manager (Administration)

79. The Grievance Redressal Committee (GRC) was formed at the project site to ensure that any affected person's grievances are adequately addressed and to facilitate timely project implementation. At project level the GRC is headed by the Project Head Mr. Rakesh Vishwakrama.

80. As informed by the developer during the site visit, whenever any complaints receives in writing from any project affected person, at first the complaint is being registered in the Grievance Registered/complain Register. At first the issues /concerns are taken care by the Deputy Manager (Administration) at the project level and forwarded to Project Head. If the Project Head is unable to resolve the issue then the matter is forwarded to the Vice President and subsequently to the COO. During the site visit it was observed that the sub project developer is maintaining a Grievance register. The sample copy of the Grievance Register is attached as **Appendix XVI.** The organization chart for handling grievances is given below:



35. EMPLOYMENT GENERATION AND INCOME RESTORATION:

81. As informed by the concessionaire, the project does not involve acquisition of any private land, so the project does not impact the livelihood of the local people. It has been confirmed by the concessionaire that employment opportunities are being provided to the local people for various unskilled and semi-skilled activities like security guards and office assistants.

36. COMMUNITY DEVELOPMENT ACTIVITIES:

82. The concessionaire has carried out community development activities based on the demands made by the local people / nearby village as below:

- Provide furniture for 4 village's school at Kanser ,Mawta ,Barkhedi and Pingrala.
- Construction of bore-well at Jawahar Navodaya Vidyalya,Kalukheda village.

- Construction and maintenance of village road in the project affected villages as per the requirement of the villagers.

37. DISCLOSURE:

83. The final ESDDR report will be accepted and owned by the Concessionaire and endorsed by IIFCL. After getting the No Objection Certificate (NOC) from the ADB, the report will be uploaded for public disclosure in IIFCL's website, Project developer's website as well as ADB's website.

38. SITE VISIT OBSERVATION:

84. A site visit was undertaken by IIFCL's Environmental and Social Safeguard Specialists on 11th December 2015. The site visit was undertaken to review the implementation of the project's environmental and social safeguards. The sub-project at the time of site visit was in the last phase of construction.

85. During the site visit it was observed that :

- Construction workers are provided with ready access to on- or off-site health care check-up facilities and are being provided with first aid for minor injuries;
- Crop compensation has been paid wherever private land has been used for ROW of transmission line which is under the scope of DJEPL. Sample copy of the crop compensation paid to the affected persons is attached as **Appendix XVII.**
- Fire extinguishers and first aid kits are available at all WTGs and sub-station.
- Emergency contact numbers have been displayed at the prominent places in project site.
- The workers and staff at the site were seen wearing personal protective equipment such as helmets, jackets, boots, gloves etc.
- The sub-project has a proper grievance handling mechanism and records are maintained at site.

86. The site visit photographs are given in **Photoplate - I.**

39. CONCLUSION:

87. Based upon the available documents and site visits it appears that the subproject developer has undertaken social safeguard measures for better and on time implementation of the sub-project. The key observations on due diligence on the social impacts are summarised as follows:

- The sub-project has been prepared by the Government of Madhya Pradesh as per the national and state government requirement and not in anticipation to ADB operation.
- The Commercial Operation Date (COD) of the project has achieved on 25th of December 2015.
- The project was disclosed to the project affected people through Gazette Notifications;
- The subproject does not impact any Schedule Caste/Schedule Tribe people get affected due to proposed project;
- Employment opportunities are being provided to the local people for various unskilled and semi-skilled activities like security guards and office assistants.
- After approval from the Bank the ESDDR will be uploaded for public disclosure.
- UUPL is located mainly over the Revenue Land granted by the Government of Madhya Pradesh allotted by Madhya Pradesh New and Renewable Energy Department (MPNRED) for a period of 25 years.
- The transmission line and substation comes under another project being implemented by DJ Energy Private Limited (DJEPL) and not in the scope of Uttar Urja Project Pvt. Ltd. (UUPL).
- The project do not have any impact on the settlement area and no cultural and community property is affected due to the project.
- Employment opportunities have been provided to the local people
- Concessionaire has undertaken community development activities based on the demands raised by the local people.

88. Based on the site visits observations and desk review, it appears that the sub-project have no negative significant social safeguard issue.

Environmental & Social Impact Assessment

180 MW Wind Power Plant

Ratlam & Mandsaur Districts, Madhya Pradesh

Prepared for

DJ Energy Pvt. Ltd & Uttar Urja Power Pvt. Ltd

February 2014

Prepared by

SENES Consultants India Pvt. Ltd.

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1 INTRODUCTION

1.1 BACKGROUND

Continuum Wind Energy (Continuum) was founded in 2009 by a group of professionals to develop wind farms in India and Asia. Continuum Wind Energy follows a philosophy of self-development of large environmentally-friendly (>100MW) , high yielding wind farms after diligent study of the wind resource, careful planning of construction program and obtaining a fully-committed, conservative financing structure. Continuum Wind Energy actively works with the local population to fund development programs, offer employment to locals and create a sustainable partnership with the community.

The Indian power market has a persistent demand-supply gap of electricity. The Indian wind energy industry is witnessing improving regulatory regime, phasing out of subsidies, grid parity in most states and a differentiation of the "green" premium of wind energy determined by market forces.

Continuum Wind Energy has operating capacity of 125 MW selling electricity under long term power sale agreements at feed-in-tariffs to distribution utilities and on negotiated tariffs to industrial consumers. It is currently developing 264MW Bothe Wind farm project, a largest project in a single location by an Indian IPP. In addition, Continuum Wind Energy is executing a 180 MW project which is one amongst the largest wind farms in India. Continuum Wind Energy has offices in Mumbai, Pune, Satara and Jaipur.

Continuum Wind Energy senior management has collective experience of over 100 years in project planning, execution, financing and operations. Singapore-based Continuum Wind Energy is majority owned by Morgan Stanley Infrastructure Partners, a leading infrastructure investment platform with $4 billion in equity under management that focuses on long-term investments in infrastructure assets associated with providing essential public goods and services to societies across the globe.

Continuum is planning to develop a 180 MW wind farm in Jaora, Ratlam District, Madhya Pradesh with installation of 85 WTGs of capacity of 2 MW for each turbine. The project is proposed to be executed through two different companies i.e. DJ Energy Pvt. Ltd. (47 turbines) and Uttar Urja Power Pvt. Ltd. (38 turbines) with the capacity of 100 MW and 80 MW respectively. For the purpose of report this project is termed as Ratlam Wind Power Project (RWPP) in the report.

1.2 KEY FEATURE OF PROJECT SITE

The project site is accessible through village roads connecting the project site with NH – 79. Salient features of the proposed site are as below:

- Favourable meteorological and topographical conditions
- Good connectivity
- Availability of revenue land with non-agricultural and barren land use

1.3 BENEFITS OF THE PROJECT

This wind power project offers the following advantages:

- The technology of electricity generation from wind has been developed fully for smooth and trouble-free operation as well as for its economic viability.
- It is pollution free and eco-friendly;
- With no fuel consumption, power generation becomes almost free after recovery of capital cost. O & M, cost is nominal.
- Energy security – decreasing dependence on fossil fuels for power generation;
- Availability of government incentives to renewable projects in India.

1.4 APPROACH & METHODOLOGY OF ESIA

1.4.1 Approach

The overall approach adopted for this assignment was to understand the project activities through discussion with site officials and desktop review of project related documents like detailed project report, permits/clearances etc. and also to gain adequate familiarization with the proposed location. This was followed by identifying environmental and social risks associated with the project due to planning, design, construction and operational phases of all components of the project. To assess the key environmental and social risks, assessment has been divided into following sub sections:

- Assessment of shadow flickering effect on nearby settlement
- Assessment of impact on birds
- Assessment of WTG noise on nearby settlement (individual and cluster of households)
- Feedback from community consultation

The review and findings were then assessed to identify the locations which are sensitive towards these impacts and need possible mitigation. Based on the findings an environmental and social action plan (with timelines & responsibilities) to implement mitigation measures has been derived. SENES has followed following steps to achieve the above mentioned approach:

- Desk review of the relevant project details, documentation
- Reconnaissance survey of project site and its surrounding

- Identification of WTG locations near to the settlements (individual and cluster of households) and water bodies
- Identification of birds species in project area near to water bodies
- Modeling to assess the shadow flickering and noise impact zone around the WTGs
- Meetings and discussions with project personnel of DJE and UUPL and local people at nearby locations
- Collection and verification of primary & secondary information on baseline environmental and social aspects
- Desk analysis and impact identification
- Developing environmental and social management plan and report writing

1.4.2 Methodology

SENES has adopted following methodology to prepare the ESIA report:

- Formulation of a team of environmental, social & ecology experts
- Carrying out initial meetings with DJE and UUPL officials to arrive at a common understanding and consensus on all important aspects, for efficient and effective delivery of the assignment's needs and objectives
- Review of basic project details and carry out reconnaissance survey of project site and its surroundings
- Separate methodology has been developed for stakeholder consultation, ecological assessment and shadows flickering and noise modeling. A brief description is as follows:
    - Stakeholder Consultation: Conducting detailed site visits, meetings, monitoring and consultations with project management & stakeholders, review and gather relevant information. During the site visit, consultation with villagers was carried out to know the socioeconomic status, expectations and scope of infrastructure improvement.
    - Ecological assessment: under this methodology, ecological sensitive areas and important bird areas existing in and around the project site area were identified through desktop review. The distance of these areas from project site along with flora and fauna details were then verified during the site visit. Considering the existence of important bird area, a detailed methodology was developed for bird and bat assessment.
    - Modeling studies: Considering the spread of the project with 85 numbers of WTGs, impacts in terms of shadow flickering and noise has been assessed through modeling software. A detailed methodology, based on limitation and assumption required for modeling has been developed and given in impact assessment chapter of this report.
- Detailed desk review and analysis of all the information gathered during the site visits and consultations meetings
- Assessment of the project compliance with respect to IFC's performance standards

- Assessment and evaluation of modeling results was carried out with respect to impact zone and effected settlements (individual and cluster of households)
- Discussion on identified tasks in Environment & Social Management Plan, resource needs for these tasks.
- Review the ESIA report along with officials of DJE and UUPL followed by incorporation of the suggestions and addresses the comments received.

1.4.3 Limitations

The social consultation was based on one to one interaction and focused group discussion among the community. Consultation with the project affected people could not be undertaken as a part of the ESIA process, since verification as well as negotiation with the PAPs is reported to be at an initial stage. However, villagers considered for one to one interaction and focused group discussion included people residing in the nearby settlements (individual household and residential colony) and encroachers. During the social assessment, village amenities given in census data were also verified during public discussion and also to find out the expectations of villagers and areas of infrastructural improvement. A formal disclosure of project by DJE and UUPL officials is also being suggested to build a better relationship with nearby communities and to prepare and implement Community Development Plan.

The time constraint is a limitation for Bird and Bat study also. During our bird and bat study which was limited for 1 week monitoring period, WTG locations near the water bodies has been identified where bird's species in flock and couples were sighted. However, their flyway could not be identified and detailed study distributed over seasons is required for this assessment. In addition to identification of birds species, nearby important bird area and wild life sanctuary were also visited to collect the information on local and migratory bird species. In absence of any established migratory flyway in the area, a detailed primary monitoring distributed over 4 seasons is required.

2 PROJECT DESCRIPTION

2.1 PROJECT OVERVIEW

Ratlam Wind Power Project is a 180 MW Greenfield Wind Power Project located in Piploda and Dalauda Tehsil of Ratlam and Mandsaur Districts of Madhya Pradesh. The site is aerially around 20 km North-West of Jaora town and around 50 km North of District Head quarter Ratlam.

The Project is situated on the Malwa Plateau with turbine base elevations ranging from 493m to 540m mean sea level. While the general terrain across the site is relatively simple there are small terrain features of moderate complexity on which many of the turbine locations are sited. Ground cover on site generally consists of open farmland with crops and scattered trees of 5-10m in height.

The Project is completely located over the Revenue Land allotted by MP New and Renewable Energy Department **"MPNRED"** for a period of 25 years. The Project has been allocated land for WTG locations, substation, roads, control room, SCADA room and 220 kV and 33 kV transmission line. In additions to the allocated revenue land parcels the Project requires some portion of private land parcels for widening and turning of the roads and transmission line.

The Project also has a dedicated power evacuation system and received an approval to evacuate 180 MW via 20.4 km long 220 kV transmission line to MP Power Transmission Company Ltd **"MPPTCL"** substation at Dalaoda, District Mandsaur, Madhya Pradesh.

The project is proposed to be commissioned by June 2015 and plans to sell electricity to MP DISCOM. The basic project details have been provided in the **Table 2.1** below.

TABLE 2.1: PROJECT AT A GLANCE

S. No	Particulars	Description
1	Project Site	Villages: Bathkhedi, Jethana, Pancheva, Kanser, Bilandpur, Bagiya, Naveli, Bathkheda, Richadevra, Khodana, Jadwasa, Pingrala, Jaliner, Barkhedi, Kachnara, Sarsodh, Chandakhedi, Kalukheda, Mawata and Mamatkheda
2	Taluka	Piploda and Dalauda
3	District Name	Ratlam and Mandsaur
4	Name of the State	Madhya Pradesh
5	Latitude	23°52'12.46"N&23°38'34.49"N
6	Longitude	74°59'28.30"E &75° 5'55.84"E
7	Road Accessibility	NH-79

S. No	Particulars	Description
8	Nearest Airport	Indore
9	Nearest Railway Station	Small Railway Station (Narrow Guage) - Katchnera Road, Major Railway Station (Broad Guage) - Jaora, Ratlam and Mandsaur
10	Nearest Town	Jaora, Ratlam and Mandsaur
11	Nearest City	Ratlam and Mandsaur
12	Project Capacity	180 MW
13	Number of WEGs	(85) nos.
14	Capacity of each turbine proposed	85 WTGs of 2.0 MW each
15	Model of wind turbine	INOXWT2000DF
16	Hub height of turbines	80 m/ 92 m
17	Rotor diameter of turbines	93 m/100 m

2.2 WIND POTENTIAL IN MADHYA PRADESH

The State of Madhya Pradesh, being one of the largest states of India, has abundant land for setting up Wind Farm Project. The results of Wind Monitoring Survey conducted by MNES envisage that western and southern part of Madhya Pradesh has adequate wind potential for setting up Wind Farm Project. In a very conservative estimate the state of Madhya Pradesh has potential of about 5500 MW capacity for setting up Wind Farm Projects. Out of this, only about 213.79 MW has been set up till 31st March2010, which is below10% of total available potential in the State.

Looking to the total installed capacity of Wind Power Project in India, the share of Madhya Pradesh is limited to 2% only. A favorable policy for the promotion of Non-conventional Energy Sources in the State had already been declared by the Govt. of Madhya Pradesh, which ensures the Wind Power Projects are commercially viable. There are about 7 sites identified through the Wind Monitoring Program of MNES having annual average wind speed over 18 Km/hr. at 20mheight and Wind Power Density (WPD) at 50 M height over 200 Watt/Sq m. The details of this site and their wind potential are given as under:

S.No.	Name of Site	District	Potential (MW)	Wind Speed (20m)	WPD (Watt/Sqm)
1.	Jamgodrani	Dewas	150	18.20	222
2.	Mahuriya	Shajapur	150	19.0	217
3.	Mamatkheda	Ratlam	250	20.04	255
4.	Kukaru	Betul	250	19.0	255
5.	Nagda	Dewas	100	22.49	371
6.	Sendhwa	Badwani	150	18.10	215
7.	Valiarpani	Badwani	100	18.20	287

2.3 WIND POTENTIAL AT PROJECT SITE

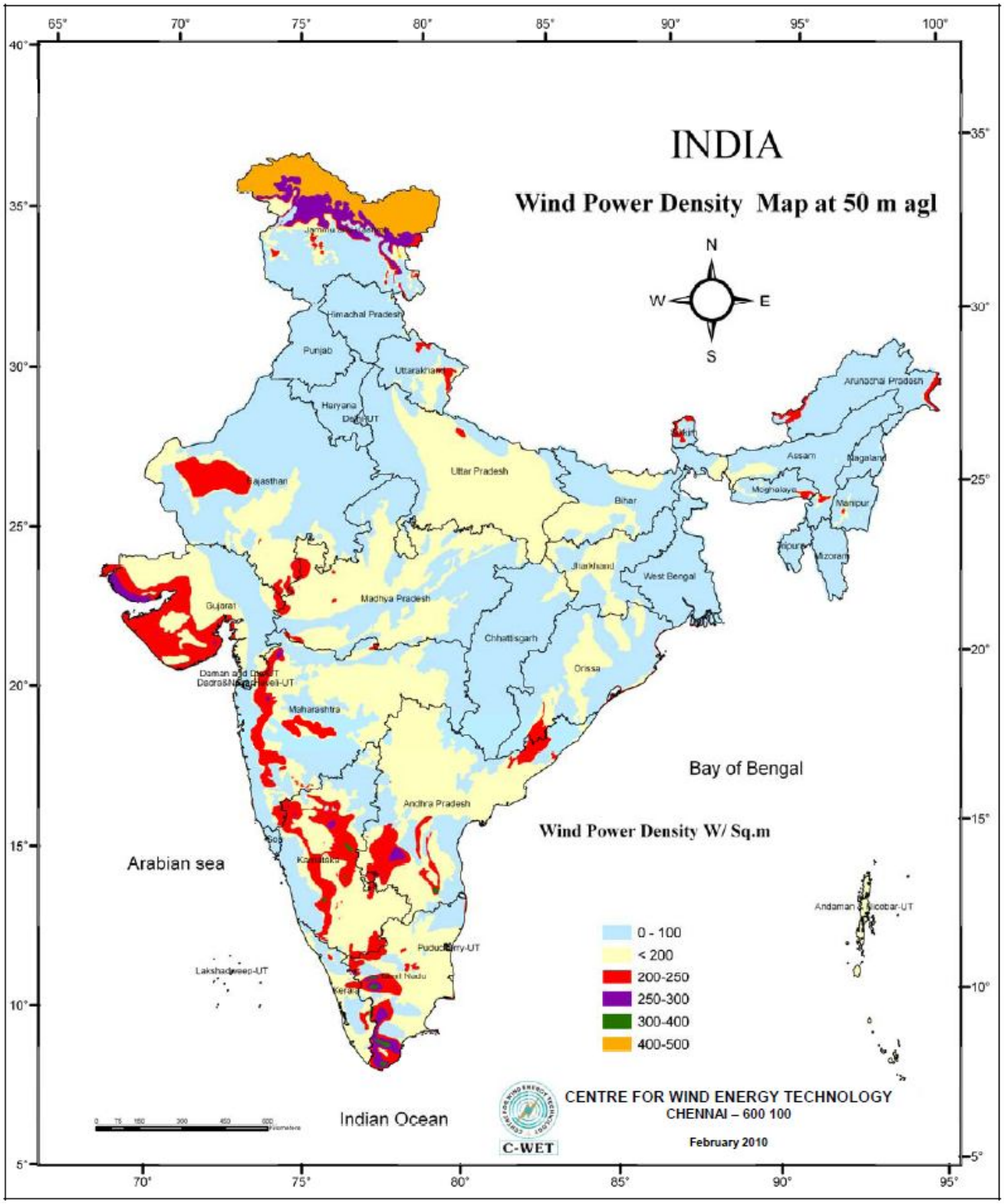
Technical feasibility of a wind power project mainly depends upon the quantity of wind energy available at the site. In planning a commercial wind power project, one must be ensured about availability of adequate wind power density (WPD) of the site. As per prevailing norm of C-WET, a site having WPD above 200 watt/sq. m could prove financial as well as technical viability of project.

In a conservative calculation, it has been summarized that annual average wind speed over 6.73 m/s from Pingrala wind mast is enough to make a wind farm project technically and commercially viable.

Wind resources could be better on hills as the experience of studies has already proved. A suitable hill is the one which is oriented perpendicular to the predominant wind direction and has level terrains for good distances on its either side. Pingrala site have almost all the above characteristic to prove a good windy site. In regard wind mast was installed at 80m height and it is equal to hub height of WEG. However, the modern technique of WAsP with the wind speeds at hub height at each WTG locations depending on topographical features of the site. In case of Pingrala, the power law index is 0.16 to 0.20. The influence of power law index is very significant in terms of annual output.

Hence, it can be concluded that proposed site having annual average wind speed over 6.73 m/s with power law index 0.18 and WPD over 200 Watt/sq. m is technically feasible to set up wind farm project.

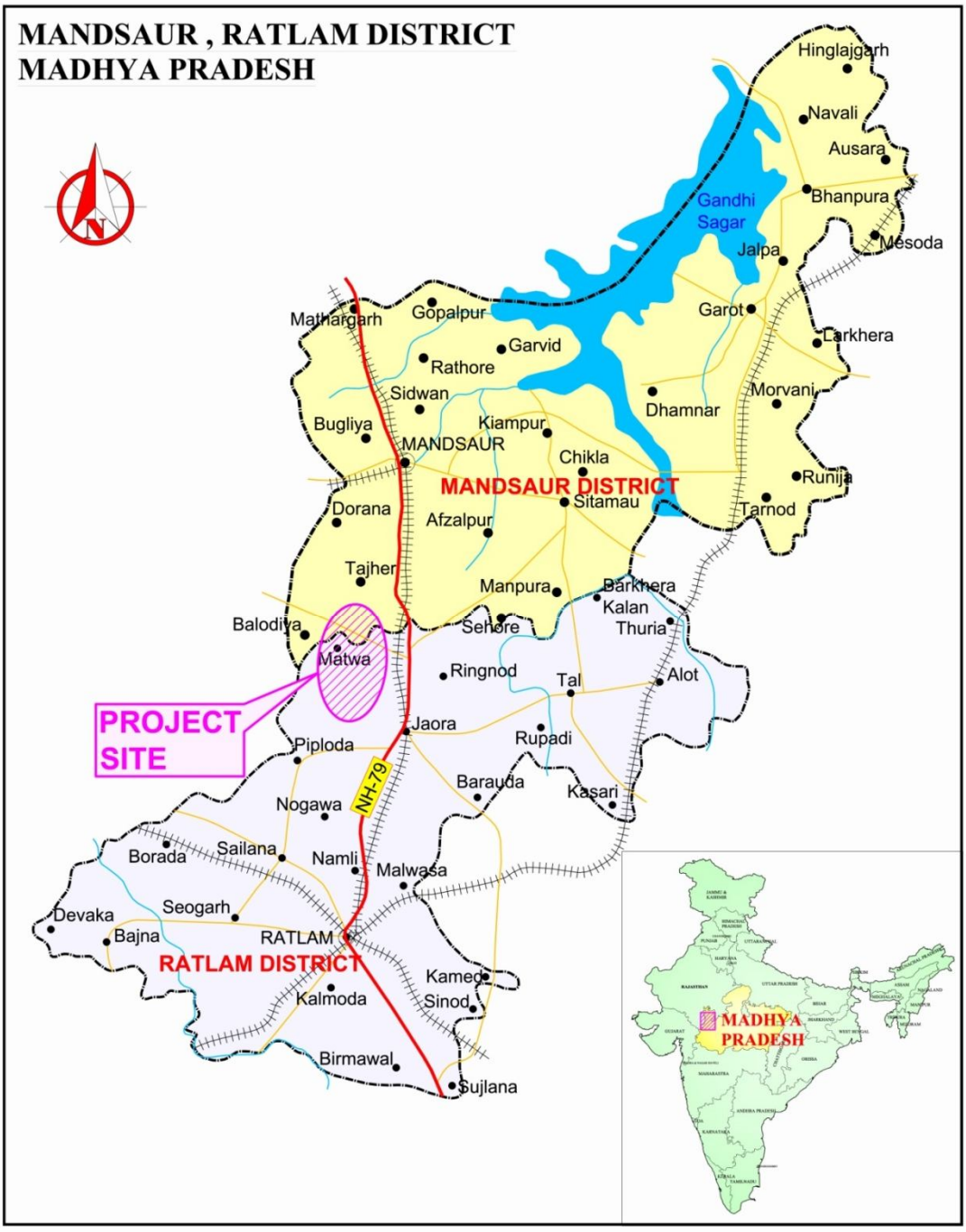
FIGURE 1: WIND POWER DENSITY MAP OF INDIA



2.4 SITE LOCATION AND ACCESSIBILITY

The project site of 180 MW wind power project is located in Piploda and Daloada Tehsil of Ratlam and Mandsaur Districts in Madhya Pradesh. Geographically, project site is situated between 23°52'12.46"N & 23°38'34.49"N latitude and 74°59'28.30"E & 75° 5'55.84"E longitude. The project site in Ratlam and Mandsaur districts is surrounded by Rajasthan State in west and north direction. The nearest town of the project site is Jaora in Ratlam district and can be shown in project location & accessibility map as presented in **Figure 2** below. The project site is accessible through village roads and National Highway (NH-79).

FIGURE 2: PROJECT LOCATION & ACCESSIBILITY MAP



2.5 SITE SELECTION & MICRO-SITING

The selection of the proposed wind farm site has been governed by list of potential sites vetted by C-WET for Wind Power Projects in Madhya Pradesh. Areas of National Parks and Sanctuaries, areas of outstanding natural beauty, national heritage sites, sites of archeological importance, sites of special scientific interest and other important landscapes have been avoided for the proposed wind project development in accordance to the Micro siting Guidelines. However, some ecological sensitive areas identified in the nearby area are listed herewith:

- Sitamata Wildlife Sanctuary is located at aerial distance of approx50 km west from the project site
- Gandhi Sagar Reservoir and wildlife sanctuary at aerial distance of approx. 80 km Northeast of the project site
- Sailana Kharmor Sanctuary at an aerial distance of approx. 22 km Southwest

As per the Wind Power Density (WPD) Map of India prepared by C-WET (February 2010) which reveals the WPD of the proposed site to generally vary within < 200 W/m2. The project site falls in the list of 7 potential sites evaluated by C-WET for wind power projects in Madhya Pradesh as on 31.05.2011.

Micrositing

Distance between WTGs

As per the micro siting guidelines, the distance between the proposed WTG with adjacent existing WTG, if any, or an existing application with Madhya Pradesh Urja Vikas Nigam Limited (MPUVN), for a proposed WTG, formed in row should be at least three times (3D) the diameter of the rotor. Row should be formed in such way that it is perpendicular to the predominant wind direction. The distance between the rows should be at least five times diameter (5D) of the Rotor, so that performance of the WTGs is not affected in any manner. Considering availability of two rotor diameters of 93 m & 100 m with the selected WTG model, the distance between two adjacent WTGs depending on the rotor diameter need to be kept 279 m & 300m while the distance between two WTG rows is to be maintained at 465 m to 500 m. In consistent with the aforesaid guidelines the distance between any two adjacent WTGs is kept accordingly as per rotor diameters i.e. 93 m /100 m.

