Environmental & Social Impact Assessment study for a 100 MW wind farm project, Shajapur & Ujjain Districts Madhya Pradesh

Ostro Madhya Wind Private Ltd

Final Report

May 2016

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ERM

FINAL REPORT

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Environmental & Social Impact Assessment study for a 100 MW wind farm project, Shajapur & Ujjain Districts Madhya Pradesh

10 May 2016

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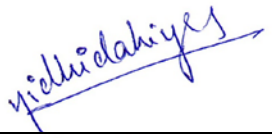
Prepared by:	**Nidhi Dahiya** *Senior Consultant*	
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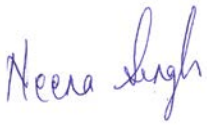
Approved by:	**Neena Singh** *Partner*	

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1 INTRODUCTION

Environmental Resources Management (ERM) has been engaged by Ostro Madhya Wind Energy Private Ltd (hereinafter referred to as "Ostro") for undertaking an Environmental and Social Impact Assessment (ESIA) study for a proposed 100 MW wind farm project located near Lahori village, in Shajapur & Ujjain Districts in the state of Madhya Pradesh.

The project will comprise of 50 wind turbine generators (WTGs) of 2 MW capacities each, which are spread across three clusters. Each WTG location will be connected to the Pooling Substation by 33 kV line. A 220 kV transmission line will be used for evacuating the power to the Shajapur State Government Grid. The wind farm project is spread across the villages of Majhaniya, Barwal, Bhilwadiya , Bamori, Kheda, Pindoniya, Chak Jiyajipur, Khoriyanayta, Khamkheda, Dillod, Lodiya, Lalghati all of which are in Shajapur district, Madhya Pradesh.

During the project life cycle, Inox, the turn-key contractor, will construct, operate and maintain the WTGs and associated facilities and will develop the complete project on behalf of Ostro. ***Figure 1.1*** highlights the location of all the proposed 53 WTGs within the project footprint.

1.1 PURPOSE OF THIS REPORT

"Ostro" intends to undertake an Environmental and Social Impact Assessment Study for its proposed wind farm in order to understand the environmental and social sensitivities and issues associated with the proposed wind farm project and to implement mitigation measures in order to avoid adverse impacts during the project lifecycle.

**Note: Wind energy projects in India at present do not require an Environmental Clearance under the EIA Notification, 2006. The ESIA is thus being undertaken as an internal management tool for "Ostro". Thus, ERM is not preparing the ESIA for any regulatory requirements, hence, if any deliverable if used for the same purpose, ERM needs to be communicated by the Client.*

1.2 APPLICABLE REFERENCE FRAMEWORK

The following reference frameworks shall be applicable for the current ESIA study:

- Applicable Indian national, state and local regulatory requirements;
- IFC Performance Standards on Environmental and Social Sustainability (2012);
- IFC/World Bank General Environmental, Health and Safety Guidelines (2007);

- IFC/World Bank EHS Guidelines for Wind Energy projects (2007);
- IFC/World Bank EHS Guidelines for Electric Power Transmission and Distribution (2007);

1.3 BASIS OF THE REPORT

ERM understands that Ostro intends to develop the project with financial assistance from its lenders (i.e. Actis – a private equity firm). The Project requires evaluating the environmental and social risks associated with the proposed project and to implement mitigation measures in order to avoid adverse impacts during the project lifecycle. It is required that proposed project is in line with the applicable International Finance Corporation (IFC)/World Bank (WB) guidelines pertaining to the environment, social issues and occupational health and safety matters as well as in compliance with local laws and regulations.

The report discusses the environmental and social baseline within which the proposed wind farm project will be commissioned and assesses the potential adverse and beneficial impacts that the project could have, along with suitable mitigation measures and an Environmental and Social Management Plan (ESMP) for the Project.

1.4 OVERVIEW OF THE PROJECT

A brief snapshot of the proposed 100 MW wind power project is provided in ***Table 1.1.***

Table 1.1 Brief Snapshot of the Project

Detail	Description
Location	• WTGs are located across the villages of Alaamrod, Baksukhedi, Barwal, Bilwadiya, Bamori, Bercha, Birgod, Biklakhedi, Bardiyason, Badoni, Chak Jiyajipur, Chosala Kulmi, Dillod, Girwar, Kheda, Khoriya nayta, Khamkheda, Kherkhedi, Lahori, Londiya, Majhania, Mullakhedi, Nolakhibeed, Pindoniya, Pipliya Indore, Lodiya, Rantbhawer, Rulki, Setkhedi, Shajapur, Singarchori, Tilawat Govind, Tilawawad Govind.
WTG's Specification	• Total 50 WTGs of 2 MW each are proposed with 100 m rotor diameter and 92 m hub height. • Make: Inox DF-100 and is DFIG type turbine.
Wind Mast	• One wind Mast of INOX was present in Kanjakheda village
Power Evacuation	• Approx. 20 towers with 100 sq. m. area each of 220 KV Lines will be connected to the Government Substation from the Wind Farm Pooling Substation of Ostro located in Shajapur. Transmission Line survey has not been done at the time of tsite visit; however, Inox team has done a transect survey and vantage point visual reconnaissance of the proposed route. As per the information obtained post site visit, transmission line survey was completed, application for approval of the proposed transmission line route

Detail	Description
	was submitted to Madhya Pradesh Power Transmission Corporation Limited (MPPTCL) and MPPTCL has approved the same. A copy of the approval was made available for review.
Land Requirement	The total land requirement for the project: • 1ha (i.e. 10,000 sq. m.) is required for each WTG. • There are 53 WTG locations identified, out of which 33 locations fall under revenue land (33 ha) and the rest 20 on private land (20 ha). Land for pooling sub-station has been reportedly purchased i.e. 15 acres but no document for the same was made available for review. • 6 ha of land required for pooling substation is on Private land which has been finalized and purchased. The document pertaining to same could not be made available for review. • The total known private land identified is 120 ha and total known revenue land identified is 33 ha. The wind farm will entail construction of access roads, however land specifications and status of easements rights was not available for review.
Current Status	• Land for WTGs locations are both private (20 locations) and government/revenue land (33 locations). • As reported, the Gram Panchayat No Objection Certificate (NoC) for establishing the transmission towers is yet to be obtained by Inox. • 2-3 batching plants are proposed. • Location for other project components required during the construction stage like storage, batching plant, Scrap Yard, etc. shall be finalised in due course of time.

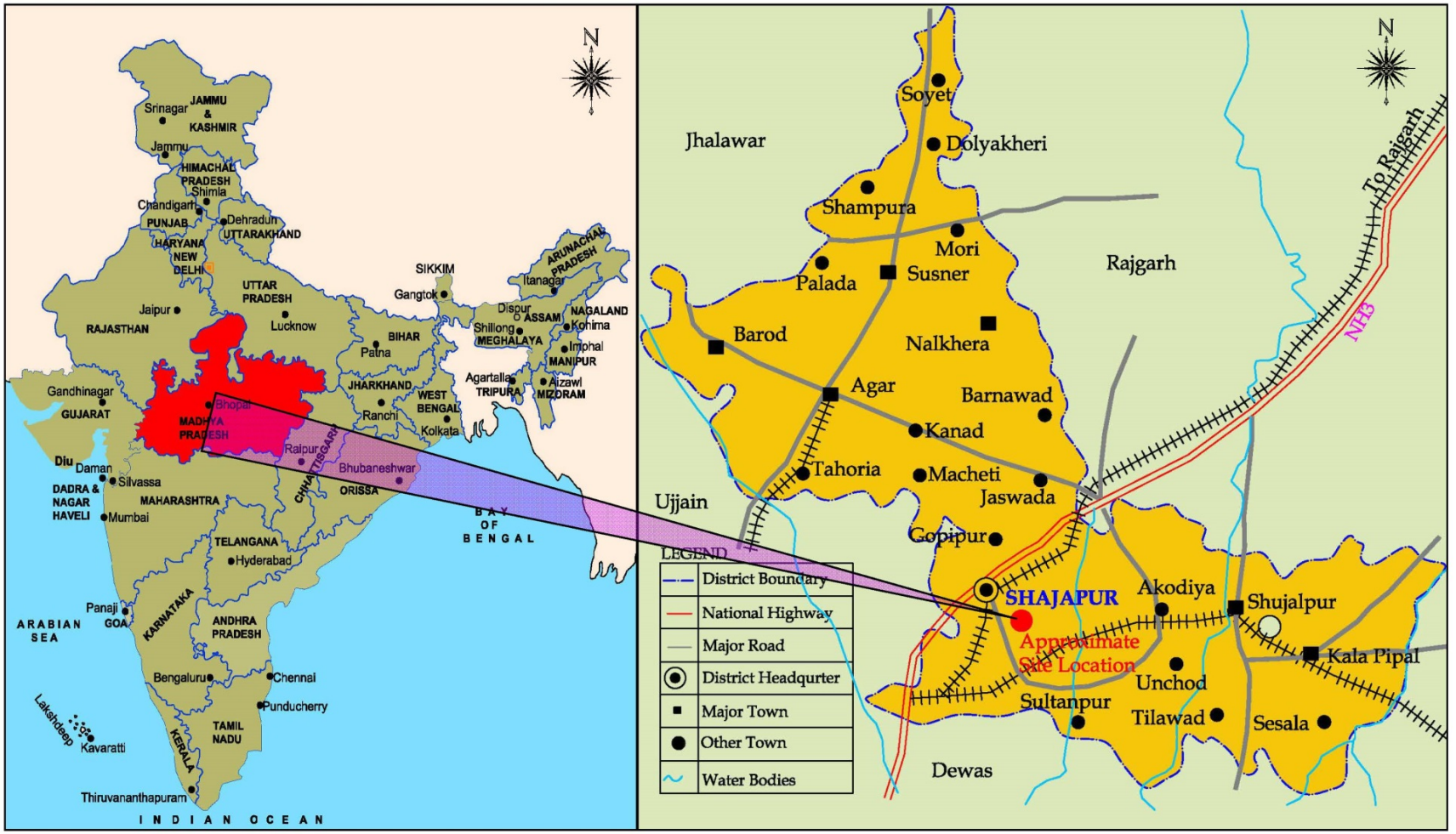
Source: Interactions with Ostro and Inox Officials

1.5 OBJECTIVES OF THE STUDY

The objectives of the ESIA were as follows:

- To identify the aspects of the Project likely to result in significant impacts to resources / receptors present within 2-5 km of the project boundary.
- To conduct the stakeholder consultations with the relevant stakeholders during the study.
- To predict and evaluate the significance of the impacts due to the project.
- To determine the significance of residual impacts, taking into account the implementation of mitigation measures; and
- To develop plans for the management and monitoring of impacts, including plans for ongoing stakeholders engagement.

Figure 1.1 Location map of Project Site



Source : Copyright © Compare Infobase Pvt. Ltd. 2004

1.6 SCOPE OF THE STUDY

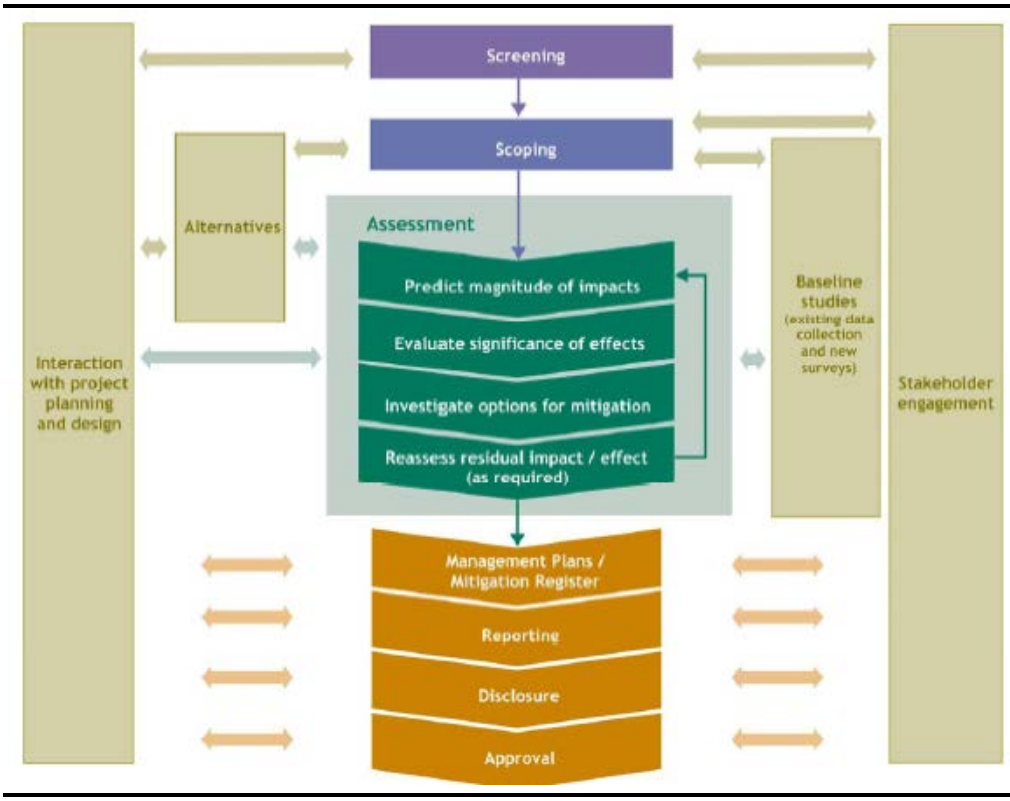
The scope of work for ESIA study broadly entails:

- Assessment of the compliance of the Project and its components vis-à-vis the applicable reference framework for the ESIA;
- Primary baseline data collection through field survey and monitoring with respect to Socio-economic characteristics within the wind farm area, Ground water quality, Noise quality within the study area of 1 km radius and ecology with an emphasis on bird and bat species within 5 km study area;
- Collection of secondary data through various documents available in the public domain with respect to meteorology, soil, land use patterns, geology, geomorphology, ecology, hydrology, Scheduled Caste, Scheduled Tribe population, along with the male, female and working people's percentile out of the general population at regional level;
- Identification of probabilities of significant shadow flicker potentially effecting human settlements in the vicinity of the Project (within 300 m from WTGs). Assessments of such impacts post identification to develop mitigation measures to reduce and overcome the impacts;
- Ascertain whether Project foot print or its immediate environment is considered to be ecologically sensitive with respect to endangered/protected species as well as birds and bats in high risk zone of collision with operational WTGs (migratory routes and foraging/breeding areas);
- Review of the land take, land lease and compensation processes to assess any adverse impacts on the project impacted villages;
- Identification, anticipation and evaluation of potential aspects and impacts on various environmental and social sensitivities due to project activities envisaged during Planning, Construction, operation and decommissioning stages;
- Propose appropriate mitigation/enhancement measures of identified environmental and social impacts;
- Formulation of Environmental and Social Management Plan (ESMP) in accordance with IFC's performance Standard 1 (PS1) addressing the various aspects considered in IFC performance standards 2 to 8 with management tools and techniques including monitoring and reporting requirements for effective implementation.

1.7 ERM'S APPROACH AND METHODOLOGY

ERM's approach and methodology (***Figure 1.2***) for the project is summarized below:

Figure 1.2 Approach adopted for the project



1.7.1 *Preliminary Discussions with Project Proponent and Document review*

- Discussions were held with Ostro and INOX in order to understand the Project, current status of agreements (i.e. land take, Power Purchase Agreement etc.);
- Collection of relevant project documents like Toposheets, Project brief, WTG technical specifications, WTG coordinates, INOX (Developer) H & S Manual, Power Evacuation Approval, Accommodation Guidelines, Acknowledgement Letter-intimation regarding land development activities.

Documents Reviewed

ERM undertook a reconnaissance as well as a detailed field survey in April 2015 to conduct the environmental and social baseline studies. The relevant documents that were obtained from Ostro and reviewed by ERM are:

- Project brief note;
- Toposheets;
- WTG Technical specifications;
- WTG coordinates;
- INOX (Developer) H & S manual;
- Power Evacuation approval;
- Acknowledge Letter-intimation regarding land development activities;
- Project Schedule; and
- Labour Accommodation Guidelines

Site Survey and Preliminary Consultations

ERM undertook a site reconnaissance for the proposed project from the 8th to 12th April, 2015. The wind farm area was again surveyed from 5th to 7th May 2015.(1) A total of 18 locations from the original 50 identified WTG locations were cancelled after the first site visit(2) and substituted with other 18; and also 3 new locations were added to the list, making the total WTG locations 53. It is to be noted, as the final list of 50 WTG locations have not been firmed up hence, a total of 53 locations were considered during WTG profiling in the report.

