ARCADIS Design & Consultancy for natural and built assets

FINAL ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT

100 MW Wind Power Project in Dhar District, Madhya Pradesh

DECEMBER 2015
Ref: D-ESM-20559

Prepared For:
Clean Wind Power (Ratlam) Pvt. Ltd.

Prepared by:
SENES Consultants India Pvt. Ltd. (An ARCADIS Company)

Inc. SENES | Langdon & Seah | Hyder Consulting | EC Harris

QUALITY ASSURANCE

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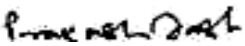
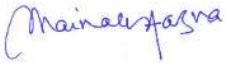
Final V.01/First Issue	17/12//15	 Menka Thakur Associate Consultant	 Prakash Dash Senior Consultant	 Mainak Hazra Director	 Sumit Barat Associate Director

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EXECUTIVE SUMMARY

Background	Hero Future Energies is developing a 100MW wind power project located in nine villages of Badnawar and Sardarpur tehsils[1] of Dhar district in the state of Madhya Pradesh though its 100% subsidiary M/s. Clean Wind Power (Ratlam) Private Limited (CWP-RATLAM). SENES Consultants India Pvt. Ltd. (Arcadis) was commissioned by CWP-RATLAM) to undertake an Environmental and Social Impact Assessment (ESIA) study of the project in accordance with IFC's Performance Standards, Indian environmental legislation, Equator Principles and IFC's Industry Specific EHS guidelines. This ESIA report has been prepared on the basis of reconnaissance survey of the site, baseline environment monitoring, data analysis and consultation & discussions with relevant stakeholders of the project.
Project Overview	The project consists of 50 WTG's and proposed in nine villages viz. Sergarh, Chandodiya, Kisanpura, Khiledi, Phuledi, Panda, Indrawal, Bor Jhadi and Gandwada covered under Badnawar and Sardarpur tehsils of Dhar District in the state of Madhya Pradesh. The proposed site is accessed through State Highway SH-31 road, connecting Kanun to Bidwal village road (adjoining the project site area).The project is being developed on revenue as well as private land. Revenue land has been procured for 47 WTG's and private agricultural land has been identified for the remaining 3 WTG's. Total revenue land procured is 225.3 ha. The power generated from the project is proposed to be evacuated through a 220kV S/C transmission line to the nearest 220/33 kV substation in Rajgarh located 25.9km away from the project site. During the construction phase, the total water requirement for civil work is 450KL for 50 WTG's and domestic water requirement is 0.9KLD. Around 30 labours would be employed in the peak phase for each WTG construction most of which will be hired locally. During operational phase, there will be around 10-12 staff onsite including security guards and the water requirement will be only for drinking purpose, which will be met through packaged drinking water.
Applicable IFC's Performance Standards	The Environment and Social Management Plan (ESMP) for the project has been designed considering the requirement and framework of Indian environmental legislation, IFC's Performance Standards, Equator Principles and IFC's Industry Specific EHS guidelines. The IFC's performance standards that are applicable for this project are PS1: Social and Environmental Assessment and Management Systems, PS2: Labour and Working Conditions, PS3: Resource Efficiency & Pollution Prevention, PS4: Community Health, Safety and Security, PS5: Land Acquisition and Involuntary Resettlement, PS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources and PS7: Indigenous Peoples. Performance standard PS8: Cultural Heritage is not applicable for this project. However IFC's core labour standards are applicable for the project.
PS1: Social and Environmental Assessment and Management Systems	The project will have environmental and social impacts due to generation of onsite noise, domestic wastes from labour camp and generation of hazardous wastes from the construction site. CWP-RATLAM needs to implement an Environmental and Social Management System to manage the risks associated with its operations. This ESIA report provides the environment and social risks arising from the project activities along with recommended mitigation measures. CWP-RATLAM should also appoint a qualified E&S personnel with appropriate responsibility to implement/ oversee/ monitor the following: *Construction Phase* a) Performance of contractors on labour and health & safety aspects

[1] Sub-division

	Operation Phase a) Periodic monitoring of social and environmental performance b) Internal and third party audit c) Management review *Both for Construction and Operation Phase* a) The implementation of the ESMP b) Community engagement and grievance redressal system/mechanism c) Regular training of employees and contractors d) Emergency preparedness and response e) Periodic reporting of E&S performance to the management
PS2: Labour and Working Conditions	The project plans to maximize local involvement in the employment during the construction phase with back up of sourcing labour from outside the region, in case the labour requirements are not met locally. To this effect, labour accommodation set up during the construction phase of the project should follow the Guidelines of *IFC Worker's Accommodation: Process and Standards* while providing labour accommodation.
PS3: Resource Efficiency & Pollution Prevention	Water for project construction phase will be sourced by tankers and drinking water supply would be through packaged drinking water. Further, CWP-RATLAM will ensure that other wastes (packing material, metal, debris, cement bags, drums/ cardboards etc.) are collected, stored and disposed to re-users or in appropriate authorized debris disposal areas. Sprinkling of water on approach roads should be undertaken to combat the fugitive dust emission. The impacts due construction activities of the proposed project are expected to be minimal, site specific, temporary and reversible in nature as construction activities will be for a short span period.
PS4: Community Health, Safety and Security	Some of the turbines will be located near some settlements. IFC PS requires settlements are avoided within 1.5 x turbine height. For the particular model of turbine it translates to 220m. Primary survey revealed that there were about 221 structures located within the radius of turbines along with 20 common property resource. PS4 becomes applicable to these structures. The project will involve movement of vehicles on the approach road passing close to few villages, entering the site through the SH-31 via the Bidwal road. Therefore, traffic has to be managed for the project vehicles to cross the road and enter the project boundary. Further, at the project site, appropriate access control is required to put in place. This control will include barricading of excavated areas; safety signage; illumination and other measures to mitigate the risk of accidents for general public during the construction phase. Also, the project envisages influx of labours from different nearby villages and migrant labours, who will be accommodated in the labour camp. Health and safety need to be taken care by the project developer, which should ensure that safety measures are put in place both during construction and operation phase of the project. Grievance Redressal Mechanism should be followed onsite and the complaints should be registered, investigated and timely resolved.
PS 5: Land Acquisition and Involuntary Resettlement	Out of total 50 WTGs, revenue land of 225.3 ha has been procured for erection of 47 WTGs whereas 3.265 ha of land was acquired for erection of 3 WTGs. The land requirement for each wind turbine generator (WTG) was 1.75 hectare (4.32 acres). Since the land requirement for each WTG is low, associated land use such as agriculture can be practised in the surrounding area. Private land required for the construction of the transmission line (either pole/ tower site and/ or for the line right-of-way (RoW) will be leased from individual land owners through a negotiated settlement by vendors appointed by CWP-RATLAM. The acquiring of private land have done through following willing to sell and willing to buy process and in this circumstance PS-5 will not be applicable. But as about 221 structures/houses were

	found within 220 meter radius of 15 WTGs, resettlement/relocation of these residents shall be carried out. In this case, PS-5 will be applicable.
PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	The land use pattern of project site is mostly agricultural and the habitat was " modified". No endangered flora and fauna species were recorded in the study area. Baseline primary survey was conducted to establish the presence of avifauna and bat. The presence of bat in the study area could not be established. The avifauna population was also limited. However, the mortality on avifauna during the operational period cannot be ruled out. Hence, this Performance Standard is applicable for this project.
PS 7: Indigenous Peoples	During Primary survey it was observed that a few settlements were established in encroached revenue land. The settlers were belonged to Scheduled Tribes, Scheduled Castes, OBC and General castes. Since Scheduled Tribes are present in the study area, the PS-7 is applicable.
Project Impacts – Construction Phase	*Impact on air quality:* because of generation of fugitive dust due to movement of project vehicles and emission from diesel generators *Water resources*: Water for construction phase will be sourced from authorised sources via tankers by local vendors. The total civil work water requirement for all 50 WTG is calculated to be 450KL. The domestic water requirement is estimated to be 0.9KLD. As per CGWB categorization w.r.t to the groundwater development, Badnawar block falls under "*Over-Exploited*" category. However, impact on the ground water is anticipated to be moderate, based on the water requirement which is minimal. *Conflict between migrant and local community*: During the peak phase of construction, maximum of 30 labours would be employed per WTG and the WTGs will be erected phase wise. The project developer will give preference to hire local labours and a small percentage of migrant labourers (highly skilled) will be hired during the construction period. The possible conflict between migrant skilled labourers with local population may be envisaged but since the maximum labourers will be from local villages, the impact is considered as minimal. *Traffic Load:* The road from SH-31 to Bidwal will be used for movement of trailer trucks carrying WTG parts and other heavy vehicles for the project activity. Village and village roads originating from this road will be utilized during construction phase for vehicular movement and movement of labours and other project materials. Hence, the impact w.r.t increase in traffic load is envisaged. *Impact on land*: The land parcels identified for this project is both open scrub and agricultural land. Revenue land has been procured for 47 WTG locations and parcels of private agricultural land has been identified for 3 WTG's in Indrawal and Sergarh village for which the negotiation was in process during the time of the primary survey. However, during the final reporting of this ESIA report, the land has been procured and a proper sale deed agreement has been executed. The land has been purchased on "*willing to buy and willing to sell*" basis and also adequate compensation (more than the circle land rate) has been provided to the land owners (Pls. refer a sample sale deed agreement in **Appendix F**).
Project Impacts – Operation Phase	*Community Health and Safety*: About 220 structures and 20 CPR are identified within 1.5 times turbine height. Impact is envisaged on community health during operation due to Electromagnetic Field (EMF) interference, shadow flicker and accidental blade throw as a part of PS 4: Community Health, Safety and Security The shadow flickering results show 17 receptors to have more than 30hrs/year taking in consideration the real time case scenario. However, to combat the shadow flickering adequate mitigation measures has been proposed in the ESIA report to reduce the impact to an insignificant level.

	Noise Impact: As per manufacturers specification, the noise level at hub height is 105dB(A). During the primary survey, ambient noise was monitored randomly at some villages/settlements. The noise modelling was carried taking into the manufactures specification as well as the baseline ambient noise level at different sources at 15 WTG sites where residents were found residing. From the noise modelling analysis, it was found total noise level during night time at all the 15 locations was above the National ambient noise standards. However, with appropriate mitigation measures, the same can be minimized to the lowest possible. *Impact on ecology*: From ecological and biodiversity point of view, the modified habitats normally have lesser ecological values/significance and it was observed from the primary survey. Bird population was found to be moderate and presence of bat could not be established. Bird collision risk cannot be ruled out in the operational phase. And proper mitigation measures shall be implemented to combat the same.
Mitigation Measures	Appropriate mitigation measures have been planned and recommended in the ESIA report. These measures will minimise the impacts on air, water, soil, noise quality, solid and liquid effluent waste, ecology and socio-economic conditions. The activities of the project during both construction and operation phase will help in improving the socioeconomic condition of the surrounding area. *Construction Phase* • During the site visit, a houses/structures were observed within the setback distance (~220 m radius) at the proposed 13 WTG locations • Relocation of structures falling within 220m of turbines or at least 150 m of turbines needs to be considered • Later on, a detailed survey was conducted to gather more information of these residents • As far as the conditions of labourers, it should be ensured that the labour camp (onsite) should have basic amenities such as electricity, drinking water, health & sanitation facility, kitchen and rest room. • Proper water sprinkling of road should be undertaken to reduce the fugitive emissions during transportation. • Integral noise shielding to be used where practicable and fixed noise sources to be acoustically treated, for example with silencers, acoustic louvers and enclosures. • Hazardous materials such waste oil, used oil should be stored at designated locations in enclosed structures over impermeable surface. • During the primary survey, private land was identified for 3 WTG locations. However, during the final reporting of this ESIA report, the land has been procured and a proper sale deed agreement has been executed. The land has been purchased on "*willing to buy and willing to sell*" basis and also adequate compensation (more than the circle land rate) has been provided to the land owners (Pls. refer a sample sale deed agreement in **Appendix F**). *Operational Phase:* • Implement the recommended complaint resolution procedure (Grievance Redressal Mechanism) to assure that any complaints regarding noise and shadow flickering or any other issue related to project activity is not left unnoticed. The complaints should be registered, investigated and timely resolved. • Wind turbines shall be designed in accordance with the international acoustic design standards • A bird and bat mortality monitoring study is recommended to be conducted.

Conclusion	The proposed wind power project is not likely to have significant adverse environmental impacts that are sensitive[2], diverse or unprecedented. However, the social impacts linked to the presence of informal settlers within the setback area needs to be mitigated in line with the measures recommended in this report. It is envisaged to have moderate impact due to ground water utilization and issues related to community safety during the construction period, insignificant impact due to generation of dust and fugitive emissions during construction phase only (short duration) and minor impact on resource utilization such as land and socio economic conditions of project area villages. There is no impact on cultural heritage in the study area. The impacts anticipated during the operation phase is fugitive emissions from movement of project vehicles within the site (air environment), surface run off and onsite drainage of storm water (water environment) and impact on soil due to storage and spillage of hazardous wastes used oil and transformer oil (land environment) which can be mitigated by adopting suggested mitigation measures. Based on the conclusion drawn from the ESIA study with respect to the kind of impacts of the project on environment, resources, biodiversity, working conditions of labourers etc, is expected to have limited social and environmental impacts which will be mitigated by adopting suitable mitigating measures.
This Executive Summary should be read in conjunction with the full report, which reflects an assessment of the site based information received by Arcadis at the time of reporting.	

[2] A potential impact is considered "sensitive" if it may be irreversible (e.g., lead to loss of a major natural habitat), affect vulnerable groups of ethnic minorities, involve involuntary displacement and resettlement, or affect significant cultural heritage sites.

1.0 INTRODUCTION

1.1 Background

Hero Future Energies (HFE) has a well-defined portfolio in wind energy and has a cumulative installed capacity of ~220 MW wind power as of 2015 with projects operational in the states of Rajasthan, Maharashtra, Karnataka, and Tamil Nadu. These projects are expected to reduce over 450,000 tons equivalent of CO_2 emission per year. About 150MW of wind power projects are under construction in the states of Madhya Pradesh and Telangana. The company has approximately 1100 MW of projects in pipeline to be developed across different states of India.

Madhya Pradesh[3] has a total installed wind power capacity of 213.79 MW. The project SPV- M/s. Clean Wind Power (Ratlam) Private Limited (CWP-RATLAM) is a 100% subsidiary of Hero Future Energies (HFE) intends to develop100 MW wind power project in Dhar district of Madhya Pradesh which shall be connected to nearest 220/33 kV substation in Rajgarh. The project is expected to generate about 202 million units (kWh) for sale in the first year of operation. CWP-RATLAM has signed a Power Purchase Agreement (PPA) with Madhya Pradesh Power Transmission Company Limited (MPPTCL) and has completed various key activities with respect to the project such as application for power evacuation, wind monitoring and C-WET certification, wind resource assessment, micro-siting, and land survey. The erection of the WTG is being undertaken by M/s GAMESA. The proposed project involves construction and operation of 50 wind turbine generators (WTGs) of capacity 2MW each.

A wind power plant is a superior and a clean option for power generation in comparison to non-renewable fossil fuels. Ministry of Environment, Forest and Climate Change (MoEFCC) in its Office Memorandum No. 86/195/97-WE (PG) dated 20th Nov, 1997 (**Appendix A**) has stated that wind power projects are not covered under the ambit of EIA Notification, 2006 and therefore does not require prior environmental clearance.

CWP-RATLAM intends to carry out an Environment & Social Impact Assessment (ESIA) study for the project in accordance to IFC's Environment and Social Performance Standards and EHS guidelines. The study will also assess the project compliance w.r.t the local and national regulations relevant to the project. The assessment will also identify the significant environmental and social risks associated with the project and recommend appropriate mitigation measures to comply with the requirement of the specified reference framework.

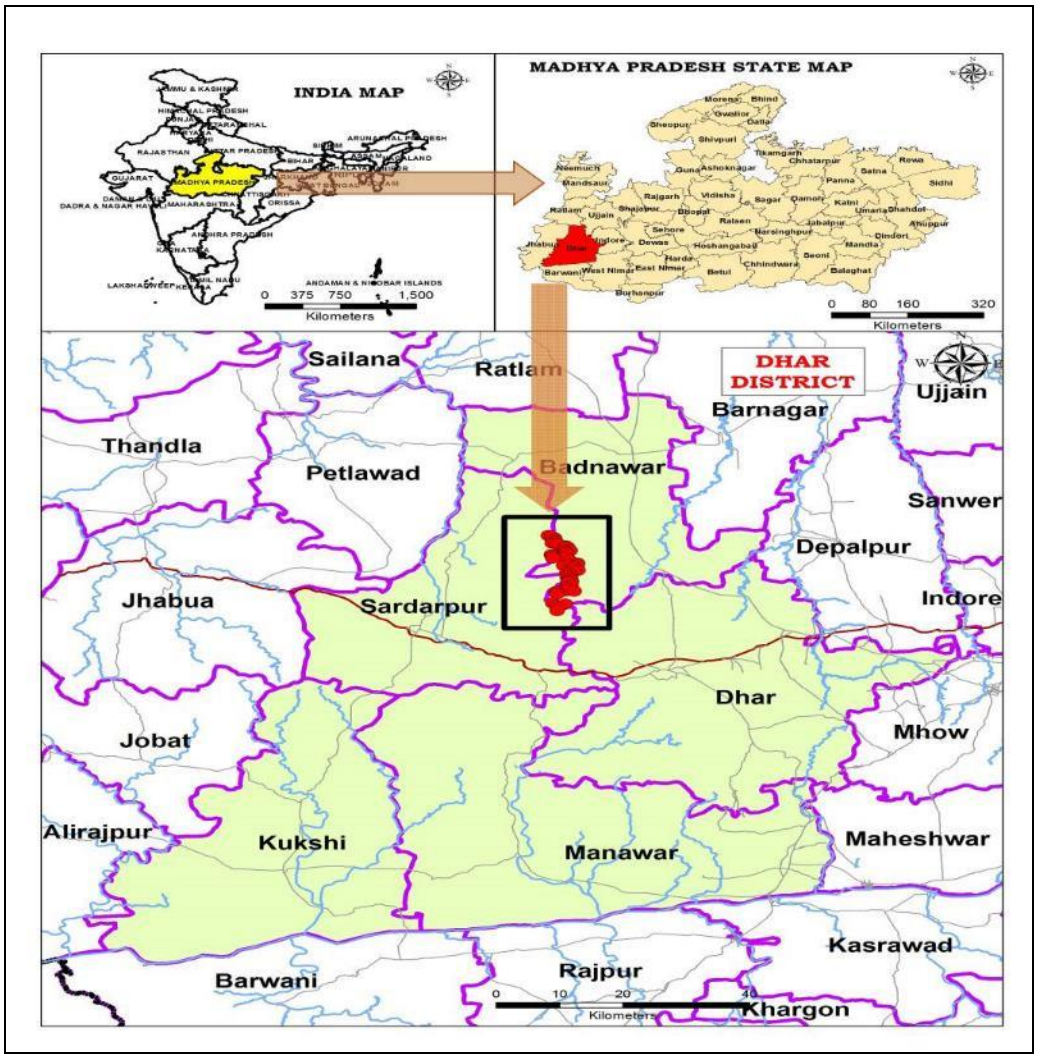
SENES Consultants India Pvt. Ltd (Arcadis) has been appointed by CWP-RATLAM as an independent environment consultant to undertake the ESIA study. The ESIA report has been prepared on the basis of reconnaissance survey of the site, environmental monitoring, data analysis, public consultations and discussions with other relevant stakeholders.

1.2 Project Location

The project site is located in nine villages' viz. Sergarh, Chandodiya, Kisanpura, Khiledi, Phuledi, Panda, Indrawal, Bor Jhadi and Gandwada of Badnawar and Sardarpur tehsils in Dhar district of Madhya Pradesh. The project location map is provided in **Figure 1.1**

[3] http://www.mprenewable.nic.in/winde.html

Figure 1-1: Project Location Map



1.3 Project Phase and Status of Permits

The structural work for building WTG foundation has been initiated at nine locations as observed during the time of primary survey. The status of permits and approvals required before the onset of construction phase has been summarised below:

Table 1-1: Status of permits for the proposed project

SN	Permits/ Approvals	Status
1	Consent to Establish from Madhya Pradesh Pollution Control Board (MPPCB)	Consent to Establish (CTE) has been obtained vide file no. CTE-45061 from MPPCB.
2	Power Purchase Agreement (PPA)	The PPA has been signed.
3.	NOC from State Electricity Board for grid connection.	NOC from Madhya Pradesh Power Transmission Company – Limited, Jabalpur for connection of 100MW wind power plant at Rajgarh 220/33 kV substation has been obtained vide letter (No. 04-02/LFS/PSP-64/505,dt. 15.02.14) **Appendix B**

SN	Permits/ Approvals	Status
4	NOC from Village Panchayat for land uptake	NOC from all nine village panchayats viz. Bor Jhadi, Chandodiya, Gandwada, Indrawal, Khiledi, Kisanpura, Panda, Phuledi and Sergarh village **(sample copy – Appendix C)**
6	Approval from Chief Electrical Inspector to Govt., (CEIG) Chennai for charging of transformers	Obtained.
7	Land allotment (Government and Private land)	Land use permission for revenue land has been obtained on 24th July, 2015 issued by Add. Secretary, New and Renewable Energy Department, Bhopal as per file no. F6-04/2015/60 **Appendix D**. As per the present status, sale deed agreement for all three private lands has been executed, a sample copy of which has been annexed in **Appendix F**

1.4 Purpose of ESIA Study

The main purpose of the ESIA study is to identify, evaluate and manage environmental and social impacts that may arise due to implementation and operation of the proposed project. The document has been prepared to comply with the requirements of IFC Performance Standards, IFC EHS guidelines, 2007 as well as applicable local and national regulations. To comply with other lender's requirements, the document also addresses Equator Principles which will be complied by the project. The objectives of ESIA study are:

- To identify and establish the baseline environmental and socioeconomic conditions, to analyse the environmental and social risk and impacts of the project and its associated components (facilities like transmission line, access road etc.) as per IFC performance standards.
- To prepare an inventory of biodiversity (flora and fauna) of project site prior to implementation of the project to evaluate the possible impacts on birds and bats, if any.
- Review of the land lease process to assess any legacy or current/ existing issues (such as informal settlers, livelihood dependence, and other usage) on the purchased/ leased land through suitable survey using acceptable socioeconomic tools. This will help in assessing the impact of the project on the community/ villagers.
- Socio-economic survey involving consultation with local community, stakeholders, household surveys to identify the needs and problems of community with respect to the project activities.
- Shadow flickering assessment and study of impact of flickering on the nearby community.
- To suggest appropriate safeguards for the associated environmental and social risk, which may not lead to project investment and activities at risk.
- To develop action plans (ESMP) for implementation & monitoring of the mitigation measures to safeguard the project envelop.

1.5 Approach and Methodology of ESIA

The approach and methodology applied for undertaking the environmental and social impact assessment study is as provided.

- Desktop review of project related documents
- Reconnaissance survey to understand site specific issues.
- Discussion with the local community in the project influenced villages to understand their perception of the project and identification of key issues.
- Baseline noise level, air, water, soil, ecology and biodiversity data collection of the site through primary and secondary data source surveys.
- Identification of environmental and social risks associated with the project w.r.t applicable national regulations & lender benchmark & standards (IFC performance standards and IFC EHS guidelines, 2007).
- Preparation of an environmental and social management action plan (with timelines & responsibilities) to manage these risk and impact.

1.6 Limitations

The study is based on the project planning information and document provided by the project proponent, community consultation and observation recorded during site survey. The baseline condition is an extrapolation of surrounding areas to site. Any significant change in the proposed activities may result in variation of outcomes. Presented information and fact has been analysed and inferences has been drawn through the professional judgement.

1.7 Structure of ESIA Report

Chapter1: Introduction

Chapter 2**:** Project Description

Chapter 3**:** Applicable Policies, Legal and Administrative Framework

Chapter 4**:** Description of Environment

Chapter 5**:** Social and Environmental Impact Assessment

Chapter 6**:** Environmental and Social Management Plan

Chapter 7**:** Conclusions

2.0 PROJECT DESCRIPTION

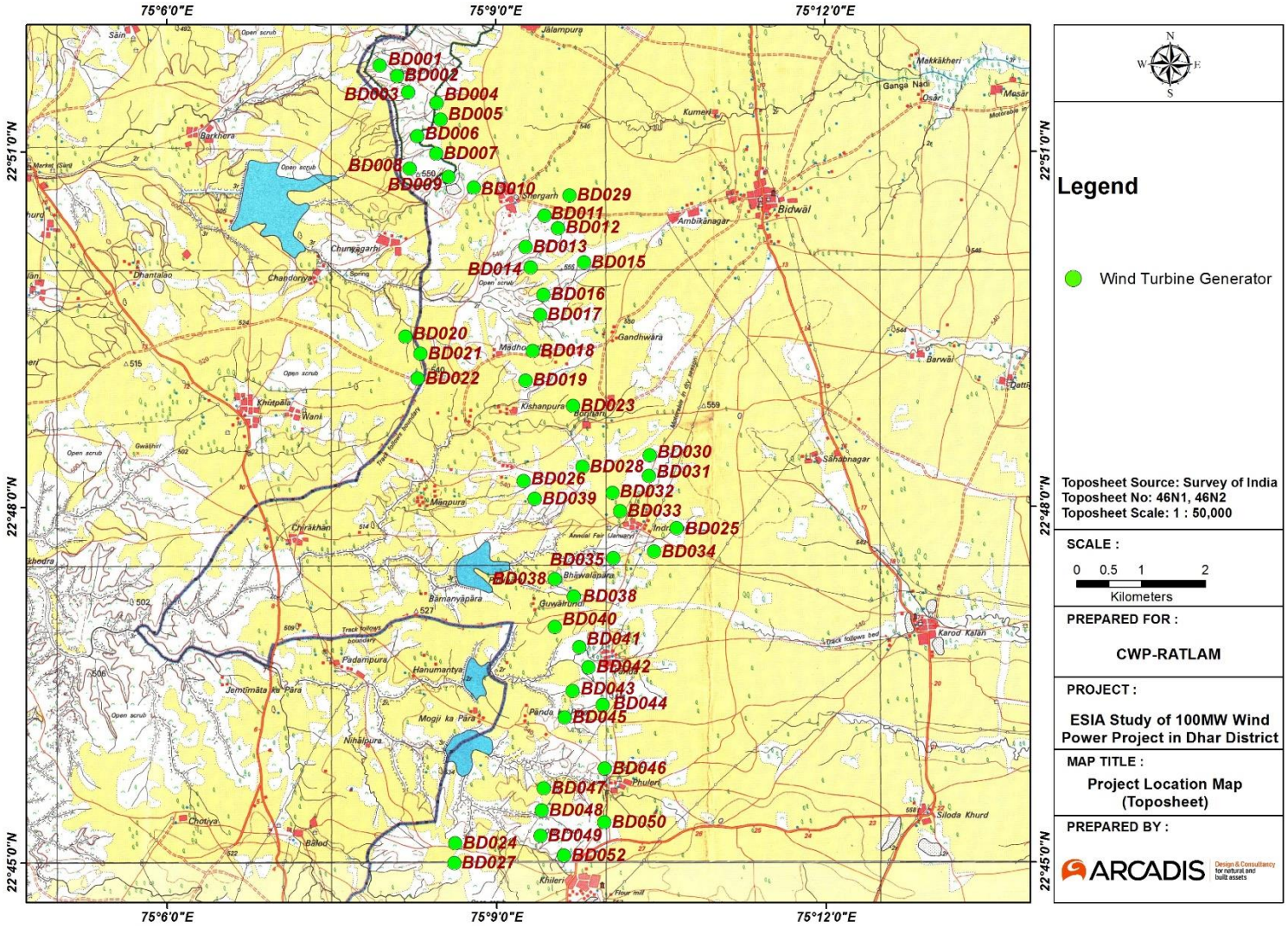
2.1 Introduction

M/s. Clean Wind Power (Ratlam) Private Limited (CWP-RATLAM) is developing 100 MW wind power project under Madhya Pradesh Wind Power Project Policy, 2012 (as amended on 21st February 2013). The project will be connected through a 220kV S/C line to Rajgarh 220/33 kV substation, located 25.9km away from the project site. The project will consist of 50 WTG's, each having 2MW installed capacity. Each WTG would requires 1.75hectare/ 4.32acres acres of land. The proposed project is planned to be commissioned by April, 2016. The project will be operated and maintained (O&M) by Gamesa under an O&M contract with CWP-RATLAM. The technical details of the project is provided in **Table 2.1** and satellite imagery of the project site is shown in **Figure 2.1**.

Table 2-1: Project snapshot in Brief

PARAMETERS	TECHNICAL DETAILS
Project Owner	M/s. Clean Wind Power (Ratlam) Private Limited (CWP-RATLAM)
Location of Site	**Villages:** Sergarh, Chandodiya, Kisanpura, Khiledi, Phuledi, Panda, Indrawal, Bor Jhadi and Gandwada **Tehsil:** Badnawar and Sardarpur **District:** Dhar, Madhya Pradesh
Project Coordinates	22°52'31.35"N, 75°08'50.86"E and 22°41'52.67"N, 75°10'49.73"E
Project Capacity	100 MW
WTG make	Gamesa Wind Turbines (P) Ltd
WTG model	G-97
Hub Height	104m
Rated Capacity (MW)	2MW
Blade Length and Pitch Diameter (m)	47.5m
Cut-in speed (m/s)	3 m/s
Cut-out speed (m/s)	25 m/s
Generator Type	DFIG Generator
Rating	2MW
Generator Voltage (kV)	690 V
Location of Pooling sub-station	Phuledi village, Badnawar Dhar
Capacity of pooling sub-station	220/33kV 2X50MVA
Transformers Location of Grid sub-station	Rajgarh, Sardarpur Dhar
Connecting voltage level (kV)	220kV

Figure 2-1: Location of the WTG on Toposheet



2.2 Site Suitability and Justification of Project

Following analysis describes the site suitability for a wind power project development and all the WTG locations have been found to be technically feasible for wind power development as per the factors discussed below:

- **Climatic parameters such as temperature, wind speed, and rainfall:** [4]Dhar district is characterized by hot and humid subtropical climate. The normal maximum temperature received during the month of May is 39.9ºC and minimum during the month of January 9.6ºC. The normal annual means maximum and minimum temperature of the district is 31.3ºC and 17.5ºC respectively. During the south – west monsoon season, relative humidity exceeds 88 % (July / August month). The rest of the year is dry. The driest part of the year is the summer season, when relative humidity is less than 30 %. April is the driest month of the year. Average rainfall recorded by Hydromet division, IMD, Delhi for the last five years (2009-2013) for Dhar district is 73.12mm
- **Wind potential at the site:** The nearest Ministry of New and Renewable Energy (MNRE) wind monitoring station is installed at Kanchroota in Dhar district, which is located at a distance of 32km from the project site. The mean annual wind speed (MAWS) recorded at 20/25/30/50/80/120m wind mast height is 5.26m/s. Wind resource assessment is conducted continuously. The average wind speed for site is in the range of 6.5 m/s to 6.58m/s at 100m height.
- **Topography:** The project site is spread across an open area with a mix of flat and undulating terrain.
- **Substation proximity:** The 220kV S/C transmission line laid for about 28km will evacuate to feeder bay at 220/33 kV Rajgarh government substation located about 25.9kms km away from the project site.
- **Accessibility:** The site can be easily accessed by State Highway 31 connecting Badnawar to the project site.
- **Geological and soil conditions:** To ascertain soil parameters of the proposed site for construction of foundations for module mounting structures, control room, HT lines & array yard, and drainage etc., the sub soil investigation through certified soil consultant has been carried out. Geological and soil investigations report confirm soil strength to support structures.
- **Water availability and quality:** CWP-RATLAM will procure water from authorised sources.
- **Near and far shading effects due to objects like transmission lines, trees, hills, wind farms etc.** The project site is an open flat area with no obstructions from trees, hills or wind farms within the project site. Though transmission lines were observed at three WTG locations, the same would be re-routed after obtaining required permission/ approval and paying of appropriate fees to MP Power Transmission Company Ltd. (MPTRANSCO).
- **Land availability:** Government land has been procured for 47 WTG's and identification of three private agricultural land was undertaken during the primary survey. However, during the final ESIA reporting the private land has been procured completely for which adequate compensation has been provided to the land owners.

2.3 Project Settings

The proposed project site is located in Sergarh, Chandodiya, Kisanpura, Khiledi, Phuledi, Panda, Indrawal, Bor Jhadi and Gandwada villages of Badnawar and Sardarpur tehsils, Dhar district of Madhya Pradesh. The soil of the region is black cotton soil. The site is located at an average elevation of 530m. The key physical features of the project site have been described below:

- The proposed site is located at a distance of around 22 km from Badnawar and around 80 km from Indore aerially.
- Out of 50 WTG's over 6 WTG are proposed on mild undulating land, the remaining fall on flat terrain.
- There are no shading elements such as mountains or trees available near any WTG site.
- State Highway 31 is located 10 km away from the proposed project area in the eastern direction from the project site.

[4] Groundwater information booklet, CGWB, Dhar district, 2013

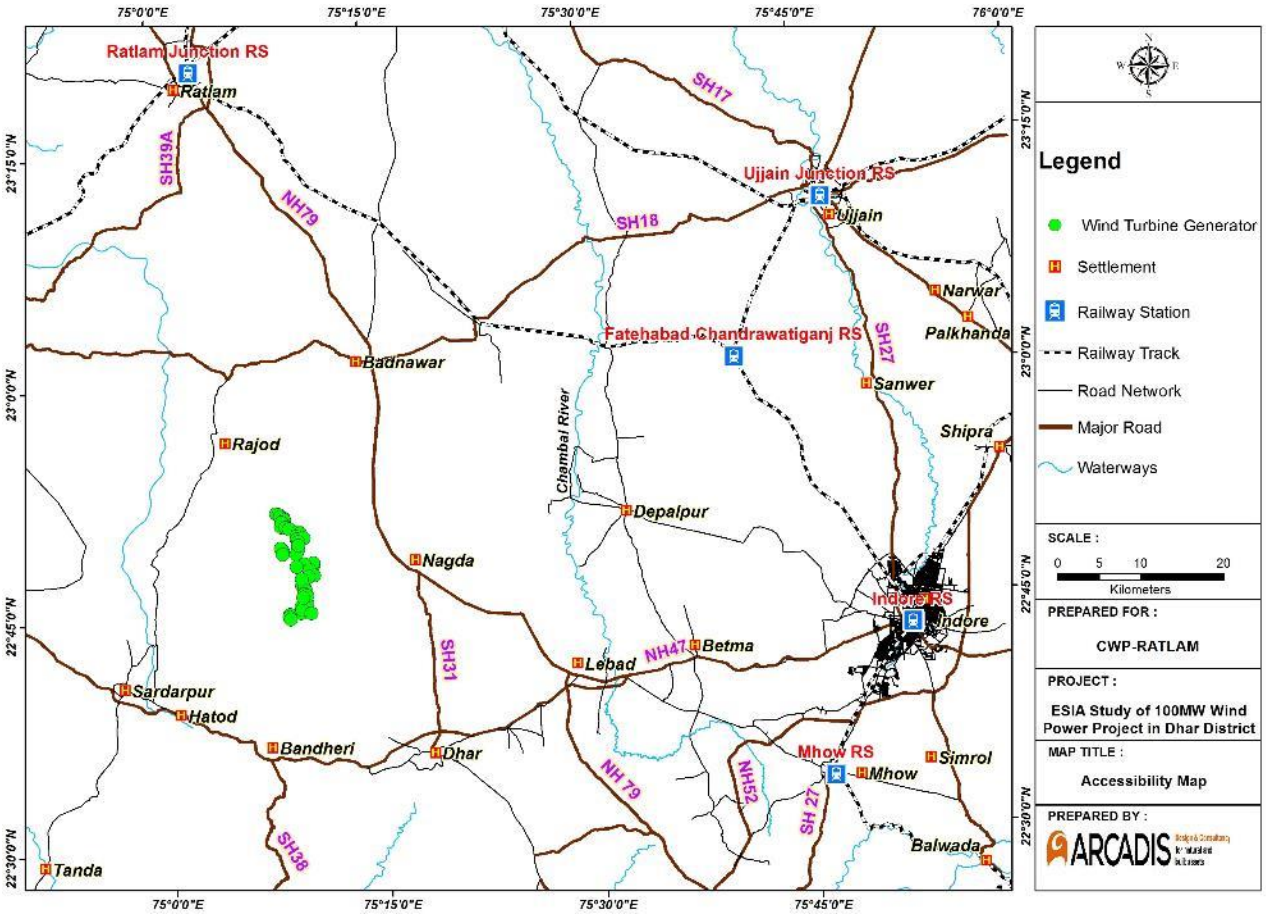
- No major river flows in around the project site. Though some small water channels were found in and around the project area, these were found dry at the time of visit. However, four medium sized ponds were sited at an average distance of more than 600m from the WTG's.
- On discussions with Superintendent of Forest, Dhar Forest division, it was confirmed that no ecological sensitive area i.e. National Parks or Wild life sanctuaries falls within 10 km radius of the project site. "***Sergarh Reserve Forest***" falls along the WTG location no. 1- 4, but none of the WTG's fall within the forest boundary as confirmed by the Sergarh Reserve Forest map.
- Apart from CWP-RATLAM wind power development activities, no other large scale industrial set up is located within 10 km of the project vicinity. However, it was observed that there are other wind farms being developed by Suzlon and Gamesa within 10km radius of the project site.
- The substation at Rajgarh (220/33 kV) is at a distance of 25.9 km from proposed site.

During the primary survey, observations w.r.t the site surrounding of each WTG location was noted and a comprehensive table has been presented in **Appendix E** detailing the physical features viz. water body, settlement, agricultural field in the vicinity of all 50 WTG locations.

2.3.1 Site Accessibility

The proposed site is accessed through State Highway SH-31 road, which further connects the project site via a connecting road from Kanun to Bidwal village (adjoining the project site area). The **Figure 2.2** below shows the accessibility of the project site.

Figure 2-2: Map showing accessibility to the project site



2.4 Project Design, Technology and Component

The wind turbines consist of a hollow steel tower with a nacelle to which the fibreglass rotor with three blades are attached. The nacelle houses the generator, gearbox, and control systems. A transformer is located in the base of each WTG tower. The make of the wind turbine is Gamesa G-97 and has a hub height of 104m. The rated capacity of each wind turbine is 2MW. The blade length of the wind turbine is 47.5m with the rotor consisting of 3 rotor blades made of high quality epoxy glass fibre/carbon fibre. The Gamesa G-97 model is covered in the list of wind turbine models possessing valid type approval/certificates as published by C-WET under "*Main List*" of "*Models & Manufacturers of Wind Turbines*". The type approval certificate is valid till 30th March 2017.

A wind power project comprises of the wind turbine generators, a pooling sub-station and transmission facilities. The associated facilities include access roads and operation and maintenance facilities.

Wind Turbine Generators: Each wind turbine consists of three major mechanical components, i.e., tower, nacelle and rotor.

Rotor: The rotor consists of three fibre glass blades that extend out of the hub. The rotor is mounted to a driveshaft within the nacelle (as defined below) to operate upwind of the tower. The rotor attaches to the drive train emerging from the front of the nacelle. Hydraulic motors within the rotor hub feather each blade according to the wind conditions, which enables the turbine to operate efficiently at varying speeds. The rotational speed of the rotor is controlled by blade pitch control. Pitch control helps in lowering the peak loads during high windy conditions.

Nacelle: The nacelle is a large housing that sits on top of the tower behind the rotor. It houses the main mechanical components of the wind turbine: drive train, yaw system and its accessories, etc. The nacelle is externally equipped with anemometer and a wind wane that signals wind speed and direction information to an electronic controller. The nacelle is mounted over yaw gear, which constantly positions the rotor upward of the tower.

Tower: The tower supports the nacelle and rotor. The towers are tubular and are double coated with anti-corrosion paint inside and Triple coated with anti-corrosion paint from outside. The towers have an access door and an internal safety ladder to access the nacelle.

2.5 Project Activities

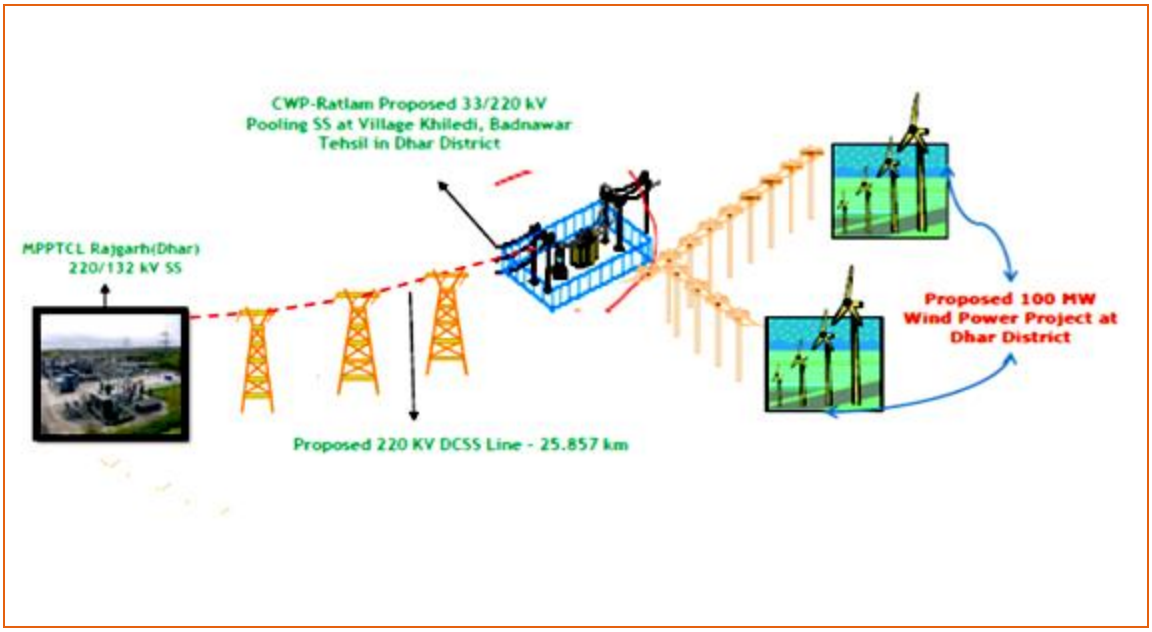
Wind Resource Assessment: The wind resource assessment unit of Centre for Wind Energy Technology (CWET) - autonomous R&D institution by the Ministry of New and Renewable Energy (MNRE), Government of India identifies wind resource rich regions in the country by conducting wind resource micro survey. CWET mast has been erected in three locations of Dhar district, out of which the closest one is installed in Kanchroota village with a height of 50m, records a mean annual wind speed of 5.26m/s. This is located 30km south west of the proposed project site. CWP-RATLAM has also installed its own wind mast of 100m height at two possible wind potential locations within the project site area viz. Sergarh village and Phuledi village in Badnawar tehsil of Dhar district. The onsite wind measurement records an average wind speed in the range of 6.5 m/s to 6.58m/s at 100m height.

Micro siting: Micro siting involves assessing the location by reference to topographical maps, satellite images and by physically examining the site. This data is used to create a computer model with digital elevation models as well as a roughness description which can include obstacles, trees, reliefs, roads and existing wind turbines. On the basis of this data, it is possible to select the appropriate turbine type, the tower height and optimum wind farm layout. In order to make sure that every turbine receives the full benefit of the wind, turbines should be located two rotor diameters apart in the direction prevailing to the wind condition and at least 10 rotor diameters apart in the direction perpendicular to the prevailing wind condition. During micro siting, the WTGs are placed in a manner which ensures maximum WTGs in a given area, so as to maximise the generation from the wind farm. Based on micro siting, the planning team releases the Land Purchase Indent (LPI) to land team which then pursues the land purchase process.

Power Evacuation: The system will generate AC power at 3 phase, 690 V, 50 Hz. The output of the Power Conditioning Units (PCU's) would be connected to transformers to step it up to 33 kV three phase AC supply

through proper isolation and circuit breaking arrangements. The electrical power at 33 kV level is evacuated through the feeders into 220/33 kV pooling substation located at Khiledi village. A single circuit (S/C) transmission line of a stretch of 26kms and 220kV capacity would be laid to the feeder bay in Rajgarh 20/33kV Govt. substation. It is planned that 95 towers would be erected for the power evacuation from the pooling substation to Rajgarh substation. Necessary metering and protection will be provided to ensure acceptable billing and safety to equipment and work force.

Figure 2-3: Evacuation Scheme of Proposed 100mw Wind Power Project at Dhar District

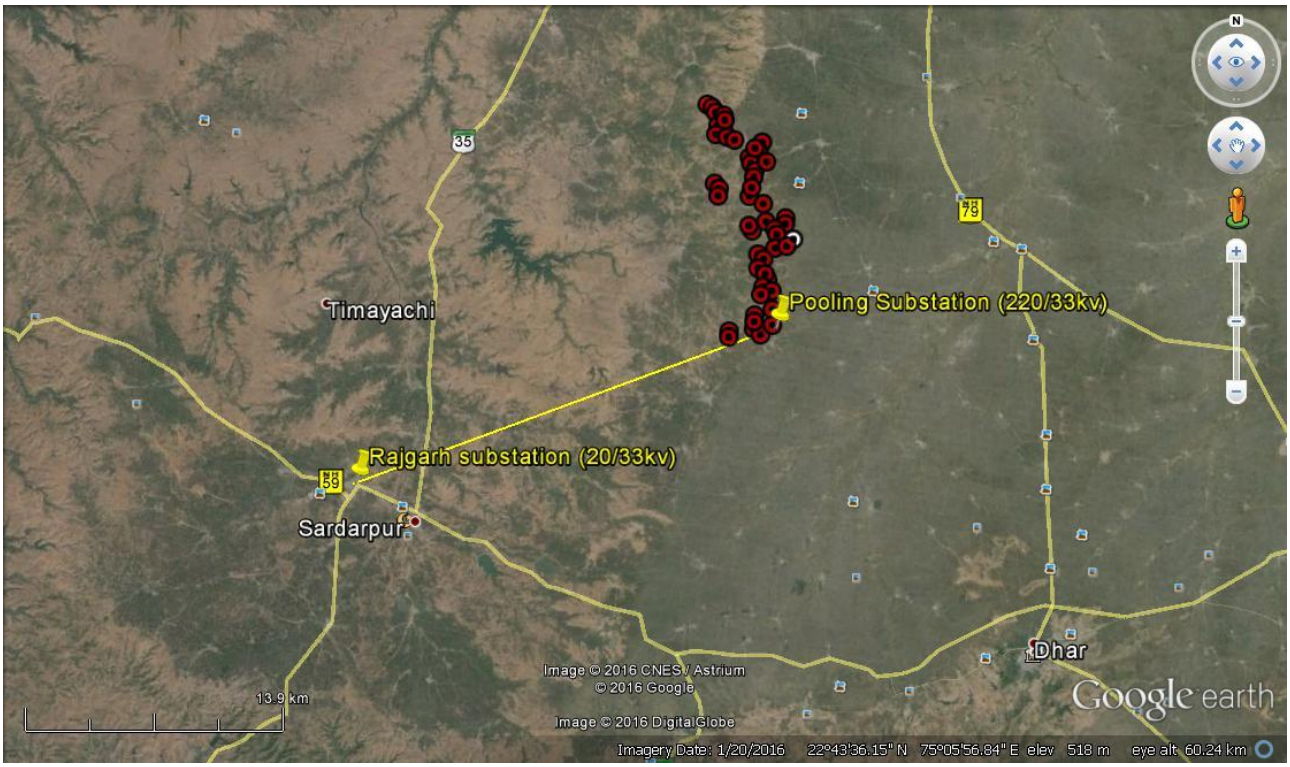


Transmission Line: In the proposed project, the generated electricity will be evacuated through a transmission line to the 220/33 kV substation at Rajgarh. MPTRANSCO is the Government agency responsible for electricity distribution in the state. The approach route identified for the transmission line was based on a criterion to reduce the environmental and socioeconomic footprint of the transmission line. The shortest feasible route after considering these factors has been selected for the transmission lines along with the following factors:

- Transmission line route does not fall under any habitations and thick vegetation.
- No households or community structures are located in the route of the transmission line.
- All environmentally sensitive sites, archaeologically significant sites, areas of ecological and cultural significance were avoided while selecting the route.
- Right of way/access roads are shared with local residents of the area wherever possible.

The route map of the transmission line connecting the project site to the 220/33 kV substation at Rajgarh is shown in **Figure 2.4**

Figure 2-4: Route map of Transmission Line connecting the Pooling Substation in the Project Site to Rajgarh Substation



It was observed at three WTG locations i.e. 17, 25 and 38, the MPTRANSCO laid power transmission line is crossing the WTG site. Since, this would pose an obstruction in the WTG construction, this should be re-routed by submitting an application along with supervision charges to MPTRANSCO. During the time of the final ESIA reporting, reportedly the same has been re-routed.

2.6 Resource Requirement

2.6.1 Land

Type of Land: Out of the total 50 WTG's, 47 WTG fall on Government land and three locations have been identified on private (agricultural) land. Out of all 50 WTG locations, six WTG locations have undulating topography and the remaining WTG locations fall on flat land.

Land requirement: On an average about 1.75 ha / 4.32 acres (approx.) per WTG of land is purchased, this includes the land for tower and transformer. A central parcel of roughly 100 m x 100 meter i.e. 2.5 acres is required for routine operation and maintenance activities. This is retained for routine maintenance activities as well as from safety point of view in case of accidental breakoff of the blades or any other part of WTG. No agricultural activities are allowed in this area. Remaining land is retained for emergency O&M activities.

Government Land: A total of 225.3ha of revenue land has been procured (**Appendix D)**

Private Land: Three private agricultural land was identified and the negotiation was in process during the time of the primary survey. However, during the final reporting of this ESIA report, the private land has been fully acquired and a proper sale deed agreement has been executed. A total of 3.265 ha of private land has been purchased on "*willing to buy and willing to sell*" basis and also an adequate compensation (more than the circle land rate) has been provided to the land owners (Pls. refer a sample sale deed agreement in **Annexure F**.

Land for Access route: An exclusive access to the construction site is usually required prior to mobilization of manpower and machinery. The land for access roads is also purchased. The construction of access road

primarily involves removal of vegetation and modification of topography. At many places, the existing kutcha roads or village roads connecting to the WTG locations has been strengthened and more than 30km of new approach road has been constructed by CWP-RATLAM. The access to this road is not restricted and thus it becomes a public utility, barring the core of WTG area.

Land for Transmission line: This land area required is small 2 ft x 2 ft and is purchased by paying a onetime compensation (which includes the compensation for crops in the Right of Way). The transmission line would pass through 32 villages of Sardarpur tehsil viz. Bhopawar, Kumarghat, Imlipura, Bodla, Sardarpur, Phulgavdi, Govindpura, Patlavada, Badveli,Chichodia, Shyampura Thakur, Undeli, Khareli, Mehgaon, Kheemakhedi, Khajrani, Laidgaon, Gondikheda, Amjhera, Daulatpur, Tandakhera, Khaloda, Talodi, Soniakhedi, Baloda, Dantoli, Bamankhedi, Galonda, Ghatoda, Semikhedikalan, Dasai and Bhellgul village and four villages under Badnawar tehsil viz. Pana, Khiledi, Phuledi and Takravada village. The District collector approval for crossing of transmission line through these village lands has been issued on 28.8.2015 (Please refer **Appendix G**). A sample copy of the land agreement for ROW procurement is given in **Appendix H**.

Land Purchase Process

CWP-RATLAM has procured Government land for 47 WTG and private agricultural lands have been identified for three WTG's for which the procurement is under negotiation (during primary survey). . However, during the final reporting of this ESIA report, the private land has been fully acquired and a proper sale deed agreement has been executed.

Procedure for procurement of Government land -

This includes identification of land through land survey. The procedure has been implemented at site. The Ministry of New and Renewable Energy Department, Govt. of Madhya Pradesh has directed the Revenue department for allotment of land to CWP-RATLAM for all 47 WTG locations. CWP-RATLAM has prepared a checklist for site selection following the Government compliances/rules, few of the major selection parameters are given below:

- Area for locating the wind power project is generally based on the climatic conditions with preference given wind resource, wind speed etc.
- Uncultivated/ fallow/ barren lands so that the costs on land are viable.
- Land/ Plot identification and evaluation of road connectivity and nearest sub-station.
- Assessment and evaluation of the land type and hydrogeology of selected plot.

Procedure for procurement of private land -

- Ownership identification through review of Government land title records for selected plot details.
- Direct negotiation with the identified land owner followed by sale agreement.
- Formulation of sale deed and fixing of land price based on prevailing Government rates and additional charges for land development to the full satisfaction of the landowner.
- Registration and change of ownership

During the final ESIA reporting, the three private land has been identified and procured. The sale deed agreements has been studied and can be inferred from the rates finalised, that the land has been purchased based on negotiation.

Land Details: The summary of the revenue land purchased has been shown in **Table 2.2** below:

Table 2-2: Total Plots, Land Owners and Amount of Land

Name of village and tehsil	Total S.F.Nos	Type of Land
Land for WTG's		
Sergarh village, Badnawar tehsil	16	Government land
Gandwada village, Badnawar tehsil	3	Government land
Kisanpura village, Sardarpur tehsil	1	Government land
Chandodiya village, Sardarpur tehsil	3	Government land
Bor Jhadi village , Badnawar tehsil	1	Government land
Indrawal village, Badnawar tehsil	12	Government land
Panda village, Badnawar tehsil	6	Government land
Phuledi village, Badnawar tehsil	1	Government land
Khiledi village, Badnawar tehsil	7	Government land
Land for WTG location	220.26 ha	
Land for Pooling substation	5ha	
Total land	**225.26ha**	**Government land**
Indrawal village, Badnawar tehsil	1 (302/2)	Private land
Sergarh village, Badnawar tehsil	1(150/2)	Private land
Indrawal village, Badnawar tehsil	1(180/2/19)	Private land
Total land	**3.265ha**	**Private land**

2.6.2 Water Requirement

During the construction phase, there is requirement for water to meet the domestic needs and civil work requirements. As per the discussion with contractor, water requirement per day during construction phase for (24 hours) for civil works is worked out to be 9KL per WTG i.e. total civil work water requirement for all 50 WTG is calculated to be 450KL. During peak construction phase, about 30 construction workers are employed per well. Hence, the total domestic water requirement purpose is 1.35KLD.

In operational phase, there will be over 10-12 staff available onsite including security guards. Water requirement will be only for drinking, which will be met by packaged drinking water.

2.6.3 Manpower Requirement

About 30 labours are employed in the peak phase for WTG construction, which involves the foundation structural work and erection of wind turbine. The contractor workforce is comprised of both skilled and unskilled labours and is being sourced from the nearby village settlements depending on their skills and capabilities. In operational phase, a total of 10-12 personnel will be required onsite including security guards, operation and maintenance officer and site engineers.

2.6.4 Waste Water Treatment and Disposal System

During the current phase, the waste water or sewage from site office toilets is being disposed in a septic tank. Waste water generation during the operation phase is limited to the domestic waste water from the toilets.

2.6.5 Logistic Arrangement

Labour Camp

During site visit, it was observed that labour camps have been constructed by the contractor for about 20-30 labours working onsite. Three medium sized tin sheds were observed housing on an average 30 – 35 labours. It was reported that the skilled workers employed, stay in rented accommodation in the surrounding areas of the project site. The labour camps provided by the contractors are equipped with the basic facilities like drinking water and power supply. The labours cook food within the sheds and the drinking water is supplied from Bidwal village with an average of 10-15 campers with 60 litres capacity on a daily basis.

Project Vehicles

Project vehicles such as water tanker, tractors, JCB, and cars has been hired to support various operations during construction phase and further efforts will be made to hire vehicles from local community.

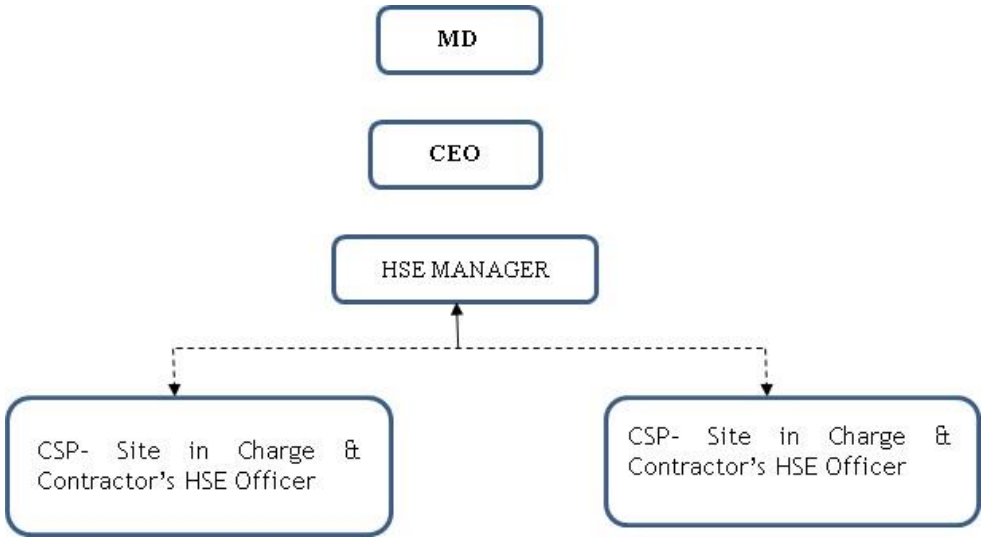
2.7 ESMS & Organizational Structure

To ensure the smooth completion of various operations or activities of project during construction and operational phases, environmental and social management system of CWP -RATLAM will be implemented for the proposed project.

From Constructions and O&M sites CWP-Ratlam's sub-contractors have their own designated HSE personnel onsite, who report the HSE related activities to the Site in charge of CWP-Ratlam as well as to the HSE Manager of the ***Hero Future Energies (HFE)*** as per requirement and implement the HSE related instructions at site. On monthly basis HSE review meeting is organized with MD, CEO & all Departmental HODs to discuss about the HSE issues (if any) concerned with the site.

During the current phase, project operation is managed by Project Site Manager whereas environmental, health and safety issues is monitored by EHS officer. The HSE organizational structure of ***Hero Future Energies (HFE)*** is shown in **Figure 2.5**

Figure 2-5: HSE Organizational Structure



Operational Phase

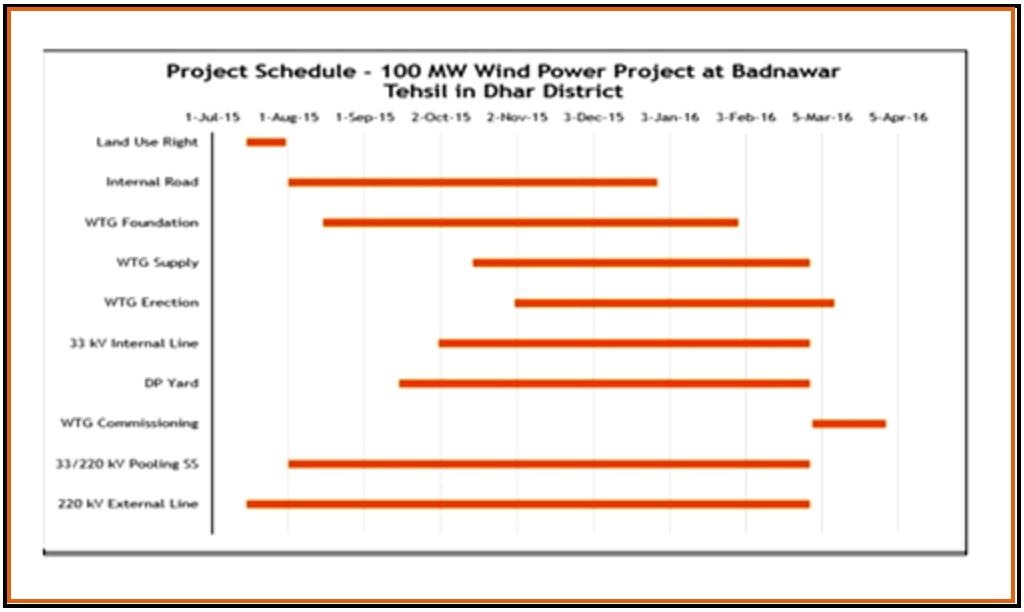
A dedicated Project Manager will be responsible for the implementation of the project. He will be the responsible authority on behalf of CWP-RATLAM to the designated authority of Madhya Pradesh state board for this project. He will be assisted by the Project Engineer (Technical), Project Administrator and Head

(Technical Services) with their respective staff. During the commissioning of the plant, training will be imparted to the Engineer, Supervisor and Operators. This operational training shall cover the following:

- The nature, purpose and limitations of all plant and equipment
- The detailed operating instructions on each section and equipment of the plant
- Normal start-up and shutdown program for the plant
- The emergency procedures and all related HSE issues according to the standards
- The basis for the training shall be the plant's O&M manual.

The Implementation Schedule for the project is as given in Figure 2.6

Figure 2-6: Project Implementation schedule



3.0 APPLICABLE LEGAL, REGULATIONS AND ADMINISTRATIVE FRAMEWORK

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

3.1 National Regulations

Environmental Protection has been given the constitutional status. Directive Principles of State Policy states that, it is the duty of the state to 'protect and improve the environment and to safeguard the forests and wildlife of the country'. It imposes Fundamental duty on every citizen 'to protect and improve the natural environment including forests, lakes, rivers and wildlife'.

In India the Ministry of Environment, Forests and Climate Change (MoEFCC) is the apex administrative body for (i) regulating and ensuring environmental protection; (ii) formulating the environmental policy framework in the country; (iii) undertaking conservation & survey of flora, fauna, forests and wildlife; and (iv) planning, promotion, co-ordination and overseeing the implementation of environmental and forestry programmes. Several laws have been framed for protection of environment and for Occupational Health & Safety in India by the Central Government. The relevant regulation pertaining to the project activity has been discussed as under. The compliance to all environmental, health, safety and social regulation have been presented in **Table 3.1**.