2.6 PROJECT SETTING

The wind power project of 180 MW capacity in Ratlam and Mandsaur district comprises of following components. To understand the project details completely, details of each component has been given below:

- Wind Turbine Generator and auxiliary facilities viz., pooling substation and site office
- Power Evacuation Arrangement

Wind Turbine Generator (WTG) and Technology:

In the Ratlam Wind Power Project, total 85 numbers of WTG (38 for UUPL and 47 for DJE) of individual capacity 2 MW will be installed by UUPL and DJE. The details of all the proposed WTGs of UUPL and DJE with respect to their locations on revenue land and area requirement is given in Table 2-2

TABLE 2-2: LOCATION DETAILS OF PROPOSED WTG - UUPL

S.No	Loc. No.	Coordinates		Village	Tehsil	District	Khasra No.	Extent Ha.	Land Type
		Easting	Northing						
1	1 UUP	500375	2621008	Jaliner	Piploda	Ratlam	221	3.39	G
							222	1.91	G
2	2 UUP	499703	2621019	Jaliner	Piploda	Ratlam	130	4.60	G
							134	2.02	G
3	3 UUP	500432	2620648	Jaliner	Piploda	Ratlam	424	1.80	G
							425	5.45	G
4	4 UUP	500808	2618292	Jethana	Piploda	Ratlam	187	4.60	G
							125	2.59	G
5	5 UUP	501206	2618763	Jethana	Piploda	Ratlam	155	10.97	G
6	6 UUP	501589	2619066	Jethana	Piploda	Ratlam	415	3.74	G
7	7 UUP	503387	2619485	Jethana	Piploda	Ratlam	975/1	28.07	G
8	31 UUP	503774	2619330						
9	8 UUP	500910	2614693	Pancheva	Piploda	Ratlam	156/1	4.20	G
10	9 UUP	500886	2615732	Pancheva	Piploda	Ratlam	113/1	12.85	G
11	10 UUP	500720	2615428	Pancheva	Piploda	Ratlam			
12	11 UUP	499912	2615668	Pancheva	Piploda	Ratlam	85/1	12.65	G
13	12 UUP	499102	2615816	Pancheva	Piploda	Ratlam	43/1	6.85	G
14	13 UUP	502300	2624778	Bagiya	Piploda	Ratlam	380	11.94	G
15	14 UUP	502602	2625059	Bagiya	Piploda	Ratlam			
16	15 UUP	503226	2628724	Richa Devra	Piploda	Ratlam	792	1.22	G
17	16 UUP	501467	2629484	Richa Devra	Piploda	Ratlam	48/1	7.48	G
18	17 UUP	500705	2629056	Richa Devra	Piploda	Ratlam	113	0.38	G
							114	1.36	G
19	18 UUP	501141	2628583	Richa Devra	Piploda	Ratlam	165	0.91	G
20	19 UUP	503628	2632973	Khodana	Dalouda	Mandsaur	355/1	3.69	G
21	20 UUP	507499	2630549	Barkhedi	Piploda	Ratlam	317	6.53	G

22	21 UUP	506557	2631607	Pingrala	Piploda	Ratlam	25	11.09	G
23	22 UUP	506378	2631865	Pingrala	Piploda	Ratlam			
24	23 UUP	510065	2637930	Kachnara	Dalouda	Mandsaur	71/1	3.86	G
25	24 UUP	510066	2638246	Kachnara	Dalouda	Mandsaur	45/1	2.07	G
26	25 UUP	509083	2637537	Sarsodh	Dalouda	Mandsaur	1380	3.00	G
27	26 UUP	509260	2638118	Sarsodh	Dalouda	Mandsaur	1353/1/1	3.00	G
28	27 UUP	509401	2638727	Sarsodh	Dalouda	Mandsaur	1328/2	3.00	G
29	28 UUP	509435	2639851	Sarsodh	Dalouda	Mandsaur	386	3.00	G
30	29 UUP	507450	2637351	Sarsodh	Dalouda	Mandsaur	1192	3.00	G
31	30 UUP	500500	2636131	Chandakhedi	Dalouda	Mandsaur	933	3.00	G
32	32 UUP	503137	2622893	Kalu Kheda	Piploda	Ratlam	313/1	5.00	G
33	33 UUP	503485	2622490						
34	34 UUP	500386	2629141	Mawata	Piploda	Ratlam	2582/5	2.87	G
35	35 UUP	499968	2629328	Mawata	Piploda	Ratlam	2418/1	4.56	G
36	36 UUP	500124	2629827	Mawata	Piploda	Ratlam	2396	5.90	G
37	37 UUP	507991	2618297	Mamatkheda	Piploda	Ratlam	387	4.63	G
38	38 UUP	508425	2619224	Mamatkheda	Piploda	Ratlam	221	14.53	G

TABLE 2-3: LOCATION DETAILS OF PROPOSED WTG - DJE

S. No	WTG No.	Coordinates		Village	Tehsil	District	Khasra No.	Extent in Ha.	Land Type
		Easting	Northing						
1	DJE - 1	505762	2618643	Bathkhedi	Piploda	Ratlam	108	16.74	G
2	DJE - 2	505753	2618271	Bathkhedi	Piploda	Ratlam			
3	DJE - 3	505834	2617875	Bathkhedi	Piploda	Ratlam	109	11.21	G
4	DJE - 4	501662	2617873	Jethana	Piploda	Ratlam	1139	20.83	G
5	DJE - 5	501344	2617428	Jethana	Piploda	Ratlam	1140	9.61	G
6	DJE - 6	501252	2616991	Pancheva	Piploda	Ratlam	346/1	27.43	G
7	DJE - 7	50055	261678	Pancheva	Piploda	Ratlam			

		1	0						
8	DJE - 8	502039	261657	Pancheva	Piploda	Ratlam	354/2	22.93	G
9	DJE - 9	503043	261683 7	Pancheva	Piploda	Ratlam			
10	DJE - 10	501847	261682 4	Pancheva	Piploda	Ratlam			
11	DJE - 11	501876	262257 0	Kanser	Piploda	Ratlam	118	10.00	G
12	DJE - 14	501795	262166 3	Bilandpur	Piploda	Ratlam	25/1	6.58	G
13	DJE - 15	501859	262397 0	Bagiya	Piploda	Ratlam	466	23.50	G
14	DJE - 16	501856	262426 7	Bagiya	Piploda	Ratlam			
15	DJE - 17	501798	262640 4	Naveli	Piploda	Ratlam	322	19.98	G
16	DJE - 18	502496	262614 9	Bagiya	Piploda	Ratlam	167	16.19	G
17	DJE - 19	502519	262650 6	Bathkhed a	Piploda	Ratlam	469	100.00	G
18	DJE - 20	502742	262688 1	Bathkhed a	Piploda	Ratlam			
19	DJE - 21	502881	262737 7	Bathkhed a	Piploda	Ratlam			
20	DJE - 22	503108	262617 1	Bathkhed a	Piploda	Ratlam			
21	DJE - 23	503563	262710 3	Bathkhed a	Piploda	Ratlam			
22	DJE - 12	503981	262688 7	Bathkhed a	Piploda	Ratlam			
23	DJE - 24	503858	262755 1	Bathkhed a	Piploda	Ratlam			
24	DJE - 25	503223	262798 2	Bathkhed a	Piploda	Ratlam	38	4.05	G
25	DJE - 13	504542	262870 8	Bathkhed a	Piploda	Ratlam	2	45.09	G
26	DJE - 26	503662	262855 9	Bathkhed a	Piploda	Ratlam			
27	DJE - 27	504129	262839 6	Bathkhed a	Piploda	Ratlam			
28	DJE - 28	504805	262851 2	Bathkhed a	Piploda	Ratlam			
29	DJE - 29	503140	262834 3	Richadevr a	Piploda	Ratlam	742	2.52	G
30	DJE - 30	504464	262904 5	Richadevr a	Piploda	Ratlam	985	8.50	G
31	DJE - 31	503993	262914 2	Richadevr a	Piploda	Ratlam	984	5.81	G
32	DJE - 32	503070	263191 8	Khodana	Daloud a	Mandsa ur	289	21.73	G
33	DJE - 33	503126	263230 6	Khodana	Daloud a	Mandsa ur			
34	DJE - 34	503499	263268 9	Khodana	Daloud a	Mandsa ur	294	3.5	G

35	DJE - 36	503381	2631423	Khodana	Daloud a	Mandsa ur	765	8.46	G
36	DJE - 37	503837	2630820	Khodana	Daloud a	Mandsa ur	1069	14.94	G
37	DJE - 35	503771	2630458	Khodana	Daloud a	Mandsa ur			
38	DJE - 38	506389	2632230	Jadwasa	Piploda	Ratlam	387	22.12	G
39	DJE - 39	506106	2632477	Jadwasa	Piploda	Ratlam			
40	DJE - 40	505753	2632863	Jadwasa	Piploda	Ratlam	376	40	G
41	DJE - 41	505675	2633236	Jadwasa	Piploda	Ratlam			
42	DJE - 42	506398	2633230	Jadwasa	Piploda	Ratlam			
43	DJE - 43	506479	2632913	Jadwasa	Piploda	Ratlam			
44	DJE - 44	504943	2633031	Jadwasa	Piploda	Ratlam	241	2.1	G
45				Khodana	Daloud a	Mandsa ur	573	6.12	G
45	DJE - 45	507046	2631545	Pingrala	Piploda	Ratlam	140/1	10.79	G
46	DJE - 46	507080	2631154	Pingrala	Piploda	Ratlam	347	20.92	G
47	DJE - 47	507318	2630905	Pingrala	Piploda	Ratlam			

WTG Technology

The proposed project will use WTG model INOXWT2000DF. This model is manufactured by INOX & AMSC Jointly. The wind turbines of the AMSCmake, INOXWT2000DF 2.0 MW platform are of the 3 (three) bladed wind-facing rotor type with a nominal power of 2.0 MW. The WTG is designed to operate in different wind conditions. The control system allows the wind turbine to be operated at variable speed, maximizing the power produced at all times and minimizing the loads and noise. The following are the main parameters of AMSC INOXWT2000DF, 2.0 MW WTG.

TABLE 2-4: TECHNICAL SPECIFICATION OF WTG

S.No.	Description	Specification
•	Company	AMSC
•	Type/ Model	INOXWT2000DF
•	Rotor Diameter	93 m/100 m
•	Rated Power	2000 KW
•	Hub height	80 m/ 92 m

•	Cut-out wind speed	20 m/s
•	Turbine Concept	Horizontal axis wind turbine
•	Rotor type	Pitch regulated upwind orientation
•	Rated speed	15.7 rpm @ rated power
•	Blade Material	Epoxy Glass Fibre
•	Hub	Rigid Cast Iron EN-GJS-400-18U-LT
•	Yaw System	Active wind direction alignment, Roller Bearing, Gear motor with 4nos. of drive units and active motor brakes.

2.7 POWER EVACUATION ARRANGEMENT

The power evacuation details for the proposed project are as follows:

- Only one substation is proposed at Bhatkheda for pooling the power with 2x100 MVA Transformers to evacuate 180 MW. Space Provision for 3rd Transformer shall be available.
- Each Transformer in Bhatkheda shall have 4 feeders capable of evacuating 30 MW connected power from WTG. Total 8 feeders will be available (4 feeders/transformer), out of which six feeders will be used for evacuating 180MW while 2 feeders will be available as additional for future use
- The 33kv lines connecting the various WTG's will be of AL59 Dog and Panther make as shown in Figure -4.
- The power at pooling substation will be stepped upto 220kv for transfer to Daluada substation through a 20km long 220kv EHV line as shown in Figure -3. The billing will happen at HV side of Bhatkheda pooling substation.
- The EHV line will be connected to two bays at the Daulada substation. The requisite amount for the construction of bays is already deposited with MPPTCL.

As per the Government of Madhya Pradesh Wind Policy January 2012, interfacing arrangements, including the transformer panels, protection, metering etc., from the point of generation to the nearest sub-station or an interconnection point or nearest transmission/distribution line shall be the responsibility of developer, subject to fulfillment of technical and safety parameters in accordance with the Madhya Pradesh State Grid Code, Madhya Pradesh Electricity Supply Code, 2004, M.P. Electricity Regulatory Commission and Central Electricity Regulatory Commission regulations as amended from time to time. This work may be executed by the Madhya Pradesh Power Transmission Company Limited (MPPTCL) and /or the other related Distribution Company of MP State or according to their terms and conditions, the cost of which shall have to be borne by the developer.

FIGURE 3: POWER TRANSMISSION LINE ROUTE MAP FROM POOLING SUB-STATION TO STATE ELECTRICAL GRID AT DAULADA

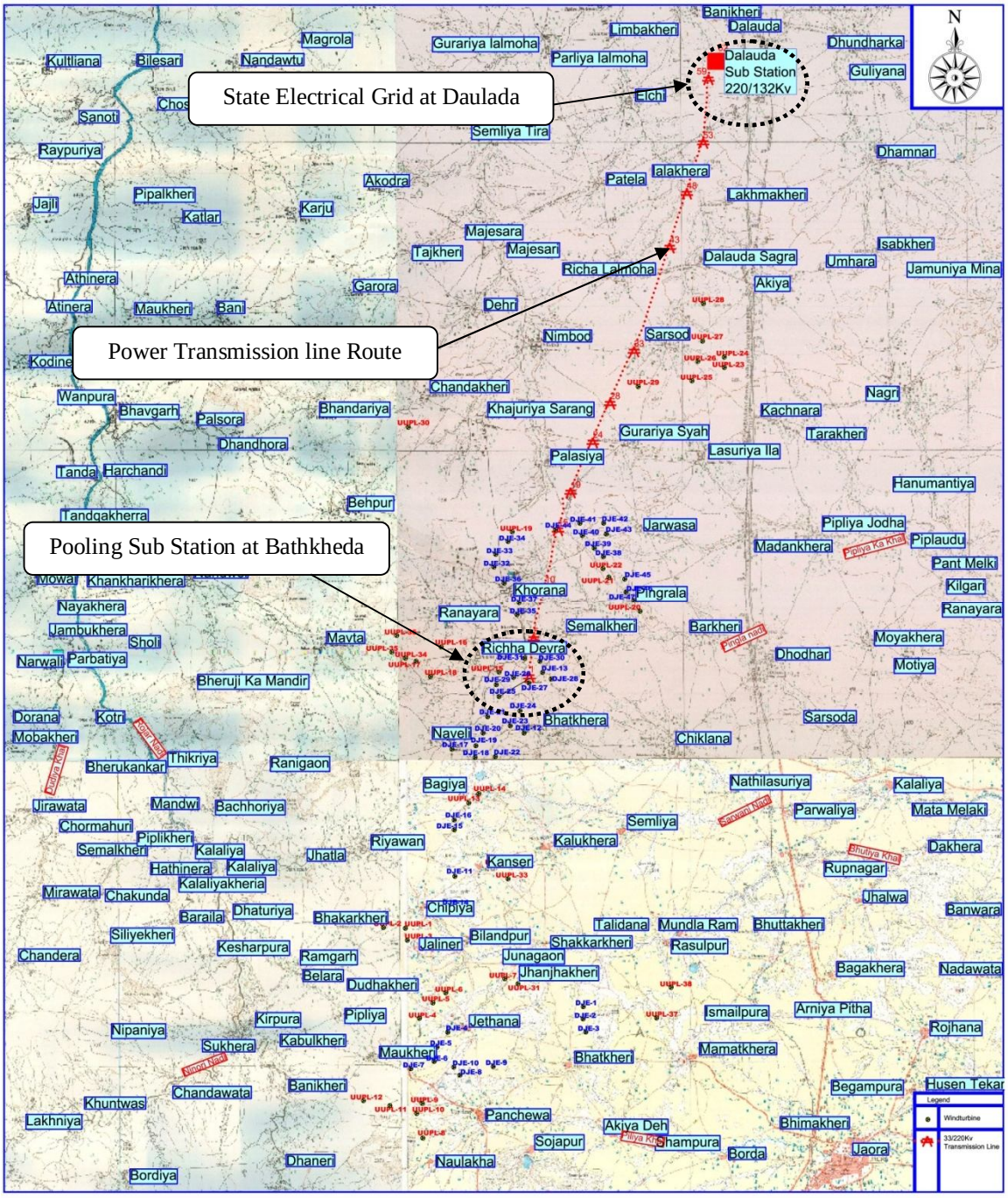
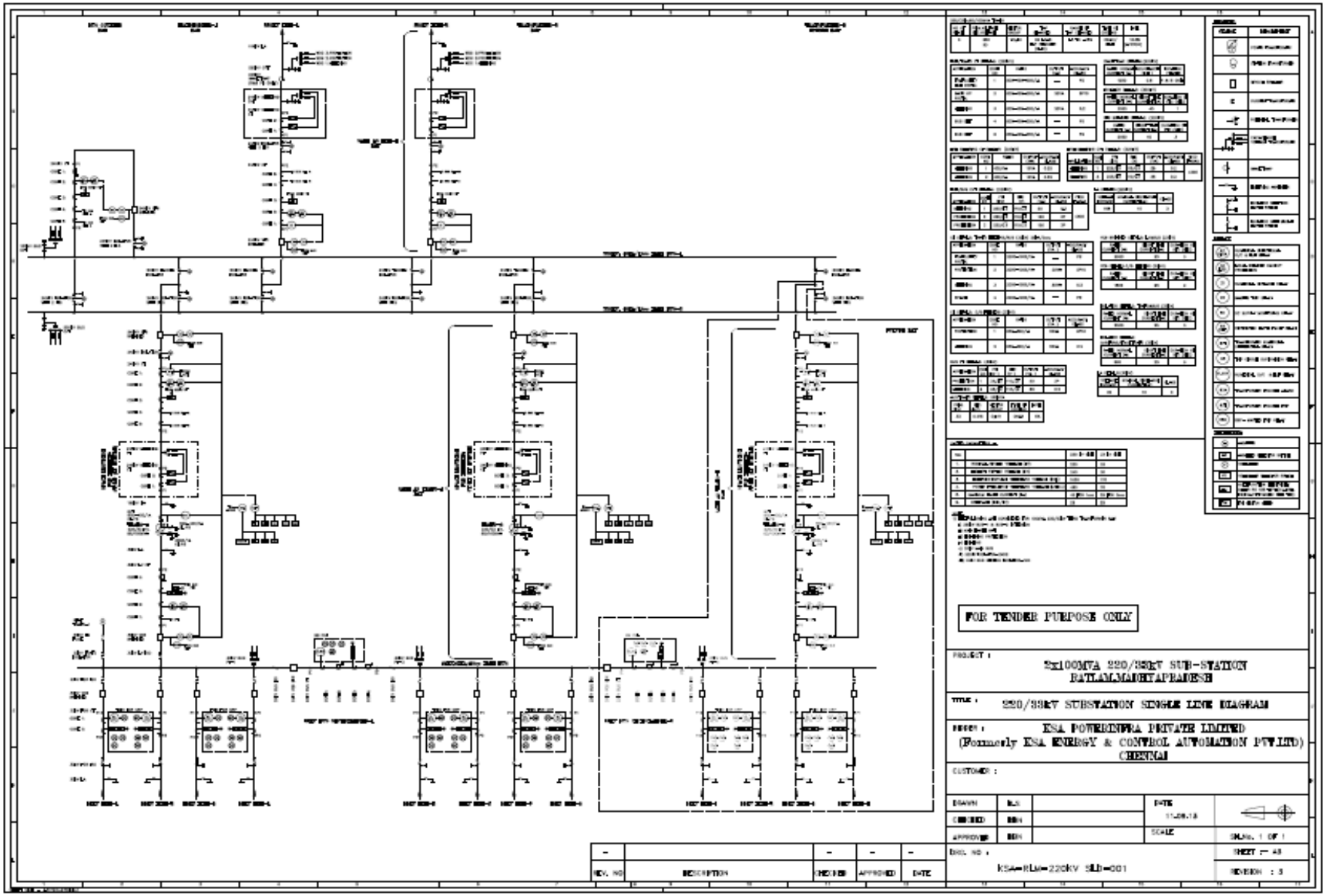


FIGURE 4: SINGLE LINE DIAGRAM - 220/33 KV SUBSTATION



2.8 RESOURCE REQUIREMENT

2.8.1 Land Requirement

Wind Turbine Generator (WTG)

For the development of 180 MW wind power project in Piploda and Daulada districts, MPNERD has granted the application for land allotment and 713.35 hectares of Govt. revenue land has been allotted for the selection of appropriate location for WTGs. Based on the micrositing assessment, total 85 locations have been selected on allotted land. As per the detail submitted by UUPL and DJE to MPNERD, right of use of land has been granted for the land area given in **Table 2-7**. The details of total land requirement for the WTG, substation and vaccume circuit breakyard (VCB) is summarized here in **Table 2.5**

TABLE 2-5: LAND REQUIREMENT - SUMMARY

Project facility	Land area required (ha)	Villages	Land classification (pvt/revenue/forest)	Status of transfer / purchase	Mode of procurement	Remarks
WTG	1.75 per WTG	20	Govt. Revenue	Transferred for 25 years	Allotment	
Access roads	16 m wide x actual length	20	Govt. Revenue and Private	Govt. Revenue land Transferred for 25 years and Private land purchasing is in process	Allotment and Compensation	-
Bathkhera Pooling sub-station/switchyard/admn building etc	275 x 275 mtr.	Bathkheda	Govt. Revenue	Transferred	Allotment	
33KV line	Along the Road	20	Govt. Revenue and Private	NA	Compensation	-
220 KV line	28 m wide x actual length	12	Govt. Revenue and Private	NA	Compensation as per Govt. Policy	-
Dalauda grid substation	NA	Daulada	Govt. Substation	NA	NA	Govt. Substation
Any other	40 x 40	Bathkhe	Govt. Revenue	Transferre	Allotment	-

utility/associated facility: Control Room Vaccume Circuit Breaker Yard	mtr	da		d		

Transmission line & Access Road

The transmission line of 220 KV in the proposed project will be 28 m wide as shown in Table 2-5. Total 62 towers locations are coming in the proposed project to evacuate power from polling sub-station to Daulada Station. Out of 62 locations, land has been identified for 45 locations and land procurement for all these locations is in process whereas land parcels for 17 locations are yet to be identified.

For the development of access road, private land will also be required at some of the locations to widen the existing road for the movement of heavy vehicles. The interconnected access road from one WTG to another will be on allotted Govt. revenue land to the extent feasible. However, temporary requirement of access during construction period is likely to use private agricultural land which would be compensated on crop yield basis that will be lost. The total area of private land required for the transmission line and access road is to be determined and will depend on actual length. The Khasra detail of private land identified for procurement is given here in Table 2.6

TABLE 2-6: PRIVATE LAND DETAILS

S.No.	Khasra Number	Villages
1.	979	RinchaDevra
2.	919	RinchaDevra
3.	53 & 54	Semalkhedi
4.	39	Semalkhedi
5.	1097	Khodana
6.	1152/1343	Khodana
7.	1165	Khodana
8.	627 & 628	Khodana
9.	526	Khodana
10.	712	Palaciya

11.	1	Jadwasa
12.	319	Guradiya shah
13.	238	Guradiya shah
14.	63	Guradiya shah
15.	110	Guradiya shah
16.	547	Guradiya shah
17.	568	Guradiya shah
18.	883	Sarsod
19.	917	Sarsod
20.	732	Sarsod
21.	195	Sarsod
22.	175	Sarsod
23.	152	Sarsod
24.	146	Sarsod
25.	122	Sarsod
26.	403	Daloda Sagra
27.	26	Daloda Sagra
28.	1282	Lalakheda
29.	1226	Lalakheda
30.	1182	Lalakheda
31.	307	Lalakheda
32.	247	Lalakheda
33.	364	Dalouda Rail

34.	310	Daloda Rail
35.	72	Daloda Rail
36.	84	Daloda Rail

Batching Plant

To meet the ready mix concrete requirement for the foundation work of WTGs, batching plant will be setup during the construction phase within the allotted Govt. revenue land. Approx. 1.5 Hectares of land would be required to setup the batching plant which would be dismantled and restored back to its original condition on completion of construction work. The location of batching plant is yet to be determined however, it will be ensured that this location is sufficiently away (>500 m) from the village settlements. This will also be setup and operated in accordance with regulatory permits required from the Madhya Pradesh Pollution Control Board (MPPCB).

2.8.2 Land Acquisition Process

The land acquisition process details adopted for both the government revenue and private land in the proposed project is as follows:

2.8.2.1 Land Acquisition Process for Revenue Land

As discussed above, for the installation of WTG and pooling substation, only revenue land will be used and the same has been taken on lease from Madhya Pradesh New and Renewable Energy Department (MPNRED) through the following process:

- Application including project details viz., proposed WTG locations and associated facilities along with required maps was submitted to New & Renewable Energy Department for land allotment and granting approval of the proposed project
- After verification, application was forwarded to revenue department by MPNRED for the land allotment to setup requested wind power project
- On order of DC Revenue Department, land was allotted to New and Renewable Energy Department, Madhya Pradesh
- On allotment of land by Revenue Department, MPNRED has granted the landuse permission for the land area given in **Table -2.7**

2.8.2.2 Land acquisition process for Private Land

As discussed earlier, transmission line and access road will be setup on private as well as revenue land. However, requirement of private land will be less as compared to revenue land. To acquire the private land following process is being adopted:

- First of all based on the micrositing guideline, private land parcels and Khasra number was identified
- Title search and due diligence studies for identified land parcels were completed to assess the family tree of land owners and any hidden issues

- The project was discussed with Gram Panchayat and NOC was also obtained
- Based on the outcomes of due diligence and title search study, land parcels were finalized and price was negotiated within Gram Panchayat meeting where price for private land was discussed and fixed
- According to the fixed price, land is being procured from individual landholders on a willing buyer and willing seller basis.

(a) Transmission line and Crop Compensation

For the purpose of laying of transmission line, application was submitted to the Madhya Pradesh Power Transmission Company Ltd. (MPPTCL) to obtain approval for preliminary survey. After obtaining approval, preliminary survey was conducted and details of tower profile and land were submitted to MPPTCL for final approval. The land was identified in the presence of Tehsildar (official of Revenue Department). Further, information viz., land owner name, khasra number, crops details, market price etc was also collected in the presence of Tehsildar. A notice was also given in local news paper about the identified land so that people can contact at project developer office if they have any concern in this regard. For the identified land parcels compensation was finalized in Gram Panchayat meeting. All the details regarding area statement, crops compensation and negotiated price was submitted to Tehsildar in Revenue Department office. On obtaining verification and approval, payment was paid to the land owners

TABLE 2-7: AREA STATEMENT - LAND USE PERMISSION PROVIDED BY MPNRED

S.No	Particulars	Land Area Requirement*	Total Land Area
1	**For WTGs installation** – DJE and UUPL	1.75 hectare per WTG	148.75 hectares for 85 WTGs
2	**For Road and Transmission line** • *11 KV line – 8 m width X real length* • *33 KV line – 16 m width X real length* • *132 KV line – 28 m width X real length*	-	-
3	**For Control Room**	40 m X 40 m	1600 sq.m. = 0.16 hectare
4	**For sub-station**		

a	*220 KV sub-station*	275 m X 275 m	75625 sq.m. (7.5 hectare)
b	*132 KV sub-station*	200 m X 200 m	40,000 sq.m. (4 hectare)
c	*33 KV sub-station*	75 m X 75 m	5625 sq.m. (0.5 hectare)
8	**For Vaccume Circuit Breaker (VCB) yard**	25 m X 25 m	625 sq.m. (0.06 hectare)
	Total land Area (hectare)		**160.97 hectares**

2.8.3 Water

During construction phase, water is required for preparing reinforced cement concrete for WTG foundations, building control room and security rooms, and domestic purposes such as drinking and washing of the construction workers and staff in labour camp. During operations, water will be required for domestic purposes only for the operations staff. The estimated quantities of water required during the construction and operation phases are presented below in **Table 2.8**.

TABLE 2-8: PROJECTED WATER REQUIREMENT FOR THE PROPOSED PROJECT

Phase	Activity	Max. Consumption
Construction	Domestic use – drinking and washing by 400 workers and staff (during peak construction phase)	62.1 KLD
Operation	Domestic use – drinking and washing by 30 site personnel	1.35 KLD

Water will be sourced through reputed water tanker service providers from nearby villages during both construction and operation phase of the proposed project to meet domestic and construction water requirements. Drinking water requirements of contractor workers and personnel will be met by nearest authorized drinking water contractor.

2.8.4 Workforce

It is anticipated that on an average 200 people will be required during construction phase. Out of 200 people approx 5-10 workmen will be on the rolls of DJ Energy and UUPL for the supervision of the project and the remaining will be on contract. The company shall ensure

that local accommodations with adequate food, water, sanitation facilities are hired for people working in project site. If in case, sufficient accommodations are not available, then only the labor camps will be set up with adequate food, water, sanitation facilities etc. The contractor workforce will comprise of both skilled and unskilled labors and is likely to be sourced from the nearby villages depending on their skills and capabilities. Less than 5% of the total workforce will be female and we expect a project to generate indirect employment of about 100-120 people (5-6 people per village). During the operations phase approx.50 people will be deployed on site including security guards.

2.9 WASTE GENERATION

The maximum waste generation in wind power project is anticipated in construction phase only. However, major part of the waste will be of construction waste. Organic waste is anticipated from the labour camp.

2.9.1 Solid Waste

The solid waste generated from the wind power project will include organic waste from labour camp, civil construction waste and metallic waste. All these wastes will be collected separately in an isolated covered storage area. The earth material generated due to civil construction will be used in back filling and road preparation, while the metallic waste will be sold to the vendors. The organic waste generated from the onsite labor camp (if any) will be disposed on a nearby identified site. During operation phase, solid waste generation is not anticipated.

2.9.2 Liquid Waste

The liquid waste which is anticipated during the construction phase is sewage from labour camp. The sewage generated from the labour camp will be disposed through septic tank soak pit system. Considering the 80% of domestic water consumption as sewage generation, total - 49.6 KLD waste water will be generated during construction phase whereas during operation phase this quantity will be 1 KLD which is considerable low

2.9.3 Hazardous waste

The hazardous wastes anticipated from the wind power project are diesel oil, used oil and transformer oil (in operational phase only). These wastes will be stored on paved area. Further, storage area for these wastes will be covered and isolated.