Environment and Social baseline data was collected through reconnaissance survey of the study area which was conducted during two site visits for different project component locations, in the months of April and May 2015 The data also involves secondary information collected from government census database and Agriculture Contingency Plan etc.

The environment baseline study included the following:

- The study area for this purpose was defined to be the area falling within 5 km radius from the WTGs;
- Primary baseline data was collected through field survey and monitoring with respect to Groundwater Quality, Ambient Noise Quality;
- ERM appointed Avon Food Laboratory Private Limited for undertaking the environmental baseline studies at site.
- The secondary data was collected through various documents available in the public domain with respect to meteorology, soil, land use patterns, geology, geomorphology, ecology and hydrology at regional level ; and
- The GIS mapping of the study area was done to present details on land use pattern, forest/vegetation cover, settlements, water bodies, drainage pattern, spot heights and contours.
- Ecological assessment on flora and fauna of the site and study area through primary and secondary surveys; and
- Preliminary bird and bat survey.

The process of data collection for the social baseline study includes the following:

- The primary data collection was based upon stakeholder (for example; the community, women's group, the community of scheduled castes and scheduled tribes and village panchayat members etc.) consultations.
- The key stakeholders also include various government departments at the district level e.g. Land, Revenue, Irrigation, Education and District Statistical Division; in order to identify key issues those might occur during the planning, construction and operation phase of the project.

(1) The site reconnaissance was completed within two sites; as few locations were cancelled and few new locations were added into the original 50, post ERM team's first sie visit.

(2) The cancellation of identified WTG locations was undertaken as a result of different reasons, such as, permits and safety issues pertaining to the locations' distance from a stone crusher or other company's already established transmission tower or govern

In the given process, ERM team assessed the socio-economic and environmental characteristics through collation of secondary information about the project site, supplemented by consultations with the local communities to understand community perception with regards to the project and its activities.

1.7.2 Impact Assessment

Following establishment of baseline quality, assessment of potential impacts on the various environmental and social elements due to the proposed Project activities has been carried out by identifying likely impacts, predicting the scale of impacts and their duration followed by evaluating significance of impacts. Mitigation measures have then been proposed for the identified impacts.

Analysis of Alternatives

A comparative analysis of alternative for the proposed Project has been done in terms of site locations and power generation technology available including no project scenario.

Environmental and Social Management Plan

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

- Introduction of purpose and aims of the ESMP;
- Summary of significant adverse impacts and potential risks;
- Mitigations and control technologies, safeguards requirement to minimize adverse impacts on environmental and social resources/receptors;
- Institutional mechanism - roles and responsibilities for ESMP implementation, training of ESMP implementation team;
- Action Plans for effective control measures to minimize adverse impacts/risks; and
- Monitoring program for effective implementation of the mitigations and ascertain efficacy of the environmental management and risk control systems in place;

Agencies Contacted

The agencies contacted by ERM during the ESIA study include the following:

- India Meteorological Department (IMD), Pune;
- Land and Revenue Department, Madhya Pradesh (MP);
- Department of Labour, MP;
- Forest and Wildlife Department , MP;
- District Planning Office, MP

1.8 LIMITATIONS

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

- INOX team has done a transect survey and vantage point visual reconnaissance of the proposed route. Detailed survey of internal transmission route was not conducted till date.
- As reported, the Gam Panchayat No Objection Certificate (NoC) for establishing the transmission towers is yet to be obtained by INOX.
- WTG profiling of all the 53 WTGs locations are done, now INOX has to finalise 50 locations amongst it.
- Land required for internal roads, storage yard, other facilities have not been provided.
- The location of the associated facilities has not been provided during the site visit stage.
- The capacity of the DG set and expected fuel used is to be provided or verified by the client.

Moreover, it shall be noted that it is a submission of draft report taking into account the data gaps listed above and ERM has submitted this report on request of Ostro to make submission despite lack of some crucial information.

1.8.1 *Uses of the Report*

ERM is not engaged in consulting or reporting for the purpose of advertising, sales promotion, or endorsement of any client interests, including raising investment capital, recommending investment decisions, or other publicity purposes. Client acknowledges this report has been prepared for their and their clients' exclusive use and agrees that ERM reports or correspondence will not be used or reproduced in full or in part for such purposes, and may not be used or relied upon in any prospectus or offering circular. Client also agrees that none of its advertising, sales promotion, or other publicity matter containing information obtained from this assessment and report will mention or imply the name of ERM.

Nothing contained in this report shall be construed as a warranty or affirmation by ERM that the site and property described in the report are suitable collateral for any loan or that acquisition of such property by any lender through foreclosure proceedings or otherwise will not expose the lender to potential environmental or social liability.

1.9 LAYOUT OF THE REPORT

The structure of the ESIA report will be as given in ***Table 1.2*** below:

Table 1.2 Structure of ESIA Report

Sections	Title	Description
Section 1	Introduction	(*this section*) Introduction to the Project and ESIA methodology
Section 2	Project Description	Technical description of the Project & related infrastructure and activities.
Section 3	Applicable Legal and Regulatory Framework	Discusses the applicable environmental and social regulatory framework and its relevance for Project.
Section 4	Impact Assessment Methodology	Description of the impact assessment process undertaken to identify potential environmental and social impacts.
Section 5	Scoping	Description of the Scoping outcomes previously undertaken as part of the ESIA process.
Section 6	Environmental and Social Baseline	Outlines Environmental and Social Baseline status in the study area of the project.
Section 7	Impact Assessment and Mitigation Measures	This section includes details of identified environmental impacts and associated risks due to project activities, assessment of significance of impacts and presents mitigation measures for minimizing and /or offsetting adverse impacts identified.
Section 8	Environmental and Social Management Plan	Outline of the Environmental and Social Management Plan (ESMP) taking into account identified impacts and planned mitigation measures and monitoring requirements.
Section 9	Impact Summary and Conclusion	Summary of impacts identified for the project
Annex A	List of approvals obtained for Lahori Project	Power Evacuation Permission from Madhya Pradesh Power Transmission Company Ltd
Annex B	Environmental Standards	-National Ambient Air Quality Standard -WHO Ambient Air Quality Guideline -Water Quality Standard -General Industrial Standards for Discharge of Environmental Pollutants -Primary Water Quality Criteria for Designated Best Use Classes -Indicative values for treated Sanitary Wastewater Discharges -National Ambient Noise Standards -IFC/WB Noise Standards
Annex C	Noise Monitoring Report	
Annex D	Photo documentation	-Photos reflecting field condition and receptor location
Annex E	Shadow Flicker Report	-The shadow calendar graphical and project data overview has been provided.
Annex F	MPPTCL permission for construction of 22KV Transmission line	Permission has been granted to Inox Wind Infrastructures Services Ltd. with conditions for constructing 220KV transmission line.

2 PROJECT DESCRIPTION

2.1 INTRODUCTION

This section provides an overview of Lahori windfarm project wherein the description of the Project is provided in terms of location, facilities and associated project planned infrastructure and activities during various stages of the project.

2.2 SITE SETTINGS

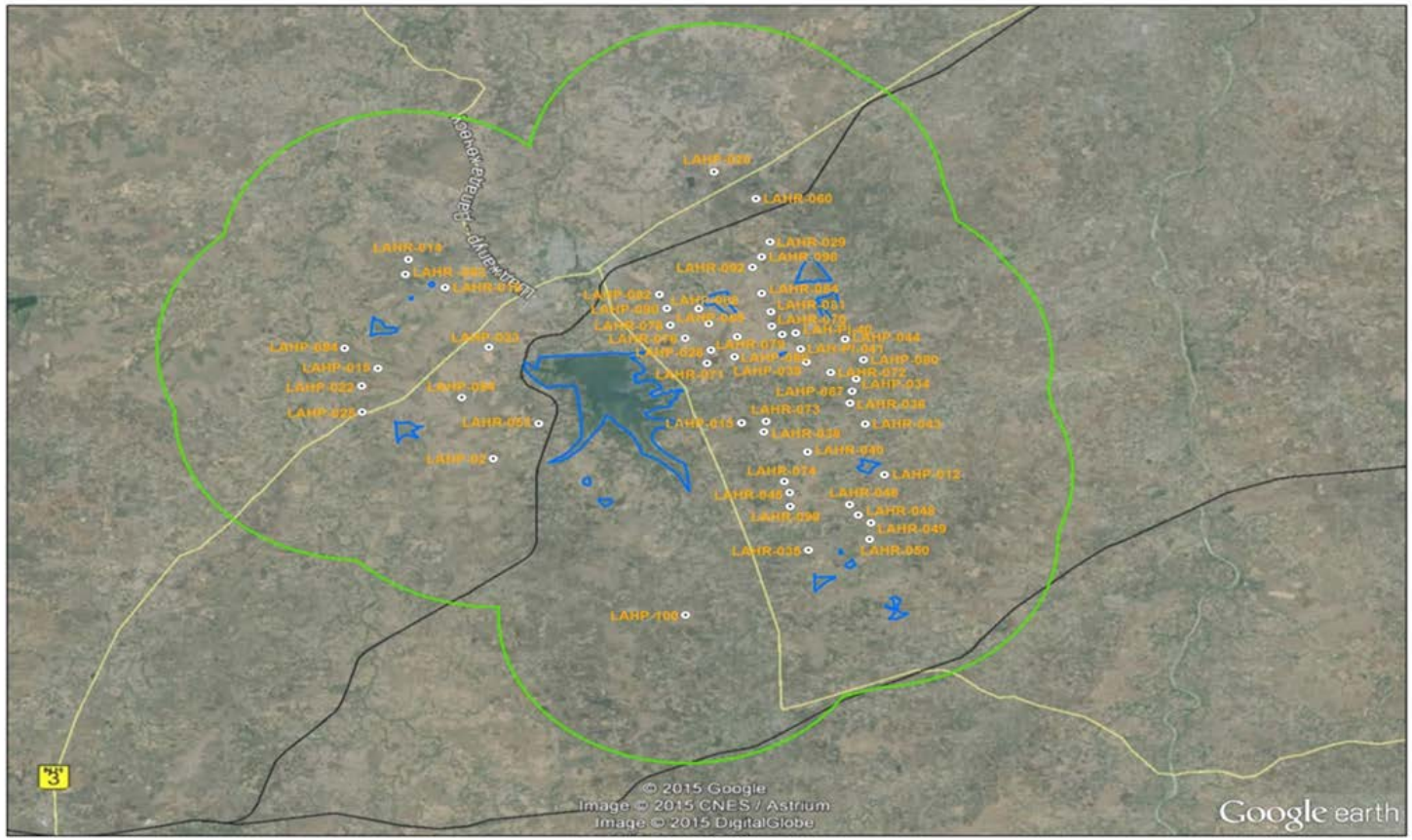
The Project site is located in Lahori,Majhania, Barwal, Bilwadiya, Bamori, Kheda, Pindoniya, Chak Jiyajipur, Khoriyanayta, Khamkheda, Dillod, Lodiya village in Tehsil and District Shajapur of the State Madhya Pradesh. The wind farm site is located on the dissected topography with intermittent undulating and plane terrain with surface elevation ranging from 335 to 608 msl.

The project comprises of three clusters, namely, Cluster 1, 2 and 3 with the following coordinates:

- Cluster 1 lies between 23°25'6.93"N to 23°22'27.32"N and 76°15'22.79"E to 76°15'7.43"E across the villages of Aaditya Nagar & Suwarkota ;
- Cluster 2 lies between 23°23'2.71"N to 23°21'20.47"N and 76°16'18.76"E to 76°15'35.61" across the villages of the Lodiya and Dillod Villages;
- Cluster 3 lies between 23°27'53.95"N to 23°18'40.30"N and 76°20'26.47"E to 76°20'37.83"E across the village of Bhilwadiya, Majhaniya, Barwal, Kheda, Pipalya Gopal , Chak Jiyajipur, Baksukhedi , Singarchori , Khoriyanayata

The location of the WTG's on the satellite imagery is as shown in ***Figure 2.1*** below and the detailed WTG Profiling data is given Section 2.4.3 of the report.

Figure 2.1: Satellite Imagery showing Lahori Wind farm site



Source: Google Earth Pro Imagery 23/05/2015

2.2.1 *Wind Farm Accessibility*

Road and Rail Network

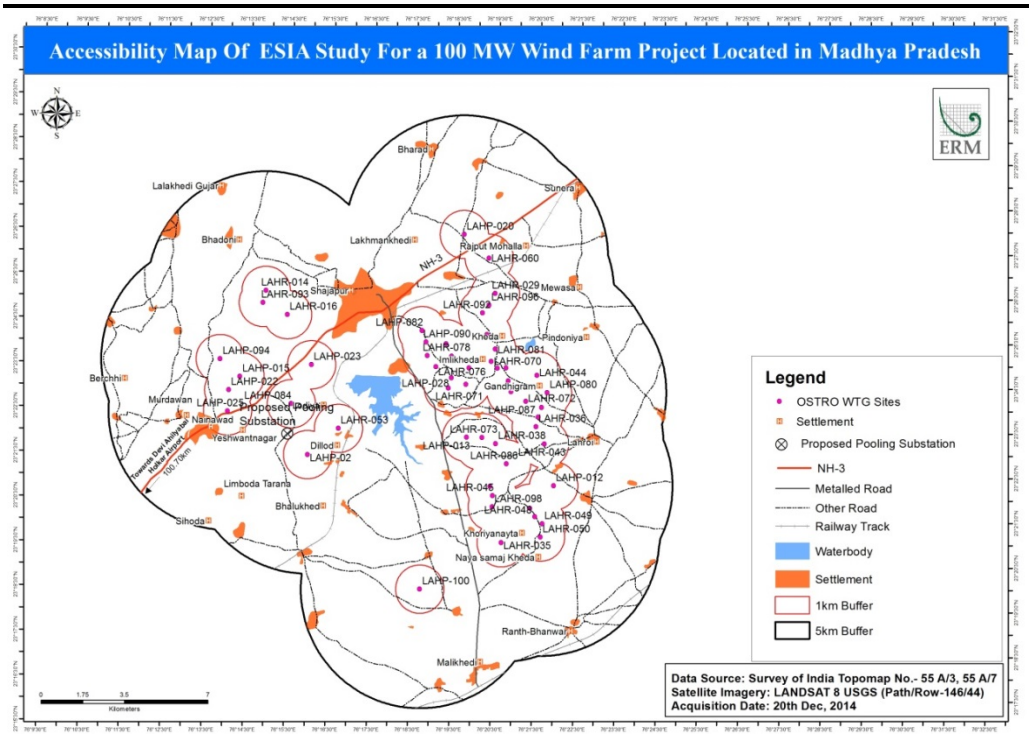
The wind farm site is well connected with other regions of the District through road and rail network. The study area is intersected by NH-3 and Shajapur - Bhopal State Highway which passes through Lahori and Piplaya Gopal villages. Other approach roads leading to WTG's are unpaved and not in good condition. Bus service is available from Shajapur and other places located on the main roads.

The accessibility map of *Shajapur* district is provided as ***Figure 2.2***
The WTGs proposed in Revenue land do not have proper access roads and are located nearly 50 m to 600 m away from the approach roads. The WTG's proposed in the Private land mostly used for cultivation also requires access road of 20 m to 300m from the main approach road. The internal roads are yet to be finalized.

Airport

The nearest airport is Devi Ahalyabai Holkar Airport at Indore, approximately 89 km away from Shajapur. On the way between Shajapur to Nainawad, there is a helipad that has been reported to be used sparingly. A WTG (LAHP-23) has been proposed on this helipad.

Figure 2.2 ***Accessibility map for Project Area***



Source: ERM

2.3 *PROJECT COMPONENTS*

The key components of the proposed wind farm include the following:

- Wind Turbines Generators (WTGs) and unit transformers associated with each WTG;
- Pooling substation (PSS) at Suwarkota;
- Transmission system (power lines of different capacities) to the PSS and Shajapur Government Sub-station;
- Access roads; and
- Additional project infrastructure Labour camps, batching plant, storage yard, etc.