Table 3-1: Applicable Environmental, Health, Safety and Social Regulation

SN	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability
1	The Air (Prevention & Control of Pollution) Act 1981	MPPCB	As per the re-classification of industries into Red, Orange and Green Category, issued by Central Pollution Control Board (CPCB) dated June 2, 2014 and orders issued by CPCB regarding the same via No. B- 33014/7/2006/PCI-II dated 2nd June 2014 the solar power generation through solar photovoltaic cell, wind power & mini hydel power (<25 MW) are classified under Green Category Industries and require Consent to Establish and Consent to Operate under section 18 (1)(b) of Water (Prevention and Control of Pollution) Act, 1974. As per Madhya Pradesh Pollution Control Board, Consent To Establish under and Consent to Operate is required for development of wind power plant in Madhya Pradesh under Section 2l of the Air (Prevention and control of Pollution) Act,1981	*CWP-RATLAM has applied for **Consent to Establish** from MPPCB vide file no. CTE-45061 from MPPCB.* *As per recent (29th Feb, 2016) CPCB Classification of industrial sectors, wind power industry falls under white category. As according to CPCB notification vide file no. B-29012/ESS(CPA)/2015-16 dated March 7, 2016 there is no requirement to obtain Consent to Operate for white industries. – **Appendix S***
2	The Water (Prevention & Control of Pollution) Act 1974	MPPCB	As per the re-classification of industries into Red, Orange and Green Category, issued by Central Pollution Control Board dated June 2, 2014 and orders issued by CPCB regarding the same via No. B- 33014/7/2006/PCI-II dated 2nd June 2014 the solar power generation through solar photovoltaic cell, wind power & mini hydel power (<25 MW) are classified under Green Category Industries and require Consent to Establish and Consent to Operate under section 18 (1)(b) of Water (Prevention and Control of Pollution) Act, 1974. As per Madhya Pradesh Pollution Control Board (MPPCB), Consent to Establish and Consent to Operate is required for development of wind power plant in Madhya Pradesh under Section 25 of the Water (Prevention and Control of Pollution) Act, 1974 as amended in 1988	*CWP-RATLAM has applied for **Consent to Establish** from MPPCB vide file no. CTE-45061 from MPPCB.* *As per recent (29th Feb, 2016) CPCB Classification of industrial sectors, wind power industry falls under white category. As according to CPCB notification vide file no. B-29012/ESS(CPA)/2015-16 dated March 7, 2016 there is no requirement to obtain Consent to Operate for white industries. – **Appendix S***
3	Forests (Conservation) Act, 1980 and Rules 1981	Principal Chief Conservator of forests, Forest Department,	The Forest Conservation Act and Rules mandate projects requiring diversion of forest land for non-forest purposes to seek Forest Clearance from the Ministry of Environment and Forests.	*Wind turbine location no. 1-4 are located near Sergarh Reserve Forest within a range of 17m – 147m. WTG-2 is the closest turbine located near the forest area at a distance of 17m is*

SN	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability
		Madhya Pradesh		*located near the forest boundary. Care should be taken that no disturbance is caused to the forest area during WTG construction and operation activities. However, it is to be noted that all WTG locations are located outside the forest boundary*
4	The Environmental (Protection) Act 1986 and Rules	MoEFCC CPCB MPPCB	Requirement of the law states that establishing the project should ensure that there is no impact or minimal impact on the environment due to project activity.	*Applicable during construction & operation Phase*
5	Environmental Impact Assessment (EIA) Notification 2006 & MoEFCC Office Memorandum dated 30th June'11.	MoEFCC	The EIA Notification 2006 and thereafter the MoEFCC Office Memorandum dated, 13th May '11 exempts wind power project from obtaining prior Environmental Clearance from the regulatory authorities. But, under the provision of MoEFCC office memorandum dated 30th June 2011, requisite permission is required to be obtained from competent authority for water and land usage.	*Permission will be taken from the concerned authority for usage of water. Government land has been procured for 47 WTG and private land was identified during the time of primary survey.*
6	Environment (Protection) Seventh Amendment Rules 2009	CPCB	Ambient air quality monitoring has to be carried out and the concentration limits for the air quality parameters should be in compliance with NAAQS 2009. Activities in the project especially during construction should not result in exceeding National Ambient Air Quality Standards (NAAQS) for ambient concentrations of air pollutants (such as particulate matter). If violation of the Rules takes place then the penalty will be decided on the basis of the parent Air Act 1981.	*During construction phase and if required during operation phase*
7	Noise (Regulation and Control) Rules 2000 amended in 2010	MPPCB	The Rules stipulate ambient noise limits during daytime and night time for industrial, commercial, residential and ecologically sensitive areas. The rules apply both during the construction and operation of the project. Violation of the standards for assessing the noise quality due to the project will lead to penalty as under the EPA Act 1986.	*During construction phase and if required during operation phase*
8	Hazardous Waste (Management, Handling	MPPCB	These Rules outline the responsibilities of the generator, transporter and recycler/re-processor of the hazardous wastes for	*Applicable during construction phase*

SN	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability
	and Trans-boundary Movement) Rules 2008		handling and management in a manner that is safe and environmentally sound. CWP-RATLAM need to obtain consent from State Pollution Control Board for generation and storage of hazardous waste like transformer oil, etc. irrespective of quantity of waste. As per the law the occupier and the operator of the facility shall be liable to pay financial penalties as levied for any violation of the provisions under these rules by the State Pollution Control Board with the prior approval of the Central Pollution Control Board.	*Currently, the construction of structural foundation work for nine WTGs is being undertaken. DG sets are being used for the civil work involved. As per the site observations, oil for DG sets is stored in enclosed containers. However, reportedly CWP-RATLAM will sell all non-biodegradable waste generated like plastics to the authorised recyclers.* *The operation phase of the proposed project will result in generation of some quantities of hazardous waste, mostly in the form of waste/used oil. CWP-RATLAM need to obtain consent from MPPCB for storage of transformer oil. All the hazardous waste generated due to the project shall be stored and disposed as per the requirements of the Hazardous Waste (Management, Handling and Trans-boundary Movement) Rules, 2008 i.e., on a paved surface in a designated area with adequate secondary containment, with adequate labelling and before it is disposed to an MPPCB approved vendor.*
9	Environment (Protection) Second Amendment Rules 2002	MoEFCC	The DG sets installed during construction should comply with maximum permissible noise levels and noise control measures for diesel generators up to 1000 KVA capacity as specified in the Act.	*The construction is being undertaken through DG sets, which will adhere to prescribed CPCB noise level limits and noise control measures.*
10	The Building and Other Construction Workers' (Regulation of Employment and Conditions of Service) Act 1996	Ministry of Labour and Employment	CWP-RATLAM through its contractors shall ensure all vendors employed should have valid labour license. Compensation to workers (own and vendors) should not be below daily wage rate as specified by Government. Muster roll must be maintained. Employee ID card must be issued (own and vendors). Safety, health and welfare measures of building and construction workers as mentioned in the act needs to be complied with. Failure to comply results in financial penalty/imprisonment of the principal employer along with vendor and closure of project	*Applicable during construction phase*

SN	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability
11	Central Electricity Authority (Safety Requirements for Operation, Construction and Maintenance of Electric Plants and Electrical Lines) Regulations 2008, (CET)	Min. of Power , Central Electricity Authority MPSEB	The Act is applicable for the wind power plant as the plant is going to be having electrical appliances and facilities installed for grid connected power generation. As per the act, all equipment's and system installed shall comply with the provision of the statute, regulations and safety codes.	*Applicable both during construction and operation phase* *CWP-RATLAM under provisions of the CET regulations ensure that the health and safety requirements and provisions for transmission lines specified under the rules are compiled.*
12	Workmen's Compensation Act, 1923 & Rules 1924	Madhya Pradesh Labour Welfare Board	The Act requires if personal injury is caused to a workman by accident arising out of and in the course of his employment, his employer shall be liable to pay compensation in accordance with the provisions of this Act.	*Applicable during construction phase* *CWP-RATLAM should ensure through its contractors in case of any accident / injury / loss of life the workmen should be paid a minimum compensation as calculated under this act both during construction and operation phase of the project. The reporting of accidents needs to be done in prescribed forms as per the act and the incident / accident register needs to be maintained accordingly. The Act also gives a framework for calculating amount of compensation and wages.*
13	The Contract Labour (Regulation and Abolition) Rules, 1971 Contract Labour (Regulation And Abolition) Madhya Pradesh Rules, 1973	Madhya Pradesh Labour Welfare Board	CWP-RATLAM shall ensure that the EPC contractor, M/s Balaji Constructions has a valid license under the Contract Labour (Regulation and Abolition) Act, 1970 for executing any work through contract labour. Any other contractors or third parties to be involved in the construction works for the proposed project, if required, will also be engaged only subject to availability of valid license.	*Applicable during construction phase* *All vendors employed through contractors of CWP-RATLAM should have valid labour license. Compensation to contract workers (own and vendors) should not be below daily wage rate as specified by Government of India. Mustard roll must be maintained. Employee ID card must be issued (own and vendors). Safety, health and welfare measures of building and construction workers as mentioned in the act needs to be complied with.*

SN	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability
				Failure to comply results in financial penalty. Failure to comply results in financial penalty. *CWP-RATLAM shall also ensure that conditions like hours of work, fixation of wages and other essential amenities in respect of contract labour are provided and in compliance with the standards.*
14	Minimum Wages Act, 1948	Madhya Pradesh Labour Welfare Board	Requires the Government to fix minimum rates of wages and reviews this at an interval of not more than 5 years. Every employer shall be responsible for the payment to persons employed by him of all wages required to be paid under this Act.	*Applicable during construction phase* *CWP-RATLAM shall ensure payment of minimum wages as fixed by the government without any gender bias.*
15	The Child Labour (Prohibition and Regulation) Act, 1986	Madhya Pradesh Labour Welfare Board	The Act prohibits employment of children in certain occupation and processes. The Act also specifies conditions of work for children, if permitted to work.	*CWP-RATLAM shall ensure that no child labour is engaged at site for construction or operation works either directly or by the sub-contractors. CWP-RATLAM shall include a clause in the subcontractor agreements prohibiting employment of child labour*
16	Companies Act, 2013	CWP-RATLAM	According to Schedule 135 sub -section 1, the companies meeting the threshold criteria specified should spend in every financial year, at least 2% of the average net profits of the Company made during the three immediately preceding financial years in pursuance of CSR policy.	*The project will need to comply with the requirement as stated in the law.*

3.2 Social and Environmental Performance Standards of the International Finance Corporation

The International Finance Corporation has laid down a set of eight Performance Standards that the project developers need to comply with while establishing the project. The provisions of the Performance Standards relevant to the wind power projects are summarized below:

Table 3-2: IFC's Environmental and Social Performance Standards

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
PS 1: Social and Environmental Assessment and Management Systems	Conduct an Environmental and Social Impact Assessment (ESIA or EIA) of the project, appropriate to the nature of the project's environmental and social risks and potential impacts, to include issues identified in Performance Standards 2 to 5	Arcadis has been appointed by CWP-RATLAM to undertake ESIA study to identify the environment and social risks that may arise due to the project and recommend mitigation measures for the same as provided in Chapter 6 The PS 1 is applicable to projects with environment and/or social risks and/or impacts. The proposed project is a wind power project and will have environmental and social impacts resulting from loss of grazing land, generation of noise, construction activities etc. **PS 1 is therefore applicable for the proposed project.**	Hero Future Energies however, has a well framed Occupational Health and Environment policy and HR policy which defines safe and healthy working environment to all its employees. HFE also has a Health, Safety and Environment (HSE) manual defining adequate policies and procedures, safety roles and responsibilities; safety management; SOP for safe working at height, incident reporting, first aid, battery handling and disposal, electrical safety, emergency preparedness etc. HFE's CSR and Occupational Health Safety and Environment Policy as well as Grievance Redressal Procedure is also in place. • The Environment and Social Management System (ESMS) manual for Hero Future Energies is under preparation. • HFE should ensure that the ESMS has provisions for prevention and mitigation of risks and impacts derived from construction and operational phases, stakeholder engagement as well as monitoring and review the efficiency of the implemented procedures.
	Establish Environmental and Social Management Plans commensurate with the findings of the ESIA and consultation with affected communities	An Environmental and Social Management Plan for the project site has been prepared and incorporated in Chapter 6 of the ESIA report taking into consideration the potential social and environmental impacts or risks already identified & assessed in ESIA	
	Establish Action Plans where specific mitigation measures and actions are required for the project to comply with applicable laws, regulations and the requirements of these Performance Standards	An ESMP has been prepared and incorporated in Chapter 6 of the ESIA report for implementation of mitigation measures in compliance with the statutory requirements and Performance Standards	

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
	Provide organizational capacity and contractor / employee training to enable project to achieve continuous environmental and social performance	Organizational structure with roles and responsibilities of the team within the organization is defined in Chapter 2	HFE's ESMS shall incorporate the following major action plans to be followed in construction and operation phase: • Occupation Health and Safety Management Plan • Grievance Redressal Mechanism • Stakeholder Engagement Plan • Emergency Preparedness and Response Plan • Monitoring and review • Documentation and Control • Waste Management Plan • Road Safety and Traffic Management Plan
	Establish and maintain a timely process of community engagement, including a grievance mechanism, focusing on disclosure of information and consultation with local communities affected by project risks or adverse impacts that is free from external manipulation, interference or coercion to ensure relevant and understandable access to project information.	A community engagement plan needs to be developed and implemented as well as adequate reporting needs to be done. This should aim to inform the community project related adverse impacts or risks. The grievance redresses mechanism has been developed in ESIA	
	Establish procedures to monitor and measure the effectiveness of the environmental and social management program, including internal reporting of the program's effectiveness to the project's senior management, disclosure of Action Plans (including material changes to such Plans) to affected communities, and external reporting to affected communities on the results of Action Plans, commensurate with the concerns of the affected communities	System of monitoring with periodic audits will be established	
PS 2: Labour and Working Conditions		The PS 2 applies to workers directly engaged by the client (direct workers), workers engaged through third parties (contracted workers), as well as workers engaged by the client's primary suppliers (supply chain workers).	*CWP RATLAM will ensure that adequate facilities and amenities are provided in the labour accommodation for construction workers including: adequate living/sleeping facilities and space per person; potable water that meets national standards and standards as laid down by ILO; toilets, washing and cleaning facilities; canteen/mess or fuel for cooking; locker/storage facilities; and facilities for*

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
		The proposed project will involve employment of direct and contracted workers during construction and operation phases. Campsite will be set up near the wind turbine locations for skilled labour that will be contracted to carry out foundation and installation works of turbines. Locals will be hired to carry out unskilled work. **PS 2 is therefore applicable for the proposed project.**	*management and disposal of garbage, sewage and other waste. The company will periodically review and monitor the condition of the labour camps. The worker accommodation standards as laid down by ILO is presented in **Appendix Q** of the document.* *The company, as a part of the contractor oversight procedures will need regular monitoring of compliance to the aforesaid guidelines/requirements and ensure that these are met. Internal audits and follow up on corrective actions will also need to be undertaken to assess efficacy of the oversight system.* *CWP-RATLAM will also require the developer to ensure usage of relevant personal protective equipment (PPE), implement work permit and incident/accident recording/reporting systems etc.). The company will (apart from the periodic internal audit) engage a qualified third party to review/audit its labour, OHS and contractor management practices during the construction phase to assess compliance to aforesaid requirements.*
	Establishment of a Human Resources Policy consistent with the requirements of this Standard that informs employees of their rights under national labour and employment laws		*HFE has a well framed HR policy at its corporate level. The policy describes about the following :* - *Terms of Employment* - *HDFC life insurance* - *Employee list* - *Group medical claim policy* - *Leave policy* - *Personal Accidental policy* - *Name change letter receipt*

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
			- *Appointment letter* - *Endowment gain insurance policy* - *Management liability insurance policy* - *Ethics policy and green code* - *Employee referral policy* - *Mobile expense reimbursement policy* - *Separation procedure* - *Code of conduct* - *Travel policy*
	Document and communicate to all employees' conditions and terms of employment.	Being complied. This needs to be implemented during construction and operation phase.	*CWP-RATLAM will preferably hire local labour during construction phase of the project. Labour camp would be provided to the migrant labour. CWP-RATLAM will engage labours through contractors as such the contractors would be supervised by CWP-RATLAM so that the engagement of workers is in accordance to applicable rules and regulations.* *CWP-RATLAM shall provide adequate provisions such as access to clean water, sanitary facilities and other necessary facilities at the labour camps and construction sites.*
	Practice non-discrimination and equal opportunity in making employment decisions	Complied. Equal opportunity is being given to both men and women depending on their skills and capacity.	*Wages, work hours and other benefits shall be as per the national labour and employment Laws.*
	Provide a mechanism for workers to raise workplace concerns.	This needs to be implemented during construction and operation phase.	*A Grievance Redressal mechanism needs to be followed, which has been provided in this report as* ***Appendix R***

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
	Provide workers with a safe and healthy work environment, taking into account risks inherent to the particular project sector	This needs to be implemented during construction and operation phase.	*Hero future Energies Private Limited (HFE) has an EHS policy (**Appendix I**). The same would be followed via an EHS team with designated roles and responsibilities onsite.*
PS 3: Resource Efficiency & Pollution Prevention		The PS-3 is applicable to projects resulting in increased levels of pollution and requires project to avoid, minimize, or reduce adverse impacts on human health and environment by adopting pollution preventive and control technologies throughout the Project life cycle. The proposed project is a clean energy project and will not have major pollution sources associated with it. The construction works for the development of project will result in generation of wastes like wastewater, waste oil and construction debris .The operation phase will result in noise emissions and generation of minor quantities of waste such as transformer oil. **PS 3 is therefore applicable for the proposed project.**	*Requirement of water for project construction phase will be sourced from tankers by authorised tanker water suppliers and drinking water supply would be through packaged drinking water.* *No material impact on ambient air quality is expected on account of this project. However, temporary impacts on ambient air quality and noise levels may be expected during construction. The noise modelling results (refer Sec. 6.2.3) for night time show a total noise level (post operation) at 150 and 220 m radius beyond the Indian Noise standards. Also the incremental load will be beyond the IFC standard* *CWP-RATLAM will implement measures during construction: for management of excavated earth and construction rubble; and minimization of fugitive dust emissions. Further, CWP-RATLAM will ensure that other wastes (packing material, metal, debris, cement bags, drums/cardboards etc.) are collected, stored and disposed to re-users or in appropriate authorized debris disposal areas.* *Limited concreting work is expected for structure foundations, sub-station, transformer yard and transmission towers. Cement concrete mixers will be expected to be used at site since significant concreting work is not expected. Concreting and other construction activities including use of earth moving equipment and increased traffic for material movement is expected to result in increase in ambient noise levels. However, this increase is short*

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
			term during construction stage only. The construction work will be carried out only during day time and no noise generating equipment will be operated at night. *No material impact on surface or groundwater resources is expected on account of the project, except that the water sourcing requirement during the construction phase will need to safeguard the immediate and medium term needs of water by the local communities. The company will have to ensure that the water made available to workers and employees' meets national potable water quality norms, and preliminary information about water quality indicates some related challenges in ground water quality of the area. Appropriate facilities for collection, treatment and disposal of sewage (septic tank and soak pit) both during construction and operation phases will also need to be provided*
	The project proponent should ensure that adequate control techniques are provided to minimize emissions or achieve a pre-established performance level and minimize pollution from project activities. The client will avoid the release of pollutants or, when avoidance is not feasible, minimize and/or control the intensity and mass flow of their release.	During the construction phase, the vehicles involved for hauling of equipment's and materials to the project site may increase the pollution level and dust in the air.	*Currently, CWP-RATLAM through its contractors ensure sprinkling of water to reduce dust in the air. Besides, CWP-RATLAM should also ensure use of vehicles having valid PUC certificates.*
	The client will implement technically and financially feasible and cost effective measures for improving efficiency in its consumption of energy, water, as well as other resources and material inputs, with	During construction and operation phase.	*CWP-RATLAM shall plan and implement pollution control measures. Practices like minimal release of waste, handling of hazardous waste, safe disposal of waste, wastewater management etc. shall be considered prior to each phase.*

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
	a focus on areas that are considered core business activities.		
PS 4: Community Health, Safety and Security		This Performance Standard is applicable to projects which entail potential risks and impacts to the health and safety of affected communities from project activities. The proposed project will involve transportation of large components such as rotor blades, towers which may pose safety risks to the affected communities. Impacts due to generation of noise and shadow – flicker effect will be assessed on habitations that are close to particular wind turbines. **The PS 4 is therefore applicable for the proposed project.**	*The Applicability will be applicable to construction as well as operation period. During construction phase, safety issues are envisaged due to movement of heavy machinery/ vehicles. During operation phase, they may be concerns due to noise and shadow flickering effect on the sensitive receptors. The noise modelling results (refer Sec. 6.2.3) for night time show a total noise level (post operation) at 150 and 220 m radius beyond the Indian Noise standards. Also the incremental load will be beyond the IFC standard.* *Adequate noise control measures (e.g. double glazed windows, acoustic treatment for the walls and roof) shall be provided for the households located within 220 m of Wind Turbines in order to achieve compliance with ambient noise standards in the houses. To reduce shadow flickering impact, curtain and blinds in households should be used with open roof, and windows, doors facing WTGs. Plantation should be undertaken to hide shadow flicker near receptors (households) identified with significant impact* *Unskilled Labour and security staff will be engaged from local community.* *The Action Plan and any other relevant project-related information is to enable the influenced communities and relevant government agencies to understand these risks and impacts, and will engage the influenced communities and agencies on an on-*

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
			going basis consistent with the requirements of PS . A Grievance Redressal mechanism needs to be followed, which has been provided in this report as ***Appendix R***
	Evaluation of risks and impacts of the project on health & safety of the affected community during the project lifecycle and establish preventive/mitigation measures to reduce/minimize the impacts. Disclosure of action plans to affected community and the government agency.	During Construction Phase	*The potential occupational hazards arising from the project activities and the impacts on health & safety of the affected community have been identified and assessed in Chapter 5 of ESIA.*
	Design, construct, operate and decommission of Structural elements or components in accordance with good industrial practice to reduce impact on community health & safety.	During Construction Phase	*An occupation health safety plan has been formulated (Chapter 6) of this report.*
	Minimization of impacts on the health and safety of the community caused by natural hazards that could arise from the land use changes due to project activities.	During Construction Phase and Operational phase	*Taking in consideration 221 structures have been identified within 220m of all 50 WTGs, hence a management plan has been formulated as part of ESIA process to address the issue.*
	Prevent or minimize the potentials for community exposure to communicable diseases during project activities	During Construction Phase	*CSR Plan and activities has been provided as a part of ESIA.*
PS 5: Land Acquisition and Involuntary Resettlement		PS 5 is applicable when there is physical and/or economic displacement due to acquisition of land for the project. *The project will be developed on Government land (47 WTG) as well as on three private land (3 WTG).*	*A relocation/resettlement plan has been developed based on ground survey of all these 221 households. This along with other measures (as defined in sections below) will be implemented by the company. Most of this relocation/resettlement is expected to be in situ*

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
		Private land required for the construction of the transmission line (either pole/tower site and/or for the line right-of-way (RoW) will be leased from individual land owners through a negotiated settlement through vendors appointed by CWP-RATLAM. As this project also involves acquiring private land, the acquiring shall be done as following Willing to Buy- Willing to Sell process, hence, in this circumstances PS-5 will not be applicable. However, PS 5 will be applicable in case of the relocation of those residents who were found residing within 220 meter radius of 15 WTGs. *Approximately 221 houses are located within the setback distance of about 220 m.* **PS 5 is applicable**	*For the informal settlers located on government lands within the setback area of the WTGs, the company will:* • *Develop and implement a relocation/resettlement plan with the objective to relocate as many people/households as possible within the radius of 150 meters. The plan will be consistent with the relevant and applicable requirements of PS 5.* • *For turbine locations where relocation of all houses is not feasible, the company will undertake a Quantitative Risk Assessment (QRA) to assess the level of safety risks.* • *For turbines locations where the risk is assessed to be higher than As Low as Reasonably Practicable (ALARP), the company will undertake measures with the objective to mitigate the risks so as to bring the risk levels down to ALARP.* • *The company will communicate, to all stakeholders, the risks of living under the turbines. This communication will be an ongoing process and will be documented by the company*
PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	As a matter of priority, the client should seek to avoid impacts on biodiversity and ecosystem services. When avoidance of impacts is not possible, measures to minimize impacts and restore biodiversity and ecosystem services should be implemented. Given the complexity in predicting project impacts on biodiversity and ecosystem services over the long term, the client should adopt a practice of adaptive	The applicability of this PS shall be established in ecology and biodiversity section of the ESIA. Implementation of the actions necessary to meet the requirements of this PS shall be managed through the Management Plan. The operation phase of the proposed Project shall ensure protection of local flora and fauna of the site and its surrounding. **PS6 is applicable to the project**	*There are neither Protected Area (N.P; WLS, Community Conserve etc.) nor Important Bird areas are located in the study area. The presence of bat in the study area also could not be established. The avifauna population was also limited. But still, the mortality on avifauna during the operational period cannot be ruled out.* *Hence, monitoring of mortality survey on bird and bat may be conducted initially for one season in particular*

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
	management in which the implementation of mitigation and management measures are responsive to changing conditions and the results of monitoring throughout the project's lifecycle.	Remarks There are no RET (Rare Endangered and Threatened) species found within the project site. The project being located in a "modified habitat" covering scrubs and farm lands, the biodiversity was found to be insignificant. The footprint of each WTG is also small and limited and not involve massive clearance of ground cover. No schedule- I (as per IWPA 1972) species was recorded/sighted during the primary survey in the project area.	*in the winter season to establish the migratory birds in the study area.*
PS 7: Indigenous Peoples	Performance Standard 7 recognizes that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population. Indigenous Peoples are particularly vulnerable if their lands and resources are transformed, encroached upon, or significantly degraded. Their languages, cultures, religions, spiritual beliefs, and institutions may also come under threat. As a consequence, Indigenous Peoples may be more vulnerable to the adverse impacts associated with project development than non-indigenous communities	Performance Standard applies to communities or groups of Indigenous Peoples whose identity as a group or community is linked, to distinct habitats or ancestral territories and the natural resources therein. During Primary survey it was observed that a most of the houses of informal settlers within the set back area of the WTGs belonged to schedule tribes, **Hence, this PS 7 is considered applicable to this project.**	*The company will implement the measures as described above (PS 5). Also the company will:* *undertake culturally suitable and appropriate communication programme to ensure disclosure/dissemination of information to all households and tribal groups in line with the processes laid out in the ICP (informed consultation and participation).*
PS 8: Cultural Heritage –	Performance Standard 8 recognizes the importance of cultural heritage for current and future generations. Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, this	This PS is applicable when tangible forms of cultural heritage, unique natural features or tangible objects that embody cultural values and certain instances of intangible forms of culture are impacted or are proposed to be used for commercial purposes.	

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
	Performance Standard aims to ensure that clients protect cultural heritage in the course of their project activities. In addition, the requirements of this Performance Standard on a project's use of cultural heritage are based in part on standards set by the Convention on Biological Diversity.	It was observed a local deity temple exist the WTG location no. 2 and 3 at an average distance of 250m, for which the access will not be affected in any way, hence **PS 8 is not applicable to this project**	

3.3 EHS Guidelines of IFC

IFC has issued Environmental, Health, and Safety Guidelines for Wind Energy on August 7, 2015. These are a compilation of:

- Environmental, Health, and Safety General Guidelines
- Environmental, Health, and Safety Guidelines for Wind Energy.

The key requirements stated in the EHS guidelines have been discussed in Table 3.3.

Table 3-3: IFC's EHS guidelines for wind energy sector

S.N	Relevant Requirements as Stated in EHS Guidelines	Section in ESIA Report where Addressed
1.	**NOISE AND VIBRATIONS**	
a)	Planning activities in consultation with local communities to minimize disturbance.	Preliminary modelling should be carried out to determine whether more detailed investigation is warranted. Keep stationary source of noise such as DG sets (currently used only for back up) at farthest point from the settlements. Detailed mitigation measures for Ambient Noise Quality are given under Table 7.1
b)	Avoiding or minimizing project transportation through community areas.	The speed limits of the vehicles should be maintained. Refer mitigation measures for Community and Social under Section 7.5.5
2.	**SOIL EROSION**	
I	**Sediment mobilization and transport**	
a)	Scheduling to avoid heavy rainfall periods (i.e., during the dry season) to the extent possible.	Refer mitigation measures for soil and water under Table 7.1 and under section 6.2..2 B and E
b)	Contouring and minimizing length and steepness of slope	Refer mitigation measures for soil and water under Section 6.2.2 D
c)	Re-vegetating areas promptly	Refer mitigation measures for Ecology under Table 7.1 , Section 6.2 E
II	**Waste Water Runoff Management**	
a)	Segregating or diverting clean water runoff to prevent it mixing with water containing high solids content, to minimize the volume of water to be treated prior to release.	Refer mitigation measures for soil and water under Table 7.1 and under section 6.2..2 B and E
III	**Road Design**	
a)	Limiting access road gradients to reduce runoff-induced erosion	Refer mitigation measures for soil and water under Table 7.1 and under section 6.2..2 B and E
b)	Providing adequate road drainage based on road width, surface material, compaction, and maintenance.	Refer mitigation measures for soil and water under Table 7.1 and under section 6.2.2 B and E
3	**AIR QUALITY**	
a	Dust suppression by spraying water or non-toxic chemicals to minimize dust from vehicle movements.	Refer mitigation measures for Air environment under Section 6.2.2. A and mitigation measures for ambient air quality under section 7.5.7 as well as Table 7.1.
b	Avoiding open burning of solid waste	Refer mitigation measures for migrant labour under Section 6.6.4 and Table 6.1

S.N	Relevant Requirements as Stated in EHS Guidelines	Section in ESIA Report where Addressed
c	Proper maintenance of vehicle for low generation of pollution load	Vehicles should have PUC certificate. Refer mitigation measures for Transport and Traffic under section 6.6.7
4	**SOLID WASTE**	
a)	Minimizing generation of solid waste	Refer mitigation measures in Table 7.1
5	**HAZARDOUS MATERIALS**	
a)	The hazardous waste like transformer oil , waste oil from DG sets should be kept in enclosed containers	Refer mitigation measures under Hazardous waste under Table 7.1 and section 6.2.2 G
6	**OCCUPATIONAL HEALTH AND SAFETY**	
	Occupational health and safety hazards during the construction, operation, and decommissioning of onshore and offshore wind energy facilities are generally similar to those of most large industrial facilities and infrastructure projects. They may include physical hazards, such as working at heights, working in confined spaces, working with rotating machinery, and falling objects.	Refer mitigation measures under Section 6.2.2 J , under Occupational safety under Table 7.1 and mitigation measures in section 7.5.6
I	**Working at Height**	
II	**Working in Remote Locations**	
III	**Lifting Operations**	
7	**COMMUNITY HEALTH AND SAFETY**	
a)	Community health and safety hazards during the construction, operation, and decommissioning of wind energy facilities. These hazards may apply to the structural safety of project infrastructure, life and fire safety, public accessibility, and emergency situations	The impacts on community health and safety has been discussed in Chapter 7 , the impacts and the possible mitigation measures has been discussed in section 7.5.2
b)	Blade Throw	Turbines must be located at an acceptable distance between wind turbines and adjacent sensitive receptors like habitations to maintain safety in the event of blade failure. Refer in Section 6.4.2. K and under Occupational Health and Safety in Table 6.1
c)	Aviation: The wind turbines height should be maintained as per air traffic safety regulations in case there are any airport nearby the project site.	Not Applicable. No airport within a radius of 10km from the project site.
d)	Marine Navigation and Safety	Not Applicable.

S.N	Relevant Requirements as Stated in EHS Guidelines	Section in ESIA Report where Addressed
		The wind energy facility is not located near any ports or harbours.
e)	Electromagnetic Interference and Radiation: Wind turbines could potentially cause electromagnetic interference with telecommunication systems (e.g., microwave, television, and radio).	Care should be taken that the wind turbines are located away from all telecommunication lines or the television broadcaster transmitter.
f)	Public Access	During construction phase, safety flags on the roadsides should be displayed during work in progress. The WTG location should also be fenced to prohibit public access to the turbines. CWP-RATLAM has put up sign boards on the road sides.
g)	Abnormal Load Transportation	The transportation of oversized or heavy wind turbine components (blades, turbine tower sections, nacelle, and transformers) and cranes on the village access roads pose a traffic threat in the region. Hence, proper traffic management plan should be adopted as detailed in Section 6.6.7 for minimizing the same.
a)	Visual Impact	The landscape should be studied in detail while siting the WTG locations, access roads and transmission line so that it does not impact the landscape of the area.
b)	Operational Noise	Wind turbines generate mechanical and aerodynamic sources. Wind turbines should be operating in reduced noise mode. Curtailing turbine operations above the wind speed at which turbine noise becomes unacceptable. Adherence to national or international acoustic design standards for wind turbines
c)	Bird/ Bat mortality and flight disturbance	The WTG locations should be sighted away from sites of local, regional, and international importance including national and international protected areas (including marine protected areas), Important Bird Areas (IBA), Key Biodiversity Areas (KBAs), Alliance for Zero Extinction (AZE) sites, Ramsar sites. During operation phase the local and migratory bird habitat study may be conducted, based on geographical location and topography of the area. Surveys may be undertaken particularly in winter season to understand the impact on migratory birds, if any. Proper measures should be considered in the pre-planning phase to reduce the cut-in wind speeds to further prevent potential bat collisions.
d)	Shadow Flicker and Blade Glint	In case of worst case scenario, the duration of shadow flicker should not exceed 30minutes 30 hours per year and 30 minutes per day.

S.N	Relevant Requirements as Stated in EHS Guidelines	Section in ESIA Report where Addressed
		Wind turbines should be programmed to shut down at times when shadow flicker limits are exceeded.
e)	Occupational Health and Safety - Working at Heights	Safety nets or airbags can be used to minimize the consequences of a fall. Proper training should be given to workers working on heights. Personal protective gears should also be provided to the workers.
f)	Community Health and Safety	Minimize the probability of a blade failure by selecting wind turbines that have been subject to independent design verification/certification Conduct periodic blade inspections for maintenance of blades. Please refer section 7.6.2 and Table 7.1

4.0 DESCRIPTION OF ENVIRONMENT

This chapter describes the existing environmental settings of the project area and its immediate surroundings. This includes physical environment comprising air, water and land components, biological environment and socio-economic environment. Attributes of the physical environment such as air, water, soil and noise quality in the block and surrounding area were assessed primarily through monitoring and analysis of samples collected from the area. Air, water, soil and noise primary monitoring was conducted by NETEL Laboratory (a NABL certified laboratory). Arcadis team were responsible for selecting the monitoring stations and supervision of onsite monitoring. Primary monitoring was conducted in October, 2015.

Information on geology, hydrology, prevailing natural hazards such as floods, and earthquakes have been collected from literature reviews and authenticated information made available by government departments. Primary surveys were carried out to understand and record the biological environment prevailing in the area and the same was verified by the forest officials and against published information and literature. The socioeconomic environment has been studied through consultations with various stakeholders within the site. Additionally, socioeconomic data have been obtained from the Census of India, 2011 reports.

4.1 Study Area

The project site is located in two tehsils namely Badnawar and Sardarpur of Dhar district in the state of Madhya Pradesh. Based on the secondary information of the region, the monitoring locations were identified to obtain the representative baseline information. Monitoring stations for air and noise were selected in proximity to the WTG locations as well as main roads and settlements taking in consideration the wind direction. Monitoring locations for surface water quality was selected based on the drainage pattern of the area. Soil sample locations were selected based on the land use and land cover of the study area. Locations of ecological and social surveys were also selected based on receptor locations; in addition, special emphasis is given to areas within 500-800m radius of the WTG sites, transmission towers and access roads.

4.2 Baseline Conditions

4.2.1 Climate and Meteorological Conditions

The climatic condition of this area is semi-arid. The winds in the area are light to moderate during summer and winter and during the end of the summer season and monsoon season year. The nearest IMD monitoring station is Indore located at approximately 96 km south west from the project site

Temperature:

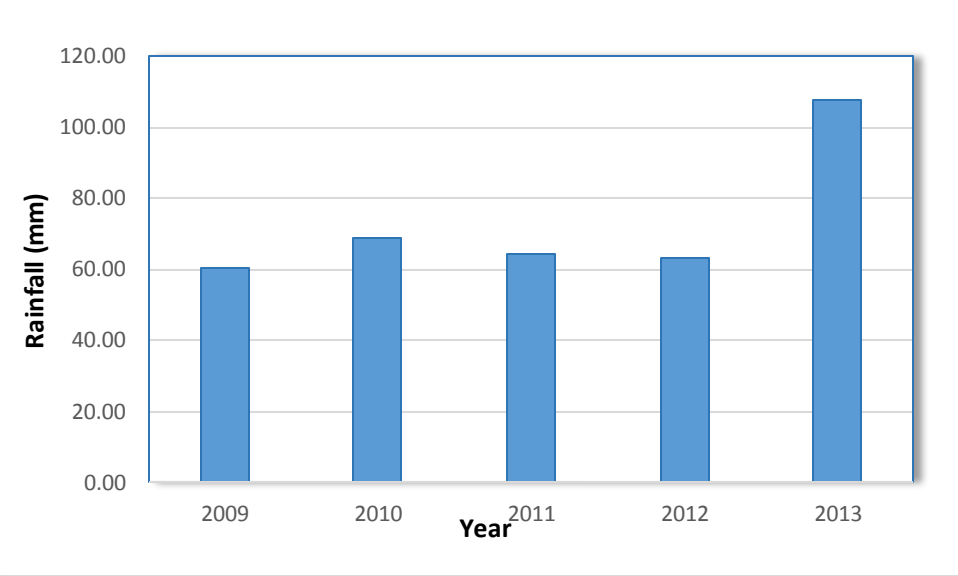
As per the CGWB report for Dhar district, the normal maximum temperature during May is 39.9º C and minimum during January is 9.6ºC. The average annual maximum and minimum temperature of the district is 31.3ºC and 17.5ºC respectively.

Rainfall:

[5]During the south – west monsoon season, relative humidity exceeds 88 % (July / August month). The rest of the year is dry. The driest part of the year is the summer season, when relative humidity is less than 30 %. April is the driest month of the year. As per the Hydromet division, IMD, New Delhi rainfall data recorded for 2009 – 2013, the average annual rainfall in the district is 73.13mm. The driest month is April, with an average rainfall of 0.04mm. The highest precipitation is observed in the month of July and August. The average annual rainfall of the district is 833.6 mm. Dhar district receives maximum rainfall during south – west monsoon period i.e. June to September

[5] Groundwater information booklet, CGWB, Dhar district, 2013

Figure 4-1: Average Annual Rainfall in Dhar district (2009-2013)



Source: Hydromet division, IMD, New Delhi

Wind speed:

As per Ministry of New & Renewable Energy's (MNRE) list of wind monitoring stations issued on 31.10.13, the nearest wind monitoring station is installed at Kanchroota in Dhar district, which is located at a distance of 32km from the project site. The mean annual wind speed (MAWS) recorded at 20/25/30/50/80/120m wind mast height is 5.26m/s. CWP-RATLAM has two wind masts of 100m height erected in Sergarh and Phuledi village in Badnawar Tehsil of Dhar-district. The onsite wind measurement reveals the average wind speed for the site is in the range of 6.5 m/s to 6.58m/s at 100m height. The monthly average wind speed for the site is as follows:

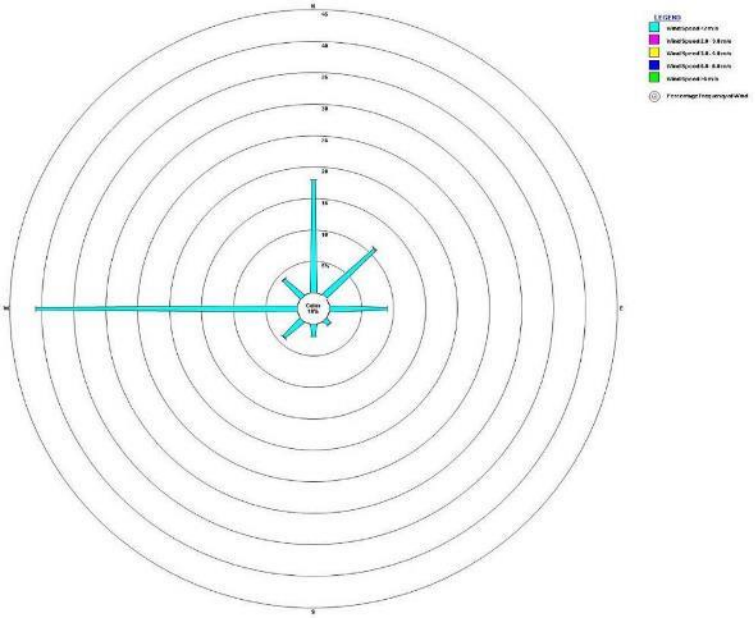
Table 4-1 Onsite wind measurements

Month	Sensor Levels height		
	100m	80m	50m
Jun-14	9.03	8.79	8.35
Jul-14	7.75	7.44	6.98
Aug-14	6.49	6.16	5.60
Sep-14	5.93	5.64	5.01
Oct-14	4.87	4.65	4.20
Nov-14	4.64	4.52	4.15
Dec-14	6.95	6.85	6.23
Jan-15	5.76	5.64	5.20
Feb-15	6.10	5.89	5.28
Mar-15	6.79	6.49	5.78
Apr-15	7.20	6.83	6.06
May-15	7.47	7.17	6.52

Source: Onsite wind measurements

As per the IMD climatological table 1973-1990, the wind direction is from West to East. The **Figure 4.2** below shows the wind rose plotted for the project site. The yearly wind speed recorded for Dhar district is <2m/s.

Figure 4-2: Wind rose for Dhar district



As per the wind rose depicted in **Figure 4.2**, the wind direction is west to east in Dhar district.

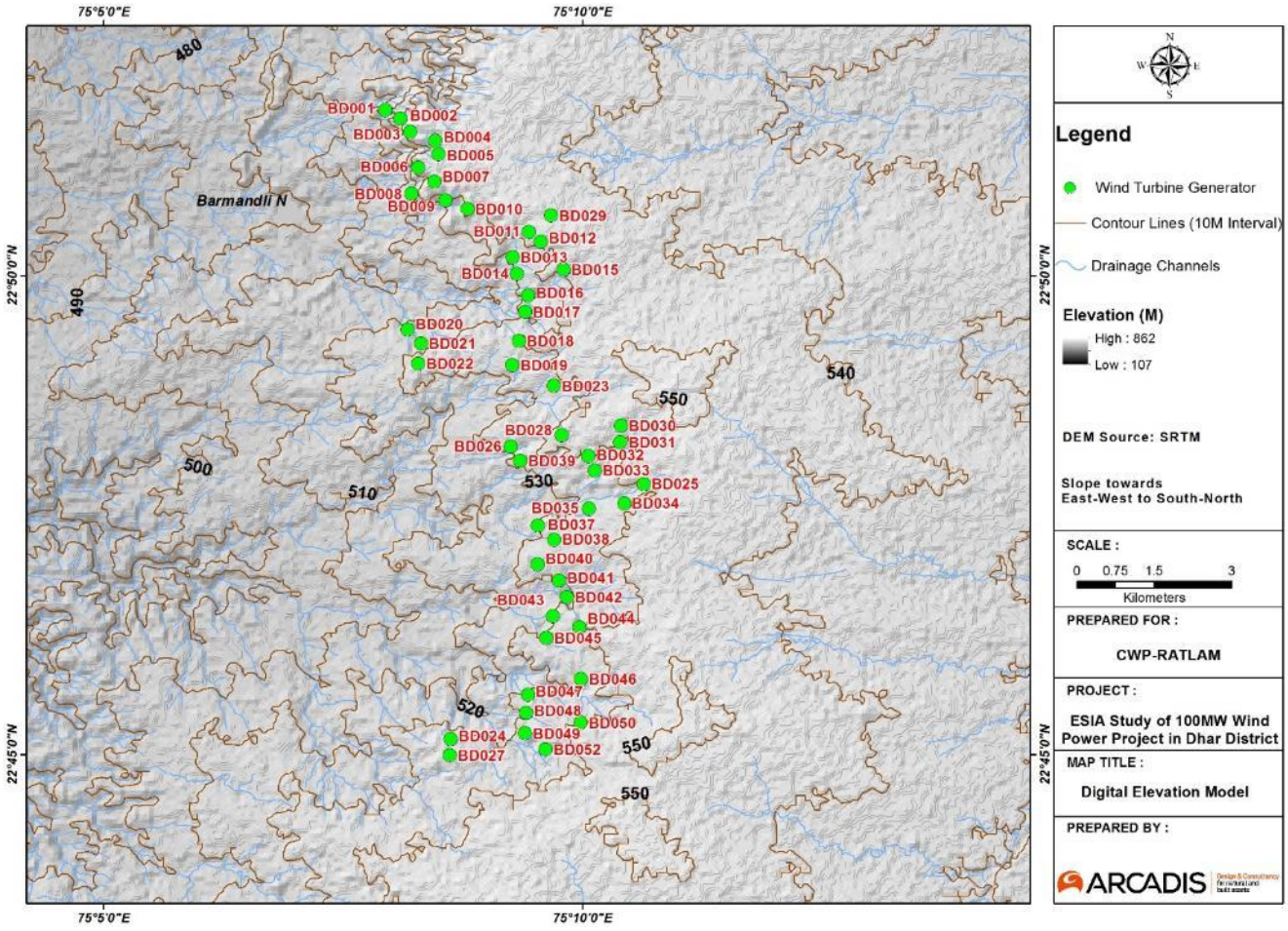
4.2.2 Topography

The topography of the project site is both undulating and flat. During site visit, it was found that out of 50 WTG locations, WT 1 location has an undulating terrain for which levelling for both access road and WTG is being undertaken. The remaining WTG locations have a flat terrain. The project site is located at an elevation of 540m above sea level. Some of the site pictures are shown in **Photo 4.1**

Photo 4-1: Topography of the project site

Generally, the regional slope of the land surface is from the south-east to the north-west direction. The Digital elevation model has been shown below in **Figure 4.3**

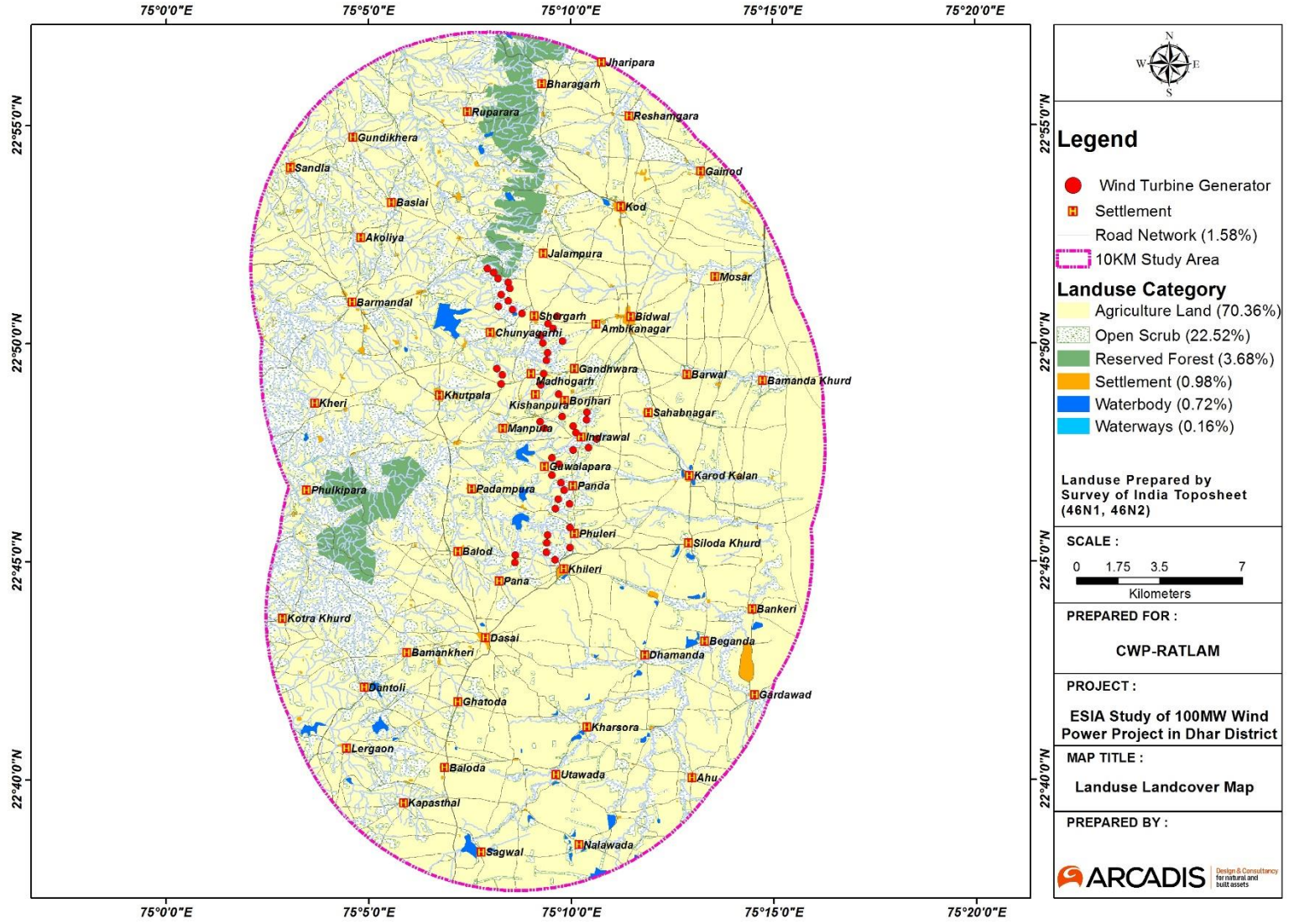
Figure 4-3: Digital elevation map of the project area



4.3 Land use Analysis

The land-use and land-cover of the study area (10 km) has been interpreted from visual interpretation, survey maps of the area, and subsequently by ground checking during field surveys. The land use at the project site is both open scrub and agricultural land. Predominant land use pattern is agricultural land (70.36%) followed by open scrub area (22.52%), forest area (3.68%), settlements (0.98%) and water bodies. Land use map showing a radius of 10 km of the project site is provided in **Figure 4.4**

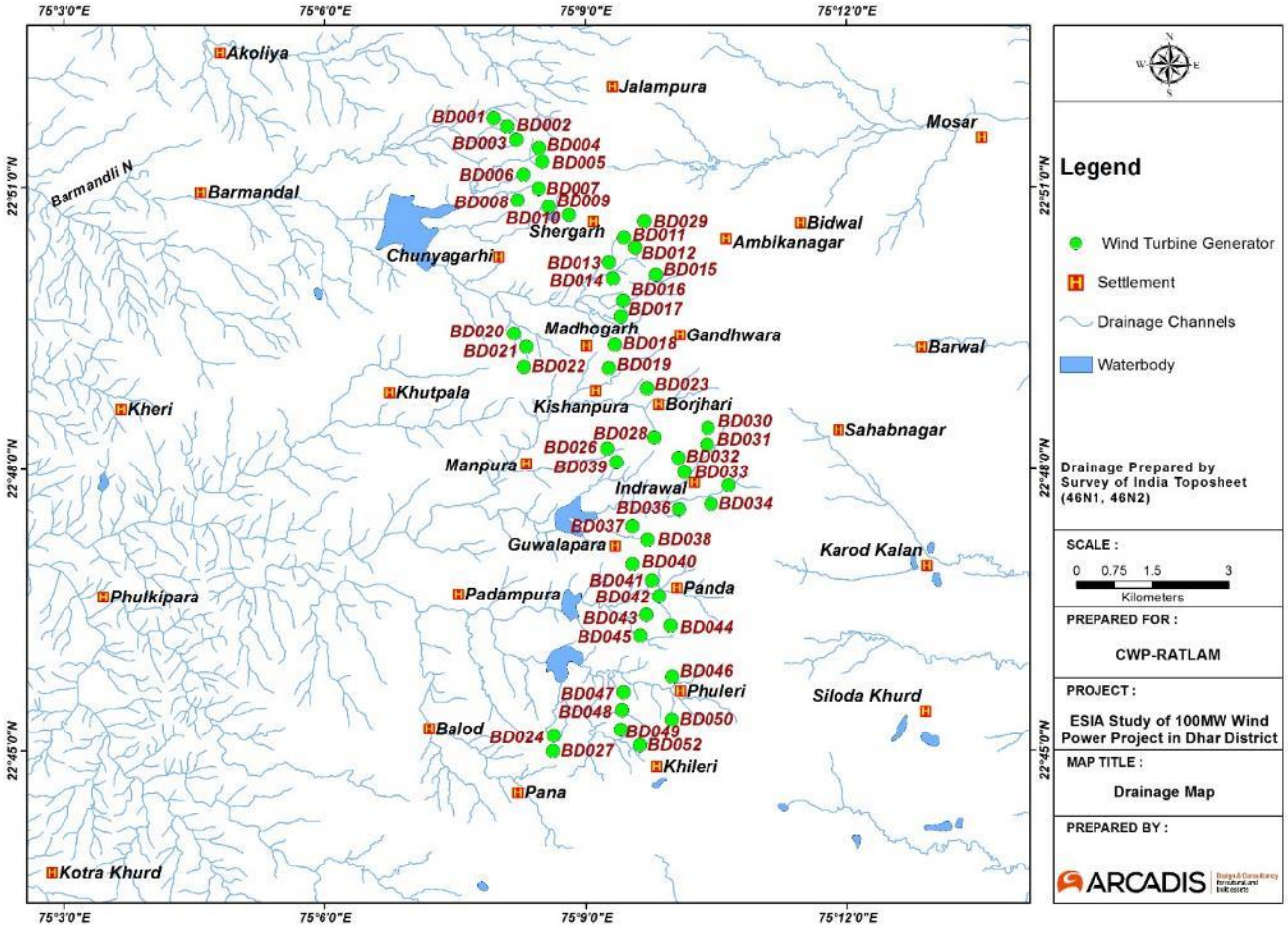
Figure 4-4: Land Use Map Of The Study Area



4.4 Drainage

Dhar district falls in the Narmada Basin. Mahi River originates from the northern slopes of Vindhyas at an altitude of 500m near village Bhopawar of Sardarpur tehsil in Dhar district of Madhya Pradesh. However the river flows beyond 10km radius of the project area. No major river flows within the project region, however small drainage channels are observed within the project site area, which are non-perennial. One medium sized and three small sized water bodies are found within the project site area which are observed to serve as habitats for birds. The drainage map of the project sites is provided in **Figure 4.5**

Figure 4-5: Drainage Map of the Study Area



4.5 Hydrogeology

Ground water occurs mostly in the weathered, jointed and fractured basalts in Dhar district. The project area is occupied by Deccan trap. The Deccan Traps area has fair ground water resources where in the ground water occurs in the weathered/ vesicular zone, and of interflow zone/ intertrappian formation. Dhar district has a net groundwater availability of 104.7 thousand hectare metres of ground water per annum, out of which Badnawar and Sardarpur tehsil of Dhar district has a net annual groundwater availability of 15579 and 15207 HQM respectively.

Table 4-1: Availability of Ground Water Resources (HQM) in Sardarpur and Badnawar Tehsil, Dhar District

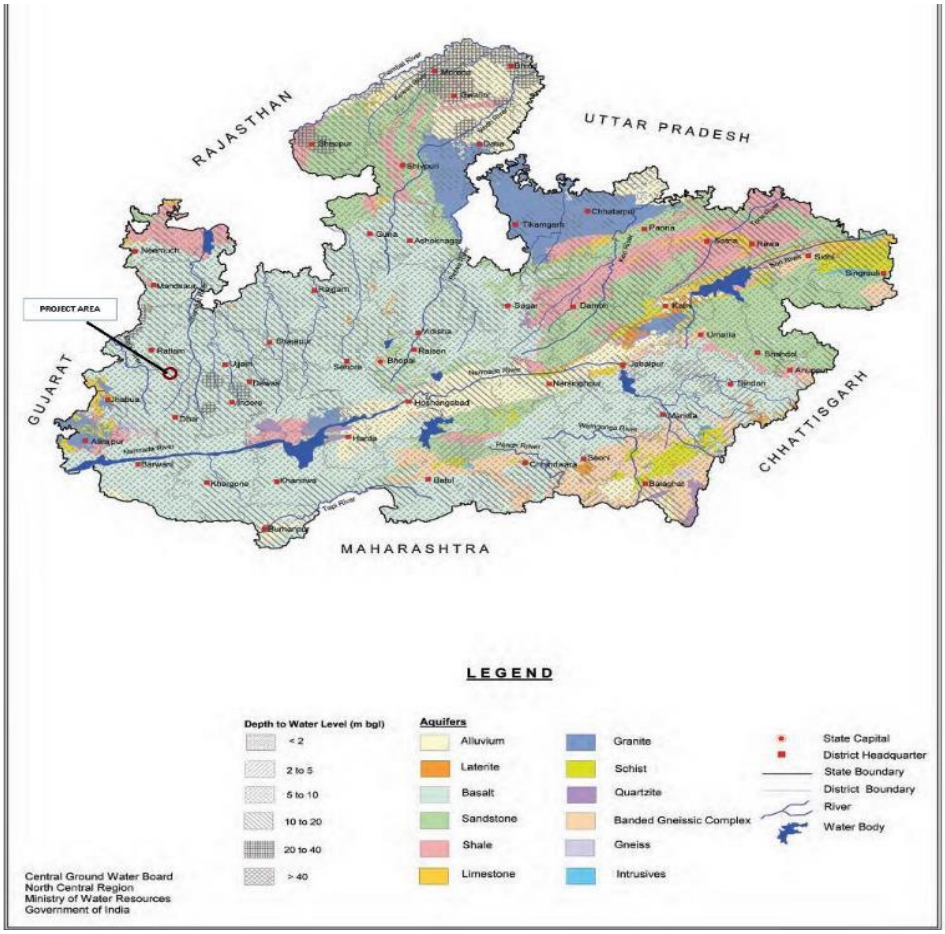
Block	Recharge from rainfall during monsoon	Recharge from other sources during monsoon	Recharge from other sources during non-monsoon season	Total annual ground water recharge	Natural discharge during non-monsoon season	Net annual ground water availability	Stage of ground water development
Badnawar	12299	528	4572	16399	820	15579	153
Sardarpur	13234	342	2432	16007	800	15207	71

Source: Report on Dynamic Ground Water Resources of M.P., 2006, Water Resources Department, Govt. of Madhya Pradesh.

As per Central Ground Water Board's (CGWB) categorization w.r.t to groundwater development, Badnawar block falls under **"Over-Exploited"** category and Sardarpur block falls under "**Safe"** category.

Depth to Water Level : The pre-monsoon decadal mean from May 2003 – 2012 show the ground water level depth of the project area in the range of 5-10mbgl. The same has been depicted in **Fig 4.6 and 4.7**

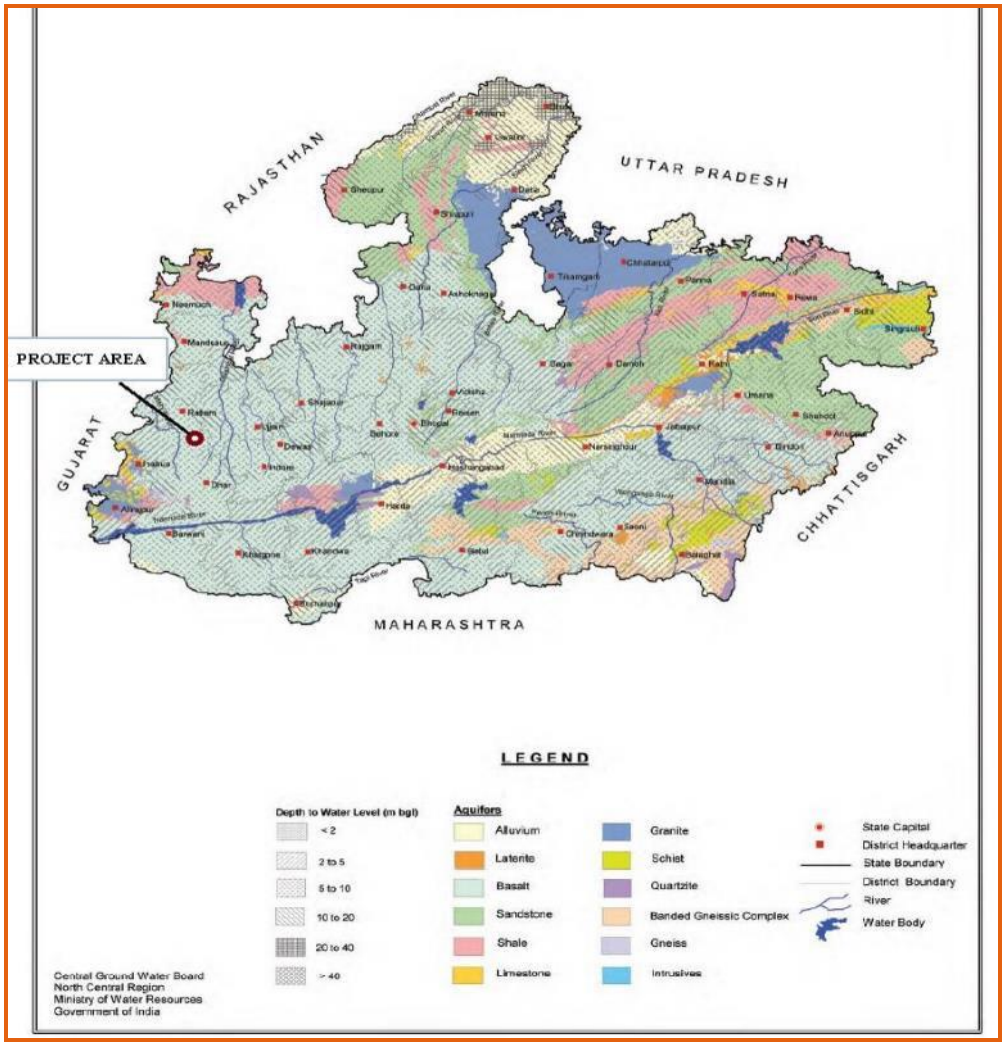
Figure 4-6: Decadal mean of depth to ground water level for pre- monsoon season between May 2003-2012 for the project area.



Source: Aquifer systems of Madhya Pradesh, CGWB, 2013

The post-monsoon decadal mean from November 2003 – 2012 also show the ground water level depth of the project area in the range of 5-10mbgl.

Figure 4-7: Decadal mean of depth to ground water level for post-monsoon season between Nov 2003-2012 for the project area.



Source: Aquifer systems of Madhya Pradesh, CGWB, 2013

4.6 Environmental Monitoring

4.6.1 Ambient Air Quality

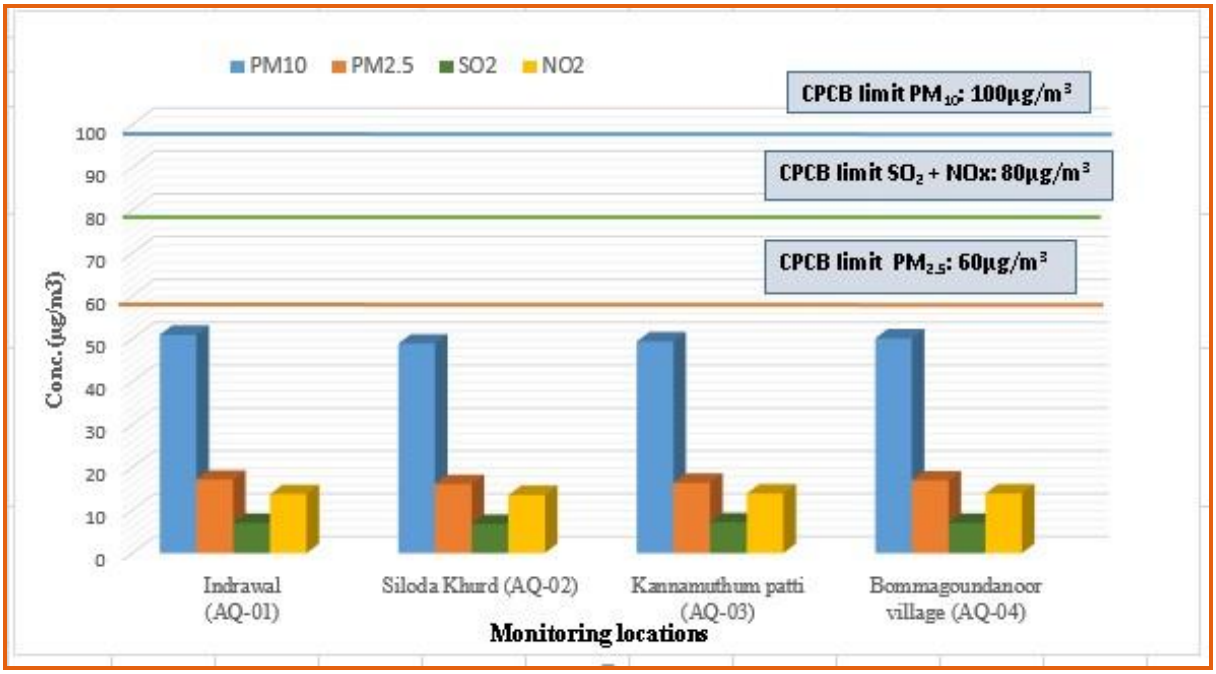
Ambient air monitoring was carried out at four locations for 24 hours (4-hourly sampling for gaseous pollutants (CO) and 8-hourly sampling for particulate matter) with a frequency of twice per week. The monitoring was conducted for one week during the period of Oct 2015. Monitoring stations were chosen on the basis of their proximity to settlements, topography and predominant wind direction. The details of the monitoring locations is given below in **Table 4.2**

Table 4-2: Ambient Air Monitoring Locations

Station Code	Villages	Wind direction
AQ1	Indrawal village	Downwind
AQ2	Siloda Khurd village	Downwind
AQ3	Karod Kalan village	Downwind
AQ4	Hanumantya Padmapura village	Upwind

Concentrations of all the ambient air quality parameters (PM_{10}, $PM_{2.5}$, SO_2, NOx and CO) at all four monitoring stations were observed to be well below the NAAQS. Overall the air quality of the project area is considered as good. The average Particulate matter (PM_{10}) monitored for the project site at four locations viz. Indrawal village, Siloda Khurd village, Hanumantya Padmapura village and Karod Kalan village was found in the range of 48.9 to 50.95 µg/m^3 i.e. well below the CPCB permissible limit of 100µg/m^3 . Concentration of Particulate Matter ($PM_{2.5}$) monitored was 16.1 to 17.15 µg/m^3 i.e. below the CPCB permissible limit of 60 µg/m^3. Sulphur dioxide and Nitrogen Oxide too were recorded well below the CPCB permissible limit of 80µg/m^3. Carbon monoxide too was reported well below the permissible limit of 2mg/m^3. The **Figure 4.8** below graphically represents the ambient air quality results. The results have been shown in **Appendix J**

Figure 4-8: Ambient Air Quality Monitoring results



4.6.2 Ambient Noise Quality

The ambient noise monitoring was conducted during the month of October, 2015 at four locations viz. Siloda Khurd village, Hanumantya Padmapura village, Indrawal village and Karod Kalan village. The noise monitoring network was established based on the understanding of the proposed project activities and professional judgment. Sound pressure level (SPL) measurements in dB (A) were recorded for every hour continuously for 24 hours for the aforesaid monitoring station and equivalent noise levels in the form of Leq day and Leq night were computed.