2.10 INFRASTRUCTURAL FACILITIES

2.10.1 Construction Phase

During construction phase, all the basic amenities like drinking water, sanitation, rest room, and kitchen will be provided for the contractual labour. If all these facilities are in contractor's scope of work then DJE and UUPL will ensure its availability.

2.10.2 Operational Phase

During operational phase, drinking water, sanitation facility along with septic tank and soak pit system will be provided at the control room.

2.11 PROJECT SPECIFIC TEAM AND ORGANIZATIONAL STRUCTURE

2.11.1 Project Specific Team Structure

In the development of proposed project, project specific structure as shown in Figure 5 will be followed. The roles and responsibilities associated with the project team structure have been distributed within the various contractors by DJE and UUPL. As it can be seen in Figure -4 that land acquisition will be take completed by in house team of Continuum whereas installation of WTG and development of power evacuation infrastructure will be facilitated by third party contractors. However, DJE and UUPL will monitor the contractors work.

2.11.2 Organizational Structure

The organizational structure of Continuum for the development of wind power project is shown in Figure -6.

Roles and Responsibility

During construction phase, engineers, manager-civil and admin accountant will be available to ensure the monitoring and supervision of contractors work and their reporting will be to the DGM projects who will assist VP projects for wind business. To manage the EHS issues during the construction phase, an EHS officer will be available who will also report to VP Projects – Wind Business. It will be the responsibility of EHS officer to address all the EHS issues. He/she will also coordinate with contractors on EHS issues .

In operational phase, an engineer will be available at the site who will support Deputy Managers for the smooth operation of project. The Deputy Manager will report to the VP-O&M services during operational phases of the project.

FIGURE 5: PROJECT SPECIFIC STRUCTURE

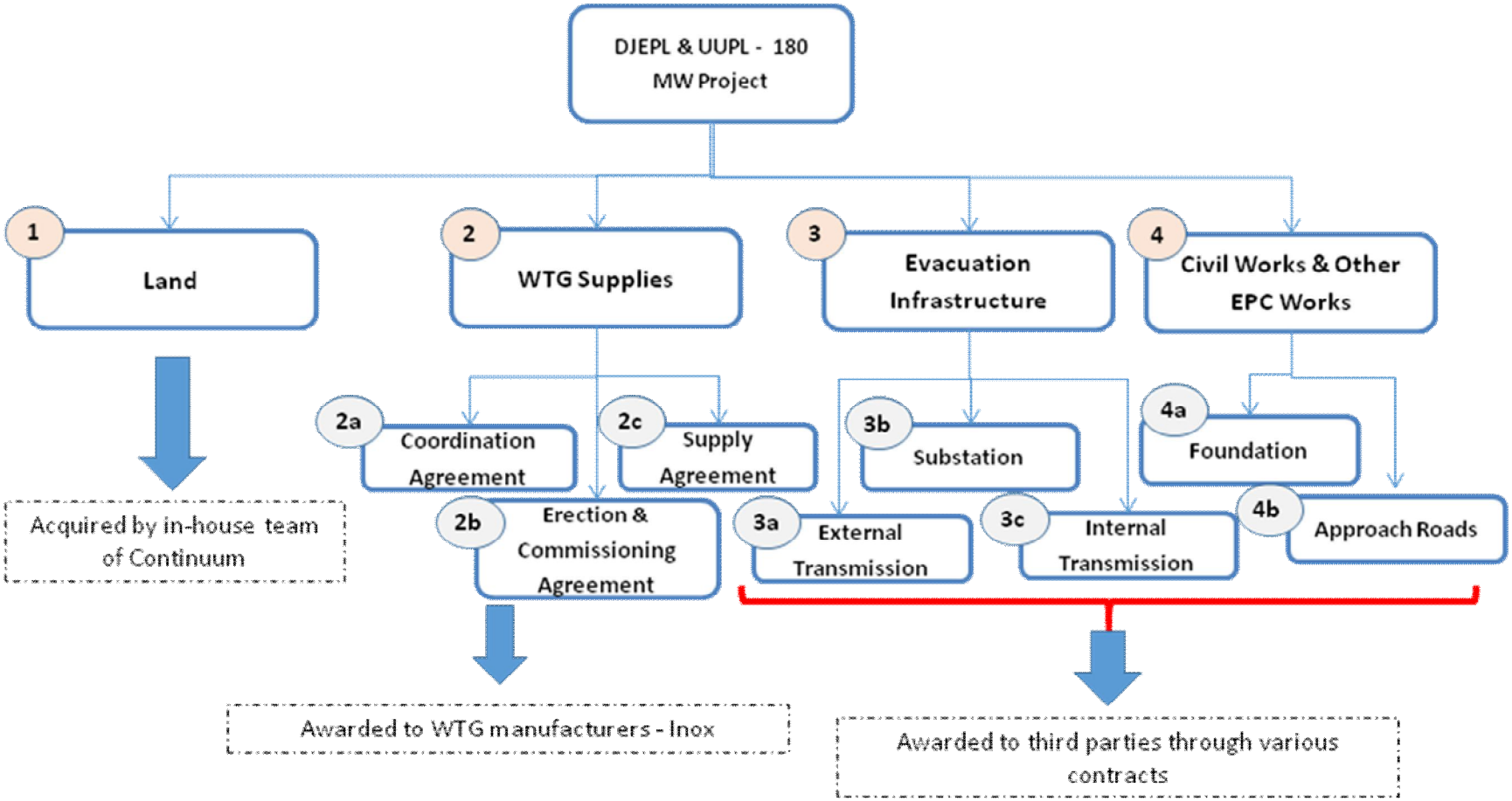
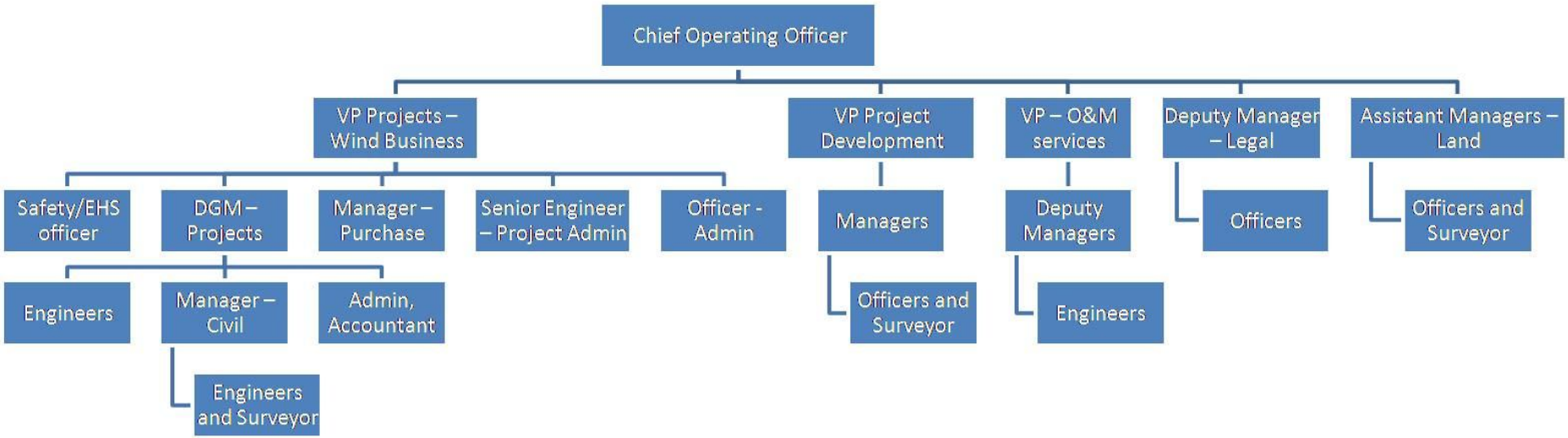


FIGURE 6: ORGANIZATIONAL STRUCTURE



2.12 PROJECT IMPLEMENTATION SCHEDULE

PROJECT STATUS AT PRESENT

All WTG land parcels are government revenue land and have been allotted to DJ & UUPL (company). Substation land is also allotted by revenue department. Most of the pathways are in revenue land and at most of the places tar roads /villages roads are available. Village roads require dressing at most of the places. Title, easementary rights, consents, as the case may be, for remaining land parcels shall be acquired by end of April 2014.

220KV line works are under progress. This 21 km line consists of 62 towers and out of that 50 tower foundations are already laid and three towers are already erected. Line is expected to ready for charging by end of March 2014, although we may delay charging.

PROJECT STRATEGY

BoP for wind farm costs about 15% (entire transmission system, all roads and foundations). These 15% cost items consume maximum time in windfarm development. Hence it is planned to start BoP first, followed by construction of 28 foundations ready for erection work, Turbines delivery at site shall be synchronized with completion of 28 foundations out of 85 locations.

85 locations will be divided into three phases of 28, 28 and 29. Turbine phases are clubbed with planned six feeder lines. (Phase I - F1 & F2, Phase II – F3 & F4, Phase III – F5 & F6)

We are budgeting twelve weeks for unexpected delays and resource planning is done on the basis of completion date of March 31, 2015. The detailed project implementation scheduled is given below:

S.No	Component	Start date	Completion date	Remarks	Order Placement
1	Completion of roads	April 1, 2014	Phase I/II in six months, Phase III progressively in 12 months	Land rights shall be acquired by March 2014	March 01, 2014 conditional to financial close
2	220 KV transmission line	October 2013	May 2014	May delay conductor stringing	Done
3	Internal Transmission network	April 1, 2014	October 31, 2014	Phase I and II – Internal lines along the roads and feeder lines shall be done first at the time of erection. Right of	March 01, 2014 conditional to financial close

				way for poles for 33KV lines is taken during the works of laying the line. This practice has been followed in Bothe project as well as for 220KV line for Ratlam project.	
4	Internal Transmission Network	November 01. 2014	February 28 , 2015	Phase III - –Internal lines along the roads and feeder lines shall be done first at the time of erection. Right of way for poles for 33KV lines is taken during the works of laying the line. This practice has been followed in Bothe project as well as for 220KV line for Ratlam project.	as above
5	Substation work	April 01 , 2014	October 31, 2014	Five Months for erection and 2 months for commissioning	March 2014 conditional to financial close
6	Foundation Casting	May 01, 2014	January 15, 2015	Break during monsoon season	April 01, 2014
7	Erection work	October 01, 2014	February 15, 2015	One erection per week per crane or four erection per week with four cranes = 21 weeks	WTG order by March 01, 2014 conditional to financial close
8	SMS (HT Yard substitute)	October 01 , 2014	February 15, 2015	Delivery of five units at site per week	May 01, 2014

3 SOCIAL & 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. The details have been provided in the **Table 3.1** below.

TABLE 3-1: SOCIAL & ENVIRONMENTAL COMPLIANCE REQUIREMENTS

S. No	Regulation/Guidelines/Policy/Orders/IFC Performance Standard	Applicability
•	Hazardous Waste (Management, Handling &Trans boundary Movement) Rules 2008 as amended	Although nominal quantities of waste oil is likely to be generated during operation and maintenance of DG set, it is categorized as a hazardous waste and need to be managed in accordance to the HWMH Rules which requires all such wastes to be disposed through State Pollution Control Board authorized recyclers. During construction and O&M stage the DG set will be hired on need basis only, hence it will be managed by either sub-contractor or owner.
•	Contract Labour (Regulation & Abolition) Act 1970 and Rules	This Act provides for the regulation the employment of contract labor in certain establishments and to provide for its abolition in certain circumstances and for matters connected therewith. This Act requires for the registration of the establishment by principal employer and licensing of the contractor engaging 20 no. or more contract labour onsite. It also specifies the welfare measures (canteen, rest room, first aid & sanitation facilities, crèche, drinking water arrangements etc.) to be implemented by the contractors for onsite workers, liability of the principal employer and appropriate registers and records to be maintained by the contractors with respect to overtime, wages, fines, advances, deductions etc. As EPC contractors will be deploying approx300 nos. labors during project peak construction phase for installation of WTGs. It is mandatory that valid license is obtained to this regard including provision of appropriate welfare measures viz. arrangement for sanitation, drinking water, first aid etc. for the onsite contractual workers/laborers.

S. No	Regulation/Guidelines/Policy/Orders/IFC Performance Standard	Applicability
•	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. As discussed for the Contract Labour Act the provision for this Act also needs to be complied by the EPC contractor and sub-contractors for the project.
•	The Minimum Wages Act 1948	This Act provide for fixing minimum rates of wages in certain employments and requires the employer to provide to every worker engaged in a scheduled employment to be paid wages at a rate not less than the minimum rate of wages fixed by such notification for that class of employees in that employment without any deductions except as may be authorized within such time and subject to such conditions as may be prescribed.
•	Workmen Compensation Act 1923 and Rules	The objective of this Act is that in the case of an employment injury compensation be provided to the injured workman and in case of his death to his dependents. Hence any injury or death of workmen that may arise under any accidental circumstance during the proposed project development need to be compensated under the provision of the is Act as specified under: In case of death - an amount equal to 50% of the monthly wage multiplied by the relevant factor as given in Schedule IV of the Act or Rs. 80,000/- whichever is more. In case of permanent total disablement, it is 60% or Rs. 90,000/- whichever is more and In case of permanent partial disablement occurs then the compensation is proportionate to the disability arrived as at above.

S. No	Regulation/Guidelines/Policy/Orders/IFC Performance Standard	Applicability
•	Revised Guidelines for Wind Power Projects - No.66/241/95-WE/PG Government of India	The proposed wind farm project requires installation of duly tested and certified quality equipment with a view to optimize energy generation. MNES has drawn up a list of manufacturers with models of wind turbines of unit capacity 225 KW and above that have obtained type approval, including power curve certification, from designated international Test Stations and Classification Societies. The WTG manufacturer has to take type approval certificate from designated certified authority Wind project developer its contractor is required to submit detailed monthly performance report in the operational phase to the SEBs/SNAs, along with a copy to MNES, as per the format specified in the said guidelines.
•	Micro-siting Guidelines for Wind Power Projects	As per the wind power project policy, the distance between the proposed WTG with adjacent existing WTG, if any, or an existing application with MPUVN, for a proposed WTG, formed in row should be at least three times (3D) the diameter of the rotor. Row should be formed in such way that it is perpendicular to the predominant wind direction. The distance between the rows should be at least five times diameter (5D) of the Rotor, so that performance of the WTGs should not be affected in any manner. Considering a rotor diameter of 93m/100m (INOXWT2000DF) for the WTGs the distance between two adjacent WTGs for the proposed need to be kept at 279m & 300m respectively while the distance between two WTG rows in to be maintained at 465 & 500m for 93m & 100 m rotor diameter respectively
•	Performance Standard 1 - Social and Environmental Assessment and Management Systems	PS1 requires Social and Environmental Impact Assessment (SEIA) study for a proposed project to be undertaken to assess potential risks and impacts described in the Performance Standards. This Standard also requires that the project

S. No	Regulation/Guidelines/Policy/Orders/IFC Performance Standard	Applicability
		proponent should disclose the details of the project to all the stakeholders and understand their views and concerns regarding the project. The standard also requires that affected communities are appropriately engaged on issues that could potentially affect them and promote improved social and environment performance of companies through the effective use of management systems.
•	Performance Standard 2 – Labour& Working Conditions	The primary objective of IFC PS2 is to establish, maintain and improve the worker-management relationship; promote the fair treatment, non-discrimination and equal opportunity of workers, and compliance with national labor and employment laws; protect the workforce by addressing child labor and forced labor; and promote safe and healthy working conditions.
•	Performance Standard 3 – Pollution Prevention & Abatement	The primary objective of IFC PS3 is to avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities. With respect to the proposed project potential adverse impacts on community health and environment is manifested through point source and fugitive dust emission from construction phase activities, disposal of domestic waste, sewage & waste oil, noise from operation of heavy machineries/equipment, conflict with competing user of surface/ground water etc. .
•	Performance Standard 4 – Community Health, Safety & Security	The primary objective of IFC PS4 is to 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 and to 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. Potential

S. No	Regulation/Guidelines/Policy/Orders/IFC Performance Standard	Applicability
		community health and safety risks is envisaged in the form of vehicular traffic accidents particularly those involved in material movement during construction phase and sudden fall of wind mill tubular tower and/or dislodging of rotor blades under emergency circumstances. .
•	Performance Standard 5 – Land Acquisition and Involuntary Settlement	The primary objective of IFC PS5 is to avoid or at least minimize involuntary resettlement wherever feasible by exploring alternative project designs; to mitigate adverse social and economic impacts from land acquisition or restrictions on affected persons' use of land; and to improve or at least restore the livelihoods and standards of living of displaced persons. .
•	Performance Standard 6 – Biodiversity Conservation & Sustainable Resource Management	The primary objective of PS 6 is to protect and conserve biodiversity and to promote the sustainable management and use of natural resources through the adoption of practices that integrate conservation needs and development priorities. .
•	Performance Standard 7 – Indigenous People	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 – Cultural Heritage	This Performance Standard requires that the

S. No	Regulation/Guidelines/Policy/Orders/IFC Performance Standard	Applicability
		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. .
•	IFC General EHS Guidelines	The impacts associated with typical construction activities are as follows: • Construction site waste generation • Soil erosion and sediment control from material sourcing areas and site preparation activities • Fugitive dust and other emissions (e.g. from vehicle traffic, land clearing activities, and material stockpiles) • Noise from heavy equipment and truck traffic • Potential for hazardous materials and oil spills associated with heavy equipment operation and fueling activities These impacts will also exist during the development wind power project and should be minimized by applying the mitigation measures as identified in IFC general EHS guidelines
•	IFC EHS guidelines – Wind Energy	The EHS issues specific to the wind energy sector has been identified by IFC and are as follows: Working at Heights: Working at heights may be required during construction activities, including the assembly of wind tower components and general maintenance activities during operations. Public Access: Safety issues may arise with public access to wind turbines (e.g. unauthorized climbing of the turbine) or to the wind farm substation.

S. No	Regulation/Guidelines/Policy/Orders/IFC Performance Standard	Applicability
		Visual Impacts: Depending on the location and local public perception, a wind farm may have an impact on visual resources. Visual impacts associated with wind energy projects typically concern the turbines themselves (e.g. color, height, and number of turbines) and impacts relating to their interaction with the character of the surrounding landscape. Noise: Wind turbines produce noise when operating. The noise is generated primarily from mechanical and aerodynamic sources. Mechanical noise may be generated by machinery in the nacelle. Aerodynamic noise emanates from the movement of air around the turbine blades and tower. Species Mortality or Injury and Disturbance: The operation of onshore wind turbines may result in collisions of birds and bats with wind turbine rotor blades and / or towers, potentially causing bird and bat mortality or injury. Shadow Flicker and Blade Glint: Shadow flicker occurs when the sun passes behind the wind turbine and casts a shadow. Similar to shadow flicker, blade or tower glint occurs when the sun strikes a rotor blade or the tower at a particular orientation. Aircraft and Marine Navigation Safety: If located near airports or known flight paths, a wind farm may impact aircraft safety directly through potential collision or alteration of flight paths.
•	IFC EHS guideline for Electric Power Transmission and Distribution	The EHS issues identified by IFC due to electric power transmission and distribution line are as follows: Terrestrial Habitat Alteration: The construction and maintenance of transmission line right of way, especially those aligned through forest areas, may result in alteration and disruption to terrestrial habitat, including impacts to avian

S. No	Regulation/Guidelines/Policy/Orders/IFC Performance Standard	Applicability
		species and an increased risk of forest fires. In present case, disruption will be less, since T line is not passing through any forest areas. Aquatic habitat alteration: Power transmission and distribution lines, and associated access roads and facilities, may require construction of corridors crossing aquatic habitats that may disrupt watercourses and wetlands, and require the removal of riparian vegetation. In addition, sediment and erosion from construction activities and storm water runoff may increase turbidity of surface watercourses. However, aquatic habitat disruption is not anticipated due to absence of any route of access road and T line through any watercourses. Electric and magnetic fields may have adverse health effect on the human therefore preventive measures as recommended in IFC guidelines should be considered Hazardous materials: It includes insulating oils/gases (e.g. Polychlorinated Biphenyl (PCB) and Sulphur Hexafluoride (SF6) and fuels. The measures as recommended in IFC guideline, associated with storage, handling and disposal should be followed

4 DESCRIPTION OF ENVIRONMENT

4.1 PHYSICAL ENVIRONMENT

4.1.1 Air Environment

Rainfall and Climate

The climate of the Mandsaur and Ratlam district is semi-tropical characterized by hot summer and well-distributed rainfall during the southwest monsoon. The year can be divided in four seasons. The winter commences from December and lasts up to February. January is the coldest month with temperature falling 9.8^0C. The period from March to first week of June is the summer season. May is the hottest month when the temperature may go up to 39.8^0C. The monsoon starts from middle of June to the first week of October. October and November constitute the post monsoon or retreating monsoon period. During the southwest monsoon season the relative humidity generally exceeds 87 % (August month). The driest part of the year is the summer season, when relative humidity is less, around 26%. April is the driest month of the year.

The wind velocity measured at a height of <10 m/s in IMD – Neemuch (nearest observatory), represent higher wind velocity during the pre-monsoon period as compared to post monsoon period. The highest wind velocity measured in June month is 4.63 m/s and minimum during the month of November (1.3 m/s). The average normal annual wind velocity in the area is 2.5 m/s. The average annual rainfall in study area is 859.5 mm. The study area receives maximum rainfall during southwest monsoon period i.e. June to November. About 90.5% of annual rainfall is received during monsoon season. Only 9.5% of annual rainfall takes place between Octobers to May period. The surplus water for groundwater recharge is available only during the southwest monsoon period. During the year 2006 maximum rainfall 953.4 mm was received at Garoth and minimum rainfall was received at Sitamau is 746.2 mm.

TABLE 4.1[1]: THE NORMAL CLIMATOLOGICAL PARAMETERS OF NEEMUCH OBSERVATORY

S. No	Parameter	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
1	Maximum Temp. ^{0}C	24.6	27.7	32.9	37.5	39.8	36.9	31.3	29.4	31.1	32.8	29.4	26.0	31.6
2	Minimum Temp. ^{0}C	9.8	12.3	17.4	22.6	25.9	25.7	23.9	23.1	22.2	19.3	14.5	10.9	19.0
3	Relative Humidity (%)	52	41	31	26	41	67	84	87	78	53	46	54	55
4	Wind Velocity (km/hr.)	5.8	6.6	7.6	9.0	13.2	16.7	14.7	12.6	9.4	5.7	4.7	4.9	9.2
5	Rainfall (mm)	3.7	2.7	5.5	1.1	10.1	101.5	272.0	254.9	149.3	35.6	18.6	4.5	859.5

[1] District Ground Water Information Booklet, Mandsaur, MoWR, CGWB NCR, GoI, July,2009

4.1.2 Ambient Air Quality

The existing quality of the ambient air environment serves as an index for assessing the pollution load and the assimilative capacity of any region and forms an important tool for planning project activities in the area. A detailed assessment of the existing air environment was undertaken for the purpose mentioned above.

The ambient air quality monitoring was conducted at four representative locations across the entire wind farm proposed. The baseline air quality status of the study area was primarily assessed by monitoring for particulates and gaseous pollutants at these four stations located within the block (**Refer Figure 11**). The monitoring network was established based on the following key criteria;

- Regional Meteorology
- Important receptor locations (eg. prominent villages and settlement.);
- Site reconnaissance survey and professional judgment

The ambient air quality monitoring was carried out in accordance with guidelines of Central Pollution Control Board (CPCB) of June 1998 and National Ambient Air Quality Standards (NAAQS) of CPCB of November 2009. Air quality monitoring was carried out for 24 hours a day twice a week for Particulate Matter (PM_{10} and $PM_{2.5}$), Sulphur Dioxide (SO_2) and Oxides of Nitrogen (NOx), and 8 hours a day twice a week for Carbon Monoxide (CO). The summary of ambient air quality results are presented in **Table 4.2**.

4.1.2.1 Interpretation of Air Quality Results

Particulate Matter (PM_{10}): The average PM_{10}values at all the monitoring locations ranged between 75.87 to 90.07 $\mu g/m^3$. The average PM_{10} concentrations at all stations were found to be in compliance to the stipulated PM_{10} standards specified for residential area i.e. 100 $\mu g/m^3$.

Particulate Matter ($PM_{2.5}$): The average $PM_{2.5}$values at all the monitoring locations ranged between 40.84 to 48.16 $\mu g/m^3$. The average $PM_{2.5}$ concentrations were observed to be below the stipulated standards of CPCB for residential areas (60 $\mu g/m^3$) at all the air quality monitoring locations.

*Oxides of Nitrogen (NO_x):*The average NO_x values at all locations were observed in the range of 14.36 to 19.09 $\mu g/m^3$ which are in compliance to the NAAQS specified for Oxides of Nitrogen (80 $\mu g/m^3$).

Sulphur dioxides (SO_2): Average Sulfur dioxide values at all locations were found to be ranging between 12.07 to 15.45 $\mu g/m^3$and in compliance with NAAQS for sulfur dioxide (80 $\mu g/m^3$).

Carbon Monoxide (CO): Average carbon monoxide values at all locations were found below 2 mg/m^3 for all the air samples collected from the monitoring locations and are in compliance to the NAAQ standard 2 mg/m^3.

Analysis result of air quality monitoring within the block reveals that all the parameters at all monitoring locations are well within the limit(as shown graphically from **Figure 7 to 10** which can be primarily attributed to the predominance of rural areas within the block.