2.3.1 *Wind Turbine Generators*

The project comprises of 50 Wind Turbine Generators (WTGs) having 2.0 MW capacity each and supplied by INOX Wind Infrastructure Services Limited. INOX's WTGs are based on AMSC Windtec technology, which has an aggregate capacity of more than 15,000MW operating successfully. The specifications of WTGs are provided in ***Table 2.1***.

Table 2.1 ***Specifications of Wind turbines***

S. No.	Parameters	Details
(a)	*Technical Specifications*	*Details*
(i)	Rated Power	2000 kW
(ii)	Rotor Diameter	100.256 m
(iii)	Tower Height	90.016m
(iv)	Hub Height	92 m
(v)	IEC WT Class	Class III B
(vi)	Turbine Concept	Variable speed, variable pitch control
(b)	*Rotor*	
(i)	Type	Upwind rotor with active pitch control
(ii)	Rotational Direction	Clockwise
(iii)	Number of Blades	3
(iv)	Swept Area	7,894 meter^2
(v)	Blade Material	Epoxy glass fibre
(vi)	Pitch Control	XYZ
(c)	*Drive train with generator*	
(i)	Hub	Rigid
(ii)	Main Bearing	Tapered roller bearing pair
(iii)	Generator	DFIG
(iv)	Braking System	Full span blade pitching systems
(v)	Yaw Control	Active via adjustment gears, load-dependent damping
(vi)	Cut-in wind speed	3 m/s
(vii)	Cut-out wind speed	20 m/s - with storm control

Source: Technical data sheet - AMSC

2.3.2 Pooling Substation

The Lahori wind farm site is connected to the pooling substation via 33 kV overhead electrical line, which is further connected with Madhya Pradesh Government Grid on 220 kV substation at Shajapur through transmission line for power evacuation from the project.

The pooling substation is located in an area of approximately (155 m x 120 m) in Suwarkota Village where the power will be stepped up to 220 kV. The substation would be fenced for safety purposes.

Minimum clearance for 220 kV & 33 kV system are mentioned in ***Table 2.2*** below:

Table 2.2 Minimum Clearance Distances

For 220 kV	
Safety working Clearance	4500 mm
Ground Clearance	5500 mm from Finished Ground Level (FGL)
For 33 kV	
Safety Working Clearance	2800 mm
Ground Clearance	3700 mm from FGL

2.4 POWER EVACUATION SET UP/ TRANSMISSION LINE DETAILS

2.4.1 Transmission Line Details

The WTGs would be connected to each other via a 33 kV overhead electrical line utilising 'dog conductor arrangement'. The electrical line between the WTGs and the pooling substation, in Shajapur would be connected utilising 'panther conductor arrangement' and 33 kV lines. Approximately, a total of 40 number of towers would be a connecting point between the pooling substation, and the government substation, Shajapur, utilising 220 kV lines and a 'zebra conductor arrangement'.

The proposed transmission route passes through a combination of government revenue land and private land. Detailed survey of internal transmission route was not conducted till the date of the site visit. However, as per the information obtained post site visit, transmission line survey was completed, application for approval of the proposed transmission line route was submitted to Madhya Pradesh Power Transmission Corporation Limited (MPPTCL) and MPPTCL has approved the same. A copy of the approval was made available for review and the permission is attached as ***Annex F*** to the report.

The Pooling substation will be connected to Madhya Pradesh State grid 220 kV Substation at Shajapur through transmission lines of approx. 4 - 4.50 km (aerial distance). It is estimated by the Ostro team, that the transmission lines

would consists of around 40 towers, which will be contiguous after approximately every 300 m.

2.4.2 Additional Project Infrastructure

Associated ancillary facilities and utilities provided for the project include:

- Batching Plant
- Metering point for measuring production from each WTGs;
- Material storage yards and stores; and
- Central Monitoring Station building and facilities.

2.4.3 WTG Profiling

All 53 WTG locations were assessed for sensitivities around them within 1 km distance. A detailed WTG profiling is provided in ***Table 2.3.***

Table 2.3 WTG Site specific surrounding features and land use for Wind farm (Based on eye view up to a distance of 1 km)

S.No.	WTG No.	GPS Coordinates	Elevation (m)	Type of Land*	Land Use**	No. of trees	Nearest settlement	Distance (km/m) and direction	Nearest Water body***	Distance (km) and Direction	Motorable? ****	North	East	West	South
1.	LAHR -38	634891E 2585548 N	507m	Flat	30% agricultural + 70% natural vegetation	Approx. 30-40 trees	Pipalya Gopal	Approx. 1.14 km east	None	NA*	Yes	U*	U	U	U
2.	LAHR-86	637051E 2584751 N	517 m	Flat	Dry Grazing land	Approx. 15-20 trees	None	NA	None	NA	Yes	U	U	U	U
3.	LAHR-45	636590E 2583390 N	520 m	Flat	Dry Grazing land	Approx 15-20 trees	None	NA	None	NA	Yes	U	U	U	U
4.	LAHR-98	636609E 2582932 N	518 m	Flat	Dry Grazing land	Approx 20-30 trees	None	NA	None	NA	No	U	U	U	U
5.	LAHR-46	638167E 2583007 N	519 m	Undulating	Dry Grazing land	Approx 20-30 trees	Nil	-	Nil	-	No	U	U	U	U
6.	LAHR-48	638399E 2582669 N	519 m	Flat	Dry Grazing land	Approx 20-30 trees	Nil	-	Nil	-	No	U	U	U	U
7.	LAHR-49	638734E 2582401 N	519 m	Flat	Dry Grazing land	Approx 20-30 trees	Nil	-	Nil	-	No	U	U	U	U
8.	LAHR-50	638705E 2581856 N	535 m	Flat	Dry Grazing land	Approx. 10-15 trees	Naya Samaj Kheda	Approx 700 m , SW	Small Pond	1.2 km southwest	Yes	U	U	U	U
9.	LAHR-60	635622E 2593175 N	479 m	Hilly	Dry Grazing land	Approx 20-30 trees	Settlement	Approx 201 m South	None	NA	No	U	U	U	U
10.	LAHP-20	634513E 2594065 N	466m	Flat	Agricultural land	Approx 20-30 trees	Ravidas colony	Approx 522 m northwest Approx.		Approx 20-30 trees	Yes	Flat	Flat	Flat	flat

S.No.	WTG No.	GPS Coordinates	Elevation (m)	Type of Land*	Land Use**	No. of trees	Nearest settlement	Distance (km/m) and direction	Nearest Water body***	Distance (km) and Direction	Motorable? ****	North	East	West	South
							One settlement	201m south							
11.	LAHP-44	638003E 2588507 N	510m	Hilly	Dry grazing land	Approx. 20-30 trees	Gandhi Gram	Approx. 443m west	None	NA	No	U	U	U	U
12.	LAHR-70	636075E 2588924 N	514 m	Flat	Agricultural land	Approx. 10-20	One house	Approx 35 NorthWest	None	NA	No	U	U	U	U
							Imlikheda village	Approx 164m northeast							
13.	LAHR-81	636190E 2589446 N	509m	Flat	Dry grazing land	Approx. 10-20	Small temple	Approx. 302 m north	None	NA	Yes	U	U	U	U
14.	LAHR-92	635550E 2590894 N	505m	Hilly	Dry grazing land	Approx. 5-10	None	NA	None	NA	Yes	U	U	U	U
15.	LAHR -96	635782E 2591240 N	499m	Hilly	Dry grazing land	Approx. 5-10	None	NA	None	NA	Yes	U	U	U	U
16.	LAHR-78	633408E 2588939 N	506m	Hilly	Dry grazing land	Approx. 5-10	Mining activity	Approx. 364m south	Small pond	230 m southeast	Yes	U	U	U	U
							Saankheda	Approx. 892m west							
17.	LAHP-90	633307E 2589504 N	512m	Hilly	Dry grazing land	Approx. 5-10	Few houses	Approx.276 m northeast	None	NA	No	U	U	U	U
18.	LAHP-82	633108E 2589955 N	501m	Hilly	Dry grazing land	Approx. 10-20	One industry type structure	Approx.716 m southwest	None	NA	No	U	U	U	U
19.	LAHR-76	633800E 2588514 N	513m	Hilly	Dry grazing land	Approx. 10-20	Mining activity	Approx. 150m west	None	NA	No	U	U	U	U
							Few	Approx.							

S.No.	WTG No.	GPS Coordinates	Elevation (m)	Type of Land*	Land Use**	No. of trees	Nearest settlement	Distance (km/m) and direction	Nearest Water body***	Distance (km) and Direction	Motorable? ****	North	East	West	South
							structures	950m west							
20.	LAHR-28	634485E 2588114 N	516m	Hilly	Dry grazing land	Approx. 10-20	None	NA	None	NA	Yes	U	U	U	U
21.	LAHR-71	634389E 2587679 N	505m	Hilly	Dry grazing land	Approx. 10-20	None	NA	None	NA	No	U	U	U	U
22.	LAHP-23	628660E 2588166 N	510m	flat	Dry grazing land	Approx. 10-20	Location on Helipad Few settlements probably of Lalghati	Approx. 282m north	None	NA	No	U	U	U	U
23.	LAHP-84	627958E 2586489 N	520m	Hilly	Dry grazing land	Approx. 10-20	Tyre industry	Approx. 240m east 150-276m	None	NA	No	U	U	U	U
24.	LAHP-02	628804E 2584448 N	513m	Flat	Dry grazing land	Approx. 20-30	Settlements Dillod	Southwest Approx. 842m east	Small water stream	690m north	No	U	U	U	U
25.	LAHR-35	637102E 2581483 N	519m	Hilly	Dry grazing land	Approx. 30-40	Few settlements probably from Biklakhedi village	836m west	None	NA	No	U	U	U	U
26.	LAHP-80	638491E 2587834 N	512m	Hilly	Dry grazing land	Approx. 20-30	Gandhi Gram	1.05 km northwest	None	NA	No	U	U	U	U
27.	LAHR-43	638552E 2585702 N	514m	Excavated area	Dry grazing land	Approx. 20-30	Mining activity	420m southwest	None	NA	Yes	U	U	U	U
28.	LAHR-29	635998E 2591737	499m	Hilly	Dry grazing land	Approx. 20-30	Nil	-	None	NA	No	U	U	U	U

S.No.	WTG No.	GPS Coordinates	Elevation (m)	Type of Land*	Land Use**	No. of trees	Nearest settlement	Distance (km/m) and direction	Nearest Water body***	Distance (km) and Direction	Motorable? ****	North	East	West	South
		N													
29.	LAHR-54	635799E 2590023 N	401m	Flat	Dry grazing land	Approx. 30-40	Kheda village One house small temple	283m east 308m west 370 m southeast	None	NA	Yes	U	U	U	U
30.	LAHR-36	638147E 2586390 N	504m	Flat	Dry grazing land	Approx. 30-40	None	NA	None	NA	No	U	U	U	U
31.	LAHR-53	629988E 2585635 N	493m	Flat	Grazing land	Approx. 30-40	None	NA	None	NA	No	U	U	U	U
32.	LAHR-68	0634146E 2589498 N	537 m	Barren, Grassland, rolling terrain (topland sloping on all sides) that has gullies and rills due to aeolian and water erosion	Cultivation at few areas other than the proposed site and the grasslands are used for grazing		Khera	800	A seasonal waterbody and a marshy low land	800m and 500m respectively	No	Flat till 250m, sloping beyond that to form structures of water erosion	Flat till 250m	Flat till 250m	Flat till 250m
33.	LAHR-69	0634420E 2588998 N	521	Barren, Grassland, rolling terrain (topland sloping on all sides) that has gullies and rills due to water and aeolian erosion	Cultivation in few locations but not in the proposed site. The grasslands are used for grazing.		Talaokhera	700	A pond	900m	No	Land undulating terrain	U	U	U
34.	LAHR-79	0635168E 2588576	503	Barren, Grassland,	Cultivation at few places but		Talaokhera village	900-950m	Few low-	500m and	No	U	U	U	U

S.No.	WTG No.	GPS Coordinates	Elevation (m)	Type of Land*	Land Use**	No. of trees	Nearest settlement	Distance (km/m) and direction	Nearest Water body***	Distance (km) and Direction	Motorable? ****	North	East	West	South
		N		rolling terrain (topland sloping on all sides) that has gullies and rills due to aeolian and water erosion A slope of 10-20m from South to North around 250m of the WTG.	not in the proposed location, grasslands are used for grazing				lying areas where wash-off collects	800m					
35.	LAHR-80	0635706E 2587896 N	502	Cultivation at few locations other than proposed site. Grasslands used for grazing.	Settlements on the N-N-East		Settlements on the N-N-East	800-900m	Embankments at lowlands.	Within 500m	No				
36.	LAHP1:41	0636835E 2588184 N	512	Flat and undulating grassland. Primarily barren scrubland. The slope of the land is from West to East	Mixed use. Agriculture is practised at the proposed land. Grazing is also done		None	NA	Embankments at lowlands.	Within 500m	Yes, kutcha road within 150m	Undulating terrain beyond 250m	Undulating terrain beyond 250m	Undulating terrain beyond 250m	Flat, gently sloping
37.	LAHP-39	0636988E 2587740 N	507	Undulating, barren scrubland. The slope of	Mixed use. Agriculture is practised at the proposed		Gandhigram at North-East and Chatpurkh	900m and 750m	Embankments at lowlands.	Within 500m	Yes, kutch road till 300m	U	U	U	U

S.No.	WTG No.	GPS Coordinates	Elevation (m)	Type of Land*	Land Use**	No. of trees	Nearest settlement	Distance (km/m) and direction	Nearest Water body***	Distance (km) and Direction	Motorable? ****	North	East	West	South
				the land is from West to East	land. Grazing is also done		era at South								
38.	LAHP-34	0638301E 2587203 N	507	Barren, undulating scrubland.	Agriculture is practised at the proposed site. The slope is gentle from North to South		Chatpurkhera at South	800-850m	Embankments at lowland	800m	Yes, Kutcha road motorable till 20m	Flat	Flat	Undulating beyond 300m	Undulating
39.	LAHP-87	0638199E 2586790 N	501	Undulating scrubland	The proposed site is barren covered with grasses. Mixed use. Agriculture and grazing		Chatpurkhera within 500m but the village front towards WTG is covered with trees and the settlements lay beyond 500	500m	Embankments at lowland	Within 500m	Yes, kutcha road motorable upto 40m	U	U	U	U
40.	LAHR-72	0637634E 2587400 N	507	Undulating scrubland	The proposed site is a barren land. The surrounding land is used for grazing and agricultural activities		Chatpurkhera	900m	Embanked lowlying waterbody	800m	Yes, kutch road toll the WTG site	Flat	Flat	Undulating	Undulating
41.	LAHP-1:40	0636703E 2588706	512	Undulating scrubland	The proposed site is used for		None	NA	None	NA	Yes, kutcha road till	Gently Sloping	Gently Sloping	Gently Sloping	Gently Sloping

S.No.	WTG No.	GPS Coordinates	Elevation (m)	Type of Land*	Land Use**	No. of trees	Nearest settlement	Distance (km/m) and direction	Nearest Water body***	Distance (km) and Direction	Motorable? ****	North	East	West	South
		N			seasonal agricultural activities						150m of the site				
42.	LAHR-16	0627494E 2590148 N	521	Undulating scrubland, A small hillock on the North	Barren scrubland, land sloping towards South						Yes, kutcha road till 300m of the site	U	U	U	U
43.	LAHR-93	0626450E 2590567 N	522	Undulating scrubland, A hillock on the North	Barren scrubland, sloping towards North		None	NA	None	NA	Yes, kutch road till 200m	Hillock	U	U	U
44.	LAHR-14	62526E 2591072 N	520	Undulating scrubland, A hillock on the North-East	Barren scrubland sloping towards South-west		None	NA	None	NA	Yes, kutcha till 150m	Hillock	U	U	U
45.	LAHP-25	0625351E 2585973 N	493m	Undulating scrubland.	There is a stone crushing unit at North. NH-3 runs 50m close to the proposed site		None	NA	None	NA	Yes, 50m from NH-3	U	U	U	U
46.	LAHP-94	624869E 2588101 N	480m	Rocky top of a small mound.	Barren scrubland		Khakri Village	700m	Embanked lowland	600	Yes, kutcha road till 600m from Proposed WTG	U	U	U	U
47.	LAHP-22	0625328E 2586847 N	492	Undulating scrubland	Agriculture practised in the proposed site. Stone		None	NA	None	NA	Yes, kutcha road till 120m away	U	U	U	U

S.No.	WTG No.	GPS Coordinates	Elevation (m)	Type of Land*	Land Use**	No. of trees	Nearest settlement	Distance (km/m) and direction	Nearest Water body***	Distance (km) and Direction	Motorable? ****	North	East	West	South
					crushing unit at 800m East.						from the site				
48.	LAHP-15	0625747E 2587434 N	498m	Undulating scrubland	Barren topland.		None	NA	None	NA	Yes, kuchcha road till 300m of the site				
49.	LAHP-13	635311E 2585708 N	516	Flat Land	Agricultural land all around		None	NA	None	NA	Within 250m of a metalled road	Sloping after 50m	Highland	Undulating	sloping
50.	LAHR-73	635947E 2585754 N	512	Gentle Sloping land	Agricultural land		NA	None	NA	None	Within 500m of a metalled road	Lowland	Undulating after 50m	Undulating after 50m	High
51.	LAHR-74	636447 E 2583768	514	Barren Land	Not cultivated		None	NA	None	NA	Not motorable within 500m	Sloping land beyond 20m	Upland till 150m than undulating	Flat land then slopes down	High
52.	LAHP-12	639072E 2584010 N	505	scrubland, site on slope	Barren		None	NA	None	NA	Not motorable within 500m	Sloping	Sloping	Flat after 200m of slope	Sloping
53.	LAHP-100	633902E 2579290 N	533	Topland	Cultivated		None	NA	None	NA	Motorable within 300m	Land slopes after 50-60m	Land slopes after 100m	Land slopes after 300m	Land slopes after 200m

Source – ERM team site visit

NA- Not Applicable, U-Undulating terrain

2.5 *LAND DETAILS*

INOX as a developer provides services to several wind farm companies in the area (Shajapur District) and also acts as a facilitator in the land take process, directly procures land in its name, is responsible for aggregation of land plots and transfer of its ownership to the concerned company. As provided in ***1.1*** and as reported, the total known land requirement for the project is 154 ha. of which 120 ha is private land.