The average day time noise level ranges from 50.4 - 53.5 dB(A) and average night time noise level ranges between 39.0 – 40.8 dB(A). It is found that day time and night time noise levels are well within CPCB limits specified for Residential area as per **Noise Pollution (Regulation and Control) Rules, 2000**.

Table 4-3: Noise level monitoring in the study area

Location Code	Location	Area Category	Daytime (L_{dn}) dB (A)		Night times (L_n) dB (A)	
			Results	Limits	Results	Limits
N1	Silod Khurd village	Residential	50.4	**55**	39.0	**45**
N2	Hanumantya Padmapura village	Residential	53.3	**55**	40.6	**45**
N3	Indrawal village	Residential	53.5	**55**	39.9	**45**
N4	Karod Kalan village	Residential	52.0	**55**	40.8	**45**

4.6.3 Surface Water Quality

Two monitoring locations were selected to understand the surface water quality of the study area. The criterion for sampling location selection was distance from anthropogenic sources and use of the surface water body. The details of the locations have been given below in **Table 4.4** The physiochemical results of surface water is provided in **Appendix K**.

Table 4-4: Surface Water Monitoring Location Details

Station Code	Sampling Location	Current Use
SW-1	Chira Khan village pond	Washing/Bathing
SW-2	Hanumantya Padmapura village pond	Washing/Bathing

Two surface water locations were monitored for their physiochemical and bacteriological characteristics. The pH was observed in the range of 8.10 to 8.19. The surface water samples taken from Chira Khan village pond and Hanumantya Padmapura village pond have Dissolved Oxygen (DO) levels at 3.1 and 3.4 mg/l respectively and Biological Oxygen demand (B.O.D) levels at 6.06mg/l and 5.94mg/l respectively. Moreover, the bacteriological examination of these two surface water samples show Total Coliform >1600 MPN/100ml. Fecal Coliform was monitored to be 430 and 350MPN/100ml respectively.

Sample collected from these two surface water bodies complies with ***Class E (Irrigation, Industrial Cooling, Controlled Waste Disposal)*** as per CPCB standard, mentioned for best use classification of surface water. The pond water is not fit for drinking and is only used for washing.

4.6.4 Ground Water

Results of physical & chemical analysis of ground water samples from two locations were studied to have an idea of the quality of ground water in the study area. Sampling stations are presented in the **Table 4.5** given below:

Table 4-5: Ground water monitoring location details

Station Code	Sampling Location	Source	Current Use	Depth of water
GW-1	Bidwal village	Hand pumps	Drinking	60ft
GW-2	Panda village	Bore well	Drinking	75ft

The criterion for sampling location selection was based on the distance from anthropogenic sources that can interfere with the monitoring results and present use of ground water sources. Results of physical and chemical analysis of the samples are presented in **Appendix L**.

Physiochemical analysis of groundwater samples show pH i.e. 7.95 to 8.2 in both locations. However, both the samples showed Total Dissolved Solids (TDS) levels at 681mg/l and 556mg/l respectively which are above the BIS 10500 2012 limit of 500mg/l. Total Hardness concentration in Bidwal village (326.4mg/l) was found above the acceptable limit of BIS 10500: 2012 set as 200mg/l whereas hardness in Panda village 140.16 mg/l was found below the BIS limit. Alkalinity, chloride, calcium and magnesium was found well below the BIS 10500: 2012 acceptable limit set for 600mg/l, 1000mg/l, 200mg/l and 100mg/l respectively. Concentration of bacteriological contamination in the groundwater samples was found nil.

4.6.5 Soil Environment

The important crops of the district are jowar, maize, bajra, rice, kodon (also known as bhadli), tuar, mung and urad, tilli or sesamum and remeli, cotton and tobacco. Soyabean and cotton are main cash crops of this region. Soyabean can withstand high temperature and short period of draught and can be grown on all types of soil. In case of cotton also, the climatic conditions are favourable in this region. The project area has black cotton soil of varying thickness.

Soil quality monitoring: Soil samples were collected from two locations viz. Bidwal and Panda village. The locations were selected to get proper understanding of the soil variability in and around the project site.

Table 4-6 Soil monitoring location details

Sampling code	Monitoring location	Source
S-1	Bidwal village	Agricultural field
S-2	Panda village	Agricultural field

Soil samples are analysed for pH, electrical conductivity, texture, nitrogen, phosphorous, potassium, magnesium, calcium, sodium absorption ratio and water holding capacity. The summary results of soil samples are presented in **Appendix M.** Soil analysis table indicates that the soil pH, at two monitoring locations are ideal viz. 7.17 and 6.92. Nutrient analysis of soil show potassium concentration between 284.08mg/l and 525.78mg/l and calcium as high as 7477.1mg/l and 6290.71mg/l in S-1 and S-2 respectively. Magnesium was found as 1960.04mg/l in S-1 and 799.29mg/l in S-2. The textural class predominately in the study area is ***Sandy Clay Soil*** as per United States Department of Agriculture (USDA) soil classification based on soil samples analysed for their silt, sand and clay ratio.

4.7 Seismic hazard

The proposed project is situated in ***Zone II and III - Low damage risk*** zone of getting affected due to earth quakes as per the Seismic Zones of India Map IS 1893 – 2002, BIS. As such the materials for construction of the wind power plant should have earthquake resistant properties to withstand and resist damage due to earthquakes.

4.8 Ecological Environment

Primary survey (to assess the existing local ecological resources) was conducted during the mid of October 2015 in and around the proposed WTG locations. The objective of the primary survey was to collect data on the flora and fauna recorded from the primary survey and gather other published/ unpublished information on floral and faunal species of the region as well. The data will enable to assess the potential ecological impacts from the proposed development. This will help in developing adequate and feasible mitigation measures (via inputs to project design and layout, working practices, or compensate where appropriate) to keep residual

ecological impacts within the acceptable limits, and also to develop ecological monitoring parameters. This section of report presents about the biological environment of the area. The main objectives for ecological surveys:

Objectives:

Floral profile assessment -

Identification of floral species, endangered as well as endemic species (if any), important habitats, forests area within the study area;

- Surveys to identify local, widespread floral species, any endangered or endemic species and protected species in the study area;
- Identification of aquatic flora near the water bodies found in the study area;
- Identification of any notified area under international conventions, national or local legislation for their ecological, landscape, cultural or other related values within the study site.

Faunal profile assessment -

- Identification of fauna (terrestrial, aerial and aquatic) by direct sighting and through secondary means like, nests, roosts, pug marks, droppings, etc.
- Identification and classification of species recognized as critically endangered, endangered, threatened etc. as per IUCN Red list and scheduled species as per WPA (1972).
- Identification of areas important for breeding, foraging, nesting, resting or over wintering areas include migratory corridors/ avian migratory routes.
- Identification and assessment of aquatic fauna near the study area.

Methodology:

Desktop Review

Desktop study was undertaken prior to site visit to gather more information on the local ecology, sensitive ecological areas (if any), Important Bird Areas of this region (if any), prominent/permanent water bodies of the area, forest types, vegetation composition, study area falling under migratory route of birds etc.

Flora Survey

The primary floral survey was conducted to record site specific floral species and its diversity. A walk through of the project area was carried out covering each WTG location and transmission route. Nearby area around the WTG, proposed access roads and surrounding area was also covered to understand the floral diversity. At the time of the survey, woody/small trees and ephemeral layer of seasonal and annual ground flora were recorded. Further seasonal species data was collected from secondary sources such as Governmental department records, forest officials and local residents.

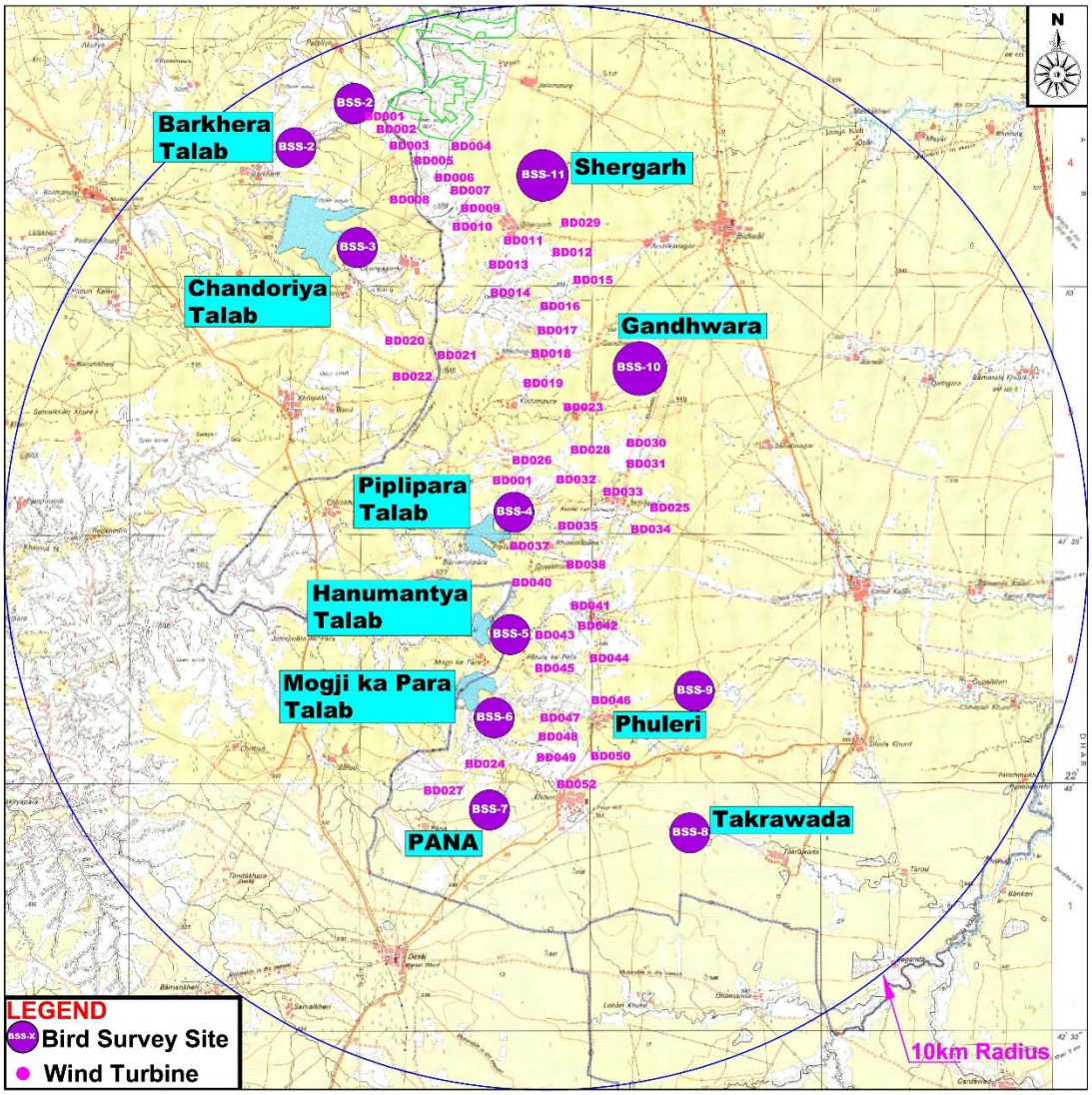
Faunal Survey

To assess the presence of fauna in the project site, a walk through survey of the area was carried out. Each WTG locations were visited to find out the presence of faunal species near the project site. The faunal survey focused mainly on three group's viz. mammals, avifauna and herpeto fauna of the study area.

Bird survey sites (can also be termed as Vantage Point Survey) were identified from the reconnaissance survey undertaken around the project area at 11 locations. The bird survey locations were selected based on the flight pattern of different birds, rich representation of bird species, conducive habitat of bird species and most importantly the potential to suffer significant impact from collision etc. Bird survey was conducted during early morning, afternoon and in the evening to keep a record on all the target species. The bird survey locations are shown in **Figure 4-9**. Data related to the other faunal species were also noted, based on the direct sightings and from authentic secondary sources. Secondary sources like published books and reports, government

departmental records, interviews with forest department and information from local residents were further used to gather information and support primary observations.

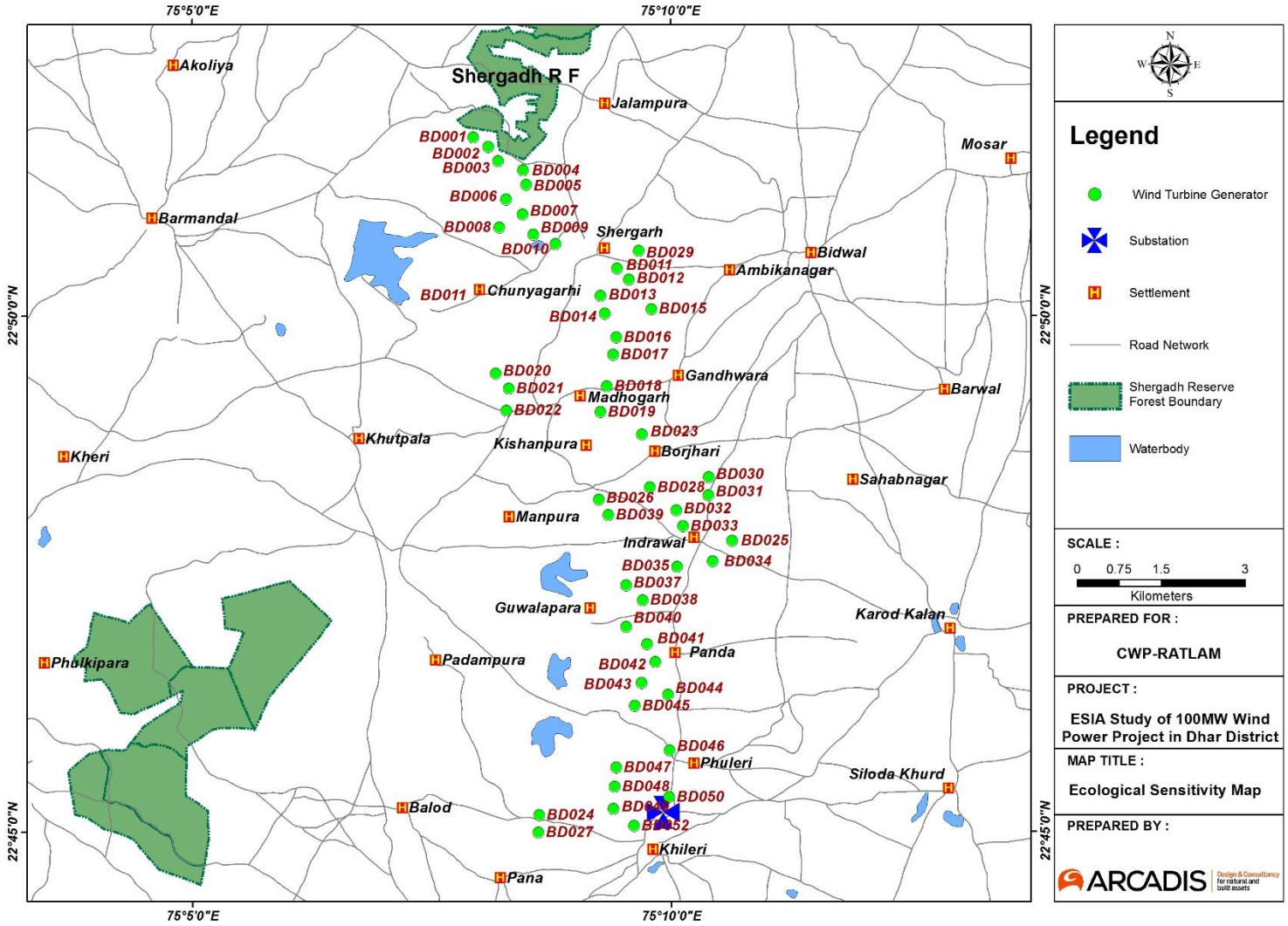
Figure 4-9: Maps shows the Bird Survey Locations in the Project Area



To assess the presence of bats in the study area, abandoned structures, large canopy old trees and other vegetative covers of the study area were surveyed during evening. Dialogue with the local seniors were made to know the presence of bats in the area.

The ecological sensitivity map is also presented below in ***Figure 4.10***

Figure 4-10: Ecological Sensitivity Map



4.8.1 Habitat assessment

According to IFC, the term "Habitat" is defined as a terrestrial, freshwater, or marine geographical unit or airway that supports assemblages of living organisms and their interactions with the non-living environment. For the purposes of implementation of Performance Standard-6 (Biodiversity Conservation and Sustainable Management of Living Natural Resources), habitats are divided into modified, natural, and critical. Critical habitats are a subset of modified or natural habitats.

Based on the risks and impacts identification process, the requirements of this Performance Standard are applied to projects (i) located in modified, natural, and critical habitats; (ii) that potentially impact on or are dependent on ecosystem services over which the client has direct management control or significant influence; or (iii) that include the production of living natural resources (e.g., agriculture, animal husbandry, fisheries, forestry).

The information on baseline condition of the proposed project site is important because project activities might lead to loss of the ecological resources, if existing. The information will further enable to evaluate the feasibility and efficacy of the mitigation options that are being proposed by environmentalist and conservationist to incorporate conservation concerns in mitigating the impacts of developmental project.

During the primary survey at all the WTG locations, the habitat was primarily found to be "modified". Large scale agricultural practices were observed all over the region. Reserved Forests (Sergarh and Bharatgarh RFs) under the Dhar Forest Division are located at Sergarh and Bharatgarh villages respectively. Normally, the Reserved Forest are named after the name of the respective villages/ nearby villages of the forests.

With respect to the stocks of the forests, the Working Plan of Dhar Forest Division has confirmed that there are limited stock forests in the division and forest types include mostly blank and low density forest. Besides, there is heavy biotic pressure of illicit felling of trees, uncontrolled grazing and force encroachment.

There are 10 WTGs proposed in Sergarh village but none of the WTG is proposed to be in the forest area. The Reserved Forest was found to be highly degraded. The ground cover comprised mostly of grass and sedges and other shrubs and small trees. Annual herbs and shrubs were also recorded. A few tree species were also found scattered. Afforestation scheme has been initiated by the Forest department in these degraded forest areas. Large scale farming by the local farmers (mostly from Sergarh village) was also observed inside the forest areas. Dialogue with a forest official at Badnawar, it was learnt that State Government has allotted a few "*patta*" to the locals to do cultivation/ farming in the forest areas as well as the revenue lands located adjacent to the forest areas. No Forest is located in other WTG locations. The proposed project area located neither within an existing nor any proposed ecological sensitive zone known for providing habitat and movement corridor for any kind of animals.

Photo 4-2: Floral diversity in the region

Photo 4-3: Avifauna diversity in the region

Ashy Crowned Lark

Crested Lark

Egret

Spotted Dove

Hoopoe

4.8.2 Terrestrial Ecology

The area comes under southern plateau geologically formation. Forests are mainly southern dry deciduous type. The working plan of Dhar Division states that 58.77% forest area of Dhar is blank, 22.66% of area is understocked, 10.47% area is under encroachment and only 0.26% is stocked. From this statistics, it is well understood that the vegetative cover of the forested areas are highly degraded.

Floral profile

The Phytosociological analysis of the local vegetation was conducted randomly at a few study plots during the primary survey. These plots were selected on the basis of similarity in vegetation component. As mentioned above, the ground cover was predominantly covered by grass/ sedges and annual herbaceous species. At each site maximum 6 quadrats were laid (each of 5 m X 5 m) and the species were listed recorded from each plot/ quadrat. The Relative frequency, relative density, relative abundance and Important Value Index (IVI) were computed from the primary survey.

Importance Value is a measure of how dominant a species is in a given area. It is a standard tool used by biologists to inventory a forest/ or any vegetation. Species diversity was also estimated as Shannon-Weiner index following Shannon and Weaver (1963).

$H = - SUM [(pi) \times ln (pi)]$

Where, "H" is the species diversity index; "S" the total number of species; "Pi" the proportion of total sample belonging to "i"th species (i.e ni/N, n is the number of individuals of each species and N is the number of individuals of all species). Random floral survey was conducted at three locations and these locations were selected after the reconnaissance survey. Five transects were laid down at each survey locations. The locations where floral survey conducted were SergarhSergarh, Kisanpura and Indrawal.

Sergarh location: A total of 52 species of shrubs/ herbs/ grass were listed during the field survey. The Phytosociological analysis is presented in **Appendix N**. The IVI of *Themeda triandra* was found to be highest with 29.6 followed by *Themeda quadrivalvis* 25.6, *Eragrostis tennela* 28.3, *Cenchrus cilliaris* 12.9 and *Cenchrus setigerus* 10.1. The grass species were found to be more visible and dominant in and around the abandoned farm lands and along the bunds of the farming lands. The other herbaceous species which were most common in that area were *Tridax procumbens*, *Lantana camara*, *Alternanthera paronychioides*, and *Parthenium hysterophorus*. The "H" value was recorded 3.4.

Kisanpura: A total of 40 species of shrubs/ herbs/ grass were listed during the field survey from Kisanpura area. The IVI of *Themeda triandra* was found to be highest with 30.3 followed by *Themeda quadrivalvis* 29.2, *Parthenium hysterophorus* 20.3, *Ocimum bacillicum* 11.7, *Cenchrus cilliaris* 11, Alternanthera paronychioides 10.9 and *Lawsonia inermis* 9. Although species such as *Themeda triandra* and *Themeda quadrivalvis* were found to be important species in this area but the other annuals/ ephemerals such as *Parthenium hysterophorus, Ocimum bacillicum* and *Alternanthera paronychioides* were also found to be more visible and distributed. The "H" value was recorded 3.3.

Indrawal: A total of 36 species of shrubs/ herbs/ grass were listed during the field survey from Indrawal area. The IVI of *Themeda quadrivalvis* was found to be highest with 32.3 followed by *Themeda triandra* 31.2, *Alternanthera paronychioides* 14.8, *Ocimum bacillicum* 13.4, *Xanthium strumarium* 12.9, *Cynodon dactylon* 12.6, *Cymbopogon spp* 11.6 and *Cenchrus cilliaris* with 11. The "H" value was recorded 3.2.

All of these species recorded during the site visit were common and none of the plant species recorded from the primary survey and or reported to occur in this region as mentioned in the Working Plan of Durg Forest Division is listed in IUCN red data category. The details of the Phytosociological analysis conducted of herbaceous species from the primary flora survey in SergarhSergarh, Kisanpura and Indrawal village is summarised in **Appendix N**.

The tree species which were recorded from the Sergarh Reserved Forests were *Azadirachta indica* (*Neem*), *Diospyros melanoxylon* (*Tendu*), *Madhuca latifolia* (*Mahua*), *Butea monosperma* (*Palash*), *Mangifera indica* (Mango), *Borassus flabellifer (*Toddy Palm*)*, *Acacia leucophloea* (*Reunjha*), *Acacia nilotica* (*Babool*) and *Ailanthus excelsa* (*Maharukh*).

Besides, these scattered presence of tree species, an ephemeral layer of ground flora mainly consisting of annuals and grass were largely recorded in and around the study area.

Faunal Profile

In order to prepare an inventory of fauna present in the study area, a walk through survey was conducted in and around the study area. The faunal surveys focused on four groups' viz., mammals (excluding chiropterans and rodents), avifauna, herpeto fauna, and lepidopteron species (butterflies) of the study area. Data on the presence of the different faunal species in the study area were recorded largely based on direct sightings and indirect evidences such as spoor, tracks, dung and calls. Secondary information sources such as published information, unpublished reports, departmental records, personal communication and informal interviews with forest officials and local inhabitants were made for the supplementing primary data collected during the field studies.

The faunal survey was conducted in different parts of the study area using the existing road, paths and trails. Standard field guides was used for identification of fauna during the survey.

1. Mammal

No direct sighting of mammal was done or evidences were found on the habitat of mammals during the course of primary survey in the entire study area. Dialogue with the local villagers could not also confirm the presence of any wild mammalian species in and around the study area.

2. Avifauna

During the primary survey, total of 47 bird species were recorded around the study area. These include Red-wattled Lapwing (*Vanellus indicus*), Ring dove (*Streptopelia capicola*), Spotted Dove (*Spilopelia chinensis)* Rock Pigeon (*Columba livia*), White breasted king fisher (*Haleyon smyrensis*), Indian roller (*Coracias benghalensis*), Common green bee eater (*Merops orientalis*), Jungle babbler (*Turdoides straiatus*), common myna (*Acridotheres tristis*) , Black drongo (*Dicrurus adsimilis*), Crow pheasant (*Centropus sinensis*), Cormorant (*Phalacrocorax carbo*), Common babbler (*Turdoides caudatus*), House crow (*Corvus splendens*), Cattle egret (*Bubulcus ibis*), Indian Pond heron (*Ardeola grayii*), Hoppoe (*Upupa epops*), Crested lark (*Galerida cristata*), Rofous tailed Lark (*Ammomanes phoenicura*), Indian bush lark (*Mirafra erythroptera*), Red vented bulbul (*Pycnonotus cafer*) and Black winged stilt (*Himantopus himantopus*). Black winged kite falls under Scheduled-I category according to the Indian Wildlife Protection Act, 1972. Rest of the bird species fall under non-significant Scheduled-IV category. None of the bird species observed during the site visit is listed in the red category of IUCN. All species are resident to Indian sub-continent and most of them were encountered frequently during the site visit. The observed flight height of these bird species found between 0 (ground) to maximum 35 meter and none of the bird species flying in the collision risk zone (between 55 meter to 150 meter). The list of bird species recorded onsite is shown in **Table 4.7**

Table 4-7: Bird Species Recorded From Site with IUCN Status

Sl No	English name	Scientific Name	IWPA Schedule	IUCN Status	Status	Sighting Frequency in Study area	Flight height as observed (in m)
1	Ashy Prinia	*Prinia socialis*	IV	LC	R	Rare	2
2	Ashy-crowned sparrow Lark	*Eremopterix grisea*	IV	LC	R	Frequent	On the ground
3	Bay backed Shrike	*Lanius vittatus*	IV	LC	R	Frequent	2 (over a pole)
4	Black drongo	*Dicrurus macrocercus*	IV	LC	R	Frequent	3 (on a tree)
5	Black redstart	*Phoenicurus ochruros*	IV	LC (Trend: Increasing)	R	Common	8

6	Black winged Kite	*Elanus caeruleus*	I	LC (Trend: Stable)	R	Common	3 (over a pole)
7	Black Winged Stilt	*Himantopus himantopus*	IV	LC	RM	Frequent	On ground
8	Blue Rock Pigeon	*Columba livia*	IV	LC	R	Frequent	On ground
9	Brahminy myna	*Sturnus pagodarum*	IV	LC	R	Common	3 (tree)
10	Common Crested Lark	*Galerida cristata*	IV	LC	R	Frequent	On ground
11	Common hoopoe	*Upupa epops*	IV	LC	R	Frequent	On ground
12	Common lora	*Aegithina tiphia*	IV	LC	R	Common	2 (tree)
13	Common Myna	*Acridotheres tristis*	IV	LC	R	Frequent	3 (tree)
14	Common Pariah	*Milvus migrans*	IV	LC	R	Common	6
15	Common tailorbird	*Orthotomus sutorius*	IV	LC	R	Common	2
16	Common Weaver Bird	*Ploceus philippinus*	IV	LC	R	Frequent	3
17	Dusky crag martin	*Hirundo concolor*	IV	LC	R	Frequent	10
18	Greater Coucal	*Centropus sinensis*	IV	LC	R	Common	2
19	Grey partridge	*Francolinus pondicerianus*	IV	LC	R	Rare	ground
20	Grey Quail	*Coturnix coturnix*	IV	LC (Trend: decreasing)	R	Rare	ground
21	House crow	*Corvus splendens*	IV	LC	R	Frequent	4
22	House sparrow	*Passer domesticus*	IV	LC (Trend : Decreasing)	R	Frequent	3 (transmission wire)
23	Indian nightjar	*Caprimulgus asiaticus*	IV	LC (Trend: Stable)	R	Rare	3 (flying in the evening)
24	Indian robin	*Saxicoloides fulicata*	IV	LC	R	Frequent	1 (bushes)
25	Indian Tree pie	*Dendrocitta vagabunda*	IV	LC	R	Common	10
26	Jungle babbler	*Turdoides striatus*	IV	LC	R	Frequent	Ground (bushes)
27	Jungle bush quail	*Perdicula asiatica*	IV	LC	R	Rare	Ground
28	Jungle Crow	*Corvus macrorhynchos*	IV	LC	R	Frequent	3 (tree)

29	Koel	*Eudynamys scolopacea*	IV	LC	R	Rare	3 on a tree
30	Lesser golden Backed Woodpecker	*Dinopium benghalense*	IV	LC	R	Common	3
31	Little Cormorant	*Microcarbo niger*	IV	LC	R	Frequent	Ground (near a water body)
32	Little Green bee-eater	*Merops orientalis*	IV	LC	R	Frequent	3 (over transmission line)
33	Little swift	*Apus affinis*	IV	LC	R	Frequent	35
34	Magpie robin	*Copsychus saularis*	IV	LC	R	Frequent	1
35	Plain prinia	*Prinia inornata*	IV	LC	R	Rare	3 (tree)
36	Pond Heron	*Ardeola grayii*	IV	LC	R	Frequent	Near water body
37	Purple Sunbird	*Nectarinia asiatica*	IV	LC	R	Frequent	1 (shrub)
38	Red Wattled Lapwing	*Vanellus indicus*	IV	LC	R	Frequent	Ground
39	Red vented Bulbul	*Pycnonotus cafer*	IV	LC	R	Frequent	1 bushes
40	Ring Dove	*Spilopelia capicola*	IV	LC	R	Frequent	ground
41	Roller/Blue jay	*Coracias benghalensis*	IV	LC (Trend: Increasing)	R	Frequent	3 (electricity pole)
42	Rose ringed parakeet	*Psittacula krameri*	IV	LC (Trend : Increasing)	R	Rare	20
43	Rufuous tailed Lark	*Ammomanes phoenicura*	IV	LC	R	Frequent	ground
44	Spotted dove	*Spilopelia chinensis*	IV	LC	R	Common	ground
45	White breasted Kingfisher	*Halcyon smyrnensis*	IV	LC	R	Frequent	3 (near a water body)
46	White wagtail	*Motacilla alba*	IV	LC	R	Common	ground
47	Yellow Wattled Lapwing	*Vanellus malabaricus*	IV	LC	R	Rare	ground

(LC: Least Concern; R: Resident, RM: Residential Migratory)

3. Butterflies

The existing landscape especially the croplands and ephemeral ground cover from various shrubs, herbs and grasses those are considered to be the food plants for the butterflies and provide an excellent habitat for the butterflies in and around the proposed project site. *Common crow, Blue pansy, Tawny coster, Striped tiger, Common Tiger, Common grass yellow, Lemon pansy and Common sailor* were recorded from the proposed site during the field survey. None of the butterfly species is included in IUCN Red category list (**Table 4.8**)

Table 4-8: List of Recorded Butterfly and Their IUCN Status

S. No.	Common name	Scientific Name	Family	Distribution	IUCN Status
1	Grass yellow	*Eurema hecabe*	Pieridea	Common	Not evaluated
2	Common Tiger	*Danaus genutia*	Nymphalidea	Common	Not evaluated
3	Common Crow	*Euploea core*	Nymphalidea	common	Least Concern
4	Tawny coster	*Acraea terpsicore*	Nymphalidea	sparse	Not evaluated
5	Common Wanderer	*Pareronia valeria*	Pieridea	Sparse	Not evaluated
6	Plain Tiger	*Danaus chrysippus*	Nymphalidea	Common	Not evaluated
7	Blue pansy	*Junonia orithya*	Nymphalidea	Common	Least concern
8	Lemon pansy	*Junonia lemonias*	Nymphalidea	Common	Not evaluated
9	Common sailor	*Neptis hylas*	Nymphalidae	Common	Not evaluated

4. Reptiles

During the site survey, on approaching Bidwal village, a local cobra was sighted passing through a field. Dialogue with the locals also confirmed that snakes such as *Cobra, Russel viper and Banded Krait* are reported to occur in that area. Three species of common reptile viz., agama (*Agama tuberculata*), garden lizard (*Calotes* sp.) and skink (*Scincilla sp*.) were also recorded in the project area. *Calotes and Skink* were mostly encountered in areas close to agricultural lands and bushy areas. Although black cobra is not included in the Red category list of IUCN but it is included in CITES[6] list of species.

5. Bats

During the primary survey no bat species was sighted in the study area. Dialogue with local seniors although confirmed the presence of bats in the area but it could not be established.

4.8.3 Aquatic environment

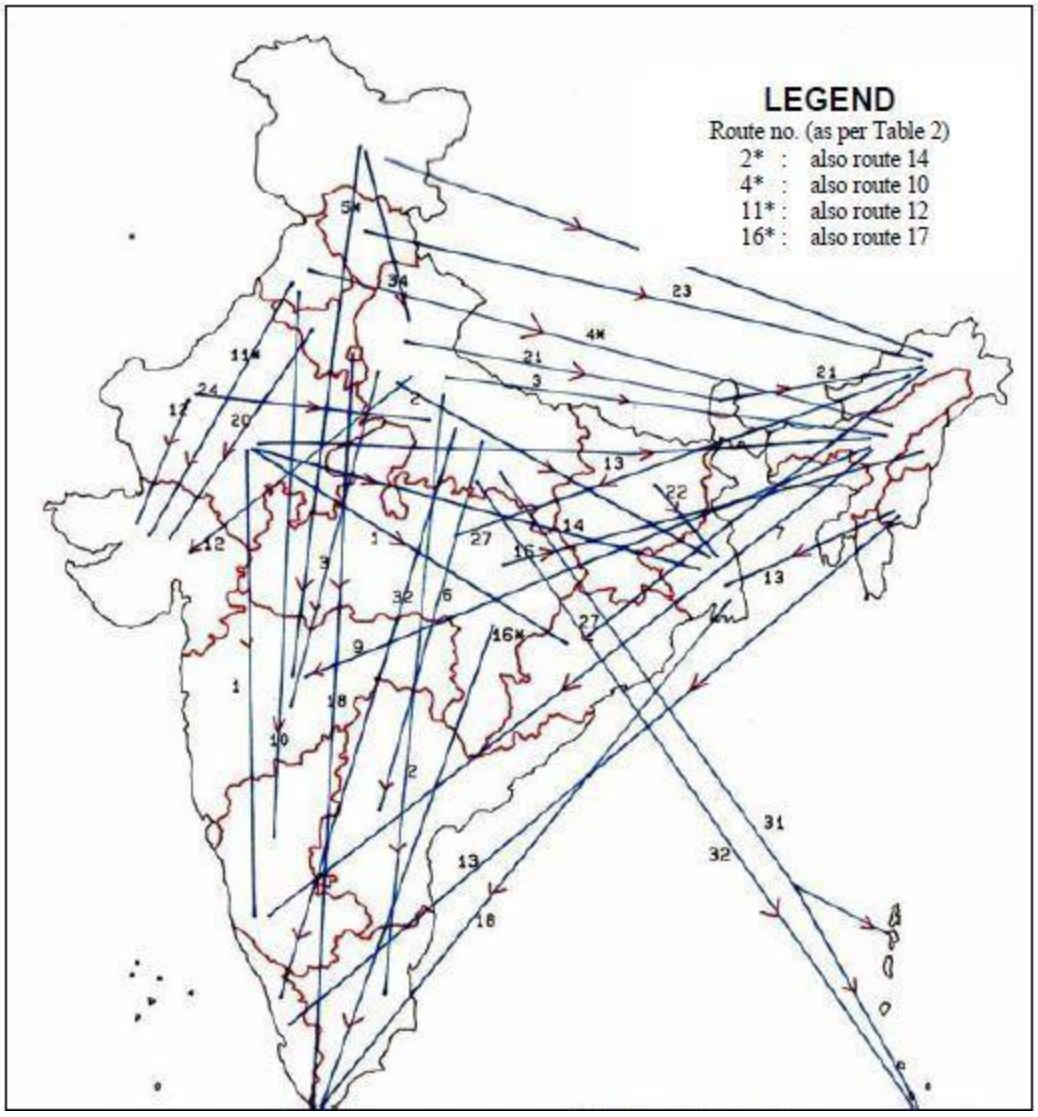
There are many manmade water bodies (big ponds and a reservoir at Sergarh) located in the project area. The water bodies are shown in the **Figure 4-9**. These were constructed by the local panchayats to store water especially for irrigation. It was also observed that the locals use the water for washing and bathing purpose. Many of these water bodies reportedly get dried up before the pre-summer. During site visit, bird such as *Black Winged Stilt, Cormorant, White breasted kingfisher, Pied wagtail, Cattle Egret, Red-Wattled Lapwing* were recorded from these water bodies. No migratory birds reportedly (dialogue with the local villagers) visit these water bodies.

4.8.4 Migratory Routes of Birds

As per *Journal of Today's Biological Sciences: Research & Review* by Swati Bopniwar et al, 2012 (Seasonal Movements and Migration of Birds: Indian Scenario); map on the seasonal migration of birds from different parts of the Globe to India (**Figure 4-11**) has been presented. According to which, birds such as Common Pochard (from Europe, Central and Western Siberia) and Lesser White Fronted Goose (from Siberia) normally migrate to India and pass through the state of Madhya Pradesh (M.P) covering the project site. A detailed study on the assemble of any winter migratory birds and other residential birds including raptors and Scheduled bird species in and around the study area can only be established once a detailed bird monitoring is conducted.

[6] The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) helps to ensure that international trade does not threaten species with extinction, protecting about 5,000 species of animals and 30 ,000 species of plants. About 179 countries are party to CITES.

Figure 4-11: Available Migratory Routes of India



Source: Journal of Today's Biological Sciences: Research & Review by Swati Bopniwar

4.9 Socio economic profile of the study area

Site visit was undertaken along with primary and secondary data collection from various sources. Primary data includes consultation with land aggregator, Panchayat Presidents of all the villages and Revenue Inspector. Interviews were also undertaken with CWP-RATLAM Officials at site, Government Officials, teachers and others. Secondary data includes Census 2011, information available on the District Dhar official website, District statistical handbook, other available data on Official Government websites and public domain. Information and documents were collected from the CWP-RATLAM related to sections of ESMS manual, Government land rates, project site boundary, land details as submitted to government as per requirements, General observation of the village from which land was purchased.

The socio economic study was based on the information provided by CWP-RATLAM such as land details and consultation conducted onsite. However, out of total 50 WTG's planned, three WTG's are proposed on private agricultural land, the agreement for which was not finalised and was is in process, hence no consultation with the land sellers could be undertaken during the time of the primary survey. However, as per the current status i.e. during the final reporting of this ESIA report, the land has been procured and a proper sale deed agreement has been executed. The land has been purchased on "*willing to buy and willing to sell*" basis and also adequate

compensation (more than the circle land rate) has been provided to the land owners (Pls. refer a sample sale deed agreement in **Appendix F)**.

Detailed Relocation Survey and action Plan

A detailed household survey was conducted for the residents/settlers residing within the setback radius of 220 m at 15 WTG locations viz. 10, 11, 18, 26, 29, 31, 32, 34, 35, 37, 39, 43, 47, 50
A separate questionnaire was prepared to gather information on their family size, livelihood pattern, economic conditions, size of the structure, type of the structure, ownership of the land, social categorisation etc. Based upon the data collected and analysed, an action plan for their relocation was also prepared. The detailed outcome has been presented Appendix- T.

Relocation Action Plan

From the detailed survey and consultations held with the local revenue official (Patwari) and village Sarpanch about 32 households have been identified as opportunists residing within the radius of 150m from the identified 15 WTGs. The opportunists are informal settlers residing on government lands and that they are not customary/traditional land owners. The remaining were genuine settlers. The settlers residing close to these 15 locations attract health and safety issues in connection to blade throw, noise and shadow flickering. During consultation with these settlers, all these issues were also discussed and it was drawn that the settlers were willing to relocate subject to adequate alternatives provided.

4.9.1 Socio Economic Conditions

Study area villages: Social consultation was conducted in a total nine villages of Badnawar and Sardarpur tehsil of Dhar district.

Table 4-9: Study area villages of the project area

S N	State and District	Mandal/ Tehsil/Block	Villages	Panchayat
1	Madhya Pradesh, Dhar	Badnawar	Sergarh	Sergarh
2			Kisanpura	Kisanpura
3			Indrawal	Indrawal
4			Gandwada	Khiledi
5			Bor Jhadi	Kisanpura
6			Panda	Phuledi
7			Phuledi	Phuledi
8			Khiledi	Khiledi
9		Sardarpur	Chandodiya	Phuledi

Demographic Profile

Madhya Pradesh is the second-largest state in India by area. With over 72 million inhabitants, it is the sixth-largest state in India by population. The total population of Madhya Pradesh is 7,26,26,809 (as per census 2011). The decadal population growth rate (2001–2011) of Madhya Pradesh has been 20.35%. Madhya Pradesh is home to a large tribal population, who have been largely cut off from the mainstream development. In Dhar district, with increased urbanization, the population grew up to 18.90% while the rural population grew at a rate of 81.10%

Table 4-10: Comparative Demographic Indicators at the State and District Level

Indicators	Madhya Pradesh	Dhar
Total Population	7,26,26,809	21,85,793
Decadal Population Growth Rate (2001-2011)	20.35%	25.60%
Percentage of Rural Population	72.37%	81.10%
Percentage of Urban Population	27.63%	18.90%

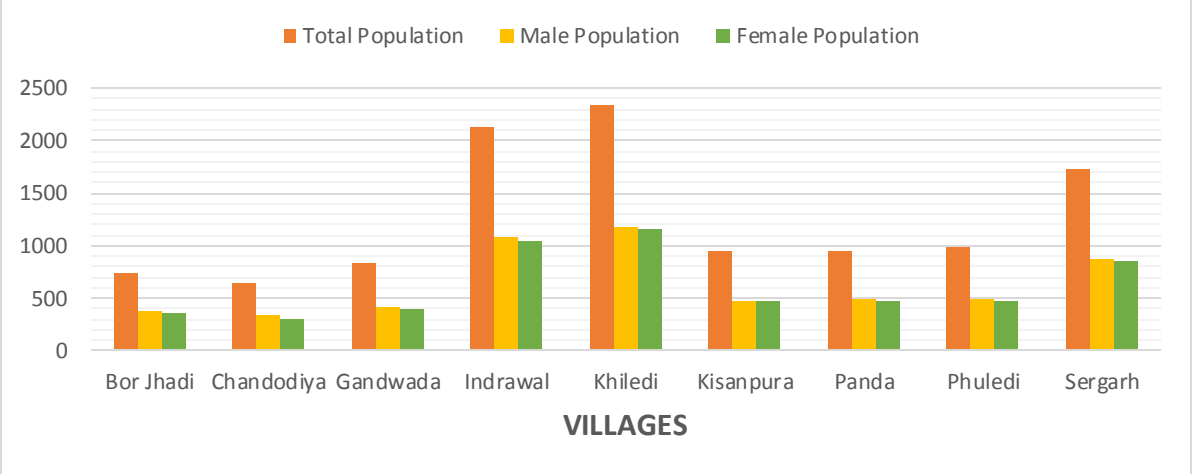
Source: Census 2011

District: The total population of Dhar district is 21, 85,793 out of which male and female population in the district is 11, 12,725 and 10, 73,068 respectively.

Tehsil: The total population of Badnawar tehsil is 2, 26,440 out of which male and female population in the district is 1, 14,825 and 1, 11,615 respectively.

Study Area: The total population of the study area is about 11,314 out of which male and female population in the study area is 5,732 and 5,582 respectively. Khiledi has the highest population (2,340) and Chandodiya has the lowest population (146). Population details of the nine villages in the study area is given below.

Figure 4-12: Demographic profile of study area villages



Source: Census, 2011

Sex Ratio

District: Sex ratio in Dhar district is 964. Sex ratio of the district shows that male population is more than the female population in the District

Tehsil: Sex ratio in Badnawar Tehsil is 972 and Sardarpur Tehsil 968. The Sex ratio shows that male population is more than female population in the said Tehsils.

Study area: There are huge variations for sex ratio between the villages which ranges between 940 to1004, Chandodiya being the lowest (940) and Kisanpura the highest (1004).

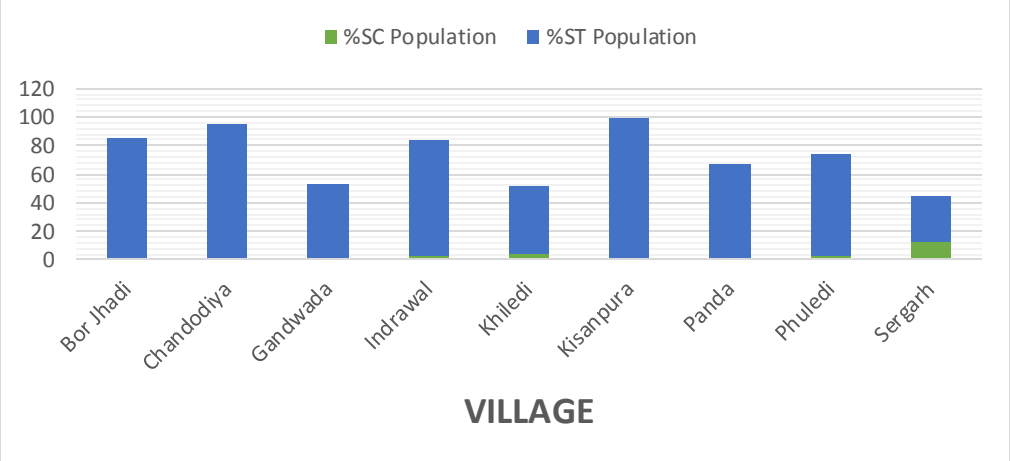
Table 4-11: Sex ratio of study area villages

S. N	Particulars	Sex Ratio
A	District Level	
1	Dhar	964
B	Tehsil Level	
1	Badnawar	972
2	Sardarpur	968
C	Study Area Village	
1	Bor Jhadi	945
2	Chandodiya	940
3	Gandwada	962
4	Indrawal	971
5	Khiledi	990
6	Kisanpura	1004
7	Panda	963
8	Phuledi	966
9	Sergarh	981

Schedule Caste and Schedule Tribes (SC/ST)

Out of total population, Dhar district has 6.65% Scheduled Caste (SC) population and 55.94% Scheduled Tribe (ST) population. In particular, Badnawar tehsil has 10.64% SCs and 36.51% STs out of total population 2, 26,440. Village wise summary of caste (General, SC and ST) population, sex ratio of the study area as per census 2011 is given below in Figure 4.10. The total population of the study area is 11,314 wherein male population averages 51% and female population 49%.

Figure 4-13: Scheduled population in the study area villages



Sergarh village has the maximum SC percentage of 12.78% out of a total population of 1,729. Highest percentage of Scheduled Tribe population i.e. 99.79% is recorded in Kisanpura village.

Below Poverty Level (BPL) population in the study area villages

The list of economical weaker sections in the study area villages was studied after taking a record of the same from the Tehsil office. The same is detailed below in **Table 4.12**

Table 4-12: Economical weaker population in the study villages

S. N	Tehsil	BPL Families No.	Panchayat	Villages	BPL Families No.
1	Badnawar, Dhar, MP	14,310	Phuledi	Panda	242
2				Phuledi	
3			Chandodiya	Chandodiya	0
4			Khiledi	Khiledi	107
5			Sergarh	Sergarh	162
6			Kumedih	Gandwada	253
7			Kisanpura	Bor Jhadi	236
8				Kisanpura	
9			Indrawal	Indrawal	189

Source: Primary consultation at Tehsil office, Badnawar

From the table above, it can be found that highest BPL population in Badnawar tehsil is found in Gandwada village of Kumedih panchayat.

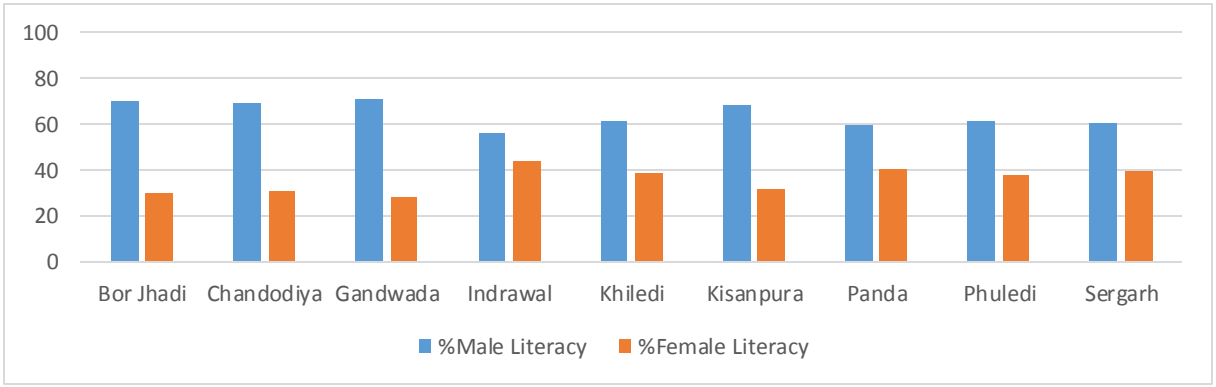
Literacy and Education

District: The district Dhar is yet to reach its height to achieve momentum in literacy and education overall. Based on Census, 2011 only 49.9% of the population is literate. Out of which only 40.74 % is female.

Tehsil: Badnawar tehsil is also close in comparison with the percentage of the district. Only 55.63% of the entire Tehsil population is literate, which consists of 16% of females.

Study Area: The village which has the highest literate population i.e. about 54.62% is Khiledi village. Special mention need to be made on female literacy in some of these areas. Indrawal village has the highest female literate population 43.72 %. The worst situation is at Gandwada village, where female literacy is only 28.57%.

Figure 4-14: Literacy status in the study area villages



Source: Census 2011

For any specific area literacy rate can be used as an indicator of development. Understanding of the education profile of these villages is essential for ensuring that the population residing closer to the project area can be

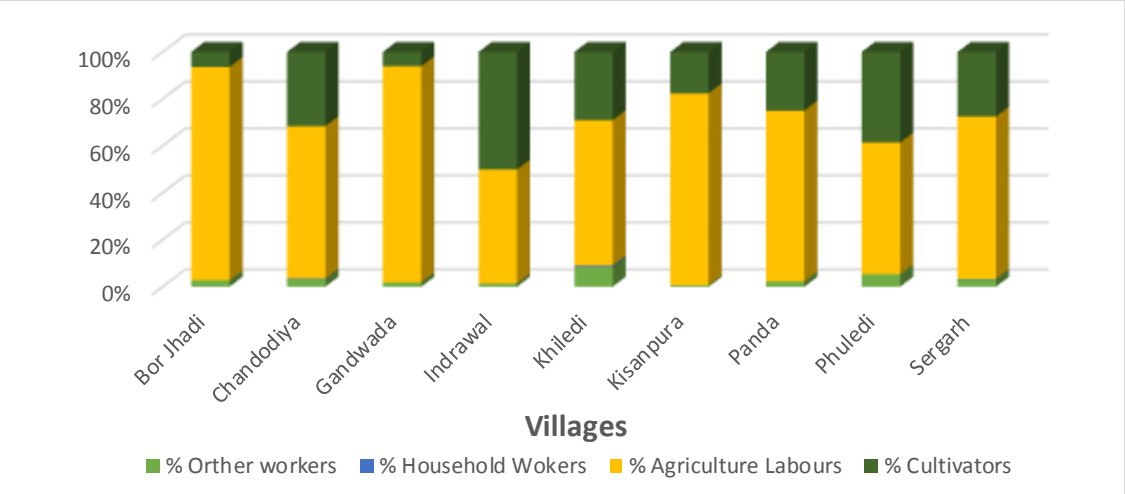
integrated into the development process and to formulating program for utilization of existing human resources. The figure above depicts the literacy rate and the education profile of the area.

Workforce participation

Analysis of the census data of the study villages reveal that majority of the population (nearly 70%) in this district are engaged as "Agricultural labourers". "Cultivators" have been identified as the second most important work category. "Household Workers" and "Other Workers" category constitute only 0.13% and 3.15% respectively of the total working population.

As an additional and alternative employment resource many of the villagers migrate seasonally to the bigger accessible areas like Gujarat, Ujjain or Ratlam for different employment opportunities. They work there as daily wagers, porters etc. Some of the population of study area villages depend on the other worker (owned livestock). In this regard, it needs to be noted that a portion of this population depend on dairy farming, milk produce and livestock. The **Figure 4.15** below graphically presents the workforce participation of the study area villages.

Figure 4-15: Employment pattern in the study area villages



Source: Census 2011

Socioeconomic status of women

As per the records available and from the consultation it was revealed that women continued to be rooted in traditional norms of social behaviour, which includes marriages at an early age (child marriage as well), unequal treatment in decision making at the household level, lesser economic and social freedom and opportunities. It was reported during community consultations the child marriage was a common phenomenon and lack of education / awareness is the main reasons of its existence.

Tribal women in this area can be viewed as falling into two groups: those who are designated to do domestic work and those who go out to work. The tribal woman who works outside the home undertake a number of physically demanding tasks alongside men. But in recognition of this, she is exempted from most of the domestic work or is given considerable help by her husband and male and female children. Women's agricultural work takes place largely from July to November (five months). Crops grown here are primarily rain fed. Upland paddy is the main crop. Irrigated millet and vegetables are grown in a few pockets where perennial streams flow or large ponds exist (as at the edge of forests). The first peak period of work in agriculture is June or July through August, when, from morning until night, women engage in breaking up sods of earth, sowing and weeding. The second peak period is October through November, when women are involved in harvesting, drying, pounding and dehiscing paddy. Agricultural lands are often far away from homes, and men and women must leave for work early in the morning, usually without having eaten. Women as well as men work as agricultural day labourers.

Agriculture in the study area

The major crops in the area are soyabean, chana and wheat. Because of the black soil, cotton farming is also common in the area. The tables below give a brief on the cropping pattern and information on their productivity yield.

Table 4-13: Major cropping pattern in the study area

Season	Irrigation Facilities	Condition	Cropping Pattern
Kharif	Groundwater and Well	Rain fed	Soybean, Bengal Gram (Chana)
		Irrigated	
Rabi		Rain fed	Wheat
		Irrigated	

Source: Primary Data, collected through Field Visit and Survey

Table 4-14: Details of productivity of food crops in terms of area, yield and price

Major crops cultivated	Name	Period	Yield (q/acre)	Rate/q
	Wheat	December	1q/acre	1500
	Soybean	June & July	1q/acre	3600
	Bengal Gram (Chana)	October	1q/acre	2500

Source: Primary Data, collected through Field Visit and Survey

In the year 2000 – 01 the irrigated area in Dhar district was 15.70 % of the total cultivated land, gradually it was increased to 21 % in the year 2001 – 02, 21.45 % in 2002 – 03, 42.87 % in 2003 – 04, 46.90 % in 2004 – 05 and 55.87% in 2009-10. The total irrigated land was 281.9 ha. The principal crops grown in the district are Soyabean, Wheat, Maise, etc.

Livestock

During the consultation, it was revealed that the most of the families own livestock. The livestock owned largely comprises of cows, goats and sheep. Buffalos are found to be in a smaller proportion. The total animal population in the villages include 2,200 buffalos, 2,650 goats, 250 sheep and 2,000 cows. During survey it was revealed that the produce from livestock is used primarily for commercial uses. Thus, livestock has significant contribution towards livelihood of the population.

The lands closer the WTG locations are fallow and used for grazing of animals. The loss of land for grazing, hence could impact the villagers. This problem can be overcome by initiatives taken to amend the original nature of the grazing land after completion of the construction work. As the basic economy for the villagers is cultivation and livestock produce, this sort of support would be highly supportive for the locals. The table below provides the livestock population in the study area villages.

Table 4-15: Livestock Population in the study area villages

Name of the Village	Cow	Buffalo	Sheep	Goat
Bor Jhadi	100	100	50	250
Chandodiya	225	150	100	200
Gandwada	200	100	0	300
Indrawal	150	100	0	300
Khiledi	1800	1200	0	500

Kisanpura	200	200	100	300
Panda	80	150	0	300
Phuledi	100	200	0	500
Sergarh	100	100	0	200

Source: Primary Data, collected through Field Visit and Survey

Common property

A well-constructed Dug Well was seen just beside WTG No. 5, which is being used by the villagers. As it is a primary source of drinking water and used commonly by the villagers there should have access roads to the well with proper safety measures.

A Govt. Primary School was found right beside WTG No.18. It need be safeguarded while maintaining provisions with accessibility towards the school building.

Culture & Heritage : No Archaeological Survey of India (ASI) recognised cultural site is located within or at a distance of 10km from the project area.

Goukhur Mata Mandir: Open/ Informal place of worship was observed in Sergarh village which falls under the study area. It is located at about 300-400m from WTG no.2 and 3. It was observed that the temple is very popular and holds strong religious importance amongst the local communities.

4.9.2 Field visit observation

Occupational Health and Safety

As per the provisions given in IFC's Performance Standard (PS) 2 there should be arrangements for safeguard of health issues and immediate arrangements for addressing accidental incidents. During site visit it was observed that all construction workers have been provided with basic PPEs viz. gloves, safety shoes, helmets, harness etc. after assessing the safety risks involved in their jobs. Most contractual workers were found to have adapted to the practice of wearing appropriate PPEs.

As most of the contract labourers are coming from Jharkhand and Bihar there is a probability of spread of disease. Hence, there should be provisions for periodic health examination not only to arrest the spread of diseases but also to take immediate measures on occurrence of such outbreaks.

- **TRAINING & MOCK DRILL:** Mock drill programs were conducted by CWP-RATLAM for the safety of workers/labours

Photo 4-4 Mock drill training

Photo 4-5 Oil spillage management training

4.9.3 Social Welfare schemes & Programmes by the Government

The social welfare schemes being run in the Badnawar tehsil was discussed with the Circle Officer, Block Development Office, Badnawar:

Beti Bachao Abhiyan: The scheme aims at making girls independent both socially as also financially through education. This approach of the Government can facilitate in generating awareness and improving the efficiency of delivery of welfare services meant for the women.

Gaon Ki Beti Yojana: has been launched by the Madhya Pradesh Government to provide financial assistance to motivate talented rural girls for higher education. As a result of to this scheme, a large number of rural girls are pursuing collegiate education. There are talented girls in every village. Though they want to study further after passing Class XII exams, they are unable to do so since colleges are located in towns and cities and their families are not financially sound to bear the expenses of their education. Even well-to-do families avoid this expenditure due to the long distance. Under the scheme Rs. 500 per month scholarship is given for 10 months to the rural girls, who pass their 12th exam in first division. So far, 60,000 rural girls have availed benefit of this scheme

Mukhyamantri Kanyadan Yojna: The scheme has been launched due to the initiative of Chief Minister Shri Shivraj Singh Chouhan. The objective is to provide financial help to poor, needy, destitute families for marrying off their daughters/ widows/ divorcees. Under the scheme, assistance of Rs. 15,000 is given for house hold items and the mass marriage expenditure. This assistance is given in mass marriages with the condition that the girl must have attained the age of 18 years.

Social Pension Scheme: The Social Justice and Empowerment Development of Madhya Pradesh has rolled out several social welfare initiatives overall supported by Government of Madhya Pradesh. The social security pension scheme is one of the important schemes which include the followings applicable:

- State Women Pension Scheme (SWPS)
- State Old Age Pension Scheme (SOAPS)
- State Disabled Pension Scheme (SDPS)
- Indira Gandhi National Old Age Pension Scheme (IGNOAPS)
- Indira Gandhi National Widow Pension Scheme (IGNWPS)
- Indira Gandhi National Disabled Pension Scheme (IGNDPS)

For those above the age of 75, will receive the old age pension of Rs.750 per month. For those, below the age of 75 and above the age of 18 will receive a pension amounting to Rs.500 per month. Beneficiaries of the age between 0 – 8 years will receive Rs.250 per month.

4.9.4 Grievance Redressal Mechanism (GRM)

Land and local issues like RoW (Right of Way) and others are addressed by land aggregator and team. The GRM register is maintained on site however the Grievance Redressal Policy, Plan and Procedure as provided in the ESIA report in **Appendix R** should be followed onsite, which incorporates procedures for lodging, processing, resolving and closing of grievances.

4.9.5 Public Disclosure

Reportedly during construction phase, public disclosure was conducted by a meeting organised by the management of CWP-RATLAM with the community, please refer the photographs below.

Photo 4-6 Meeting held by CWP-RATLAM with community

4.9.6 Community Development Initiatives

CSR Rules under Companies Act, 2013 embrace both private and public firms, and spell out a range of activities for companies to undertake in order to meet their obligations. As of now Community Development Plan/ Corporate Social Responsibility Plan/ Policy has been formally prepared for the project. Some CSR activities have been planned/conducted by CWP-RATLAM in the study area villages:

- Environmental awareness programs was conducted by CWP-RATLAM in the study area. Under the program, saplings were planted in the project site.
- Boundary of a school in Sergarh village is planned to be constructed by CWP-RATLAM.
- Girl's toilet is also planned to be constructed in Sergarh School by CWP-RATLAM.
- Approach roads of a length of 35km has been constructed, which can be used as an access pathway by the villagers.

Photo 4-7 Environmental awareness programs conducted onsite

4.9.7 Need Assessment

Madhya Pradesh is home to a large tribal population, who have been largely cut off from the mainstream development. Majority of the population is tribal in study area. They are highly dependent on agricultural. Facilities provided to the tribal people by the Government is not being utilized or even accessed due to lack of knowledge and awareness among the tribals. The main tribal groups in Madhya Pradesh are Gond, Bhil, Baiga, Korku, Bhariya, Halba, Kaul, Mariya, and Sahariya.

Most of the basic support facilities such as drinking water, transport, primary health centre services, and primary education facilities are almost absent within the study area. The local development machinery is often found to be not very responsive to the need of the community. The human development indicators are low for these areas as revealed by the development indicators for the project affected area. The basic need of the area assessed during consultation is briefed below.

- ***Educational Facilities:*** Primary consultation reveals that educational facilities from primary to secondary level is available in these villages. For higher education and professional training course, student needs to go to Indore, Ratlam or Dhar district town. The table below enumerates the distance of educational institutes from the villages as received from the information available during site visit.
  - As per the consultation with school teachers in Sergarh village, it was known that there is a fear of safety of children during their commutation to school as they would pass around the site and roads where heavy vehicles like cranes would ply during construction phase. Hence, it is needed that proper safety signs and breakers should be arranged at required places.
  - Separate toilet arrangements for girls should also be provided.

Table 4-16: Distance of schools in from the study area villages.

Village	Distance from the villages (km)				
	Primary School	Middle School	Higher Secondary Schools	Colleges	Anganwadi Centres
Bor Jhadi	0	5	5	40	0
Chandodiya	0	3	7	45	0
Gandwada	0	2	6	30	0
Indrawal	0	0	5	0	0
Khiledi	0	0	6	20	0
Kisanpura	0	5	5	40	0
Panda	0	0	6	45	0
Phuledi	0	2	7	50	0
Sergarh	0	0	5	30	0

Source: Primary Data, collected through Field Visit and Survey

- ***Health Facilities:*** Study area villages do not have any health sub-centre or any other health facility that can be availed during time of need. On the other hand, there is practice of different unscientific and unsanitary ways to deal with health problems. Almost all the delivery case take place in the household itself. The nearest Public Health Centre (PHC) is located at Bidwal, which is at an average distance of around 5 to 7 km.