FIGURE 7: PM10 LEVELS RECORDED AT AAQ STATIONS

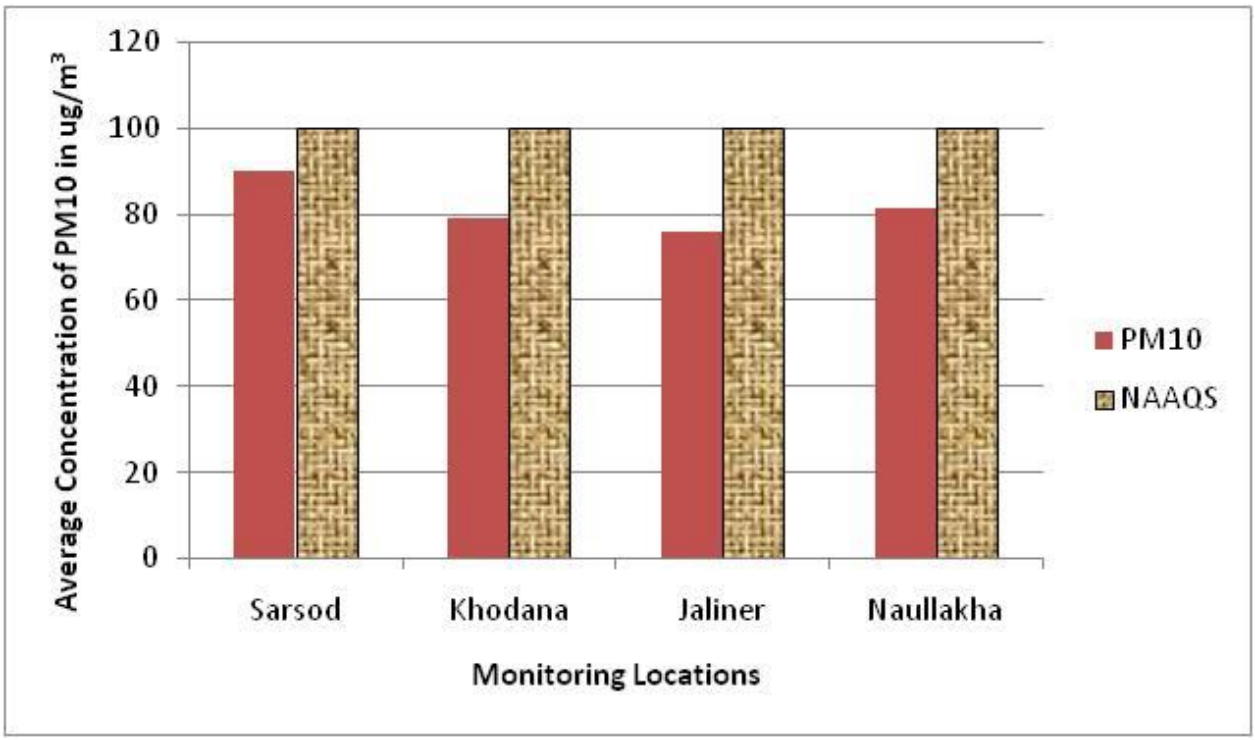


FIGURE 8: PM2.5 LEVELS RECORDED AT AAQ STATIONS

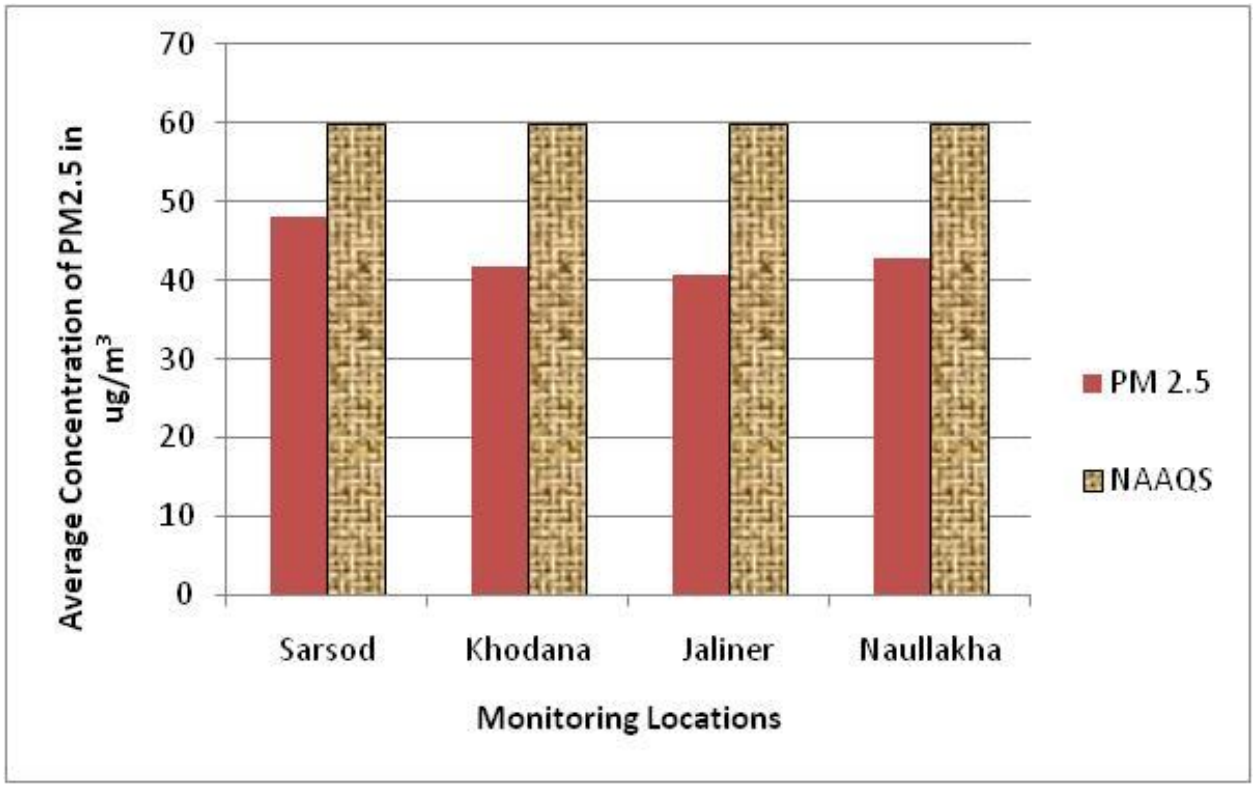


FIGURE 9: NO_X LEVELS RECORDED AT AAQ STATIONS

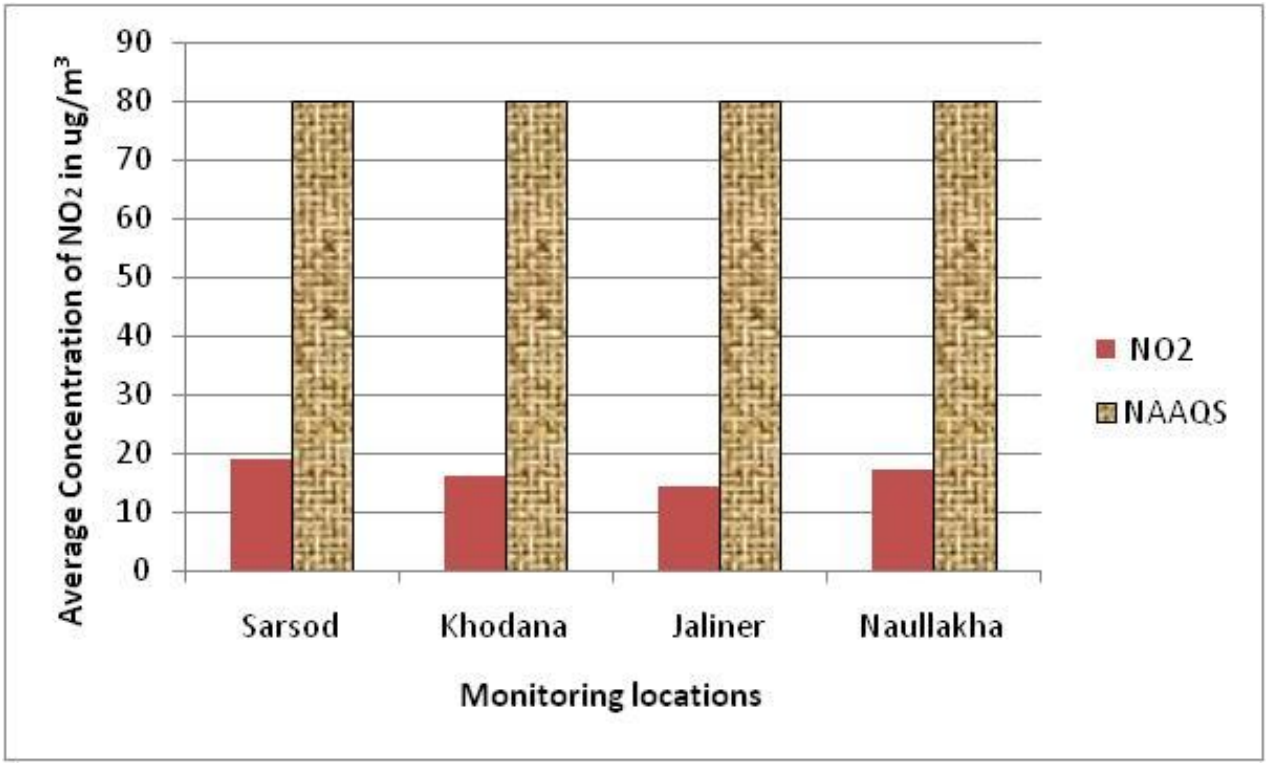


FIGURE 10: SO_2 LEVELS RECORDED AT AAQ STATIONS

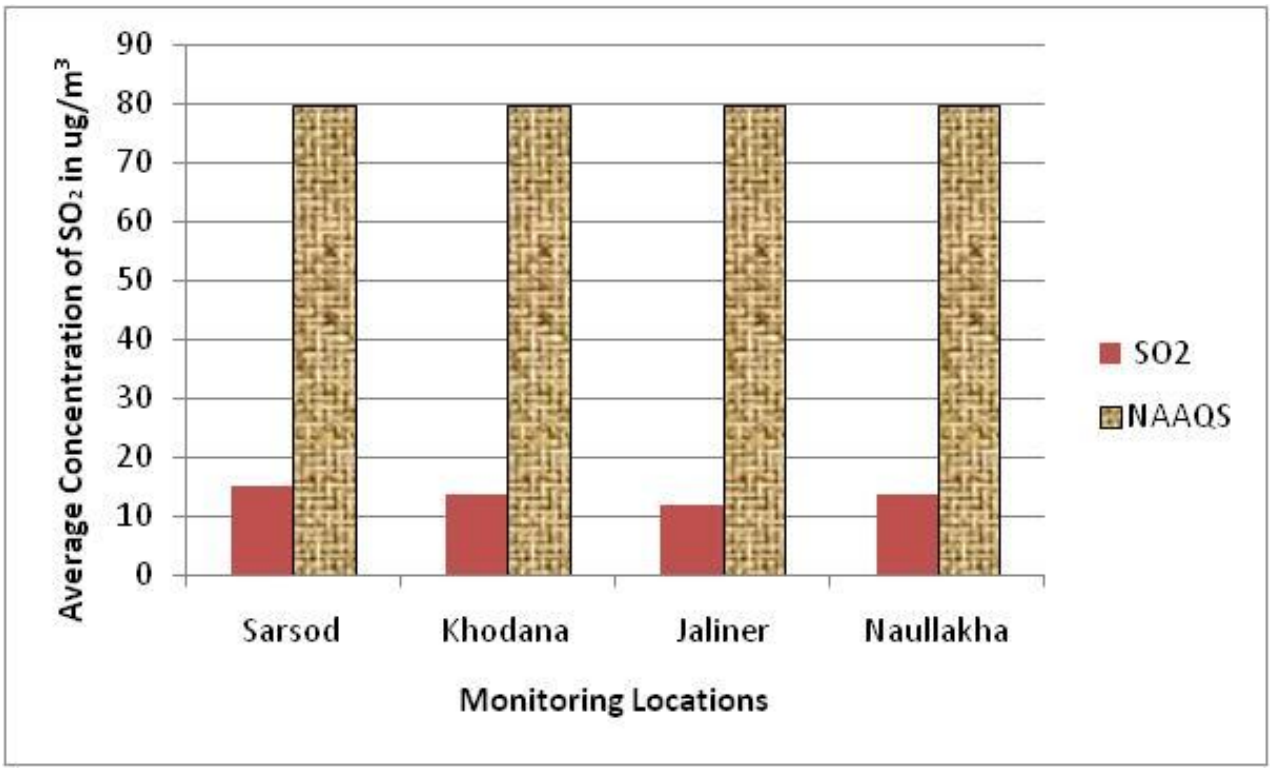


FIGURE 11: MONITORING LOCATIONS MAP

Surface Water Monitoring Locations

Soil Monitoring Locations

Air Monitoring Locations

Ground Water Monitoring Locations

Noise Monitoring Locations

TABLE 4.2: AMBIENT AIR MONITORING RESULTS

Parameter	Unit	Statistics	AQ1	AQ2	AQ3	AQ4
			Sarsod	**Khodana**	**Jaliner**	**Naullakha**
$PM_{2.5}$	µg/m³	Maximum	49.03	42.34	41.23	43.70
		Minimum	47.3	41.2	40.45	42.23
		Average	***48.16***	***41.77***	***40.84***	***42.96***
		NAQQS-CPCB	**100**	**100**	**100**	**100**
PM_{10}	µg/m³	Maximum	90.34	79.37	76.76	81.79
		Minimum	89.8	78.7	74.98	80.73
		Average	***90.07***	***79.03***	***75.87***	***81.26***
		NAQQS-CPCB	**60**	**60**	**60**	**60**
Nitrogen Oxides	µg/m³	Maximum	19.23	16.4	15.4	17.45
		Minimum	18.96	15.96	13.32	16.56
		Average	***19.09***	***16.18***	***14.36***	***17.0***
		NAQQS-CPCB	**80**	**80**	**80**	**80**
Sulphur Dioxides	µg/m³	Maximum	16.45	14.43	12.7	14.43
		Minimum	14.45	13.7	11.45	13.43
		Average	***15.45***	***14.06***	***12.07***	***13.93***
		NAQQS-CPCB	**80**	**80**	**80**	**80**
Carbon Monoxide	mg/m^3	Maximum	<0.2	<0.2	<0.2	<0.2
		Minimum	<0.2	<0.2	<0.2	<0.2
		Average	**-**	**-**	**-**	**-**
		NAQQS-CPCB	**2**	**2**	**2**	**2**

4.1.3 Ambient Noise Quality

The ambient noise monitoring was conducted in January 2014 (winter season) at four locations within the study area. The noise monitoring network was established based on the understanding of the proposed project activities and professional judgment. The location of the ambient noise quality stations have been represented in the **Figure -11** for reference.

Sound pressure level (SPL) measurements in dB (A) were recorded for every hour continuously for 24 hours at 15 minutes interval for the aforesaid monitoring stations and equivalent noise levels in the form of Leq day and Leq night was computed. The results so obtained were compared with the standard specified in Schedule III, Rule 3 of Environmental Protection Rules. The summary of noise quality results are presented in **Table 4.3** below.

4.1.3.1 Interpretation of Noise Quality Results

The equivalent day time noise levels at all the monitoring stations are within the range of 57.62 to 64.93 dB (A) and are more than the day time noise standards (55 decibels) specified for residential area. The higher value of noise level during day time may be due to commercial activities and vehicles movement in the area. The night time noise levels at all the monitoring stations were found to be in the range of 40.05 to 43.87 dB (A) and were in compliance to the night time noise standards (45 decibels) specified for residential area.

TABLE 4.3: AMBIENT NOISE MONITORING RESULTS (IN DECIBELS)

S. No.	Test Parameters	NQ1 Jaliner	NQ2 Bhatkheda	NQ3 Pingrala	NQ4 Khodana	NQ5 Sarsod	NQ6 Naullakha	NQ7 Jethana	NQ8 Bagiya	NQ9 Jadwasa	NQ10 Naveli	NQ11 Richa Devda	NQ12 Near Substation Bhatkheda	Requirement (as per CPCB Guidelines) Limits in dB(A) Leq. Residential Area	
														Leq (day)	Leq (night)
1.	Lmin dB(A)	37.1	37.8	38.2	36.9	40.1	38.3	36.8	38.2	37.8	38.7	35.3	35.8	55	45
2.	L10 dB(A)	62.71	61.38	60.23	62.13	68.39	61.79	61.15	61.11	64.11	60.6	62.41	60.27		
3.	L50 dB(A)	55.5	54.9	53.6	55.15	59.4	56.0	56.45	57.85	58.05	52.1	59.85	56.0		
4.	L90 dB(A)	39.96	38.99	39.99	39.17	42.02	39.83	39.01	39.16	38.82	39.62	39.39	38.83		
5.	Leq dB(A)	59.49	57.37	56.32	58.54	63.40	59.26	57.62	57.78	60.90	56.34	59.71	57.31		
6.	Lmax dB(A)	67.2	62.8	61.8	65.2	70.1	66.9	61.8	61.4	70.6	61.3	63.8	63.2		
7.	Leq-Day dB(A)	**60.95**	**58.94**	**57.62**	**59.96**	**64.93**	**60.77**	**59.17**	**59.18**	**62.56**	**57.97**	**60.90**	**58.83**		
8.	Leq-Night dB(A)	40.55	42.10	43.87	42.98	43.19	43.08	42.90	42.55	42.41	40.05	42.47	40.73		

4.1.4 Soil Quality

Geomorphology

Topography: The study area in Mandsaur & Ratlam district is covered by Malwa Plateau, by gently sloping topography ranging the elevation between 445 m and 518 m above mean sea level. Main surface water divide Chambal sub basin from Shiva micro-basin. Shivna is tributary of Chambal River and flowing in the ENE-WSW direction in southwestern parts of the area. Physiographically, the area is characterized by a rather flat topography with a view peculiar hillocks at various places, prominenet hill occurs at southwestern part of the study area having an elevation of 483 m near Sawakhera village.

Prominent isolated residual hillocks formed of Deccan Trap basalt are observed in north part of Bhanpura town is forming northern plateau area, consisting of Vindhyan formation. Northern plateau area is highly undulating in topography and forming escarp running northwest, southeast direction. Highest elevation of the escarpment is 510 m above mean sea level, located north of village Kotri.

Landforms: The land form of the study area includes mounds, soil representing erosional and depositional features respectively. The basaltic lava flows in horizontally disposed and resulting in almost flat-topped hills developed at places. The lava plains cover most of the areas.

Soils

The soils in the study area is generally of four types:

1. Black cotton soil
2. Red loamy soil
3. Laterite soil
4. Alluvial soil

Black cotton soil is derived from weathering and disintegration of basaltic lava flow. Major parts of the Mandsaur and Ratlam district are covered by black cotton soil. Red loamy soils consist of sandy loam to clayey loam and brick in colour. This soil is derived from Vindhyan sandstone and shales and occurring in valley portion on the plateau and adjacent to hill composed of Vindhyan sandstone. This type of soil covers a northern part of the Mandsaur district. Laterite soil dark brown to pink coloured lateritic soil is found as capping over hillocks of basaltic terrain. Alluvial soils are greyish yellow to brownish yellow in colour and occupy along the major rivers.

4.1.4.1 Interpretation of Primary Soil Monitoring Results

Soil samples were undertaken at three locations as shown in **Figure -11**. Based on the particle size distribution obtained from the soil analysis, the texture of soil at the project site is sandy silty. The result shows that the water holding capacity of the soil is 12.43 – 21.34 %. Soil of the area is basic with a pH in the range of 8.1 – 8.7. The organic matter content of the collected samples is in the range of 0.6-0.81 %.

TABLE 4-4: SOIL MONITORING RESULTS

S.No.	Test Parameters	Unit	SQ1 – Sarsod (Agriculture Land Soil)	SQ2 – Jethana (Agriculture Land Soil)	SQ3 – Bhatkheda (Barren Land Soil)	Test Method
1	pH	-	8.3	8.1	8.7	IS 2720(P-26)-1987, Reaff-2007
2	Conductivity	µS/cm	903	919	503	IS 2720(P-21)-1977, Reaff-2006
3	Potassium as K	mg/Kg	137.1	133.8	85.9	AAL/SOP/ENV/010-D
4	Total Kjeldahl Nitrogen	% by mass	0.43	0.61	0.24	AAL/SOP/ENV/010-C
5	Organic Matter	% by mass	0.71	0.81	0.6	IS 2720(P-22)-1972, Reaff-2005
6	Magnesium (as Mg)	Meq/100gm	17.5	22.5	15.7	AAL/SOP/ENV/010-B
7	Water Holding Capacity	% by mass	12.43	15.43	21.34	AAL/SOP/ENV/010-H
8	Bulk Density	gm/cc	1.2	1.21	1.12	-
9	Zinc	mg/Kg	<1.0	<1.0	<1.0	By AAS
10	Iron	mg/Kg	<1.0	<1.0	<1.0	By AAS
11	Chloride	% by mass	0.11	0.12	0.13	AAL/SOP/ENV/010-F
12	Sodium	mg/Kg	389.3	403.7	304.6	AAL/SOP/ENV/010-D
13	Cation Exchange Capacity	Meq/100gm	22.43	21.23	25.43	IS 2720(P-24)-1976, Reaff-2005
14	Phosphate	mg/Kg	50.43	101.3	49.34	AAL/SOP/ENV/010-G
15	Sulphate	mg/Kg	89.73	25.73	21.34	-
16						
(a)	Sand	% by mass	78.75	76.25	80.75	IS 2720(P-4)-1985, Reaff. 2001

(b)	Silt	% by mass	12.25	12.25	11.25	IS 2720(P-4)-1985, Reaff. 2001
(c)	Clay	% by mass	9.0	11.50	8.0	IS 2720(P-4)-1985, Reaff. 2001

4.1.5 Land Use

Mandsaur district is located on northwest part of Madhya Pradesh state. The district is bounded by Neemuch district in the north, Ratlam district in the south, Banswara district of Rajasthan state in the west and Jhalawar district of Rajasthan state in the east. The district area extends between the parallels of latitude 23^0 46' and 24^0 45' North and between the meridians of longitude 74^0 44' and 75^0 54' East, and it is falling in the Survey of India Topo Sheet No. 45P and 46M. In past three decades industries had rapidly grown up in the district. Mandsaur is mainly agriculture-based district and its cropping pattern is diversified. Mandsaur district is well connected by roads and rail. The total geographical area of the district is 5,517 Sq.Km

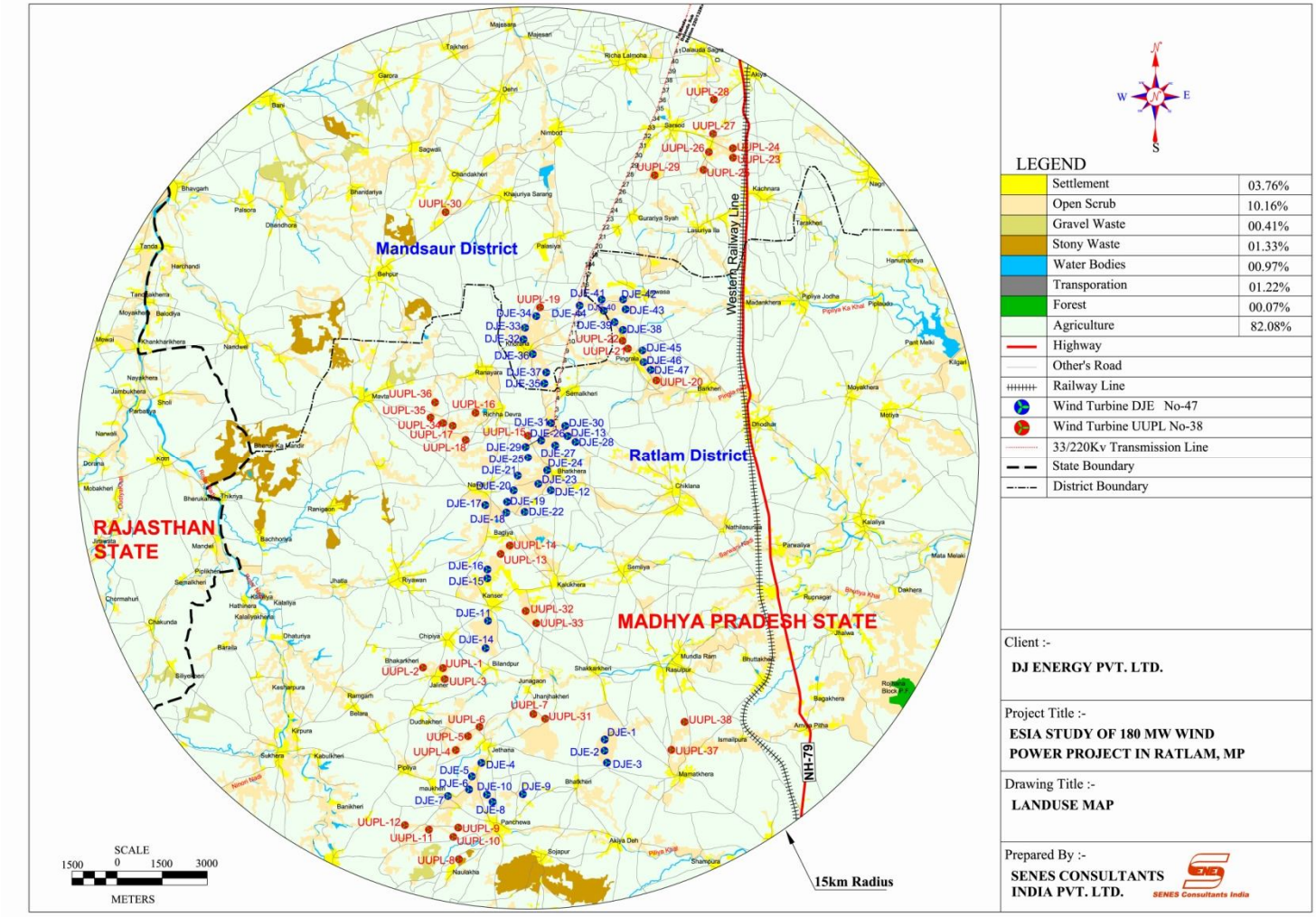
Ratlam district with a geographical area of 486000 hectares has cultivable land (333000 hectares) as the major land use followed by barren and uncultivable land (41600 hectares). The other types of land use in the district are forest area (34300 hectares), land under nonagricultural use (30700 hectare), Permanent Pastures (28600 hectares), cultivable wasteland (15200 hectares), current fallows (1300 hectares) and old fallows (1100 hectares)

Mandsaur district with a geographical area of 551790 hectares has cultivable land (358700 hectares) as the major land use followed by barren and uncultivable land (47700 hectares). The other types of land use in the district are forest area (38600 hectares), land under nonagricultural use (73800 hectare), Permanent Pastures (14300 hectares), cultivable wasteland (15700 hectares), current fallows (1900 hectares) and old fallows (1100 hectares)

4.1.5.1 Study Area Land Use

The land use map for the project site at Mandsaur and Ratlam district has been prepared through satellite image and Survey of India Topo sheet. Analysis of land use map reveals that major land use within the project site is agricultural land (82.08%) followed by open scrub land (10.16%) where WTG are planned for installation. The permanent pastures or settlement accounts for 3.76 % whereas stony waste and water bodies indicate land use percentage of 1.33 % and 0.97% respectively. Land use map also confirm that forest land is not involved within the project site. During the site visit, the land use classification was verified and found that most of the WTG locations are coming under open scrub. Detailed information on the type of land use of WTG locations as per revenue record, satellite image and observed during site visit is given in Annexure –1. The land use pattern of project site and surrounding area is shown in **Figure -12**.

FIGURE 12: LAND USE MAP OF STUDY AREA



4.1.6 Hydrogeology

Drainage- Basin & Sub basin

Ganga Basin: The study area in Ratlam and Mandsaur districts of Madhya Pradesh comes under Ganga basin as shown in **Figure - 13**. In Madhya Pradesh, the Ganga basin extends upto the districts of Mandsaur, Ujjain, Shahjapur, Rajgarh, Neemuch, Vidisha, Guna, Shivpuri, Datia, Gwalior, Morena, Sheopur, Bhind, Tikamgarh, Chhatarpur, Panna, Satna, Rewa, Ashoknagar, Dindori, Dhar, Ratlam, Indore, Dewas, Sehore, Raisen, Sagar, Bhopal and Damoh. The Ganga Basin can be further sub-divided into three sub-basins viz. Yamuna, Tons and Son. The Yamuna sub basin again divides into Chambal sub-sub basin where the proposed project site is located as shown in **Figure -14 & 15.** The details of Yamuna sub basin and Chambal sub-sub basin is discussed below:

Yamuna Sub-basin : Total geographical area of Yamuna sub-basin in Madhya Pradesh is 1,42,250 sq.km.. The major rivers of this sub basin in Madhya Pradesh are Chambal, Ken, Dhasan, Betwa, Kunwari, Sindh, Paisuni and Jamni.

Chambal sub-sub basin: River Chambal originates from Indore district and meets river Yamuna near Bhind. Total catchment area of Chambal in Madhya Pradesh is 59,940 km. Total length of the river 938 km, out of which initial length of 320 km lies in Madhya Pradesh, 226 km in Rajasthan, 216 km makes the boundary between Madhya Pradesh and Rajasthan, 112 km makes the boundary between Madhya Pradesh and Uttar Pradesh and 64 km in Uttar Pradesh before confluence with Yamuna river. Kalisindh, Parvati, Kuno and Sip are the main tributaries of the river Chambal.