Reportedly, the village wise distribution of the land plots identified for the WTGs are as follows:

Table 2.4 Village wise land distribution for WTGs

S. No.	Turbine ID	Zone	Land Type	Plot no.s	Village
1	LH-114	43 Q	Private		Birgod
2	LH-115	43 Q	Private		Birgod
3	LH-116	43 Q	Private		Birgod
4	LH-117	43 Q	Private		Birgod
5	LAHP-037	43 Q	Private	1745	Tilawat govind
6	LAHP-093	43 Q	Private		Chosala Kulmi
7	LAHP-047	43 Q	Private		Pipliya Indore
8	LAHR-050	43 Q	Revenue	818/1	Pipliya Indore
9	LAHR-049	43 Q	Private	91/2,91/5,91/4,91/3	Pipliya Indore
10	LAHR-055	43 Q	Revenue	945	Pipliya Indore
11	LAHP-052	43 Q	Private		Rulki
12	LAHR-093	43 Q	Revenue	644	Kherkhedi
13	LAHP-092	43 Q	Private		Setkhedi
14	LAHP-095	43 Q	Private		Setkhedi
15	LAHR-046	43 Q	Revenue	798	Khoriya Nayta
16	LAHR-035	43 Q	Revenue		Khoriya Nayta
17	LAHR-048	43 Q	Revenue	801	Khoriya Nayta
18	LAHP-030	43 Q	Unknown		Nolakhibeed
19	LAHR-056	43 Q	Private		Tilawawad Govind
20	LAHP-074	43 Q	Private		Tilawawad Govind
21	LAHP-100	43 Q	Private	1	Tilawad govind
22	LAHP-073	43 Q	Private		Tilawad govind
23	LAHP-012	43 Q	Private		Singarchori
24	LAHP-034	43 Q	Private	109	Lahori
25	LAHP-044	43 Q	Private	992	Lahori

S. No.	Turbine ID	Zone	Land Type	Plot no.s	Village
26	LAHP-087	43 Q	Private	4,10,409	Lahori
27	LAHP-080	43 Q	Private		Lahori
28	LAHP-072 part 1 & 2	43 Q	Private	138, 301 300	Lahori
29	LAHR-043	43 Q	Private	4,77,578	Lahori
30	LAHR-086	43 Q	Private	1	Bakshukhedi
31	LAHR-016	43 Q	Unknown		Girwar
32	LAHP-057	43 Q	Private	31	Rantbhawer
33	LAHR-027	43 Q	Private		Pindoniya
34	LAHR-045	43 Q	Private		Biklakhedi
35	LAHP-019	43 Q	Unknown	36	Nolakhibeed
36	LAHP-097	43 Q	Unknown		Nolakhibeed
37	LAHP-005	43 Q	Unknown	36	Nolakhibeed
38	LAHP-010	43 Q	Private		Bardiyason
39	LAHR-014	43 Q	Revenue	1011	Badoni
40	LAHP-084	43 Q	Unknown		Londiya
41	LAHR-036	43 Q	Private	178252	Chakjiyajipur
42	LAHR-098	43 Q	Private	409410	Alaamrod
43	LAHP-023	43 Q	Unknown	1125	Shajapur
44	LAHR-074	43 Q	Revenue		Mullakhedi
45	LAHP-002	43 Q	Private		Dillod
46	LAHPI-041	43 Q	Private		Kheda
47	LH-103	43 Q	Private		Bercha
48	LH-104	43 Q	Private		Bercha
49	LH-105	43 Q	Private		Bercha
50	LAHP-091	43 Q	Private	626	Bercha

Source: Inox land team

2.5.1 *Land Footprint and Procurement Status*

WTGs

The land requirement for each WTG is approximately One (1) hectare. There are total 53 WTG locations identified from which the project will be implemented with 50, out of which, 20 would be located on private land and 33 would be located on revenue land.

Approximately One (1) hectare for each WTG is the project's land requirement. There are total 20 private locations for the WTGs at present. Reportedly, agreement to Sell (ATS) for 9 locations has been executed; however the copies of the same were not made available for review.

Access Roads

The WTG locations identified were found to be on the plateau like structures in the interior parts of the villages, away from the cement concrete roads which mainly are used for general transportation. Accessibility to these locations needs to be modified, mainly for material transportation by vehicles to the location. Reportedly, no new roads will be constructed as the routes to

these locations exist but at present are unpaved and unsuitable for carrying heavy material required for construction of WTGs, hence shall be paved.

It shall be noted that most of these routes are already being used by the community dwellers as pathways or grazing fields. Moreover, the project will not use these approach roads for all times of the day and after construction of the WTGs. Furthermore, some of these stretches of land are classified as revenue land parcels by the government, wherein some are privately owned. Considering all of the above, the land for access roads/approach roads will not be purchased but leased in case of government land and taken on the bases of easement rights(1) in case of private land, as reported.

The total land requirement for the access roads is not yet confirmed by Inox, though the width of the each approach road shall be approximately 3 m wide.

Pooling sub station

Six (6) hectare of land required for the pooling substation had already been purchased as of the first week of April 2015, as reported by Inox. The copies of were not made available for review.

Transmission Line

Reportedly, 40 transmission towers will be erected for the transmission line (TL) which shall occupy approximately 100 m^2 for each tower which will be taken on the bases of Right to Use agreement. There were stretches of private land observed to be located near a stone crusher and behind INI Farms Pvt Ltd (which is a horticulture farm). The TL will also cross NH-3 near Bordi Kheda village which is small hamlet of approximately 40 households as reported by Inox.

Batching Plant

There is a requirement of 2 or 3 batching plants as reported by Ostro. The exact requirement of the number of batching plants is yet to get finalised by the company. Approximate land requirement and type of land on which components would be located is not known at this stage.

(1) An easement is a right which the owner or occupier of certain land possesses, as such, for the beneficial enjoyment of that land, to do and continue to do something, or to prevent and continue to prevent something being done, in or upon, or in respect of, certain other land that is not his own. For example, Ostro here could become an Easement Owner of certain land parcels identified for building approach roads to the WTG locations, for the purpose of transportation of material and general access to the WTG locations. In this case, the original owner will be paid the compensation for the easement right which could be permanent or temporary as decided mutually by both the parties. The original owners might have to take permissions from the easement owner i.e. Ostro to conduct certain activities on these land parcels as both the parties have ownership of that particular land. Vis-à-vis will be the scenario in case Ostro wants to use the land in any other way specified in the contract between the original owners and the company.

2.5.2 Land Purchase Process

Identification/ Procurement of Land

Land identification, negotiations and purchase for Ostro's Lahori project is managed by Inox's dedicated land department. A Wind Mast was installed by Inox in the year 2013, followed by a Wind Resource Assessment (WRA) in the same year. The basic identification of private and revenue land was undertaken by Inox in the mid-2014, along with the identification of land for other wind farm projects apart from Ostro. The identification of land plays a crucial role in a wind farm project because it sets the first step to the successful development of a wind farm. The first component for this identification is done on the basis of wind speed frequency distribution collected by the meteorological towers over the period of one year. Secondly the legalities related to the purchase, lease and user rights over private and revenue land, differ state wise all over the country. Any breach of law could cause unnecessary litigations on the project.

As reported, the key informants from the communities helped Inox identify interested land sellers in the study area. Procurement of these 20 locations on private land identified for WTGs will then go through the first step where the Inox land department would approach the interested land sellers individually for negotiations. Once the deal between both the parties is finalised all the parcels will be inspected by the *Patwari* of the district, who is the land record officer at sub-division level, which is again Shajapur in this particular context.

In case of the revenue land, Inox had to make an application to the Revenue Department of the District Shajapur with specifications of the land owner and plot number of the parcel, for leasing of land for industrial purpose. Such application had been made to the Revenue department as reported. However the details of time of the application were not shared by the Inox land team.
Market Rate

The basis of the rate used for negotiations at the time of land purchase is reported to be the government circle rates that vary as per the type of land and village/location. Further, there is negotiation with each land owner through Inox's land team. For instance, Inox's land team reported to have paid INR 1,35,000 thousand for 1 bigha (0.19 ha) i.e. 21,000 sq. ft. for land which has not been used for agricultural purposes.

Due to the lack of access to documentation on the land transactions, it cannot be determined if it was at replacement value and the negotiation process was duly documented or not. However, as reported, copies of the agreement to sale are shared with Ostro by Inox. The land purchased by Inox for Ostro location will get eventually sold to Ostro by a sale transaction between Inox and Ostro. Further, during, land acquisition, Inox shares the title search records for all the locations where Ostro WTGs will be erected.

2.5.3 *Other Issues related to Land*

The ERM team could not conduct consultations with the land losers since the list of land losers was not made available by Inox. The reason being that, the negotiations and transactions were yet to happen, before which the company did not want people to be in the anticipation of the land process for a simple reason that the land rates might suddenly raise, making the land procurement process difficult. Hence, there is limited or no access to information on some important aspects of the land take process, involving vulnerable groups and legalities with regards to type of land. At present ERM is not aware, if there are any people amongst the land owners belonging to Scheduled Caste and Scheduled Tribe groups or if any of the land parcels identified are on forest land. However, Ostro has confirmed that land belonging to scheduled caste and scheduled tribes will not be considered for project components.

According to the discussions with the project team, it is understood that no land owners will become landless due to the procurement for the project. However, in case any land owner's 100% land holding is procured, the compensation provided will be identified based on negotiations with the land owners and will be done by keeping with the prevalent District Level Committee land rates for Shajapur. Presently no encroachers or squatters have been identified on the project footprint area. In case any encroachers or squatters are identified, the project shall comply with the applicable reference framework, especially the IFC PS 5, in regards to the non-title holders.

If any household might become landless due to the project; what is the average rate of compensation promised with respect to the current District Level Committee (DLC) land rate of Shajapur; what is the process of handling any encroachment or informal land users on revenue land and if they are going to be compensated for it.

While there are no categorised grazing lands, it should be noted that livestock owners and herders take sheep and livestock to the unoccupied areas surrounding their villages as observed during Site reconnaissance stage.

2.6 *INDIGENOUS PEOPLE*

The Scheduled Tribes form 21.08% of the total population with 7,26,26,809 in the State of Madhya Pradesh, which has ten (10) Schedule V areas viz. Jhabua, Mandla, Dhar, Khargone, East Nimar (khandwa), Sailana Tehsil in Ratlam District, Betul, Seoni, Balaghat and Morena. Shajapur District is not one of them and consists of only 2.5 % of the total Scheduled Tribes population in the State. As the details of exact land owners could not be made available during the site visit, it cannot be determined if any of the tribes are land owners of the land identified for the project.

2.7 PROJECT PHASES AND ACTIVITIES

The project life-cycle can be divided into four phases as follows:

- Planning and preconstruction phase;
- Construction phase;
- Operation (including maintenance and repair) phase; and
- Decommissioning.

These phases are outlined in the sections below. The project is currently in the planning and pre-construction phase.

2.7.1 *Planning Phase*

The planning or pre-construction phase has four components:

- Identification of land area and site;
- Site surveys as topographic, geo-technical investigations, micro-siting studies, electrical grid studies etc.;
- Obtaining all necessary approvals/clearances; and
- Design and finalization of contractors;

During the period of ESIA study, the project was under planning phase and after its completion it shall soon enter into second phase (Construction).

2.7.2 *Construction*

The major activities involved during the construction phase of a wind farm are given below:

- Site preparation, including subcontractor mobilisation, erection of fencing or suitable barriers, where required to protect sensitive habitat and archaeological sites, construction of site compound and lay down areas;
- Establishment of labour camps
- Upgrading and construction of internal roads for heavy vehicle movement;
- Laying of cables;
- Site clearance;
- Establishment of borrow pits;
- Installation of outdoor lightening, security fence and gate;
- Operating cranes for unloading and installation of equipment;
- Establishment of sub-station at Suwarkota village;
- Establishment of SCADA centre;
- Laying of turbine foundations, turbine delivery and installation;
- Completion of internal electrical connections;
- Turbine testing to verify proper operation of the facility; and
- Approval for commissioning;
- Commissioning

Route survey for Transmission line for the appropriate alignment and Right of Way (ROW) land is under process.

2.7.3 Operation and Maintenance Phase

The wind farm projects have limited activities for the operations and maintenance phase and involve:

- Regular remote monitoring of the WTG operations;
- Normal greasing and cleaning activities;
- Annual shut down for maintenance which will mostly include cleaning and greasing, change of parts etc.; and
- Internal road repairs, as and when required.

The design life of the project is expected to be 30 years from the date of commissioning. Regular maintenance would be required to ensure that the turbines are kept in optimal working order. Most day to day facility operations would be done remotely through the use of computer networks but some limited maintenance and repair activities would be undertaken on site.

The contract for O & M services and supply will be carried out with INOX. In-house as well as outsourced O & M activities will be carried out by trained staff for maintaining the availability of wind power and high performance.

2.7.4 Decommissioning Phase

The wind farm site, after having remained in operation for the lifecycle estimated at 30 years, will not lose its value as a wind power generation system. However, it is not yet decided if the project would approach for upgradation/ expansion, once this project life is completed.

If the site is to be abandoned after completion of the designed plant life, decommissioning will be initiated by dismantling of the turbines, supporting towers, O&M building and transporting them out of the project area. It is expected that these activities will take approximately 1-2 months. The turbine components will be sold as scrap.

The concrete will be broken up and removed to a landfill site. The stored fuel and oil, together with the containers, will be transported out of the site for sale /disposal at suitable landfill sites. The site will be restored as far as possible to its original condition. The access roads and water ponds will be left intact to be used by villagers.

2.8 CONTRACTORS

The Company has appointed INOX Wind Infrastructure Services Ltd which will be responsible for project development and operation and maintenance of the project.