Table 4-17 Medical facilities in the villages

Village	Medical facilities	Drinking water facilities
Bor Jhadi	Health Sub-Center not Available, PHC available within 5 km.	Tube Well, Community Well
Chandodiya	Health Sub-Center not Available, PHC available within 5 km and district hospital available 45 km	Tube Well, Community Well
Gandwada	Health Sub-Center not Available, PHC available within 7 km and district hospital 45 km	Tube Well, Community Well

Indrawal	Health Sub-Center not Available, PHC available within 7 km.	Tube Well, Community Well
Khiledi	Health Sub-Center, District Hospital available within 45 km.	Tube Well, Community Well
Kisanpura	Health Sub-Center not Available, PHC available within 5 km.	Tube Well, Community Well
Panda	Health Sub-Center not Available, PHC available within 5 km and district hospital available 50 km	Tube Well, Community Well
Phuledi	Health Sub-Center not Available, PHC available within 5 km and district hospital available 50 km	Tube Well, Community Well
Sergarh	Primary Health Centre 4 km, district hospital available 40 km	Tube Well, Community Well, pipe water connection

Source: Primary Data, collected through Field Visit and Survey

- Since the locals face health problems like diarrhoea, malaria etc. which is basically due to unhygienic conditions, hence it is recommended that proper health awareness camps are organized to generate awareness on the issues related to water borne diseases and also a general health check-up, eye check-up, session on health and hygiene may be conducted in the health camp.

- ***Drinking Water:*** The villages are totally dependent on ground water. They have community wells used mostly for bathing, washing and other common purposes. The wells are also used for agriculture. All the households in the villages have individual tube wells for drinking purpose. However, there is a program run by the State Government to supply ground water through constructing overhead tanks in the villages. Such small overhead tanks (OHT's) were observed with capacity of approx. 5 gallons. There are plans of storing ground water and thereafter supply through pipe lines, but the system is yet to be functional.
- ***Electricity Connections:*** All the individual households have electricity connections in the project area. Tariffs are being charged for these connections. Frequent power failures is a common problem in the area. Villagers expect that the situation will improve after the wind mills are functional.
- ***Transportation Facilities:*** Transportation facilities are available in the district, tehsil and village level. Buses are the major mode of transportation in the area. Self-owned motor cycles and bicycles are the frequently used private transport for the villagers. Only a few villagers own either bicycle or motor cycle. Thus the local people faces difficulty in commuting during emergencies. The table below lists the transport facilities in the area.

Table 4-18: Transportation Facilities in the Study Area

Village	Own Transport	Bus	Railway
Bor Jhadi	Bicycle, Two Wheeler, Four Wheeler	Yes	Distance : 90 – 100 km (Ratlam and Indore)
Chandodiya	Bicycle, Two Wheeler	Yes	Distance : 90 – 100 km (Ratlam and Indore)
Gandwada	Bicycle, Two Wheeler	Yes	Distance : 90 – 100 km (Ratlam and Indore)
Indrawal	Bicycle, Two Wheeler, Four Wheeler	Yes	Distance : 90 – 100 km (Ratlam and Indore)
Khiledi	Bicycle, Two Wheeler, Four Wheeler	Yes	Distance : 90 – 100 km (Ratlam and Indore)
Kisanpura	Bicycle, Two Wheeler, Four Wheeler	Yes	Distance : 90 – 100 km (Ratlam and Indore)

Panda	Bicycle, Two Wheeler	Yes	Distance : 90 – 100 km (Ratlam and Indore)
Phuledi	Bicycle, Two Wheeler, Four Wheeler	Yes	Distance : 90 – 100 km (Ratlam and Indore)
Sergarh	Bicycle, Two Wheeler, Four Wheeler	Yes	Distance : 90 – 100 km (Ratlam and Indore)

Source: Primary Data, collected through Field Visit and Survey

- ***Sanitation Facility:*** During community consultation, it was observed that highest open defecation was observed in Kisanpura village (100%) and maximum number of latrines (90%) constructed was found in Chandodiya village.
  - Proper health awareness camps may be organized to generate awareness as well as aid in the Government run sanitation schemes.
- ***Source of Fuel for Cooking:*** Most of the villagers in all the surveyed villages use fire wood, cow dung, and crop residue as fuel for cooking. In Sergarh and Khiledi village, the percentage of LPG users are 70% and 65% respectively. In Chandodiya, Indrawal, Panda and Phuledi village the percentage of LPG users are 10%. In Bor Jhadi only 5% of the village population are LPG.

Table 4-19: Source of fuel for cooking study area villages

Name of the Village	Fire Wood %	Kerosene %	Cow Dung %	Crop Residue %	LPG %
Bor Jhadi	10	0	40	45	5
Chandodiya	20	0	30	40	10
Gandwada	30	0	40	30	0
Indrawal	20	0	30	40	10
Khiledi	35	0	0	0	65
Kisanpura	25	0	25	50	0
Panda	20	0	40	30	10
Phuledi	20	0	40	30	10
Sergarh	0	0	20	10	70

Source: Primary Data, collected through Field Visit and Survey

4.9.8 Stakeholder and Community Consultation

The feedback received from consultations are important in identifying the impacts. The project has been structured to ensure that all the stakeholders especially the vulnerable part including the indigenous people, have ample scope to get involved in the process and their interests are safeguarded. The table lists the stakeholder identified for consultation.

Table 4-20: Stakeholder identification for the project

S. N.	Stakeholder Group	Role of Stakeholders in Project	Stakeholder significance category based on influence and involvement in Project	Strategy for Stakeholder engagement	Responsible Department/ Person
1	Local Panchayat Body	The local Panchayat is the nodal body which provides permission in terms of NOC to setup the project in administrative boundary of village.	Low	Involved in initial phase of project to provide consent and approval.	Project Manager
2	Land Sellers	Land sellers are associated with the company by providing land on lease basis to setup transmission line	Moderate	Required to be engaged regularly	Land department
3	Revenue Department	Land parcel identification and allotment of land to set proposed wind power project	Low	Involved in initial phase of project to provide consent and approval	Land department/ project director
4	Local communities	Include community affected by project such as transportation of equipment, excavation, and operations of construction equipment.	Moderate	Required to be engaged regularly	Head HSE
5	Lenders	Providing financing for the Project which will be disbursed based on fulfilment of certain deliverables/ conditions.	High	Involved in planning, execution and management of project therefore required to be updated on regular basis and decision process.	Finance department/ Finance Manager
6	Contractors and sub-contractors	Involved in project execution	Moderate	Involved in planning, execution and management of project therefore required to be engaged on regular basis and decision process.	Project director/ construction team
7	Contractual Labors	Any person who is engaged on account of the project developer. Carry out different activities such as doing civil and electrical work, and setting up transmission evacuation infrastructure.	Moderate	Required to be engaged regularly.	Construction Manager

The table summarises the key findings of consultations conducted with the identified stakeholders.

Table 4-21: Key Findings of consultation conducted

S. N.	Stakeholder Group	Name and Village	Methodology	Findings
1	Community	Sanjay Patel, Ashish Savera, Bishnu Patel and Suresh Singh Village: Sergarh	Group Discussion	• The major crops produced in this region is wheat and soybean. • Most of the lands are irrigated land • Apart from wheat, soybean, villagers cultivate Gawar (a locally produced type of crop) and Bengal Gram, though quantum of the production of these crops is very low. • Each house hold has significant number of livestock. • Major livelihood in this area is agriculture. • A notable part of the population migrates to big cities like Gujrat, Mumbai or Ujjain to work as daily wagers, laborer's etc. • A very low number of villagers own vehicle. • The major festival in this area is ***Diwali,*** which occurs in November.
2	Administration	Mr. Manoj Sharma, Circle Officer. Om Prakash Goyal, Revenue Inspector, Badnawar Tehsil	One to One Interaction	The Revenue Inspector of Badnawar Tehsil confirmed that all the proposed land in the project site is revenue land and has been procured from Govt. of Madhya Pradesh. It was also verified that there was no litigation on the procured land. Some of the land are declared as Govt. Land (Khas) and those recorded in the document as grazing land.
3	Schools Teachers	Sumen Singh Rathod, Rajesh Sisodiya, Rajesh Patidas. Camella International School Village: Sergarh	Group discussion	The teaching community is esteemed highly by the villagers. During consultations, teachers were approached to find out their points of view regarding the risks and impacts. • School teachers here are worried about safety of the students. As some student travel on foot or by bicycles while going to school, they have to pass around heavy vehicles used at the construction site. According to the apprehensions of teachers and many of the parents, the students may fall prey to accidents due to these vehicles. • As the teaching community is very much optimistic about the betterment of education scenario in the region, they expect the Govt. schools to be upgraded and more provisions for education like other institutions to be opened to meet the demand of the population. In addition the teachers also expressed that technical institutions like ITI, polytechnic college etc. could be opened, which in turn will enhance chance for the younger generation to improve technical skills and

S. N.	Stakeholder Group	Name and Village	Methodology	Findings
				employability and grab open employment opportunities.
4	Primary Health Centre	MS.Subhadra Bamaniya, Pharmacist Village: Bidwal	One to One Interaction	Consultation with the Pharmacist was held to develop understanding of the disease profile which exists in the project villages. The discussion also tried to identify the special health concerns in these villages. The key findings of the discussion are as follows: • Babies are usually delivered at homes. It was informed that the delivery facilities are also available in the PHC of Bidwal village. • The main aliments are respiratory problems, malaria, diarrhea and cold & cough. • Basic facilities such as Hb testing, blood testing for general diseases, thermometer and iron medicine are available. • In the emergency situation patients refer to District Hospital approx. 50km away from the study area villages.
5	Govt. Primary School	Smt.Deepmal Vaishnav, Teacher Village: Kishanpura	One to One Interaction	It was observed that the basic infrastructure facilities such as benches, electricity, drinking water facilities, fan and school building etc. are not adequate in the school. • However, prayer room and teacher's common room etc. are yet to be made. • Total 63 student come from the nearby villages and tollahs. • Separate toilet arrangements for girls were seen.
6	Laborers	Kamlesh singh, Sukhiya paswan, Manoj kumar, Ragho murmur Village :Sergarh	Group Discussion	There are some people working as construction laborer's in the power plant or as factory laborer's in nearby power plants who have migrated from Jharkhad, Bihar and adjacent districts. The key findings based on discussions are as follows. • The laborers coming from the villages located nearby expect generation of more job opportunities, as most of them are not very keen to move outside for work. • It was observed that all construction workers have been provided with basic PPEs after assessing the safety risks involved in their jobs. Most contractual workers were found to have adapted to the practice of wearing appropriate PPEs.

Photo 4-8: Photographs showing stakeholder consultation conducted onsite

Gour Mata Mandir, Sergarh

Community Consultation, Indrawal

Govt.Primary School, Kishanpura

Meeting with Patwari, Chandodiya

Hand Pump, Phuledi

Revenue Inspector, Badnawar

5.0 ANALYSIS OF ALTERNATIVES

Madhya Pradesh Electricity Regulatory Commission (MPERC) has formulated Wind Power Project Policy of Madhya Pradesh in 2012 for setting up of one or more than one wind turbine generators. Fiscal and tax incentives have been offered by the state government for promotion of wind power projects under this policy, these include:

- No energy cess shall be payable on the power supplied by wind power project;
- Projects implemented under this policy shall receive the status of industry and shall be eligible for all the incentives provided under "Industrial Promotion Policy" of state government as amended from time to time;
- The industrial consumer opting to buy energy from wind power projects in regard of corresponding pro rata reduction in contract demand on a permanent basis The decision of the Madhya Pradesh Electricity Regulatory Commission in this subject shall be final;
- For captive consumption and third party sale the installed project shall be entitled to receive exemption from payment of electricity duty for a period of 10 years;
- In case of power consumption for self-use or power sale to third party the Madhya Pradesh Power Transmission Company Ltd. (MPPTCL) or related State Distribution Company shall facilitate wheeling of power at the rates prescribed by Madhya Pradesh Electricity Regulatory Commission (MPERC). In case of power sale to Third party within the state, the related Distribution Company shall avail a wheeling grant at the rate of 4.0 percent from the state government;
- Banking of 100% of energy in each financial year shall be permitted subject to the conditions;
- Carbon credits or any other similar incentives which are available for such wind power projects shall be made available to the developer as per the guidelines issued by MPERC from time to time;
- The evacuation of the power generated from projects up to 15 Megawatt capacities at the nearest 33/11 K.V sub-station shall be carried out on 33 K.V. lines;
- The exemption from VAT/ Entry Taxes for wind power plants shall be available in accordance with the Madhya Pradesh Government Gazette (Extraordinary) Notification No. 380, dated 01.08.09.

This section of the report presents the analysis of the alternatives considered for the proposed project.

5.1 Project versus No project Scenario

In 2007 the Ministry of Environment Forests and Climate Change (MoEFCC), Ministry of Power (MoP) and the Bureau of Energy Efficiency (BEE) issued a paper entitled 'India: Addressing Energy Security and Climate Change'. In India the need for expanding the role of domestic Renewable Energy (RE) sources is a logical next step. Wind power is already in a position to provide a significant portion of India's planned capacity addition up to 2030, with simple regulatory and grid modernization initiatives. Unlike oil, coal or LNG, wind power is not subject to fluctuating fuel prices which drain India's limited foreign reserves, and in addition, wind power helps in reducing the carbon footprint of the economy. In the **Figure 6.1**, India's projected power requirement uptil 2030 has been indicated.

Figure 5-1 Estimated Power requirement of India till 2030

There is a need to bridge the gap between the demand and supply, renewable/non-conventional sources of power to supplement the conventional sources. The proposed project intends to contribute towards bridging this demand supply gap being a non-conventional source of power generation.

As per the Ministry of Power, Govt. of India, the present power supply position in the country during 2009-2015-16 is given below in the Figure 5.2

Figure 5-2 Present power supply position in the country (2009-2015-16)

Year	Energy				Peak			
	Requirement	Availability	Surplus(+)/Deficts(-)		Peak Demand	Peak Met	Surplus(+) / Deficts(-)	
	(MU)	(MU)	(MU)	(%)	(MW)	(MW)	(MW)	(%)
2009-10	8,30,594	7,46,644	-83,950	-10.1	1,19,166	1,04,009	-15,157	-12.7
2010-11	8,61,591	7,88,355	-73,236	-8.5	1,22,287	1,10,256	-12,031	-9.8
2011-12	9,37,199	8,57,886	-79,313	-8.5	1,30,006	1,16,191	-13,815	-10.6
2012-13	9,95,557	9,08,652	-86,905	-8.7	1,35,453	1,23,294	-12,159	-9.0
2013-14	10,02,257	9,59,829	-42,428	-4.2	1,35,918	1,29,815	-6,103	-4.5
2014-15	10,68,923	10,30,785	-38,138	-3.6	1,48,166	1,41,160	-7,006	-4.7
2015-16*	10,17,954	9,95,981	-21,973	-2.2	1,53,366	1,48,463	-4,903	-3.2

***Provisional Upto February, 2016**

Source: Ministry of Power , Govt. of India http://powermin.nic.in/power-sector-glance-all-india

The proposed project being a non-conventional source of power generation intends to contribute towards the energy security of the country. Hence, to achieve the target of 2030 power generation of the country, it is imperative to explore new sites for setting up of wind power projects. The proposed project presents an

opportunity to utilize the potential for wind power generation. A "***No Project Scenario***" is not favourable, as it will render one of the potential sites for development of wind energy projects. The project being a wind power project will not lead in any CO_2 and SO_2 emissions during the operation phase. It does not deplete the natural resources.

5.2 Alternate method for power generation

Wind power is a free and inexhaustible ("renewable") source of energy. Unlike fossil fuels such as coal and oil, which exist in a finite supply and which must be extracted from the earth at great environmental cost, wind turbines harness a boundless supply of kinetic energy in the form of wind. The environmental impact of wind power when compared to the environmental impacts of fossil fuels, is relatively minor. According to the Intergovernmental Panel on Climate Change (IPCC), in assessments of the life cycle global warming potential for energy resources, wind turbines have a medium value of between 12 and 11 (gCO2eq/kWh) depending on whether on and off shore turbines are being assessed.

Wind farm may cover a large area of land, many land uses such as agriculture are compatible with it as only small areas of turbine foundation and infrastructures are made unavailable for use.

5.3 Alternate location for the proposed project

Madhya Pradesh[7] today remains the most preferred destination for investors for alternative energy generation. The state has a potential of more than 5,000 MW wind power, 1,200 MW biomass based energy, 750 MW small hydro power, and 5,000 MW solar power.

C-WET data suggests that at 80 m and 50 m hub-height, an estimated potential of 2,931 MW and 920 MW exists in the state of Madhya Pradesh. The Government of Madhya Pradesh has been encouraging wind power as an additional, alternate source of energy. Wind power based projects with a cumulative capacity of around 314.29 MW have been commissioned in the state. The year-wise installation trend for Wind power projects is presented below in **Table 5.1**:

Table 5-1: Year wise installation of wind power projects

S.N	Financial Year	Capacity (MW)	Cumulative Capacity (MW)
1	Till 2003-2004	21.69	21.69
2	2004-05	6.25	27.94
3	2005-06	11.20	39.14
4	2006-07	17.45	56.59
5	2007-08	69.0	125.59
6	2008-09	25.1	150.69
7	2009-10	16.6	167.29
8	2010-11	46.5	213.79
9	2011-12	100.5	314.29
	2012-13 (as on date)	**314.29**	**314.29**

Source: New and Energy Renewable Department, Government of Madhya Pradesh

Ministry of New & Renewable Energy (Wind Energy Division), Govt. of India has issued a notification No.58/82/2012-WE on 11th July, 2014 specifying guidelines for implementation of Wind Resource Assessment in uncovered/ new areas under National Clean Energy Fund (NCEF) scheme and subsequent development.

[7] Akshay Urja, MNRE, Nov-Dec 2014

Badnawar tehsil of Dhar district has been identified as one of the uncovered tehsil wherein there is potential of good wind resource.

The wind resource assessment conducted for the site shows a long term mean wind speed at the location of the two wind masts of 100m height erected in Sergarh and Phuledi village in Badnawar Tehsil of Dhar-district. The calculated onsite wind measurement reveals the average wind speed for the area is in the range of 6.5 m/s to 6.58m/s at 100m height. There are no ecological sensitive area such National Parks or wildlife sanctuaries in the radius of 10km from the project area. Besides, availability of large area of revenue land further adds to the feasibility of the project in the area.

5.4 Identification of alternate WTG locations

Land procurement for development of wind turbine generator (WTG) has been undertaken based on certain conditions. These include the following:

- Site is preferable a Government land, if available.
- In case of private land, procurement is only executed based on willing to buy and willing to sell basis. Also to ensure that the households affected by land acquisition for the Project are compensated for their land and assets, which will enable them to attain a standard of living similar to and, if possible, better than the existing one.
- Site is free from encroachments, if any to rule out future conflicts.
- Locations away from habitations so that WTGs do not pose a safety hazard to the community.

Reportedly, a few WTGs were shifted to alternate locations upon suitability of locations on various issues. The table below presents sample summary of 12 WTG locations which were shifted to an alternate locations based on land use pattern, community health & safety and social and economic impact during micro siting.

Table 5-2 Brief on the sample WTG locations shifted to alternate locations

S.N	WTG No	Old Coordinate		Observation	Remark	Shifted Final location Coordinate	
		Northing	Easting			Northing	Easting
1	BD -05	22°51'16.36"N	75° 8'30.54"E	During micro siting, it was found that the WTG blade would rotate in private land, so the location was shifted to Government land.		22°51'16.56"N	75° 8'29.80"E
2	BD -06	22°51'7.98"N	75° 8'18.00"E	During micro siting, it was found that the WTG blade would rotate in private land, so the location was shifted to Government land.		22°51'8.08"N	75° 8'17.09"E
3	BD - 10	22°50'42.03"N	75° 8'48.11"E	During ground survey, it was known that the WTG location falls in 305/2 survey no. and not in 343/2, as allotted, hence a request was made for the allotment of survey number 305/2. It was decided that an alternative coordinate would be suggested during land demarcation.		22°50'42.07"N	75° 8'47.97"E
4	BD -11	22°50'30.16"N	75° 9'24.84"E	During micro siting, it was found that the WTG blade would rotate in private land. There was a need to purchase private land (survey no. 429 and 476) for blade shadow.		22°50'27.79"N	75° 9'26.52"E
5	BD - 12	22°50'19.97"N	75° 9'35.53"E	During micro siting, it was found that the WTG blade would rotate in private land, so the location was shifted to Government land.		22°50'21.40"N	75° 9'33.99"E
6	BD - 15	22°49'56.87"N	75° 9'46.87"E	During micro siting, it was found that the WTG blade would rotate in private land, so the	This locationis getting wake effect	22°50'4.19"N	75° 9'48.11"E

				location was shifted to Government land. There was a need to purchase private land (survey no. 15 and 17) for blade shadow.	by WTG-16. Please suggestanyalternate.		
7	BD - 17	22°49'39.04"N	75° 9'23.06"E	During micro siting, it was found that the WTG blade would rotate in Shergarh village, so shifted the WTG is in allotted survey no. area.		22°49'37.61"N	75° 9'24.11"E
8	BD - 18	22°49'21.81"N	75° 9'18.59"E	The WTG is situated as per records in Shergarh village, so shifted the WTG location in Gandhwada village i.e. the desired survey no.		22°49'19.37"N	75° 9'20.13"E
9	BD - 23	22°48'50.66"N	75° 9'43.18"E	The total area is under encroachment.		22°48'51.38"N	75° 9'42.09"E
10	BD - 32	22°47'23.90"N	75° 9'34.16"E	The WTG is falling near the houses and village area. Need to shift the location.	Need to identify the alternative location.	22°47'37.67"N	75°10'26.23"E
11	BD - 44	22°45'12.16"N	75°10'7.18"E	The WTG is falling in the centre of CWP-Ratlam pooling substation area.	Need to identify the alternative location.	22°45'37.83"N	75° 9'25.84"E
12	BD - 48	22°48'27.65"N	75° 9'27.01"E	The identified location for WTG falls in ST land. The surrounding nearby area also belongs to Schedule Tribe	Need to identify the alternative location.	22°45'10.00"N	75° 8'37.49"E

5.5 Alternate routes for transmission lines

The route for the transmission line will be selected based on the following factors:

- Transmission line route will be planned to avoid any habitations along the route;
- No house or community structures will be located under the transmission line;
- Areas requiring extensive clearing of vegetation will be avoided;
- Selection of the transmission route shall avoid any environmental sensitive site if identified;
- Right of way/ access roads will be shared with the common user of the substation.

The shortest possible route after considering the above factors will be selected for the transmission lines. Consideration of all the above factors will reduce the environmental and social footprint of the transmission line.

6.0 ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT

6.1 Approach & Methodology

Primary impacts are assessed for a radius of 2 km around the project site and secondary impacts are assessed beyond this radius for the proposed project. Also, 100 m RoW along the transmission line route is also considered for impact assessment. The methodology adopted to assess the significance of impact associated with project activities during construction and operational has taken following criteria into consideration. Details of screening criteria are given in **Table 6-1**

Table 6-1: Screening Criteria for Environmental and Social Impact Assessment

Impact	Distribution of impact	Duration of Impact	Intensity
Low/ Short	Influence of impact within the project site boundary and RoW of Transmission line	Limited for duration of less than 6 months	Limited local scale impact resulting in temporary disturbance/loss of environment/social components
Moderate/ Medium	Spread of impact within 2 km from the of the project site boundary	Impact may extends up to 2 years	Local scale impact resulting in short term change and/or damage to the environment components.
High/ Long	Influence of impact between 2 km to 5km from the project site boundary	impact extends beyond 2 years	Regional impact resulting in long term changes and/or damage to the environment components.

Significance Evaluation Matrix

Significance evaluation matrix as shown in **Table 6-2** has been used to evaluate the significance of identified potential environmental impacts. This matrix includes criteria as discussed above to analyse the significance of impact. Colour codes have been given to signify the impact intensity.

Significance of environmental impact has been analysed and the aspect–impact matrix for construction, and operation phase is presented in **Table 6.5**. The environmental impacts associated with the project activities have been identified and analysed to evaluate their significance. Because of clean category projects, environmental impacts are very few with minor significance and can be controlled through mitigation measures.

Table 6-2: Impact Significance Matrix

Distribution	Duration	Intensity	Significance
Local	Short	Low	LOW
Local	Short	Medium	
Local	Medium	Low	
Local	Medium	Medium	
Moderate	Short	Low	
Local	Long	Low	
Local	Short	High	MODERATE
Local	Medium	High	
Local	Long	Medium	
Medium	Short	Medium	
Moderate	Medium	Low	
Moderate	Medium	Medium	
Moderate	Long	Low	
Moderate	Long	Medium	
High	Short	Low	
High	Short	Medium	
High	Medium	Low	
High	Medium	Medium	
High	Long	Low	
Local	Long	High	HIGH
Moderate	Short	High	
Moderate	Long	High	
High	Short	High	
High	Medium	High	
High	Long	Medium	
High	Short	Low	
High	Short	High	
			NO IMPACT
			POSITIVE IMPACT

6.2 Impacts on Physical Environment

6.2.1 Air Quality

Construction Phase

During construction phase, various project components such as transmission cable laying, switchgear, approach roads, internal road network and porta cabin construction require land clearing, levelling, excavation, grading activities, vehicle movement, DG set operation. This results in an increased level of dust and particulate matter emissions, which in turn will directly and temporarily impact ambient air quality. If improperly managed, there is a risk of nuisance and health effects to construction workers onsite and to a lesser extent to nearby receptors from windblown dust (on the village access roads like the Karod Kalan village road that passes to the east of the project site) due to transportation of raw materials. The baseline monitoring results show concentrations of all the ambient air quality parameters (PM_{10}, $PM_{2.5}$, SO_2, NOx and CO) at all four monitoring stations well below the NAAQS permissible limit.

However, most of these project activities are expected to be restricted within the project boundary. Further, the movement of vehicles carrying materials on unpaved area within the project site and on access road causes fugitive dust emission and may extend to surrounding of project site like nearest settlements. Hence, the distribution of impact can be considered medium, duration of impact is short an intensity of the impact as medium. The impact can be termed of a ***Moderate*** significance. But, the impact is reversible, and temporary in nature, if the following mitigation measures are adopted.

Mitigation Measures:

- Vehicles speed to be restricted to 20-30 km/hr. on unpaved road.
- Raw material should be covered with tarpaulin sheet during transportation and in storage area
- Water sprinkling on unpaved area but ensure use of tanker water purchased form suitable authorised vendor only.
- All the project vehicles shall have valid Pollution under Control (PUC) certificate. Ensure regularly maintenance of project vehicles during construction and operational phase
- Turn off the machineries when not in use

Operational Phase:

During operational phase, there would be minimal vehicular movement about 2-3 project vehicles for commuting purpose. DG sets will be only be used as a backup during power supply failure. Considering the above facts, impact on ambient air quality is considered of ***Low*** significance.

PHASE	INTENSITY OF IMPACT
Construction phase	Moderate
Operation phase	Low

6.2.2 Soil Quality

These impacts are associated with the project activities such as erection of WTG towers, construction of access roads and storage of diesel, spent oil or transformer oil.

Construction Phase:

The project has been proposed on open scrub and agricultural land. Loose top soil is generated due to excavation on project site due to site levelling for erection of WTG towers and access roads. The impact anticipated here is loss of top soil because of inappropriate storage. However, these activities and associated impacts are limited to be within the project boundary and during construction phase only. The intensity of the impact can be considered as low because topography in the area is majorly flat with very low requirement of levelling. Considering the local distribution, short duration of construction phase and low intensity, significance of impact is evaluated as ***Low***. Soil contamination may result due to accidental spillage and inappropriate storage of diesel or used oil during construction phase. However, distribution of impact within the project boundary and short duration of construction phase makes impact of ***Low*** significance and can be controlled with the recommended mitigation measures:

Mitigation Measures:

- Provide appropriate storage of top soil in an isolated and covered area to prevent its loss in high wind and runoff.
- Allow only covered transportation of top soil within the project site.
- Use top soil at the time of plantation and it can be given to nearby agricultural field after taking consent with the landowners/farmers.
- Plantation activities should be undertaken by CWP-RATLAM to appease the chances of soil erosion
- Store hazardous material like diesel and used oil in isolated room and on impervious surface to prevent seepage into project site soil
- Filling and transfer of oil to and from the container shall be on impervious surface

Operational Phase:

During operational phase, project activities such as excavation and usage of chemicals such as diesel and spent oil will be absent therefore impact associated with these activities such as top soil loss and soil contamination are not anticipated in operational phase of the project. Considering all above facts, the impact can termed as ***Low*** significance.

Mitigation Measures:

- All the hazardous material like transformer waste oil, oil for DG sets should be properly stored in designated areas and timely disposed to the nearest Common Hazardous waste TSDF facility after obtaining due permissions.

PHASE	INTENSITY OF IMPACT
Construction phase	Low
Operation phase	Low

6.2.3 Noise Level

The environmental impact anticipated in the proposed project is the increment in ambient noise level due to various project activities.

Construction Phase:

The construction activity will be mainly carried out during day time. Project construction involves activities such as road construction, grading, excavating and drilling of tower foundations, concrete batching, tower erection, construction of ancillary structures, and operation of diesel generators, concreting, material movement and site clean-up. The project site is located in an area with no continuous noise generating sources in the vicinity of the project site. Noise levels generated by construction equipment vary significantly depending on the type and condition of equipment, operation methods and schedule, will be generally in the range of in the range of 84–109 dB(A).

The construction phase will be of short period. Therefore the impact from construction noise is deemed to be minor. Workers in close proximity to machines are prone to exposure of high levels of noise of machinery. This will be taken care by proving personal protective equipment like ear plugs/muffs and works will be rotated in shifts to avoid long term noise exposure. The ambient noise levels in the area were monitored at four locations in nearby settlement (Siloda Khurd village, Hanumantya Padmapura village, Indrawal village and Karod Kalan village). Monitored results for day & night were within the applicable CPCB standards for ambient noise set for residential area. Considering the short duration, localized distribution and low intensity, impact has been assessed as ***Low*** significance.

Mitigation measures

- Keep stationary source of noise such as DG sets (currently used only for back up) at farthest point from the settlements
- Restrict major noise generating activities during night time 10:00 pm to 6:00 am
- Provide personal protective equipment to workers wherever noise is generated due to machinery operation.
- Regular maintenance of project vehicles

Operation Phase from Wind Turbines

The sources of noise generation from operating wind turbines can be divided into two categories, mechanical sounds, from the interaction of turbine components, and aerodynamic sounds, produced by the flow of air over the blades. Aerodynamic noise generation is very sensitive to the speed of translation at the very tip of the blade. To limit the generation of aerodynamic noise, modern wind turbines limit the rotor rotation speeds. Large variable wind turbines in general rotates at slower speeds in low winds and its rotational speeds increases with increase in wind speed until the limiting rotor speed reached. This result in much quieter operation in low winds than a comparable constant wind speed turbine. Recent improvement in mechanical design of wind turbines have resulted in significantly reduced mechanical noise from both broadband and pure tones. Thus the noise emission from modern wind turbines is dominated by broadband aerodynamic noise (Fegeant, 1999). Blades moving through the air produce an aerodynamic noise. This noise is detectable when it is greater than the background noise, generally at wind speeds up to 8 meters per second.

Wind Turbines for the proposed project will be of Gamesa make G97-2.0 MW. The model has aerodynamic design of the blade tip and mechanical components design minimize noise emissions. In addition, Gamesa has developed the Gamesa NRS noise control system, which makes it possible to program the turbine to reduce noise emissions accordingly to such criteria as the date, time or wind direction. This operational mode and mechanical design improvement contributes considerably to the minimization of noise. Some of noise levels for different activities are as follow:

Source/Activity	Indicative Noise Level dB (A)
Threshold of hearing	0
Rural night-time background	20-40
Quiet bedroom	35
Wind farm at 350m	35-45
Car at 40mph at 100m	55
Busy general office	60
Truck at 30mph at 100m	65
Pneumatic drill at 7m	95
Jet aircraft at 250m	105
Threshold of pain	140

Source: The Scottish Office, Environment Department, Planning Advice Note, PAN 45, Annex A: Wind Power, A.27. Renewable Energy Technologies, August 1994
Committee on Environmental Impacts of Wind Energy Projects, National Research Council (2007). Environmental Impacts of Wind-Energy Projects, p. 158-9.

Noise Propagation

During noise propagation, initial energy in noise is distributed over a larger and larger area as the distance from the source increase which leads to reduction in noise pressure level. Thus assuming spherical propagation, the same energy that is distributed over a square meter at a distance of one meter from the source is distributed over 10,000 sq.m at a distance of 100 m away from the source. (Anthony L. Roagers, march 2004). To estimate the sound pressure level at a desirable distance following simple model calculation is used.

$$L_p = L_w - 10 \log_{10} (2\pi R^2) - \alpha R$$

Here, Lp = sound pressure level (dB) at a distance of R from a noise source radiating at a power level,

Lw = sound pressure level (dB) at source

R = distance of receptor from source

α = frequency dependent sound absorption coefficient.

The above given equation can be used with either broadband sound power levels and a broadband estimate of the sound absorption coefficient (α = 0.005 dB(A)/meter)

Impact due to Wind Turbine Noise

The ability to hear wind turbines noise depends on the ambient noise level. When the background noise level and wind turbine noise are of the same magnitude, the wind turbine noise gets masked by the background noise. Therefore wind turbine noise level of higher magnitude than background noise level can be considered as significant. However, this noise level can be reduced by the aerodynamic design of the G-97 turbine having Gamesa NRS noise control system. Noise modelling has been carried out for all 50WTGs for which the noise model map has been presented below. The assumptions made for modelling are:

- Noise modelling has been conducted using the fixed wind speed (at hub height level) of 10.0 m/s as provided
- As per manufacturers specification, the noise level at hub height is 105 dB(A). The noise modelling was conducted considering the manufacturer's specification (105 dB(A) when the maximum wind speed of 10 m/s and the ambient noise level monitored at 4 villages/settlements. As residents were located within 150 m and 220 meter radius of 15 proposed WTGs, noise modelling was carried out for these proposed WTG locations to draw the likely incremental noise load on them once the WTGs become operational.
- The baseline ambient noise level monitored during day time was 53.5 dB(A) whereas the night time was monitored as 39.9 dB(A). The night time noise level was well below the CPCB standards (45 dB(A) Leq) but the day time level was slightly below (55 d B(A) Leq) than the National ambient noise standards.
- The predicted noise level for the day time at 150 m radius ranges between 50.2 to 51.9 dB(A) at different WTG locations and the total noise level ranges between 55.2 to 55.8 dB(A) with an incremental noise of 1.7 to 2.3 d B(A).
- The predicted noise level for the day time at 220 m radius ranges between 47.8 to 50.1 dB(A) at different WTG locations and the total noise level ranges between 54.6 to 55.1 dB(A) with an incremental noise of 1 to 1.6 d B(A).
- From the above analysis, it was found that the total noise level during the day time will be above the Indian ambient Noise standards
- The predicted noise level during the night time at 150 m radius ranges between 50.2 to 51.5 dB(A) at different WTG locations and the total noise level ranges between 50.6 to 51.7 dB(A) with an incremental load of 10.9 to 12.3 dB(A).
- The predicted noise level for the night time at 220 m radius ranges between 47.8 to 50.1 dB(A) at different WTG locations and the total noise level ranges between 48.5 to 50.5 dB(A) with an incremental load of 8.6 to 10.6 dB(A).
- From the night time noise level analysis, it was found that the predicted and total noise level (post operation) at 150 and 220 m radius will be beyond the Indian Noise standards. Also the incremental load will be beyond the IFC standard.

The modelling results drawn from 15 sensitive locations have been shown below in Table 6.3

Table 6-3 Noise level predicted at the receptors identified 15 WTGs (day time)

WTG *	Noise level at Receptor (150 m distance from WTG)				Noise level at Receptor (220 m distance from WTG)			
Name	WTG noise level predicted (A)	Ambient noise level (Indraval village) B	Total Noise level (C)	Incremental noise level (C-B)	WTG noise level predicted (A)	Ambient noise level (Indraval village) B	Total Noise level (C)	Incremental noise level (C-B)
BD-10	50.2	53.5	55.2	1.7	47.8	53.5	54.5	1.0
BD-11	51.2	53.5	55.5	2.0	49.4	53.5	54.9	1.4
BD-18	50.4	53.5	55.2	1.7	47.8	53.5	54.5	1.0
BD-26	51.9	53.5	55.8	2.3	50.1	53.5	55.1	1.6

BD-29	51.1	53.5	55.5	2.0	49.4	53.5	54.9	1.4
BD-30	51.4	53.5	55.6	2.1	49.3	53.5	54.9	1.4
BD-31	51.4	53.5	55.6	2.1	49.7	53.5	55.0	1.5
BD-32	50.9	53.5	55.4	1.9	49.1	53.5	54.8	1.3
BD-34	50.9	53.5	55.4	1.9	49	53.5	54.8	1.3
BD-35	50.9	53.5	55.4	1.9	48.9	53.5	54.8	1.3
BD-37	50.6	53.5	55.3	1.8	48.1	53.5	54.6	1.1
BD-39	51.5	53.5	55.6	2.1	49.9	53.5	55.1	1.6
BD-43	50.4	53.5	55.2	1.7	48.1	53.5	54.6	1.1
BD-47	50.4	53.5	55.2	1.7	47.9	53.5	54.6	1.1
BD-50	50.4	53.5	55.2	1.7	48	53.5	54.6	1.1

Table 6-4 Noise level predicted at the receptors identified 15 WTGs (night time)

WTG *	Noise level at Receptor (150 m distance from WTG)				Noise level at Receptor (220 m distance from WTG)			
Name	WTG noise level predicted (A)	Ambient noise level (Indraval village) B	Total Noise level (C)	Incremental noise level (C-B)	WTG noise level predicted (A)	Ambient noise level (Indraval village) B	Total Noise level (C)	Incremental noise level (C-B)
BD-10	50.2	39.9	50.6	10.7	47.8	39.9	48.5	8.6
BD-11	51.2	39.9	51.5	11.6	49.4	39.9	49.9	10.0
BD-18	50.4	39.9	50.8	10.9	47.8	39.9	48.5	8.6
BD-26	51.9	39.9	52.2	12.3	50.1	39.9	50.5	10.6
BD-29	51.1	39.9	51.4	11.5	49.4	39.9	49.9	10.0
BD-30	51.4	39.9	51.7	11.8	49.3	39.9	49.8	9.9
BD-31	51.4	39.9	51.7	11.8	49.7	39.9	50.1	10.2
BD-32	50.9	39.9	51.2	11.3	49.1	39.9	49.6	9.7
BD-34	50.9	39.9	51.2	11.3	49	39.9	49.5	9.6
BD-35	50.9	39.9	51.2	11.3	48.9	39.9	49.4	9.5
BD-37	50.6	39.9	51.0	11.1	48.1	39.9	48.7	8.8
BD-39	51.5	39.9	51.8	11.9	49.9	39.9	50.3	10.4
BD-43	50.4	39.9	50.8	10.9	48.1	39.9	48.7	8.8
BD-47	50.4	39.9	50.8	10.9	47.9	39.9	48.5	8.6
BD-50	50.4	39.9	50.8	10.9	48	39.9	48.6	8.7

Considering the modelling results, the impact during the operation phase is envisaged to have **Moderate impact in the worst case scenario.** Details modelling results are presented in ***Appendix O.***

PHASE	INTENSITY OF IMPACT
Construction phase	**Low**
Operation phase	**Moderate**

Mitigation Measures

The following mitigation measures shall be incorporated to avoid/reduce potential impacts-

- WTG models should be selected having inbuilt noise control mechanism.
- Regular maintenance of WTGs should be carried out for attenuation of noise.
- Adequate noise control measures (e.g. double glazed windows, acoustic treatment for the walls and roof) shall be provided for the households located within 220 m of Wind Turbines in order to achieve compliance with ambient noise standards in the houses. .
- In case of complaints of high noise levels from inhabitants of nearby settlements, possibility of putting noise barriers such as development of green belt plantation between source and receptors should be considered as a long term mitigation measure.
- Long term monitoring of noise level should be carried out during high wind season at all identified receptors

6.2.4 Drainage and Physiography

Although, topography of almost all WTG's has almost flat land. Levelling or filling is expected to cause change in terms of natural drainage pattern due to alteration in contour level.

Construction Phase:

All WTG locations have flat terrain with only one WTG location having undulating terrain. Besides, the construction of access road involves levelling of land. This might bring in some minor changes in the contour level and natural drainage pattern in the project area. Considering the slope of the project site SE- NW (please refer **Figure 5.5**), the sensitivity of alteration in drainage pattern within the project site and surrounding area is considered low. However, it should also be ensured that levelling of project site will not cause accumulation of surface runoff in adjacent surrounding areas. Considering the limited distribution of impact (within the project boundary), short duration of activities and flat topography of site, significance of impact is assessed as **Low**.

Mitigation Measures:

- Design of contour level with minimum alteration to be considered for the project site.
- Provide alternatives to collect surface runoff from the project site during the monsoon period
- Don't allow exit of runoff from the project site in the adjacent surrounding land area.

Operational Phase:

In operational phase, project activities causing the alteration of natural drainage pattern do not exist therefore associated impact is not anticipated.

6.2.5 Water Resource

Water is required for various project activities, fulfilment of this water requirement through ground water may have impact in terms of ground water depletion. However, severity of impact depends on the ground water potential.

Construction Phase:

As discussed in Chapter 4, studies undertaken by CGWB show water level in the region varied between 5-10mbgl during pre-monsoon (Decadal mean 2003-12) and post monsoon (Decadal mean 2003-12). In the construction phase, water requirement for civil work per WTG would be 9KL, which works out to be 450KL for construction of 50 WTG's. During peak construction phase, about 30 construction workers are employed per well. Hence, the total domestic water requirement purpose is 1.35KLD. In operational phase, there will be over 10-12 staff available

onsite including security guards. Water requirement will be only for drinking, which will be met by packaged drinking water. The project site falls under Badnawar tehsil which has been categorized under "**Over Exploited"** zone by CGWB. Considering all facts above the impact can be considered as of **Moderate** significance.

Mitigation Measures:

- The water for construction should only be sourced from authorized sources and the water requirement would only for 2-3 months

Operation Phase:

Very low quantity of water would be required during the operation phase. The only requirement during the operation phase would be domestic water requirement, which will be met by packaged drinking water. Hence, the impact on groundwater can be considered as Negligible and will have "No impact" on water resources of the region.

PHASE	INTENSITY OF IMPACT
Construction phase	Moderate
Operation phase	No Impact

6.2.6 Water Quality

Construction Phase:

During the construction works, there is a possibility of contaminated runoff from the site as the activities involve the installation of wind turbine foundation, underground cables, soil compaction, increased run off and sedimentation of surface waters. During site visit three medium sized water bodies were observed close to the WTG settings.

Some labour camps have been set up for onsite migrant labours. These camps discharge domestic wastewater due to bathing, washing and cooking. Stagnant pools of water would increase breeding of mosquitoes and generally create insanitary conditions. However, septic tanks and soak pits has been provided for the disposal of waste water. Besides, construction processes include fabrication of concrete and related water usage. Wastewater from construction activities would mostly contain suspended impurities. Taking the short period of construction phase, the impact is considered of **Low** Significance.

Operation Phase

Groundwater contamination can occur if chemicals are not properly handled or are incorrectly disposed of and leach into the water table or if wastewater from plant activities is not properly disposed. Very small volume of waste will be produced from the operation of the wind farm (e.g., used oil, paint cans), which will be disposed to authorized vendors. Minor volumes of sewage will be generated from toilet facilities at the site office. This will be disposed to septic tank, thus no significant impact is anticipated to surface or groundwater.

Besides, storm water may collect on the project site in the absence of storm water drainage channels during monsoon. But, CWP-RATLAM should ensure construction of storm water drainage structures along the length of the roads. Taking the erratic rainfall as well as the duration of operation phase for 25 years, the impact is considered to have no impact. Considering all above factors the impact on groundwater quality during operation phase will have **No impact.**

Mitigation measures

The following mitigation measures shall be incorporated to avoid/reduce the potential impacts:

- Temporary paved areas shall be constructed to be used while refuelling the machineries;
- Machinery and vehicles shall be thoroughly checked for the presence of leaks if any;
- Drip pans shall be provided with vehicles with leaks to prevent soil contamination; and
- Storage of oil shall be undertaken on paved impervious surface and secondary containment shall be provided for fuel storage tanks.
- Proper storm water drainage channels to collect surface runoff (due to monsoon) from the project site

PHASE	INTENSITY OF IMPACT
Construction phase	Low
Operation phase	No Impact

6.2.7 Solid/ Hazardous waste

Construction Phase:

Solid waste during the construction phase consists primarily of scrapped building materials, excess concrete and cement, excavated material, rejected components and materials, packing materials (pallets, crates, plastics etc.) and human waste. However, taking the flat terrain of the site, considerable levelling is not required. Taking the short period of the construction phase and impact to be restricted within the project boundary, the impact is considered as ***Low.***

Mitigation Measures

- The excavated material generated will be reused for site filling and levelling operation to the maximum extent possible.
- Food waste and recyclables viz. paper, plastic, glass, scrap metal waste etc. will be properly segregated and stored in designated waste bins/containers and periodically sold to local recyclers while food waste will be disposed through waste handling agency.
- Hazardous waste viz. waste oil etc. will be collected and stored in paved and enclosed area and subsequently sold to authorized recyclers.

Operation phase:

There will not be any substantial generation of solid waste, other than insignificant domestic waste. The impact is considered to have "**No Impact"**

Mitigation measures

- Food waste and recyclables viz. paper, plastic, glass, scrap metal waste etc. will be properly segregated and stored in designated waste bins/containers and periodically sold to local recyclers.

PHASE	INTENSITY OF IMPACT
Construction phase	Low
Operation phase	No Impact

6.2.8 Impact on Land and landuse

Construction Phase

Activities that cause land disturbance include installation of tower foundations, road preparation, excavation, etc. Excavation will be carried out to the minimum. The soil will be mainly excavated for laying foundation of towers, site levelling and road work. The soil structure of this area is ***Sandy Clay Soil*** This excavated earth material be utilized on site for road soling and site levelling as per requirement. The top soil excavated during construction, will be stock pilled and will be used for plantation. The roads will not be paved and only soling will be done with excavated earth & rock material, so land disturbance will be minimized. The access roads would also improve the accessibility in the area and would hence add to the social and economic development of the area. The cranes used for construction activities will be placed on hard, flat surface area and if required, ground levelling will be done.

The project site has been proposed majorly on revenue land, for which procurement of 225.3ha of land has been completed. In addition, three private agricultural land of a total area of 3.265ha has been identified in two villages' viz. Sergarh and Indrawal village for which the negotiation was under process at the time of primary survey. Land requirement for each wind turbine generator (WTG) is 1.75hectare/ 4.32acres. The internal path ways covering a length of about 32 km has been constructed on Revenue land. During operation phase, the legal status of the land will not be changed. A total length of 28 km of 220kV transmission line will be established to connect the pooling

substation at Khiledi village to 220/132kV MPPTCL Rajgarh substation for which the land requirement for transmission line will be limited to the area required for the foundation of pylons. Procurement of 3 private agricultural lands will not have adverse impact on the project as it does not involve any physical displacement and also during the time of final reporting of ESIA report, the private land has been completely procured for which compensation has been paid more than the prevailing circle rate of the area, hence no economic displacement is also not envisaged (Refer sample sale deed **Appendix F.** Taking in consideration the low land uptake for the WTG construction and adoption of suitable mitigation measures, the impacts would be **"Low".**

Mitigation measures

- After construction phase, the areas acquired by labour colonies should be reverted back similar to preconstruction stage

Operation Phase

Care should be taken with regard to possible changes in soil quality due to human activities, such as disposal of waste material and domestic effluents on soil of the surrounding area. Waste water holding tanks / septic tank will be located at more than 500 m away from bore wells or any other underground water holding tanks in surrounding areas. Very small quantity of solid waste will be generated by workers during project operation, and this material will be handled and disposed of in an approved manner; therefore no soil contamination will result. Any hazardous waste like waste oil, paint containers will be disposed to authorized vendors after due permission of concerned authority/ body.

Mitigation Measures:

- The project proponent is suggested to provide open access for grazing without any restrictions.
- CWP-RATLAM shall undertake a formal consultation with all landowners from whom right of way is to be obtained for construction of transmission towers and make them aware of the project details;
- CWP-RATLAM should ensure that all agreements have been executed properly;

PHASE	INTENSITY OF IMPACT
Construction phase	Low
Operation phase	No Impact

6.3 Impact on Biological Environment

Construction Phase

Vegetation Clearance: Project construction involved land clearance, excavation, filling and levelling, causing the loss of vegetation. The clearance of vegetation will be restricted along a radius of 50 m around each wind turbine site and the entire area procured for each wind turbine may not be cleared. Most of the locations identified for the wind turbine generators do not comprise any trees in the immediate vicinity. Clearing of vegetation will also be done for access route and transmission lines.

The impact on ecological environment is assessed to be negligible from the project activities since the cleared area is seemed to be small and presence of undisturbed areas in the vicinity could buffer for the displaced areas. As the proposed project is wind power project where land requirement is low, therefore, impacts due to site clearance activities in terms of loss of vegetation would be limited. Moreover, absence of site boundary and fencing in the wind project (excluding transformers) is beneficial and would not pose any restrictions on movement of animals. The soil compaction will also affect the regeneration of understorey vegetation due to heavy equipment usage after construction phase.

Habitat Loss, Disturbance and Modification: Habitat loss due to wind turbines and associated infrastructures viz., turbine bases, substation and access roads is anticipated from such type of project. As the land requirement to setup the wind turbines is relatively low, therefore high risk in general not anticipated due to habitat loss. But large quantities of earth will be excavated for the purpose of making roads, etc. and vegetation clearance will result in habitat modification in the study area. Moreover, project area is not a designated or qualifying site of national and international importance for biodiversity.

Mitigation Measures

The following measures should be considered in the project design to mitigate the bird and bat impact due to the project:

- Temporary barriers be installed around the excavated areas so that the wildlife and livestock is not trapped in pits.
- Shepherd be informed through sign boards to avoid the construction area for grazing their livestock.
- Vegetation removal should occur in areas where absolutely necessary.
- Plantation wherever done should be planted with locally occurring native plant species.
- Trapping, hunting and injuring wildlife (if any) should be strictly prohibited.
- Labourers should be asked to stay within the project footprint area.
- Minimal possible number of routes should be authorized for use during construction by the labourers and staff.
- Awareness programme regarding the significance of conserving wildlife and the penalty associated with killing wild animals should be conducted for the labourers and sub-contractors.

Operation Phase

Wind turbine operation has few direct and indirect impact on bird and bat communities. Bird and bat mortalities has been reported from various operational wind farms across the country. The impacts during operation phase of wind farm is discussed in the sections below.

Impact on Bird and Bat of the region

Although wind-generated electricity is renewable and generally considered environmentally clean, fatalities of bats and birds have been recorded at wind facilities worldwide (Huso et al, 2010). The principal risk to birds believed to be posed by turbines, is the potential for individuals to be killed as a result of collision with moving rotors. Clearly a risk of collision with rotors exists only when a bird is in flight within the rotor-swept- area, or may be affected by turbulence caused by rotors. Flight behaviours, including the heights at which birds fly, vary considerably between species. Many birds rarely, if ever, reach rotor-swept height, while others do so routinely and some frequently fly above that height. It is also the case that different types of flight, such as hovering, circling, vertical and horizontal flights made by different species of birds, and by birds engaged in different activities, may pose quite different risks of collision.

Variations in visibility due to time of day or night and weather conditions are also likely to be influential in altering risk. Bats are a long-lived species with low reproductive rates, which tend to make such populations particularly vulnerable to additional mortality. Significant bird mortality due to collisions with wind turbines is obviously not desirable and it is the intent of both the power generation industry and regulators representing the community to minimise it as far as possible. It should be noted, however, that in addition to wind farms, there are numerous other anthropogenic causes of fauna mortality, the great majority of which are entirely unquantified.

In general, in different seasons, due to climatic conditions, the availability of resource may change in the study area. Moreover, due to local and global migration, the composition and distribution of avian species might change in the study area. As a result, at different season the target species may also change. It is also pertinent to mention here that during the dialogue with the local villagers the visit of any visible migratory bird species in these water bodies could not also be confirmed. However, the primary data base prepared through site observation does not record bird species, which falls in IUCN's red data list.

Collision Mortality

The collision mortality is another impact due to wind power project, especially in area of more bird usage i.e. important bird area. Direct mortality or lethal injury of birds can result from collision with rotor, towers, nacelles and associated infrastructure such as guy cables, power lines and meteorological masts. Although majority of studies indicates low mortality level from wind turbines (Painter et al. 1999, Erickson et al. 2001). Collision risk depends on a range of factors related to bird species, numbers and behaviour, weather condition, topography and scale of wind farm. During the site visit, bird survey was conducted for WTGs and transmission line at 11 locations around the project site. Effect of wind turbines on local birds cannot be completely ruled out.

The observed flying height of varied from ground level to maximum of 35 meter. None of the bird species found flying within collision risk zone (55 meter to 150 meter) . No bats were spotted or any suitable habitat, roosts were identified although the presence of bats in the area was confirmed by the local seniors during dialogue with them.

Loss of habitats resulting from wind turbines and associated infrastructure

The loss of habitat, loss or fragmentation of feeding areas, displacement are considered to be major aspects of bird collision risks involved in wind farm projects. So far this site is concerned, no major change will occur in terms of habitat and foraging/ feeding areas for birds. The footprint area of WTG's are very limited. The majority of the birds recorded feed on insects followed by grains, nuts, seeds etc. On the basis of the type of farming and variety & growth of ground cover, the project activity is not envisaged to have impact on agricultural produce of the area. Considering these factors, it may be concluded that loss of habitats, displacement and loss of foraging/feeding areas from this project is not envisaged.

Injuries and mortality from Electrocution

Electrocutions kill many birds. This occurs mainly when large birds such as raptors make contact between a live electrical wire and a ground such as a pole. The transmission lines used for power evacuation from the WTG's to the substation pose a threat of electrocution to bird and bats. Some birds tend to use these wires and poles to perch and are likely to be electrocuted. Studies have reported that mortality of birds has occurred in many places.

- **Risk of Electrocution**- Birds sitting on power lines and/or conducting cables are killed if they cause short circuits. Numerous medium-sized and large birds which use power poles as perching, roosting, and even nesting sites
- **Risk of Collision-** In flight, birds can collide into the cables of power lines because cables are often difficult to see. In most cases the impact of collision leads to immediate death or fatal injuries
- **Reduction in availability for birds of staging and wintering areas-** Mainly when above ground power lines cut across open landscapes and habitats (wetlands, grasslands)

High Risk Potential Areas

- Areas of high avifauna importance including high bird populations and a high percentage of migratory birds, especially during migration; Particularly high losses are reported where power lines cut across important flyways and migration corridors
- Wetlands, marshes, coastal areas, grasslands, especially in staging and wintering areas, in particular when the aboveground power lines separate nesting ground and feeding areas or are otherwise in the flight approach of important staging and feeding areas, in particular close to water, power lines, thus, in effect degrade the quality of staging and wintering habitats
- Migrating birds, when power lines are perpendicular to their flight path
- Birds migrating at night are at high risk
- Bad visibility of conductor cables, which are coated with aluminum oxide (grey coloured)
- Unfavorable weather conditions, like fog, precipitations, strong winds, these conditions tend to concentrate bird migration at a lower height
- Most collision accidents happen during the night and during dawn and dusk

The impact during the operation phase due to collision risk and electrocution is assessed as ***Moderate***.

Mitigation Measures

Following measures to be undertaken for reduction in bird bat collision

- During operational period, a bird and bat mortality monitoring study by following the methods of carcass survey and scavengers removal estimation shall be conducted at some selective WTG sites (around vegetated areas and water bodies) to estimate the mortality of these species from colliding with the WTGs and electrocution from Transmission lines. And if an alarming rate of collision/mortality found, then only a

a long term detailed bird and bat mortality study shall be undertaken and appropriate mitigation measures shall be taken to reduce the mortality numbers.

- Towers should be regularly checked to ensure that birds do not nest in any suitable gaps or platforms, and
- Bird-safe strain poles with insulating chains at least 60 centimeters in length should be used.
- The tip of blades of WTGs should be painted to increase visibility and avoid collision. This is also done for established aircraft navigation path.
- Any dead animals/carcass shall be removed in time from the site so that it does not attract movement of raptors near to the WTGs
- Training of local staff and security guards for spotting of bird carcass and reporting the same. This will help to ensure the strategic actions, when the species are spotted in the region.

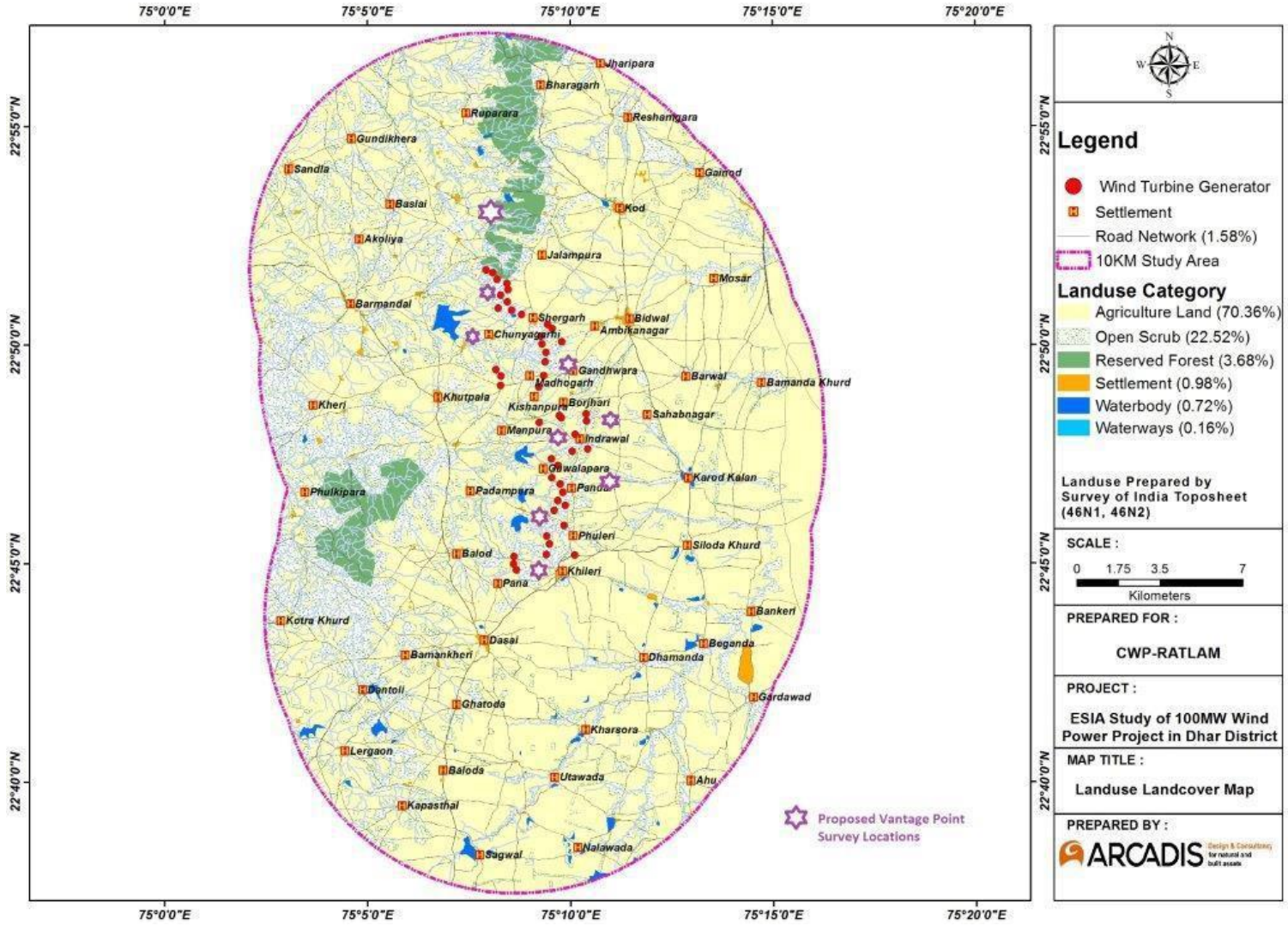
The overall assessment suggests that the proposed project will not lead to displacement of habitat for birds or mammals. The bird survey (vantage point study) undertaken for bird collision risk assessment revealed that there is only one Schedule- I species (as per Indian Wildlife Protection Act, 1972) observed to be present in the study area. From the observation, it can be concluded that the overall impact on local biological resources (flora and fauna both) during construction period will be **Low** while the overall impact during the operational period will be Moderate.

PHASE	INTENSITY OF IMPACT
Construction phase	**Low**
Operation phase	**Moderate**

6.3.1 Recommended Avifauna Vantage point survey locations

The map below shows the vantage point survey locations for a primary level bird study to gather more information on foraging habitats, population of birds, type of birds, flying height, breeding/nesting habitat etc. The vantage points are selected based on the existing land use pattern, vegetative area, presence of water bodies and most importantly to covering all WTG locations.

Figure 6-1 Recommended vantage point survey locations



For Bat monitoring, forested areas/dense vegetated patches close to water bodies in the Reserved Forest areas shall be covered. Besides, old trees, abandoned structures (if any) located in the villages will also be covered during the survey.

6.4 Socioeconomic Impact

6.4.1 Relocation impact on households falling within setback area of 15 WTGs

The project involves private land, the acquiring shall be done as following "willing to buy- willing to sell" process, hence no relocation of households will be required. However, a more detailed ground truthing study revealed that out of 50 WTGs, village households/structures were found within a radius of 150m -220m at 15 WTGs locations viz. 10,11, 18, 26, 29, 31, 32, 34, 35, 37, 39, 43, 47, 50

Approximately 221 houses are located within the setback distance of about 220 m and a total of 110 structures households are likely to be impacted within a radius of 150m from these WTGs

During Construction phase

However, considering the short duration of the construction phase the significance of the impact can be considered as "Low"

During operation phase:

Considering the fact that relocation would be decided based on Quantitative Risk Assessment (QRA) to assess the level of safety risks before commissioning of WTGs, the impact can be termed as "High" on the households to be relocated. Nevertheless it should be noted that, no significant impact on livelihoods of these people is envisaged as most of the people will be relocated in near vicinity.

PHASE	INTENSITY OF IMPACT
Construction phase	Low
Operation phase	High

Mitigation Measures:

Operation phase

- A relocation/resettlement plan has been developed based on ground survey of all households located within 150 – 220m to 15WTGs. Most of this relocation/resettlement is expected to be in situ
- For turbine locations where relocation of all structures/people is not feasible (for both within a setback area of 150 & 220 meters), CWP-Ratlam will undertake a Quantitative Risk Assessment (QRA) to assess the level of safety risks. For turbines locations where the risk is assessed to be higher than As Low As Reasonably Practicable (ALARP), CWP-Ratlam will undertake measures with the objective to mitigate the risks so as to bring the risk levels down to ALARP. These measures will consist of a number of options as suggested by third party appointed to carry out QRA, based on the risk levels quantified to minimize the safety risks. These would include (but not be limited to) strengthening of foundations/hub, enhanced monitoring/inspection, on-going communication, relocation of turbines/ people and other measures (included in the ESIA). The decision tree for the selection of the mitigation measures and the outcome of the risk assessment (pre and post-mitigation) will be documented.

6.4.2 Occupational Health & Safety Impact

Occupational Health & Safety Hazards for workers

Occupational Health and safety hazard associated with project activities (during construction and operational phase) in wind power plant are identified as follows:

Working at height: The maintenance activities for the turbines such as turbine service and repair will involve working at heights (≥ 2m). The workers engaged in such activities may fall or slip from the scaffolding or ladders which may result in minor injuries such as muscle sprain or major ones such as ligament tear, fractures, haemorrhage depending on the height at which they are working.

Electrical/ Fire Hazards: Turbine maintenance activities like motor/wire repairing will involve electrical work. The workers involved in such activities are susceptible to risks viz., electrical shocks, electrical burns, and fire and/or explosion hazards. Some of the risks are identified below:

- **Eye injuries:** Retina damage due to flash or sparks emanating from the welding arc
- **Electrical shocks**: Such incidents can occur when the fixing equipment in operation by the workers come in contact with live power lines etc. In some cases, it may lead to electrocution of the worker(s) involved in such works.
- **Electrical burns:** They occur when the skin comes in contact with live power lines etc. The severity of the burn depends on voltage, current, time of contact etc. The burns can be classified as low voltage, high voltage, flash, flame, arc and oral burns depending on the factors.