FIGURE 13: RIVER BASIN MAP OF AREA WITH RESPECT TO PROJECT SITE

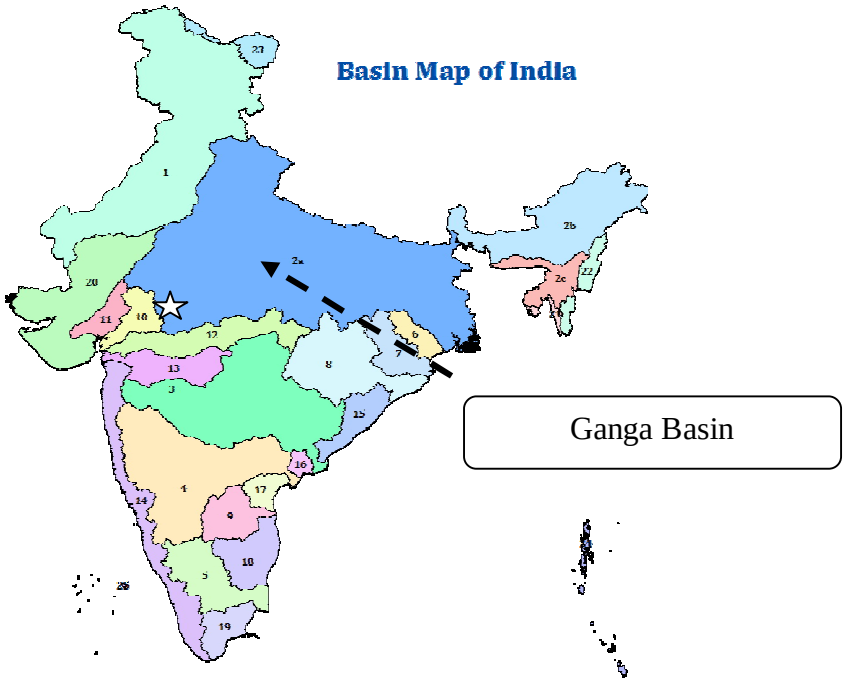


FIGURE 14: GANGA BASIN MAP OF AREA WITH RESPECT TO PROJECT SITE

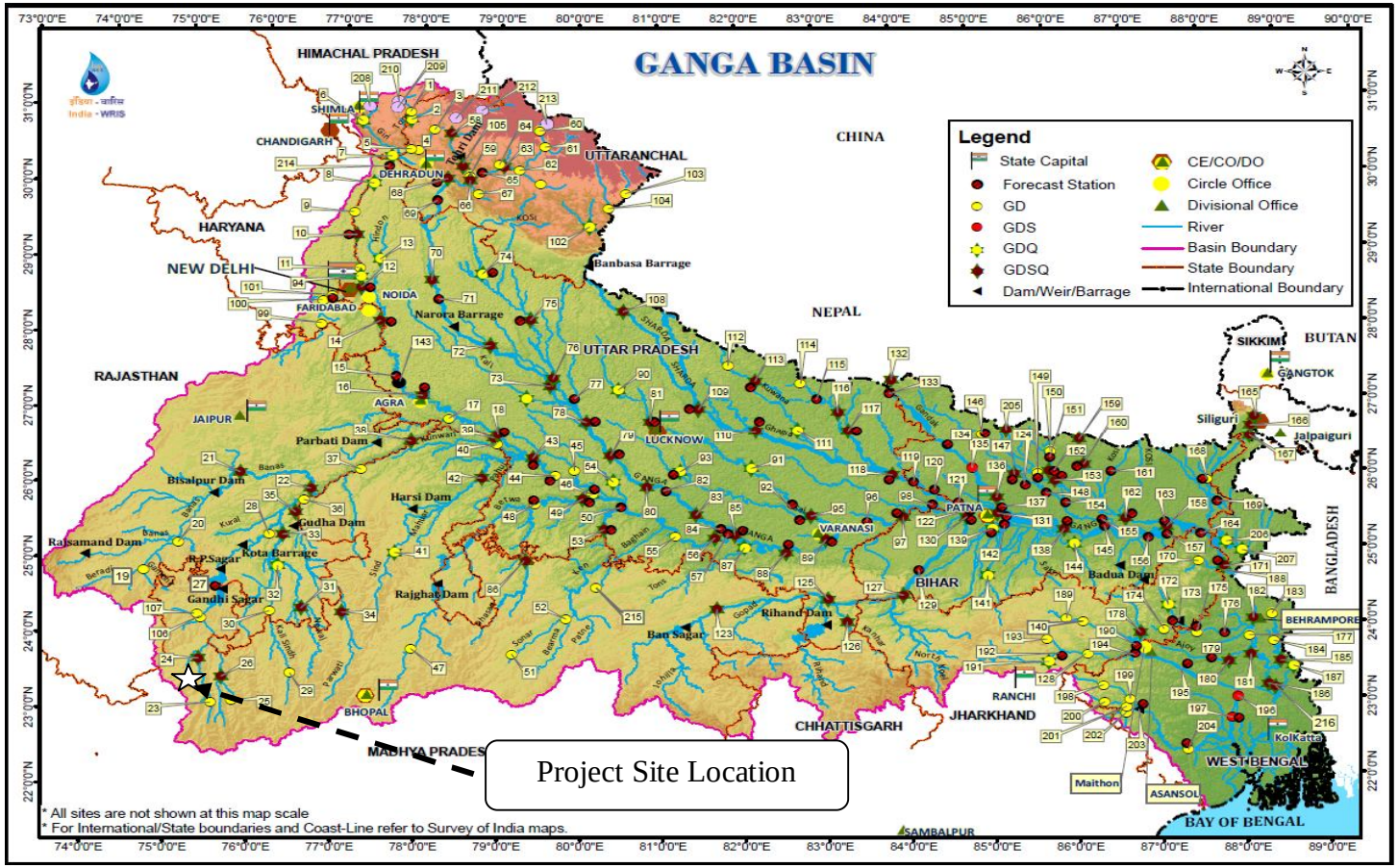
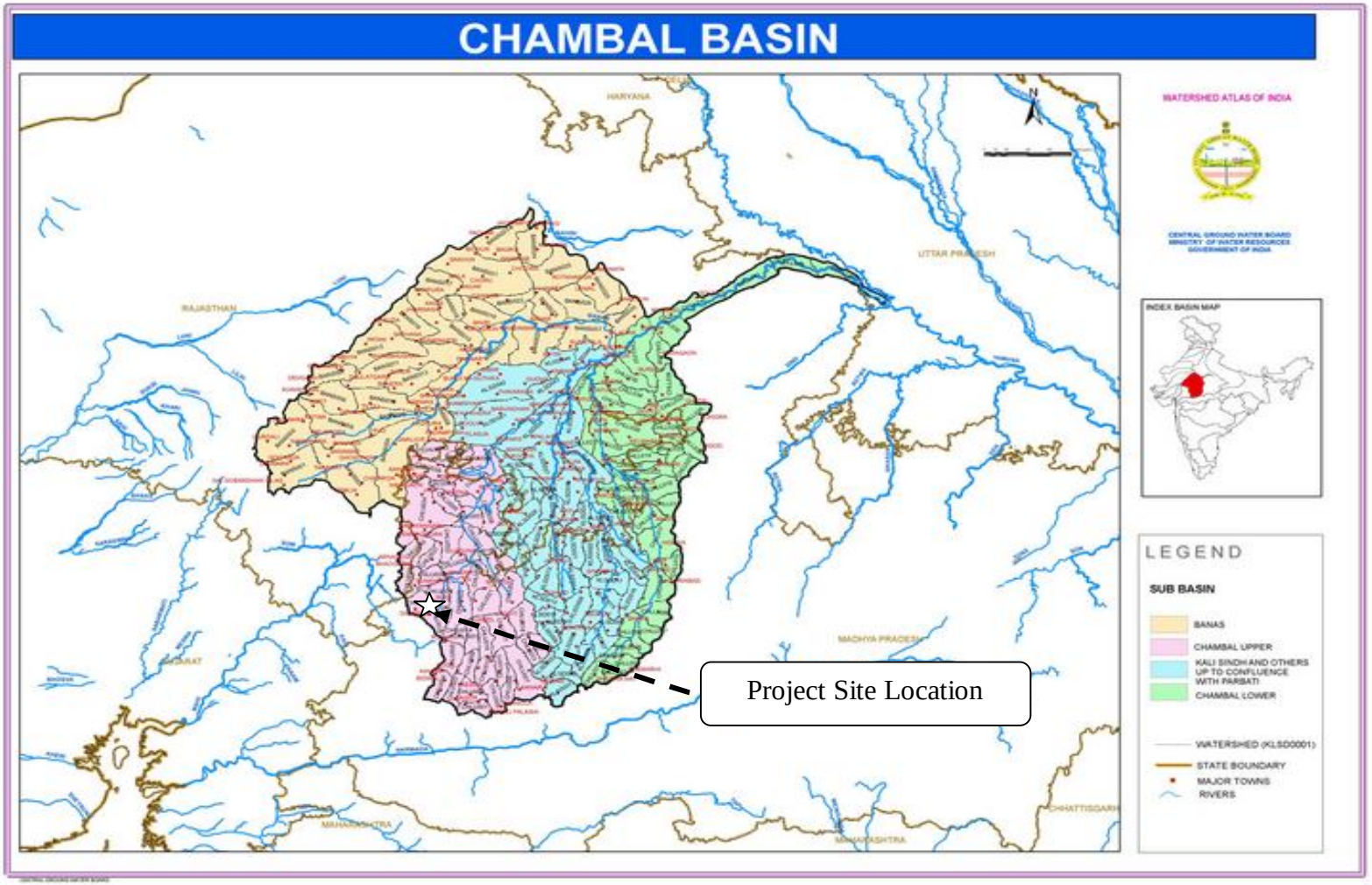


FIGURE 15: CHAMBAL SUB-SUB BASIN MAP OF AREA WITH RESPECT TO PROJECT SITE



Hydrogeology[2]

Geologically major parts of the study area is occupied by Deccan Trap basalts except narrow patch of alluvium and sedimentary rocks of Vindhyans super group in isolated patches, which are forming different type of aquifers in the area. Occurrence and movement of groundwater in hard rock is mainly controlled by secondary porosity through joints and fractures. Presences of vesicle in basaltic lava flow of Deccan Traps play an important role in groundwater movement. Groundwater in general occurs under unconfined to semi-confined conditions. The general hydrogeological condition of the study area is depicted in **Figure-16** below and formation wise settings are discussed below.

Vindhyans

The Vindhyan sandstone has primary porosity, but this depends on the degree of compaction. Ground water availability in sandstone is controlled by secondary porosity generated by weathering, jointing and fracturing. Ground water is sandstone occurs under confined conditions. Yield of Vindhyans sandstone formation is generally poor to moderate and less than 2 liters per second.

Basalts

The basalts underlie a major part of the district and generally groundwater occurs under phreatic conditions in shallow weathered, jointed and fractured horizons. Basalts does not exhibits uniform occurrence of groundwater both vertically and latterly. Physiographic location, thickness of weathered mantle, degree of jointing, fracture or shear zones, characteristics of vesicular horizons and their inter connection are important factor, which play a deciding role in the yield capacity of open wells tapping shallow aquifers. The deeper aquifer system appear to be under unconfined to semi-confined conditions while visualizing lava flow sequence which shows alternate units of vesicular and massive horizons. The hydrogeological regime in different tires, deeper aquifer is more likely to be governed by the secondary porosity jointed/fractured form of massive units is creating possibilities of their acting as leaky confining bed consequently resulting into semi-confined condition for water bearing vesicular units occurring below it. Yield of basalts in this is reported low to moderates (1 to 5 lps).

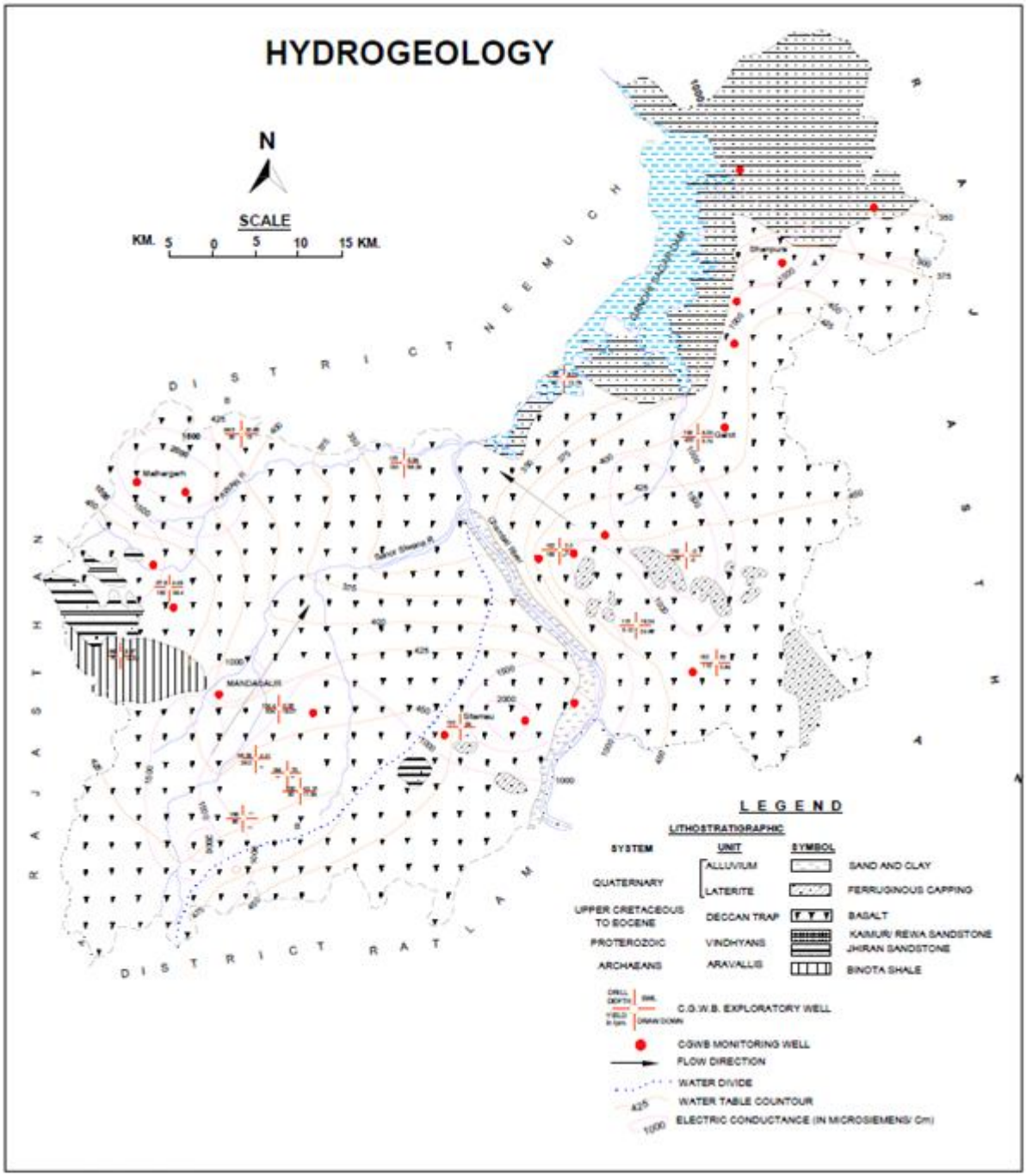
Alluvium

The alluvium deposits are restricted to narrow linear along the river courses of Chambal and Shivna. The thickness of alluvium varies from 5 to 10 meters, which is proportionately thinning away from the river line. The thickness of alluvium along the Chambal River reported about 20 meter thick. The alluvium deposits consist series of consolidated, fine to

[2] District Ground Water Information Booklet, Mandsaur, MoWR, CGWB NCR, GoI, July' 2009

medium grained sand admix in varying proportion and yield varies from 1 to 8 liters per second.

FIGURE 16: HYDROGEOLOGY OF MANDSAUR DISTRICT



4.1.7 Groundwater levels

Variation of groundwater levels in an area is an important component of hydrological cycle because it is a physical reflection of aquifer systems. As the change in groundwater level is directly related to groundwater balance and its continuous records provide direct information of subsurface geo-environmental changes due to withdrawal of groundwater. To monitor the

seasonal and annual change in quantity and quality of groundwater, CGWB has established 22 Groundwater Monitoring Wells and 12 Piezometers in entire Mandsaur district.

The monitoring of groundwater levels in these wells is being carried out by CGWB during the month of May, August, November and January. High frequency Groundwater level monitoring is being carried out at Mandsaur, Pipliya and Suwasra deep piezometer using Automatic Water Level Recorders. The brief details of groundwater level in Mandsaur district for the year 2006 are being discussed below:

Pre-monsoon (May 2006)

In pre-monsoon period, May 2006, (**Figure-17**) depth to water level ranges between 6.45 m bgl at Sitamau to 22.05 m bgl at Sandhara. The most part of the district have water level in the range of 6-9, 9-12 and 12-15 m bgl during the pre-monsoon. Water level more than 15 m bgl have been recorded at Nayakhera, Kachnera, Daloda, Basakheda, Botalganj and Sandhara Groundwater monitoring well. The deepest water level 22.05 m bgl was recorded at Sandhara Groundwater monitoring well.

Post-monsoon (November 2006)

During post-monsoon period, November 2006, (**Figure-18**) the water level ranges from 2.05 m bgl at Shamgarh to 8.90 m bgl at Suwasra in Sitamau block. It is observed that in most part of the district the water level lies between 3 to 6 and 6 to 9 m bgl. During post monsoon period water level more than 8.0 m bgl has been recorded only at Botalganj and Suwasra Groundwater monitoring well.

Water level fluctuation (May 2006 to November2006)

A comparison of pre-monsoon water level data with the post-monsoon water level data reveals that there is rise of water level in entire district. The rise of 3 to 6 m has been observed in many Groundwater monitoring wells of the district. Rise in water level more than 12 m has been recorded at Daloda, Basakheda and Sandhara Groundwater monitoring wells. Minimum rise in water level has been recorded as 2.60 m at Daramrajeshwar Groundwater monitoring well. Maximum rise in water level has been recorded as 17.35 m at Sandhara Groundwater monitoring well.

Groundwater level trend (May1997 to May 2006)

Analyses of Groundwater level data of pre-monsoon period indicate that there is declining trend in water level in entire district except in few wells. In general 0.01 to 0.72 m/year water level declines have been observed in the district. The maximum decline in water level 0.72 m/year has been observed at Kachnera Groundwater monitoring well.

Groundwater level trend (November 1997 to November 2006)

Analyses of Groundwater level data of post-monsoon period indicate that there is declining trend in water level in entire district. In general 0.02 to 0.76 m/year water level declines have been observed in the district. The maximum decline in water level 0.76 m/year has been observed at Basakheda Groundwater monitoring well.

FIGURE 17: DEPTH OF GROUNDWATER LEVEL IN MANDSAUR (MAY-2006)

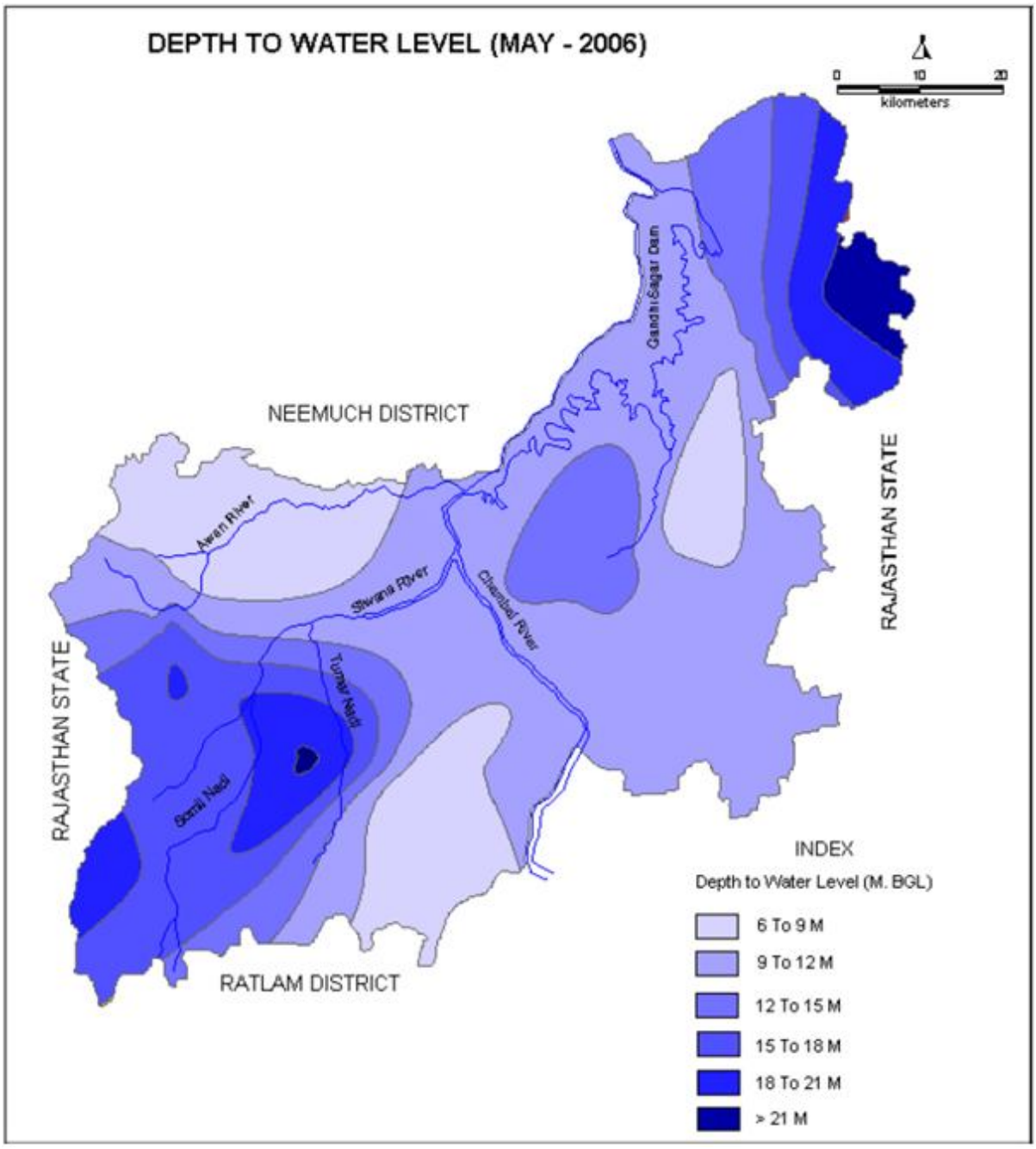
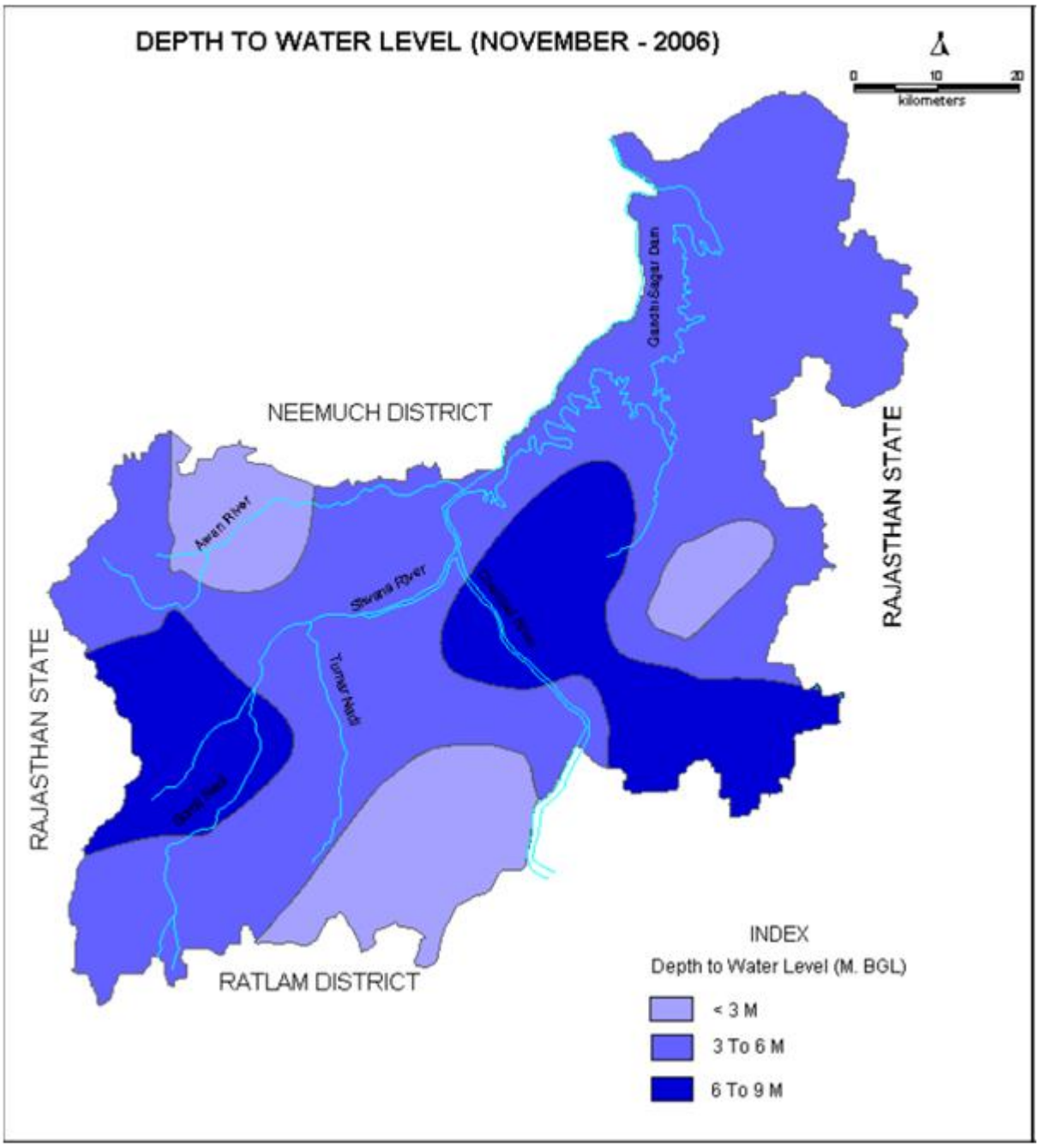


FIGURE 18: DEPTH OF GROUNDWATER LEVEL IN MANDSAUR (NOVEMBER-2006)



4.1.8 Ground Water and Surface Water Resources

Groundwater resource estimation of Mandsaur district has been computed for base year 2004, on block-wise basis. All the blocks fall under non-command category, as there is no major or medium irrigation project for surface water irrigation. Mandsaur, Malhargarh and Sitamau blocks have been categorized as over-exploited having ground water development more than 100%. The highest stage of groundwater development is computed as 136% for Malhargarh block while Mandsaur block 128% and Sitamau block 114%.

The Garoth and Bhanpura blocks comes under Semi-Critical category and has ground water development 82 % and 81 % respectively .The district total stage of ground water development is 109 %.

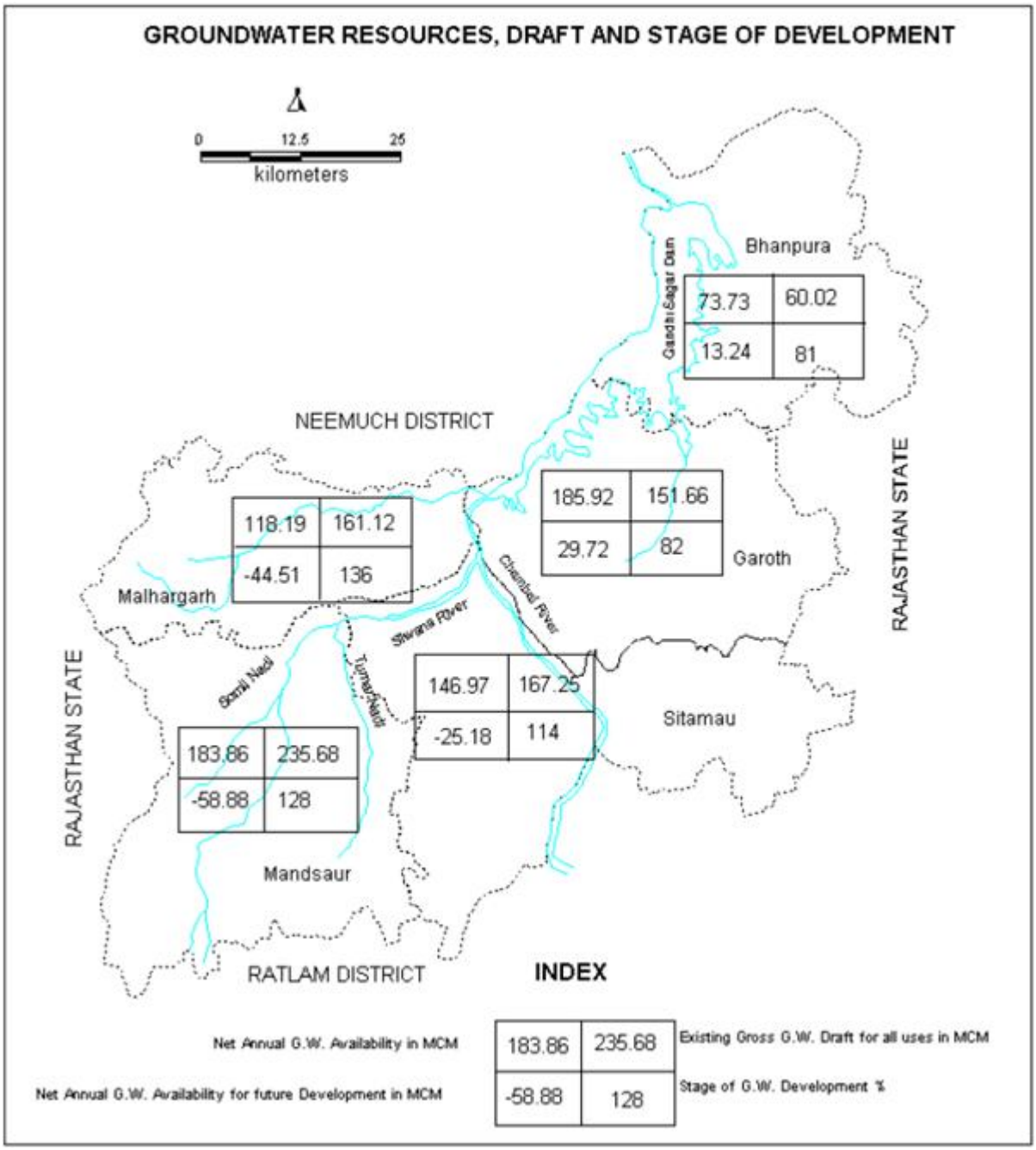
As per groundwater resource estimation figures, net groundwater availability in Mandsaur district is 708.68 MCM and groundwater draft for all uses is 775.73 MCM, making stage of groundwater development 109% as a whole for the district. Allocation for future domestic and industrial supply of groundwater is negative figure, because as a whole the district is over-exploited.