2.9 RESOURCE REQUIREMENTS

2.9.1 Man Power

Most of the unskilled/ semi- skilled workers will be employed from the local villages and the skilled workers would also be hired from nearby areas to the extent possible. During the construction phase the number of labourers will keep on changing in the range of 40-100 depending on work requirement. Accommodation will be provided for labourers. The size of single rooms will be minimum of 4 sq. m. with a height of 2.4 m with adequate ventilations. Creches will be provided for children below six where the number of female employees exceeds 50 in number. A minimum of one toilet, one had wash basin and one bathroom should be provided for every 15 workers.

INOX being the principle employer should ensure that the labour camp is provided with necessary infrastructure and basic amenities including health and hygiene facilities for the construction workers as mentioned below:

- Potable water supply;
- Kitchen and mess facility;
- Sanitation and sewage disposal arrangements;
- Electricity supply;
- First aid;
- Security.

During operation and maintenance phase it is estimated that a maximum of around 50 employees per shift, in addition to the security staff will be deployed at the site/office.

2.9.2 Water requirement

Approximately 100 m^3 per WTG of water will be required during construction activities and about 100 m^3 for pooling substation construction. Storage ponds would be constructed near the batching plant sites to store water for construction activities. The water will be stored in these ponds and will be distributed throughout the project area through tankers. In addition, 10-14 m^3/day of water will be required for domestic usages and for washing and bathing purposes in labour camp.

Water requirement will meet with the help of water tankers which will be procured from the Chillar Dam located in the study area.

Operation Phase

Approximately 2.25 kld of domestic water will be required during the Operation and Maintenance phase at site and PSS. This will be obtained from tankers and stored in a tank on-site. For drinking purposes, mineral water will be provided at site office.

2.9.3 Power requirement

Construction Phase

During Construction phase, if required, power will be supplied by means of small DG sets or by taking connections by means of electricity lines passing nearby. A total of 2-3 DG sets of capacity 15 kV each are proposed.

Operation Phase

The power requirement at site office during operation phase shall be supplied by means of DG sets or nearby any existing line.

2.9.4 Raw Material

Raw materials required for construction would primarily involve cement, sand, steel, stone etc.

The construction material required includes cement, aggregates, steel, paints, solvents etc. Besides these, other supplies required for the project are fuels and oils, drilling requirements, spare parts for construction machinery and food and supplies for construction workforce. Most of the supplies will be procured from the local Market of Shajapur or Indore.

The details of the construction materials required during the construction phase and their source is shown in ***Table 2.5***

Table 2.5 Details of Materials required during Construction Phase

Type of Materials	Approximate Quantities	Mode of Transport
Cement	50000 Bags	Truck
Coarse Aggregate	2016 kg	Truck
Fine Aggregate	1260 kg	Truck
Sand	1764 kg	Truck

Source: Inox

Operations Phase

Supplies, both for operational requirements and for the site staff, will be transported from Shajapur. This will include all fuels and oils, spare parts required for maintenance and food and supplies for the site staff.

2.9.5 Fuel, Oil and Storage arrangements

Construction Phase

Fuel for the vehicles during construction will be procured from nearby petrol pump and if required, it would be stored in barrels. It is estimated that about 2 numbers of barrels of quantity 200 litres capacity each will be used during construction phase. As reported, there would be no storage of fuel on the site.

Operation Phase

It is estimated about 20 litres per annum of oil would be required for the gearbox and generator maintenance activities.

2.9.6 Fire Safety and Security

Adequate fire safety and security system has to be built in during the construction and operation phase. Firefighting equipment's like Fire extinguishers (DCP/CO_2), Sand buckets), fire blankets shall be placed at strategic locations to combat fire incidents. Fire proof suits should be made available to personnel who are engaged in activities where there are greater incidences of flash fires. Emergency contact numbers shall also be displayed onsite.

Operations

Structural fire protection

Wind Turbines comprise predominantly of non-flammable materials. Most components of the WTGs are predominantly metal. The only inflammable components are rotor blades and the panelling of the machine house, which are made from glass-fibre reinforced plastic, electric cables and electrical components, Gear box, transformer and hydraulic oils, hoses and other plastic components. It is practically impossible for a fire to spread from the transformer station to the wind turbine or vice versa.

Fire prevention

The service personnel will take all appropriate measures to prevent fires. Lightening protection system will be based on lightening protection zone concept and in accordance to IEC 61400- 24, 62305-1, 3, 4 and DIN EN 50164-1,2. A lightning strike as a cause of fire is practically excluded.

Fire extinguishers

One portable powder fire extinguisher will be maintained at each WTG. These extinguishers are meant for immediate fighting of fire in early stages.

2.9.7 Wastewater Management

Construction Phase

- The liquid effluents generated during the construction phase will include domestic sewage from project site office;
- As part of the site preparation stage, a drainage and sewerage system will be constructed for the site office. The sewerage system will consist of soak pits for the collection of waste water from the camp kitchen and washing areas. Sewage from the toilets will go into lined septic tanks. Sewage disposal trucks will be used to periodically remove the sludge/sewage from the site.

Operations Phase

The operation phase will have negligible wastewater generation. Septic tank and soak pits will be provided at SCADA building and CMS monitoring station for disposal of sewage.

2.9.8 Waste Management

Construction Phase

The solid waste generated by the project will consist of labour camp waste, garbage waste, metal scrap, and excess construction materials. The main types of waste that will be generated and sources are shown in***Table 2.6***.

Table 2.6 Waste generated, their sources and method of disposal

S. No.	Waste Type	Source	Estimated Quantity for approximately 100 workers	Method of Disposal
Non-hazardous waste				
1	Domestic solid waste	Labour activities	~45 kg/day	Waste will be segregated onsite and will be disposed of at site as approved by local authority.
2	Construction Debris (excavated earth)	Construction of WTG, Access road, substation, Storage yard etc.	0.5 – 1.0 tonne/day	Excavated materials to be used for backfilling and levelling and other debris shall be used for road construction.
3	Packaging waste containing wood, cardboard and other recyclables	Packing material for WTGs and Accessories	~10 kg per WTG	Return back to the suppliers
4	Sludge from Wastewater Septic Tanks	Site Office	~6-8 kg/month	Collected and disposed of through contractors
5	All non-recyclables	Construction activities	5- 10 kg/day	Collected and disposed of by the contractor at designated landfill sites.

S. No.	Waste Type	Source	Estimated Quantity for approximately 100 workers	Method of Disposal
Hazardous waste				
1	Used oil/ waste oil	DG set, construction machinery	5-10 litres/month	Collected and disposed of through approved recyclers in accordance to *Hazardous Waste Rules, 2008.*
2	Oil contaminated rags	Cleaning activities	10 kg/month	Collected and disposed of through approved vendors in accordance to *Hazardous Waste Rules, 2008.*

Operation Phase

- During operation phase, the waste generated from project will include domestic solid waste at SCADA and substation and hazardous waste like waste oil, lubricants and oil contaminated rags will be generated during maintenance activities;
- The hazardous wastes will be stored onsite at separate designated covered area provided with impervious flooring. The storage containers/ bins/ drum will be clearly marked and identified for their hazards;
- The hazardous wastes will be disposed of in accordance to Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008, as amended, through MPPCB/ CPCB approved vendors;
- Non-recyclable material will be collected, segregated onsite and handed over to local Municipal Corporation for disposal;
- Sewage will be disposed off through septic tanks and soak pits.

2.9.9 Air Emissions

To control air emission during construction phase from operation of DG sets to be used during emergency purpose, adequate stack height as per CPCB norms shall be provided. Fugitive dust emission arising out of various activities in the batching plants will be mitigated through better material handling and provision of enclosure around the facility. Vehicular emission will be controlled through proper maintenance of vehicles and vehicles with proper PUC will be operated at project site.

Fugitive dust emission arising from various activities such as excavation, transportation of material (loading and unloading), vehicular movement (dirt road) will be minimized through sprinkling of water and maintaining vehicular speed to 10-15 km/hr.

2.9.10 Noise Emissions

Construction

Noise emission from the vehicles and equipment's shall not exceed 91 dB(A) (*for Passenger or commercial vehicles with gross vehicle weight above 12000 kgs as specified in Central Motor Vehicles Rules, 1989*). Workers near noise generating

machines will be provided with ear plugs as safeguard against high noise hazards.

Operations

Wind turbines produce noise when operating. The noise is generated primarily from mechanical and aerodynamic sources. Mechanical noise may be generated by machinery in the nacelle of the wind turbines. Aerodynamic noise emanates from the movement of air around the turbine blades and tower. The types of aerodynamic noise may include low frequency, impulsive low frequency, tonal, and continuous broadband. In addition, the amount of noise may rise with increasing rotation speed of the turbine blades, therefore turbine designs which allow lower rotational speeds in higher winds will limit the amount of noise generated.

The Project will have 50 WTGs of 2 MW with hub height of 90 m. Sound power levels of the WTG, was not available at different wind speeds, so for gross reference we are presenting for WTG of different company. These noise levels are at a hub-height of 95 m with different standardised wind speeds at 10 m height have been presented in***Table 2.7.***

Table 2.7 Noise Level of 2 MW Wind Turbine for different W_{10} [m/s]

Wind Speed (at 10 m height) W_{10} [m/s]	**Estimated Noise Level L_w [dB(A)]**
3	93.8
4	96.0
5	100.1
6	103.9
7	105.0
8	105.0
9	105.0
10	105.0

Source: Vestas 100

2.10 PROJECT SCHEDULE

The key ongoing activities currently at the project site include the erection of transmission towers, construction of the substation, as well as local liasoning by Inox's in-house team.

2.11 PROJECT ORGANIZATIONAL STRUCTURE

2.11.1 Project Proponent

The Lahori wind farm project is overseen by a management team of Ostro at the corporate level at New Delhi and an onsite team at Madhya Pradesh (Project office is located in Shajapur). During the construction phase the site HSE officer along with Project manager in-charge will look after the EHS issues and coordinate with the EHS team of EPC contractor. The social issues

will be taken care by the Land and CSR Head and his team who reports to the Project Manager.

2.11.2 Engineering Procurement and Construction (EPC) Contractor

INOX is the EPC contractor for the project. EPC contractors have the responsibility of engineering, procurement, supply, construction, erection, installation, commissioning of the WTGs. INOX in turn will hire several sub-contractors for civil, mechanical, electrical and power evacuation etc. for project completion.

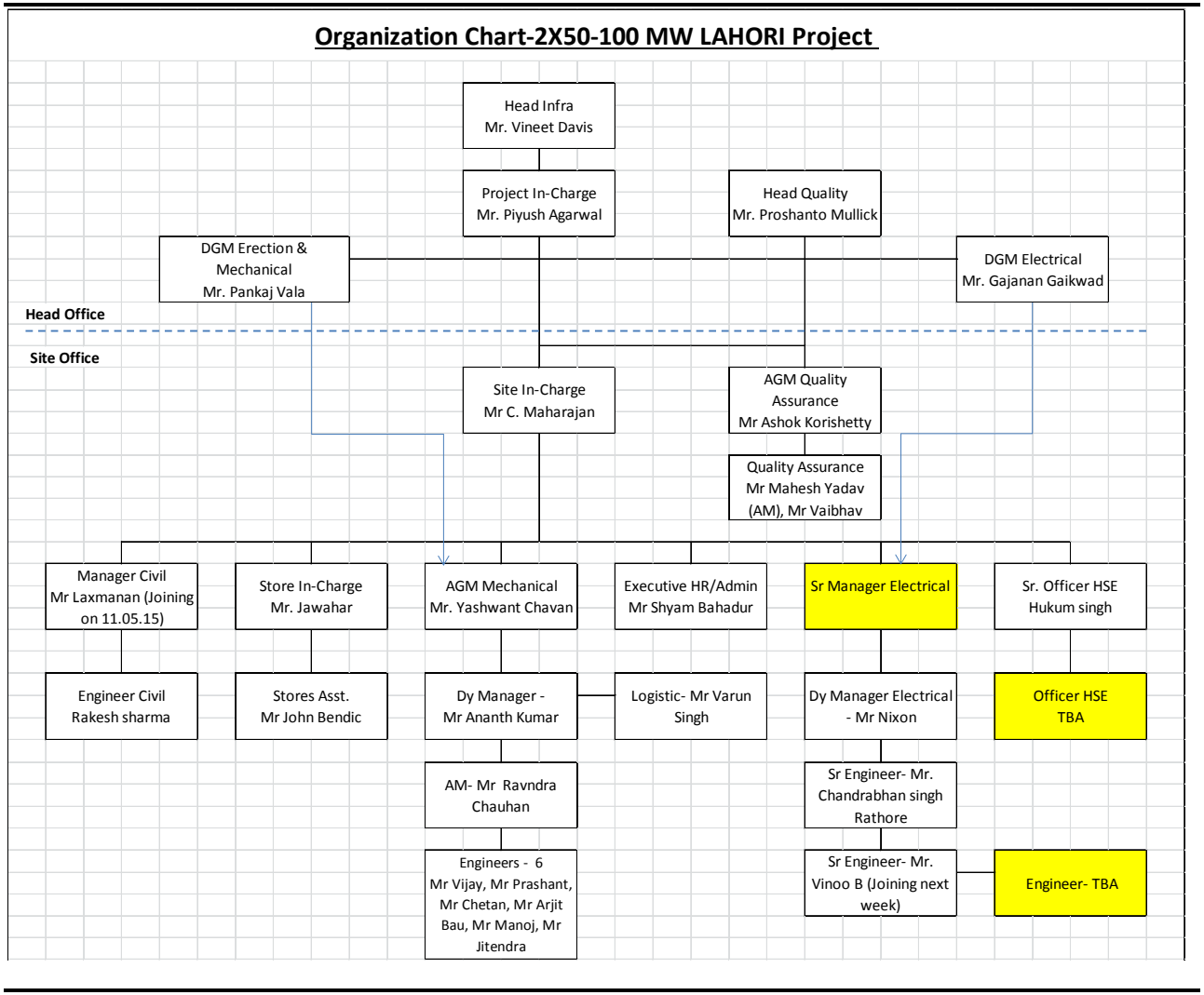
2.11.3 Operation and Maintenance (O&M) Contractor

INOX would be the O&M contractor also for the project. The likely responsibilities of the O&M contractor are as follows:

- Maintenance and service for WTGs, supply of spare parts, maintenance of spares, consumables and tools, provision of crane for maintenance.
- Provide technical assistance and guidance during O&M.
- Provide remote monitoring and operations of the WTGs.

The Organizational structure of INOX for O&M of wind farm is provided as***Figure 2.3*** below. **.**

Figure 2.3 Organizational structure for Construction Phase



Source: Ostro/INOX

3 APPLICABLE LEGAL AND REGULATORY FRAMEWORK

3.1 INTRODUCTION

This section provides legal and regulatory framework along with Institutional framework for the Project, covering national requirements as well as applicable international treaties and conventions, guidelines and standards. The intent of this section is to lay out the regulatory and non-regulatory performance requirements for all stages of the Project. The section broadly focuses on:

- Applicable regulatory framework for Lahori Project;
- Institutional Framework for the implementation of the regulations; and
- Applicable national and international Environmental Standards.

Approval from various regulatory agencies authorized by the Central and State Governments, in the form of Licenses, Permits, or Authorizations, are required for the establishment and operation of proposed project.

3.2 PROJECT PERMITTING STATUS FOR THE PROJECT

As per the EIA Notification (2006) and its amendments, the wind farm project does not require any environmental clearance from the Ministry of Environment and Forests (*MoEF*) or the Madhya Pradesh State Environmental Impact Assessment Authority (*SEIAA*).

However, as per the Central Pollution Control Board's (*CPCB*) latest guidelines for Directions u/s 18(1) (b) of Water (P&CP) Act, 1974 and Air Act (P&CB) ,1981 and RSPCB letter : No.F.14(23) Policy/RPCB/Plg/10548-10587 dated 07 March 2013 regarding Classification of Industries into Red, Green and Orange Category for Consent management, the Project would require Consent to Establish (CTE) from MPPCB in accordance under the Air Act, Water Act and Hazardous Waste Rules.

3.3 INSTITUTIONAL FRAMEWORK- ENFORCEMENT AGENCIES

A brief description of the relevant enforcement agencies with respect to the institutional framework is described in the following ***Table 3.1***:

Table 3.1 Enforcement Agencies relevant to the Project

Agency	Functions	Relevance & Applicability to the project
Madhya Pradesh State Pollution Control Board	The MPPCB is a statutory authority entrusted to implement environmental laws and rules within the jurisdiction of the State of	The project will need to obtain Consent to Establish and Consent to Operate under the Water (Prevention and Control of Water Pollution) Act, and Air (Prevention and Control of Pollution) Act, 1981.