Fire and/or explosion hazard: These can occur due to short-circuiting of power lines. The injuries can range from burns to death of the workers involved in the work.

Basic amenities or facilities to workers

Three labour sheds (one medium sized and two small sized) have been provided to the migratory labours who have migrated from Jharkhand and Bihar. Facilities like drinking water, power supply has been provided.

About 20-25 labours stay in the labour shed provided by the sub-contractor of CWP-RATLAM. As per International Labour Organisation (ILO) standards, the basic working condition to be provided to the labours/workers has been considered by the developer.

Mitigation Measures

- Ensure availability of all the basic amenities such as separate kitchen, rest room and adequate toilets.
- The sanitation facilities for contract labours should be maintained as per the provision of the Contract Labour Rules, 1971, which requires the operator of a construction site to provide adequate sanitation facilities to worker within the site premises (Latrine: One per 25 male/female; urinal one per 50 male/female.

Other Hazards

The workers involved in activities such as loading and unloading of turbine components (spare components or discarded ones), crane operation (to move damaged components), storage and placing of turbine components etc. are susceptible to risks viz., physical injuries and trip/ fall hazards.

- ***Physical injuries:*** These can occur when workers involved in loading/unloading activities don't adhere to proper ergonomics discipline. Injuries like muscle strain, ligament tear, slip disc can occur which may prove to be fatal.
- ***Trip and fall hazards:*** The injuries are similar to those discussed under working at height. They occur when workers trip over/fall when debris etc. lies in the walkway/ passages.
- ***Accident/ injury due to vehicle collision/ slip along terrain:*** Such incidents can occur during transportation of damaged or spare turbine components.

The impact on occupational health and safety during project operation is expected to be **Moderate**.

Mitigation Measures:

- Provide and ensure wearing of personal protective equipment's such as gloves, helmets, ear plug, and safety belt.
- Ensure effective work permit system for critical activities such as electrical work and civil work.
- Prepare emergency communication system and emergency preparedness plan for the site.
- Ensure proper sanitation facilities.
- All work at height to be undertaken during daytime with sufficient sunlight; Work permit system shall be implemented for working at height (typically when working over 2 m above) and for hot jobs;

- Prior to undertaking work, integrity of structures shall be inspected; Fixtures shall be installed on tower components to facilitate the use of fall protection systems;
- Only workers trained in climbing techniques and use of fall protection measures shall be engaged for work at height;
- Safety incidents shall be recorded and monitored.
- Wind turbines shall be equipped with earthing system;
- The substation should be provided with fire extinguishers and sand buckets at all strategic locations to deal with any incident of fire
- Access to areas containing exposed electrical equipment shall be enclosed and posted with warning signs

Hero Future Energies Private Limited-the corporate office has formulated Emergency Preparedness plan to deal with health and safety issues during project life cycle of a wind farm. However, it is recommended to devise an Emergency Response Plan for onsite activities as per the recommendations given in the ESIA report.

Emergency Preparedness and Plan for On-Site Emergencies: the plan has defined nature of emergencies that can be encountered during operation of a wind farm. Requirements of an Emergency Control Centre (ECC), firefighting facilities and medical facilities has also been detailed out. Roles and Responsibilities of personnel at site, communication channel to be followed, and procedures for different emergencies have also been detailed.

CWP-RATLAM should ensure that all its hired contractors should abide by the requirements of plan formulated like undertaking mock drills, identification of first aiders and fire fighters, display of emergency numbers onsite etc.

During construction phase, the working conditions will be as per applicable labour laws and working hours shall be specified. Job rotation shall be done and adequate breaks shall be provided.

Operation Phase: Occupational health and safety can be affected only during routine maintenance of the WTG's, which require working at height and might have possibility of electrocution if proper mitigation measures are not taken. However, considering that the maintenance activities will be handled with proper PPE's, the impact can be taken as Low.

PHASE	INTENSITY OF IMPACT
Construction phase	**Moderate**
Operation phase	**Low**

6.4.3 Community health & safety

During Construction phase:

During construction phase, various project components such as transmission cable laying, switchgear, approach roads, internal road network and porta cabin construction require land clearing, levelling, excavation, grading activities, vehicle movement, DG set operation . This will results in an increased level of dust and particulate matter emissions, which in turn will directly and temporarily impact the local community. If improperly managed, there is a risk of nuisance and health effects. However, considering the short duration of the construction phase the significance of the impact can be considered as "**Low"**

Operation Phase

According to IFC EHS guidelines, community health and safety hazards specific to wind energy facilities primarily include the following during the operation phase:

- Shadow flicker;
- Blade throw;
- Electromagnetic interference and radiation; and
- Public access

Shadow Flicker:

Shadow flicker refers to the shadows that a wind turbine casts over structures and observers at times of the day when the sun is directly behind the turbine rotor from an observer's position. The shadow flicker effects usually during periods after sunrise and before sunset. During intervals of sunshine, wind turbine generators will cast a shadow on surrounding areas as the rotor blades pass in front of the sun, causing a flickering effect while the rotor is in motion. The light effect caused when the sun is positioned behind a rotating wind turbine has been described as shadow flicker. With the sun in the background, large moving shadows can be produced which some people may find distasteful. The **Table 6.3** below shows the approximate sensitivity to shadow flicker at different RPM for three blade turbines, according to Stankovik et al.

Table 6-5: Shadow Flicker Sensitivity

Flicker Rate (Hertz)	Human Perception	Equivalent RPM Rate for a 3-Bladed Turbine
< 2.5	Negligible Effect	<50
2.5 - 3	May Affect 0.25% of the Population	50-60
3 - 10	Effect is Perceptible	<200
10 - 25	Greatest Sensitivity	200-500
>50	Continuous Light Source	1000

Source: Stankovik et al., 2009,

Larger turbines generally operate between 18 and 45 RPM, while smaller turbines generally operate below 150 RPM (Stankovik et al., 2009, p.96). The present design of wind turbines for this project is designed with speed of 19.0 RPM. So the effect is expected to be negligible.

It has been stated that "*Flicker effects have been proven to occur only within ten rotor diameters of a turbine*". The greater the distance between the turbines and the observer the less noticeable the shadow flicker will be (Office of the Deputy Prime Minister, 2004, p.177)[8].

The following assumptions were made for mapping the shadow flicker effect for the WTGs.

1. Window size of 1 x 1 m has been taken as input parameter for real case modeling
2. Minimum sun height over horizon for influence 3 °
3. Day step for calculation 1 days
4. Time step for calculation 1 minutes
5. In the event group of receptors identified, they have been cumulatively taken as one shadow receptor.

The model shows that the real time case scenario for all WTGs. The different coloured zones suggests number of worst case of shadow flicker occurrence (in hours) on the receptors in a year. A total of 17 receptors have been identified to have expected shadow hours for more than 30hrs/year. The details are shown below in **Table 6-5**

8 The Real Truth about Wind Energy, A Literature Review on Wind Turbines in Ontario, June 10, 2011, SIERRA Club Canada.

Table 6-6: List of sensitive receptors wrt WTG's having shadow flickering for more than 30hrs/year

S.N	Impacting WTG's	WTG Impacting Receptor	Receptor no	Details	Village	Receptor coordinate		Shadow hours per year (hour/year)	Distance (m)	Picture
	New name					Easting	Northing			
1	BD18 BD21 BD22	17SR	G	Group of houses – semi permanent structure , predominant occupant belonging to SC and ST	Gandhwada	516,359	2,523,943	32:00:00	406m 2.1km 2.2km	
2	BD11	29SR	B	Single house –pakka house; cattle shed and government godown Owner: Jagdish Kataria 10 occupants	Indrawal	516,003	2,526,093	53:45:00	213m	
3	BD10 BD11 BD27	9SR	E	Kachha house Occupant: Bhanwar Lal Residing since last 15 years Occupants: 7	Sergarh	515,141	2,526,432	195:41:00	113m 1.1km 1.4km	
4	BD10 BD11 BD12 BD27	10SR	F	Kachha house Occupants : 11 Occupant: Joharson Residing since last 20 years	Sergarh	515,121	2,526,394	159:19:00	80m 1.1km 1.4km 1.4km	
5	BD18	18SR	H	Pakka house	Gandhwada	516,016	2,523,802	30:57:00	54m	

	BD21			Occupants : 7 Occupant: Sunder bai Residing since last 30 years					1.8km	
	BD22								1.9km	
6	BD25	26+39SR	J	Semi-permanent house Occupants : 4 Occupant: Dinesh Residing since last 10 years	Indrawal and Borjhadi	515,770	2,521,912	107:11:00	0.12km	
	BD29								1.47km	
	BD30								1.4km	
	BD31								1.6km	
7	BD30	35SR	M	Farmer store house Occupants : 0 Occupant: Dinesh	Indrawal	517,419	2,520,964	32:34:00	690m	
8	BD34	37SR	O	Semi-permanent house Occupants : 3 Occupant: Dalu Bai Residing since last 10 years	Indrawal	516,391	2,520,276	114:21:00	85m	
9	BD38	38SR	P		Indrawal	516,576	2,520,039	120:24:00	50m	
10	BD37	40SR	Q	Kachha house Occupants : 6 Occupant: Nandi Residing since last 15 years	Panda	516,179	2,519,626	149:59:00	157m	

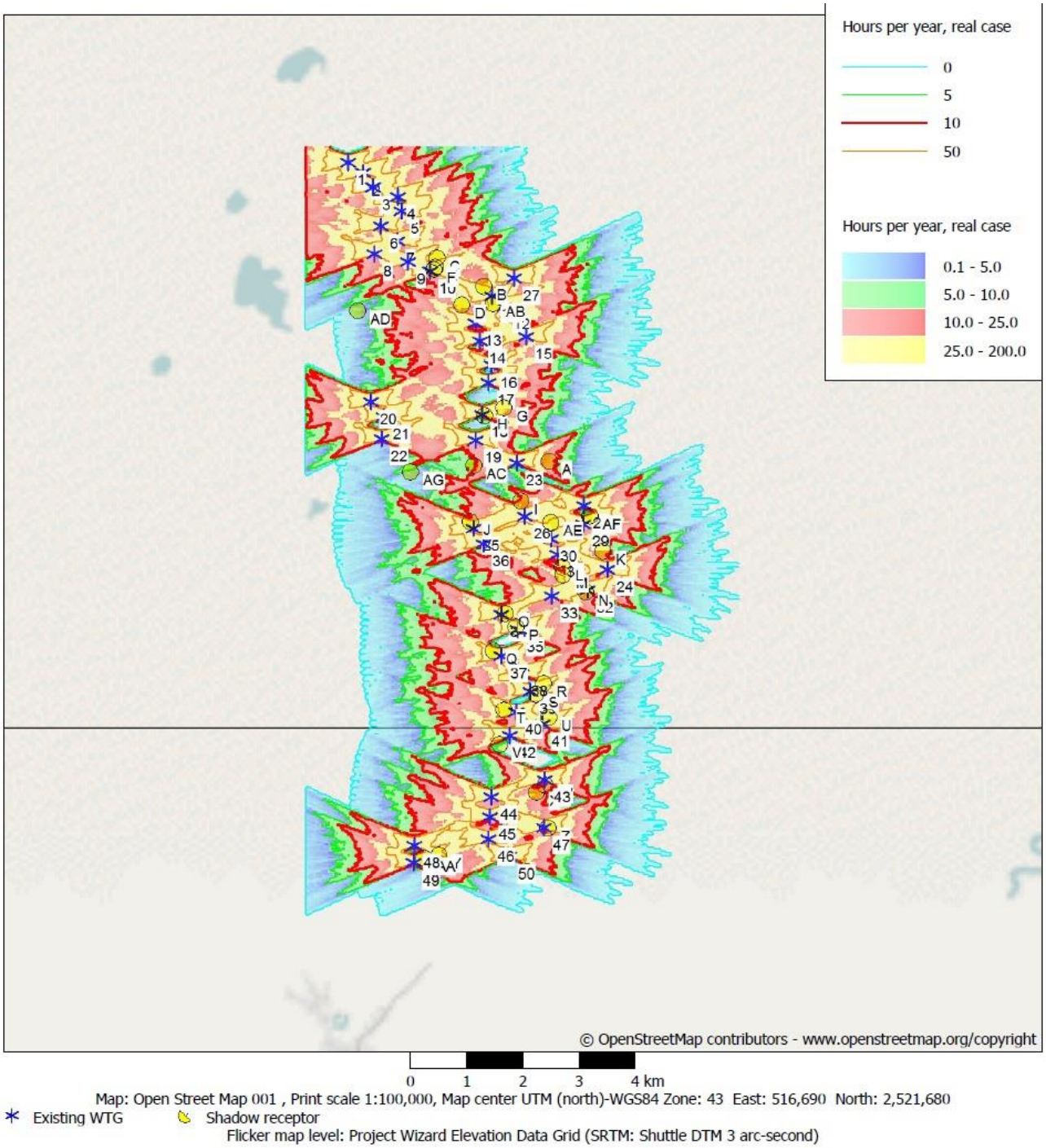
11	BD39	41SR	R	Semi-permanent house Occupants : 10 Occupant: Bhagirath Muniya Residing since last 8 years	Panda	517,082	2,519,032	93:37:00	282m	
12	BD40	43SR	T		Panda	516,366	2,518,573	82:12:00	229m	
	BD41								745m	
13	BD41	44SR	U		Panda	517,170	2,518,426	163:34:00	155m	
	BD42								773m	
14	BD46	50SR	Z	Semi-permanent house Occupants : 12 Occupant: Janki Bai Residing since last 70 years	Khiledi	517,157	2,516,469	60.13	1.09km	
	BD47								0.08Km	
	BD48								2.41km	
	BD49								2.51km	
15	BD49	24+27SR	AA	Pakka house Occupants : 5 Occupant: Kailash Nimana Residing since last 5 years	Borjhadi and Indrawal	514,935	2,515,934	100:39:00	212m	
	BD50								1.5km	
16	BD12	11+12SR	AB		Indrawal	516,170	2,525,792	89:39:00	201m	
17	BD25	30+31SR	AF	Brick house Occupants : 6 Occupant: Dhanna Lal	Indrawal	517,902	2,522,010	123:09:00	2.1km	
	BD26								1.2km	
	BD29								200m	

BD30			Residing since last 20 years					831m	2.0km	
BD52										

* Representative receptors indicating settlement/villages

The shadow flickering map is shown below in **Figure 6.2**

Figure 6-2 Shadow Flickering map



Mitigation Measures:

The following site specific mitigation measures have been suggested to reduce the significant impact on nearby communities.

- The impact of shadow flicker has been explained in the above table (Table 6.5) on the sensitive receptors. If these locations are unavoidable then following mitigation measures can be used to

control the impact:

- Provide curtain and blinds in households with open roof, and windows, doors facing WTGs.
- Undertake plantation to hide shadow flicker near receptors (households) identified with significant impact

Shadow flickering detailed modelling results have been provided in **Appendix P.**

Recommendations:

- Recommendation: Shifting of 17 receptors has been identified in the table 6.5 as one of the options. If shifting is not possible, adequate mitigation measure like planting and maintaining of shade providing tree is recommended.
- It is recommended that CWP-RATLAM should formulate a complaint resolution procedure for the local community so that any issues or concerns associated with shadow flicker are reported to the site staff. CWP-RATLAM will ensure that appropriate and timely action is taken in case of receipt of such complaints.
- Moreover, each dweller close to the WTG will be informed about possible negative impacts i.e. noise, shadow flicker, blade throw etc. If the owner is willing to relocate, the structure will be dismantled with mutual agreement and appropriate compensation will be provided as per local/national regulations and in line with IFC PS' physical and/or economic displacement requirements.

Considering all the above points, the impact significance during operation phase can be termed as **"Moderate"**

PHASE	INTENSITY OF IMPACT
Construction phase	Low
Operation phase	Moderate

Electromagnetic Fields:

All electronic devices, power lines, and generating stations produce EMFs. Wind turbines convert wind energy into electricity. The electricity is carried from the turbine by a cable, either underground or overhead, to the main electricity transmission grid for distribution, creating a small magnetic field. When a charged object, such as an animal, crosses the path of this magnetic field, a very small, momentary electric field may be created. There are four potential sources of electric and magnetic fields associated with the wind farm project. These are:

- Transmission line
- Wind turbine generator
- Generator transformer, and
- Underground cable

Though wind power produces EMFs like any other source of power and power transmission there are two major benefits to wind power in respect to safety. Wind turbines are ~85 meters above the ground and therefore the EMF[9] created by the production of energy is generally well above any people who may be in the area.

The electromagnetic fields produced by the generation and export of electricity from a wind farm do not pose a threat to public health. Grid connection is normally made at no more than 132 kilovolts (kV)[10], similar to the

9 Rideout, Karen & Constance Bos. January 2010. Wind Turbines and Health. National Collaborating Centre for Environmental Health. Vancouver, Canada & Sustainable Energy Australia (SEA) Pty. Ltd. The electromagnetic compatibility and electromagnetic field implications for wind farming in Australia. Melbourne and Canberra: Australian Greenhouse Office & Australian Wind Energy Association; 2004 [cited 2009 July 21].

10 The Real Truth about Wind Energy, An Analysis of the Potential Impacts of Wind Turbine Development in Ontario. Sierra Club Canada, June 2010

voltages used by utilities in existing residential distribution networks. In addition, project developers would design the entire electrical system to adhere to applicable state guidelines and industry standards to minimize EMF exposure from any new overhead transmission lines.

The grid connection lines are similar to other power lines and generate low levels of EMF, comparable to those generated by household appliances. Thus, it can be concluded that the electromagnetic fields produced by the generation and export of electricity from a wind farm do not pose a threat to public health.[11]

Blade Throw:

Blade throw is a potential safety hazard which involves dropping of a rotor blade or the blade being thrown from the nacelle of the wind turbine in a high wind zone. The occurrence of blade throw can be due to two types of infrastructure failure:

- The whole blade detaching from the rotor and falling away from the turbine; or
- Part of the blade breaking off and falling away from the turbine;

Occurrences of these two scenarios could be caused by the factors such as:

- Design or manufacturing defect;
- Poor maintenance regime;
- Excessive winds during a storm;
- Exceeding maximum design loads;
- Rotor over-speed; or
- Lightning or fire.

The overall risk of blade throw is considered to be low as occurrence of dust storms in the project area is occasional.

Mitigation Measures

- Mandatory safety standards in turbine design, manufacturing, and installation as well as more frequent maintenance have made the occurrence of blade throw a rare phenomenon. Wind turbines can also be equipped with vibration sensors that can react to any imbalance in the rotor blades and automatically shut down the turbine if necessary, to avoid any chance of blade throw.
- **Approach to relocate the WTG's:** *Approximately 221houses are located within the setback distance of about 220 m. A relocation/resettlement plan has been developed based on ground survey of all these households. This along with other measures (as defined in sections below) will be implemented by the company. Most of this relocation/resettlement is expected to be in situ*

  For the informal settlers located on government lands within the set back area of the WTGs, the company will:
  - Develop and implement a relocation/resettlement plan with the objective to relocate as many people/households as possible within the radius of 150 meters. The plan will be consistent with the relevant and applicable requirements of PS 5.
  - For turbine locations where relocation of all houses is not feasible, the company will undertake a Quantitative Risk Assessment (QRA) to assess the level of safety risks.
  - For turbines locations where the risk is assessed to be higher than As Low As Reasonably Practicable (ALARP), the company will undertake measures with the objective to mitigate the risks so as to bring the risk levels down to ALARP.
  - The company will communicate, to all stakeholders, the risks of living under the turbines. This communication will be an ongoing process and will be documented by the company

11 Evidence Review Wind Turbines and Health: A Rapid Review of the Evidence, National Health & Medical Research Council, Govt. of Australia

The impact due to potential blade throw is expected to be of local spread, long duration and low intensity with mitigation measures and the overall impact is assessed to be insignificant.

PHASE	INTENSITY OF IMPACT
Construction phase	Low
Operation phase	Low

Public Access:

CWP-RATLAM should ensure that the entire wind farm area is not fenced/ barb wired and shall provide access to the movement of livestock in the area for grazing purposes. CWP-RATLAM shall ensure that all the transformers are fenced and locked and cables are insulated to avoid any electrical hazards. Access to turbine tower ladders shall be restricted. The impact on community/ social issues is expected to be of local spread, long duration and low intensity with mitigation measures and the overall impact is assessed to be minor.

6.4.4 Traffic Load

The road from SH31 to Bidwal will be used for movement of trailer trucks carrying WTG parts and other heavy vehicles for the project activity. Village and village roads originating from this road will be utilized during construction and operation phase for vehicular movement and movement of labours and other project materials.

Construction Phase

The vehicular movement in construction phase will be more compared to operation phase. The village roads are well developed but proper access roads needs to be constructed to reach every WTG location. Also as the number of vehicles increases the noise in the surrounding area will increase and generation of dust will also slightly increase in the area. The risk of accidents increases as the construction phase will see movement of vehicles and local people using the same village roads. Although low movement of population in surrounding area due to lack of industrial areas and commercial activities, low traffic was observed on village roads but the movement of public buses and two wheelers were observed to be in good numbers. Addition of construction vehicles on local villagers is going to be of low impact due to shorter period but adequate preventive measures should be taken to mitigate the risks of accidents.

Mitigation Measures:

- During the development of roads and site preparation all the drainage courses should be properly channelized to maintain the drainage pattern of the area.
- If the widths of roads are found to be inadequate for the transport requirements of turbine blades and other large construction equipment's, permission shall be taken from the respective authorities for required widening.
- Signage shall be erected to identify site access routes and to inform motorists that local roads will be accommodating construction traffic.
- Signage warning for the site access junction locations and an advisory speed restriction of 30 km/hr shall be erected.
- Widening and strengthening of the carriageway shall be undertaken where necessary, to accommodate the turbine delivery vehicle wheel tracks.
- When practicable, construction traffic movements (equipment and materials) shall be scheduled to avoid the peak traffic periods at the beginning and end of each day and other sensitive periods, in order to minimize any potential disturbance to local traffic.
- Telegraph poles and overhead cables may be relocated where necessary.
- If any bottlenecks are identified appropriate measures will be taken to avoid congestion due to the project.
- Alternative access routes for the transport of project construction equipment's and wind turbine parts to project site shall be identified whenever necessary.

Operational Phase

In operational phase very few (2-3 nos.) of vehicles will be required for commuting from home to site office therefore impact associated with movement of project vehicles is not anticipated. Vehicular movement in operation phase is negligible. Only maintenance staff and their vehicles are present and hence no significant impact is envisaged.

PHASE	INTENSITY OF IMPACT
Construction phase	Low
Operation phase	No Impact

6.4.5 Communal harmony and Stakeholder Engagement

This probable impact is applicable throughout the project life. The project influenced area is home to communities from various castes, religions and Schedule Tribes.

At any stage of the project, preference and bias towards certain communities over others for labour, business or CSR initiatives could result in communal disharmony. There is Grievance register maintained on site to effectively deal with the communities' concerns, grievances and keep them adequately informed about the project. However, the GRM procedure and plans should be followed as per the recommendations given in **Appendix R** of the report to maintain a healthy relationship between the company and local community.

Mitigation Measures

- To ensure an open and effective communication between the local populations and GAMESA and CWP-RATLAM, a documented grievance redress mechanism must be adopted at the site level for external stakeholders such as the local community.
- Furthermore, the local community must be kept informed of the project and its relevant details, with information disclosure meetings being necessary prior to every major stage of the project.

Land and Land sellers

For the project, revenue land has been obtained on lease for 47 WTG locations and in addition three private agricultural land in Sergarh and Indrawal village have been identified for which the negotiation is under process based on willing to buy and willing to sell basis as per the primary survey. No structures are present on these agricultural or revenue land, therefore there is nil displacement.

During site survey, it was found that locals practise farming on three WTG locations (21,25 and 33), which fall on revenue land as per land records. During consultation, the locals claimed of their "Patta land" at these three locations for which they also claim to submit annual fees to the Revenue Department. However, no documental proof for the same was made available by the claimants. On consultation with Revenue Inspector, as well as after checking the land allotment letter as well as the status of land provided on Bhulekh website of Madhya Pradesh, it was fully confirmed that these are revenue land. Taking these conditions into consideration there seems to be an encroachment issue at these locations.

Local Employment and Procurement

The project will provide direct employment in the form of casual labour, skilled labour, and procurement opportunities primarily during project construction thus helping improvement of local economic conditions. CWP-RATLAM is committed to providing employment to locals in the project, wherever possible. During operation phase, employment and procurement opportunities will be lesser as the manpower requirement would be limited and would majorly involve skilled personnel.

Impact on Cultural/ Archaeological Site

The site does not contain any archaeological monuments or sites as per the Archaeological Survey of India. Open/ Informal place of worship was observed in Sergarh village, which falls under the study area. It is located

at about 300-400m from WTG location no.2 and 3. It was observed that the temple is very popular and holds strong religious importance amongst the local communities. However, the access to the same would not be blocked by the project activity.

No historical and cultural monuments will be affected by the project. Chance find procedure is required to be planned and implemented in case of accidental discovery of artefacts during construction activities.

Mitigation Measures:

- Two seating arrangement can be provided near the entrance
- To prevent visual interference a display board would be provided around the periphery.

Engagement of Local and Migrant Labour : The social impact associated with the engagement of local and migrant labour in the proposed project may give rise to conflict between labour and contractor or developer which in turn may result in suspension of project and reputational risk on project developer.

Mitigation Measures:

- CWP-RATLAM through its contractors should inform the labour about the grievance redressal mechanism by which they can inform about their grievances.
- CWP-RATLAM needs to ensure that labour is being adequately paid by contractors. The contractor should ensure that wages is being paid as per the requirement of Minimum Wages Act, 1948.
- Ensure the compliance of labour law and availability of facilities mentioned by reviewing muster roll, wages register, attendance register through a regular internal EHS audit by CWP-RATLAM.
- CWP-RATLAM through their contractors should generate awareness and training programs about emergency preparedness and communication system to be followed during emergency situation.
- CWP-RATLAM through its contractors should ensure that labours receive training on health and safety issues involved in the proposed project.

PHASE	INTENSITY OF IMPACT
Construction phase	**Low**
Operation phase	**No Impact**

Table 6-7: Impact Aspect Matrix for Construction and Operation Phase

	PHYSICAL ENVIRONMENT									BIOLOGICAL ENVIRONMENT						SOCIO-ECONOMIC ENVIRONMENT						
	Aesthetics and Visual impacts	Air Quality	Noise Quality	Top soil removal / Soil Quality	Land Use / Land	Local Drainage and Physiography	Surface water quality	Ground Water Resources	Ground water quality	Terrestrial habitat	Ecological Sensitive Areas	Aquatic Habitat and resources	Migratory Birds	Agriculture	Domesticated Animals	Loss of land and livelihood source	Common Property Usage Conflict	Local Job and Economic Opportunity	Cultural and Behavioral Conflict	Community Health and Safety	Occupational Health and Safety	Loss of property (house or structure)
A. Construction Phase																						
Land lease/purchase process										M				L		M	M	P				
Sourcing and transportation of construction material etc.	L	M	L	L		L				L							L		M	L	M	
Storage and handling of raw material and debris	L	L		L	L				L											L	M	
Establishment of labour camp and hiring of labour.	L	L	L	L	L			L	L	L							L	P	M		M	
Operation of DG sets		M	L	L	L				L	L										L	L	
Access road construction		M	L	L	L		L	M		L							M	P	M	L	L	
Site Clearance	L	M	L	L	M	L		L								L		P		L	M	
Foundation excavation		M	L	M	M		L	M										P	M	L	M	
Transportation of WTG components to site and storage		M	L	L			L											P	M	L	M	
Erection of WTG's	L	M	L		M			M										P		L	M	
Relocation of houses and structures within setback area of 15 WTGs prior to commissioning	L															L		P				H
Transformer yard construction		M	L	L	M															L	M	
Substation construction			L	M	M															L	M	
Laying of transmission lines	L	L	L	L	L											L	L		L	L	M	
B. Operation Phase																						
Physical Presence at site during routine inspection and operation of all WTG's																						
Periodic maintenance of all WTG's at every location		L	L																		L	

	PHYSICAL ENVIRONMENT									BIOLOGICAL ENVIRONMENT						SOCIO-ECONOMIC ENVIRONMENT						
	Aesthetics and Visual impacts	Air Quality	Noise Quality	Top soil removal / Soil Quality	Land Use / Land	Local Drainage and Physiography	Surface water quality	Ground Water Resources	Ground water quality	Terrestrial habitat	Ecological Sensitive Areas	Aquatic Habitat and resources	Migratory Birds	Agriculture	Domesticated Animals	Loss of land and livelihood source	Common Property Usage Conflict	Local Job and Economic Opportunity	Cultural and Behavioral Conflict	Community Health and Safety	Occupational Health and Safety	Loss of property (house or structure)
Maintenance of ancillary facilities such as store, yard, site office		L			L																	
Inspection of transmission lines																					L	
Security of WTG's in operation																		P			L	
Operation of wind turbines			M										M							M	M	

7.0 ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN

The Environment and Social management Plan specifies measures for addressing the limited negative risks and impacts and for enhancing the beneficial impacts. In addition, organizational capacity and training requirements, required to check and ensure effectiveness of the plan throughout the lifecycle of the project, have also been discussed.

This chapter addresses the requirement of IFC Performance Standard-1 which highlights the importance of managing the social and environmental performance throughout the life of the project. CWP-RATLAM is committed to implement an effective Environmental and Social Management System (hereinafter referred as ESMS) to continuously manage and communicate the potential social and environmental impacts and risks imposed on the project employees (direct and indirect) and the local communities residing in the immediate vicinity of the project area. The outcomes of the Environmental and Social Impact Assessment of the proposed project have been used to formulate a Social and Environmental Management & Monitoring Plan for the project, presented in **Table 7.1**. The Plan specifies measures for addressing the limited negative risks and impacts and for enhancing the beneficial impacts. In addition, organizational capacity and training requirements, required to check and ensure effectiveness of the plan throughout the lifecycle of the project, have also been discussed.

7.1 Training of Personnel & Contractors

CWP-RATLAM should ensure that the job specific training and EHS Induction training needs are identified based on the specific requirements of ESMS and existing capacity of site and project personnel (including the contractors and sub-contractors). Special emphasis shall be placed on traffic management, operation of cranes, stakeholder's engagement and grievance redressal. General environmental awareness shall be increased among the project's team to encourage the implementation of environmentally sound practices and compliance requirements of the project activities. This will help in minimizing adverse environmental impacts, ensuring compliance with the applicable regulations and standards, and achieving performance beyond compliance. The same level of awareness and commitment shall be imparted to the contractors and sub-contractors prior to the commencement of the project.

An environmental and social management training programme shall be conducted to ensure effective implementation of the management and control measures during construction and operation of the project. The training programme shall ensure that all concerned members of the team understand the following aspects:

- Purpose of action plan for the project activities;
- Requirements of the specific Action Plans
- Understanding of the sensitive environmental and social features within and surrounding the project areas; and
- Aware of the potential risks from the project activities.
- A basic occupational training program and specialty courses shall be provided, as needed, to ensure that workers are oriented to the specific hazards of individual work assignments.
- Training shall be provided to management, supervisors, workers, and occasional visitors to areas of risks and hazards.
- Workers with rescue and first-aid duties must receive dedicated training so as not to inadvertently aggravate exposures and health hazards to themselves or their co-workers.
- Through appropriate contract specifications and monitoring, the employer shall ensure that service providers, as well as contracted and subcontracted labour, are trained adequately before assignments begin.

7.2 Monitoring

In order to implement the ESMP, the on-site team should adhere to a time-bound and action-oriented Environmental and Social Action Plan to implement the mitigation measures provided for each of the

identified environmental and social impacts. This ESMP should be monitored on a regular basis, y and all outcomes would need to be audited in accordance with existing EHS commitments.

The monitoring process should cover all stakeholders including contractors, labourers, suppliers and the local community impacted by the project activities and associated facilities thereby increasing the effectiveness of suggested mitigations measures. CWP-RATLAM should ensure that all the contractors comply with the requirements of conditions for all applicable permits, suggested action plans and scheduled monitoring. The inspections and audits should be carried out by an internal trained team and external agencies/experts. The entire process of inspections and audits shall be documented and key findings of which should be implemented by the proponent and contractors in their respective areas.

7.3 Documentation & Record Keeping

Documentation and record keeping system has to be established to ensure updating and recording of requirements specified in ESMP. Responsibilities have to be assigned to relevant personnel for ensuring that the ESMP documentation system is maintained and that document control is ensured. The following records should be maintained at site:

- Documented Environment Management System;
- Legal Register;
- Operation control procedures;
- Work instructions;
- Incident reports;
- Emergency preparedness and response procedures;
- Training records;
- Monitoring reports;
- Auditing reports; and
- Complaints register and issues attended/closed

Table 7-1: Environment and Social Management Plan

S. N	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
CONSTRUCTION PHASE							
A	**Environmental Management Plan**						
1	**LANDSCAPE AND VISUAL**	Visual and landscape impacts due to presence of elements typical of a construction site such as equipment and machinery.	**LOW**	• Ensure the construction site is left in an orderly state at the end of each work day • Construction machinery, equipment, and vehicles not in use should be removed in a timely manner to the extent possible • Proper handling of waste streams	**NO IMPACT**		Contractor under the supervision of CWP-RATLAM's Personnel
2	**GROUND WATER ABSTRACTION**	The total water requirement is high, the region as per CGWB falls in "over-exploited" zone and hence the impact is envisaged.	**MODERATE**	• The water should be sourced from authorised sources who have taken prior approval from CGWB.	**LOW**	Maximum efforts should be made to reuse and recycle water to reduce water consumption.	Project Developer/ Contractor under the supervision of CWP-RATLAM's Personnel
3	**GROUND WATER QUALITY**	• Possibility of contaminated runoff from the site entering the nearby water bodies. • Domestic water runoff from the portable toilets into neighbouring water bodies can lead to degradation of water quality.	**LOW**	• Drip pans shall be provided with vehicles with leaks to prevent soil contamination; • Storage of oil shall be undertaken on paved impervious surface and secondary containment shall be provided for fuel storage tanks • Adequate drainage of road based on road width, surface material, compaction and maintenance • Leak-proof holding tanks for sanitary waste water should be constructed to protect the shallow ground water level. • Waste water holding tanks / septic tank should be located at more than 500 m away from bore wells or any other underground water holding tanks. • It should be ensured that the waste water does not find its way into surface waters or water wells.		• Machinery and vehicles shall be thoroughly checked for the presence of leaks if any; • Leakage of vehicles to be checked; • Storage of oil on site to be checked	
4	**AIR QUALITY**	• Fugitive Dust due to movement of project vehicles • Emission from Diesel Generators	**MODERATE**	• Vehicles speed to be restricted to 20-30 km/hr. on unpaved road. This will reduce dust emission • Raw material should be covered with tarpaulin sheet during transportation and in storage area • Practices water sprinkling wherever required on unpaved area but ensure use of tanker water purchased form authorized vendor only • All the project vehicles shall have valid PUC certificate • Ensure regularly maintenance of project vehicles during construction and operational phase • Turn off the DG sets & machineries which are not in use • DG sets preferably should be placed away from settlement area.	**LOW**		Project Developer/ Contractor under the supervision of CWP-RATLAM's Personnel

S. N	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• It will be ensured that exhaust emissions of construction equipment adhere to emission norms as set out by MoEFCC/ CPCB.			
5	**SOIL QUALITY**	Top Soil Loss	**LOW**	• Provide appropriate storage of top soil in an isolated and covered area to prevent its loss in high wind and runoff. • Allow only covered transportation of top soil within project site. • Use top soil at the time of plantation • Construction debris shall be reused in paving on site approach road to prevent dust generation due to vehicular movement • Re-vegetation shall be done in the area after the completion of construction, in order to reduce the risk of soil erosion	**NO IMPACT**	• The workforce shall be sensitized to handling and storage of hazardous substances viz. fuel oil, machine oil/fluid etc. • The workers engaged in handling hazardous substances shall be briefed about the possible hazards and the need to prevent contamination.	Project Developer/ Contractor under the supervision of CWP-RATLAM's Personnel
		Soil Contamination		• In case of any accidental spill, the soil will be cut and stored securely for disposal with hazardous waste. • Store hazardous material (like used oil) in isolated room with impervious surface. • Filling and transfer of oil to and from the container shall be on impervious surface. • Waste disposal grounds that are in use by the local people should be identified and permission from local administration for use of the same needs to be obtained for disposing domestic wastes. • Hazardous wastes, when accumulated, should be disposed to facilities registered with the Central Pollution Control Board.			
6	**NOISE LEVEL**	• Disturbance to habitants • Vehicular noise from heavy vehicles utilized to deliver construction materials and WTG parts • Noise from DG sets • Construction noise from using mobile equipment, cranes and concrete mixing	**LOW**	• Regular maintenance of construction machinery and equipment shall be carried out to ensure noise emissions are maintained at design levels. • Integral noise shielding to be used where practicable and fixed noise sources to be acoustically treated, for example with silencers, acoustic louvers and enclosures. • Keep stationary source of noise such as DG sets (during construction phase) at farthest point from the settlements • Restrict major noise generating activities during night time 10:00 pm to 6:00 am • Provide personal protective equipment to workers working near DG sets and other high noise source. • Local communities need to be informed about the vehicular movement before start of heavy vehicle carrying materials and machines to site. Sensitive locations should be identified and avoided as far as possible from the route and if unavoidable, drivers should be informed to restrict speed at those locations. • Diesel generator sets, if used; will adhere to noise standards of MoEFCC.	**NO IMPACT**	It will be ensured that noise emissions of construction equipment adhere to emission norms as set out by MoEFCC/CPCB	Project Developer/ Contractor under the supervision of CWP-RATLAM's Personnel

S. N	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
7	**HAZARDOUS WASTE**	Contamination of land and soil	**LOW**	• Hazardous materials like waste oil, used oil should be stored at designated locations in enclosed structures over impermeable surface. • Maintain a register of all hazardous materials used and accompanying MSDS must present at all times. • Spilled material should be tracked and accounted for. • The hazardous materials stored at the construction site like acetylene cylinders, petroleum, spirit, diesel, lubricating oil, paints etc. shall be stored as per the statutory provisions of Manufactures, Storage and Import of Hazardous Chemicals Rules. 1989 under the Environment (Protection) Act, 1986	**NO IMPACT**	Periodic EHS audits should be conducted to monitor the use of hazardous materials and its inventory maintained	Project Developer/ Contractor under the supervision of CWP-RATLAM's Personnel
8	**SOLID WASTE**	Contamination of land	**LOW**	• Distribute appropriate number of properly contained litter bins and containers properly marked as "Municipal Waste". • Domestic and construction waste like recyclables viz. paper, plastic, glass, scrap metal waste etc. will be properly segregated and stored in designated waste bins/containers and periodically sold to local recyclers	**NO IMPACT**	Periodic EHS audits should be conducted to monitor the same	Project Developer/ Contractor under the supervision of CWP-RATLAM's Personnel
9	**CHANGE IN LOCAL TOPOGRAPHY**	Alteration in natural drainage pattern	**LOW**	• Don't allow the considerable alteration of contour level • Provide alternatives to collect surface runoff from the project site during the monsoon period • Don't allow exit of runoff from the project site in the adjacent areas. • Site preparation activities should be designed to avoid any significant elevation of the land or blocking or altering natural drainage channels in the project site. • Site preparation and development shall be planned only after a detailed drainage plan has been prepared for site. • If channels/drains get blocked due to negligence, it will be ensure that they are cleaned especially during monsoon season.	**NO IMPACT**	The drainage patterns of the area will be maintained.	Project Developer/ Contractor under the supervision of CWP-RATLAM's Personnel
10	**ECOLOGY**	• The construction activities may lead to loss of vegetation resulting in displacement of wildlife species. • Disturbance to local livestock population	**LOW**	• The site clearance for tower erection, access road and ancillary facilities shall be restricted to the necessary footprint area around WTG. • The primary survey revealed that the land use pattern of project site is mostly agricultural and the habitat was " modified". No endangered flora and fauna species were recorded in the study area. Baseline primary survey was conducted to establish the presence of avifauna and bat. The presence of bat in the study area could not be established. The avifauna population was also limited. • The crane staging area, intervening areas, overhead clearance for suspended turbine components shall be planned in such a way that minimum tree felling is required; • Contractors should ensure that labour colonies are not set up in the regions where faunal species are commonly found; • In order to avoid deterioration of water quality and to prevent release of pollutants into the water body by the workers, project proponent should provide adequate sanitation facilities and garbage disposal bins in the labour camp.	**NO IMPACT**	The entire workforce shall be sensitized (by the construction contractor) to possible adverse ecological impacts during the construction phase by conducting awareness programs	Project Developer/ Contractor under the supervision of CWP-RATLAM's Personnel

S. N	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• Sign boards on the roadside should be installed and strict regulations on speed limits should be imposed to control the road kills of animals during transportation of materials			
11	**BIODIVERSITY**	Site development will lead to the loss of mainly herbaceous species	**LOW**	• Care should be taken to install the wind turbine in non-monsoon season and special precautions will be taken to minimize sediment run-off during the rainy days. • Excavated soil should be kept in bund walls to protect sediment run-off during rainy days especially near water body and areas with natural slope; • Store topsoil and other soil separately in designated areas of the construction compounds, in such a way that it is not mixed with subsoil or trafficked on by vehicles; • To limit the disturbance of soil structure, humus/topsoil layers has been separated from the infertile deposits to use it correctly after completion of works; • Care should be taken towards deciding the approach road, it should not be an obstruction to micro drainage channels near water body, local drainage should not be blocked. The land use pattern of project site is mostly agricultural and the habitat was “modified”. No endangered flora and fauna species were recorded in the study area. Baseline primary survey was conducted to establish the presence of avifauna and bat. The presence of bat in the study area could not be established. The avifauna population was also limited. However, the mortality on avifauna during the operational period cannot be ruled out. • Green area is proposed in the area. Plantations along the approach roads, site office is one of the preferred methods to not only increase the green cover of the area but also serve as a sink for air pollutants	**NO IMPACT**	Periodic EHS audits should be conducted to monitor the same	Project Developer/ Contractor under the supervision of CWP-RATLAM's Personnel
B	**Social Management Plan**						
1	**ENGAGEMENT OF LOCAL AND MIGRANT LABOUR**	Conflicts between labour and contractor	**MODERATE**	• Employment will be provided to local people wherever possible, especially as unskilled construction workers and security guards • CWP-RATLAM should include clause or provisions related with non-engagement of forced and child labour, gender equity, non-discrimination on employment and opportunity and freedom to express their view in contractors agreement and HR policy • CWP-RATLAM through its contractors should ensure that labour is being adequately paid by contractors. Also ensure that wages is being paid as per the requirement of minimum wages act • CWP-RATLAM shall conduct internal audits as when required to monitor the performance of contractor. • CWP-RATLAM through the contractor inform the labour about emergency preparedness plan and communication system to be followed during emergency situation	**LOW**	Periodic EHS audits should be conducted to monitor the same	Project Developer/ Contractor under the supervision of CWP-RATLAM's Personnel

S. N	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• CWP-RATLAM through contractor should ensure that labour receive training on health and safety issues involved in the proposed project.			
2	**LABOUR ACCOMMODATION (Onsite and offsite Labour camp)**	Conflicts between labour and local community	**MODERATE**	• CWP-RATLAM to setup onsite labour camp for labours employed through contractors to restrict the interaction of migrated labour with local community as to avoid any conflict.	**LOW**	Grievance Redressal mechanism should be followed and monitored	Project Developer/ Contractor under the supervision of CWP-RATLAM's Personnel
3	**SOCIAL/LIVELIHOODS**	• ROW for transmission lines • Obstruction to places of relevance	**MODERATE**	• The layout for access roads and transmission lines shall consider minimum land requirement and shall avoid procurement of agricultural land; • The project management shall undertake a formal consultation with all Farmers from whom right of way shall be obtained, gain an informed consent • Site Management should ensure that all agreements will be executed properly and documented • The access road to the turbines shall not obstruct the access to the religious structure in any way • Any waste generated during the construction phase should not be accumulated near the religious structure as this might affect the sentiment of the locals • Implement the recommended complaint resolution procedure (Grievance Redress Mechanism) to assure that any complaints regarding project related components are promptly and adequately investigated and resolved .	**LOW**	• Construction contractors shall adhere to social obligations, labour laws and international commitments • CWP-RATLAM, through contract agreement, shall ensure that The contractor shall provide the migrant workers adequate information on expected social behaviour and hygiene practices to be followed at site • Water usage shall be monitored and controlled to minimize the wastewater generation • CWP-RATLAM, to ensure that all site personnel and migrant labourers avoid using any community infrastructure facilities like water bodies, electricity etc., without prior permission from the Panchayats	Project Developer/ Contractor under the supervision of CWP-RATLAM's Personnel Social Management team for grievance Handling
4	**RELOCATION OF HOUSEHOLDS/STRUCTURES BASED ON QRA STUDY BEFORE COMISSIOINING OF WTGs**	Loss of property (house)	HIGH	• Approximately 221 houses are located within the setback distance of about 220 m from 15WTGs. A relocation/resettlement plan has been developed based on ground survey of all these households. Most of this relocation/resettlement is expected to be in situ • For turbine locations where relocation of all structures/people is not feasible (for both within a setback area of 150 & 220 meters), CWP-RATLAM will undertake a Quantitative Risk Assessment (QRA) to assess the level of safety risks. For turbines locations where the risk is assessed to be higher than As Low As Reasonably Practicable (ALARP), CWP-RATLAM will undertake measures with the objective to mitigate the risks so as to bring the risk levels down to ALARP. These measures will consist of a number of options as suggested by third party appointed to carry out QRA, based on the risk levels quantified to minimize the safety risks. These would include (but not be limited to) strengthening of foundations/hub, enhanced monitoring/inspection, on-	**LOW**	• Implement the recommended complaint resolution procedure (Grievance Redress Mechanism) to assure that any complaints regarding project related components are promptly and adequately investigated and resolved. • The company will communicate, to all stakeholders, the risks of living under the turbines. This communication will be an ongoing process and will be documented by the company	Project Developer/ Contractor under the supervision of CWP-RATLAM's Personnel Social Management team for grievance Handling

S. N	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				going communication, relocation of turbines/ people and other measures (included in the ESIA). • The decision tree for the selection of the mitigation measures and the outcome of the risk assessment (pre and post-mitigation) will be documented. •			
5	**COMMUNITY ENGAGEMENT**	Community empowerment	**MODERATE**	• Given the short duration of the Project construction phase efforts will be made to engage with the community through the Panchayati Raj Institution representatives and key identified leaders of the community.	**LOW**	• Continuously throughout the project lifecycle. • Grievance Redressal Mechanism should be followed and grievance register should be maintained onsite.	Contractor under the supervision of CWP-RATLAM's Personnel / PRI representatives
6	**OCCUPATIONAL HEALTH AND SAFETY**	• Material handling and storage • Possible injuries associated with working at height (≥ 2m • Other occupational hazards	**MODERATE**	• All material will be arranged in a systematic manner with proper labelling and without protrusion or extension onto the access corridor. • Loading and unloading operation of equipment shall be done under the supervision of a trained professional • All work at height to be undertaken during daytime with sufficient sunlight • Proper PPEs shall be provided to workers handling welding, electricity and related components. • Fire extinguishing equipment shall be provided in adequate number on site to handle any possible fire outbreaks • An accident reporting and monitoring record should be maintained • Display of phone numbers of the city/local fire services, etc. at site should be done • The labour engaged for working at height shall be trained for temporary fall protection devices	**LOW**	• The labour engaged for working at height shall be trained for temporary fall • All the workers shall be made aware of the possible occupational risks/hazards by the way of an OHS training/awareness programme • An accident reporting and monitoring record should be maintained	Contractor under the supervision of CWP-RATLAM's Personnel
7	**CORPORATE SOCIAL RESPONSIBILITY**	Community empowerment	**MODERATE**	Employment will be provided to local people wherever possible, especially as unskilled construction workers and security guards	**NO IMPACT**	CSR Activities should be documented	Project Developer/ Contractor under the supervision of CWP-RATLAM's Personnel
				Developmental needs and expectations (such as employment in the project or up-gradation of educational health care facilities, cultural property and infrastructure) of local communities will be identified through the Gram Panchayat, villagers and local administration.		Should be conducted continuously through the project cycle.	CWP-RATLAM's Personnel
				Opportunities for contributing to the economic and developmental needs of villagers through skill training will be explored.		Should be conducted continuously through the project cycle.	CWP-RATLAM's Personnel
OPERATION PHASE							
A. ENVIRONMENT MANGEMENT PLAN							

S. N	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
1	**AMBIENT NOISE LEVELS**	Noise generation due to operation of wind turbines.	**MODERATE**	• Wind turbines shall be designed in accordance with the international acoustic design standards • Proper and regular maintenance of the WTG's • Implement the recommended complaint resolution procedure (Grievance Redress Mechanism) to assure that any complaints regarding operational noise are promptly and adequately investigated and resolved; • Roof packages shall also be provided to the residents who are having non RCC roofs. • Adequate noise control measures (e.g. double glazed windows, acoustic treatment for the walls and roof) shall be provided for the households located within 220 m of Wind Turbines in order to achieve compliance with ambient noise standards in the houses. . • In case of complaints of high noise levels from inhabitants of nearby settlements, possibility of putting noise barriers such as development of green belt plantation between source and receptors should be considered as a long term mitigation measure. • Long term monitoring of noise level should be carried out during high wind season at all identified receptors	**LOW**	Undertake ambient noise level monitoring on in order to understand the increase in noise levels due to the project operation	GAMESA / CWP-RATLAM Personnel
2	**BIODIVERSITY**	• Bird Collision • Modification of habitat	**MODERATE**	• Adequate space between each turbine shall be provided; • Daytime visual markers on transmission lines; • Visibility enhancement objects such as marker balls, diverters on transmission lines; • The land use pattern of project site is mostly agricultural and the habitat was " modified". No endangered flora and fauna species were recorded in the study area. Baseline primary survey was conducted to establish the presence of avifauna and bat. The presence of bat in the study area could not be established. The avifauna population was also limited. However, the mortality on avifauna during the operational period cannot be ruled out. Birds and bat mortality survey in operation stage of wind power project shall be conducted (at least in particular at Shergarh area, around Shergarh reservoir, Chandoliya and Barkhera Ponds) to assess the mortality of bird and bats of the area from the WTGs; • In case of high mortality of birds or bats (if established from the post-operational bird & bat carcass and scavengers removal estimations) measures to reduce the possibility of collisions shall be adopted e.g. reducing the speed of the turbines, switching off some of the turbines under certain meteorological conditions and seasons of the year or the system which emits warnings signals to dissuade birds. Client should keep track of the latest solution to mitigate impact of wind turbines on birds and bats so as to choose the best option. • Any dead animals/carcass shall be removed in time from the site so that it does not attract movement of raptors;	**LOW**	Bird and bat monitoring study should be conducted per season for one year.	CWP-RATLAM personnel

S. N	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• Towers be regularly checked to avoid any nesting in any suitable gaps or platforms.			
3	**SHADOW FLICKER AND BLADE THROW HAZARD**	Disturbance to nearby community due to shadow flickering caused by wind turbines Injury due to accidental blade throw	**MODERATE**	• Provide curtain and blinds in households with open roof, and windows, doors facing WTGs. • Undertake plantation to hide shadow flicker near receptors (households) identified with significant impact • Recommendation: Shifting of 17 receptors has been identified in the table 6.5 as one of the options. If shifting is not possible, adequate mitigation measure like planting and maintaining of shade providing tree is recommended. • Residents located within the narrow bands will be informed about possible negative impacts from shadow flicker, blade throw etc. • Equip wind turbines with vibration sensors that can react to any imbalance in the rotor blades and shut down the turbine if necessary. • Regularly maintain the wind turbine. • Use warning signs shall be put to alert the public at risk.	**LOW**	Necessary procedure will be followed and records will be maintained for consultations, essential documents, compensation benefits etc.	GAMESA / CWP-RATLAM Personnel
B	**SOCIAL MANAGEMENT PLAN**						
1	**COMMUNITY HEALTH AND SAFETY**	• All WTGs shall be located away from habitations • Visual Aesthetics and Blade Glint • Electromagnetic Field (EMF) interference	**MODERATE**	• Reducing the occurrence of impacts due to blade glint by application of non-reflective paints • Ensuring absence of any auxiliary structures except the required ones such as access roads and transformer yards which accompany the turbines • Implement the recommended complaint resolution procedure (Grievance Redress Mechanism) to assure that any complaints regarding blade glint are promptly and adequately investigated and resolved • Adequate noise control measures (e.g. double glazed windows, acoustic treatment for the walls and roof) shall be provided for the households located within 220 m of Wind Turbines in order to achieve compliance with ambient noise standards in the houses. . • In case of complaints of high noise levels from inhabitants of nearby settlements, possibility of putting noise barriers such as development of green belt plantation between source and receptors should be considered as a long term mitigation measure. • Provide curtain and blinds in households with open roof, and windows, doors facing WTGs. • Undertake plantation to hide shadow flicker near receptors (households) identified with significant impact. • Shifting of 17 receptors has been identified as one of the options. If shifting is not possible, adequate mitigation measure like planting and maintaining of shade providing tree is recommended.	**LOW**	Complaint Register should be maintained and grievances registered and timely action should be taken	GAMESA / CWP-RATLAM personnel Social Management Team for Grievance Handling
2	**OCCUPATIONAL HEALTH AND SAFETY OF WORKERS**	• Electrocution • Firing due to short-circuit	**MODERATE**	• Provide and ensure wearing of personal protective equipment's viz., gloves, helmets, ear plug, safety belt etc.	**LOW**	Periodic EHS audits	GAMESA / CWP-RATLAM EHS officer

S. N	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
		• Possible injuries associated with working at height Diseases due to unhygienic condition		• Ensure effective work permit system for critical activities such as electrical work and working at height • Prepare emergency communication system and emergency preparedness plan • Ensure proper sanitation facilities.			
6	**SOCIAL WELFARE**	Dissatisfaction among locals due to project operation	**MODERATE**	• Maximum employment will be provided to local people, especially as security guards wherever possible on need basis. This should be incorporated in the agreements with contractors and the local employment and procurement policy. • A Community Development Plan shall be prepared to address community needs and improve social conditions of the local. • Grievance Redressal Mechanism shall be prepared and implemented to address communities concerns and resolve conflicts if any. • Stakeholder Engagement Plan for engaging and communicating with various stakeholders (local communities, concerned Government and regulatory bodies, lenders/financial institutions etc.) • Typical communication mechanism with various stakeholders include but not limited to: • Consultations with community members and key stakeholders through all the phases of the project • Building trust among the community members and other stakeholders for successful implementation of the project as well as community development plan • Role of CWP-RATLAM in development activities of the villages and its commitment towards the community development programs need to be clearly defined as community members, village level institutions and local government department may have expectations from CWP-RATLAM. • The local, state level and the central governments have many existing/ongoing development programs for up-liftment of village communities. In such cases the project need not duplicate the efforts, rather the community development programs can be dove tailed into ongoing government programs • The community development plan should be able to yield long-term benefits to the community members. • The community development plan would initially be targeted to villages close to project site	**LOW**	Periodic EHS audits	GAMESA / CWP-RATLAM EHS officer

7.4 Environmental and Social monitoring plan

The Environmental Monitoring Plan is formulated to ensure and demonstrate compliance with the Regulatory and Institutional Agency's EHS requirements. Monitoring of environmental and social parameters and comparing them with benchmarks set by regulatory and institutional authorities will help CWP-RATLAM assess the environmental performance and identify gaps or non-conformance ensuring immediate actions. The following environmental parameters (**Table 7.2)** will be monitored as when required during project operational phase for compliance.

Table 7-2: Environment and Social Monitoring Plan

A. Environmental and Social Performance Monitoring

EPI No.	Environmental and Social Performance Indicator (ESPI)	Monitoring Parameter	Location	Period & Frequency
A.	**CONSTRUCTION PHASE**			
A1	Air emissions from vehicles and machineries	CO, HC based on emission factors % of vehicles possessing valid PUCC Certificates	Exhausts	Once during construction phase
A2	Dust generated from site clearance / levelling	Visual observation of dust generation	Site & approach road	Once during site preparation
A3	Noise emissions from vehicles and machineries	Noise pressure level in dB(A) Compliance with CPCB noise limits specified for DG sets. Check for valid certificates of Type Approval and also valid certificates of Conformity of Production for equipment's particularly DG sets.	Near noise sources (5m)	Once during construction phase
A4	Gaseous pollutant emissions from DG Set	Pollutant concentrations in gaseous emissions and maintenance parameters (air, fuel filters & air-fuel ratio) of DG sets influencing air emissions. Emission rates of PM, NOx, SOx, CO, HC based on emission factors	DG Stack	Once during construction phase
A5	Sourcing of water	Volume of water sourced and consumed for construction work	Sourcing and usage areas	Daily during construction phase
A6	Fugitive emissions from handling and storage of raw materials	Visual observation	Material stockpiles	Daily during construction phase
A7	Community health and safety	Complaints registered by the local communities No. of. Accidents reported if any.	Grievance Records Safety Records	Monthly during construction phase.
A8	Relocation	Mutually agreed compensation shall be paid To ensure implementation of GRM and resolution of disputes	Set back area of WTGs no- 10,11, 18, 26, 29, 31, 32, 34, 35, 37, 39, 43, 47, 50	Prior to commissioning of WTGs
A9	Occupational health and safety	To ensure no encroachment in setback area (150m -220 m)	Medical records	Monthly during construction phase

EPI No.	Environmental and Social Performance Indicator (ESPI)	Monitoring Parameter	Location	Period & Frequency
		Sanitation status of labours working during construction phase	Onsite records	
		Potable nature of drinking water viz. coliform, pH, TSS, Residual chlorine	Drinking water storage tanks	
		Usage of proper PPEs Safety performance indicators viz. LTIs. Near misses, fatalities etc.	Construction site	Daily during construction phase
A10	Landscape Development	No of saplings planted	Landscape area	Monthly during construction phase
		% of total plant area covered under green belt		
A11	Disposal of sewage	Visual observation of leaks, overflows and odour problems if any.	Septic tank and soak pits	Daily during construction phase
A12	Surface run-off discharge	Visual observation of water logging due to drainage disruption	Areas abutting construction site	In the event of storm/floods during construction
		CPCB Inland Water Discharge Parameters	Discharge point	
A13	Domestic waste generation, storage, handling and disposal	Quantity of waste generated and recycled Visual observation of waste segregation and storage conditions viz. usage of labelled and covered bins, insect repellents etc.	Waste generating areas viz. canteen, site office.	Weekly during construction phase
		Awareness level of onsite workers	Workers involved in waste handling and storage	
A14	Hazardous chemicals and waste storage, handling and disposal	Quantity of fuel consumed	Chemical and fuel storage and consumption areas	Daily during construction phase
		Visual observation of fuel and chemical storage conditions viz. presence of spill kits, drip trays, fire extinguisher		
		Quantity of waste oil and other hazardous waste generated and recycled to registered recyclers Awareness level of onsite workers	Hazardous waste storage areas Workers involved in waste handling and storage	Weekly during construction phase
B.	**OPERATIONAL PHASE**			
B1	Noise generated from operation of wind mill	Noise pressure level in dB(A)	Near noise sources (5m)	Once in a year
		Maintenance parameter check with respect to noise attenuation and control	Noise generating equipment	As per supplier manual

EPI No.	Environmental and Social Performance Indicator (ESPI)	Monitoring Parameter	Location	Period & Frequency
B2	Surface run-off discharge	Visual observation of water logging due to any possible drainage disruption	Areas abutting plant site	In the event of storm/floods during construction
		CPCB Inland Water Discharge Parameters and Effluent Standards of IFC Thermal Power Plant EHS Guidelines	Discharge point	
B3	Domestic waste generation, storage, handling and disposal	Quantity of waste generated and recycled Visual observation of waste segregation and storage conditions viz. usage of labelled and covered bins, insect repellents	Waste generating areas viz. canteen, site office etc.	Monthly during operational phase
		Awareness level of operational workforce	Workforce involved in waste handling and storage	
B4	Hazardous chemicals and waste storage, handling and disposal	Visual observation of chemical storage conditions viz. presence of spill kits, drip trays, fire extinguisher, display of MSDS	Chemical and fuel storage and consumption areas	As per Rule
		Quantity of waste oil and other hazardous waste generated and recycled to registered recyclers Awareness level of operational workforce	Hazardous waste storage areas Workforce involved in waste handling and storage	As per Rule
B5	Community health and safety	**Blade throw** No. of. Accidents to be reported **Discomfort due to noise** -Complaints registered by the local communities In case of complaints of high noise levels from inhabitants of nearby settlements, possibility of putting noise barriers such as development of green belt plantation between source and receptors should be considered as a long term mitigation measure. **Shadow Flicker impact** Complaints received from the communities .Mitigation include Provision of curtain and blinds in households with open roof, and windows, doors facing WTGs as well as undertake plantation to hide shadow flicker near receptors (households) identified with significant impact	Grievance Records Safety Records	Detailed study of shadow flickering, noise and blade throw incidents should be conducted as according to complaints received
B6		Health surveillance of workers	Medical records	

EPI No.	Environmental and Social Performance Indicator (ESPI)	Monitoring Parameter	Location	Period & Frequency
	Occupational health and safety			Monthly during operational phase
		Sanitation status of onsite office building and canteen	Office building maintenance records	
		Potable nature of drinking water viz. coliform, pH, TSS, Residual chlorine	Drinking water storage tank	
		Usage of proper PPEs Safety performance indicators viz. LTIs. Near misses, fatalities	Operational sites	Daily during operational phase

B. Environmental Quality Monitoring

EQI No	Environmental Quality Indicator (EQI)	Monitoring Parameter	Location	Period & Frequency
A.	**CONSTRUCTION PHASE**			
A1	Ambient Air Quality	Measurement of $PM_{2.5}$, SOx, NOx, CO	Nearest receptor viz. villages, schools, ecological habitat	Once during construction phase
A2	Ambient Noise quality	Measurement of Noise Pressure Level in dB(A)	Nearest receptor viz. villages, schools, ecological habitat	Once during construction phase
A3	Ground Water quality	IS 10500 parameters	Nearby villages	Once during construction phase
A4	Surface Water quality	IS 10500 parameters	Nearby surface water body	Once during construction phase
A5	Soil Quality	Soil parameters viz. pH, SAR, Water holding capacity, Conductivity, Organic Carbon, NPK	Abutting village land & project site	Once during construction phase
B.	**OPERATIONAL PHASE**			
B1	Ambient Noise quality	Measurement of Noise Pressure Level in dB(A)	Nearest receptor viz. villages, schools, ecological habitat	Once in a year
B2	Ecological environment	(i). Bird and Bat carcass and scavengers removal estimation survey	At shergarh and Shergarh reservoir, Chandoliya and Barkhera pond areas	Monthly once

EQI No	Environmental Quality Indicator (EQI)	Monitoring Parameter	Location	Period & Frequency
		(ii). Once the mortality is established, a detailed study shall be undertaken		1 year

7.5 Environmental Management Plans

The ESMP is comprised of some site specific management plans viz. Emergency Management Plan, Waste Management Plan, Storm Water Management Plan, Environmental Monitoring Plan, Traffic Management Plan and Social Development Plan for the CWP-RATLAM 100 MW Wind Power Plant at Dhar District of Madhya Pradesh. The management plans will be executed through Environmental Social Management System.

7.5.1 Emergency Preparedness and Response Plan

Purpose

Hero Future Energies under which CWP-RATLAM is a subsidiary unit has an Emergency Response plan at the corporate level. However, CWP-RATLAM has also developed a site specific Emergency Management Plan for implementation at the proposed site in the event of an emergency situation so that the loss of life and damage to the properties & natural resources are minimized. However, given below is an Emergency Preparedness and response plan outlining a series of emergency actions that will be executed by CWP-RATLAM & its Contractors to ensure preparedness and response to emergency situations throughout the life-cycle of the project.

Emergencies

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

- Fire at site during temporary construction phase which cannot be doused by fire extinguishers; Also fire due to short circuit at the plant and equipment during both construction & operation phase.
- Collapse of any structure
- Outbreak of endemic disease among a large section of construction workers due to contaminated drinking water, unhygienic conditions that have developed at workplace;
- Protests by the local community or other stakeholders at any point of the project lifecycle due to grievances;
- Serious injury or death of employee or sub-contracted worker at work, due to non-work related illness or work-related accident.
- Onset of any natural disaster like earthquake.