The net annual groundwater available in the Mandsaur district and groundwater draft from all uses for all blocks is shown in figure –19 and is also presented in figure– 20.

Figure 19: Groundwater availability and stage of development in Mandsaur district

Assessment Unit/ Blocks	Command/ non-Command/ Total	Net Annual Groundwater Availability MCM	Existing Gross Groundwater Draft for Irrigation MCM	Existing Gross Groundwater Draft for Domestic Industrial water Supply MCM	Existing Gross Groundwater Draft for All uses MCM	Allocation for domestic and industrial requirement supply up to next 25years MCM	Net Ground Water Availability for future irrigation development MCM	Stage of Ground Water Development %
Mandsaur	**Command**	-	-	-	-	-	-	-
	Non-Command	183.86	232.81	2.87	235.68	9.93	-58.88	128
	Block Total	**183.86**	**232.81**	**2.87**	**235.68**	**9.93**	**-58.88**	**128**
Malhargarh	**Command**	-	-	-	-	-	-	-
	Non-Command	118.19	157.74	3.38	161.12	4.96	-44.51	136
	Block Total	**118.19**	**157.74**	**3.38**	**161.12**	**4.96**	**-44.51**	**136**
Sitamau	**Command**	-	-	-	-	-	-	-
	Non-Command	146.97	163.68	3.57	167.25	8.48	-25.18	114
	Block Total	**146.97**	**163.68**	**3.57**	**167.25**	**8.48**	**-25.18**	**114**
Garoth	**Command**	-	-	-	-	-	-	-
	Non-Command	185.92	147.72	3.94	151.66	8.48	29.72	82
	Block Total	**185.92**	**147.72**	**3.94**	**151.66**	**8.48**	**29.72**	**82**
Bhanpura	**Command**	-	-	-	-	-	-	-
	Non-Command	73.73	57.70	2.32	60.02	2.78	13.24	81
	Block Total	**73.73**	**57.70**	**2.32**	**60.02**	**2.78**	**13.24**	**81**
	District Total	**708.68**	**759.66**	**16.08**	**77573**	**34.63**	**-85.61**	**109**

Figure 20: GW Resources, Draft and Stage of Development - Mandsaur



Ground Water Quality

Groundwater quality in Mandsaur district is assessed annually by CGWB on the basis of analysis of groundwater samples collected from groundwater monitoring wells in the district. On the basis of examination of data for the year 2006, the water quality is described as follows.

Quality of Groundwater for Drinking Purpose

The pH value (the hydrogen ions activity) of water samples ranged in between 7.22 to 8.06 hence proved alkaline in nature and were generally within permissible limit (6.5 to 8.5) as set by BIS (1991). The EC values were found to be in the range of 532 and 2530 µS/cm.

The EC values exceeding BIS limit (1250 µS/cm) were noticed at Babulda (1505 µS/cm), Barhkeranayak (1679 µS/cm), Shamgarh (2390 µS/cm), Narayangarh (1798 µS/cm), Basakheda (12954 µS/cm) and Nayakheda (highest 25µS/cm). The anion chemistry shows that the wells of Nayakheda and Shamgarh have highest concentration of chloride with a highest value 514 mg/l against the safe limit of 250 mg/l fixed by BIS (1990). The concentration of NO_3^- exceeding 45 mg/l (BIS, 1990) was reported from most of the wells of the district with highest as 217 mg/l of Shamgarh village.

The higher concentration of NO_3^- is an indicative of man-made pollution. High nitrate in the village area is appears due to excessive use of fertilizers and agriculture waste. A scrutiny of data shows that only one well located at Suwasra was reported having fluoride 1.61 mg/l. No arsenic content was detected in the groundwater of district as per the analysis carried out in the year 2003.

Quality of Groundwater for Irrigation Purpose

In classification of water for irrigation purpose, it is assumed that the water will be used under average conditions with respect to soil texture, infiltration rate, drainage and climate. The chemical data of all the water samples pertaining to Mandsaur district was plotted on U.S. Salinity Laboratory diagram.

It is clear that wells of Garoth and Babulda were observed under C2-S1class (Medium Salinity and Low Sodium), which means that this water can be used for irrigation purposes without any chance of development of soil salinity.

The ground water representing the wells of Babulda, Bhanpura, Dudhakheri, Sandhara, Barkheranayak, Dharamrajeshwar, Botalganj, Malhargarh, Narayangarh, Pipliya, Basakheda, Daloda, Mandsaur, Khejariya, Sitamau and Surjani were grouped under C2-S1 (High Salinity and Low Sodium) class. This water can be used with the special management practices for salinity control. Salt tolerance crops may be grown in these areas. Two wells namely Shamgarh and Nayakheda were found under C4-S1 class (Very High Salinity and Low Sodium) types of water; hence these waters are not suitable for irrigation purposes.

Ground & Surface Water Monitoring

Primary monitoring of surface water quality was given importance during scoping of the EIA study as the domestic effluent generated from temporary labor camps during project construction phase is likely to be discharged to nearby surface water bodies or natural drainage channels. Also considering that ground water is likely to cater to the domestic and drinking water requirements of construction workers hence it necessary to establish the drinking water quality in the study area in conformance with the IS 10500 standards.

A monitoring network consisting of three location of surface water and three locations for groundwater was selected and representative sampling was carried out at each of the

locations (Refer **Figure -11**). Water sampling and analysis was done following CPCB[3] standard guidelines for physical, chemical and bacteriological parameters.

The detailed results of surface water and ground water analysis are presented in **Tables 4.6** and **4.7** respectively.

4.1.8.1 Interpretation of Surface Water Quality Results

Surface water characteristics were assessed against water quality criteria as per CPCB guidelines for water resources.

TABLE 4-5: SURFACE WATER QUALITY CRITERIA FOR DESIGNATED BEST USE CLASSES

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

Source: Central Pollution Control Board

The analysis of surface water samples collected from the Bhatkheda, Pancheva and Naveli reveals that surface water quality at Bhatkheda village matches with the requirement of Class-A of CPCB surface water quality criteria for designated best use classes and is suitable

[3] CPCB Guidelines for Water Quality Monitoring - **MINARS/27/2007-08**

for drinking water source without conventional treatment but after disinfection while quality of water collected from ponds in Pancheva and Naveli villages matches with the Class-C best use which is drinking water source after conventional treatment and disinfection.

TABLE 4.6: SURFACE WATER QUALITY RESULTS

S.No	Parameter	Unit	Sampling Site			Requirements As per IS: 2296(Class C)	Testing Method
			SW-1 Ponds- Bhatkheda Village	SW-2 Pond- Pancheva Village	SW-3 Pond- Naveli Village		
1.	Colour	Hazen	<5.0	<5.0	<5.0	300 Max.	IS 3025(P-4)-1983
2.	Odour	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	-	IS 3025(P-5)-1983
3.	Conductivity	µmhos/cm	210	245	358	-	IS 3025(P-14)-1984
4.	pH Value	..	8.13	7.85	8.24	8.5 Max.	IS 3025(P-11)-1983
5.	Total Dissolved Solids	mg/l	164	178	231	-	IS 3025(P-16)1984
6.	Oil & Grease	mg/l	<0.1	<0.1	<0.1	0.1 Max.	IS 3025(P-39)-1991
7.	Dissolved oxygen	mg/l	6.0	5.7	5.5	4 Min.	IS 3025(P-38)-1989
8.	Chemical Oxygen Demand (COD)	mg/l	8.0	16.0	12.0	-	IS 3025(P-58)-2006
9.	Biochemical oxygen demand (BOD), at 27 ^{o}C-3 days	mg/l	2.0	5.0	4.0	3 Max.	IS 3025(P-44)-1993
10.	Total Suspended Solids	mg/l	16.8	29.2	22.8	-	IS 3025(P-17)-1984
11.	Boron	mg/l	ND	ND	ND	-	IS 3025(P-57)-2005

12.	Total Alkalinity(as $CaCO_3$)	mg/l	63.6	95.5	147	-	IS 3025(P-23)-1986
13.	Sodium as (Na)	mg/l	49.2	58.4	67.8	-	IS 3025(P-45)-1993
14.	Aluminium as (Al)	mg/l	ND	ND	ND	-	IS 3025(P-55)-2003
15.	Nickel as (Ni)	mg/l	ND	ND	ND	-	IS 3025(P-54)-2003
16.	Barium	mg/l	ND	ND	ND	-	IS 13428-2005 (Annex. F)
17.	Chlorides (as Cl)	mg/l	29.8	47.7	35.7	600 Max.	IS3025(P-32)-1988
18.	Total Hardness (as $CaCO_3$)	mg/l	53.7	84.4	115	-	IS 3025(P-21)-2009
19.	Free CO_2	mg/l	1.5	1.3	1.6	-	APHA 4500-CO_2
20.	Cadmium (as Cd)	mg/l	ND	ND	ND	0.01 Max.	IS 3025(P-59)-2006
21.	Selenium (as Se)	mg/l	ND	ND	ND	0.05 Max.	IS 3025(P-53)-2003
22.	Arsenic (as As)	mg/l	ND	ND	ND	0.2 Max.	IS 3025(P-37)-1988
23.	Cynide (as CN)	mg/l	ND	ND	ND	0.05 Max.	IS 3025(P-27)-1986
24.	Lead (as Pb)	mg/l	ND	ND	ND	0.1 Max.	IS 3025(P-47)-1994
25.	Zinc	mg/l	ND	ND	0.07	15 Max.	IS 3025(P-49)1994
26.	Anionic Detergent (as MABS	mg/l	ND	ND	ND	1 Max.	IS 13428-2005 (Annex. K
27.	Chromium (as Cr)	mg/l	ND	ND	ND	0.05 Max.	IS 3025(P-52)-2003
28.	Mineral oil	mg/l	ND	ND	ND	-	IS 3025(P-39)-1991

29.	Copper (as Cu)	mg/l	ND	ND	ND	1.5 Max.	IS 3025(P-42)-1992
30.	Manganese (as Mn)	mg/l	ND	ND	ND	-	IS 3025(P-59)-2006
31.	Sulphate (as SO_4)	mg/l	29.0	12.0	19.6	400 Max.	IS3025(P-24)-1986
32.	Calcium (as Ca)	mg/l	10.7	18.4	21.5	-	IS 3025(P-40)-1991
33.	Nitrate (as NO_3)	mg/l	2.6	2.8	3.2	50 Max.	IS 3025(P-34)-1988
34.	Magnesium (as Mg)	mg/l	6.0	8.6	13.8	-	IS 3025(P-46)-1994
35.	Fluoride (as F)	mg/l	0.06	0.08	0.13	1.5 Max.	IS 3025(P-60)-2008
36.	Phenolic compound (as C6H5OH)	mg/l	ND	ND	ND	0.005 Max.	IS 3025(P-43)-1992
37.	Mercury (as Hg)	mg/l	ND	ND	ND	-	IS 3025(P-48)-1994
38.	Iron (as Fe)	mg/l	<0.1	<0.1	0.1	50 Max.	IS 3025(P-53)-2003
39.	Total Coliform	MPN/100ml	5	6	5	5000 Max.	IS: 1622-1981
40.	Faecal Coliform	MPN/100ml	3	4	3	-	IS: 1622-1981

4.1.8.2 Interpretation of Ground Water Quality Results

A total of three nos. ground water samples were collected from bore wells within the study area villages i.e. Sarsod, Khodana and Jaliner. The samples were analyzed for physicochemical and microbiological parameters and results compared with IS: 10500 (2012) drinking water standards to identify and interpret any deviation in the statutory limits set for parameters under this standard. The results for relevant drinking water quality parameters have been discussed below.

pH and Turbidity: The pH and turbidity value in the collected samples are within the prescribed limit

Total Dissolved Solids: Sample collected from Sarsod and Jaliner village shows the total dissolved solids as higher than the desirable limit but within the permissible limit while at Khodana village TDS value is within the desirable as well as permissible limit

Total Hardness: At Sarsod village, total hardness is observed as higher than the desirable limit only whereas this value is well within the prescribed limit at Khodana and Jaliner village

Iron and Fluoride: Iron and fluoride content is well within the prescribed limit at all the three locations

Nitrates&Sulphates: The concentration of nitrates and sulphates is within the prescribed limit at all the three locations

TABLE 4.7: GROUNDWATER MONITORING RESULTS

S.No	TEST PARAMETERS	UNITS	GW1- Sarsod (HP)	GW2-Khodana (well)	GW3-Jaliner (HP)	Desirable Limits (As per IS: 10500:2012)	Permissible Limits (As per IS: 10500:2012)	Testing Method
1.	Colour	Hazen	<5.0	<5.0	<5.0	5 Max.	15 Max.	IS 3025(P-4)-1983
2.	Odour	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	IS 3025(P-5)-1983
3.	Taste	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	IS 3025(P-7)-1984
4.	Turbidity	NTU	<1.0	<1.0	<1.0	5 Max.	10 Max.	IS 3025(P-10)-1984
5.	pH Value	..	7.96	7.89	7.94	6.5-8.5	6.5-8.5	IS 3025(P-11)-1983
6.	Total Dissolved Solids	mg/l	1294	435	588	500 Max.	2000 Max.	IS 3025(P-15)1984
7.	Aluminum (as Al)	mg/l	ND	ND	ND	0.03 Max.	0.2 Max.	IS 3025(P-55)-2003
8.	Anionic Detergent (as MABS)	mg/l	ND	ND	ND	0.2 Max.	1.0 Max.	Annex K of IS 13428-2005
9.	Barium (as Ba)	mg/l	ND	ND	ND	0.7 Max.	0.7 Max.	Annex F of IS 13428-2005
10.	Boron (as B)	mg/l	ND	ND	ND	0.5 Max.	0.5 Max.	IS 3025(P-57)-2005
11.	Calcium (as Ca)	mg/l	123	53.7	64.5	75 Max.	200 Max.	IS 3025(P-40)-1991

12.	Chlorides (as Cl)	mg/l	538	35.7	183	250 Max.	1000 Max.	IS 3025(P-32)-1988
13.	Copper (as Cu)	mg/l	ND	ND	ND	0.05 Max.	1.5 Max.	IS 3025(P-42)-1992
14.	Fluoride (as F)	mg/l	0.14	0.09	0.11	1 Max.	1.5 Max.	IS 3025(P-60)-1984
15.	Residual free chlorine	mg/l	Nil	Nil	Nil	0.2 Min. (when Chlorinated)	-	IS 3025(P-26)-1986
16.	Iron (as Fe)	mg/l	0.12	<0.1	0.1	0.3 Max.	0.3 Max.	IS 3025(P-53)-2003
17.	Magnesium (as Mg)	mg/l	26.0	19.6	18.6	30 Max.	100 Max.	IS 3025(P-46)-1994
18.	Mangaese (as Mn)	mg/l	ND	ND	ND	0.1 Max.	0.3 Max.	IS 3025(P-59)-2006
19.	Mineral Oil	mg/l	ND	ND	ND	0.5 Max.	0.5 Max.	IS 3025(P-39)-1991
20.	Nitrate (as NO_3)	mg/l	4.5	2.0	2.8	45 Max.	100 Max.	IS 3025(P-34)-1988
21.	Phenolic Compound (as C_6H_5OH)	mg/l	ND	ND	ND	0.001 Max.	0.002 Max.	IS 3025(P-43)-1992
22.	Selenium (as Se)	mg/l	ND	ND	ND	0.01 Max.	0.01 Max.	IS 3025(P-56)-2003
23.	Sulphate (as SO_4)	mg/l	68.6	15.0	33.4	200 Max.	400 Max.	IS 3025(P-24)-1986

24.	Total Alkalinity (as $CaCO_3$)	mg/l	63.6	179	167	200 Max.	600 Max.	IS 3025(P-23)-1986
25.	Total Hardness (as $CaCO_3$)	mg/l	422.4	222	245	200 Max.	600 Max.	IS 3025(P-21)-2009
26.	Zinc (as Zn)	mg/l	0.09	ND	ND	5 Max.	15 Max.	IS 3025(P-49)-1994
27.	Cadmium (as Cd)	mg/l	ND	ND	ND	0.003 Max.	0.003 Max.	IS 3025(P-41)-1992
28.	Cyanide (as CN)	mg/l	ND	ND	ND	0.05 Max.	0.05 Max.	IS 3025(P-27)-1986
29.	Lead (as Pb)	mg/l	ND	ND	ND	0.01 Max.	0.01 Max.	IS 3025(P-47)-1994
30.	Mercury (as Hg)	mg/l	ND	ND	ND	0.001 Max.	0.001 Max.	IS 3025(P-48)-1992
31.	Total Arsenic (as As)	mg/l	ND	ND	ND	0.01 Max.	0.05 Max.	IS 3025(P-37)-1988
32.	Total Chromium (as Cr)	mg/l	ND	ND	ND	0.05 Max.	0.05 Max.	IS 3025(P-52)-2003
33.	Total Suspended Solids	mg/l	<5.0	<5.0	<5.0	-	-	IS 3025(P-17)-1984
34.	Sodium (as Na)	mg/l	38.2	32.4	35.7	-	-	IS 3025(P-45)-1993
35.	Chemical Oxygen Demand (COD)	mg/l	<4.0	<4.0	<4.0	-	-	IS 3025(P-58)-2006
36.	Nickel	mg/l	ND	ND	ND	0.02 Max.	0.02 Max.	IS 3025(P-54)-2003
37.	E.Coli	MPN/100ml	Absent	Absent	Absent	Absent	Absent	IS 1622-1981
38.	Total Coliform	MPN/100ml	<2.0	<2.0	<2.0	10 Max.	-	IS 1622-1981

4.2 ECOLOGICAL ENVIRONMENT

4.2.1 Introduction

The proposed Ratlam wind power project site lies in Biome-11 (Indo-Malayan Tropical Dry Zone), which has the biome-restricted assemblages of avi -fauna.Recognized by Bird Life International (Box for Biome 11).

The primary objective of the biological environment study is to:

- Assess vegetation types and floral diversity
- Evaluate wildlife habitat –natural and modified
- Identify common fauna;especially the birds and bats
- Find out any endemic and threatened plant and animal species (if any);
- Identification of migratory corridor/path (if any);
- Identification of sensitive ecological habitat;
- Evaluate impacts on wildlife & their habitats.

4.2.2 Study Area

The study area for ecological surveys was considered taking the entire proposed wind power site (**core zone**) and radius ten kilometer from the boundary of the proposed plant site (**buffer zone**). However, to assess the migratory birds habitat and migration path of the birds, a regional study has been conducted-specially the important migratory birds habitat within 100 km of the proposed project site.

4.2.3 Methodology

1.4.3.1 Desktop Review

A desktop review was conducted to determine the predominant habitat like forest, grassland and wetlands through study of Toposheet, National Wetland Atlas and Satellite imagery. The floral assemblage in the study area was reviewed through vegetation type of Champion and Seth, 1962. The predominant birds species was reviewed through the published books and publication like BNHS, Important Bird Areas.

1.4.3.2 Baseline Survey

Baseline survey was carried out to determine the existing ecological conditions and was designed to fill any data gaps, and to facilitate an adequate assessment of the project's impacts upon ecology and the formulate a site specific mitigation measures.Baseline survey was conducted on 3rd to 7thFebruary, 2014 for habitat survey, flora & faunal assemblage, in the study area. Baseline survey has two part- (i) secondary data collection and (ii) primary survey.

4.2.3.1 Secondary Data Collection

Secondary baseline data regarding sensitive ecological habitat (Sanctuary, Important Bird Area, Migratory corridor/path, etc.), floraland faunal diversity, census of the targeted species, etc was collected for Forest Department's website; Forest Working Plan. Stakeholder consultations ((Forest Department, Local People, Researcher, etc) were also conducted to understand the migratory bird's habitat, migration path, species richness, threats on habitat and species, presence of any Schedule I species in the study area.

4.2.3.2 Primary Survey

Primary survey was carried out the targeted study area for habitat (terrestrial and aquatic), flora and faunadiversity. Ann effort has been made to understand the species diversity and species counts of migratory birds in the study area through quadrant method for water bodies located within the project site, Special attention was paid to understand the local migration pattern of the birds through the observation of birds counts in different times in day and subsequent consultations with the local people.

4.2.4 Terrestrial Ecosystem

1.4.3.3 Forest and Faunal Diversity

4.2.4.1 Forest Resources

The proposed project site falls under Manndsour district of Madhya Pradesh. The district has only 264[4]sq km of forest, i.e. 4.77 percent of its total geographical area. The forest cover of the district comprises of 89 sq. km (33.71%) moderately dense forest and 175 sq. km (66.29%) of open forest.The proposed project has no forest land. However, there are some scrub vegetation mostly shrubs and few small tress.

4.2.4.2 Vegetation Types

Forest types occurring in this region are primarily of Tropical Deciduous[5] type with presence of two classes viz. C-1 Dry Teak forest and C-2 Dry mixed deciduous forest. From ecological point of view, the forest maybe divided into the following types: -

- ***Dry Deciduous Teak***: Teak (*Tectonagrandis*), Saj (*Terminaliatomentosa*), Dhawda(*Anogeissuslatifolia*), etc.
- ***Mixed Type***: *Terminaliatomentosa, Emblicaofficinalis, Terminaliaarjuna, Aeglemarmelos, Pongamiapinnata, Annogessiuslatifolia, Madhucaindica, Ailanthus excelsa*etc.
- ***Secondary Scrub Vegetation***: Abandoned village fields and foot hills represent this vegetation type. The proposed project site falls under this type of vegetation. The

[4] State of Forest Report 2011, FSI
[5]Champion and Seth's classification of forests

predominant vegetations are Bel (*Aeglemormalos*), Neem (*Azadirachtaindica),* Babool (*Acacia Arabica),* Salai (*Bosweliaserrata*), Semal (*Bombaxceiba*).

- ***Riparian Vegetation*:** Vegetation around the side of water body and streams, major plant species are *Anthocephalussinensis, Alistoniascholaris, Bombaxceiba, Terminaliaarjuna, etc.*

4.2.4.3 Floral Diversity

During the terrestrial plant survey, about 59 numbers of plant species was recorded, which includes 34 species of trees, 10 species of shrubs, 10 species of herbs, 5 species of climbers. The dominant plant species are Teak (*Tectonagrandis*), Saj (*Terminaliatomentosa*), Dhawda(*Anogeissuslatifolia*), Haldu (*Adina cordifolia*), Landia (*Lagerstroemia parviflora*), Bija (*Plerocarpusmarsupium*), Shisum (*Dalbergialotifolia*),Tendu (*Diospyrosmelanoxylon*), Palash (*Buteamonosperma*), Bhirra (*Chlorozylonsweitenia*), Astra (*Bahuniaverigata*), Bel (*Aeglemormalos*). The detailed listing of floral species recorded in the study area is given in **Annexure 2**.

4.2.4.4 Endemic, Threatened & Endangered Floral Species

The Wildlife (Protection) Act 1972 prohibits picking, uprooting, damaging, destroying, acquiring or collecting six species of plants from forest land and any area specified, by notification, by the Central Government [Clause 17A of Chapter IIIA (Protection of Specified Plants), page 346 of Handbook Vol. 1]. The six species are: Beddome's cycad (*Cycasbeddomei*), Blue Vanda (*Vanda coerulea*), Kuth (*Sassurealappa*), Ladies slipper orchids (*Paphiopedilum* spp.), Pitcher plant (*Nepenthes khasiana*), Red Vanda (*Ranantheraimshootiana*). None of these species is recorded in the forests of the study area during the EIA.

4.2.4.5 Invasive Alien Species (IAS)

IAS are non-native species in a specific ecosystem whose introduction and subsequent establishment adversely impacted the economy, agriculture, biodiversity and human health. Major invasive species recorded during the study period are: *Acacia auriculiformis, Leucaenaleucocephala, Lantana camara, Mikaniamicrantha, Mimosa diplotricha, Eichhorniacrassipes, Hyptissuaveolens, Chromolaenaodorata.*

1.4.3.4 Wildlife Habitat & Faunal Diversity

4.2.4.6 Wildlife Habitat

Wildlife Habitat in the Study Area: The entire study area including the proposed project site has no natural forest. The site is a mosaic of agricultural fields, orchards and plantations, human habitation in the form of small hamlets to large villages, grass lands and scrubs, mostly distributed over the small hills and water bodies. This type of habitat is not suitable for the large and medium sized mammals. Only some common mammals like mongoose, jackal, jungle cat, squirrel, rodents and bats etc. have habitat in this area. The grass land and

scrub land provides suitable habitat for number of terrestrial bird's habitat as well as habitat for reptiles.

4.2.4.7 Sensitive Ecological Habitat

Madhya Pradesh is home to a number of charismatic mammalian fauna like Elephant, Tiger, Leopard, Sloth bear, Gaur, etc.Wildlife in Madhya Pradesh is given protection through a network of fiveNational Park, 20 Wildlife Sanctuaries, three Tiger Reserves and five Elephant Reserves**.** There is no National Park, Wildlife Sanctuary, and Tiger Reserve in the entire study (10 km around the project site).

The regional study reveals thatthree sanctuaries which are also known as Important Bird Areas located in Madhya Pradesh and adjoining Rajasthan (Refer **Figure 21)**. The details of these sanctuaries are given in **Table 4.8**.