Agency	Functions	Relevance & Applicability to the project
	Madhya Pradesh, India. The Board ensures proper implementation of the statutes, judicial and legislative pronouncements related to environmental protection within the State.	The project would generate spent oil from generator sets and thus requires to obtain authorization under Hazardous Waste Management, Handling and Trans boundary Movement) Rules, 2000. As reported, Ni-Cd batteries will be used for DC supply in PSS and WTGs; hence Batteries (Management and Handling) Rules will not be applicable for the Project. However, the project will fall under the purview of Batteries (Management and Handling) Rules, 2001 as amended in 2010; if it purchases more than 100 lead-acid batteries in a year.
Centre for wind Energy technology (C-WET)	• Research & Development • Wind Resource Assessment Unit: • Standards and Certification Unit: • R & D Testing unit	The Project has to be developed on a C-WET approved site for wind power defining the wind capacity of the particular region.
Indian Renewable Energy Development Agency Limited (IREDA)	The main objectives of IREDA is to promote, develop and extend financial support to specific projects and schemes for generating electricity and / or energy through new and renewable sources and conserving energy through energy efficiency.	Projects should be developed based on the IREDA guidelines for renewable energy
Madhya Pradesh Urja Vikas Nigam Limited (MPUVNL)	The main objectives of the MPUVNL are : • **To promote and create awareness** about the uses of Solar Renewable Energy and Energy efficient products based various technologies among the public. • **To promote the policies** and programs necessary for popularizing the applications of various new and renewable energy technologies in the State. • **To promote the installation** of power plants based on renewable energy sources for Energy Security. • **To promote the energy** conservation	The project should be developed based on the Madhya Pradesh Urja Vikas Nigam Limited guidelines for renewable energy

Agency	Functions	Relevance & Applicability to the project
	measures for efficient use of energy resources. • **To promote green building** design for efficient use of energy in housing, commercial and industrial sector.	
Panchayats	The local Panchayats are empowered with management of local resources like forests, groundwater, common land and infrastructure like roads, buildings etc.	No Objection Certificates were required to be taken from the Panchayats at the time of initiating the project in the area. Panchayats are empowered to levy and collect local taxes on land, property and provisioning of facilities.
State Labour Department	All issues pertaining to implementation of labour laws in any establishment, shop or factory.	Labour to be involved during the construction phase and few in the operation should be provided with wages and other facilities with state as well as local labour laws and acts such as Building and other Construction Worker's Act, 1996.
District Administration (Collector's Office)	Private land purchase process by the land aggregator will be regularized by the state government under Madhya Pradesh Land Revenue Act, 1959 (including rules for land conversion) through District collector and revenue department	Land purchase process for the various components of the Project would be followed as per State Land revenue code and land registration act of Madhya Pradesh.
Madhya Pradesh Factory Inspectorate	As per Clause 2.k.iii of Factories Act, 1948, any facility generating, transforming or transmitting power is defined as a factory and comes under the purview of Factory Act, 1948.	As Ostro is involved in all the three activities, the Wind Farm has to obtain license under Factory's Act, 1948. It has been a common perception that Factory's Act is not applicable to the Wind Farms but few court rulings in Tamil Nadu has passed the verdict that has deemed Wind Farms as factories. Given below, are the urls showing the court rulings. • http://www.thehindu.com/todays-paper/tp-national/tp-tamilnadu/windmills-fall-under-definition-of-factory-hc/article2641079.ece • http://www.citehr.com/221648-applicability-factory-act-pdf-download.html • http://www.thehindubusinessline.com/economy/each-windmill-is-a-factory-court/article2744852.ece. However, to remove all ambiguities, Ostro should approach the Factory Inspector, Madhya Pradesh and clarify the applicability of Factories License for the Wind Farm.
National Green Tribunal	The tribunal will have jurisdiction over all civil cases relating to	U/s 17, any person responsible for any untoward incidents (defined in Schedule II of the Act) is liable to pay relief or compensation as determined by the

Agency	Functions	Relevance & Applicability to the project
	implementation of the following regulations: • The Water Act, 1974; • The Water Cess Act, 1977; • The Forest Conservation Act, 1980; • The Air Act, 1981; • The Environment Protection Act, 1986; • The Public Liability Insurance Act, 1991; and • The Biological Diversity Act, 2002 The Act provides for compensation on account of following • Relief and compensation to the victims of pollution and other environmental damage arising under enactment of the above acts; • Restitution of property damaged; and • Restitution of the environment.	tribunal, failing which a penalty (u/s 26 and 27) is imposable which may lead to imprisonment up to 3 years or fine up to Rs. 10 Crores or both and an additional fine of Rs 25,000 per day for any delay, which may further be increased to one lac per day.

3.4 *STATUS ON PERMITS ACQUIRED FOR THE PROJECT*

The wind farm is located in C-WET approved location. The project has received permission to evacuate power from Madhya Pradesh Power and Transmission Company Limited ***(Annex A).***

Based on interactions held with the Ostro and INOX team and document review, key permitting and compliance status for the proposed project is provided in the ***Table 3.2.***

Table 3.2 Permitting and Compliance Status

Permit	Authority	Remarks
Environmental Clearance	Ministry of Environment, Forest and Climate Change (MoEFCC)	Wind power projects are exempted from obtaining an environmental clearance (EC) from Ministry of Environment, Forest and Climate Change (MoEF & CC), as per the EIA notification, 2006 and its subsequent amendments.
Forest Clearance from MoEF/ State	Forest Department	No forest clearance is required; since the land associated with the project and the study area is partly located in Government land and private land and does

Permit	Authority	Remarks
Government		not involve any diversion of forest land.
Power evacuation approval	Madhya Pradesh State Electricity Board	There are still some WTG locations that may get shifted and once the locations of the WTGs are finalized, Ostro will move ahead with Power Purchase Agreement (PPA), the process for which was reported to be initiated; however as per the recent information from the company, obtaining PPA will be initiated during construction phase of the project. As per the Madhya Pradesh New and Renewable Energy Department MPNRED notification, the documents that are required during PPA also, comprises of a map showing WTG location and the commissioner's certificate for WTGs.
Consent to Establish (CTE) Consent to Operate (CTO)	Yet to be applied Has to be obtained before operational phase.	These are mandatory requirements under Water (Prevention and Control of Pollution) Act, 1974 and Air ((Prevention and Control of Pollution) Act, 1981, from Madhya Pradesh Pollution Control Board (MPPCB). • CTE shall be obtained by Inox prior to start of construction for the project; • CTO shall be obtained prior to the commencement of operation of the project by Ostro.
Contractor permits	Not applicable at this stage	The contractor will need to abide by the following laws and Inox will have to ensure its being done being the principle employer: • The Workmen's Compensation Act, 1923; • The Maternity Benefit Act, 1961; • The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996; • The Inter-state Migrant Workmen (Regulation of Employment and Condition of Service) Act, 1979; • The Contract Labour Act, 1970; • The Child Labour (Prohibition and Regulation) Act, 1986; • The Bonded Labour System (Abolition) Act 1976; • The Minimum Wages Act, 1948; and • The Equal Remuneration Act 1976.
No Objection Certificate from the Gram Panchayat	Gram Panchayat	The Inox team reported to have an NOC obtained from the concerned Gram Panchayats but a copy of the same is yet to be provided for validation.

3.5 APPLICABLE ENVIRONMENTAL STANDARDS

The Central Pollution Control Board (CPCB) has stipulated different environmental standards w.r.t. ambient air quality, noise quality, water and waste water for the country as a whole under EP Act, 1986 and are given below and included as ***Annex A*** in detail.

- National Ambient Air Quality Standards (NAAQ Standards), as prescribed by MoEF vide, *Gazette Notification dated 16th November, 2009;*
- Drinking water quality- Indian Drinking Water Standard (IS 10500: 2012);
- General standards for discharge as prescribed under the Environment Protection Rules, 1986 and amendments (G.S.R 422 (E) dated 19.05.1993 and G.S.R 801 (E) dated 31.12.1993 issued under the provisions of E (P) Act 1986);
- Noise standards specified by the MoEF vide gazette notification dated 14th February, 2000 (Noise Pollution (Regulation and control) Rules, 2000);
- The Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008;

3.5.1 Hazardous Waste Management

The Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008 were promulgated under Environment (Protection) Act 1986, which was further amended in July 2009, September 2009, March 2010 and August 2010.

The major hazardous wastes to be generated due to the proposed project will include spent transformer oil that is categorized under Class E, Hazardous Waste Management, Handling and Transboundary Movements, 2008, cotton/cloth waste contaminated with oil. Spent transformer oil is a hazardous waste and.

3.6 INTERNATIONAL STANDARDS

3.6.1 IFC Requirements

IFC applies the Performance Standards (1) to manage social and environmental risks and impacts and to enhance development opportunities in its private sector financing in its member countries eligible for financing. The Performance Standards may also be applied by other financial institutions choosing to support them in the proposed project. These performance standards and guidelines provide ways and means to identify impacts and affected stakeholders and lay down processes for management and mitigation of adverse impacts.

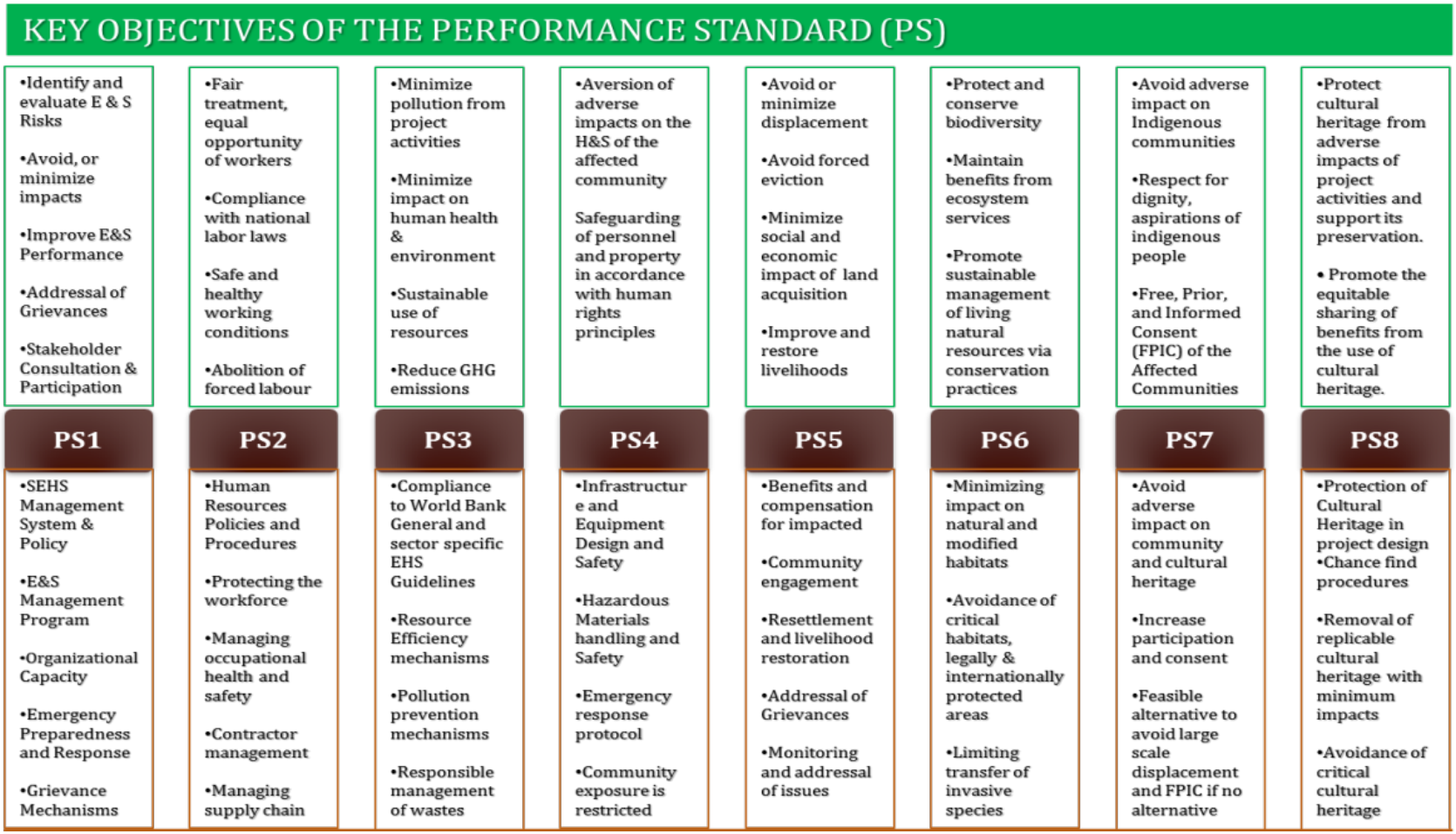
Together, the eight Performance Standards establish standards that the client is required to meet throughout the life of an investment by IFC or other relevant financial institution.

Box 3.1 highlights the key objectives of the IFC Performance Standards. In addition, during the construction , operation and eventual decommissioning of the site, the IFC EHS Guidelines for Wind Energy and the

(1) http://www.ifc.org/ifcext/sustainability.nsf/Content/PerformanceStandards

General Environmental, Health and Safety (EHS) General Guidelines (April 30, 2007) will also be applicable for this project .

Box 3.1 Key Requirement of Performance Standards



4 ENVIRONMENTAL AND SOCIAL BASELINE

4.1 INTRODUCTION

This section establishes the baseline environmental and socio economic status of the proposed wind farm site and surrounding area to provide a context within which the impacts of the proposed wind farm project are to be assessed. It also helps in environmental and social management planning and strategy to minimise any potential impact due to plant activities on surrounding environment.

4.2 METHODOLOGY

The environmental and social baseline has been assessed covering an area of 5 km distance (hereinafter referred to as the *study area*) from the Project boundary; to be specific 2 km radius for environmental and social parameters and 5 km for ecology purpose. A reconnaissance survey of the study area was initially conducted to identify environmentally and socially sensitive receptors and features located within the study area.

Limited environmental and social baseline data was collected through primary surveys as well as secondary sources by literature survey and discussions with the concerned departments/agencies. Details of data collected is summarised in subsequent sections.

4.2.1 Primary Baseline Data Collection

M/s Avon Food Lab Private limited recognized by Ministry of Environment and Forests (MoEF), Government of India was engaged for collection of baseline information on groundwater quality and ambient noise quality during the month of April, 2015. Rapid ecology surveys and consultations were conducted to collect the information related to the biological environmental conditions of the study area. Stakeholder consultations were carried out by ERM to collect information on socio-economic status of the study area. The primary baseline data was collected for aspects detailed out in ***Table 4.1.***

Table 4.1 ***Primary Baseline Data Collection***

S.N	Environmental Attribute	No. of Locations	Frequency	Remarks
1	**Groundwater Quality** (As per IS 10500): pH, temperature, turbidity, total hardness, total alkalinity, chloride, sulphate, nitrite, nitrate, fluoride, sodium, potassium, salinity, total nitrogen, total phosphorus, DO, BOD, COD, phenol, heavy	4	Once during the study period	Ground water samples were collected from the study area.

	metals, total coliform and faecal coliform.			
2	**Ambient Noise Quality**	6	Once during the study period	Noise levels were monitored on hourly basis for 24 hours using continuous noise monitoring equipment
3	**Socio- economic Status**	Project affected villages	Once during the study period	Primary consultation was carried out in select villages to understand the history and socioeconomic aspects of the site and surrounding areas.
4.	Flora and Fauna Survey of the study area to: *Flora* • Identification of floral species (terrestrial and aquatic), sensitive habitats, endangered species and forest land falling within the study area (including project site); • Enumeration of tree species present at wind farm site and surrounding 5 km radius area; • Classification of flora for any endangered or protected species or endemic floral species prevailing in the study area (including wind farm) based on field survey; • Identification of areas protected under international conventions, national or local legislation for their ecological, landscape, cultural or other related value; and • Identification of aquatic flora in the water bodies falling in the study area. *Fauna* • Identification of fauna (terrestrial, aerial and aquatic), based on spotting, pug marks, droppings, nesting, etc; • Identification and classification of any species	Project site and Study area of 5 km radius	Once during study period	Ecological survey was undertaken to assess the biodiversity aspects of the area.

	recognized as critically endangered or endangered (in accordance with the IUCN Red List, or according to the schedules of the Wildlife (Preservation) Act 1972 and amendments); • Identification of areas which are important or sensitive for ecological reasons including species breeding, nesting, foraging, resting, over wintering areas including wildlife migratory corridors /avian migratory routes; and • Identification and assessment of aquatic ecological resources within the study area.			