Emergency Management

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

- The nearest civil hospitals, private health care centers or practitioner clinic shall be identified and a agreements shall be made with the aforesaid medical centers/practitioners to provide prompt health care services (including ambulance services) in the event of an emergency situation at site.
- A list of important telephone numbers such as fire brigade, health care facility/practitioner, police station, EHS and Social Coordinator, project office, head offices shall be displayed at all the prime locations at site & the worker's camp (during construction phase).
- Regular liaising with the police, Gram Panchayat, district administration shall be carried out to ensure that prompt assistance is readily available in the event of an emergency.
- An Emergency Management (including Disaster Management) team comprising of 4-6 professionals both from the developer and contractors' side, during construction phase and 2-3 professionals during operation of the proposed project; shall be formed to combat any emergency situation and ensure safety of the life

and property at site. For this purpose 2-3 personnel employed in the plant during operation phase shall be trained during emergency scenarios and their management measures including their roles and responsibilities in case of an emergency situation.

- The workers (staff & contractual workers from both CWP-RATLAM & contractors) shall be trained on their duties and emergency preparedness during an emergency. In case of an emergency, all site personnel shall be trained to follow the communication lines given below:
  a. Personnel at site affected by the emergency situations immediately inform the project office and the external agencies (such as police, fire brigade, ambulance services); In case, project office cannot be reached, the coordinator will be informed directly;
  b. The HSE officer on being informed about the emergency by project offices or by the employee directly; reaches site if necessary, and also follows-up with the aforesaid external agencies for aid;
  c. The HSE coordinator takes charge of the emergency response and direct further action and co-ordination, including escalating the matter to the CEO or other top-level managers as required.

Responsibilities

The HSE coordinator will be responsible for implementing this procedure, which includes

- Ensuring that the emergency preparedness measures are in place;
- Providing training to the personnel at site regarding reporting of the emergencies, and to site office personnel regarding response to emergency calls from the site personnel,
- Direct action-and co-ordination at the time of an emergency

The above points are being taken in consideration by the HSE coordinator onsite.

Community health and safety hazards specific to wind energy facilities primarily include the following:

Setback: Turbines must be sited at an acceptable distance ("setback") between wind turbines and adjacent users, including buildings, roads, and wildlife, in an effort to, among others, ensure acceptable noise levels and visual disturbance.

Electromagnetic Interference and Radiation: Wind turbines could potentially cause electromagnetic interference with telecommunication systems (e.g., microwave, television, and radio). This interference could be caused by path obstruction, shadowing, reflection, scattering, or re-radiation. The nature of the potential impacts depends primarily on the location of the wind turbine relative to the transmitter and receiver, characteristics of the rotor blades, signal frequency receiver characteristics, and radio wave propagation characteristics in the local atmosphere. Suitable mitigation measures to enhance the quality of the television signal and lower the impact of wind turbine on telecommunication need to be adopted.

Public Access: Safety issues may arise with public access to wind turbines (e.g., unauthorized climbing of the turbine) or to the wind energy facility substation. Any public rights of way located within and close to the wind energy facility site should be identified prior to construction to establish any measures that may be required to ensure the safety of their users. Prevention and control measures to manage public accesses include:

- Use gates on access roads.
- Where public access is not promoted to the site and/or there are no current rights of way across the site, consider fencing the wind energy facility site, or individual turbines, to prohibit public access to the turbine.
- Provide fencing of an appropriate standard around the sub-station with anti-climb paint and warning signs.
- Prevent access to turbine tower ladders
- Post information boards about public safety hazards and emergency contact information.

Blade Throw: A failure of the rotor blade can result in the “throwing” of a rotor blade, or part thereof, which may affect public safety. The overall risk of blade throw is extremely low. Blade throw risk management strategies include:

- Establish setback distances between turbines and populated locations. The minimum recommended setback distance is 2 x hub height, although it can vary with the size, shape, weight, and speed of the blades, and the height of the turbine.
- Minimize the probability of a blade failure by selecting wind turbines that have been subject to independent design verification/certification (e.g., IEC 61400-1), and surveillance of manufacturing quality.
- Ensure that lightning protection systems are properly installed and maintained.
- Carry out periodic blade inspections and repair any defects that could affect blade integrity.
- Equip wind turbines with vibration sensors that can react to any imbalance in the rotor blades and shut down the turbine if necessary.

It is observed that approximately 221 houses are located within the setback distance of about 220 m. A relocation/resettlement plan has been developed based on ground survey of all these households. This along with other measures (as defined in sections below) will be implemented by the company. Most of this relocation/resettlement is expected to be in situ

For the informal settlers located on government lands within the setback area of the WTGs, the company will:

- Develop and implement a relocation/resettlement plan with the objective to relocate as many people/households as possible within the radius of 150 meters. The plan will be consistent with the relevant and applicable requirements of PS 5.
- For turbine locations where relocation of all houses is not feasible, the company will undertake a Quantitative Risk Assessment (QRA) to assess the level of safety risks.
- For turbines locations where the risk is assessed to be higher than As Low As Reasonably Practicable (ALARP), the company will undertake measures with the objective to mitigate the risks so as to bring the risk levels down to ALARP.
- The company will communicate, to all stakeholders, the risks of living under the turbines. This communication will be an ongoing process and will be documented by the company

7.5.2 Community Liaison Plan

The Community Liaison Plan is a critical element of the overall Social Management Plans. Regular transparent communication between both the project and the communities and vice versa is crucial in building positive relationships between the two parties. This relationship should be crucial for managing unexpected situations which might arise during the course of the project. This plan should be read with other social management plan because the liaison which needs to be done for the individual plan is detailed within the plan. The communication plan mainly focuses on the communication issues during the construction stage however it also includes some community Liaison measures for the operation phase as well.

Objectives:

The Performance Standards mandates continuous communication between project and the different stakeholders e.g. workers, local community. The onus of initiating the process of communication rests on the project proponent. The project proponent should ensure that disclosure of relevant project information that would help the affected communities understand the risks, impacts and opportunities of the project. The Community Liaison Plan is developed to ensure a clear communication channel between the project and the local community. Even though the focus of the plan is primarily on communication with the community areas where there are likely interactions between the community and the contractors such areas have also been covered. The community liaison plan would concentrate on the following aspects:

Communication with the Community: As mandated in the Performance standards CWP-RATLAM would disclose the project details to make the community aware of the important features of the project. A project information booklet would be prepared and distributed in the project affected villages. This booklet should preferably be presented in local language. The booklet in addition to containing the salient features of the project should have a map depicting the boundaries of the plant and its ancillary facilities. The important landmarks e.g. the settlement, schools and the roads, etc. should also be demarcated so that it becomes easy for the people in the villages to relate to the ground conditions. In addition to the project information the booklet

should also highlight the impacts on the community as presented in the ESIA document and the commitments for the safeguards including the entitlement matrix. To ensure wide circulation of the Project Information Booklet the booklet would be made available at all the schools, Anganwadi centres, and other public facilities in the project affected village.

To ensure continuity of the flow of information to the community it is suggested that a quarterly **Community Information Booklet** should be published. During the construction phase the booklet would contain the information about the progress of the project and also information which are pertinent to community e.g. disruption of the transportation links, outcome of consultation process on community development etc. It is proposed that the community Information Booklet be continued even during the operations stage where this also acts as a transfer of information from the project to the community. In addition it can also be used to share information between the communities e.g. achievement of a particular member of the community or any worker can be published in this booklet.

7.5.3 Grievance Redressal Mechanism

The IFC requires that the client will establish a grievance mechanism to receive and address specific concerns about compensation including a recourse mechanism designed to resolve disputes in an impartial manner. If the client anticipates ongoing risks to or adverse impacts on affected communities, the client will establish a grievance mechanism to receive and facilitate resolution of the affected communities' concerns and grievances about the client's environmental and social performance. The grievance mechanism should be scaled to the risks and adverse impacts of the project. It should address concerns promptly, using an understandable and transparent process that is culturally appropriate and readily accessible to all segments of the affected communities, and at no cost and without retribution. The mechanism should not impede access to judicial or administrative remedies. The client will inform the affected communities about the mechanism in the course of its community engagement process.

- In efforts to develop an effective two way communication a Grievance Redressal Mechanism would be developed by CWP-RATLAM. The broad outline of the mechanism is as follows:
- The decision on the grievance would be communicated to the aggrieved person within a timeframe to be stipulated during the preparation of the ESAP.
- There should be a single point of contact between the community and CWP-RATLAM for the Redressal of grievance.
- All grievances should be documented and indexed for future reference. The proceeding and actions against each of the grievance should be documented and should also carry this index number for easy traceability.
- If required the aggrieved community member can also be made a part of the Redressal process so he is able to place his point of view.
- The Grievance Redressal committee should meet at regular interval and discuss on the grievance and take necessary action.

Communication with Contractor Staff: During the construction phase there would be an influx of people into the project area. As these people would have cultural differences with the resident population there is a potential of conflicts arising because of issues related to safety and privacy issues of the women in the surrounding villages, spread of various communicable diseases, nuisance caused by workers due to improper sanitation facilities, etc. It is thus proposed a Community Interaction Brochure would be prepared specifically stating the 'Dos' and 'Don'ts' and requesting proper behavioural actions and discipline amenable with the local customs and traditions during their association with the project. The brochure would also be highlight the importance of any of nearby cultural place and need to maintain the sanctity and dignity of the place. This Community Interaction Brochure would be made available to all employees during their induction into the project and also when they report back to the project after leave or absence. A record of the induction or refresher on the community interaction would be maintained.

Responsibility: CWP-RATLAM (through the implementing agency) would prepare all the information disclosure booklets as discussed above. They would also ensure circulation of the booklet among the community in the project affected villages.

CWP-RATLAM would also ensure that the Grievance Redressal Mechanism is developed. It would also ensure that the system is made community friendly so that the people who have grievance are encouraged to come forward and register their grievance. It would also ensure that the grievance of the community is discussed and recorded. It would ensure that the issues are closed to the satisfaction of the community members.

During construction CWP-RATLAM and its contractors would ensure that each of the people working on the project is aware of the Do's and Don'ts of community interaction. CWP-RATLAM and also the Contractors would ensure that the record of the induction and refresher is maintained. All the resources required for the implementation of the different subcomponents of the plan would be provided by CWP-RATLAM and its Contractors.

7.5.4 Waste Management Plan

The Waste Management Plan (WMP) will be applicable to the wastes arising during commissioning and operation of the proposed wind power plant of CWP-RATLAM. Major waste streams from the project include non-hazardous solid waste, wash water generated from panel washing and sewage.

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

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

The EPC contractor will manage the waste generated during construction phase like construction debris, packing material, paint containers and filters. The management measures of the aforementioned solid wastes and the hazardous wastes are discussed in details below:

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

7.5.5 Community Property Resource

During the project construction phase there might be some sharing of resources by the villagers and the workers working on the project. To an extent feasible this should be avoided to prevent potential conflicts between the project and the community. The movement of heavy vehicles and machineries might lead to conditions like disruption of electric wires and telephone wires in the project area and along transportation routes. All these damage utilities should be repaired/replaced to normal conditions, at the earliest. An account of the damage to the community resource should be documented and the root cause analysis carried out. The findings of the root cause analysis should also be documented and discussed with the agency/agencies found responsible for the incident. No water should be extracted from surface water bodies which are used by the community for drinking or domestic purpose. Any vacant or barren land, not assigned for project, should not be used for storage of fill/construction material, wastes, etc.

Responsibility: CWP-RATLAM would take responsibility for construction of the road before the existing road is diverted / closed for use by villagers. CWP-RATLAM (through the implementing agency) should start the process of dialogue with the community to decide on the alignment of the road and also fix up the likely time line for the construction.

CWP-RATLAM and its contractors should ensure that the sharing of community resource is minimized by organizing necessary support infrastructure/facilities within premises. However, in case where sharing would be essential CWP-RATLAM (including contractors) should have an agreement with the Gram Sabha for the sharing of the resource. In case of damage to community property CWP-RATLAM including its contractors should ensure that it is repaired or replaced to the satisfaction of the community at the earliest. CWP-RATLAM should maintain documentation of all incidents of damages to the community property. All cost for repair/replacement should be borne by CWP-RATLAM /contractor.

As part of the Environmental and Social Management System proposed, a system should also be developed for recording such incidents and tracking the incident till it is closed to the satisfaction of the community.

7.5.6 Occupation Health and Safety Management Plan

The Occupational Health and Safety (OHS) of the employee and contractual labours will be maintained at the work sites during both construction and operation phase. The OHS Management measures shall comply with the Indian Regulatory requirements under OHSAS and the Factories Act.

Construction Phase: The following occupation health and safety measures will be adopted during the construction phase:

- Currently, the workers have been provided PPE's like face shields, helmets, goggles etc. However, it should be ensured that all workers wear their proper personal protective equipment (PPEs) i.e. safety shoes and goggle, helmet, coverall, gloves, ear plugs etc. as per their nature of work during construction related activities to ensure health and safety of workers at workplace.
- Ensure provision and maintenance of drinking water and sanitation facilitation for construction workers in accordance with the provision of Contract Labour Act and Building and Other Construction Workers Act.
- Periodic cleaning of work areas will be undertaken and supervised by the contractors to ensure hygienic conditions on site.
- Workers will stop working in extreme natural climatic conditions i.e. heat wave, heavy rain etc.
- All work places will have adequate fire alarms and firefighting equipment's to handle any outbreak of fire in O& M.
- Adequate drinking water will be supplied at workplace for workers onsite and water quality meets drinking water quality standards. CWP-RATLAM needs to ensure it through its contractors.
- Sufficient light and ventilation will be provided for workers working in confined space.
- Periodic health check-up camps for workers onsite will be organized to ensure prevention of occupational health hazards.
- All work areas should have First Aid kits to manage injuries occurring in the area.
- The switchyard building will be provided with fire extinguishers and sand buckets at all strategic locations to deal with any incident of fire.

Operational Phase: Although no significant occupational health and safety risks are identified during operations, the following mitigation measures need to be adopted:

- Operators are provided with adequate PPEs depending upon nature of the operation and occupation health and safety risks associated with it viz. electrical maintenance activities, replacement wind turbine components etc.
- Special emphasis on electrical safety will be laid and all employees will be trained in electrical safety and First Aid
- Standard Operation Procedures (SOPs) will be developed for operational activities likely to have potential occupational health and safety risks
- Periodic medical examination will be undertaken for workers including contractor and subcontractor of the plant.

- Periodic inspections will be carried out to ensure all the above are implemented and any non-conformances will be recorded along with grievance related to OHS issues.
- An EHS coordinator will effectively implement and monitor the OHS Management System and ESMP.

7.5.7 Road Safety and Traffic Management Plan

Scope and Purpose

The plan encompasses the addressal of community safety related impacts that may arise from the increased vehicular traffic due to movement of heavy equipment/machineries and vehicles along the site access and approach roads particularly during construction phase. The plan will be regularly updated by the contractor with the project progress and as vehicle movement requirements are identified in detail. Designated traffic coordinator will be responsible for overall coordination of traffic management.

During Construction Phase

The following mitigation measures will be implemented during this phase:

- Project vehicular movement will be restricted to defined access routes.
- Proper signage will be displayed at important traffic junctions along the vehicular access routes to be used by construction phase traffic. The signage will serve to prevent any diversion from designated routes and ensure proper speed limits are maintained near residential areas.
- Any road diversions and closures will be informed in advance to the project vehicles accessing the above route. Usage of horns by project vehicles will be restricted near sensitive receptors viz. schools, settlements etc.
- Traffic flows will be timed wherever practicable during period of increased commuter movement in the day.
- Temporary parking facilities shall be provided within the work areas and the construction sites to avoid road congestion.
- Vehicular movement to be controlled near sensitive locations viz. schools, colleges, hospitals identified along designated vehicular transportation routes.
- Routine maintenance of project vehicles will be ensured to prevent any abnormal emissions and high noise generation.
- Adequate training on traffic and road safety operations will be imparted to the drivers of project vehicles. Road safety awareness programs will be organized in coordination with local authorities to sensitize target groups viz. school children, commuters on traffic safety rules and signage.
- The contractor(s) shall frame and implement a “No Drug No Alcohol” Policy to prevent road accidents/incidents.

During Operational Phase

Since limited vehicular movement is anticipated during operational phase considering only the daily movement of project personnel any impacts arising from the same can be effectively addressed through implementation of mitigation measures as discussed during the construction phase. In addiction following measures will be emphasised.

- Use of horns near the villages along the access road to villages, main plant and internal roads shall be restricted.
- The vehicular movements along the access roads and highways shall be restricted during the night time.
- All the vehicles entering the access roads and plant shall have Pollution under Control (PUC) certificates.

- The speed limit in the internal roads shall be restricted to 25 km/hr. Proper warning signs and road safety awareness posters shall be displayed to create road safety awareness among the personnel accessing the site.
- Periodic road safety and Traffic management campaigns and awareness sessions shall be carried out among the villagers and the plant workers/personnel to develop road safety awareness among the people likely to be impacted by the project.
- An emergency road safety plan shall be framed by the Proponent to combat any emergency conditions/accidents along the highways, access roads and within plant area.
- The Proponent shall frame and implement a "No Drug No Alcohol" Policy to prevent road accidents/incidents.
- The drivers shall be given an induction on road safety and traffic management policy.
- A permanent parking lot shall be provided within the main plant site (in individual work areas) and the associated facilities.
- Use of seat belts for both drivers and passengers shall be made compulsory to minimize death & injuries in the event of an accident.

8.0 CONCLUSION

An environment and social analysis has been carried out looking at various criteria such as topography, air, noise, water resources and water quality, ecology, demography of the area, climate, natural habitat, community and employee health and safety etc.

Most impacts are expected to occur during the construction phase which are considered to be temporary in nature. The main project impacts are associated with clearing of ground cover, waste management. relocation of identified households based on quantitative risk assessment (QRA) falling within the setback area of WTGs, excavation and movement of soils. No endangered or protected species of flora or fauna are reported at any of the project sites. Adequate provisions have been made for the environmental mitigation and monitoring of predicted impacts. The project also involves some of the positive impacts and are as follows.

- During the final reporting of this ESIA report, the private land has been procured and adequate compensation has been provided to the land owners which is above the circle rate of the area (**Appendix F**). Private parcels of land shall be taken on lease for transmission poles/ towers on a willing buyer – willing seller basis. The land sellers are expected to benefit monetarily from leasing out this required land.
- During the construction phase, local populations often supply manpower for services such as those of drivers, vehicle vendors, contractors, watchmen etc.
- In addition, demand for auxiliary services such as canteen and food catering, tea and snacks stalls, poultry, farm products and lodging facilities, is expected to increase. The affected villages are likely to gain economically in this manner.
- With expected improvement in existing road conditions, the villagers shall have improved access to transportation and nearby towns.

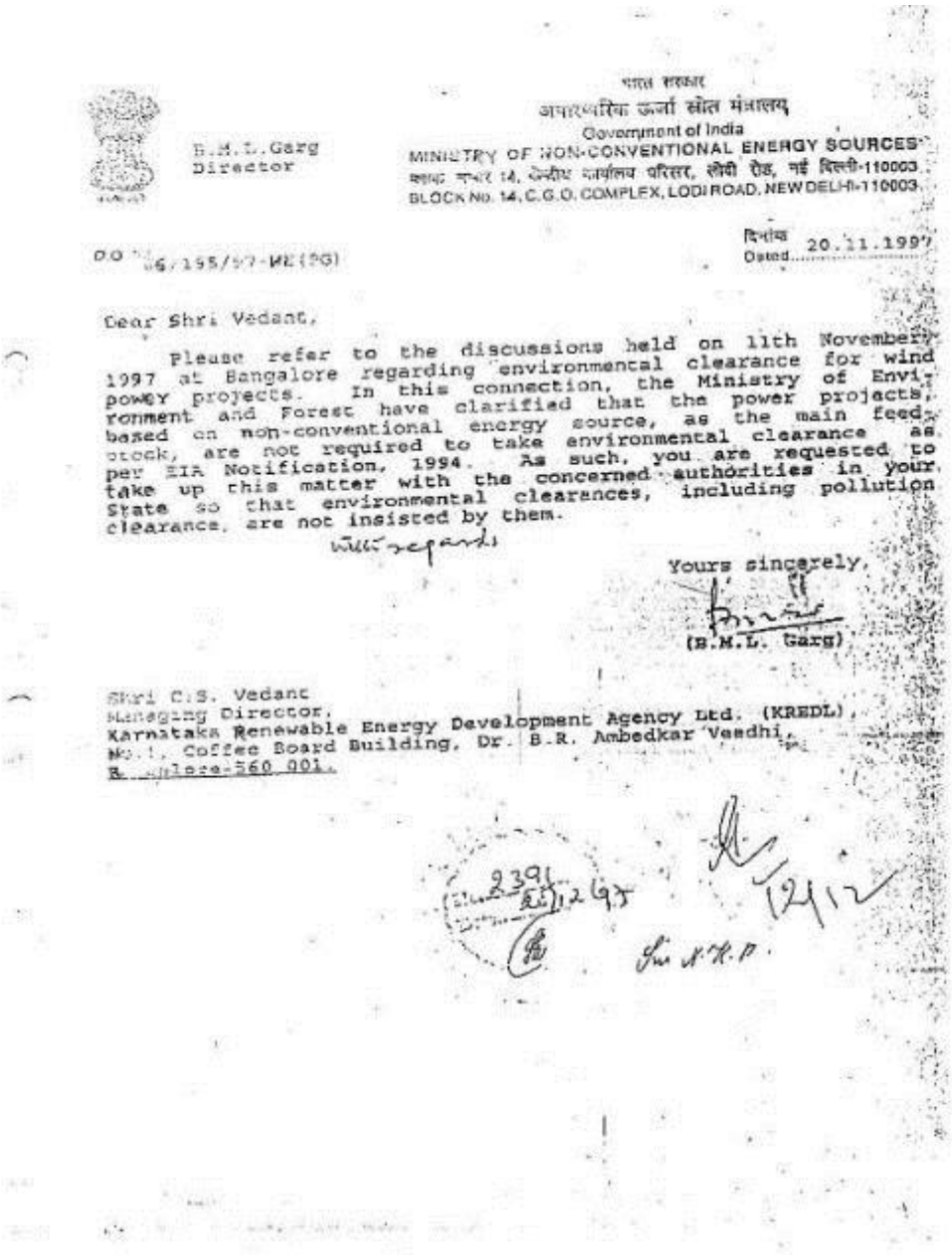
Access to essential services including electricity, medical facilities, water and higher education is likely to improve due to better road connectivity and possible CSR initiatives by the wind farm investors.

Proper Grievance Redressal Mechanism (GRM) will have to be implemented by CWP-RATLAM to overcome public inconvenience during the proposed project activities. Based on the environmental and social assessment and surveys conducted for the Project, the potential adverse environmental impacts can be mitigated to an acceptable level by adequate implementation of the mitigation measures identified in the EMP.

There is no other large scale or small scale industrial activity operating in the vicinity of 10km from the project site. Therefore, setting up of the proposed wind power plant at the proposed site will not degrade the quality of surrounding environment, while improving the socio-economic conditions of the surrounding area.

APPENDIX A

MoEFCC Notification



भारत सरकार
अपारंपरिक ऊर्जा स्रोत मंत्रालय
Government of India
MINISTRY OF NON-CONVENTIONAL ENERGY SOURCES
ब्लाक नं. 14, सी.जी.ओ. कॉम्प्लेक्स, लोदी रोड, नई दिल्ली-110003
BLOCK No. 14, C.G.O. COMPLEX, LODI ROAD, NEW DELHI-110003

B.M.L. Garg
Director

D.O. No. 6/195/97-WE(PG)

दिनांक
Dated 20.11.1997

Dear Shri Vedant,

Please refer to the discussions held on 11th November, 1997 at Bangalore regarding environmental clearance for wind power projects. In this connection, the Ministry of Environment and Forest have clarified that the power projects, based on non-conventional energy source, as the main feedstock, are not required to take environmental clearance as per EIA Notification, 1994. As such, you are requested to take up this matter with the concerned authorities in your State so that environmental clearances, including pollution clearance, are not insisted by them.

With regards,

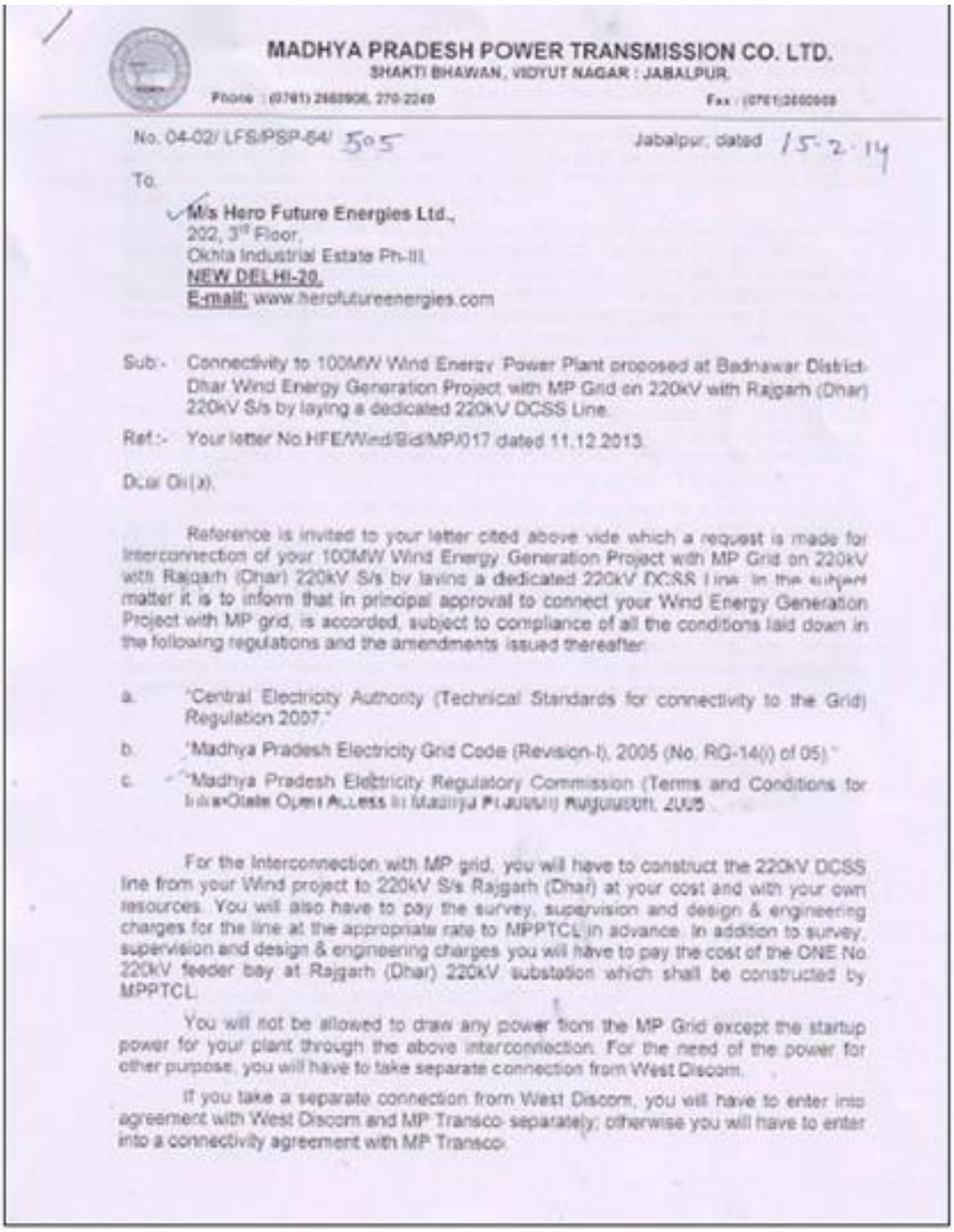
Yours sincerely,

(B.M.L. Garg)

Shri C.S. Vedant
Managing Director,
Karnataka Renewable Energy Development Agency Ltd. (KREDL),
No.1, Coffee Board Building, Dr. B.R. Ambedkar Veedhi,
Bangalore-560 001.

APPENDIX B

State Grid Connectivity Approval Letter



MADHYA PRADESH POWER TRANSMISSION CO. LTD.
SHAKTI BHAWAN, VIDYUT NAGAR : JABALPUR.
Phone : (0761) 2660906, 270 2249 Fax : (0761)2660908

No. 04-02/ LFS/PSP-64/ 505 Jabalpur, dated 15-2-14

To,

M/s Hero Future Energies Ltd.,
202, 3rd Floor,
Okhla Industrial Estate Ph-III
NEW DELHI-20.
E-mail: www.herofutureenergies.com

Sub :- Connectivity to 100MW Wind Energy Power Plant proposed at Badnawar District-Dhar Wind Energy Generation Project with MP Grid on 220kV with Rajgarh (Dhar) 220kV S/s by laying a dedicated 220kV DCSS Line.

Ref :- Your letter No.HFE/Wind/Bid/MP/017 dated 11.12.2013.

Dear Sir(s),

Reference is invited to your letter cited above vide which a request is made for interconnection of your 100MW Wind Energy Generation Project with MP Grid on 220kV with Rajgarh (Dhar) 220kV S/s by laying a dedicated 220kV DCSS Line. In the subject matter it is to inform that in principal approval to connect your Wind Energy Generation Project with MP grid, is accorded, subject to compliance of all the conditions laid down in the following regulations and the amendments issued thereafter.

a. "Central Electricity Authority (Technical Standards for connectivity to the Grid) Regulation 2007."

b. "Madhya Pradesh Electricity Grid Code (Revision-I), 2005 (No. RG-14(I) of 05)."

c. "Madhya Pradesh Electricity Regulatory Commission (Terms and Conditions for Intra-State Open Access in Madhya Pradesh) Regulations, 2005."

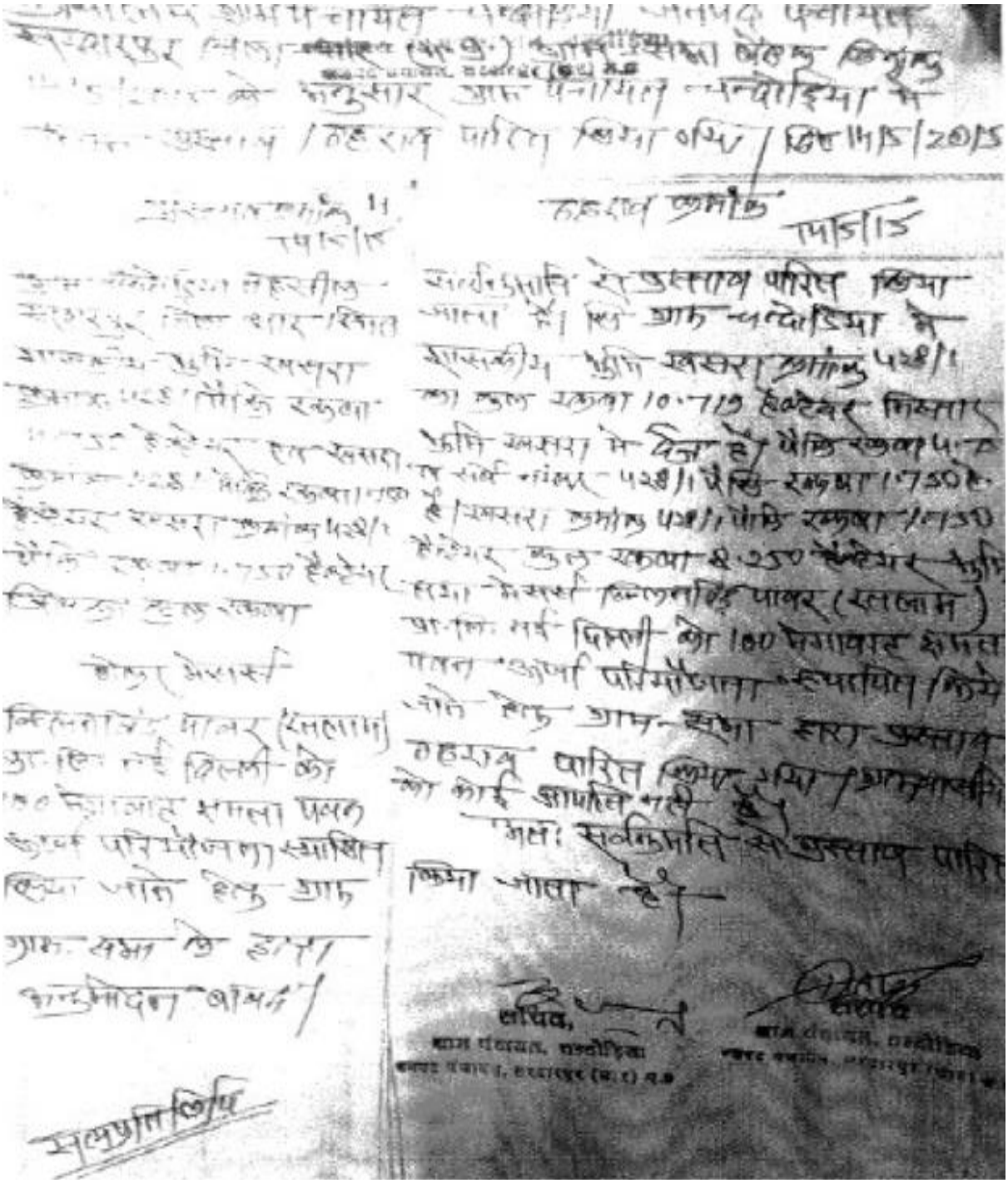
For the interconnection with MP grid, you will have to construct the 220kV DCSS line from your Wind project to 220kV S/s Rajgarh (Dhar) at your cost and with your own resources. You will also have to pay the survey, supervision and design & engineering charges for the line at the appropriate rate to MPPTCL in advance. In addition to survey, supervision and design & engineering charges you will have to pay the cost of the DNE No. 220kV feeder bay at Rajgarh (Dhar) 220kV substation which shall be constructed by MPPTCL.

You will not be allowed to draw any power from the MP Grid except the startup power for your plant through the above interconnection. For the need of the power for other purpose, you will have to take separate connection from West Discom.

If you take a separate connection from West Discom, you will have to enter into agreement with West Discom and MP Transco separately; otherwise you will have to enter into a connectivity agreement with MP Transco.

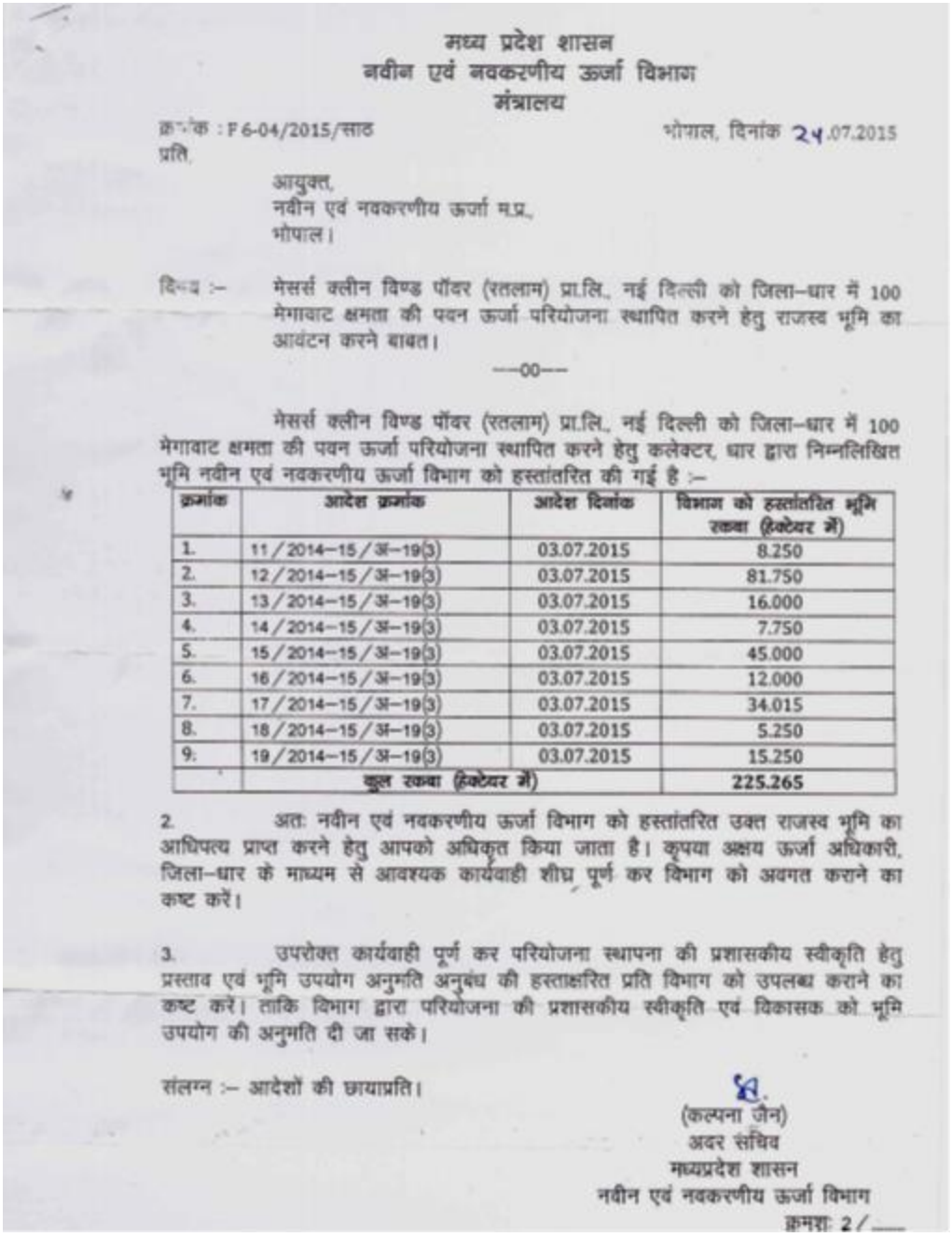
APPENDIX C

NOC from Village Panchayat (sample copy –Indrawal village)



APPENDIX D

Land Allotment letter



मध्य प्रदेश शासन
नवीन एवं नवकरणीय ऊर्जा विभाग
मंत्रालय

क्रमांक : F 6-04/2015/साठ — भोपाल, दिनांक 24.07.2015

प्रति,

आयुक्त,
नवीन एवं नवकरणीय ऊर्जा म.प्र.,
भोपाल।

विषय :– मेसर्स क्लीन विण्ड पॉवर (रतलाम) प्रा.लि., नई दिल्ली को जिला–धार में 100 मेगावाट क्षमता की पवन ऊर्जा परियोजना स्थापित करने हेतु राजस्व भूमि का आवंटन करने बाबत।

—00—

मेसर्स क्लीन विण्ड पॉवर (रतलाम) प्रा.लि., नई दिल्ली को जिला–धार में 100 मेगावाट क्षमता की पवन ऊर्जा परियोजना स्थापित करने हेतु कलेक्टर, धार द्वारा निम्नलिखित भूमि नवीन एवं नवकरणीय ऊर्जा विभाग को हस्तांतरित की गई है :–

क्रमांक	आदेश क्रमांक	आदेश दिनांक	विभाग को हस्तांतरित भूमि रकबा (हेक्टेयर में)
1.	11/2014–15/अ–19(3)	03.07.2015	8.250
2.	12/2014–15/अ–19(3)	03.07.2015	81.750
3.	13/2014–15/अ–19(3)	03.07.2015	16.000
4.	14/2014–15/अ–19(3)	03.07.2015	7.750
5.	15/2014–15/अ–19(3)	03.07.2015	45.000
6.	16/2014–15/अ–19(3)	03.07.2015	12.000
7.	17/2014–15/अ–19(3)	03.07.2015	34.015
8.	18/2014–15/अ–19(3)	03.07.2015	5.250
9.	19/2014–15/अ–19(3)	03.07.2015	15.250
	कुल रकबा (हेक्टेयर में)		225.265

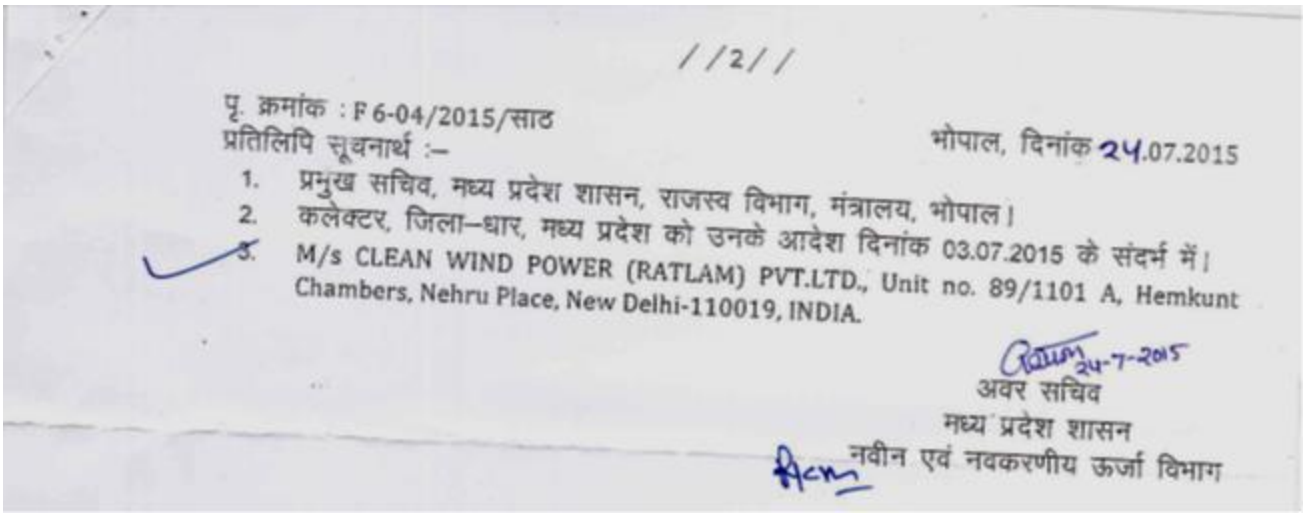
2. अतः नवीन एवं नवकरणीय ऊर्जा विभाग को हस्तांतरित उक्त राजस्व भूमि का आधिपत्य प्राप्त करने हेतु आपको अधिकृत किया जाता है। कृपया अक्षय ऊर्जा अधिकारी, जिला–धार के माध्यम से आवश्यक कार्यवाही शीघ्र पूर्ण कर विभाग को अवगत कराने का कष्ट करें।

3. उपरोक्त कार्यवाही पूर्ण कर परियोजना स्थापना की प्रशासकीय स्वीकृति हेतु प्रस्ताव एवं भूमि उपयोग अनुमति अनुबंध की हस्ताक्षरित प्रति विभाग को उपलब्ध कराने का कष्ट करें। ताकि विभाग द्वारा परियोजना की प्रशासकीय स्वीकृति एवं विकासक को भूमि उपयोग की अनुमति दी जा सके।

संलग्न :– आदेशों की छायाप्रति।

(कल्पना जैन)
अवर सचिव
मध्यप्रदेश शासन
नवीन एवं नवकरणीय ऊर्जा विभाग

क्रमशः 2/—



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पृ. क्रमांक : F 6-04/2015/साठ
प्रतिलिपि सूचनार्थ :–

भोपाल, दिनांक 24.07.2015

1. प्रमुख सचिव, मध्य प्रदेश शासन, राजस्व विभाग, मंत्रालय, भोपाल।
2. कलेक्टर, जिला–धार, मध्य प्रदेश को उनके आदेश दिनांक 03.07.2015 के संदर्भ में।
3. M/s CLEAN WIND POWER (RATLAM) PVT.LTD., Unit no. 89/1101 A, Hemkunt Chambers, Nehru Place, New Delhi-110019, INDIA.

24-7-2015
अवर सचिव
मध्य प्रदेश शासन
नवीन एवं नवकरणीय ऊर्जा विभाग

APPENDIX E

Site surroundings of all 50 WTG's

The results of additional survey conducted for 15 locations viz. BD-10, 11, 18, 26, 29, 30, 31, 32, 34, 35, 37, 39, 43, 47 and 50

WTG Identification No.	Geographical coordinates	Location	Land		Project Status	Name of the nearest village/House		Topography	Site Surroundings	Remarks/Observations	Site photograph
BD-1	22°51'43.15"N 75° 7'56.31"E	Sergarh village	Govt. land	Open scrub	No construction	Sergarh	2.53km -S	Undulating terrain	Local deity temple : 600m Water body : Not within 1km radius Approach road: Under construction Forest Area: Sardarpur Reserve Forest boundary at a distance of 170m East	No risk factor observed	
BD-2	22°51'39.31"N 75° 8'6.28"E	Sergarh village	Govt. land	Open scrub	Structural work of foundation in progress	Shivgarh	2.16km - E	Flat terrain	Local deity temple : 300m Water body : Not within 1km radius Approach road: Kachha approach road constructed Forest Area: Sardarpur Reserve Forest boundary at a distance of 15m East	No risk factor observed	
BD-3	22°51'30.29"N 75° 8'12.55"E	Sergarh village	Govt. land	Open scrub	Structural work of foundation in progress	Sergarh	1.98km-SE	Flat terrain	Local deity temple : 160m Connecting village road : 180m Water body : Not within 1km radius Approach road: Kachha approach road constructed Forest Area: Sardarpur Reserve Forest boundary at a distance of 100m NE	No risk factor observed Care should be taken so that the cultural sentiments of the locals is not disturbed due to the location of the temple along the approach road.	
BD-4	22°51'24.82"N 75° 8'27.25"E	Sergarh village	Govt. land	Open scrub	Structural work of foundation in progress	Sergarh	1.5km-SE	Flat terrain	Local deity temple : 470m Connecting village road : 105m Water body: Not within 1km radius Approach road: Kachha approach road under construction. Forest Area: Sardarpur Reserve Forest boundary at a distance of 180m N.	No risk factor observed	

WTG Identification No.	Geographical coordinates	Location	Land		Project Status	Name of the nearest village/House		Topography	Site Surroundings	Remarks/Observations	Site photograph
BD-5	22°51'16.49"N 75° 8'29.03"E	Sergarh village	Govt. land	Open scrub	Structural work of foundation in progress	Sergarh	1.2km-SE	Flat terrain	Local deity temple : 690m Ag. Field : 100m East Dug well : 70m Connecting village road : 70m Approach road: Kachha approach road constructed. Forest Area: Sardarpur Reserve Forest boundary at a distance of 440m N. Water body: 1.2km - SE	No risk factor observed	
BD-6	22°51'8.47"N 75° 8'17.51"E	Sergarh village	Govt. land	Open scrub	Structural work of foundation in progress	Sergarh	1.28km-SE	Flat terrain	Ag. Field : 300m Connecting road : 250m Approach road: Kachha approach road under construction. Forest Area: Sardarpur Reserve Forest boundary at a distance of 740m North. Water body:1.3km-SE	No risk factor observed	
BD-7	22°50'59.29"N 75° 8'27.78"E	Sergarh village	Govt. land	Open scrub	Structural work of foundation in progress	Sergarh	750m-SE	Flat terrain	Ag. Field : 120m Connecting road : 80m Dug well : 140m Approach road: Kachha approach road under construction. Forest Area: Sardarpur Reserve Forest boundary at a distance of 920m North. Water body: 860m -SE	No risk factor observed	
BD-8	22°50'50.58"N 75° 8'14.47"E	Sergarh village	Govt. land	Open scrub	Structural work of foundation in progress	Chunyagadi	1.2km-SW	Flat terrain	Ag. Field : 300m Connecting road : 555m Dug well : 250m -SW Approach road: Kachha approach road constructed. Forest Area: Sardarpur Reserve Forest boundary at a distance of 1.29km North. Water body: 1.2km-SE	No risk factor observed	

WTG Identification No.	Geographical coordinates	Location	Land		Project Status	Name of the nearest village/House		Topography	Site Surroundings	Remarks/Observations	Site photograph
BD-9	22°50'48.29"N 75° 8'34.05"E	Sergarh village	Govt. land	Open scrub	Structural work of foundation in progress	Sergarh	500m-SE	Flat terrain	Ag. Field : 130m -SE Connecting road : 237m Approach road: Kachha approach road constructed. Labour sheds: 80m Water body: 500m-SE	No risk factor observed	
BD-10	22°50'42.26"N 75° 8'48.64"E	Sergarh village	Govt. land	Open scrub	No construction	Sergarh village	100m-E (approx.)	Flat terrain	Connecting village road : 50m Water body: 150m Ag. Field : 60m –W Approach road: Kachha approach road constructed	Number of households within 150m: 5 Number of households within 220m: 2	
BD- 11	22°50'28.76"N 75° 9'26.91"E	(Sergarh village)	Govt. land	Agricultural land	No construction	Sergarh village	160m - S	Flat terrain	Connecting road : 30m Ag. Field : 50m Water body: 900m –NW Located along the village Connecting road at a distance of 15m	Number of households within 150m: 0 Number of households within 220m: 3	
BD-12	22°50'22.71"N 75° 9'33.88"E	Sergarh-SINGLE house	Govt. land	Agricultural land	No construction	Sergarh	200m-NW	Flat terrain	Connecting road: 80m Ag. Field : 50m Water body: 1.2km –NW	Care should be taken that the agricultural activity and settlement in the surrounding is not disturbed.	
BD-13	22°50'12.41"N 75° 9'17.20"E	Sergarh village	Govt. land	Agricultural land	No construction	Sergarh village	420m – NW	Flat terrain	Water channel : 60m Water body: 550m Scarce vegetation observed around the site except for wild grasses. Approach road: Kachha approach road constructed	No risk factor observed	

WTG Identification No.	Geographical coordinates	Location	Land		Project Status	Name of the nearest village/House		Topography	Site Surroundings	Remarks/Observations	Site photograph
BD- 14	22°50'1.81"N 75° 9'19.16"E	Sergarh village	Govt. land	Agricultural land	No construction	Sergarh village	710m – North	Undulating terrain	Water channel : 120m Water body : 390m Scarce vegetation observed around the site except for wild grasses. Approach road: Kachha approach road constructed	No risk factor observed	
BD- 15	22°50'4.61"N 75° 9'47.86"E	Gandwada village	Govt. land	Agricultural land	No construction	Sergarh village	1.26km – NW	Flat terrain	Locals practising farming on land Connecting road : 20m Approach road: Kachha approach road constructed	No risk involved. Encroachment of the locals as reported	
BD- 16	22°49'50.39"N 75° 9'24.97"E	Sergarh village	Govt. land	Agricultural land	No construction	Kisanpura village	1.15km - SW	Flat terrain	Water channel : 200m Water body : 400m Locals practising farming on land	Encroachment of the locals as reported	
BD-17	22°49'37.41"N 75° 9'23.76"E	Gandwada village	Govt. land	Agricultural land	Structural work in progress	Kisanpura village	530m - SE	Undulating terrain	Water channel : 70m Approach road: Kachha approach road constructed.	No risk factor observed	
BD-18	22°49'19.37"N 75° 9'20.13"E	Gandwada village	Govt. land	Agricultural land	No construction		House within 100m (approx.)	Flat terrain	Connecting road: 50m Ag. Field : 40m	Number of households within 150m: 2 Number of households within 220m: 11	

WTG Identification No.	Geographical coordinates	Location	Land		Project Status	Name of the nearest village/House		Topography	Site Surroundings	Remarks/Observations	Site photograph
BD-19	22°49'4.38"N 75° 9'16.04"E	Kisanpura village	Govt. land	Agricultural land	Structural work of foundation in progress		440m-SE	Flat terrain	Connecting road: 60m Ag. Field : 100m	No risk involved	
BD-20	22°49'26.68"N 75° 8'10.64"E	Chandodiya village	Govt. land	Agricultural land	No construction	Kisanpura village	1.45km - SE	Flat terrain	Connecting road : 600m Kachha approach road under construction. Water body: Beyond 1.0km	No risk involved	
BD-21	22°49'17.90"N 75° 8'18.45"E	Chandodiya village	Govt. land	Agricultural land	No construction	Kisanpura village	1.08km - SE	Flat terrain	Connecting road : 490m Kachha approach road under construction. Water body: 1.13km NE	No risk involved. However, patta land was claimed at the WTG location, which as verified by land records can be termed as encroachment.	
BD-22	22°49'4.76"N 75° 8'17.49"E	Chandodiya village	Govt. land	Agricultural land	No construction	Kisanpura village	750m-SE	Flat terrain	Connecting road : 30m Water body: 1.5km SW Approach road under construction.	No risk involved	
BD-23	22°48'51.38"N 75° 9'42.09"E	Borjhadi village	Govt. land	Agricultural land	No construction	Bor Jhadi village	600m-E	Flat terrain	Connecting road : 390m	No risk involved	
BD-24	22°47'49.50"N 75°10'38.52"E	Borjhadi village	Govt. land	Agricultural land	No construction	Indrawal village	320m - N	Flat terrain	Connecting road : 40m	No risk involved	

WTG Identification No.	Geographical coordinates	Location	Land		Project Status	Name of the nearest village/House		Topography	Site Surroundings	Remarks/Observations	Site photograph
BD- 25	22°48'20.28"N 75° 9'47.10"E	Indrawal village	Govt. land	Agricultural land	No construction	Indrawal village	120m - NW	Flat terrain	Connecting road : 30m Water body: 1.23km SE	Care should be taken that the neighbouring settlement is not disturbed due to WTG activity. However, patta land was claimed at the WTG location, which as verified by land records can be termed as encroachment.	
BD- 26	22°48'20.51"N 75° 9'47.10"E	Indrawal village	Govt. land	Agricultural land	No construction	Bor Jhadi village	300m - N	Flat terrain	Connecting road : 65m	Number of households within 150m : 1 Number of households within 220m : 0	
BD- 27	22°50'38.08"N 75° 9'40.25"E	Indrawal village	Govt. land	Agricultural land	Excavated	Indrawal village	House within 550m	Flat terrain	Connecting road : 240m Water body: 1.19km - NW	No risk involved	
BD-28	22°48'26.46"N 75°10'24.01"E	Indrawal village	Govt. land	Agricultural land	No construction	Bor Jhadi village	Settlement : 220m -S	Flat terrain	Connecting road: 110m Locals practising farming on land (rice sown)	Care should be taken that the nearby settlements are not disturbed due to the WTG activity. Encroachment of the locals as reported	
BD-29	22°48'15.89"N 75°10'23.54"E	Indrawal village	Govt. land	Agricultural land	No construction	Indrawal village	Settlement : 200m-NE	Flat terrain	Connecting road: 60m	Number of households within 150m : 1 Number of households within 220m : 4	

WTG Identification No.	Geographical coordinates	Location	Land		Project Status	Name of the nearest village/House		Topography	Site Surroundings	Remarks/Observations	Site photograph
BD- 30	22°48'7.32"N 75°10'3.58"E	Indrawal village	Govt. land	Agricultural land	No construction	Indrawal village	House : 320m-N	Flat terrain	Connecting road : 40m Water body: 2km	Number of households within 150m: 2 Number of households within 220m: 0	
BD- 31	22°47'58.05"N 75°10'7.67"E	Indrawal village	Govt. land	Agricultural land	Excavation	Indrawal village	250m -S	Flat terrain	Water body : 2.2km Connecting road : 20m	Number of households within 150m: 1 Number of households within 220m: 1	
BD-32	22°47'37.67"N 75°10'26.23"E	Indrawal village	Govt. land	Agricultural land	No construction	Indrawal village	House : 100m (approx.)-SW	Flat terrain	Water body : 2.5km Connecting road : 20m	Number of households within 150m: 9 Number of households within 220m: 6	
BD-33	22°47'34.38"N 75°10'3.96"E	Indrawal village	Govt. land	Agricultural land	No construction	Indrawal village	400m-NE	Flat terrain	Water body: 2km Connecting road: 20m	No risk factor involved	
BD- 34	22°47'23.65"N 75° 9'32.06"E	Indrawal village	Govt. land	Agricultural land	No construction	Panda village	100m (approx.)- E	Flat terrain	Water body: 800m -NW	Number of households within 150m: 47 Number of households within 220m: 10	

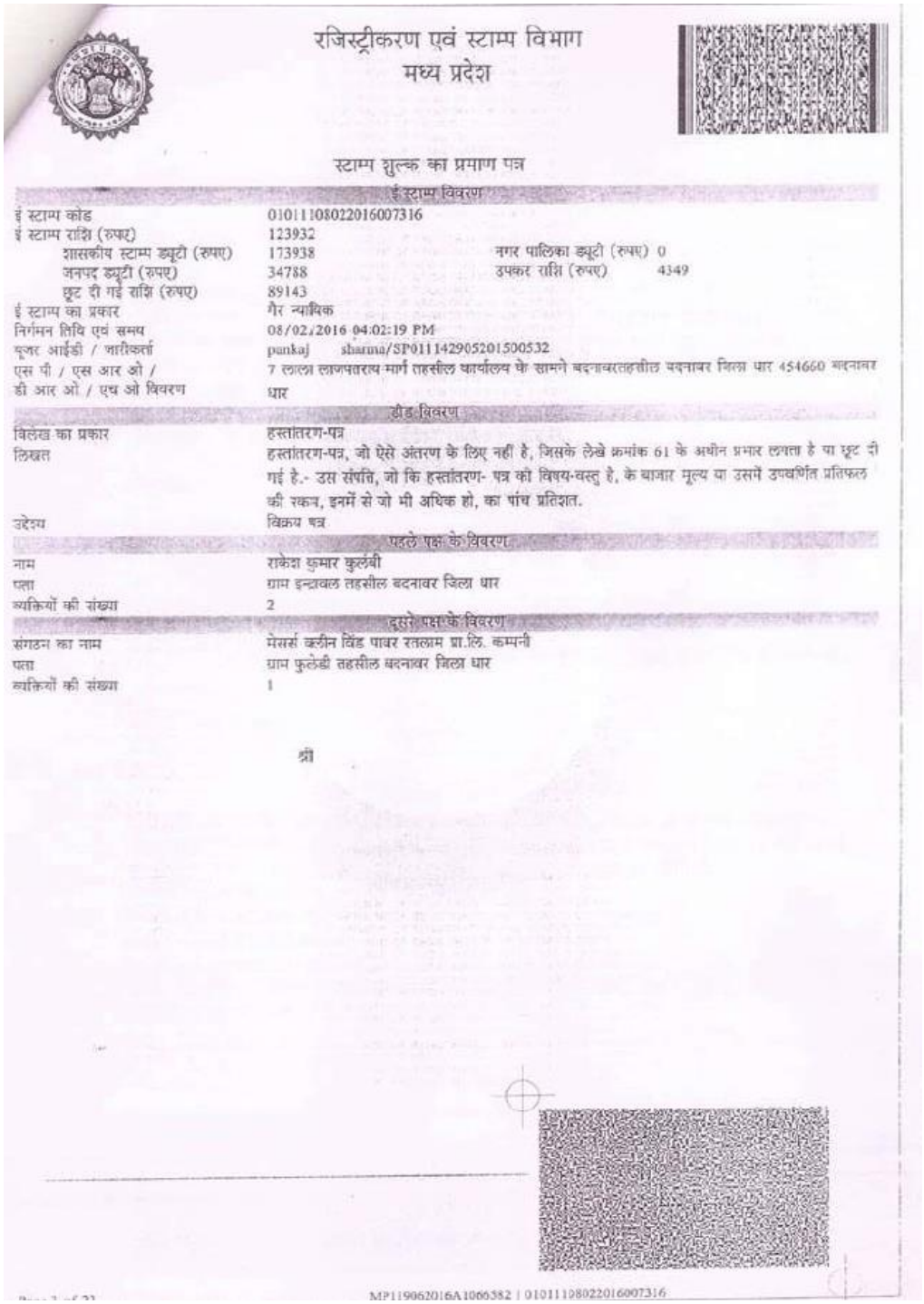
WTG Identification No.	Geographical coordinates	Location	Land		Project Status	Name of the nearest village/House		Topography	Site Surroundings	Remarks/Observations	Site photograph
BD-35	22°47'14.95"N 75° 9'42.40"E	Indrawal village	Govt. land	Agricultural land	No construction	Panda village	100m (approx.)-NW	Flat terrain	Water body: 1km	Number of households within 150m: 8 Number of households within 220m: 7	
BD-37	22°46'59.52"N 75° 9'31.96"E	Panda village	Govt. land	Agricultural land	No construction	Panda village	200m -NW	Flat terrain	Connecting road: 20m	Number of households within 150m: 0 Number of households within 220m: 2	
BD-38	22°46'49.36"N 75° 9'45.28"E	Panda village	Govt. land	Agricultural land	No construction	Panda village	450m -SE	Flat terrain	Connecting road: 20m	No risk factor involved	
BD-39	22°46'38.98"N 75° 9'50.28"E	Panda village	Govt. land	Agricultural land	No construction	Panda village	House : 120m-SE	Flat terrain	Connecting road: 30m	Number of households within 150m: 2 Number of households within 220m: 13	
BD-40	22°46'26.95"N 75° 9'41.57"E	Panda village	Govt. land	Agricultural land	No construction	Panda village	220m -NW	Flat terrain	Connecting road : 20m	Care should be taken that the neighbouring settlement is not disturbed due to WTG activity.	