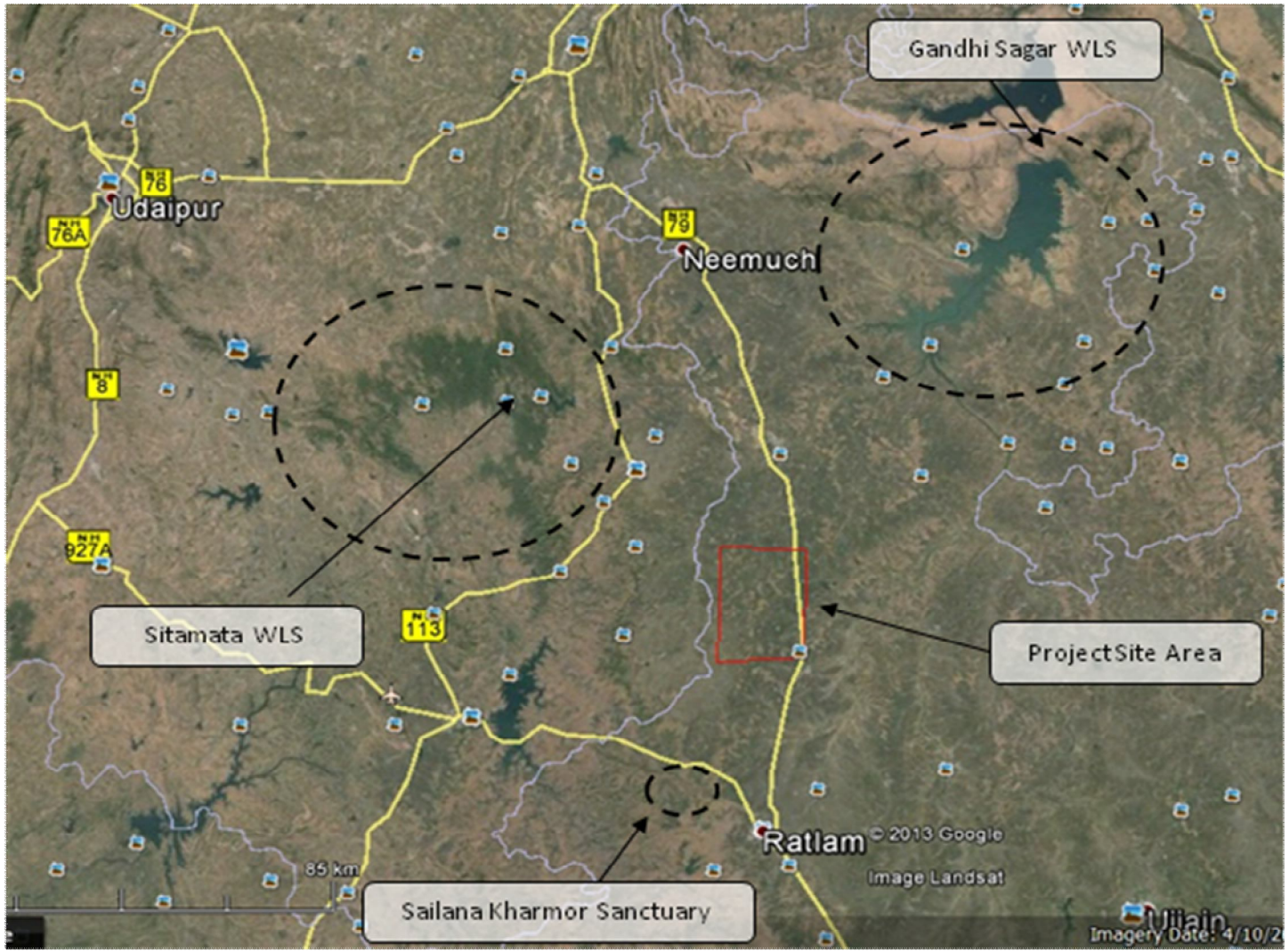
TABLE 4.8: ECOLOGICAL SENSITIVE AREA

Name	**Location**	**Distance and Direction**
SitamataWildlife Sanctuary	Pratapgarh district, Rajasthan	50 km W
Gandhi Sagar Reservoir and Wildlife Sanctuary	Mandsaur and Nimach district, Madhya Pradesh	80 km NE
SailanaKharmorWildlife Sanctuary	Ratlam district, Rajasthan	22 km W

Indian Bird Conservation Network's[6] has declared these sanctuaries as Important Bird Areas (IBA), where migratory and endangered species of birds reside.The presence of three large water bodies/dams near these sanctuaries (1) Jakham Dam - 45 km in North West (2) Mahi Dam - 35 km in South West (3) Gandhi Sagar Dam – 80 km North East make these locations very favorable for the birds.

[6]The Indian Bird Conservation Network (IBCN) is a network of individuals, organizations and government. It was established in 1998 by the Bombay Natural History Society (BNHS) in collaboration with Bird Life International, UK and the Royal Society for the Protection of Birds (RSPB) – Bird Life Partner in the UK. The IBCN is promoting the conservation of birds and their habitats in India and strengthening the biological diversity of the region.

Figure 21: Ecological Sensitivity Map



Box 1: SalianaKharmor Sanctuary[7]

The SalianaKharmor Sanctuary was declared a protected area in June 1983 to safeguard the highly endangered Lesser Florican (*Sypheotidesindica*), known locally as *Kharmor*or 'Grass Peacock'. It comprises of 354 ha of grassland, crop fields and grazing lands.

The Sanctuary is bounded by three villages, Sailana, Adwanya and Gordhanpura, and the whole area is jointly owned by agriculturists. The grassland area within the sanctuary is about 200 ha and is known as Naulakha*beed*(Sankaran 1990). The grassland was maintained and protected primarily for fodder production.

The most dominated by the grass species *Sehimanervosum, Chrysopogonfulvus*in the sanctuary. Other grass species are *Heteropogoncontortus, Apludamutica,Cymbopogonmartinii, Aristida funiculate* and species of genera *Brachiaria, Eragrostis, Dicanthium, Digitaria, Setaria,Bothriocloa*and *Pseudoanthistiria.* The scattered trees found in the sanctuary area are *Prosopischilensis, Zizyphusjujuba, Acaciacatechu* and *Buteamonosperma*.

The BNHS initiated studies on this bird sanctuary in 1984. During these preliminary surveys, 15 Floricans, mainly males were seen (Sankaran and Rahmani 1990). Intensive studies were conducted from 1986 to 1989 (Sankaran and Rahmani 1990, Sankaran 1991). The area was going through a cyclic dry phase, and 1987 experienced extreme drought. The Florican population declined, and by 1989, only 11 males were sighted. However, from 1991 onwards, for almost a decade the rainfall was normal or above normal but the Florican number still declined mainly due to shrinkage of habitat. As the grassland habitat was converted into crop fields, there was less and less habitat available for Florican.

Besides the Lesser Florican, 125 species of birds have been reported from Sailana grasslands (Anon. 1990). In the 1980s, a pair of Sarus Crane (*Grusantigone*)was found in the Sanctuary, and many more in the surrounding areas. Lesser Whistling Duck (*Dendrocygnajavanica)* commonly breeds in the grasslands near wetlands, especially during normal monsoon years when the grass is tall. During winter, three species of harriers (*Circus macrourus, C. pygargus* and *C. aeruginosus*) are seen, sometimes as many as 40-50 gather to roost. Sailana grasslands are good breeding grounds for the endemic Sykes' Crested Lark *Galerida deva*. Hundreds of European Rollers *Coraciasgarrulus*, Blue-cheeked Bee-eaters (*Meropssuperciliosu) s*and Blue-tailed Bee-eaters (*M. philippinus*are) seen on passage migration.

There is no large wild mammal in Sailana and the surrounding areas. Golden Jackal (*Canisaureus)*, Indian Fox (*Vulpesbengalensis)* and Jungle Cat (*Felischaus)* are the major predators of Lesser Florican, other birds and Black-naped Hare (*Lepusnigricollis)*. Many species of snakes are found, including Indian Cobra (*Najanaja)*, but none of them are of any conservation concern as they are commonly found in many areas

[7] Important Bird Areas in India – Madhya Pradesh http://ibcn.in/wp-content/uploads/2011/12/28-657_690-Madhya-Pradesh.pdf

Box 2: GandhisagarReservoir and Wildlife Sanctuary

Gandhisagar is the second largest reservoir (in area) in the country, next only to Hirakud in Orissa. It is formed by an impoundment on the River Chambal. The Chambal, at the dam site, is fed by the catchment areas from the Vindhyachal ranges to the south andAravalli to the northeast, covering a drainage area of 23,025 sq.km. The maximum length and width of the reservoir are 68 and 26km respectively, while the Sanctuary is 36,700 ha in area.Gandhisagar Dam is one among the four dams of the IntegratedChambal Development Programme shared by Mandsaur and Neemuch districts.

Gandhisagar reservoir is an Important Bird Area[8], which draws a large number of migratory and non-migratory birds throughout the year. This reservoir qualifies for A4iii criteria, i.e. congregation of 20,000 or morewaterbirds. There are reports of Lesser Adjutant (*Leptoptilosjavanicus)* and flamingos (*Phoenicopterus*spp). This reservoir is alsofamous for large numbers of the Bar-headed Goose (*Anserindicus)*.Although no proper census of this species has been conducted, itspopulation could easily reach the 1% threshold determined byWetlands International (2002).

Box 3: Sitamata Wildlife Sanctuary

Sitamata Sanctuary is located in South Rajasthan at a distance of 130 km from Udaipur city in Chittorgarh district. The Sanctuary represents the only teak forest, and is known for the presence of an isolated population of Large Brown Flying Squirrel (*Petauristapetauristaphilippensis)* (Tehsin 1980). The Sanctuary is an Important Bird Area[9].

The area is quite rich in avifauna, and 178 bird species are reported from the site (Sharma, 2002). The site lies in Biome-11 (Indo-Malayan Tropical Dry Zone), where Bird Life International has listed 59 species in the biome-restricted assemblages. In forests and grasslands of Sanctuary, 31 species of this biome have been recognized; hence the site is important for the biome restricted assemblages. It also has a small nesting colony of Long-billed Vultures, now much depleted. Five species recognized as Near Threatened are also found here.

4.2.4.8 Faunal Diversity

*Mammals:*As described in the wildlife habitat section, the proposed project site and its study area has no significant wildlife habitat. However, the mammalian species like Golden Jackal (*Canisaureus)*, Indian Fox (*Vulpesbengalensis)*, Jungle Cat (*Felischaus),* Black-naped Hare (*Lepusnigricollis)*, Indian Grey Mongoose*(Herpestesedwardi)*, squirrel

[8] Important Bird Areas in India – Madhya Pradesh http://ibcn.in/wp-content/uploads/2011/12/28-657_690-Madhya-Pradesh.pdf

[9] Important Bird Areas of India – Rajasthan - http://ibcn.in/wp-content/uploads/2011/12/37-847_897-Rajasthan.pdf

(*Funambuluspalmarum)*, rodents- *Bandicotaindica*, *BandicotabengalensisMusmusculus* and bats etc are reported from this area.

During the rapid ecological survey, a mass roosting site of Indian Flying Fox (*Pteropusgiganteus*) was recorded at Mawta (23°46'56.81"N, 74°58'51.83"E). Nearest wind Turbine Location isUUPL 35 &UUPL 36, which lies about 2km towards east.Roosting was observed in the Banyan and Tamarind trees beside the road. About 50 bats were recorded in the roosting site.

*Avifauna:*The terrestrial avifauna in the study area represents by the Parakeet, Owls, Nightjar, Pigeon, Bulbul, Myna, Babblers, Bee eater, Barbets, Dove, Indian roller, Oriole, Robin, Fly catcher, Crow pheasant, Crows, Drano, Sarus Crane, etc. A total of 40species of avi-fauna were recorded from thestudy area. The detailed checklist of avi-fauna in has been presented in **Annexure 3**.

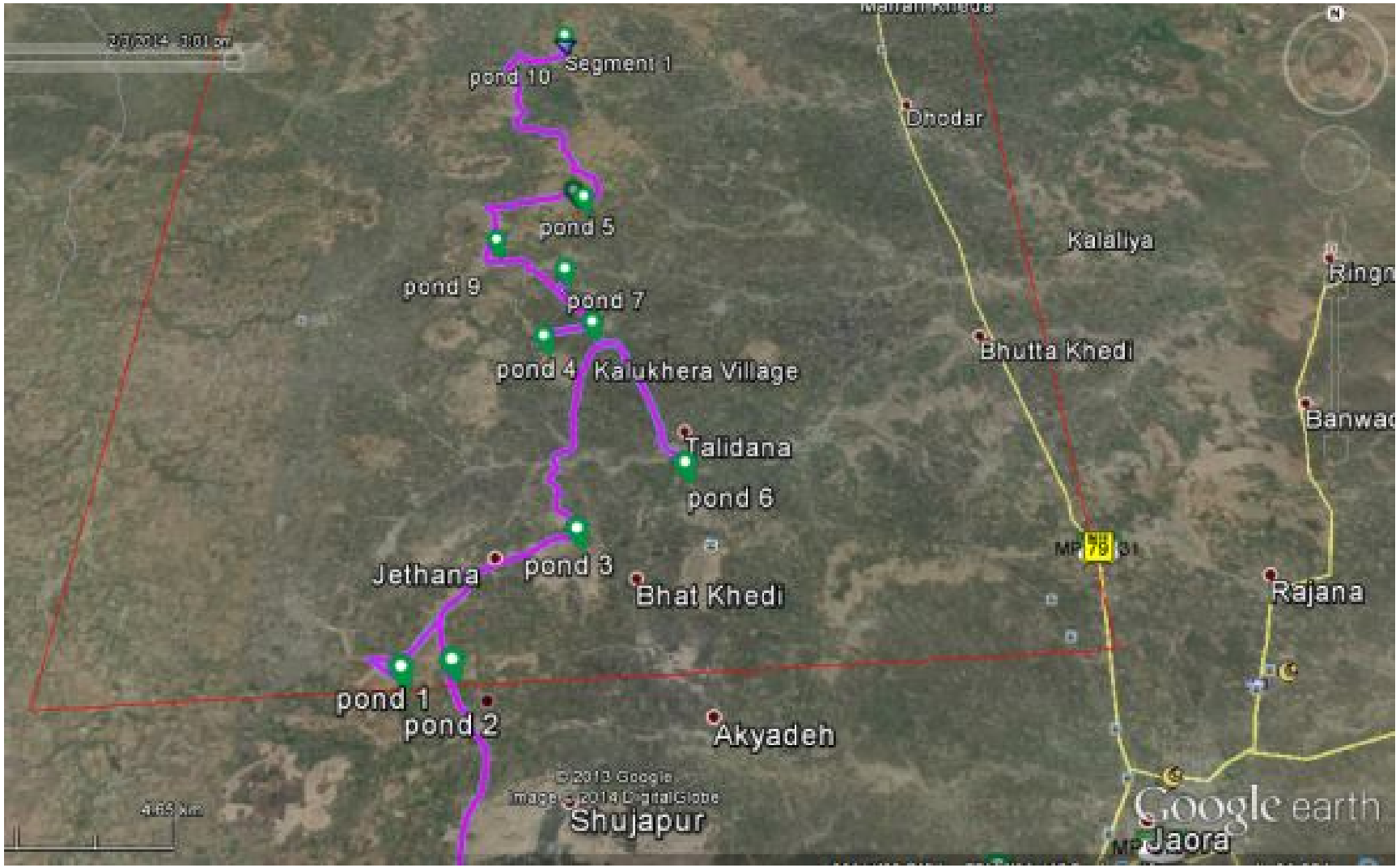
Reptilian Species: Reptilian fauna in the study area represents by the Indian cobra, Cat snake, Common garden lizard, Common Skink, Common Rat snake, saw scaled viper etc. A total of 10 reptilian species were recorded from the study area.

4.2.5 Aquatic Ecosystem

1.4.3.5 Aquatic Habitat

There are about 10 water bodies located in proximity to the WTG sites, most of these water bodies are seasonal and remain dry during the dry seasons. For the rapid ecological survey, all these water bodies (**Figure 22)** have been selected for ecological study, specially for aquatic birds. bird sighting at fixed interval of time for one week period. During the survey, out of these 10 water bodies, 6 water bodies were found to house 8 species of migratory birds.

Figure 22: Water Bodies & Primary Aquatic Bird Survey Map



1.4.3.6 Macrophytes

Seasonal wetlands and marshy lands are suitable habitat for aquatic macrophytes. The most dominant macrophyteswere*Phragmiteskarka, Arundodonax, Alternanthasessilis, Cyperusiria, Hydrillaverticillata*and *Nymphoidescristrat*.

1.4.3.7 Aquatic Birds

The water bodies have aquatic vegetation, which provides suitable habitat for aquatic birds; especially habitat for migratory birds. During the survey, the migratory birds were recorded in the six water bodies; those are less disturbed and away from human settlement.

The survey results show 11 species of aquatic birds in the study area (**Table 4.9)**. Out of 8 species are migratory and rest are residential species/local migratory.

4.2.5.1 Migratory Path for Birds

Migration remains one of the most compelling aspects of the avian world. Twice a year, billions of birds migrate vast distances across the globe. Typically, these journeys follow a predominantly north-south axis, linking breeding grounds in arctic and temperate regions with non-breeding sites in temperate and tropical areas. Many species migrate along broadly similar, well-established routes known as flyways. Recent research has identified eight such pathways: the East Atlantic, the Mediterranean/Black Sea, the East Asia/East Africa, the Central Asia, the East Asia/Australasia, and three flyways in the Americas and the Neotropics.

About eight trans Himalayan migratory birds were recorded from the study area, all which have breeding ground in the palaearctic and temperate regions of Central Asia. So they follow the Central Asian Flyway to complete their yearly migratory journey. The Central Asian Flyway is the shortest flyway in the world. Lying entirely within the Northern Hemisphere, it connects a large swathe of the Palaearctic with the Indian subcontinent. Separating the subcontinent from the Tibetan Plateau to the north are the Himalayas, which rise to over 8km and stretch 200km from north to south. Most of the birds, ‘squeeze’ into the Indian subcontinent via routes at the two ends of the Tibetan massif. Others, like the Bar-headed Goose (Anser indicus), follow a route directly over the Himalayan range. The species is the world's highest-altitude migrant, capable of clearing even Mount Everest. More than 300 species travel along the Central Asian Flyway. These include several species that undertake regular, seasonal movements within the Indian subcontinent**.**

Figure 23: Central Asian Flyway Map

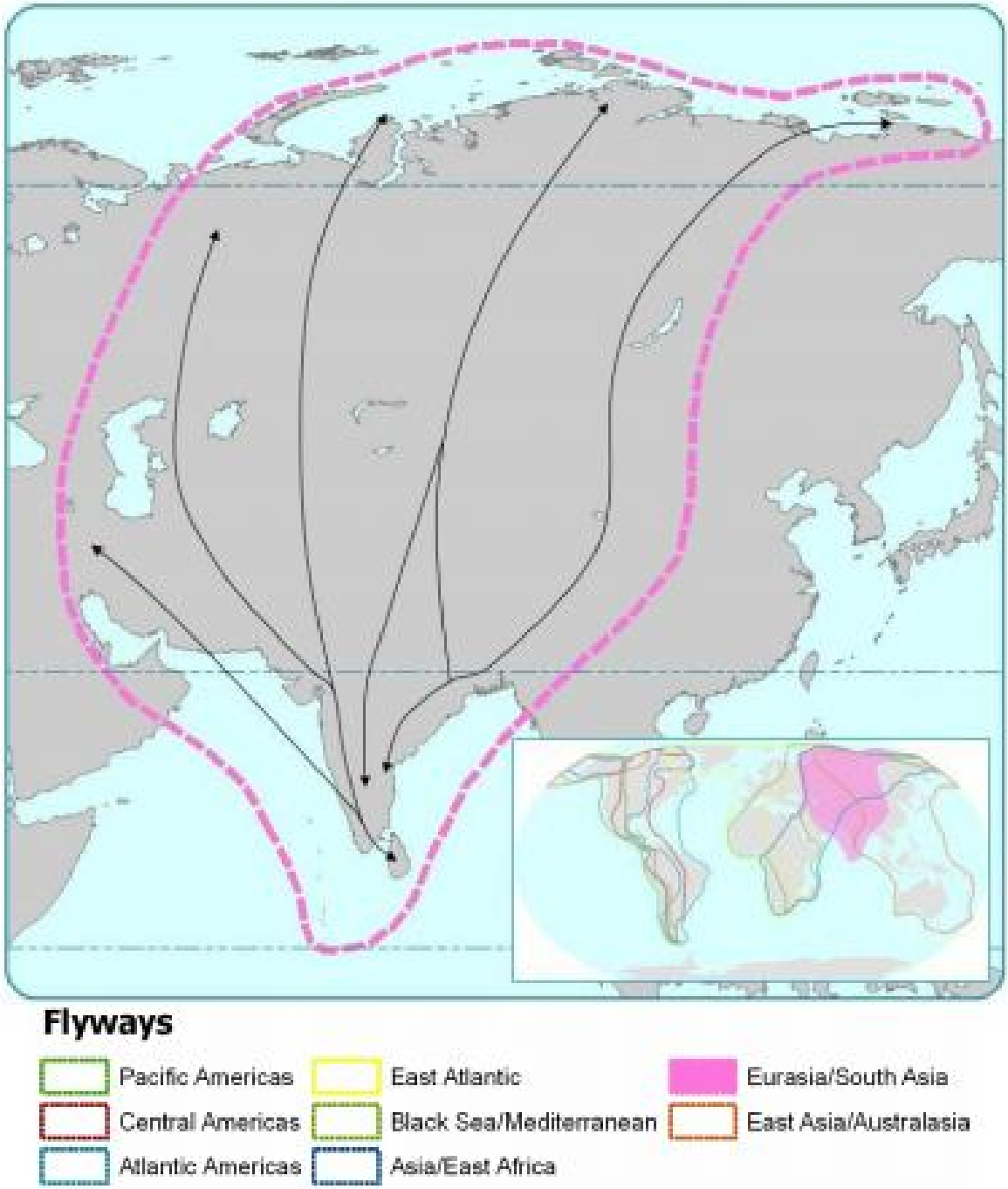


TABLE 4.9: LIST OF AQUATIC BIRD IN THE STUDY AREA

Sl No.	Common Name	Scientific Name	Location & Abundance						IUCN Status	Wildlife Schedule	Migration Status
			P-1	P-2	P-4	P-7	P-9	P-10			
A.	**Migratory Birds**										
1	Bar Headed Goose	*Anserindicus*			4				LC	IV	Trans Himalayan Migratory Bird. Breeding ground rages in the high altitude lakes of Central Asia from Tien Shan to Kokonor.
2	Common Teal	*Anascrecca*		8		9		1	LC	IV	Trans Himalayan Migratory Bird. Breeding Range extends from Europe and Central Asia.
3	Spot Billed Duck	*Anaspoecilorhyncha*	5		120	127	34		LC	IV	Large breeding range extending from Southern Russia, Central Asia, India, China up to Southern Japan. During winter period, the population residing in Southern Russia, Central Asia, China and Japan, migrates to South Asia and South East Asia
4	Mallard	*Anasplatyrhynchos*				2			LC	IV	Trans Himalayan Migratory Bird. Large proportion of this winter migrant comes from Siberia.
5	Northern Pintail	*Anasacuta*				2			LC	IV	Trans Himalayan Migratory Bird. Breeding Range lies in the Northern Part of Asia, Europe and North America.
6	Red Crusted Pochard	*Nettarufina*					4		LC	IV	Trans Himalayan Migratory bird. Breeding Range extends from Europe and Central Asia.

Sl No.	Common Name	Scientific Name	Location & Abundance						IUCN Status	Wildlife Schedule	Migration Status
			P-1	P-2	P-4	P-7	P-9	P-10			
7	Ruddy Shelduck	*Tadornaferruginea*				21			LC	IV	Trans Himalayan Migratory bird. Breeding range Extends from Southern Europe, Central Asia to High altitude water bodies of Himalaya
8	Tufted Duck	*Aythyafuligula*						5	LC	IV	Trans Himalayan Migratory Bird. Mainly breeds in Europe and Central Asia, particularly lake Baikal.
B.	**Residential/Local Migratory**										
9	Sarus Crane	*Grusantigone*			1				VU	IV	
10	Painted Stork	*Mycterialeucocephala*			1				NT	IV	
11	Black-headed Ibis	*Threskiornismelanocephalus*				1			NT	IV	

[P-1: Pond near Pancheva village; P-2: Pond near Pancheva village; P-4: Pond near Kalukhera village; P-7: Pond near Kalukhera village; P-9: Pond near Bagiya village; P-10: Pond near Khodana village]

4.2.5.2 Endemic, Threatened & Endangered Species

The study reveals that, no Schedule I species as per Indian Wildlife (Protection) Act, 1972 was recorded from the study area. As per IUCN Redlist only one vulnerable species were recorded from the study area.

4.3 SOCIOECONOMIC ENVIRONMENT

This section discusses the baseline socio-economic environment of the study area defined for the proposed Wind power project located at Piploda, and Dalouda Tehsils, Districts Ratlam and Mandsaur in the state of Madhya Pradesh. 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 2011, District Information Centre, District Statistical Handbook etc.). The village-wise secondary data (as obtained from Census, 2011) has been taken into consideration for analyzing the socio-economic profile in a comparative manner.

4.3.1 General Socioeconomic Profile

Given the scale and nature of the proposed project a study area has been defined for profiling of socio-economic environment of nearby villages of Piploda and Daloudatalukas in Ratlam and Mandsaur districts of Madhya Pradesh where the proposed site is located and is primarily based on reconnaissance surveys, understanding of the project and professional judgment.

As the proposed project involves the setting up of wind power project in Piploda and Daloudatalukas, Ratlam andMandsaur district of Madhya Pradesh state, the following villages have been considered for socio-economic profiling as presented in **Table 4-9** below.

TABLE 4-10 : LIST OF VILLAGES SELECTED FOR SOCIO-ECONOMIC PROFILING

S. No.	District	Taluka	Village name
1.	Ratlam	Piploda	Bathkhedi
2.	Ratlam	Piploda	Jethana
3.	Ratlam	Piploda	Pancheva
4.	Ratlam	Piploda	Kanser
5.	Ratlam	Piploda	Bilandpur
6.	Ratlam	Piploda	Bagiya
7.	Ratlam	Piploda	Naveli

S. No.	District	Taluka	Village name
8.	Ratlam	Piploda	Bathkheda
9.	Ratlam	Piploda	Richadevra
10.	Mandsaur	Dalouda	Khodana
11.	Ratlam	Piploda	Jadwasa
12.	Ratlam	Piploda	Pingrala
13.	Ratlam	Piploda	Jaliner
14.	Ratlam	Piploda	Barkhedi
15.	Mandsaur	Dalouda	Kachnara
16.	Mandsaur	Dalouda	Sarsodh
17.	Mandsaur	Dalouda	Chandakhedi
18.	Ratlam	Piploda	KaluKheda
19.	Ratlam	Piploda	Mawata
20.	Ratlam	Piploda	Mamatkheda

4.3.1.1 Ratlam and Mandsaur District

Ratlam district is located in the North West part of the state of Madhya Pradesh and is bounded by Mandsaur district to the North and have coordinates 23° 31' N, 75° 07' E and is spread across an area of almost 4861 square kilometers. It is bounded by Mandsaur district to North, Jhalawar district to Northwest, Ujjain district to the west,Dhar district to the south east and Chittorgarh district to East.The district is divided into five tehsils and is home to 9 towns and 1063 villages. The district is part of Ujjain division. While Mandsaur district forms the northern projection of Madhya Pradeshfrom its western division, Ujjain and have an area of 5521 square kilometers and it lies between the parallels of latitude 230 45’ 50” North and 250 2’ 55” North and between the meridians of longitude 740 42’30” East and 750 50’ 20” East. The proposed project is located in Piploda and Dalouda Tehsil of Ratlam and Mandsaur districts. According to the 2011 census, total population of Ratlam district is 14,55,069;number of males in Ratlam is7,38,241 and number of females is7,16,828. Sex ratio of Ratlam is 971 females per 1000 males. Population of Mandsaur is 13,40,411of males in Mandsaur are 6,82,851 and number of females are 657560.Sex ratio of Mandsaur is 963 females per 1000 males.

4.3.2 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 has been discussed in section below and presented in **Table 4-10** .

4.3.2.1 Population & Household Size

As per the Census 2011 records, highest population among the study villages is recorded for KaluKheda (5436) and Lowest population is recorded for Bagiya (544). Average household size for study area villages is 5 except BhatKheda, Kanser, and Bagiya for which average household size is 4.

4.3.2.2 Sex Ratio

The minimum sex ratio among study area villages is recorded for RichaDevra (889) and maximum sex ratio is recorded for Barkhedi (1020).

TABLE 4-11 : DEMOGRAPHIC PROFILE OF THE STUDY AREA VILLAGES

Village Name	HH Nos.	Total Pop.	HH Size(avg)	Male Pop.	% M	Female Pop.	% F	Sex Ratio
BhatKhedi	197	958	5	499	52.1	459	47.9	919.8
Jethana	287	1367	5	706	51.6	661	48.4	936.3
Pancheva	627	2951	5	1510	51.2	1441	48.8	954.3
Kanser	268	1187	4	599	50.5	588	49.5	981.6
Bilandpur	126	586	5	300	51.2	286	48.8	953.3
Bagiya	129	544	4	279	51.3	265	48.7	949.8
Naveli	300	1356	5	684	50.4	672	49.6	982.5
BhatKheda	300	1255	4	642	51.2	613	48.8	954.8
Richadevra	305	1417	5	750	52.9	667	47.1	889.3
Khodana	324	1661	5	831	50.0	830	50.0	998.8
Jadwasa	316	1422	5	723	50.8	699	49.2	966.8
Pingrala	358	1638	5	836	51.0	802	49.0	959.3
Jaliner	164	831	5	417	50.2	414	49.8	992.8
Barkhedi	435	2012	5	996	49.5	1016	50.5	1020.1
Kachnara	618	3230	5	1643	50.9	1587	49.1	965.9
Sarsodh	586	2743	5	1409	51.4	1334	48.6	946.8
Chandakhedi	325	1572	5	818	52.0	754	48.0	921.8
KaluKheda	1052	5436	5	2836	52.2	2600	47.8	916.8
Mawata	1036	4756	5	2428	51.1	2328	48.9	958.8
Mamatkheda	601	2806	5	1438	51.2	1368	48.8	951.3

4.3.2.3 Scheduled Caste and Scheduled Tribes

In the study area villages' percentage of Schedule Caste varies from 1.5% – 41.6%. Maximum percentage of Schedule Caste is recorded for Bilandpur (41.6%) and minimum for Bagiya (1.5%).