4.2.2 Secondary Baseline Data Collection

Secondary baseline data collection involved identifying and collecting existing published materials and documents. Information on various environment aspects (like geology, hydrogeology, hydrology, drainage pattern, ecology etc.), meteorology and socio economic aspects were collected from different institutions, government offices and literatures etc. Secondary data was collected for the aspects as given in ***Table 4.2.***

Table 4.2 ***Secondary Baseline Data Collection***

S.N	Attribute	Source of Data Collection
1.	Long term meteorological data	India Meteorological Department
2.	Geology, geomorphology, hydrogeology and hydrology	District Resource Map, Geological Survey of India, District Gazetteer and State Ground Water Board
3.	Land use	Through Satellite Imageries
4.	Forest area	Forest Department of Madhya Pradesh and Review of District Gazetteer
5.	Environmental Quality	MPPCB website and reports
6.	Physical Features	District Planning Series, Survey of India
7.	Natural Hazards	• Building Materials and Technology Promotion Council of India (BMTPC) • Meteorological Department
8.	Socio-economic	Census of India

4.3 LOCATION AND ADMINISTRATIVE SETTING

The Wind farm is situated in Lahori and other villages of Tehsil and District Shajapur of Madhya Pradesh State, India. The district is bounded by *Ujjain* and *Agar-Malwa* in the west, *Dewas* and *Sehore* in the South, *Rajgarh* in the North and *Sehore* district in the east. The district is situated in the north

western part of the state. The district map of Shajapur is presented in ***Figure 1.1.***

The WTGs in the wind farm site is located on land parcels across a series of ridges/ hill tops at elevations ranging from 466m to 533 m above mean sea level. The project comprises of three clusters, namely, Cluster 1, 2 and 3 with the following coordinates:

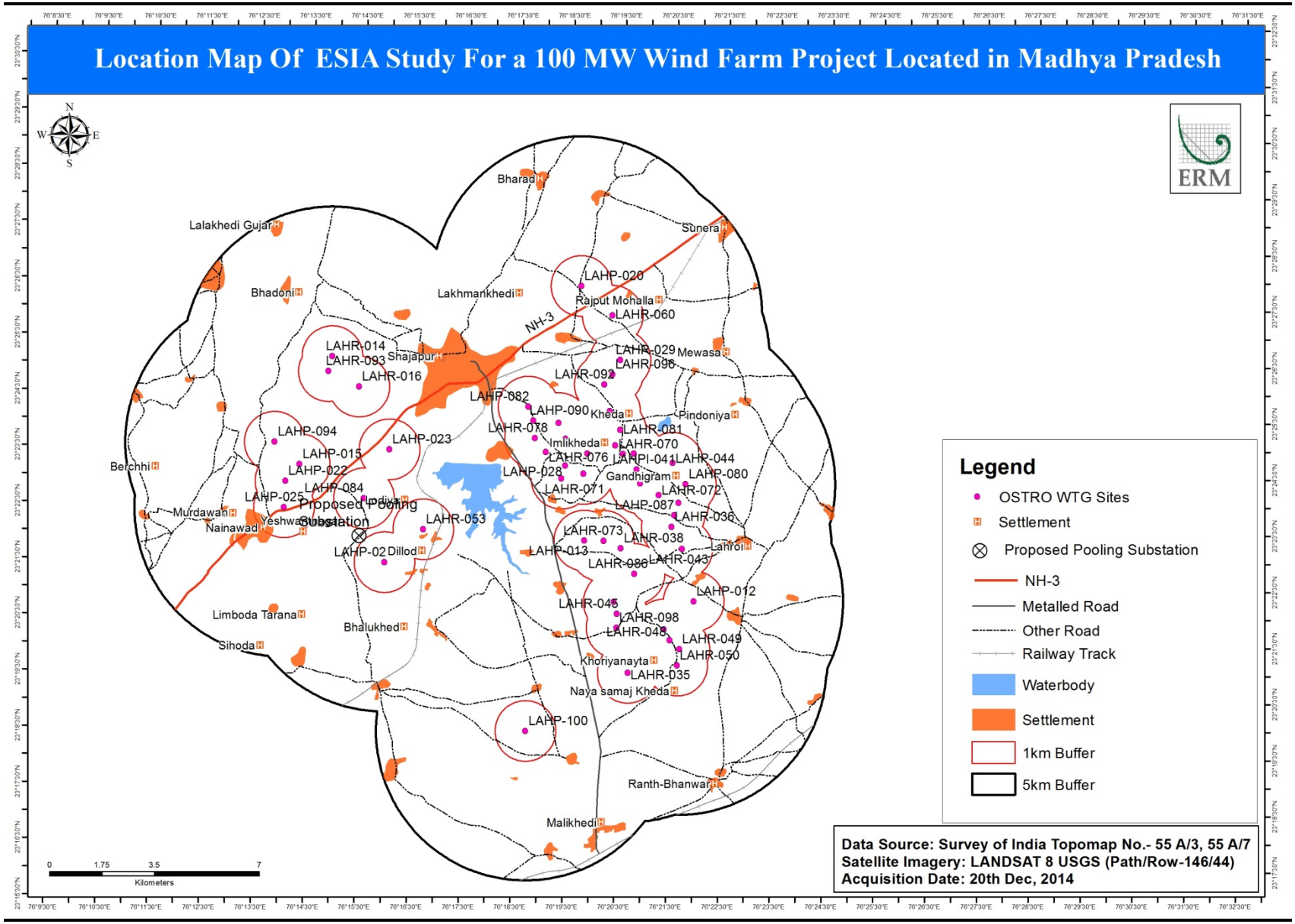
- Cluster 1 lies between 23°25'6.93"N to 23°22'27.32"N and 76°15'22.79"E to 76°15'7.43"E across the villages of Aaditya Nagar & Suwarkota ;

- Cluster 2 lies between 23°23'2.71"N to 23°21'20.47"N and 76°16'18.76"E to 76°15'35.61" across the villages of the Lodiya and Dillod Villages;

- Cluster 3 lies between 23°27'53.95"N to 23°18'40.30"N and 76°20'26.47"E to 76°20'37.83"E across the village of Bhilwadiya, Majhaniya, Barwal, Kheda, Pipalya Gopal , Chak Jiyajipur, Baksukhedi , Singarchori , Khoriyanayata

The proposed locations of WTGs in the study area are given in ***Figure 4.1.***
No national park, wildlife sanctuaries, biosphere reserves, notified historical and cultural sites etc. are located within the study area of 5 km radius from the Project site.

Figure 4.1 Location of proposed WTGs in study area



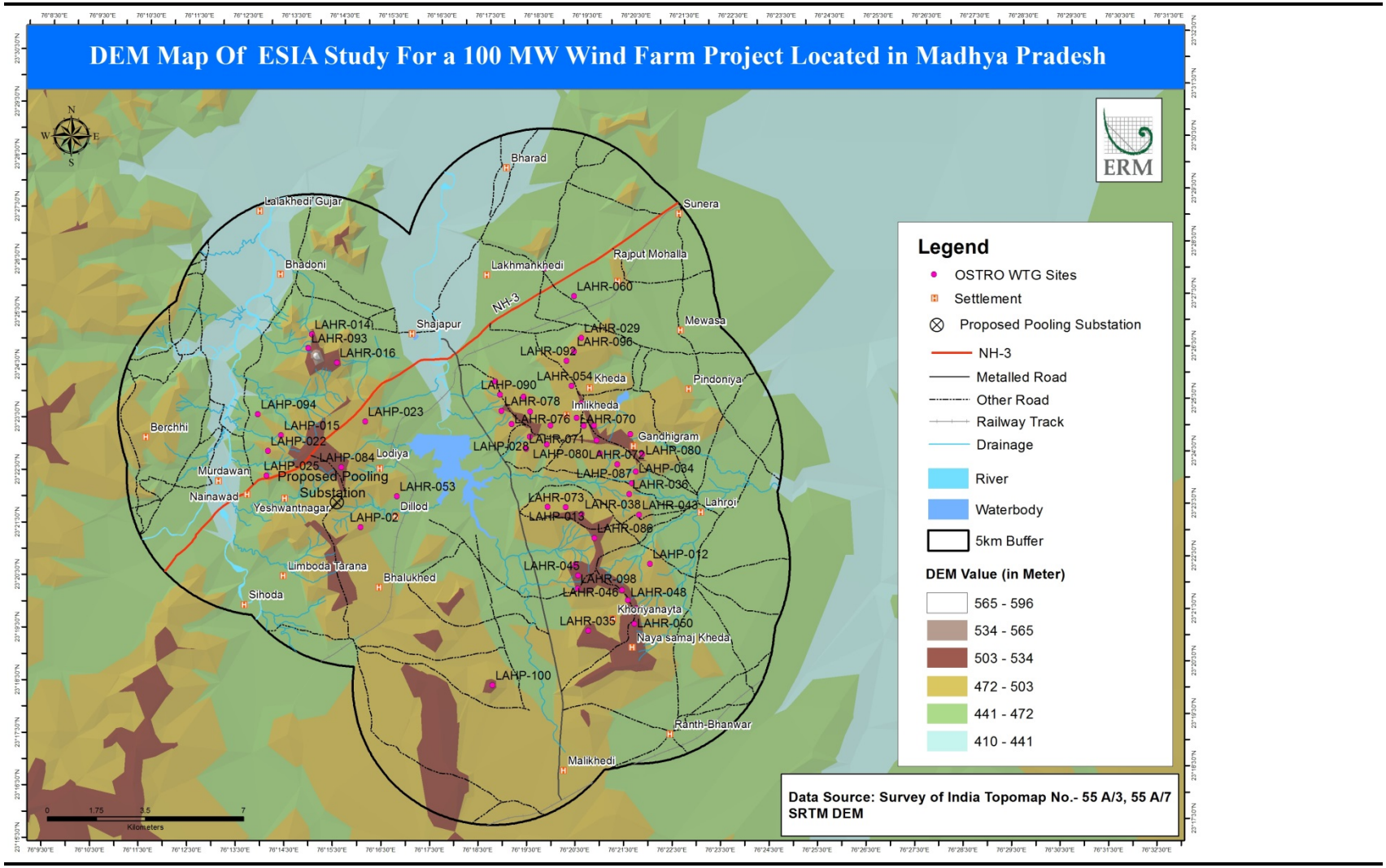
4.4 ENVIRONMENTAL BASELINE

4.4.1 Topography

The entire district is characterized by a typical Trappean geomorphology comprising extensive plain, low lying hills and hill clusters with gentle northerly slope. Western, south, south-eastern parts are highly undulated with broad flat topped hills, cluster terraces and isolated hills. A number of hills capped by laterite are noticed in the north-western, western part. The central area is plain with scattered hillocks. The highest point 608m amsl occurs a few kilometers south-west of Shajapur and the lowest part is about 335m in the Kali Sind and Newaj river valleys. Bad land topography along small nalah courses and scarp development upto maximum of 20m are the quite common along the rivers. The general slope is from south to north marked by a number of small rivers which later join the Kali Sind river (*Source: CGWB information booklet, Shajapur district*).

The study area is a part of Malwa plateau and represents a dissected topography. There is a continuous chain of hills in the entire region with intermittent undulating and plain terrain. The ground cover at the proposed locations consists mainly of grazing land with scattered trees and other vegetation. The contour map of the study area is provided as ***Figure 4.2***.

Figure 4.2 Contour map of Study Area



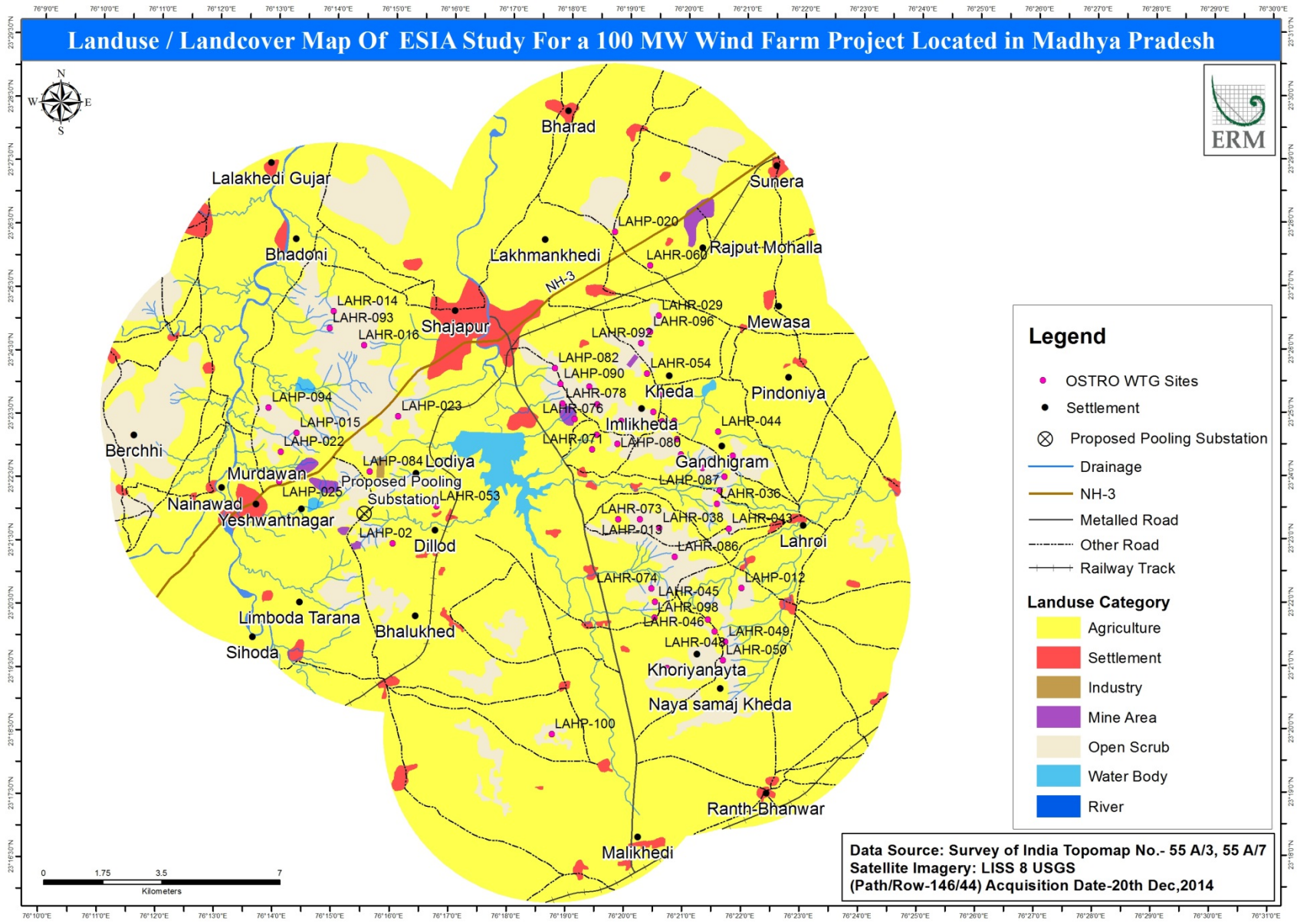
4.4.2 Land use and Land cover

The project land primarily consists of Government revenue land and private land.. The landuse prevailing in the study area of 5 km includes settlements, agricultural land, open forest areas, open and dense scrubs, fallow and barren land. Land use map of the study area is presented as ***Figure 4.3.***
The land use of the area is predominantly rural with the domination of agriculture (81.53%) followed by open scrub (13.04%). The land use in detail in 5 km study area is given below in ***Table 4.3***