WTG Identification No.	Geographical coordinates	Location	Land		Project Status	Name of the nearest village/House		Topography	Site Surroundings	Remarks/Observations	Site photograph
BD-41	22°46'20.07"N 75° 9'58.15"E	Panda village	Govt. land	Agricultural land	No construction	Panda village	140m-NE	Flat terrain	Connecting road : 40m	Care should be taken that the neighbouring settlement is not disturbed due to WTG activity.	
BD-42	22°46'13.56"N 75° 9'37.34"E	Panda village	Govt. land	Agricultural land	No construction	Khiledi village	250m-SW	Flat terrain	Connecting road : 20m	No risk factor involved	
BD-43	22°45'47.75"N 75° 9'59.09"E	Phuledi village	Govt. land	Agricultural land	No construction	Phukedi village	100m-S	Flat terrain	Connecting road : 20m	Number of households within 150m : 5 Number of households within 220m : 36	
BD-44	22°45'37.83"N 75° 9'25.84"E	Khiledi village	Govt. land	Agricultural land	No construction	Phuledi village	820m-E	Flat terrain	Connecting road : 20m	No risk involved	
BD-45	22°45'26.51"N 75° 9'24.67"E	Khiledi village	Govt. land	Agricultural land	No construction	Phuledi village	900m-SE	Flat terrain	Connecting road : 20m	No risk involved	

WTG Identification No.	Geographical coordinates	Location	Land		Project Status	Name of the nearest village/House		Topography	Site Surroundings	Remarks/Observations	Site photograph
BD-46	22°45'13.80"N 75° 9'24.02"E	Khiledi village	Govt. land	Agricultural land	No construction	Khiledi village	600m-SE	Flat terrain	Connecting road : 10m	No risk involved	
BD-47	22°45'20.46"N 75° 9'58.88"E	Khiledi village	Govt. land	Agricultural land	No construction	Phuledi village	100m (approx.)-E	Flat terrain	Connecting road : 30m	Number of households within 150m: 14 Number of households within 220m: 12	
BD- 48	22°45'10.00"N 75° 8'37.49"E	Khiledi village	Private land	Agricultural land	No construction	Panda village	300m-E	Flat terrain	Connecting road : 130m Water body: 1.13km SW	No risk involved	
BD- 49	22°44'59.99"N 75° 8'36.95"E	Khiledi village	Private land	Agricultural land	No construction	Panda village	200mNW	Flat terrain	Connecting road : 170m	Care should be taken that the neighbouring settlement is not disturbed due to WTG activity.	
BD-50	22°48'4.41"N 75° 9'21.06"E	Khiledi village	Govt. land	Agricultural land	No construction	Panda village	470m-NW	Flat terrain	Water body: 1.2km Connecting road: 420m	Number of households within 150m: 13 Number of households within 220m: 6	

APPENDIX F

Sample sale deed agreement



रजिस्ट्रीकरण एवं स्टाम्प विभाग
मध्य प्रदेश

स्टाम्प शुल्क का प्रमाण पत्र

ई स्टाम्प विवरण

ई स्टाम्प कोड	0101110802201600731 6		
ई स्टाम्प राशि (रुपए)	123932		
शासकीय स्टाम्प ड्यूटी (रुपए)	173938	नगर पालिका ड्यूटी (रुपए)	0
जनपद ड्यूटी (रुपए)	34788	उपकर राशि (रुपए)	4349
छूट दी गई राशि (रुपए)	89143		
ई स्टाम्प का प्रकार	गैर न्यायिक		
निर्गमन तिथि एवं समय	08/02/2016 04:02:19 PM		
यूजर आईडी / जारीकर्ता	pankaj sharma/SP0111429052015005 32		
एस पी / एस आर ओ / डी आर ओ / एच ओ विवरण	7 लाला लाजपतराय मार्ग तहसील कार्यालय के सामने बदनावरतहसील बदनावर जिला धार 454660 बदनावर धार		

डीड विवरण

विलेख का प्रकार	हस्तांतरण-पत्र
लिखत	हस्तांतरण-पत्र, जो ऐसे अंतरण के लिए नहीं है, जिसके लेखे क्रमांक 61 के अधीन प्रभार लगता है या छूट दी गई है.- उस संपत्ति, जो कि हस्तांतरण- पत्र की विषय-वस्तु है, के बाजार मूल्य या उसमें उपवर्णित प्रतिफल की रकम, इनमें से जो भी अधिक हो, का पांच प्रतिशत.
उद्देश्य	विक्रय पत्र

पहले पक्ष के विवरण

नाम	राकेश कुमार कुलेबी
पता	ग्राम इन्द्रावल तहसील बदनावर जिला धार
व्यक्तियों की संख्या	2

दूसरे पक्ष के विवरण

संगठन का नाम	मेसर्स क्लीन विंड पावर रतलाम प्रा.लि. कम्पनी
पता	ग्राम फुलेडी तहसील बदनावर जिला धार
व्यक्तियों की संख्या	1

श्री

MP119062016A1066382 | 0101112802201600731 6

रजिस्ट्रीकरण एवं स्टाम्प विभाग
मध्य प्रदेश

विक्रय संपत्ति का विवरण :-
ग्राम इन्दावल पटवारी हल्का नंबर 31/55 तह.बदनावर जिला धार रा.नि.बृ.क्रं.2(कानवन)

सर्वे नंबर	रकबा(हे.आरे)	लगान(रू.पै.)	किस्म – सिंचित
180/2/19	1.265	3.00	दो फसली

चतुर्सीमा :-
पुर्व में - सर्वे नं.14 की भूमि ।
पश्चिम में - शासकीय भूमि ।
उत्तर में - शासकीय भूमि ।
दक्षिण में - सर्वे नं. 29 की भूमि ।
उपरोक्त भूमि विक्रीशुदा भूमि हैं।

1. यह कि विक्रेता घोषणा करते हैं तथा क्रेता से करार करते हैं कि विक्रयाधीन सम्पति की वह एकल एवं पूर्ण स्वामी हैं तथा उसे उक्त सम्पति को विक्रय करने का वैध अधिकार प्राप्त है इसलीये उसे इस विलेख मे वर्णित शर्तो के आधार पर क्रेता को विक्रय करने का अधिकार प्राप्त हैं। आगे विक्रेता इस बात की घोषणा करते हैं कि उसके विरूद्ध किसी भी प्रकार के कार्य इस विलेख मे निष्पादित नहीं किये गये हैं जो उसे इस विलेख में वर्णित शर्तो के आधार पर क्रेता को उक्त सम्पति को विक्रय करने के उसके अधिकारो में भ्रांति अथवा बाधा उत्पन्न करे।

2. यह कि विक्रेता विक्रयाधीन सम्पति को विक्रय करने एवं क्रेता उस सम्पति को क्रय करने के लिये सहमत हैं तथा उक्त सम्पति समस्त प्रकार के ऋण, भार, प्रभार, रहन, विक्रय इकरार, विधिक मुकदमेंबाजी एवं अन्य विधिक प्रभारो से मुक्त हैं।

3. यह कि क्रेता ने यहां वर्णित सम्पूर्ण विक्रय मूल्य का भुगतान कर दिया हैं, जिसकी अभिस्वीकृति विक्रेता प्रदान करते हैं, जिस पर क्रेता ने विक्रेता से उसके पक्ष में विक्रय विलेख निष्पादित करने का अनुरोध किया, जिस पर विक्रेता ने अपनी सहमती प्रदान की एवं यह विक्रय विलेख निम्न प्रकार से निष्पादित किया जा रहा है :-

4. यह कि क्रेता द्वारा विक्रय प्रतिफल की राशि रूपये 20,30,000/-बीस लाख तीस हजार रूपये का सम्पूर्ण भुगतान निम्न प्रकार से किया गया हैं :-
(अ) रूपये 5,000/- पांच हजार रूपये नगदी बयाना पैटे पुर्व में दिया गया।
(ब) रूपये 3,95,000/- तीन लाख पिच्चानवे हजार रूपये डी.डी. क्रमांक 514055 दिनांक 03/02/2016 से बैंक आय.सी.आय.सी.आय. शाखा कनाट प्लेस देहली से बैंक ऋण प्रभार मुक्त करने हेतु किया गया।
(स) रूपये 16,30,000/- सौलह लाख तीस हजार रूपये चैक क्रमांक 769908 दिनांक 02/02/2016 बैंक आय.सी.आय.सी.आय शाखा न्यु देहली से कर दिया गया है।

[redacted]

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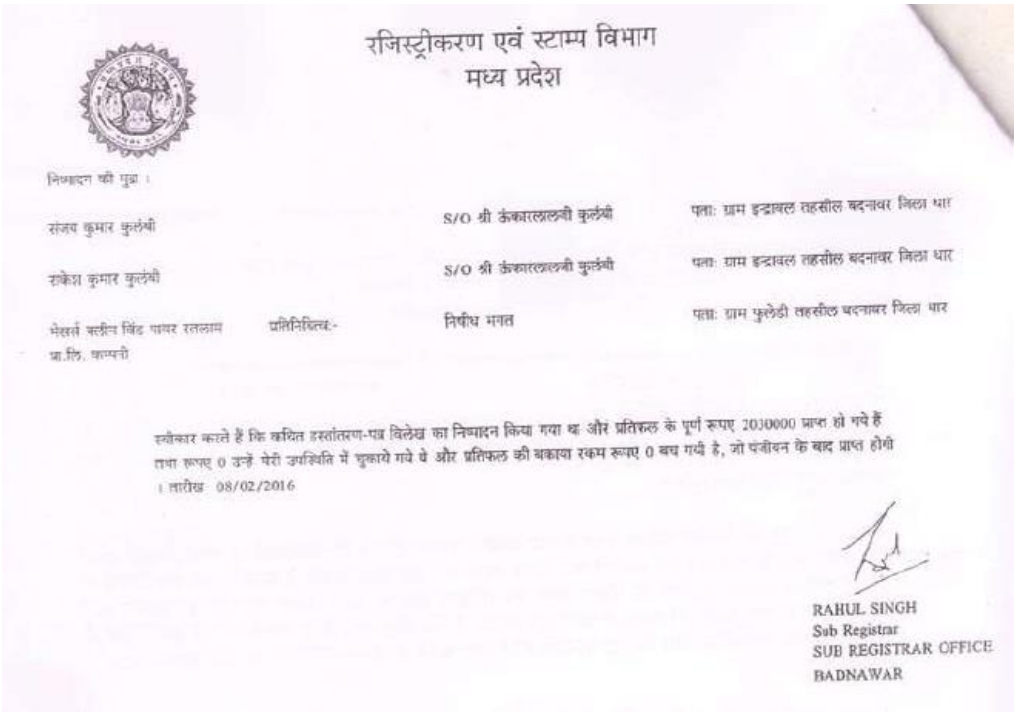
रजिस्ट्रीकरण एवं स्टाम्प विभाग
मध्य प्रदेश

RAHUL SINGH
Sub Registrar
SUB REGISTRAR OFFICE
BADNAWAR



रजिस्ट्रीकरण एवं स्टाम्प विभाग
मध्य प्रदेश

निष्पादन की पुष्टि :

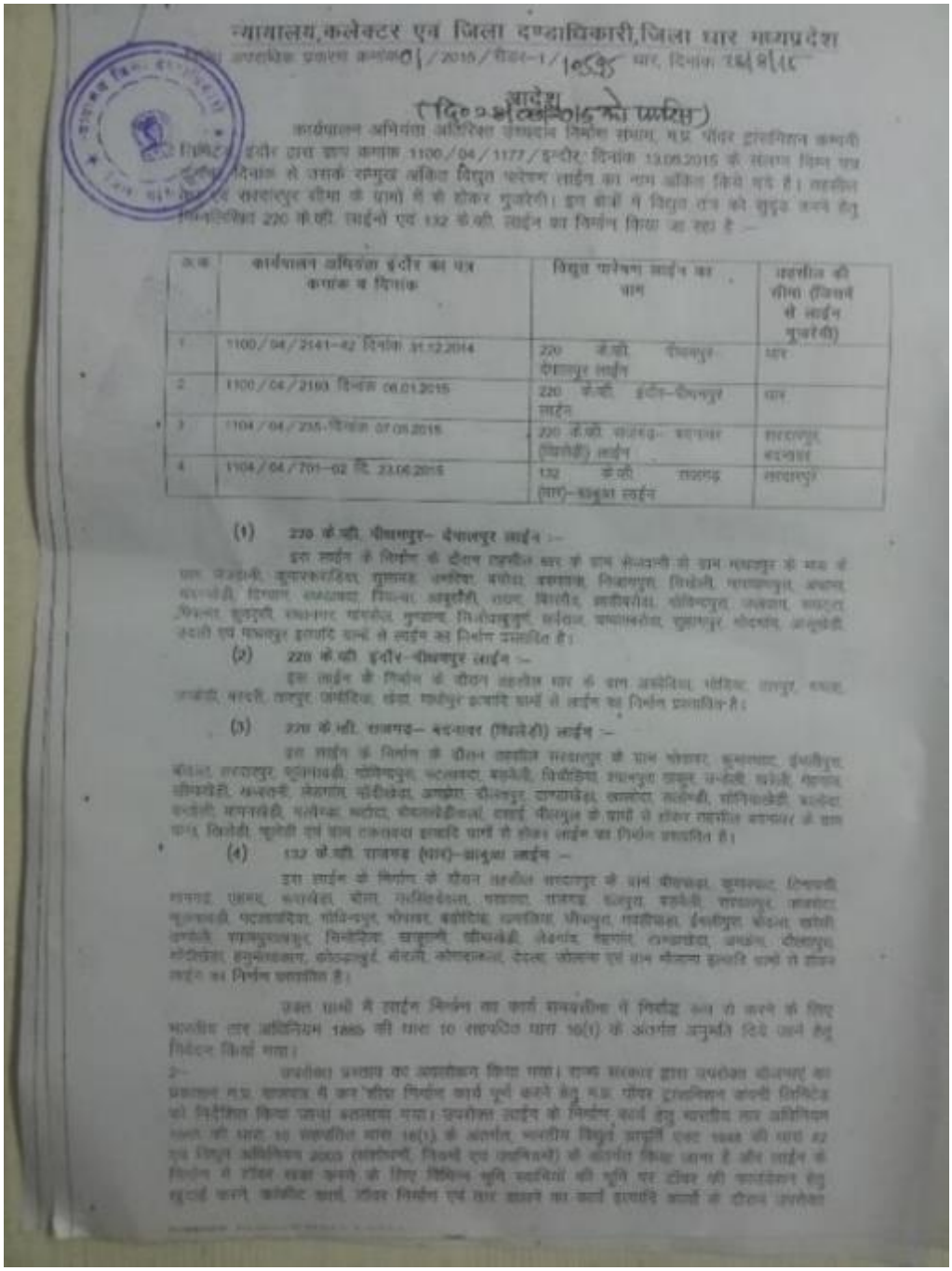
संजय कुमार कुलश्रेष्ठी		S/O श्री ओंकारलालजी कुलश्रेष्ठी	पता: ग्राम इन्द्रावल तहसील बदनावर जिला धार
राकेश कुमार कुलश्रेष्ठी		S/O श्री ओंकारलालजी कुलश्रेष्ठी	पता: ग्राम इन्द्रावल तहसील बदनावर जिला धार
भेस्रर्स वस्टीन विंड पावर रतलाम प्रा.लि. कानपुर	प्रतिनिधित्व:-	निषीध भगत	पता: ग्राम फुलेडी तहसील बदनावर जिला धार

स्वीकार करते हैं कि कथित हस्तांतरण-पत्र विलेख का निष्पादन किया गया था और प्रतिफल के पूर्ण रूपए 2030000 प्राप्त हो गये हैं तथा रूपए 0 उन्हें पेरी उपस्थिति में चुकाये गये थे और प्रतिफल की बकाया रकम रूपए 0 बच गयी है, जो पंजीयन के बाद प्राप्त होगी । तारीख 08/02/2016

RAHUL SINGH
Sub Registrar
SUB REGISTRAR OFFICE
BADNAWAR

APPENDIX G

District Collector Approval for transmission line



न्यायालय कलेक्टर एवं जिला दण्डाधिकारी, जिला धार मध्यप्रदेश

आदेश

क्र.क्र.	कार्यपालन अभियंता इंदौर का पत्र क्रमांक व दिनांक	विद्युत पारेषण लाईन का नाम	तहसील की सीमा जिसमें से लाईन गुजरेगी
1	1100/04/2141-42 दिनांक 31.12.2014	220 के.वी. पीथमपुर धार लाईन	धार
2	1100/04/2193 दिनांक 06.01.2015	220 के.वी. इंदौर-पीथमपुर लाईन	धार
3	1104/04/235 दिनांक 07.05.2015	220 के.वी. सरदार- बदनावर (सिंगोली) लाईन	सरदारपुर बदनावर
4	1104/04/701-02 दि. 23.06.2015	132 के.वी. सरदार (मार)-बाकुआ लाईन	सरदारपुर

(1) 220 के.वी. पीथमपुर- देपालपुर लाईन :-

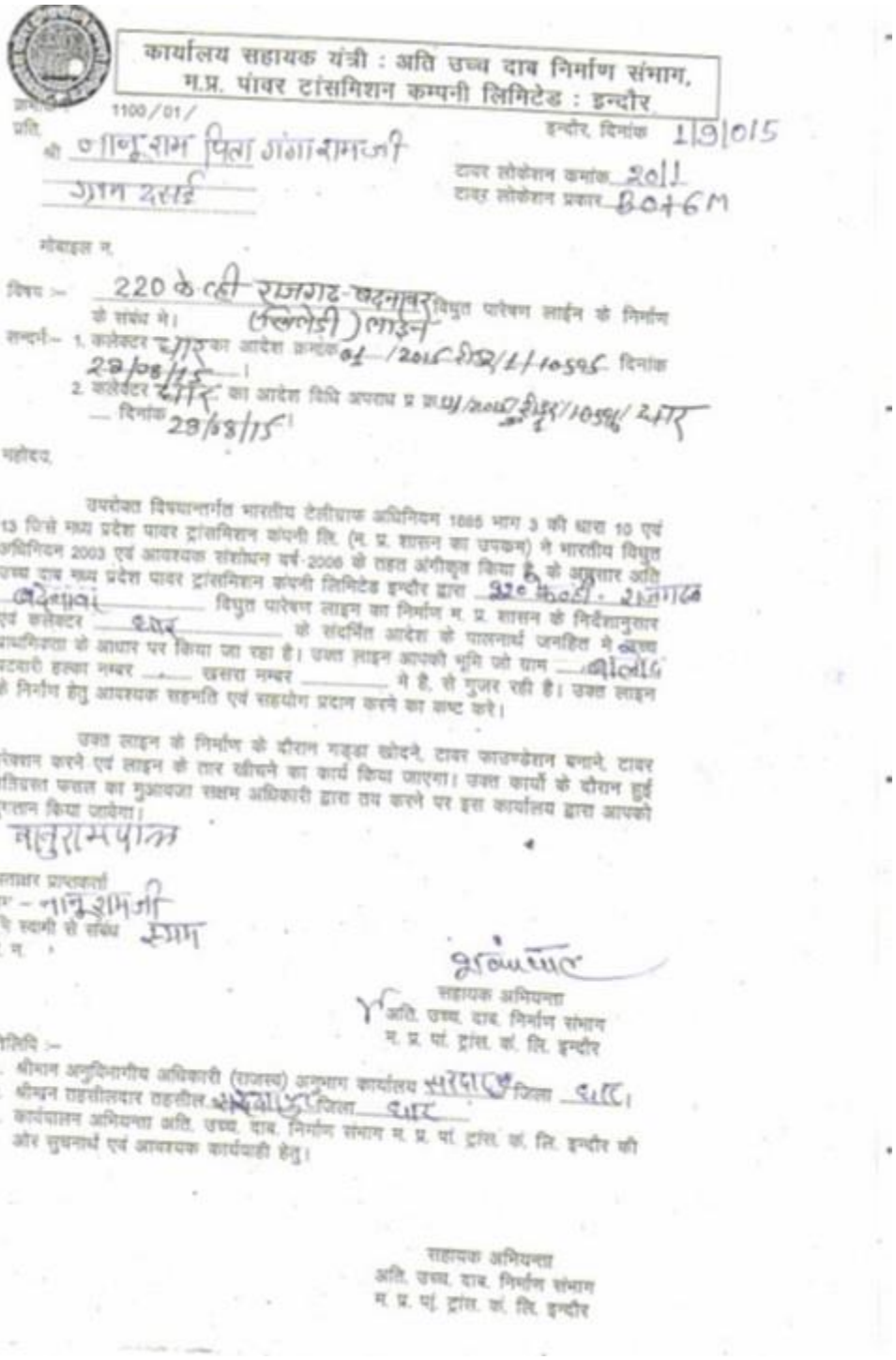
(2) 220 के.वी. इंदौर-पीथमपुर लाईन :-

(3) 220 के.वी. सरदार- बदनावर (सिंगोली) लाईन :-

(4) 132 के.वी. सरदार (मार)-बाकुआ लाईन :-

APPENDIX H

Sample copy of land agreement for ROW procurement



कार्यालय सहायक यंत्री : अति उच्च दाब निर्माण संभाग,
म.प्र. पॉवर ट्रांसमिशन कम्पनी लिमिटेड : इन्दौर

क्रमांक 1100/01/ इन्दौर, दिनांक 1/9/015

प्रति, श्री गनिराम पिता गंगारामजी
ग्राम दसई

टावर लोकेशन क्रमांक 201
टावर लोकेशन प्रकार B0+6M

मोबाइल नं.

विषय :- 220 के.वी. राजगढ़-बदनावर (धरमपुरी) लाईन विद्युत पारेषण लाईन के निर्माण के संबंध में।

सन्दर्भ :- 1. कलेक्टर धार का आदेश क्रमांक 01/2015/डीडब्ल्यू/1/10596 दिनांक 29/08/15।
2. कलेक्टर धार का आदेश विधि अपराध प्र.क्र.01/2015/डीडब्ल्यू/10596/धार दिनांक 29/08/15।

महोदय,

उपरोक्त विषयान्तर्गत भारतीय टेलीग्राफ अधिनियम 1885 भाग 3 की धारा 10 एवं 13 जिसे मध्य प्रदेश पावर ट्रांसमिशन कंपनी लि. (म. प्र. शासन का उपक्रम) ने भारतीय विद्युत अधिनियम 2003 एवं आवश्यक संशोधन वर्ष-2006 के तहत अंगीकृत किया है के अनुसार अति उच्च दाब मध्य प्रदेश पावर ट्रांसमिशन कंपनी लिमिटेड इन्दौर द्वारा 220 के.वी. राजगढ़ बदनावर विद्युत पारेषण लाइन का निर्माण म. प्र. शासन के निर्देशानुसार एवं कलेक्टर धार के संदर्भित आदेश के पालनार्थ जनहित में उच्च प्राथमिकता के आधार पर किया जा रहा है। उक्त लाइन आपकी भूमि जो ग्राम बोरलाई पटवारी हल्का नम्बर ... खसरा नम्बर ... में है, से गुजर रही है। उक्त लाइन के निर्माण हेतु आवश्यक सहमति एवं सहयोग प्रदान करने का कष्ट करें।

उक्त लाइन के निर्माण के दौरान गड्ढा खोदने, टावर फाउन्डेशन बनाने, टावर इरेक्शन करने एवं लाइन के तार खींचने का कार्य किया जाएगा। उक्त कार्यों के दौरान हुई क्षतिग्रस्त फसल का मुआवजा सक्षम अधिकारी द्वारा तय करने पर इस कार्यालय द्वारा आपको भुगतान किया जावेगा।

गनुराम पाल

हस्ताक्षर प्राप्तकर्ता
नाम - गनिरामजी
भूमि स्वामी से संबंध ग्राम
मो. नं.

सहायक अभियन्ता
अति. उच्च. दाब. निर्माण संभाग
म. प्र. पॉ. ट्रांस. कं. लि. इन्दौर

प्रतिलिपि :-
1. श्रीमान अनुविभागीय अधिकारी (राजस्व) अनुभाग कार्यालय सरदारपुर जिला धार।
2. श्रीमान तहसीलदार तहसील धरमपुरी जिला धार
3. कार्यपालन अभियन्ता अति. उच्च. दाब. निर्माण संभाग म. प्र. पॉ. ट्रांस. कं. लि. इन्दौर को और सूचनार्थ एवं आवश्यक कार्यवाही हेतु।

सहायक अभियन्ता
अति. उच्च. दाब. निर्माण संभाग
म. प्र. पॉ. ट्रांस. कं. लि. इन्दौर

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APPENDIX I

Hero Future Energies EHS Policy

HERO FUTURE ENERGIES ™

planet positive power

PRESERVE

Occupational **Health Safety & Environment** Policy

Hero Future Energies Private Limited (HFE), the renewable energy venture of the Hero Group, is committed to safeguard occupational health, safety and environment of its employees, contractors, clients, stakeholder and the communities in which we operate. HFE is poised to attain sustainable development by improving occupational health, safety and environmental conditions at all our offices & project locations by adhering to the following practices:

- Adoption of safe work culture at all our project locations and offices.
- Identification and mitigation of significant environmental aspects and occupational health and safety hazards by practicing effective HSE Management System.
- Preventing employees, contractors and interested parties from injury and ill health.
- Preventing & controlling pollution by adopting good Environmental Management Practices.
- Providing regular HSE training to employees associated with us.
- Complying with all relevant legal and other requirements applicable to us.
- Communicating, involving and consulting employees in our HSE Management System.
- Ensuring this policy is communicated and available for employees and other interested parties.
- Ensuring reporting of all relevant incidents and investigating them to prevent recurrence.
- Conducting regular inspection and audits.
- Ensuring commitment towards sustainability by complying with the Green Code of Company, implementing 3R (Reduce, Reuse and Recycle) and I.E.R (Individual Environment Responsibility).
- Ensuring minimum Occupational Health & Safety impact on the society in which we operate by complying with National & International Standards applicable to us.
- Continuous improvement in the HSE performance at all our offices and project locations is an integral part of our work culture.

Sunil Jain
Chief Executive Officer

Rahul Munjal
Managing Director

Hero Future Energies Pvt. Ltd.
(A Hero Group Company)
P +91 11 49598000
F +91 11 49598022
E info@herofutureenergies.com
W www.herofutureenergies.com

APPENDIX J

Ambient Air Quality Monitoring results

S.N	Village	Date of Sampling	1	2	3	4	5		
			PM_{10} µg/m^3	$PM_{2.5}$ µg/m^3	SO_2 µg/m^3	NO_2 µg/m^3	CO mg/m^3		
							6 am–2 pm	2 pm–10 pm	10 pm–6 am
1	Indrawal village -(AQ-01)	14/10/2015	49.5	16.8	7.2	14.0	0.71	0.89	0.56
		17/10/2015	52.4	17.5	6.9	13.5	0.53	0.80	0.64
2	Siloda Khurd village(AQ-02)	14/10/2015	47.3	15.7	6.6	13.4	0.55	0.67	0.70
		17/10/2015	50.5	16.5	7.0	13.7	0.46	0.86	0.62
3	Karod Kalan village(AQ-03)	15/10/2015	50.7	16.7	7.3	14.2	0.42	0.75	0.60
		18/10/2015	48.1	16.1	7.1	13.6	0.53	0.64	0.46
4	Hanumantya Padmapura village (AQ-04)	15/10/2015	47.0	16.2	6.7	13.2	0.57	0.76	0.81
		18/10/2015	53.2	17.7	7.4	14.6	0.47	0.71	0.63
	CPCB limit		**100**	**60**	**80**	**80**	**2**		

APPENDIX K

Surface water quality monitoring results

S. No.	Parameter	Unit	Surface Water	
			Chira khan	Padmapura-Hanumantya
	Sample Code		**NIL/W/10/15/059**	**NIL/W/10/15/060**
1	pH	---	8.1	8.19
2	Electrical Conductivity	mS/cm	0.613	0.56
3	Dissolved Oxygen	mg/l	3.4	3.1
4	BOD (3 days, at 27^0C)	mg/l	6.06	5.94
5	TDS	mg/l	339	206
6	Oil & grease	mg/l	BDL	BDL
7	Total hardness	mg/l	201.6	245.76
8	Chlorides	mg/l	36.91	20.6
9	Sulphate	mg/l	36.41	13.72
10	Nitrate	mg/l	0.61	4.49
11	Fluoride	mg/l	0.74	BDL
12	Iron	mg/l	0.35	0.72
13	Mercury	mg/l	BDL	BDL
14	Zinc	mg/l	BDL	BDL
15	Total Coliform	Nos/100ml	>1600	>1600
16	Fecal Coliform	Nos/100ml	430	350

APPENDIX L

Groundwater quality monitoring results

S.N	Parameters	Units	Test Methods	Bidwal village GW-01	Panda village GW-02	IS 10500: 2012	
						Acceptable limit	Permissible limit
1	Temperature	°C		24	24		
2	pH Value	-	APHA 4500- H+B	7.95	8.2	6.5 – 8.5	--
3	Turbidity	NTU	APHA - 2130 - B	BDL	BDL	1	5
4	Total Hardness (as $CaCO_3$)	mg/l	APHA 2340 - C	326.4	140.16	200	600
5	Iron (as Fe)	mg/l	APHA -3111-B	BDL	BDL	0.3	No relaxation
6	Chlorides (as Cl)	mg/l	APHA 4500-CL-B	82.56	61.19	250	1000
7	Fluorides (F)	mg/l	APHA - 4500 - F- B	BDL	0.69	1	1.5
8	TDS	mg/l	APHA -2540-C	681	556	500	2000
9	Calcium	mg/l	APHA -3111-B	96	35.3	75	200
10	Magnesium	mg/l	APHA -3111-B	20.7	12.4	30	100
11	Copper	mg/l	APHA -3111-B	BDL	BDL	0.05	1.5
12	Nitrate (as NO_3)	mg/l	IS 3025 P-34	26.3	14.99	45	No relaxation
13	Mercury	mg/l	IS : 3025 (P-48)	BDL	BDL	0.001	No relaxation
14	Arsenic	mg/l	IS : 3025 (P-37)	BDL	BDL	0.01	0.05
15	Zinc	mg/l	APHA -3111-B	BDL	BDL	5	15
16	Alkalinity	mg/l	APHA -2320-B	175	255	200	600
17	Total Coliform	MPN/100ml	IS:1622 :1982	0	0	10	No relaxation
18	Fecal Coliform	MPN/100ml	IS:1622 :1982	0	0	No relaxation	No relaxation

APPENDIX M

Soil Quality Monitoring Results

S. N	Parameter	Unit	Bidwal village	Panda Village
	Sample Reference No.	–	**NIL/SO/10/15/010**	**NIL/SO/10/15/011**
1	Particle size distribution			
	i. Sand	%	65.82	67.1
	ii. Slit	%	10.56	11.5
	iii. Clay	%	23.62	21.4
2	Texture	--	Sandy Clay Loam	Sandy Clay Loam
3	pH	--	7.17	6.92
4	Colour	--	Black	Black
5	Conductivity	mmhos/cm	0..364	0.054
6	Total Nitrogen	mg/kg	529.76	148.3
7	Phosphate	mg/kg	<1.0	7.66
8	Potassium	mg/kg	284.08	525.76
9	Calcium	mg/kg	7477.1	6290.71
10	Magnesium	mg/kg	1960.04	799.29
11	Sodium Adsorption Ratio	--	12.22	9.84
12	Water holding capacity	%	38.7	40.5

APPENDIX N

Phyto sociological Analysis of herbaceous species from the primary flora survey

Phytosociological analysis of herbaceous species from the primary flora survey in Sergarh

S. N	Species	Relative Frequency	Relative Abundance	Relative Density	IVI
1.	*Achyranthus aspera*	2.39	0.5	0.7	3.6
2.	*Ageratum conyzoides*	1.91	0.6	0.6	3.1
3.	*Alternanthera paronychioides*	1.91	2.2	2.3	6.4
4.	*Alysicarpus monilifer*	1.91	0.9	1.0	3.8
5.	*Amaranthus sp..*	1.91	0.6	0.7	3.2
6.	*Argemone mexicana*	0.96	0.2	0.2	1.3
7.	*Asparagus racemosus*	0.96	0.1	0.1	1.2
8.	*Blumea glomerata*	1.91	0.8	0.7	3.4
9.	*Boerhaavia diffusa*	1.91	0.7	0.5	3.1
10.	*Borreria articularis*	2.39	0.7	0.9	3.9
11.	*Bothriochloa pertusa*	1.91	1.6	2.1	5.6
12.	*Calotropis procera*	0.96	0.6	0.3	1.8
13.	*Cassia tora*	1.91	0.6	0.7	3.2
14.	*Cassia occidentalis*	1.91	1.1	1.2	4.2
15.	*Cenchrus setigerus*	1.91	3.9	4.2	10.1
16.	*Cenchrus cilliaris*	2.87	3.9	6.2	12.9
17.	*Chloris spp.*	1.44	0.7	0.5	2.6
18.	*Cochorus tridens*	1.44	0.6	0.5	2.5
19.	*Cymbopogon spp*	2.87	1.9	3.1	7.8
20.	*Cynodon dactylon*	2.87	2.7	4.4	10.0
21.	*Cyperus rotundus*	1.91	1.3	1.4	4.5
22.	*Datura metel*	1.44	0.5	0.4	2.3
23.	*Digitaria saunginalis*	2.39	2.0	2.6	7.0
24.	*Eclipta alba*	1.91	0.6	0.6	3.1
25.	*Eleucine indica*	1.44	1.0	0.8	3.3
26.	*Elionurus spp*	1.91	0.6	0.6	3.1
27.	*Eragrostis tennela*	1.44	14.9	12.0	28.3
28.	*Euphorbia hirta*	2.39	1.1	1.4	4.9
29.	*Evolvulus alsinoides*	2.87	1.4	2.2	6.5
30.	*Gomphrena serrata*	2.39	1.4	1.9	5.7
31.	*Ipomoea batata*	1.91	0.7	0.7	3.3
32.	*Imperata cylindrica*	1.44	1.8	1.5	4.8
33.	*Jatropha curcas*	0.96	1.5	0.8	3.3
34.	*Lantana camara*	2.39	0.8	1.1	4.4
35.	*Lawsonia inermis*	0.96	1.5	0.8	3.3
36.	*Leucas aspera*	2.39	1.4	1.8	5.6
37.	*Martynia annua*	2.39	1.6	2.1	6.1

S. N	Species	Relative Frequency	Relative Abundance	Relative Density	IVI
38.	*Mimosa pudica*	2.39	0.9	1.0	4.3
39.	*Ocimum bacilicum*	2.39	2.5	3.4	8.3
40.	*Oldenlandia spp*	2.87	1.5	2.5	6.8
41.	*Parthenium hysterophorus*	0.96	0.6	0.5	2.0
42.	*Physalis peruviana*	1.44	0.6	0.5	2.5
43.	*Ricinus communis*	1.44	0.4	0.4	2.2
44.	*Setaria gluaca*	1.44	0.8	0.7	2.9
45.	*Sida cordifolia*	1.44	0.6	0.5	2.5
46.	*Sida acuta*	1.44	0.6	0.5	2.5
47.	*Solanum nigrum*	0.96	0.7	0.4	2.0
48.	*Tephrosia purpurea*	1.44	0.9	0.7	3.1
49.	*Themeda triandra*	2.87	14.8	11.9	29.6
50.	*Themeda quadrivalvis*	2.87	12.6	10.2	25.6
51.	*Tridax procumbens*	2.87	3.1	2.5	8.6
52.	*Xanthium strumarium*	2.39	0.6	0.8	3.8

Phyto sociological Analysis of herbaceous species from the primary flora survey in Kisanpura village

S. N	Species	Relative Frequency	Relative Abundance	Relative Density	IVI
1.	*Achyranthus aspera*	3.07	0.7	1.0	4.8
2.	*Ageratum conyzoides*	2.45	0.8	0.9	4.1
3.	*Alternanthera paronychioides*	2.45	4.1	4.4	10.9
4.	*Alysicarpus monilifer*	2.45	1.3	1.4	5.1
5.	*Amaranthus sp..*	2.45	0.9	0.9	4.3
6.	*Argemone mexicana*	1.23	0.2	0.3	1.7
7.	*Calotropis procera*	1.23	0.8	0.4	2.5
8.	*Cassia tora*	2.45	0.9	0.9	4.3
9.	*Cassia occidentalis*	2.45	1.6	1.7	5.7
10.	*Cenchrus setigerus*	2.45	2.0	2.1	6.6
11.	*Cenchrus cilliaris*	3.68	2.8	4.5	11.0
12.	*Chloris spp.*	1.84	0.9	0.8	3.5
13.	*Cochorus tridens*	1.84	0.9	0.7	3.4
14.	*Cymbopogon spp*	3.68	2.2	3.6	9.6
15.	*Cynodon dactylon*	3.68	2.6	4.2	10.5
16.	*Cyperus rotundus*	2.45	1.8	1.9	6.2
17.	*Datura metel*	1.84	0.7	0.6	3.1
18.	*Eleucine indica*	1.84	1.5	1.2	4.5
19.	*Elionurus spp*	2.45	2.1	2.3	6.8
20.	*Euphorbia hirta*	3.07	1.5	2.1	6.7
21.	*Evolvulus alsinoides*	3.68	2.0	3.2	8.9
22.	*Gomphrena serrata*	3.07	2.0	2.7	7.8
23.	*Ipomoea batata*	2.45	1.0	1.1	4.5
24.	*Jatropha curcas*	1.23	2.2	1.2	4.6

S. N	Species	Relative Frequency	Relative Abundance	Relative Density	IVI
25.	*Lawsonia inermis*	1.23	5.6	3.0	9.8
26.	*Leucas aspera*	3.07	2.0	2.6	7.7
27.	*Martynia annua*	3.07	1.6	2.1	6.8
28.	*Ocimum bacilicum*	3.07	3.7	4.9	11.7
29.	*Oldenlandia spp*	3.68	2.2	3.5	9.4
30.	*Parthenium hysterophorus*	1.23	10.5	8.5	20.3
31.	*Physalis peruviana*	1.84	0.9	0.7	3.4
32.	*Ricinus communis*	1.84	0.3	0.3	2.4
33.	*Setaria gluaca*	1.84	0.7	0.6	3.1
34.	*Sida cordifolia*	1.84	0.4	0.3	2.5
35.	*Sida acuta*	1.84	0.9	0.7	3.4
36.	*Tephrosia purpurea*	1.84	0.5	0.4	2.7
37.	*Themeda triandra*	3.68	14.7	11.9	30.3
38.	*Themeda quadrivalvis*	3.68	14.1	11.4	29.2
39.	*Tridax procumbens*	3.68	2.1	1.7	7.5
40.	*Xanthium strumarium*	3.07	2.5	3.4	9.0

Phyto sociological Analysis of herbaceous species from the primary flora survey in Indrawal village

S. N	Species	Relative Frequency	Relative Abundance	Relative Density	IVI
1.	*Achyranthus aspera*	3.33	0.9	1.2	5.4
2.	*Ageratum conyzoides*	2.67	1.0	1.0	4.7
3.	*Alternanthera paronychioides*	2.67	6.0	6.2	14.8
4.	*Alysicarpus monilifer*	2.67	1.5	1.6	5.8
5.	*Amaranthus spp.*	2.67	1.1	1.1	4.8
6.	*Blumea glomerata*	2.67	1.4	1.4	5.4
7.	*Boerhaavia diffusa*	2.67	1.1	0.9	4.7
8.	*Calotropis procera*	1.33	1.0	0.5	2.8
9.	*Cassia tora*	2.67	1.1	1.1	4.8
10.	*Cenchrus setigerus*	2.67	3.2	3.3	9.2
11.	*Cenchrus cilliaris*	4.00	2.8	4.3	11.0
12.	*Chloris spp.*	2.00	1.1	0.9	4.0
13.	*Corchorus tridens*	2.00	1.0	0.8	3.8
14.	*Cymbopogon spp*	4.00	3.0	4.6	11.6
15.	*Cynodon dactylon*	4.00	3.4	5.2	12.6
16.	*Cyperus rotundus*	2.67	2.2	2.2	7.1
17.	*datura metel*	2.00	0.8	0.7	3.5
18.	*Eleucine indica*	2.00	1.8	1.4	5.2
19.	*Elionurus spp*	2.67	1.0	1.0	4.7
20.	*Eragrostis tennela*	2.00	2.4	1.9	6.3
21.	*Euphorbia hirta*	3.33	1.9	2.4	7.6
22.	*Evolvulus alsinoides*	4.00	1.5	2.4	7.9
23.	*Gomphrena serrata*	3.33	2.4	3.1	8.9

S. N	Species	Relative Frequency	Relative Abundance	Relative Density	IVI
24.	*Ipomoea batata*	2.67	1.1	1.2	5.0
25.	*Imperata cylindrica*	2.00	3.2	2.5	7.6
26.	*Lawsonia inermis*	1.33	2.7	1.4	5.4
27.	*Leucas aspera*	3.33	2.4	3.0	8.7
28.	*Martynia annua*	3.33	2.7	3.5	9.5
29.	*Mimosa pudica*	3.33	1.6	1.7	6.6
30.	*Ocimum bacilicum*	3.33	4.4	5.7	13.4
31.	*Parthenium hysterophorus*	1.33	1.0	0.8	3.2
32.	*Sida cordifolia*	2.00	1.0	0.8	3.8
33.	*Sida acuta*	2.00	1.0	0.8	3.8
34.	*Themeda triandra*	4.00	15.3	11.9	31.2
35.	*Themeda quadrivalvis*	4.00	15.9	12.3	32.2
36.	*Xanthium strumarium*	3.33	4.2	5.4	12.9

APPENDIX O

Noise modelling results

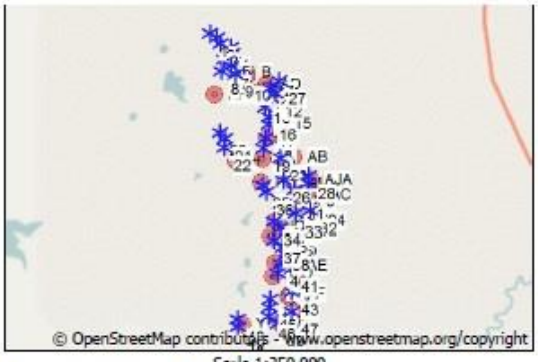
Project:
Dhar_modified WTGs

Licensed user:
Langdon & Seah Consulting India Pvt. Ltd
3rd Floor, Logix techno park, tower B, sector 127, Noida
IN-201304 Noida
01204368426
Girish Shukla / gshukla@senesindia.com
Calculated:
8/9/2016 4:21 PM/3.0.639

DECIBEL - Main Result

Calculation: Noise120 dba

Noise calculation model:
ISO 9613-2 General
Wind speed:
10.0 m/s
Ground attenuation:
Alternative
Meteorological coefficient, C0:
0.0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Pure and Impulse tone penalty are added to WTG source noise
Height above ground level, when no value in NSA object:
0.0 m Don't allow override of model height with height from NSA object
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0.0 dB(A)



Scale 1:250,000
Existing WTG
Noise sensitive area

WTGs

	Easting	Northing	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data Creator	Name	Wind speed [m/s]	Status	LwA,ref [dB(A)]	Pure tones
1	513,582	2,528,276	530.6	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
2	513,849	2,528,109	540.4	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
3	514,026	2,527,854	548.2	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
4	514,469	2,527,689	547.7	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
5	514,528	2,527,431	546.3	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
6	514,166	2,527,170	545.8	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
7	514,459	2,526,899	550.8	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
8	514,048	2,526,669	538.9	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
9	514,653	2,526,538	541.0	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
10	515,047	2,526,371	545.9	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
11	516,146	2,525,933	544.9	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
12	516,359	2,525,737	545.3	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
13	515,852	2,525,445	534.3	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
14	515,930	2,525,126	534.4	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
15	516,762	2,525,208	540.7	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
16	516,132	2,524,704	531.2	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
17	516,079	2,524,390	532.6	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
18	515,966	2,523,829	540.1	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
19	515,850	2,523,368	538.9	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
20	513,980	2,524,051	521.5	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
21	514,217	2,523,785	524.3	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
22	514,173	2,523,394	534.9	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
23	516,593	2,522,969	538.0	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
24	518,204	2,521,068	540.4	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
25	515,822	2,521,800	537.3	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
26	516,737	2,522,020	544.9	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
27	516,537	2,526,250	548.0	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
28	517,789	2,522,204	544.2	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
29	517,776	2,521,879	539.6	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
30	517,207	2,521,615	541.9	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
31	517,324	2,521,330	537.0	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
32	517,854	2,520,704	538.4	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
33	517,219	2,520,602	533.8	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
34	516,310	2,520,271	531.7	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
35	516,605	2,520,004	535.2	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
36	515,995	2,521,524	536.4	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
37	516,308	2,519,529	535.3	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
38	516,688	2,519,217	531.8	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
39	516,831	2,518,898	528.3	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
40	516,583	2,518,528	531.7	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
41	517,056	2,518,317	538.3	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
42	516,463	2,518,116	530.8	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
43	517,084	2,517,323	536.2	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
44	516,136	2,517,017	530.8	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
45	516,103	2,516,669	533.7	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
46	516,085	2,516,278	535.8	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
47	517,079	2,516,484	538.7	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No

To be continued on next page...

Project:
Dhar_modified WTGs

Licensed user:
Langdon & Seah Consulting India Pvt. Ltd
3rd Floor, Logix techno park, tower B, sector 127, Noida
IN-201304 Noida
01204368426
Girish Shukla / gshukla@senesindia.com
Calculated:
8/9/2016 4:21 PM/3.0.639

DECIBEL - Main Result

Calculation: Noise120 dba

...continued from previous page

	Easting	Northing	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Noise data Creator	Name	Wind speed	Status	LwA,ref	Pure tones
			[m]					[kW]	[m]	[m]			[m/s]		[dB(A)]	
48	514,758	2,516,160	534.2	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
49	514,743	2,515,852	536.6	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No
50	516,452	2,515,969	535.3	GAMESA G97 2000 97.0 IO...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	EMD	Level 0 - Estimated - - 07-2012	10.0	User value	120.0	No

Calculation Results

Sound Level

Noise sensitive area

No.	Name	Easting	Northing	Z [m]	Imission height [m]	Demands Noise [dB(A)]	Sound Level From WTGs [dB(A)]	Distance to noise demand [m]	Demands fulfilled ? Noise
A	Noise sensitive point: (5)	518,652	2,522,010	546.6	0.0	0.0	54.4	-9.999999933815812S1E36	No
B	Noise sensitive point: (6)	515,166	2,526,601	543.0	0.0	0.0	64.0	-9.999999933815812S1E36	No
C	Noise sensitive point: (12)	515,141	2,526,432	541.9	0.0	0.0	68.4	-9.999999933815812S1E36	No
D	Noise sensitive point: (13)	515,121	2,526,394	541.5	0.0	0.0	69.6	-9.999999933815812S1E36	No
E	Noise sensitive point: (14)	515,608	2,525,758	542.4	0.0	0.0	62.1	-9.999999933815812S1E36	No
F	Noise sensitive point: (15)	516,359	2,523,943	539.0	0.0	0.0	61.5	-9.999999933815812S1E36	No
G	Noise sensitive point: (16)	516,016	2,523,802	541.2	0.0	0.0	70.7	-9.999999933815812S1E36	No
H	Noise sensitive point: (17)	514,694	2,522,800	526.3	0.0	0.0	54.3	-9.999999933815812S1E36	No
I	Noise sensitive point: (18)	515,770	2,521,912	538.3	0.0	0.0	68.1	-9.999999933815812S1E36	No
J	Noise sensitive point: (19)	516,671	2,522,284	539.2	0.0	0.0	63.3	-9.999999933815812S1E36	No
K	Noise sensitive point: (20)	517,408	2,521,108	536.6	0.0	0.0	65.2	-9.999999933815812S1E36	No
L	Noise sensitive point: (21)	517,824	2,520,657	539.3	0.0	0.0	70.7	-9.999999933815812S1E36	No
M	Noise sensitive point: (22)	517,419	2,520,964	535.0	0.0	0.0	63.7	-9.999999933815812S1E36	No
N	Noise sensitive point: (23)	516,391	2,520,276	534.8	0.0	0.0	70.2	-9.999999933815812S1E36	No
O	Noise sensitive point: (24)	516,576	2,520,039	534.9	0.0	0.0	71.3	-9.999999933815812S1E36	No
P	Noise sensitive point: (25)	516,179	2,519,626	534.8	0.0	0.0	66.8	-9.999999933815812S1E36	No
Q	Noise sensitive point: (26)	517,082	2,519,032	534.0	0.0	0.0	64.2	-9.999999933815812S1E36	No
R	Noise sensitive point: (27)	516,941	2,518,845	530.1	0.0	0.0	68.7	-9.999999933815812S1E36	No
S	Noise sensitive point: (28)	516,366	2,518,573	526.0	0.0	0.0	65.4	-9.999999933815812S1E36	No
T	Noise sensitive point: (29)	516,284	2,517,949	533.5	0.0	0.0	64.1	-9.999999933815812S1E36	No
U	Noise sensitive point: (30)	517,000	2,517,160	537.0	0.0	0.0	65.7	-9.999999933815812S1E36	No
V	Noise sensitive point: (31)	516,947	2,517,102	532.5	0.0	0.0	63.6	-9.999999933815812S1E36	No
W	Noise sensitive point: (32)	516,568	2,515,983	534.6	0.0	0.0	68.2	-9.999999933815812S1E36	No
X	Noise sensitive point: (33)	517,157	2,516,469	539.3	0.0	0.0	69.6	-9.999999933815812S1E36	No
Y	Noise sensitive point: (34)	514,935	2,515,934	535.9	0.0	0.0	66.3	-9.999999933815812S1E36	No
Z	Noise sensitive point: (35)	516,170	2,525,792	544.3	0.0	0.0	69.4	-9.999999933815812S1E36	No
AA	Noise sensitive point: (36)	515,834	2,522,915	533.1	0.0	0.0	59.4	-9.999999933815812S1E36	No
AB	Noise sensitive point: (37)	517,178	2,522,996	543.8	0.0	0.0	57.0	-9.999999933815812S1E36	No
AC	Noise sensitive point: (38)	518,139	2,521,381	544.0	0.0	0.0	62.7	-9.999999933815812S1E36	No
AD	Noise sensitive point: (39)	516,003	2,526,093	545.5	0.0	0.0	65.5	-9.999999933815812S1E36	No
AE	Noise sensitive point: (40)	517,170	2,518,426	539.7	0.0	0.0	66.9	-9.999999933815812S1E36	No
AF	Noise sensitive point: (41)	517,103	2,517,226	537.6	0.0	0.0	68.9	-9.999999933815812S1E36	No
AG	Noise sensitive point: (42)	513,752	2,525,663	520.8	0.0	0.0	53.2	-9.999999933815812S1E36	No
AH	Noise sensitive point: (43)	513,752	2,525,662	520.8	0.0	0.0	53.2	-9.999999933815812S1E36	No
AI	Noise sensitive point: (44)	517,205	2,521,905	547.1	0.0	0.0	64.4	-9.999999933815812S1E36	No
AJ	Noise sensitive point: (45)	517,902	2,522,010	541.6	0.0	0.0	67.8	-9.999999933815812S1E36	No

Distances (m)

WTG	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
1	8060	2305	2415	2431	3232	5147	5094	5588	6730	6741	8125	8720	8257	8479	8765	9032	9685	10011	10094	10675	11629	11670
2	7763	2002	2117	2135	2937	4864	4822	5376	6488	6472	7853	8446	7987	8235	8519	8797	9636	9766	9862	10448	11393	11435
3	7453	1694	1807	1825	2626	4554	4515	5098	6193	6166	7546	8138	7680	7938	8221	8505	9336	9469	9571	10159	11099	11142
4	7053	1292	1426	1450	2242	4196	4184	4894	5922	5836	7207	7792	7343	7658	7935	8243	9043	9183	9311	9908	10828	10873
5	6811	1047	1172	1194	1992	3940	3923	4634	5658	5575	6948	7533	7083	7393	7671	7978	8779	8918	9046	9643	10564	10609
6	6837	1151	1223	1230	2019	3902	3843	4402	5498	5490	6874	7470	7007	7244	7528	7808	8645	8775	8874	9461	10403	10445
7	6441	767	827	832	1620	3514	3467	4106	5157	5117	6498	7091	6632	6899	7180	7474	8293	8428	8541	9134	10065	10108
8	6550	1120	1119	1107	1807	3574	3478	3922	5060	5109	6497	7100	6626	6809	7096	7359	8218	8341	8421	9002	9956	9997
9	6041	517	500	489	1234	3106	3057	3738	4759	4708	6089	6682	6222	6499	6778	7079	7889	8026	8147	8742	9667	9711

To be continued on next page...

Project:
Dhar_modified WTGs

Licensed user:
Langdon & Seah Consulting India Pvt. Ltd
3rd Floor, Logix techno park, tower B, sector 127, Noida
IN-201304 Noida
01204368426
Girish Shukla / gshukla@senesindia.com
Calculated:
8/9/2016 4:21 PM/3.0.639

DECIBEL - Main Result

Calculation: Noise120 dba

...continued from previous page

WTG	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
10	5658	259	112	77	831	2760	2746	3588	4518	4398	5768	6353	5904	6241	6514	6840	7616	7760	7908	8512	9415	9462
11	4655	1186	1122	1124	565	2002	2135	3453	4039	3686	4987	5537	5129	5662	5910	6307	6964	7132	7363	7985	8814	8867
12	4376	1473	1402	1402	751	1795	1965	3376	3870	3467	4746	5287	4889	5461	5702	6114	6744	6916	7164	7788	8600	8655
13	4431	1344	1216	1198	396	1586	1651	2888	3534	3265	4607	5178	4747	5197	5455	5828	6530	6689	6891	7508	8364	8415
14	4137	1661	1525	1504	709	1259	1327	2634	3218	2937	4281	4854	4420	4872	5128	5506	6202	6362	6567	7186	8037	8088
15	3715	2118	2031	2025	1278	1328	1592	3174	3442	2925	4150	4673	4294	4946	5173	5613	6184	6365	6646	7275	8051	8108
16	3689	2129	1992	1970	1177	795	910	2386	2816	2479	3815	4387	3955	4435	4686	5078	5751	5914	6135	6757	7593	7646
17	3505	2392	2247	2222	1446	528	592	2109	2498	2187	3540	4121	3678	4126	4380	4765	5451	5611	5824	6444	7288	7340
18	3244	2885	2730	2701	1962	409	57	1636	1927	1698	3079	3676	3212	3578	3839	4209	4925	5078	5271	5888	6748	6798
19	3114	3305	3145	3113	2402	767	465	1288	1459	1360	2745	3354	2870	3139	3408	3757	4508	4652	4822	5436	6313	6362
20	5098	2812	2649	2606	2359	2381	2052	1440	2790	3219	4518	5128	4621	4479	4779	4942	5900	5989	5975	6522	7523	7556
21	4777	2972	2804	2761	2414	2147	1799	1094	2434	2876	4165	4775	4267	4128	4427	4599	5550	5641	5637	6191	7185	7219
22	4688	3357	3188	3146	2765	2253	1888	790	2179	2733	3961	4563	4054	3826	4127	4269	5243	5325	5296	5840	6845	6877
23	2271	3902	3755	3728	2957	1001	1013	1907	1340	689	2031	2619	2168	2700	2930	3369	3967	4138	4401	5029	5823	5878
24	1043	6312	6177	6154	5360	3416	3501	3914	2576	1957	797	560	792	1978	1926	2486	2325	2557	3099	3662	4089	4160
25	2838	4846	4682	4647	3963	2209	2011	1508	123	977	1730	2305	1802	1627	1916	2203	3041	3159	3272	3879	4787	4831
26	1915	4843	4691	4663	3904	1959	1922	2187	973	272	1132	1744	1257	1778	1988	2458	3008	3181	3467	4096	4867	4923
27	4738	1415	1407	1424	1051	2314	2503	3912	4406	3968	5215	5739	5359	5976	6211	6634	7239	7416	7679	8305	9101	9157
28	885	5120	4988	4968	4169	2251	2386	3152	2040	1121	1160	1548	1294	2381	2482	3040	3250	3464	3900	4513	5105	5171
29	886	5395	5260	5238	4443	2503	2606	3217	2006	1177	854	1223	982	2118	2197	2762	2930	3147	3594	4203	4782	4848
30	1498	5388	5241	5215	4440	2477	2490	2779	1467	858	545	1140	684	1568	1698	2239	2586	2783	3156	3780	4459	4521
31	1492	5696	5549	5523	4748	2785	2796	3013	1659	1156	237	839	378	1408	1492	2053	2311	2514	2918	3537	4182	4245
32	1531	6481	6338	6313	5530	3567	3602	3792	2408	1974	602	56	507	1524	1440	1992	1842	2071	2599	3171	3645	3714
33	2009	6341	6189	6161	5401	3450	3418	3348	1953	1769	540	607	414	890	855	1426	1576	1779	2201	2813	3449	3511
34	2917	6433	6271	6238	5531	3672	3543	3001	1727	2045	1381	1562	1308	81	353	658	1460	1559	1699	2322	3186	3233
35	2866	6752	6592	6560	5839	3946	3843	3387	2082	2281	1365	1383	1259	346	45	570	1083	1206	1450	2080	2871	2922
36	2701	5144	4981	4948	4251	2446	2278	1823	448	1017	1473	2024	1530	1309	1595	1907	2719	2841	2974	3587	4478	4524
37	3413	7164	7001	6967	6268	4414	4283	3648	2442	2779	1924	1890	1815	752	576	161	920	932	957	1580	2467	2510
38	3415	7539	7379	7346	6629	4737	4634	4101	2847	3067	2024	1834	1894	1100	829	653	435	450	720	1331	2080	2131
39	3606	7881	7721	7689	6968	5067	4971	4449	3195	3390	2284	2020	2148	1447	1169	977	285	122	567	1095	1746	1800
40	4051	8197	8034	8001	7295	5419	5304	4671	3480	3757	2709	2464	2576	1759	1511	1170	709	478	222	651	1430	1472
41	4023	8497	8338	8306	7580	5669	5582	5067	3818	3986	2813	2463	2672	2069	1787	1575	715	541	736	855	1158	1220
42	4467	8584	8420	8386	7689	5827	5703	5007	3858	4174	3138	2882	3004	2161	1926	1536	1106	872	468	244	1096	1124
43	4943	9474	9314	9281	8563	6659	6566	5976	4773	4978	3799	3415	3657	3033	2763	2474	1709	1529	1442	1016	183	260
44	5591	9633	9467	9432	8757	6929	6786	5960	4908	5294	4284	4012	4150	3269	3054	2609	2226	1997	1573	944	876	816
45	5918	9976	9810	9775	9102	7278	7133	6291	5253	5644	4627	4343	4492	3619	3403	2958	2558	2332	1922	1293	1023	949
46	6281	10364	10198	10162	9492	7669	7524	6669	5642	6035	5008	4711	4872	4010	3793	3349	2929	2706	2313	1683	1271	1193
47	5746	10296	10135	10102	9390	7493	7394	6751	5583	5815	4636	4239	4493	3854	3590	3268	2548	2365	2208	1667	681	632
48	7028	10449	10279	10241	9635	7945	7745	6640	5840	6416	5613	5443	5492	4428	4284	3746	3694	3460	2900	2352	2455	2383
49	7294	10757	10587	10549	9943	8250	8051	6948	6146	6715	5893	5708	5770	4721	4571	4038	3948	3713	3168	2603	2609	2534
50	6429	10710	10545	10510	9825	7974	7845	7054	5982	6319	5227	4884	5088	4308	4072	3667	3127	2917	2606	1987	1311	1236

WTG	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ
1	12650	12337	12416	3587	5815	6388	8264	3260	10483	11598	2619	2620	7329	7611
2	12427	12101	12223	3279	5561	6101	7979	2951	10237	11359	2448	2449	7053	7323
3	12140	11808	11954	2974	5260	5791	7669	2648	9939	11065	2208	2209	6745	7012
4	11892	11538	11764	2548	4966	5419	7297	2214	9649	10790	2149	2150	6398	6636
5	11628	11273	11504	2320	4701	5166	7045	1992	9385	10525	1931	1932	6140	6385
6	11442	11112	11262	2432	4571	5147	7021	2130	9246	10369	1563	1564	6079	6370
7	11118	10774	10975	2038	4215	4757	6632	1742	8896	10028	1424	1425	5699	5979
8	10979	10664	10771	2296	4157	4826	6685	2039	8815	9925	1049	1050	5715	6046
9	10727	10376	10607	1690	3811	4350	6224	1422	8494	9629	1256	1257	5289	5573
10	10498	10125	10437	1263	3545	3991	5870	996	8224	9374	1476	1476	4960	5212
11	9959	9518	10072	143	3034	3113	4969	214	7577	8760	2409	2409	4165	4298
12	9756	9303	9906	197	2871	2861	4705	503	7356	8544	2608	2608	3924	4034
13	9489	9071	9555	471	2530	2785	4663	665	7142	8314	2111	2111	3790	4000
14	9165	8744	9245	708	2213	2469	4347	970	6814	7987	2243	2243	3464	3687
15	9227	8748	9452	832	2474	2251	4067	1166	6795	7990	3044	3044	3332	3395
16	8732	8299	8851	1089	1814	2003	3882	1395	6364	7541	2566	2566	2997	3223
17	8421	7995	8533	1405	1495	1775	3646	1705	6063	7237	2652	2652	2728	2998
18	7869	7456	7962	1974	924	1471	3273	2264	5536	6700	2875	2874	2288	2656
19	7419	7022	7490	2445	453	1379	3031	2729	5116	6269	3109	3109	1994	2461

To be continued on next page...

Project:
Dhar_modified WTGs

Licensed user:
Langdon & Seah Consulting India Pvt. Ltd
3rd Floor, Logix techno park, tower B, sector 127, Noida
IN-201304 Noida
01204368426
Girish Shukla / gshukla@senesindia.com
Calculated:
8/9/2016 4:21 PM/3.0.639

DECIBEL - Main Result

Calculation: Noise120 dba

...continued from previous page

WTG	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ
20	8473	8221	8173	2798	2175	3367	4942	2875	6467	7506	1628	1627	3874	4421
21	8148	7885	7883	2801	1837	3064	4600	2919	6119	7166	1934	1934	3530	4090
22	7788	7541	7498	3121	1729	3031	4447	3261	5802	6829	2307	2307	3378	3977
23	6986	6525	7227	2855	761	585	2216	3179	4580	5766	3915	3915	1227	1623
24	5341	4717	6086	5144	3004	2184	320	5486	2838	3997	6398	6397	1303	989
25	5864	5496	5932	4007	1115	1808	2354	4297	3634	4750	4382	4382	1387	2091
26	6039	5567	6347	3815	1271	1071	1540	4138	3620	4808	4709	4709	482	1165
27	10267	9801	10439	587	3408	3317	5125	556	7850	9042	2846	2846	4396	4454
28	6339	5770	6889	3937	2080	1000	894	4279	3829	5025	5316	5316	656	224
29	6018	5446	6589	4230	2201	1267	616	4572	3506	4702	5523	5523	571	182
30	5668	5147	6118	4304	1890	1381	960	4637	3190	4391	5322	5321	290	800
31	5400	4864	5901	4609	2175	1672	816	4943	2909	4110	5615	5615	587	893
32	4893	4292	5592	5360	2995	2390	735	5698	2379	3558	6435	6435	1365	1307
33	4664	4134	5196	5295	2696	2394	1206	5624	2177	3378	6134	6134	1303	1565
34	4295	3896	4549	5523	2686	2860	2139	5830	2036	3147	5968	5967	1864	2358
35	4021	3578	4399	5805	3011	3046	2061	6119	1676	2823	6337	6337	1994	2389
36	5570	5187	5689	4272	1400	1888	2148	4569	3314	4439	4707	4707	1269	1968
37	3555	3176	3848	6265	3419	3574	2604	6571	1400	2437	6645	6644	2540	2949
38	3236	2788	3721	6596	3795	3811	2606	6910	926	2034	7083	7082	2738	3046
39	2926	2451	3518	6926	4139	4113	2807	7242	581	1694	7432	7432	3031	3291
40	2545	2138	3073	7276	4450	4507	3250	7587	595	1402	7676	7675	3434	3724
41	2384	1851	3190	7528	4757	4681	3250	7847	157	1092	8054	8054	3591	3789
42	2135	1788	2663	7682	4840	4932	3670	7990	771	1096	8019	8018	3861	4152
43	1435	858	2558	8518	5730	5674	4193	8836	1106	99	8981	8980	4584	4758
44	1120	1159	1617	8775	5906	6069	4802	9077	1747	989	8968	8968	5004	5296
45	829	1073	1380	9123	6252	6418	5133	9424	2055	1144	9296	9295	5351	5636
46	566	1089	1200	9515	6642	6806	5501	9815	2406	1391	9670	9670	5738	6013
47	715	80	2213	9353	6550	6513	5011	9669	1944	742	9763	9762	5423	5587
48	1819	2419	287	9735	6840	7252	6220	10011	3309	2576	9556	9555	6245	6642
49	1830	2492	209	10042	7147	7548	6489	10318	3537	2731	9861	9860	6535	6921
50	117	864	1517	9827	6973	7064	5669	10134	2559	1415	10063	10062	5984	6213

APPENDIX P

Shadow flickering modelling results

Project:
Dhar_modified WTGs_RECOVER001 3_10_2016 4_19_37 PM

Licensed user:
Langdon & Seah Consulting India Pvt. Ltd
3rd Floor, Logix techno park, tower B, sector 127, Noida
IN-201304 Noida
01204368426
Girish Shukla / gshukla@senesindia.com
Calculated:
8/9/2016 6:10 PM/3.0.639

SHADOW - Main Result

Calculation: Shadow Flicker Dhar IFC

Assumptions for shadow calculations

Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

Sunshine probability S (Average daily sunshine hours) [AHMADABAD]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
9.33	9.71	9.21	10.06	10.59	7.88	4.10	3.52	7.19	9.34	9.27	9.20

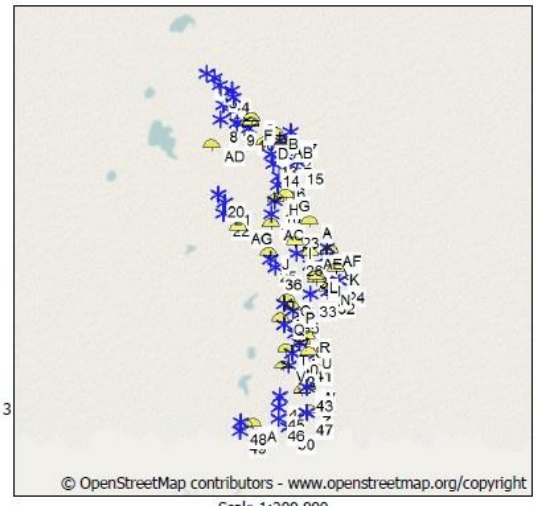
Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
277	251	537	1,266	607	259	225	267	495	2,216	1,502	579	8,481

Idle start wind speed: Cut in wind speed from power curve

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Project Wizard Elevation Data Grid (SRTM: Shuttle DTM 3
Obstacles used in calculation
Eye height: 1.5 m
Grid resolution: 10.0 m

All coordinates are in
UTM (north)-WGS84 Zone: 43



Scale 1:200,000
Existing WTG Shadow receptor

WTGs

	Easting	Northing	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
1	513,582	2,528,276	530.6	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
2	513,849	2,528,109	540.4	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
3	514,026	2,527,854	548.2	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
4	514,469	2,527,689	547.7	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
5	514,528	2,527,431	546.3	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
6	514,166	2,527,170	545.8	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
7	514,459	2,526,899	550.8	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
8	514,048	2,526,669	538.9	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
9	514,653	2,526,538	541.0	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
10	515,047	2,526,371	545.9	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
11	516,146	2,525,933	544.9	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
12	516,359	2,525,737	545.3	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
13	515,852	2,525,445	534.3	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
14	515,930	2,525,126	534.4	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
15	516,762	2,525,208	540.7	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
16	516,132	2,524,704	531.2	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
17	516,079	2,524,390	532.6	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
18	515,966	2,523,829	540.1	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
19	515,850	2,523,368	538.9	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
20	513,980	2,524,051	521.5	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
21	514,217	2,523,785	524.3	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
22	514,173	2,523,394	534.9	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
23	516,593	2,522,969	538.0	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
24	518,204	2,521,068	540.4	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
25	515,822	2,521,800	537.3	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
26	516,737	2,522,020	544.9	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
27	516,537	2,526,250	548.0	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
28	517,789	2,522,204	544.2	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0

To be continued on next page...