In the study area villages' percentage of Schedule Tribes varies from 0% – 27.3%. Maximum percentage of Schedule Caste is recorded for RichaDevra (27.3%) and minimum for BhatKhedi and ChandaKhedi (0%).

TABLE 4-12 : SCHEDULE CASTE AND SCHEDULE TRIBES OF STUDY AREA VILLAGES

Village Name	SC Population	% SC	ST Population	% ST
BhatKhedi	346	36.1	0	0
Jethana	354	25.9	57	4.2
Pancheva	420	14.2	163	5.5
Kanser	204	17.2	39	3.3
Bilandpur	244	41.6	130	22.2
Bagiya	8	1.5	124	22.8
Naveli	153	11.3	204	15.0
BhatKheda	116	9.2	70	5.6
RichhaDewada	148	10.4	387	27.3
Khodana	345	20.8	169	10.2
Jadwasa	248	17.4	42	3.0
Pingrala	257	15.7	39	2.4
Jaliner	141	17.0	143	17.2
Barkhedi	393	19.5	24	1.2
Kachnara	572	17.7	52	1.6
Sarsod	162	5.9	34	1.2
Chandakhedi	97	6.2	0	0.0
KaluKheda	975	17.9	388	7.1
Mawata	963	20.2	131	2.8
Mamatkheda	475	16.9	435	15.5

4.3.3 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 2011 is presented in **Table 4-12.**

TABLE 4-13 : LITERACY PROFILE OF THE STUDY AREA VILLAGES

Village Name	Total Literate	%	Male Literate	%	Female Literate	%	Illiterates	%
BhatKhedi	557	58.1	347	62.3	210	37.7	401	41.9
Jethana	926	67.7	552	59.6	374	40.4	441	32.3
Pancheva	1834	62.1	1133	61.8	701	38.2	1117	37.9
Kanser	835	70.3	457	54.7	378	45.3	352	29.7
Bilandpur	332	56.7	206	62.0	126	38.0	254	43.3
Bagiya	292	53.7	190	65.1	102	34.9	252	46.3
Naveli	888	65.5	533	60.0	355	40.0	468	34.5
BhatKheda	817	65.1	511	62.5	306	37.5	438	34.9
RichhaDewada	968	68.3	584	60.3	384	39.7	449	31.7
Khodana	1069	64.4	628	58.7	441	41.3	592	35.6
Jadwasa	880	61.9	539	61.3	341	38.8	542	38.1
Pingrala	1035	63.2	648	62.6	387	37.4	603	36.8
Jaliner	455	54.8	281	61.8	174	38.2	376	45.2
Barkhedi	1413	70.2	788	55.8	625	44.2	599	29.8
Kachnara	2081	64.4	1260	60.5	821	39.5	1149	35.6
Sarsod	1804	65.8	1114	61.8	690	38.2	939	34.2
Chandakhedi	1007	64.1	624	62.0	383	38.0	565	35.9
KaluKheda	3867	71.1	2281	59.0	1586	41.0	1569	28.9
Mawata	2845	59.8	1758	61.8	1087	38.2	1911	40.2
Mamatkheda	1814	64.6	1068	58.9	746	41.1	992	35.4

4.3.4 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 2011 is presented in **Table 4-13.**

TABLE 4-14 : WORKFORCE PARTICIPATION FOR STUDY AREA VILLAGES

Villages	Total Worker	Work Participation Rate	% Cultivator	% Agriculture Labour	% Household Worker	% Other Worker
BhatKhedi	526	54.9	44.9	32.5	0.19	3.2
Jethana	744	54.4	29.7	48.9	0.27	2.0
Pancheva	1575	53.4	38.2	18.7	0.57	7.4
Kanser	507	42.7	15.0	10.5	0.00	6.1
Bilandpur	335	57.2	26.0	43.0	0.00	3.6
Bagiya	337	61.9	30.6	3.6	1.48	5.0
Naveli	548	40.4	54.0	6.4	0.18	3.6
BhatKheda	690	55.0	28.3	0.1	0.00	2.6
RichhaDewada	730	51.5	51.8	40.0	0.14	6.3
Khodana	937	56.4	42.4	16.8	0.00	1.9
Jadwasa	863	60.7	50.6	22.2	0.12	2.1
Pingrala	950	58.0	53.1	39.1	1.58	2.2
Jaliner	391	47.1	27.9	14.3	0.00	0.8
Barkhedi	1109	55.1	29.5	63.3	0.45	3.4
Kachnara	1779	55.1	36.0	41.7	0.90	12.3
Sarsod	1595	58.1	57.9	17.9	0.88	14.0
Chandakhedi	757	48.2	85.2	10.2	0.00	3.2
KaluKheda	1745	32.1	28.8	17.9	0.86	18.5
Mawata	2797	58.8	32.6	37.5	0.14	6.3
Mamatkheda	1616	57.6	36.6	34.3	1.18	6.1

4.3.5 Socioeconomic Infrastructure

The information/data provided in this section has been primarily derived from secondary sources (Census of India 2001, District Information Centre, District Statistical Handbook etc.).

Educational Facilities

Only primary education facility is observed in villages *Bhatkhedi,Bilandpur,Bagiya,Naveli,Jaliner,and Chandakhedi,*whilein rest of the villages both

primary and middle school facilities are observed. Educational facility in the study area is given in **Table 4-14**.

Drinking Water Facilities

It is observed that villagers in the study area access drinking water through wells, tube wells and hand pumps. Drinking water facilities in the study area is given in **Table 4-14**.

Medical Facilities

There is no primary medical facility in the villages except in Pancheva where both primary health center and primary health sub-centers are available. Medical facilities in the study area are given in **Table 4-14.**

TABLE 4-15 : BASIC AMENITIES IN THE STUDY AREA

Village	Education Facility	Medical Facility	Drinking Water Source	Post and Telegraph	Approach to Village	Power Supply	Communication facilities
BhatKhedi	P_SCH (1)	PHSC(0) PHC(0)	W(1) HP(1)	PO(0) PH(1)	PR(1) MR(0)	Available	Nearest town is Jaora 10 km
Jethana	P_SCH (1) M_SCH (1)	PHSC(0) PHC(0)	W(1) TW(1)	PO(0) PH(6)	PR(0) MR(1)	Available	Nearest town is Jaora 15 km
Pancheva	P_SCH (2) M_SCH (1)	PHSC(1) PHC(1)	W(1) TW(1)	PO(1) PH(25)	PR(1) MR(0)	Available	Bus services Nearest town is Piploda15 km
Kanser	P_SCH (1) M_SCH (1)	PHSC(0) PHC(0)	W(1) TW(1)	PO(0) PH(10)	PR(1) MR(0)	Available	Bus services Nearest town is Jaora 18 km
Bilandpur	P_SCH (1)	PHSC(0) PHC(0)	W(1) TW(1)	PO(0) PH(4)	PR(0) MR(1)	Available	Nearest town is Jaora 19 km
Bagiya	P_SCH (1)	PHSC(0) PHC(0)	W(1) TW(1) TK(1) HP(1)	PO(0) PH(1)	PR(0) MR(1)	Available	Nearest town is Jaora 21km
Naveli	P_SCH (1)	PHSC(0) PHC(0)	W(1) TW(1) HP(1)	PO(1) PH(18)	PR(1) MR(0)	Available	Bus services Nearest town is Jaora 20 km
BhatKheda	P_SCH (1) M_SCH (1)	PHSC(0) PHC(0)	W(1) HP(1)	PO(0) PH(0)	PR(1) MR(0)	Available	Bus services Nearest town is Jaora 25 km
RichhaDewada	P_SCH (2) M_SCH (1)	PHSC(0) PHC(0)	W(1) HP(1)	PO(0) PH(8)	PR(1) MR(0)	Available	Bus services Nearest town is Jaora 30 km
Khodana	P_SCH (1) M_SCH (1)	PHSC(0) PHC(0)	W(1) TW(1) HP(1)	PO(0) PH(1)	PR(0) MR(1)	Available	Bus services Nearest town is Nagri 5 km

Village	Education Facility	Medical Facility	Drinking Water Source	Post and Telegraph	Approach to Village	Power Supply	Communication facilities
Jadwasa	P_SCH (2) M_SCH (1)	PHSC(0) PHC(0)	W(1) HP(1)	PO(1) PH(5)	PR(1) MR(0)	Available	Bus services Nearest town is Jaora 22 km
Pingrala	P_SCH (2) M_SCH (1)	PHSC(0) PHC(0)	W(1) HP(1)	PO(1) PH(6)	PR(0) MR(1)	Available	Bus services Nearest town is Jaora 23 km
Jaliner	P_SCH (1)	PHSC(0) PHC(0)	W(1) TW(1) HP(1)	PO(0) PH(1)	PR(1) MR(0)	Available	Bus services Nearest town is Jaora 20 km
Barkhedi	P_SCH (2) M_SCH (1)	PHSC(0) PHC(0)	W(1) TW(1) HP(1)	PO(0) PH(12)	PR(0) MR(1)	Available	Bus services Nearest town is Jaora 19 km
Kachnara	P_SCH (1) M_SCH (1)	PHSC(0) PHC(0)	W(1) HP(1)	PO(1) PH(0)	PR(1) MR(0)	Available	Bus and Rail services Nearest town is Nagri 5 km
Sarsod	P_SCH (1) M_SCH (1)	PHSC(0) PHC(0)	W(1) HP(1)	PO(1) PH(10)	PR(1) MR(0)	Available	Bus services Nearest town is Nagri 10 km
Chandakhedi	P_SCH (3)	PHSC(0) PHC(0)	W(1) HP(1)	PO(0) PH(10)	PR(0) MR(1)	Available	Bus services Nearest town is Mandsaur 20 km
KaluKheda	P_SCH (4) M_SCH (1)	PHSC(0) PHC(0)	W(1) TK(1) TW(1) HP(1)	PO(1) PH(107)	PR(1) MR(0)	Available	Bus services Nearest town is Jaora 15 km
Mawata	P_SCH (2) M_SCH (1)	PHSC(0) PHC(0)	W(1) TW(1) HP(1)	PO(1) PH(15)	PR(1) MR(0)	Available	Bus services Nearest town is Jaora 33 km
Mamatkheda	P_SCH (4) M_SCH (1)	PHSC(0) PHC(0)	W(1) TW(1) HP(1)	PO(1) PH(29)	PR(1) MR(0)	Available	Bus services Nearest town is Jaora 5 km

[Source: Census of India 2001]

Education Facility: *P_SCH = Primary School; M_SCH = Middle School*

Medical Facility: *PHSC-Primary heath sub center; PHC-Primary Health center;*

Drinking Water Facility*: TK = TANK*

Post and Telegraph*: PO = Post Office,PH=Phone*

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

Power Supply*: ED = Electricity for domestic use, EO = Electricity for other purposes,*

Drinking Water Source: *HP=Hand Pump TW=Tube Wel,W=Well*

4.3.6 Details of Project Affected People (PAP)

As described earlier, the procurement of private land for T-line and partially for the access roads is likely to involve around 40 persons which can be considered as project affected people. However, land is being procured on willing to sell and willing to buy basis and a negotiated amount of compensation is also paid to these project affected people. Since the private land requirement is less due to the major involvement of Govt. revenue land therefore project affected people number is also very limited. Consultation with these PAPs could not be undertaken as a part of the ESIA process, since verification as well as negotiation with these PAPs is reported to be at an initial stage.

4.3.7 Primary Survey – Observations & Assessment

In addition to secondary data of Census of India, information from the local people was gathered through one to one interactions and focused group discussions to substantiate the secondary information on socioeconomic environment of the study area.

Encroachments

During the interaction with local villagers in Bhatkheda, Naulakha, Jaliner, Pingrala, Sarsod,Khodana, Kalukheda, Richadevda and Pancheva villages, it was reported that the main livelihood in the area is agriculture. After the agriculture practices which is the major livelihood, people also depends on livestock. During the site visit and interaction with local people and encroachers, encroachments in the form of agriculture practices on revenue land have also been observed. The factors responsible for increasing the encroachment issues in the area includes Good availability of ground water for irrigation, availability of plenty of vacant revenue land and very low penalty of Rs.1500 /acre/ year by revenue department.

Community perception about wind power project

Discussion with community people revealed that local people are getting employment opportunities due to wind power projects. As a result of wind power project villagers are benefitted with improved condition of access roads. It was also informed by the villagers that people are investing their compensation amount in some other business and agricultural land at nearby locations. It was also observed that the low requirement of land to setup individual WTG, no restriction on their movement and working on nearby land and no pollution due to operation of wind turbine are the main factors to create positive perception among the community.

Community Needs & Expectations

Infrastructural facility viz., water supply, electricity, education facility and road network is good in the area. However, internal village roads at various places are still unpaved and during monsoon movement on these roads is very difficult. In addition to this, very few primary health centers are available in the area. During the community discussion, it was noted that village roads, employment opportunities, primary health centers and medical checkup camps are the prime community needs and expectations

5 STAKE HOLDER CONSULTATION AND COMMUNITY ENGAGEMENT

5.1 PROJECT STAKEHOLDERS

Stakeholders are persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project and/or the ability to influence its outcome, either positively or negatively. For the proposed project, list of the stakeholder identified is given here.

STAKEHODLER IDENTIFIED FOR THE PROPOSED PROJECT

S. No.	Project Stakeholders	Role of Stakeholders	Responsible Person
1	Local Panchayat Body	The local Panchayat is the nodal body which provides permission for doing the road works, to lay electrical poles, t-lines, build store yard and electricity sub-station in the village.	Construction Manager
2	Land Sellers	Land sellers are associated with the company by the sale of land which they make to the Project Company	Purchase Manager
3	State Electricity Board	SEB gives all the initial approvals which are required for the Company to connect their Project to the grid and sell the power	Purchase Manager
4	CEOG (Chief Electrical Officer to Government)	Provides the approval for technical design and safety before you can commission your WTG. Ensures that all the technical parameters have been taken care off.	Purchase Manager
5	MPUVNL (Madhya Pradesh Urja Vikas Nigam Limited)	Provides infrastructure clearances which is the permission to set up a WTG in the state and commissioning clearance which is the permission that you can formally commission the WTG and connect it to the grid.	Purchase Manager
7	Local communities	These include communities which are affected by transportation of wind equipment, excavation, wind turbine operations (shadow flickering, noise, blade throw etc.).	Head HSE
8	Continuum Employees	Engaged as developers of the Project	Head HR
9	Lenders	Providing financing for the Project which will be disbursed based on fulfillment of certain deliverables / conditions.	Finance Manager
10	Contractors	Actual work on the Project is done by	Construction

		contractors and their sub-contractors. Any person who is engaged on account of the Project Developer. Carry out different activities for us ranging from land acquisition, obtaining approvals, doing civil work, supplying WTG equipment and setting up transmission / evacuation infrastructure.	Manager
11	State Pollution Control Board (SPCB)	Consent to Establish and Consent to Operate is provided by SPCB for wind power projects.	Purchase Manager

Stakeholder Engagement - Status and Planning

The stakeholder engagement for the proposed project has been initiated. The stakeholder engagement includes discussion and planning of projects by engaging the identified stakeholders. Detailed status of stakeholder engagement is given below:

- Meeting with Gram Panchayat completed and in this regard NOC has also been obtained
- Discussion with lend seller i.e. MPUVNL and private land owner is completed
- State Electricity Board and CEOG has been engaged to examine the project with respect to preparation of electrical design, safety and infrastructure. Power purchase agreement has also been signed off
- MPUVNL has examined the project and provided infrastructure clearances for the WTG
- Communities: The first level of consultation with the community has been carried out during the ESIA study and view of community is also recorded and presented in further section of this report. However, detailed community consultation for the proposed project will be carried out by DJE and UUPL before the commencement of project.
- Discussion with State Pollution Control Board is ongoing. As per the direction of SPCB, environmental issues will be taken care
- Lenders: Discussion with lenders regarding the proposed project planning is already initiated
- Contractors will be involved for the planning of project activities to ensure control of environmental, health, safety and social risk and impacts.

5.2 STAKEHOLDER CONSULTATION

In accordance with the IFC guidelines and national laws, the concerns of local communities are taken into account through Focused Group Discussions and one to one interactions. DJE and UUPL are committed to undertake business with the approach of sustainable development. Stakeholder consultation was carried out in Bhatkheda, Naulakha, Jaliner, Pingrala, Sarsod, Khodana, Kalukheda, Richadevda andPancheva villages through focused group discussion and one to one interaction. As referred in section 4.3.6 of this report, PAPs in the proposed project is very limited since the most of the land requirement of the project is being met by the allotted Govt. revenue land. Consultation with the PAPs could not be undertaken as a part of the ESIA process, since verification as well as negotiation with the PAPs is reported to be at an initial stage. However, a public consultation is being planned up by DJE & UUPL as a part of stakeholder engagement before the commencement of construction phase. The details of consultation and photographs are given here in **Table -5.1** and **Figure -24** respectively.

TABLE 5-1 : SOCIO-ECONOMIC DETAILS OF PROJECT AFFECTED PEOPLE

Sl No	Respondent name	Address (Village/Tehshil/Dist)	Community Feedback
1	Madan lal and Dhanalal	Nolakha	At present, village roads are unpaved and in monsoon movement on these unpaved roads become very difficult. Expectation: improvement in road conditions Very few Anganwadi centre are present. Expectation: some more centre can be developed Primary health centre is absent Expectation: Medical camp and health centre can be provided Further expectation in terms of employment opportunity for unskilled labour, hiring of their vehicles for project work also observed
2	Tejram Mali and Manalal	Panchewa	
3	Parvat Singh and Chaganlal	Jaliner	
4	Bhawar singh	Bhatkheda	
5	Amar singh	Kacthnera	
6	Bala	Sarsod	

Figure 24: Community Consultation Photographs






5.3 FINDINGS OF STAKEHOLDER CONSULTATION

Livelihood

During discussion with community people, it was found that most of the people in this area are engaged in agricultural activities followed by livestock rearing. This area is characterized by plenty of irrigational water sources. Ground water table is also high in the area. People in the area are using surface water bodies and ground water to fulfill irrigational water requirement. The main crops observed in the area are Wheat, Paddy, Mustard, Gram, Soyabean etc. Few farmers also cultivate vegetables such as potato, sweet potato, onion, carrot and other seasonal vegetables. The main livestock in these villages are cows, buffalos, goats, sheep etc. Few villagers are engaged in selling of milk products. At most of the places in the project area, encroachment in terms of agricultural practices on revenue land was observed and also acknowledged by the encroachers for which they pay an annual penalty to revenue department.

Community Perception for Wind Power Project

During discussion, it was also found that people in the nearby villages are already aware of the wind power plants, as many of the wind power plants are already operating in the adjoining area. The local people are informed about the direct and indirect support in terms of employment for skilled and unskilled persons due to the wind power projects already operating in the area. During the development of wind power projects operating in the area, people have started their own business from the compensation provided to them against land purchased i.e. increased the cattle population, purchased agricultural land elsewhere etc.

Community Expectation and Needs

Feedback received from community people revealed that there is requirement of improvement for village access road, primary health centers etc. Electricity availability in the villages is good with very few power cuts. The village amenity database of Census of India also substantiates the requirement of medical facility including primary health centers. As per the information collected by Census Department of Government of India, water supply, electricity and educational facility (to some extent) are good in the study area village but primary health center and internal village road's condition are the areas where improvement is required.

Vulnerable Group

During discussion with local communities, it is also found that the area along the highway (NH-79, near the Sarsod village) has a significant habitation of female sex workers and the same is further confirmed by the report of Madhya Pradesh State Human Rights Commission. According to this report, the Banchhara community is practicing caste based prostitution in the area of Ratlam, Neemuch and Mandsaur districts.

Conclusion

Based on the community consultation outcomes it can be concluded that environmental and social impact due to the proposed wind power project is low as almost the entire land procured for the project is barren revenue land. However, encroached cultivation needs to be dealt carefully after discussion with encroachers. Also, engagement of local people in the project in terms of unskilled labour and support for the development of infrastructural amenities in the nearby villages are suggested to include in community development plan. Considering the large scale of project and people expectation a grievances redressal mechanism as given below should be implemented to address and resolve the community concerns and to minimize the social impacts due to this wind power project.

5.4 COMMUNITY ENGAGEMENT

A detailed community development plan should be prepared by DJE and UUPL based on the community feedback received during stakeholder consultation and observations of DJE and UUPL officials recorded during interactions with villagers. Further, a formal disclosure of the project will be carried out by DJE and UUPL to the community including the PAPs to meet the land requirement of T-line and access roads. To initiate the community development plan a community engagement plan should be prepared. The outline of community engagement plan, stakeholder engagement plan and community development plan is provided in Environmental Management chapter of this report. In addition to the management plans, an outline of Grievance Redressal Mechanism for both community and workers is also being described in the following section

5.5 GRIEVANCE REDRESSAL MECHANISM FOR COMMUNITIES

Grievance management is one of the pillars of stakeholder engagement. At the time of stakeholder engagement process, community shall be informed about the grievance redressal mechanism to take care of any concern or complaints raised during the development of project.

Objective

- To inform the affected communities about the grievance redressal mechanism.
- To ensure that grievances from affected communities are responded to and managed appropriately.

Applicability

This mechanism delineates measures that should be adopted to identify and address concerns and complaints of communities during construction and operation stages. It should be administered by the Project Manager / Asset Manager during construction and O&M stage respectively with the help of contractor.

Grievance

Complaints affecting nearby communities associated with project construction and operation activities i.e. vehicular movement, fugitive dust, usage of local natural resources, noise disturbance etc. and encroachment would constitute a grievance. Where the points of disputes are of general applicability or of considerable magnitude, they will fall outside the scope of this mechanism.

Grievance Handling Procedure

Project Developer itself and through contractor should ensure that grievances of affected communities are reported and addressed in effective manner through following measures

- Inform community about the GRM developed at the time of Community Engagement to take care of any concern or complaints raised during various stages of project development. Details of the Project and Grievance Redressal Mechanism will be communicated to the Gram Panchayat office who in turn communicates it to the community members. The Company will also engage directly with the community in smaller groups to directly communicate the Grievance Redressal Mechanism.
- Communicate the point of contact (venues, locations, staff, and contact information) to submit grievances i.e. Company Project Site Office.
- The grievance will be recorded in a Grievance Register placed at the Project office of the Company. Grievances can be in a written / verbal format.DJE and UUPL will seek the opinion of the local communities to understand need for enhanced access, and accordingly ensure that the points of contact and the place of recording grievances are convenient for the communities spread-out adjacent to the project site.
- Each grievance received from an aggrieved community member including encroachments issues and complaints due to construction activities will be received and addressed by the Project Manager as soon as possible and not later than 30 days from the day the grievance is communicated to the Company. The grievances that can be handled at the site level itself without requiring significant resources or interventions from the corporate office of the company will be closed within a week's time.
- If the Project Manager is unable to resolve the matter within the stipulated period, then the grievance will be escalated to the Senior Management of the Company by the Project Manager himself after the expiry of the 30 days period along with action taken by him to resolve the same during the expired 30 day period.
- The Senior Management of the Company will ensure to resolve the grievance within 60 days from the day the grievance is recorded. In case the grievance is expected to take more time to get resolved, the same will be communicated to the aggrieved community member.
- The resolution timeline will be monitored through the weekly reports which are sent to the EHS specialist and cause for any delays will be detailed in the grievance register.
- A grievance will be considered to be resolved only once the aggrieved person or leader of the aggrieved group has signed off on the grievance mechanism register. For this signature or thumb print on the register will be taken.

Records

Maintain record of grievances raised by the community and measures taken to resolve the same in the Grievance Register at the Project Office.

Review

The implementation status of this mechanism will be reviewed on a weekly basis by DJE and UUPL's Site Supervisor who in turn will report the grievances and status of actions taken/pending to DJE and UUPL's EHS Specialist. The EHS specialist will then verify the compliance status and its effectiveness onsite on fortnightly basis. Procedural deviations and actions required will be brought to the notice of the Site Supervisor as well as the Project Manager. The follow-up actions required will be taken up by the Site Supervisor based on the feedback received. In case of non-compliances specific to commitments made to the communities, the EHS specialist will seek the required support from the Project Managers of DJE and UUPL and its OEM contractor for corrective actions. The EHS specialist in turn will pursue closure of the corrective actions on a daily basis, and report to the Project Manager of DJE and UUPL.

The Project Manger of DJE and UUPL will audit the mechanism and its effectiveness once in month. Based on the outcomes of this audit the project manger will then direct:

- Site Supervisor of DJE and UUPL to pursue resolution of unaddressed grievances
- EHS Specialist to make appropriate changes in the mechanism for enhancing its effectiveness

5.6 GRIEVANCE REDRESSAL MECHANISM FOR WORKERS

Objective

The objective of grievance handling system is to ensure that all workmen get an opportunity to escalate the grievances to the management so that it can be settled, leading to increased job satisfaction and improved efficiency.

Applicability

This system is applicable to all employees and workers of the contractors appointed by the Company and sub-contractors appointed by the contractors as per Indian Legislation. The grievance redressal for employees of DJE and UUPL will be covered as a part of Corporate HR system and is not covered under this procedure.

Grievance

Complaints affecting one or more individual employees in respect of their wage payments, leave, insurance, transfer, working hours, working conditions, dismissal and discharge etc. would constitute a grievance. Where the points of disputes are of general applicability or of considerable magnitude, they will fall outside the scope of this procedure.

Grievance Handling Procedure

- An aggrieved workman /employee shall first present his/her grievance verbally in person to their respective supervisor (for Contractor employee to their respective Contractor Supervisor) and the grievance will be settled by the concerned supervisor within 5 days.
- The grievance will be either recorded by the Supervisor in a Grievance Register placed at the Site Office or maintained confidentially if required.
- If the workman/employee is not satisfied with the reply of the supervisor reply within the stipulated period (i.e. 5 days), he shall present his grievance to the Supervisor of DJE and UUPL. The grievance will be escalated to the Worker / employee's respective Manager orally or telephonically. Details of the Manager and their contacts shall be made available to all the workers / employees. The Supervisor will review the grievance and will either settle the same or will communicate to the aggrieved employee within 10 days of the presentation of the grievance.
- If the aggrieved employee doesn't receive a reply from the manager or is unsatisfied with the reply, the aggrieved employee may communicate his grievance to the Senior Management / Owner of the Company. The grievance will be escalated by the aggrieved worker / employee verbally in person / telephonically. Contact details of the Senior Management / Owner shall be made available to the aggrieved employee by the Manager. The grievance will be settled by the Senior Management / Owner within a period of 30 days from the day it has been presented to the Owner.
- A grievance will be considered to be resolved only once the aggrieved worker / employee has signed off on the grievance mechanism register, or is satisfied if dealt with in a confidential manner. For this his/her signature or thumb print on the register will be taken, and in case of confidential grievance – a written acknowledgment will be ensured.
- The resolution timeline will be monitored through the weekly review by the DJE and UUPL's Site Supervisor who in turn will send a compliance mail to the EHS specialist and any concerns / delays will be taken up with Contractor.

Dissemination of Grievance Mechanism

The grievance mechanism shall be shared orally by the Projects team with all the workers working on the Project site through the tool box talks. The communication will also include detail of the respective Project Supervisor, Manager, DJE and UUPL's Project Supervisor and location of DJE and UUPL's Project Office.

Records

All the grievances raised need to be recorded in a register along with the settlement details and date of settlement. It is the responsibility of the contractor management.

Review

The implementation status of this mechanism will be reviewed on a weekly basis by DJE and UUPL's Site Supervisor who in turn will report the grievances and status of actions taken/pending to DJE and UUPL's EHS Specialist. The EHS specialist will then verify the compliance status and its effectiveness onsite on fortnightly basis. Procedural deviations and actions required will be brought to the notice of the Site Supervisor as well as the Project Manager. The follow-up actions required will be taken up by the Site Supervisor based on the feedback received. In case of non-compliances specific to legal requirements and lenders commitments, the EHS specialist will seek the required support from the Project Managers of DJE and UUPL and the OEM contractor for corrective actions. The EHS specialist in turn will pursue closure of the corrective actions on a daily basis, and report to the Project Manager of DJE and UUPL.

The Project Manger of DJE and UUPL will audit the mechanism and its effectiveness once in month. Based on the outcomes of this audit the project manager will then direct:

- Site Supervisor of DJE and UUPL to pursue resolution of unaddressed grievances
- EHS Specialist to make appropriate changes in the mechanism for enhancing its effectiveness