Project:
Dhar_modified WTGs_RECOVER001 3_10_2016 4_19_37 PM

Licensed user:
Langdon & Seah Consulting India Pvt. Ltd
3rd Floor, Logix techno park, tower B, sector 127, Noida
IN-201304 Noida
01204368426
Girish Shukla / gshukla@senesindia.com
Calculated:
8/9/2016 6:10 PM/3.0.639

SHADOW - Main Result

Calculation: Shadow Flicker Dhar IFC

...continued from previous page

	Easting	Northing	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
29	517,776	2,521,879	539.6	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
30	517,207	2,521,615	541.9	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
31	517,324	2,521,330	537.0	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
32	517,854	2,520,704	538.4	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
33	517,219	2,520,602	533.8	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
34	516,310	2,520,271	531.7	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
35	516,605	2,520,004	535.2	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
36	515,995	2,521,524	536.4	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
37	516,308	2,519,529	535.3	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
38	516,688	2,519,217	531.8	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
39	516,831	2,518,898	528.3	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
40	516,583	2,518,528	531.7	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
41	517,056	2,518,317	538.3	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
42	516,463	2,518,116	530.8	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
43	517,084	2,517,323	536.2	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
44	516,136	2,517,017	530.8	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
45	516,103	2,516,669	533.7	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
46	516,085	2,516,278	535.8	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
47	517,079	2,516,484	538.7	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
48	514,758	2,516,160	534.2	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
49	514,743	2,515,852	536.6	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0
50	516,452	2,515,969	535.3	GAMESA G97 2000 97.0 !O! hub: 104.0 ...	Yes	GAMESA	G97-2,000	2,000	97.0	104.0	2,500	0.0

Shadow receptor-Input

No.	Easting	Northing	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
			[m]	[m]	[m]	[m]	[°]	[°]	
A	517,178	2,522,996	543.8	1.0	1.0	1.0	0.0	90.0	Fixed direction
B	516,003	2,526,093	545.5	1.0	1.0	1.0	0.0	90.0	Fixed direction
C	515,166	2,526,601	543.0	1.0	1.0	1.0	0.0	90.0	Fixed direction
D	515,608	2,525,758	542.4	1.0	1.0	1.0	0.0	90.0	Fixed direction
E	515,141	2,526,432	541.9	1.0	1.0	1.0	0.0	90.0	Fixed direction
F	515,121	2,526,394	541.5	1.0	1.0	1.0	0.0	90.0	Fixed direction
G	516,359	2,523,943	539.0	1.0	1.0	1.0	0.0	90.0	Fixed direction
H	516,016	2,523,802	541.2	1.0	1.0	1.0	0.0	90.0	Fixed direction
I	516,671	2,522,284	539.2	1.0	1.0	1.0	0.0	90.0	Fixed direction
J	515,770	2,521,912	538.3	1.0	1.0	1.0	0.0	90.0	Fixed direction
K	518,139	2,521,381	544.0	1.0	1.0	1.0	0.0	90.0	Fixed direction
L	517,408	2,521,108	536.6	1.0	1.0	1.0	0.0	90.0	Fixed direction
M	517,419	2,520,964	535.0	1.0	1.0	1.0	0.0	90.0	Fixed direction
N	517,824	2,520,657	539.3	1.0	1.0	1.0	0.0	90.0	Fixed direction
O	516,391	2,520,276	534.8	1.0	1.0	1.0	0.0	90.0	Fixed direction
P	516,576	2,520,039	534.9	1.0	1.0	1.0	0.0	90.0	Fixed direction
Q	516,179	2,519,626	534.8	1.0	1.0	1.0	0.0	90.0	Fixed direction
R	517,082	2,519,032	534.0	1.0	1.0	1.0	0.0	90.0	Fixed direction
S	516,941	2,518,845	530.1	1.0	1.0	1.0	0.0	90.0	Fixed direction
T	516,366	2,518,573	526.0	1.0	1.0	1.0	0.0	90.0	Fixed direction
U	517,170	2,518,426	539.7	1.0	1.0	1.0	0.0	90.0	Fixed direction
V	516,284	2,517,949	533.5	1.0	1.0	1.0	0.0	90.0	Fixed direction
W	517,103	2,517,226	537.6	1.0	1.0	1.0	0.0	90.0	Fixed direction
X	516,947	2,517,102	532.5	1.0	1.0	1.0	0.0	90.0	Fixed direction
Y	515,202	2,515,983	533.2	1.0	1.0	1.0	0.0	90.0	Fixed direction
Z	517,157	2,516,469	539.3	1.0	1.0	1.0	0.0	90.0	Fixed direction
AA	514,935	2,515,934	535.9	1.0	1.0	1.0	0.0	90.0	Fixed direction
AB	516,170	2,525,792	544.3	1.0	1.0	1.0	0.0	90.0	Fixed direction
AC	515,834	2,522,915	533.1	1.0	1.0	1.0	0.0	90.0	Fixed direction
AD	513,752	2,525,663	520.8	1.0	1.0	1.0	0.0	90.0	Fixed direction

To be continued on next page...

Project:
Dhar_modified WTGs_RECOVER001 3_10_2016 4_19_37 PM

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Langdon & Seah Consulting India Pvt. Ltd
3rd Floor, Logix techno park, tower B, sector 127, Noida
IN-201304 Noida
01204368426
Girish Shukla / gshukla@senesindia.com
Calculated:
8/9/2016 6:10 PM/3.0.639

SHADOW - Main Result

Calculation: Shadow Flicker Dhar IFC

...continued from previous page

No.	Easting	Northing	Z [m]	Width [m]	Height [m]	Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]	Direction mode
AE	517,205	2,521,905	547.1	1.0	1.0	1.0	0.0	90.0	Fixed direction
AF	517,902	2,522,010	541.6	1.0	1.0	1.0	0.0	90.0	Fixed direction
AG	514,694	2,522,800	526.3	1.0	1.0	1.0	0.0	90.0	Fixed direction

Calculation Results

Shadow receptor

No.	Shadow, worst case: Shadow hours per year [h/year]	Shadow, worst case: Shadow days per year [days/year]	Shadow, worst case: Max shadow hours per day [h/day]	Shadow, expected values: Shadow hours per year [h/year]
A	19:43	44	0:38	10:41
B	111:36	92	1:32	53:45
C	34:06	77	0:42	19:48
D	24:33	99	0:29	14:15
E	341:57	245	2:17	195:41
F	309:47	255	2:21	159:19
G	50:24	76	0:53	32:00
H	80:52	101	1:38	30:57
I	28:35	102	0:23	17:38
J	273:33	154	2:32	107:11
K	12:22	35	0:28	6:47
L	12:23	35	0:28	6:39
M	55:42	82	0:47	32:34
N	34:54	118	0:37	20:06
O	231:53	145	2:15	114:21
P	328:50	217	2:32	120:24
Q	277:41	173	1:55	149:59
R	146:31	140	1:16	93:37
S	0:00	0	0:00	0:00
T	147:07	168	1:24	82:12
U	285:13	153	2:31	163:34
V	0:00	0	0:00	0:00
W	19:10	71	0:23	12:22
X	38:15	103	0:27	23:58
Y	41:07	82	0:46	25:58
Z	134:45	133	1:59	60:13
AA	162:57	139	1:32	100:39
AB	159:55	133	1:34	89:39
AC	2:32	32	0:07	1:33
AD	1:54	25	0:06	1:11
AE	28:35	75	0:46	16:05
AF	216:54	149	2:24	123:09
AG	1:36	18	0:07	0:59

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]	Expected [h/year]
1	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (1)	0:00	0:00
2	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (2)	0:00	0:00
3	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (3)	0:00	0:00
4	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (4)	0:00	0:00
5	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (5)	0:00	0:00
6	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (6)	0:00	0:00
7	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (7)	0:00	0:00
8	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (8)	0:00	0:00
9	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (9)	29:51	17:07
10	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (10)	469:46	254:30

To be continued on next page...

Project:
Dhar_modified WTGs_RECOVER001 3_10_2016 4_19_37 PM

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3rd Floor, Logix techno park, tower B, sector 127, Noida
IN-201304 Noida
01204368426
Girish Shukla / gshukla@senesindia.com
Calculated:
8/9/2016 6:10 PM/3.0.639

SHADOW - Main Result

Calculation: Shadow Flicker Dhar IFC

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
11	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (11)	137:27	69:32
12	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (12)	180:45	101:30
13	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (13)	1:01	0:37
14	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (14)	0:53	0:33
15	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (15)	13:37	8:18
16	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (16)	0:00	0:00
17	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (17)	0:00	0:00
18	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (18)	128:53	61:32
19	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (19)	0:00	0:00
20	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (20)	0:00	0:00
21	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (21)	0:55	0:30
22	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (22)	1:21	0:52
23	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (23)	19:43	10:41
24	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (24)	12:23	6:39
25	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (25)	283:12	114:15
26	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (26)	3:51	2:12
27	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (27)	9:53	5:56
28	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (28)	8:14	4:39
29	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (29)	218:29	123:43
30	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (30)	28:33	16:18
31	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (31)	15:23	8:00
32	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (32)	57:37	33:12
33	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (33)	21:54	12:19
34	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (34)	234:18	115:56
35	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (35)	337:30	126:00
36	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (36)	5:55	3:47
37	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (37)	277:41	149:59
38	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (38)	0:00	0:00
39	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (39)	146:31	93:37
40	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (40)	127:29	69:58
41	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (41)	280:46	161:42
42	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (42)	24:05	14:03
43	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (43)	0:00	0:00
44	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (44)	21:08	12:50
45	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (45)	25:24	16:25
46	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (46)	7:00	4:27
47	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (47)	127:29	55:38
48	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (48)	0:39	0:24
49	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (49)	196:43	122:18
50	GAMESA G97 2000 97.0 !O! hub: 104.0 m (TOT: 152.5 m) (50)	3:23	1:48

APPENDIX Q

PS 2 Guideline for Workers accommodation: processes and standards

The PS 2 applies to workers directly engaged by the client (direct workers), workers engaged through third parties (contracted workers), as well as workers engaged by the client's primary suppliers (supply chain workers).

PART II: STANDARDS FOR AND MANAGEMENT OF WORKERS' ACCOMMODATION

I. Standards for workers' accommodation

This section looks at the principles and standards applicable to the location and construction of workers' accommodation, including the transport systems provided, the general living facilities, rooms/dormitories facilities, sanitary facilities, canteen and cooking facilities, food safety, medical facilities and leisure/social facilities.

A. National/local standards

The key standards that need to be taken into consideration, as a baseline, are those contained in national/local regulations. Although it is quite unusual to find regulations specifically covering workers' accommodation, there may well be general construction standards which will be relevant. These may include the following standards:

- Building construction: for example, quality of material, construction methods, resistance to earthquakes.
- Housing and public housing: in some countries regulations for housing and public housing contain requirements on issues such as the basic amenities, and standards of repair.
- General health, safety and security: requirements on health and safety are often an important part of building standards and might include provisions on occupation density, minimal air volumes, ventilation, the quality of the flooring (slip-resistant) or security against intrusion.
- Fire safety: requirements on fire safety are common and are likely to apply to housing facilities of any type. This can include provision on fire extinguishers, fire alarms, number and size of staircases and emergency exits, restrictions on the use of certain building materials.
- Electricity, plumbing, water and sanitation: national design and construction standards often include very detailed provisions on electricity or plumbing fixtures/fittings, water and sanitation connection/equipment.

Benchmark

1. The relevant national and local regulations have been identified and implemented.

B. General living facilities

Ensuring good standards in living facilities is important in order to avoid safety hazards and to protect workers from diseases and/or illness resulting from humidity, bad/stagnant water (or lack of water), cold, spread of fungus, proliferation of insects or rodents, as well as to maintain a good level of morale. The location of the facilities is important to prevent exposure to wind, fire, flood and other natural hazards. It is also important that workers' accommodation is unaffected by the environmental or operational impacts of the worksite (for example noise, emissions or dust) but is sufficiently close that workers do not have to spend undue amounts of time travelling from their accommodation to the worksite. Living facilities should be built using adequate materials and should always be kept in good repair, clean and free from rubbish and other refuse.

Benchmarks

1. Living facilities are located to avoid flooding and other natural hazards.
2. Where possible, living facilities are located within a reasonable distance from the worksite.
3. Transport from the living facilities to worksite is safe and free.
4. The living facilities are built with adequate materials, kept in good repair and kept clean and free from rubbish and other refuse.

Drainage

The presence of stagnant water is a factor of proliferation of potential disease vectors such as mosquitoes, flies and others, and must be avoided.

Benchmarks

1. The building site is adequately drained to avoid the accumulation of stagnant water.

Heating, air conditioning, ventilation and light

Heating, air-conditioning and ventilation should be appropriate for the climatic conditions and provide workers with a comfortable and healthy environment to rest and spend their spare time.

Benchmarks

1. For facilities located in cold weather zones, the temperature is kept at a level of around 20 degrees Celsius notwithstanding the need for adequate ventilation.
2. For facilities located in hot weather zones, adequate ventilation and/or air conditioning systems are provided.
3. Both natural and artificial lighting are provided and maintained in living facilities. It is best practice that the window area represents not less than 5% to 10% of the floor area. Emergency lighting is provided.

Water

Special attention to water quality and quantity is absolutely essential. To prevent dehydration, water poisoning and diseases resulting from lack of hygiene, workers should always have easy access to a source of clean water. An adequate supply of potable water must be available in the same buildings where bedrooms or dormitories are provided. Drinking water must meet local or WHO drinking water standards[7] and water quality must be monitored regularly. Depending on the local context, it could either be produced by dedicated catchment and treatment facilities or tapped from existing municipal facilities if their capacity and quality are adequate.

Benchmarks

1. Access to an adequate and convenient supply of free potable water is always available to workers. Depending on climate, weather conditions and accommodation standards, 80 to 180 litres per person per day are available.
2. Drinking water meets national/local or WHO drinking water standards.[8]
3. All tanks used for the storage of drinking water are constructed and covered as to prevent water stored therein from becoming polluted or contaminated.
4. Drinking water quality is regularly monitored.

Wastewater and solid waste

Wastewater treatment and effluent discharge as well as solid waste treatment and disposal must comply with local or World Bank effluent discharge standards[9] and be adequately designed to prevent contamination of any water body, to ensure hygiene and to avoid the spread of infections and diseases, the proliferation of mosquitoes, flies, rodents, and other pest vectors. Depending on the local context, treatment and disposal services can be either provided by dedicated or existing municipal facilities.

Benchmarks

1. Wastewater, sewage, food and any other waste materials are adequately discharged, in compliance with local or World Bank standards – whichever is more stringent – and without causing any significant impacts on camp residents, the biophysical environment or surrounding communities.
2. Specific containers for rubbish collection are provided and emptied on a regular basis. Standards range from providing an adequate number of rubbish containers to providing leak proof, non-absorbent, rust and corrosion-resistant containers protected from insects and rodents. In addition it is best practice to locate rubbish containers 30 metres from each shelter on a wooden, metal, or concrete stand. Such containers must be emptied at regular intervals (to be determined based on temperatures and volumes generated) to avoid unpleasant odours associated with decaying organic materials.
3. Pest extermination, vector control and disinfection are carried out throughout the living facilities in compliance with local requirements and/or good practice. Where warranted, pest and vector monitoring should be performed on a regular basis.

C. Room/dormitory facilities

The standards of the rooms or dormitory facilities are important to allow workers to rest properly and to maintain good standards of hygiene. Overcrowding should be avoided particularly. This also has an impact on workers' productivity and reduces work-related accidents. It is generally acknowledged that rooms/dormitories should be kept clean and in a good condition. Exposure to noise and odour should be minimised. In addition, room/dormitory design and equipment should strive to offer workers a maximum of privacy. Resorting to dormitories should be minimised and single or double rooms are preferred. Dormitories and rooms must be single-sex.

Benchmarks

1. Rooms/dormitories are kept in good condition.

2. Rooms/dormitories are aired and cleaned at regular intervals.

3. Rooms/dormitories are built with easily cleanable flooring material.

4. Sanitary facilities are located within the same buildings and provided separately for men and women.

5. Density standards are expressed either in terms of minimal volume per resident or of minimal floor space. Usual standards range from 10 to 12.5 cubic metres (volume) or 4 to 5.5 square metres (surface).

6. A minimum ceiling height of 2.10 metres is provided.

7. In collective rooms, which are minimised, in order to provide workers with some privacy, only a reasonable number of workers are allowed to share the same room. Standards range from 2 to 8 workers.

8. All doors and windows should be lockable, and provided with mosquito screens where conditions warrant.

9. There should be mobile partitions or curtains to ensure privacy.

10. Every resident is provided with adequate furniture such as a table, a chair, a mirror and a bedside light.

11. Separate sleeping areas are provided for men and women, except in family accommodation.

Additional issue

Irrespective of whether workers are supposed to keep their facilities clean, it is the responsibility of the accommodation manager to ensure that rooms/dormitories and sanitary facilities are in good condition.

Bed arrangements and storage facilities
The provision of an adequate numbers of beds of an appropriate size is essential to provide workers with decent, safe and hygienic conditions to rest and sleep. Here again, particular attention should be paid to privacy. Consideration should be given to local customs so beds could be replaced by hammocks or sleeping mats for instance.

Benchmarks

1. A separate bed for each worker is provided. The practice of "hot-bedding" should be avoided.

2. There is a minimum space between beds of 1 metre.

3. Double deck bunks are not advisable for fire safety and hygiene reasons, and their use is minimised. Where they are used, there must be enough clear space between the lower and upper bunk of the bed. Standards range from to 0.7 to 1.10 metres.

4. Triple deck bunks are prohibited.

5. Each worker is provided with a comfortable mattress, pillow, cover and clean bedding.

6. Bed linen is washed frequently and applied with repellents and disinfectants where conditions warrant (malaria).

7. Facilities for the storage of personal belongings for workers are provided. Standards vary from providing an individual cupboard for each worker to providing 475-litre big lockers and 1 metre of shelf unit.

8. Separate storage for work boots and other personal protection equipment, as well as drying/airing areas may need to be provided depending on conditions.

D. Sanitary and toilet facilities

It is essential to allow workers to maintain a good standard of personal hygiene but also to prevent contamination and the spread of diseases which result from inadequate sanitary facilities. Sanitary and toilet facilities will always include all of the following: toilets, urinals, washbasins and showers. Sanitary and toilet facilities should be kept in a clean and fully working condition. Facilities should also be constructed of materials that are easily cleanable and ensure privacy. Sanitary and toilet facilities are never shared between male and female residents, except in family accommodation. Where necessary, specific additional sanitary facilities are provided for women.

Benchmarks

1. Sanitary and toilet facilities are constructed of materials that are easily cleanable.

2. Sanitary and toilet facilities are cleaned frequently and kept in working condition.

3. Sanitary and toilet facilities are designed to provide workers with adequate privacy, including ceiling to floor partitions and lockable doors.

4. Sanitary and toilet facilities are not shared between men and women, except in family accommodation.

Toilet facilities
Toilet arrangements are essential to avoid any contamination and prevent the spread of infectious disease.

Benchmarks

1. An adequate number of toilets is provided to workers. Standards range from 1 unit to 15 persons to 1 unit per 6 persons. For urinals, usual standards are 1 unit to 15 persons.

2. Toilet facilities are conveniently located and easily accessible. Standards range from 30 to 60 metres from rooms/dormitories. Toilet rooms shall be located so as to be accessible without any individual passing through any sleeping room. In addition, all toilet rooms should be well-lit, have good ventilation or external windows, have sufficient hand wash basins and be conveniently located. Toilets and other sanitary facilities should be ("must be" in cold climates) in the same building as rooms and dormitories.

Showers/bathrooms and other sanitary facilities
Hand wash basins and showers should be provided in conjunction with rooms/dormitories. These facilities must be kept in good working condition and cleaned frequently. The flooring for shower facilities should be of hard washable materials, damp-proof and properly drained. Adequate space must be provided for hanging, drying and airing clothes. Suitable light, ventilation and soap should be provided. Lastly, hand washing, shower and other sanitary facilities should be located within a reasonable distance from other facilities and from sleeping facilities in particular.

Benchmarks

1. Shower/bathroom flooring is made of anti-slip hard washable materials.

2. An adequate number of handwash facilities is provided to workers. Standards range from 1 unit to each 15 persons to 1 unit per 6 workers. Handwash facilities should consist of a tap and a basin, soap and hygienic means of drying hands.

3. An adequate number of shower/bathroom facilities is provided to workers. Standards range from 1 unit to 15 persons to 1 unit per 6 persons.

4. Showers/bathrooms are conveniently located.

5. Shower/bathroom facilities are provided with an adequate supply of cold and hot running water.

E. Canteen, cooking and laundry facilities

Good standards of hygiene in canteen/dining halls and cooking facilities are crucial. Adequate canteen, cooking and laundry facilities and equipments should also be provided. When caterers are contracted to manage kitchens and canteens, special attention should be paid to ensure that contractors take into account and implement the benchmarks below, and that adequate reporting and monitoring mechanisms are in place. When workers can individually cook their meals, they should be provided with a space separate from the sleeping areas. Facilities must be kept in a clean and sanitary condition. In addition, canteen, kitchen, cooking and laundry floors, ceilings and walls should be made of easily cleanable materials.

Benchmarks

1. Canteen, cooking and laundry facilities are built in adequate and easy to clean materials.

2. Canteen, cooking and laundry facilities are kept in a clean and sanitary condition.

3. If workers can cook their own meals, kitchen space is provided separate from sleeping areas.

Laundry facilities

Providing facilities for workers to wash both work and non-work related clothes is essential for personal hygiene. The alternative is for the employer to provide a free laundry service.

Benchmarks

1. Adequate facilities for washing and drying clothes are provided. Standards range from providing sinks or tubs with hot and cold water, cleaning soap and drying lines to providing washing machines and dryers.

2. When work clothes are used in contact with dangerous substance (for example, application of pesticide), special laundry facilities (washing machines) should be provided.

Additional Issue

When workers are provided with facilities allowing them to individually do their laundry or cooking, it should be the responsibility of each worker to keep the facilities in a clean and sanitary condition. Nonetheless, it is the responsibility of the accomodation manager to make sure the standards are respected and to provide an adequate cleaning, disinfection and pest/vector control service when necessary.

Additional Issue

When the employer provides family accommodation, it is best practice to provide each family with a private kitchen or the necessary cooking equipment to allow the family to cook on their own.

Canteen and cooking facilities

Canteen and cooking facilities should provide sufficient space for preparing food and eating, as well as conform to hygiene and safety requirements.

Benchmarks

1. Canteens have a reasonable amount of space per worker. Standards range from 1 square metre to 1.5 square metres.

2. Canteens are adequately furnished. Standards range from providing tables, benches, individual drinking cups and plates to providing special drinking fountains.

3. Places for food preparation are designed to permit good food hygiene practices, including protection against contamination between and during food preparation.

4. Kitchens are provided with facilities to maintain adequate personal hygiene including a sufficient number of washbasins designated for cleaning hands with clean, running water and materials for hygienic drying.

5. Wall surfaces adjacent to cooking areas are made of fire-resistant materials. Food preparation tables are also equipped with a smooth durable washable surface. Lastly, in order to enable easy cleaning, it is good practice that stoves are not sealed against a wall, benches and fixtures are not built into the floor, and all cupboards and other fixtures and all walls and ceilings have a smooth durable washable surface.

6. All kitchen floors, ceiling and wall surfaces adjacent to or above food preparation and cooking areas are built using durable, non-absorbent, easily cleanable, non-toxic materials.

7. Wall surfaces adjacent to cooking areas are made of fire-resistant materials. Food preparation tables are equipped with a smooth, durable, easily cleanable, non-corrosive surface made of non-toxic materials. Lastly, in order to enable easy cleaning, it is good practice that stoves are not sealed against a wall, benches and fixtures are not built into the floor, and all cupboards and other fixtures have a smooth, durable and washable surface.

8. Adequate facilities for cleaning, disinfecting and storage of cooking utensils and equipment are provided.

9. Food waste and other refuse are to be adequately deposited in sealable containers and removed from the kitchen frequently to avoid accumulation.

ILO Guidelines

No.6

ILO HELPDESK

ASSISTANCE@ILO.ORG

International Labour Organization

Workers' housing

Housing provided to workers as part of the employment contract should meet certain minimum specifications in respect of the nature and standard of the accommodation and facilities to be made available.

The following guidance is based on international labour standards. National or state regulation will often set baseline specifications as part of housing, labour, health or even fire safety regulations; they should be checked and followed. National employers and workers organizations may also be a good source of information on national law, collective bargaining agreements and customs pertaining to housing for workers; or may be able to refer you to the appropriate statutory authority.

Guiding principles

➡ In providing worker[1] housing, the objective should be to ensure "adequate and decent housing accommodation and a suitable living environment"[2] for workers. This includes upkeep, improvement and modernisation of housing and related community facilities.[3]

It is "generally not desirable that employers should provide housing for their workers directly".[4] Employers are encouraged to help their workers to obtain housing through autonomous private agencies, public housing schemes, or cooperatives.[5] This is because workers living at the work site on property owned or controlled by the employer tend to be less integrated into the local community, and more dependent on the employer. However, certain circumstances, such as when an undertaking is located far from normal centres of population, or where the nature of the employment requires that the worker should be available at short notice may require the employer to provide housing for his or her workers.[6]

If housing is provided by the employer "the fundamental human rights of the workers, in particular freedom of association, should be recognised."[7] Arrangements where accommodation and communal services are provided as payment for work should take care to ensure that the interests of the workers are protected. If rent is charged, it should not cost the worker more than a reasonable proportion of his or her income.[8]

Siting and construction

➡ The housing and related community facilities should be of durable construction, taking into account local conditions, such as liability to earthquakes.[9]

The location of workers' housing should ensure that workers are not affected by air pollution, surface run-off or sewage or other wastes.[10]

Housing Standards

➡ Housing should ensure "structural safety and reasonable levels of decency, hygiene and comfort".[11] The undertaking should ensure the following:

a) a separate bed for each worker;
b) adequate headroom, providing full and free movement, of not less than 203 centimetres;
c) the minimum inside dimensions of a sleeping space should be at least 198 centimetres by 80 centimetres;
d) beds should not be arranged in tiers of more than two;
e) bedding materials should be reasonably comfortable;
f) bedding and bedframe materials should be designed to deter vermin;
g) separate accommodation of the sexes;
h) adequate natural light during the daytime and adequate artificial light;
i) a reading lamp for each bed;
j) adequate ventilation to ensure sufficient movement of air in all conditions of weather and climate;
k) heating where appropriate;
l) adequate supply of safe potable water;
m) adequate sanitary facilities (see below);
n) adequate drainage;
o) adequate furniture for each worker to secure his or her belongings, such as a ventilated clothes locker which can be locked by the occupant to ensure privacy;
p) common dining rooms, canteens or mess rooms, located away from the sleeping areas;
q) appropriately situated and furnished laundry facilities;
r) reasonable access to telephone or other modes of communications, with any charges for the use of these services being reasonable in amount; and

[1] Workers' Housing Recommendation, 1961 (No. 115). The section entitled "Suggestions concerning methods of application," Part I, paragraph 5, encourages "equality of treatment between migrant workers and national workers". Therefore, this guidance applies equally to migrant workers and national workers.
[2] R. 115, General Principles, Part II, paragraph 2.
[3] R. 115, paragraph 3.
[4] R. 115, Part IV, paragraph 12(2).
[5] R. 115, Part IV, paragraph 12(1).
[6] R. 115, Part IV, paragraph 12(2).
[7] R. 115, Part IV, paragraph 12(3a).
[8] R. 115, Part II, paragraph 4, Part IV, paragraph 12(3c) and (4).
[9] R. 115, Suggestions Concerning Methods of Application, Part I, paragraphs 10-11.
[10] R. 115, Suggestions Concerning Methods of Application, Part IX, paragraph 43.
[11] R. 115, paragraph 19.

s) rest and recreation rooms and health facilities, where not otherwise available in the community.

In workers' sleeping rooms the floor area should not be less than 7.5 square metres in rooms accommodating two persons; 11.5 square metres in rooms accommodating three persons; or 14.5 square metres in rooms accommodating four persons. If a room accommodates more than four persons, the floor area should be at least 3.6 square metres per person. Rooms should indicate the permitted number of occupants.

As far as practicable, sleeping rooms should be arranged so that shifts are separated and that no workers working during the day share a room with workers on night shifts.

Sanitation facilities

➡ Adequate sanitary facilities should include a minimum of one toilet, one wash basin and one tub or shower for every six persons. They should be provided at a convenient location which prevents nuisances. Sanitary facilities provided should meet minimum standards of health and hygiene. They should also provide reasonable standards of comfort, including hot and cold fresh running water. There should be separate sanitary facilities provided for men and for women. Sanitary facilities should have ventilation to the open air, independently of any other part of the accommodation. Soap and hygienic paper should be adequately stocked.

Health and safety

➡ As far as possible, floors walls, ceilings and equipment should be constructed to minimize health risks.

The accommodations should be kept free of rats, mice, insects and vermin. In areas where mosquitoes are prevalent, workers should be provided netting.

Measures should be taken to prevent the spread of diseases. Separate facilities should be provided for sick workers to prevent the spread of transmissible diseases among the occupants. Fire safety measures should be taken, including installing and maintaining fire equipment (alarms, extinguishers, etc.). Workers should be trained in fire procedures. Bedding should not contain flammable materials. Radiators and other heating apparatus should be placed so as to avoid risk of fire, and shielded where necessary to prevent discomfort to occupants.

Safety exits should be clearly marked. Adequate means of escape should be provided and properly maintained.

Provisions should be made for workers' physical safety and well-being, and protection of their belongings. Measures should be reasonable and not unduly restrict workers' freedom of movement. Workers should be allowed visits for social relations or business, including trade union business.[12]

Inspection of premises

➡ Premises should be inspected frequently to ensure that the accommodation is clean, decently habitable and maintained in a good state of repair. The results of each such inspection should be recorded and be available for review.

Vacating the premises upon termination of employment

➡ When a worker's contract of employment is terminated, the worker should be entitled to a reasonable period of time to vacate the premises, in accordance with national law and custom.[13]

Consultation

➡ In the design of housing for workers, "every effort should be made to consult those bodies representative of future occupants best able to advise on the most suitable means of meeting their housing and environmental needs."[14]

References

➡ Workers' Housing Recommendation, 1961 (No. 115); full text available at: http://www.ilo.org/ilolex/english/recdisp1.htm.

➡ For comparison, you may also wish to consult the Maritime Labour Convention (MLC), 2006, Title 3, which gives detailed guidance for workers' accommodation for seafarers; full text available at: http://www.ilo.org/ilolex/cgi-lex/convde.pl?C186.

[12] R. 115, Suggestions Concerning Methods of Application, Part IV, paragraph 17.
[13] R. 115, General Principles, Part IV, paragraphs 12(3b) and Suggestions Concerning Methods of Application, Part IV, paragraph 15.
[14] R. 115, Suggestions Concerning Methods of Application, Part IX, paragraph 42.

ILO Helpdesk
Multinational Enterprises Programme
International Labour Office
4, route des Morillons
1211 Geneva 22, Switzerland
Tel: +41.22.799.6264
Fax: +41.22.799.6354
assistance@ilo.org

APPENDIX R

Grievance Redressal policy, plan and procedure

Objective

The objective of the "Grievance Redressal Policy, Plan and Procedure" is to set out an organizational framework to receive and facilitate prompt resolution of the grievances of the affected communities on project environmental and social performance through an understandable and transparent process that is culturally appropriate and readily accessible to all segments of the communities.

GRM Policy

Grievance redress mechanism plays an important role for sustained business growth. This policy details grievances handling through a structured grievance redressal framework. Complaint redressal is supported by a review mechanism, to minimize the recurrence of similar issues in future. The Grievance Redressal policy follows the following principles:

- Grievances raised by various stakeholders are dealt in a timely manner.
- Roles and responsibilities for handling grievances are established.
- Procedure for grievances reporting and addressing is formulated and implemented by the Company.

Scope

The "Grievance Redressal Policy, Plan and Procedure" which is developed as part of the Grievance Redressal Mechanism is specifically designed to focus on the grievances of the local communities and other identified stakeholders that are likely to be affected by the project.

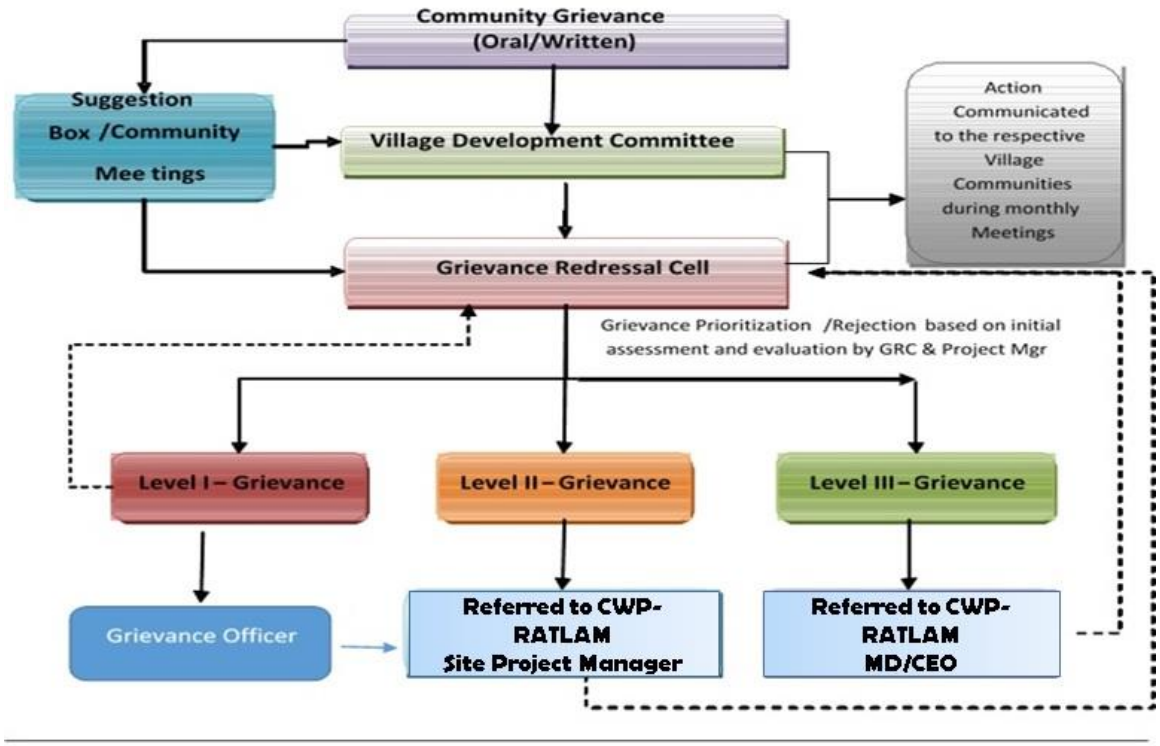
Applicable Legislative Requirements

IFC Performance Standard 1: Social and Environmental Assessment Management System

Responsibility

The ultimate responsibility for designing, implementing, and monitoring project-level "Grievance Redressal Plan & Procedure" lies with the Grievance Redressal Cell (GRC) with necessary assistance from respective Village Development Committees (VDCs). In case of Urban set up, respective Urban Development Committee (UDC)/or Residential Welfare Associations (RWA) etc. The GRC and VDC/UDC/RWA will be formed as part of the Grievance Redressal Mechanism to be formed by CWP-RATLAM.

The composition and specific roles and responsibilities of the key members of GRC and VDC/UDC/RWAs have been discussed in the subsequent sections of the "Grievance Redressal Plan and Procedure". The Grievance Redressal Flow Chart is presented in the **Figure** below for reference.



Village Development Committee (VDC) Composition & Responsibilities

The Village Development Committee (VDC) of the both project affected and nearby villages need to be constituted of the following members:

- Representatives of women PAPs;
- Representative from each of the Scheduled Castes and Scheduled Tribes (if any) residing in the affected villages/area;
- Representative of Village Gram Panchayat and/or Primary School Headmaster/Senior Teaching Members/intellectual/health worker;
- Representative of respective Village SHGs (if any);

The functions to be performed by the VDC with respect to redressal of grievance have been outlined below:

- Generate awareness of Grievance Redressal Mechanism and its functioning at village level;
- Organize village level GRC meeting in coordination with AL, GRC members and share the outcome of the meeting with the village communities;
- Ensure participation of all members of the communities (including indigenous groups) at GRC meetings; and
- Maintain regular coordination with the GRC on the status of pending issues/grievances lodged by the community.

Grievance Redressal Cell (GRC) Composition & Responsibilities

The GRC need to include representatives from AL representative and the community. A Grievance Redressal Officer will be designated by AL as officer-in-charge of all matters related to grievance raised with respect to the project and its activities. The key functions of the GRC have been discussed below:

- Proactively disclose information about the process, as well as the results of resolution in individual cases;
- Conduct consultation with the communities on ways to improve the company grievance mechanism;
- Establish the time schedule for reporting and recording of grievances and redressal of grievances.
- Corrective action taken towards addressing grievances and closure of the same.
- Informing complainant about the action taken for addressing grievances.
- Report back to communities regularly through VDCs on actions taken to resolve their concerns, publicize successful complaint resolution, and documentation of community feedback.

Grievance Redressal Procedure

- At Project level the Project Manager will designate one Officer preferable from HR/CSR/Environment, Safety and Health Departments and an assistant for grievance handling. Grievance Register should be maintained in the prescribed format (Annexure A). The GRM Register should be checked once in every week by the Grievance Officer and once in a month by Project Manager.
- Signboards will be displayed (written in local vernacular language, Hindi and English) at the main gate, dispensaries, labour colonies and affected villages etc giving the details of the Grievance Officer viz. name, telephone numbers, mobile number etc. Grievance register can also be maintained at the security gate of the upcoming project.
- Grievance/Suggestion boxes will be placed in various public places in the affected villages and company premises to enable stakeholders to register their grievances directly to the company at no costs to themselves. The box must contain slots at the top or sides and be clearly marked in the local language. It must be kept locked with the keys to be retained in the custody of the Grievance Officer. The box will be opened on a weekly basis by an officer designated by GRC. A separate register for suggestion must be maintained to enable acceptance and incorporation of the said suggestion into relevant CSR activities and programs. A separate procedure for handling of suggestion box has been developed and will be implemented to this regard.
- Review of grievances done will be conducted fortnightly from 10.00 a.m. to 1.00 p.m.
- Based on the grievances received by the Grievance Officer will visit the respective areas and interact with the affected families/persons for understanding their concerns if found necessary. The VDC members of the concerned village will be requested to remain present during site visit. Other grievances not specifically related to project and CSR will also be addressed. The visits will be critical in creating goodwill, improving rapport building and communication between all stakeholders and reducing conflicts.

A project wise Grievance Register (Annexure A) to be maintained. Grievances should be addressed within 15 days. For Level II and Level III grievances necessary interventions will be required from Project Manager and Managing Director respectively to resolve the grievances at the earliest. The report should contain a summary date wise of action taken, response received and pending issues.

- In the case of written complaints directly to GRC/VDC an acknowledgment token (Annexure B) mentioning Register number, unique serial number and date in the will be provided to the petitioner to enable him to make telephonic enquiry to check the status of grievance.
- The general reports generated from the GRC may be in the form of a monthly, quarterly and yearly report covering the following:
  a) Number of cases registered with the GRC, level of jurisdiction (Individual, Group or Collective), name of the projects / sub project name, nature/category of grievances, action taken, and the status of pending cases.

b) Lists of cases in process and already decided upon may be prepared with details such as Name, Unique Serial Number, date of application, decision, remarks (action taken) issues.

- It is important to maintain detailed documentation of proceedings at every stage of grievance redress. Care should be maintained in specifically documenting the following:

c) Documentation of grievance applications with number, nature, action taken. If necessary photo documentation should be maintained.

d) Date of redressal or action taken or to be taken, Nature of action taken, official responsible for action and timeline for the action to be taken.

e) Documentation of response/orders sent to the applicants.

The action taken will be communicated to the communities, complainant/stakeholder through various means including circulating the minutes of the meeting to VDCs, displaying on notice board etc.

Annexure A: Project wise Grievance Register (updated monthly)

Sl.No	Date of Grievance	Nature of Grievance	Complainant Name	Mode of Grievance Registration	Action Taken/to be Taken	Responsibility	Date of Action Taken	If action not taken Reasons for the same	Status to be filled in date wise	Remarks

Annexure B: Monthly Progress Report of Grievance Redressal

Information to be provided by Grievance Officer _____Date: _____

Sl. No.	Grievances Received			Disposed off			Balance Pending			
	Upto Last month	During the current month	Total	Upto Last month	During the current month	Total	Last 6 months	Last 3 months	Last 1 month	Total

APPENDIX S

CPCB notification for exemption of obtaining CTO for white industries

केन्द्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
(पर्यावरण एवं वन मंत्रालय, भारत सरकार)
(MINISTRY OF ENVIRONMENT & FORESTS, GOVT. OF INDIA)

No.B-29012/ESS(CPA)/2015-16/ March 07, 2016

To
The Chairman
All the State Pollution Control Boards / Pollution Control Committees
(List Attached)

SUB: MODIFIED DIRECTIONS UNDER SECTION 18(1)(b) OF THE WATER (PREVENTION & CONTROL OF POLLUTION) ACT, 1974 and THE AIR (PREVENTION & CONTROL OF POLLUTION) ACT, 1981 REGARDING HARMONIZATION OF CLASSIFICATION OF INDUSTRIAL SECTORS UNDER RED / ORANGE / GREEN / WHITE CATEGORIES.

WHEREAS, under section 16 (2)(b) of the Water (Prevention and Control of Pollution) Act, 1974 and under Section 16 (2)(c) of the Air (Prevention & Control of Pollution) Act, 1981, one of the functions of the Central Pollution Control Board (CPCB), constituted under the Water (Prevention and Control of Pollution) Act, 1974, is to coordinate activities of the State Pollution Control Boards (SPCBs) and Pollution Control Committees (PCCs); and

WHEREAS, under section 16 (2)(c) of the Water (Prevention and Control of Pollution) Act, 1974 and under Section 16 (2)(d) of the Air (Prevention & Control of Pollution) Act, 1981, one of the functions of the CPCB is to provide technical assistance and guidance to SPCBs and PCCs; and

WHEREAS, it was brought to the notice of CPCB, that different SPCBs /PCCs were following different criteria for classification of industrial sectors under Red/Orange/ Green category and that classification was being used by the SPCBs/PCCs for grant of consents to industries and for Inventorization / surveillance of industries.

WHEREAS, the issue regarding classification of industries was deliberated upon in the 56th Conference of Chairmen & Member Secretaries of CPCB & SPCBs/PCCs held on August 31, 2010 and a working group comprising of representatives from SPCBs & CPCB was constituted to prepare a consolidated list of industrial sectors falling under Red/Orange/Green category to bring uniformity in classification of industrial sectors across the country;

'परिवेश भवन' पूर्वी अर्जुन नगर, दिल्ली-110032
'Parivesh Bhawan', East Arjun Nagar, Delhi - 110032
दूरभाष/Tel. : 43102030, फैक्स/Fax : 22305793, 22307078, 22307079, 22301932, 22304948
ई-मेल/e-mail : cpcb@nic.in वेबसाईट/Website : www.cpcb.nic.in

WHEREAS, the report prepared by the Working Group was discussed in the 57th Conference of Chairmen & Member Secretaries of CPCB& SPCBs/PCCs held in Delhi on September 15, 2011, wherein some modifications were proposed;

WHEREAS, the final report of the working group was prepared, incorporating the suggestions/observations made in the 57th Conference of Chairmen and Member Secretaries of CPCB & SPCBs/PCCs and in exercise of the powers delegated to the Chairman, CPCB under Section 18(1)(b) of the Water Act, 1974, following directions were issued for compliance to all SPCBs/PCCs to maintain uniformity in categorization of industries as red, orange and green as per list finalized by CPCB, which identified 85 types of industrial sectors as 'Red', 73 industrial sectors as 'Orange' and 86 sectors as 'Green':

a). To maintain uniformity in categorization of industries under Red/ Orange/Green category, the SPCBs /PCCs shall adopt the list as finalized by CPCB based on the recommendations of that Working Group for grant of Consent, inventorization of industries under Red, Orange and Green categories and other related activities.

(b). The SPCBs/PCCs shall revise the list of Red, Orange and Green categories of industries operating in their jurisdiction based on the criteria specified in the final report of that Working Group and submit the same to CPCB within 90 days in hard copy as well as soft copy;

WHEREAS, later-on, it was observed that the process of categorization thus far was primarily based on the size of the industries and consumption of resources and pollution due to discharge of emissions and effluents and its likely impact on health was not considered as primary criteria;

WHEREAS, there have been proposals from the SPCBs / PCCs and industrial associations for categorization of the industrial sectors in a more pragmatic manner. The issue was discussed during the national level conference of the Environment Ministers of the States, held in New Delhi during April 06-07, 2015 and also during the Conference of the Chairmen and Member Secretaries of CPCB and SPCBs/PCCs held in New Delhi on April 08, 2015. Accordingly, a 'Working Group' comprising of the Members from Central Pollution Control Board and State Pollution Control Boards representing the States of Andhra Pradesh, Punjab, Tamilnadu, West Bengal, Madhya Pradesh and Maharashtra, was constituted to revisit the criteria of categorization of industries and suggest rationale based on pollution potential for categorization of industrial sectors and adopting it for implementation of pollution control plan;

WHEREAS, the Working Group has developed the criteria of categorization of industrial sectors based on the concept of Pollution Index which is a function of the emissions (air pollutants), effluents (water pollutants), hazardous wastes generated and consumption of resources. For this purpose the references are taken from the the Water (Prevention and Control

of Pollution) Cess (Amendment) Act, 2003, Standards so far prescribed for various pollutants under Environment (Protection) Act , 1986 and Doon Valley Notification, 1989 issued by MoEFCC. The Pollution Index (PI) of any industrial sector is a number from 0 to 100 and the increasing value of PI denotes the increasing degree of pollution load from the industrial sector;

WHEREAS , based on the series of consultations with SPCBs, different Government / Non-government Institutions including industries and MoEFCC , the following criteria on 'Range of Pollution Index 'for the purpose of categorization of industrial sectors has been finalized:

- Industrial Sectors having Pollution Index score of 60 and above - Red category
- Industrial Sectors having Pollution Index score of 41 to 59 -Orange category
- Industrial Sectors having Pollution Index score of 21 to 40 -Green category
- Industrial Sectors having Pollution Index score incl. & upto 20 -White category

WHEREAS, based on the revised criteria, the 'Final Report on Revised Categorization of Industrial Sectors under Red/Orange/Green/White' has been evolved. The 'Categorization' is based on the relative pollution potential of the industrial sectors and grouping of the industrial sectors based on the use of raw materials, manufacturing process adopted and pollutants likely to be generated;

WHEREAS, based on relative Pollution Index, the number of industries in various categories are as under :

i. The Red category of industrial sectors: 60
ii. The Orange category of industrial sectors: 83
iii. The Green category of industrial sectors: 63 and
iv. The Newly introduced White category: 36

WHEREAS, there shall be no necessity of obtaining the Consent to Operate" for White category of industries and an intimation to concerned SPCB / PCC shall suffice;

WHEREAS, the purpose of categorization is to ensure that the industry is established in a manner consistent with the environmental objectives and to prompt industrial sectors to adopt cleaner technologies, ultimately resulting in generation of no or minimum pollutants.

WHEREAS the new categorization system shall also facilitate in self-assessment by industries;

Now, therefore, in exercise of the powers delegated to the Chairman, CPCB under Section 18(1)(b) of the Water (Prevention & Control of Pollution) Act, 1974 and Section 18(1)(b) of the Air (Prevention & Control of Pollution), Act , 1981 the earlier Directions issued in June 2012 in the context of categorisation of industries as Red, Orange & Green are withdrawn with immediate effect and following **'Directions'** are hereby issued for compliance by all SPCBs and PCCs :

1. That the SPCBs and PCCs shall adopt the Revised Criteria of categorization of industrial sectors as detailed in table nos. F1, F2, F3 and F4 and Revised Lists of Red, Orange, Green and White categories of industrial sectors, presented at table no. G2, G3, G4 and G5 respectively, in the 'Final Report' as attached herewith immediately.
2. That all pending applications for consideration of 'Consent to Establish' and 'Consent to Operate' and future such applications shall be processed as per revised criteria.
3. That the SPCBs and PCCs will provide the list of industries identified in each category existing in the State which have been considered for grant of consents. SPCBs/PCCs will forward the list of such industries before 31.05.2016 and the same will be uploaded on the websites of respective SPCB/PCC.

4. That the 'Revised Lists of Red, Orange, Green and White category of industrial sectors' shall be used by the SPCBs and PCCs for Consent Management and inventorization of industries under Red, Orange ,Green and White categories. Siting of industries shall be only in conforming areas. SPCBs / PCCs shall evolve sector specific plans for control of pollution and industrial surveillance for verifying compliance.

5. That the SPCBs and PCCs shall revise /prepare the inventory of Red, Orange, Green and White categories of industries operating in their jurisdiction based on the revised criteria specified in the Final Report and submit the same to CPCB within 90 days i.e., before 30.05.2016 in hard copy as well as soft copy.

6. That the listed category of industries or those identified later-on under different categories shall not be linked to sanction of loan /finance or bank proceedings.

7. That any further addition of any new or left-over industrial sector and their categorization which is not listed in the revised list of Red, Orange, Green and White industrial sectors, shall be done at the level of concerned SPCB /PCC following revised criteria & guidelines as detailed in the attached document and no concurrence of CPCB shall normally be required. It is further clarified that while categorizing the industries, fractional numbers shall be rounded off to nearest integer.

The SPCBs/PCCs shall acknowledge the receipt of directions and submit the 'Action Taken Report' in compliance with these directions to CPCB before 15.04.2016.

(Arun Kumar Mehta)
Chairman
7/3/16

Copy to:

1. The Chief Secretary of all the States and UTs
2. The Secretary ,
   Ministry of Micro, Small and Medium Entrepreneurs
   Udyog Bhawan, Rafi Marg, New Delhi - 110 011
3. The Secretary ,
   Ministry of Heavy Industries
   Udyog Bhawan, Rafi Marg, New Delhi - 110 011
4. The Secretary,
   Ministry of New and Renewable Energy
   Block-14, CGO Complex,
   Lodhi Road,New Delhi-110 003,
5. The Advisor(CP Division)
   Ministry of Environment ,Forests and Climate Change
   Indira Paryavaran Bhawan
   Jor Bagh Road, New Delhi – 110 003
6. All Zonal Offices of CPCB

(A. B. Akolkar) 7.3.16
Member Secretary

APPENDIX T

Findings from survey of structures located in close proximity to WTGs

Purpose of the Study

As per ESIA report 15 wind turbine out of the total 50 wind turbines are located close to human settlements i.e., within a distance of 220 metres radius. International Finance Corporation (IFC) guidelines suggest a minimum set back distance of approximately 220 metres [1.5 x turbine height (tower + rotor radius)] should be maintained from the Wind Turbine. CWP-Ratlam had conducted an internal rapid survey of the structures located within the 150m setback distance in respective settlements/habitations. The survey results were shared by CWP-Ratlam with IFC. A site visit was also undertaken jointly with the IFC social & environment safeguards experts and representative of CWP-Ratlam. Based on the joint rapid survey results and site visit, the IFC suggested CWP-Ratlam to consider the option of relocating the structures close to the 15 turbines. For the same a third party view was recommended to estimate cost of relocating the structures in the event CWP-Ratlam decides to do so.

Accordingly, CWP-Ratlam retained Arcadis India (an Independent consultant) to undertake the study.

The Rapid Relocation assessment has been prepared on the basis of primary survey, site observations and consultations with likely affected persons. Relocation assessment has been conducted for scenarios:

1. Structures falling within 150 m of wind turbine distance {i.e., turbine height (tower + rotor radius)}, and
2. Structures falling within 220 m {200 being 1.5 x turbine height (tower + rotor radius)}.

Objectives of the study

The objectives of this study was to undertake a detailed door to door survey for the people residing within 220m radius of the WTGs to gather information on the status of the land, type of structure, area of the structure, usages of structures, total members of family, livelihood pattern, income, willingness to relocate/choice of relocation etc. The information was collected for two situations: (1) Structures located within a radius of 150 m, and (2) structures located within 220 m. The scope of work for this study is as follows:

- Undertake site visit/data collection and validate the primary survey carried out by CWP-Ratlam for 15 WTG locations.
- Based on the ground survey and validation; validate/categorize the structures in two categories; a) within 150 meter of the WTGs and b) within 1.5 x turbine height (tower + rotor radius) from the WTGs i.e., 220 m.
- With the support of CWP-Ratlam team, to prepare a relocation plan for each of the surveyed households/structures. In preparing the plan the consultant should:
    - Identify the household/structure;
    - Assess/identify if the household is genuine/opportunistic (structures/households that are constructed/ expanded after the construction of the WTG would be considered as opportunistic)
    - Provide basic details of the surveyed household/structure (demographics/livelihood etc);

- Provide a relocation plan including choices (for eg. cash compensation/in situ relocation/relocation to a different/nearby location etc for these identified households/families) sharing the choice of relocation with CWP-Ratlam team;
- Provide tentative cost estimates along with timelines.

Approach and Methodology of Relocation Assessment Plan

The approach and methodology adopted for undertaking this assessment is as provided.

The methodology adopted for conducting the study consisted of desk exercise, primary survey of likely to be affected families, observations, and consultations. Desk exercise entailed drawing a boundary line at a distance of 150m and 220 m from the location of the wind turbine on a Google map. Structures likely to be affected within the boundary were marked on the Google map. A combination of soft copy (in a laptop) as well as the printed version of the Google map was used for easy identification of structures at site. This was followed by actual measurement at site with measuring tape on a sample basis in order to cross check the desk exercise for each of the 15 turbines. Thus ground truthing was established for each wind turbine before conducting the primary survey.

Before administering the questionnaire, the survey team introduced themselves to family members and briefly explained the purpose of the survey to the head of the family, preferably or to an adult member of the family, in case of non-availability of the head of the family. Each structure falling within the radius of 150m (safety zone) and 150 -220m of the wind turbine was covered for data collection as per approved format. A unique number was assigned to each structure in order to avoid mixing up of photographs. Further measurements and photographs of structures were also likely to be affected were also taken with due permission from the structure owners. Data collected from site has been computerised in MS excel and tables generated for analysis.

The information collected through questionnaire survey covered: socio-and economic data, demography, education level and occupation of head of household, typology of structures, measurement of structures, sources of income, choice of relocation, etc.

Limitations

The study is based on the project planning information and document provided by the project proponent. The status of the ownership of land and improvements on land (owned land, Panchayat land, Govt Land encroached, squatted etc.) could not be verified as this stage due to time limitation and also apprehension of non-cooperation by the likely affected families. The budget has been estimated as per the prevailing guideline values for different categories of immovable properties collected from the Office of District Collector, Dhar.

Summary of the Relocation Assessment

As per the scope shared with us the survey was conducted and relocation assessment has been done within a setback distance of 150 metres and 150-220m. Data collected from field survey has been tabulated and presented below.

Number of households located near WTG

Within a setback of 150 m:
A total of 110 structures households are likely to be impacted within a radius of 150m. Besides, 11 common property resources (CPRs) would also be affected in the event of clearing of setback distance from the wind turbines. Distribution of number of households falling within a radius of 150m is presented in Table 1. BD 34 is the most critical having 47 households within the said setback distance followed by BD 47, BD 50, BD 32, etc.

Within a setback of 220 m:
A total of 221 households are likely to be impacted within a radius of 220m. Besides, 20 common property resources (CPRs) would also be affected in the event of clearing of setback distance from the wind turbines. Distribution of number of households falling within the said radius is presented in Table 1. BD 43 is the most critical having 35 households within the setback distance followed by BD 47, BD 50, BD 32, etc.

Table 1 – Distribution of households located at 150m & 220m radius of WTG

Sr. No.	WTG location	No of Household within 150 m	CPR within 150 m	No of Household within 220 m	CPR within 220 m
1	BD-10	5	1-Shamsan Ghat 1-Community pond	2	
2	BD-11	0	-	3	1-Govt. Warehouse
3	BD-18	2	1-Govt. primary School & AWC	9	
4	BD-26	1	-		
5	BD-29	1	1-Community pond	4	
6	BD-30	0	1-community well		
7	BD-31	2	-	1	
8	BD-32	9	-	7	
9	BD-34	47	2- Temple	11	1-Govt. primary School 1- Anganwadi Centre (AWC)
10	BD-35	8	-	7	
11	BD-37	0	-	2	1-Govt. primary School, 1- Small open temple
12	BD-39	2	-	13	
13	BD-43	5	1-Temple	36	1-Well 1-Punchayat building under construction 2- Temple (small open)

14	BD-47	15	-	11	
15	BD-50	13	1-AWC 1-Warehouse 1-Overhead tank	5	1-Pump house
Total		110	11	111	9

Social category of households within a setback of 150m and 220m from the WTG are presented in Table 2 & Table 3 respectively. It may be observed that most of the households belong to ST category. Many of them are native to the area and have been staying for several years on revenue land and don't have customary rights.

Social category of residents

Majority of structures except 1 belong to residents belonging to either SC / ST or OBC category. Details of social category for residents residing in structure within 150m is provided in Table 2 while Table 3 details the social category of residents residing within a distance of 150-220 m.

Table 2 - Social category of households within a radius of 150m of WTG

Sr. No.	WTG location	Social Category of households (No.)			
		ST	OBC	SC	Total
1	BD-10	5	0	0	5
2	BD-11	0	0	0	0
3	BD-18	1	1	0	2
4	BD-26	1	0	0	1
5	BD-29	0	1	0	1
6	BD-30	1	0	0	0
7	BD-31	2	0	0	2
8	BD-32	7	1	1	9
9	BD-34	46	1	0	47
10	BD-35	8	0	0	8
11	BD-37	0	0	0	0
12	BD-39	2	0	0	2
13	BD-43	5	0	0	5
14	BD-47	15	0	0	14
15	BD-50	13	0	0	13
Total		106	4	1	110

Table 3 - Social category of households within a radius of 150-220 m of WTG

Sr. No.	WTG location	Social Category of households (No.)				
		ST	OBC	SC	General	Total
1	BD-10	2	0	0	0	2
2	BD-11	1	2	0	0	3
3	BD-18	6	5	0	0	11

4	BD-26	0	0	0	0	0
5	BD-29	4	0	0	0	4
6	BD-30	0	0	0	0	0
7	BD-31	0	0	0	0	0
8	BD-32	5	0	1	0	6
9	BD-34	10	0	0	0	10
10	BD-35	6	0	1	0	7
11	BD-37	2	0	0	0	2
12	BD-39	13	0	0	0	13
13	BD-43	36	0	0	0	36
14	BD-47	8	2	0	1	11
15	BD-50	5	1	0	0	6
	Total	**98**	**10**	**2**	**1**	111

Categorisation of genuine and opportunistic households

To be able to differentiate among people (households) residing near WTG as genuine or opportunistic was arrived at in consultation with village revenue official (Patwari & Sarpanch) and primary survey. As such, the year of construction of dwelling structure was considered to differentiate between the genuine and opportunistic residents. It is to be noted that the analysis depends on the responses found during the primary survey and consultations. Households residing within the specified radius from the WTGs before the commencement of developmental activities on site have been deemed to be genuine while those after the developmental activities have been termed as opportunists. A majority of households have been residing for more than 10 years. A total of 32 households have been identified as opportunistic within a radius of 150m from the WTGs. Many of them are native to the area and have been staying for several years on revenue land and don't have customary rights.

Willingness to Relocate

A majority of structure owners (81% in case of structure located within 150 m and 80% in case of structures located between 150 -220m) showed willingness to relocate in the event adequate compensation is paid. However, adequacy and reasonableness of the compensation has to be determined based on engagement. Rest were not sure. Only one structure owner whose structure falls within 150-220 m radius was not willing to relocate. Summary of response is provided in Table 5.

Table 5 Willingness to relocate

S.no	Willingness to relocate	Located within 150m	Located within 150 -220	Total
1	Yes if adequate compensation is paid	90	88	178
2	Not Sure	20	22	43
3	No		1	1
4	Total	110	111	221

FINDINGS

1. People are residing within a radius of 150m at thirteen (13) WTG locations out of 15 locations. A total of 221 households would be affected within the setback distance of these WTGs, 110 within 150m and 111 within 220m respectively.
2. For household residing within 150m fifty households (45%) accepted that they didn't have ownership of the land and have encroached the land. These people are informal settlers residing on government lands and that they are not customary/traditional land owners. To avoid such situation, at present the legal status of the land as stated by the respondents have been considered. Similar situation prevailed for structures located within a 150 -220m zone.
3. A total of 32 households have been identified as opportunists within a radius of 150m from the WTGs.
4. The distribution of structures likely to be affected by type of construction materials used/typology has been identified. Majority of the structures likely to be impacted is semi-pucca followed by kutcha structures with GCI roof (31%) and pucca structures constitute to be less than 15%.
5. The sources of livelihood of a very large majority of households are dependent on agriculture and wage labour. No significant impact on livelihoods of these people is envisaged as most of the people will be relocated in near vicinity. Also they will continue to use the lands
6. The size of households varies from 6-8 members.
7. Regarding the choice of relocation, majority of households responded positively for relocation to a safer site provided adequate monetary compensation is offered to them. However, some of the respondents were clueless about relocation plan.
8. A total of 11 CPRs have been found within the 150m radius of the WTGs and 9 within a radius of 150-220m. CPRs comprise Anganwadi Centre, Grain Warehouse and Overhead Water Reservoir, temples, crematorium, community ponds, primary school, and community dug well.

CONCLUSION

Although the legal status of the residents residing within a radius of 150m from the WTG locations could not be verified through authenticate documents/records and would require re-validation at a later stage. In terms of their socio-economic conditions most of them belong to vulnerable category i.e. Schedule Tribe. Majority of the respondents expressed willingness for relocation provided adequate compensation is provided. Keeping all these facts in view, CWP-Ratlam will undertake the following mitigation and risk minimisation measures:

- CWP-Ratlam will make efforts to relocate all people/households living within the setback area/distance of 150 meters. To this effect, the company will develop and implement a relocation/resettlement plan including budget and timelines. It will be implemented by the company and monitored through a third party on a bi-annual basis. A framework underlining the principles governing these relocations will be developed.

- For turbine locations where relocation of all structures/people is not feasible (for both within a setback area of 150 & 220 meters), CWP-Ratlam will undertake a Quantitative Risk Assessment (QRA) to assess the level of safety risks. For turbines locations where the risk is assessed to be higher than As Low As Reasonably Practicable (ALARP), CWP-Ratlam will undertake measures with the objective to mitigate the risks so as to bring the risk levels down to ALARP. These measures will consist of a number of options as suggested by third party appointed to carry out QRA, based on the risk levels quantified to minimize the safety risks. These would include (but not be limited to) strengthening of foundations/hub, enhanced monitoring/inspection, on-going communication, relocation of turbines/ people and other measures (included in the ESIA). The decision tree for the selection of the mitigation measures and the outcome of the risk assessment (pre and post-mitigation) will be documented.

- CWP-Ratlam will conduct consultations and awareness programme among villagers in general, and people residing within a distance of 150/220m from the WTG in particular biannually about the likely risks of blade throw, turbine fall and other associated risks. The consultations and awareness programme will be documented and supported with photographs, videos, etc.