Table.4.3 Landuse Classification of the study area

S.N	Landuse	Upto 5 km	
		Area (sq. km)	% Total
1.	Agriculture	334.53	81.53
2.	Settlement	12.33	3.01
3.	Industry	0.14	0.03
4.	Mine Area	1.52	0.37
5.	Open Scrub	53.50	13.04
6.	Railway Track	0.26	0.06
7.	River	2.37	0.58

Figure 4.3 Landuse map of Study area



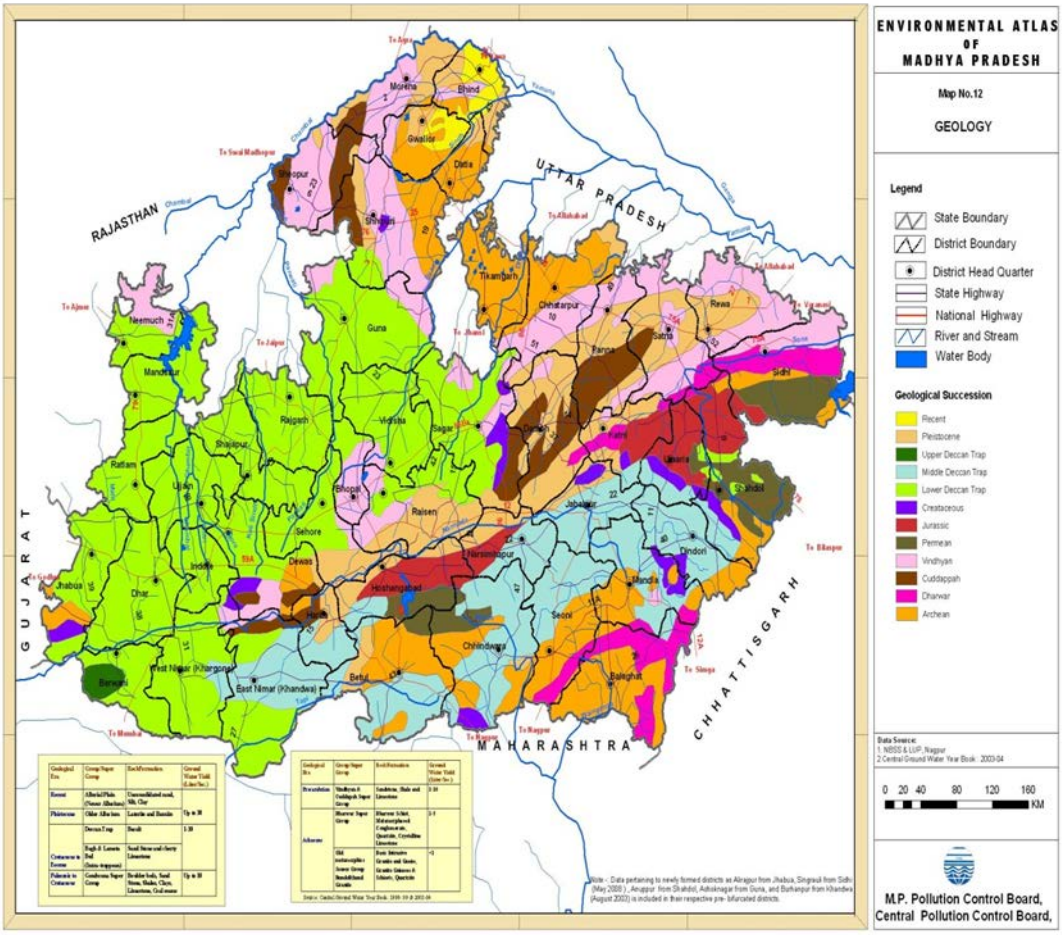
4.4.3 *Geology*

The entire Shajapur district is occupied by Deccan Trap basaltic rock of upper cretaceous to lower Eocene age. A typical flow unit consist of a lower dense massive, horizon passing upwards into a vesicular, amygdaloidal or jointed basalt. At places, top of individual flows are marked by reddish brown clayey material (Red bole) of few cm to 5 m thickness. Usually the red- bole and vesicular basalt are prone to weathering and give rise extensive black cotton soil. There are sixteen basaltic flows which were identified by Geological Survey of India in a vertical column of 275m between altitude of 335 to 610 m amsl in entire Shajapur district. The various flows of basalts are at times inter-bedded and fossiliferous inter trappen.

The overall study area falls under Deccan trap. The different flows of basaltic rock are mostly of "Aa" type but "Pahoehoes" and intermediate type are also present.

The geology map of the region is presented in ***Figure 4.4*** below.

Figure 4.4 Geology Map of Madhya Pradesh

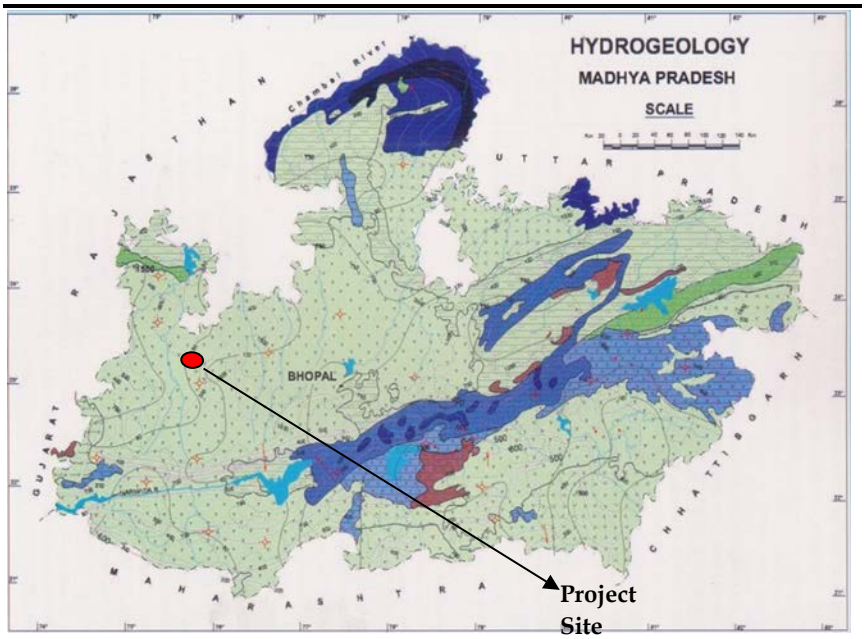


Source – MPPCB, CPCB

4.4.4 *Hydrogeology*

As per Central Ground Water Board, hydrogeologically the region has very diverse conditions since it is occupied by rocks ranging in age from Archean to Recent. The Hydrogeology map of Shajapur District is provided as *Error! Reference source not found.*. The alluvial deposits form prolific aquifers where tube wells can yield in the range of 50-80 m3/hr. The yield of tube wells in sand stones of Gondwanas ranges between 20-30 m3/hr; whereas in limestones of Gondwanas, it varies between 50-80 m3/hr. The yield of tube wells in basalts in select area ranges between 20-30 m3/hr.

Figure 4.5 Hydrogeology Map of Madhya Pradesh



Source: District Resource Map, GSI

As per the CGWB report, "*Ground Water Information, Shajapur District, Madhya Pradesh, May 2009*", the Shajpur Tehsil has been categorised as '*Semi- Critical*'.

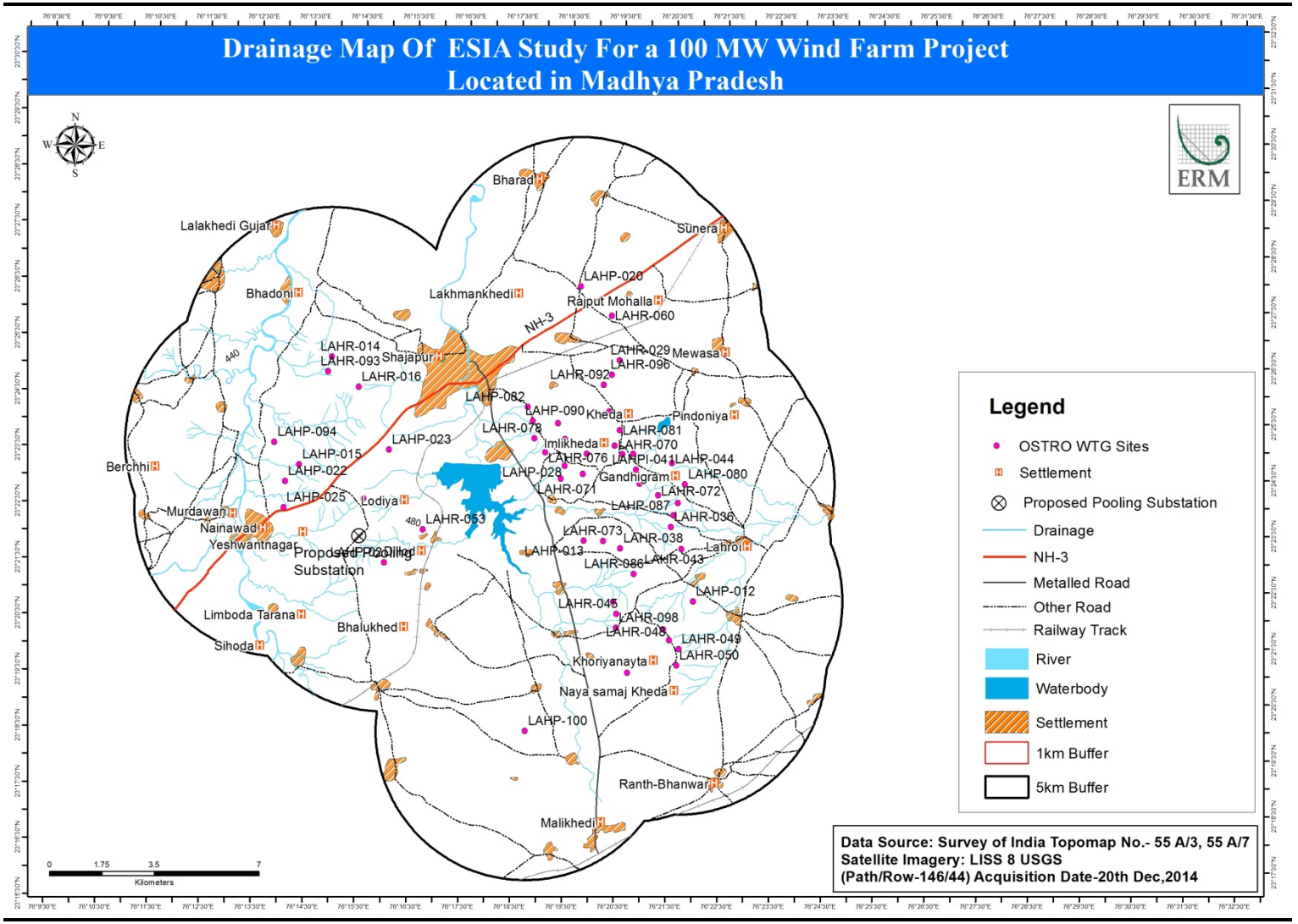
4.4.5 *Hydrology and Drainage Pattern*

The Drainage pattern was found to be affected due to the presence of hills in the 5 km study area. Kalisindh was found to be the main river which tranverses through the hills and further flows in the east from the study area. Another Lakunder river which was the main rivulets of river Kalisindh was found to be present in the west side of the study area.

An embankment on the Lakunder River has created a large surface water body - "Chiller Dam " that forms the main source of water for drinking purpose for nearby urban and rural settings through pipe water supply facilities. Apart from private sources, hand pumps are the main source of rural water supply in the district. Small ponds of water were found to be accumulated due to rain and are used by the nearby villagers for domestic purpose. It was found that there is scarcity of water in the nearby villages and hence, they have to go to long distances to take water from dug wells.

The drainage map of the study area is provided as ***Figure 4.6****Error! Reference source not found.*.

Figure 4.6 Drainage Map of the Study Area



4.4.6 Soil

As per CGWB, the largest State of the country is underlain by formations in age ranging from Archaean to Recent. One fifth of the area is occupied by granite gneisses and meta-sedimentary rocks, whereas one tenth by Gondwanas comprising sand stones, lime stones & marbles. The Deccan Trap covers a larger part of the State whereas the Quaternary alluvium covers 6% of the State area.

It was observed in the study area that the soil in Shajapur district are of mixed type [(1)] . There are three categories of soils, which were identified in the study area e.g

- **Black cotton Soil -** These soils are dark grey to black in color and are fertile in nature.

- **Lateritic soil -** These soils consist of sandy loam to clayey loam and brick red to red in colour.

- **Alluvium soil -**The presence of alluvium is limited to the bank of stream and rivers.

It is to be noted that the topsoil is only 2-3 inch in depth. In the hilly areas, the land is strewn with pebbles and boulders.
The soil map of Madhya Pradesh with Project site is presented in ***Figure 4.7***

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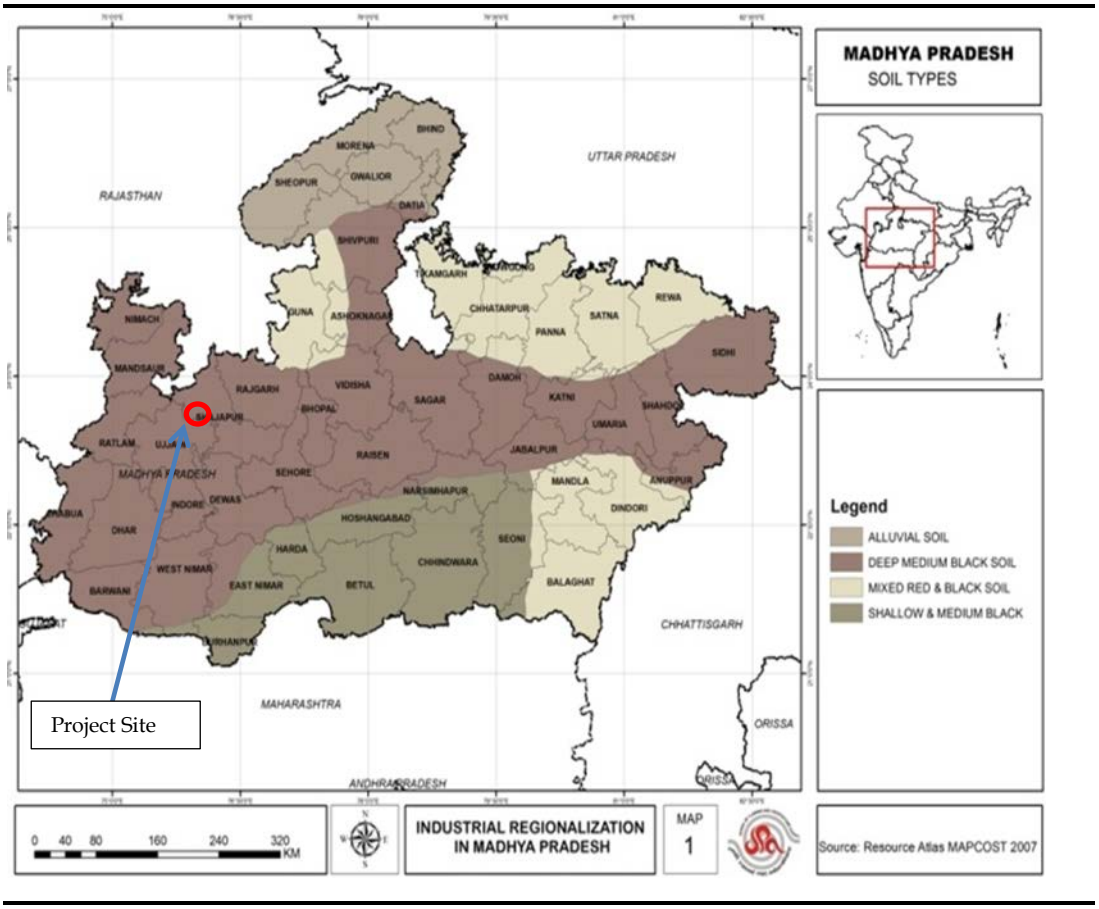
(1) "Ground Water Information, Shajapur District, Madhya Pradesh, May 2009"

Figure 4.7 Soil Map of Madhya Pradesh



4.4.7 *Natural Hazards*

Earthquake, Wind Hazard and Flood are the three major potential natural hazards that the Project might experience in the proposed area. The vulnerability to natural hazards has been inferred from published Government reports and has been tabulated below:

Table 4.4 Potential Natural Hazards for the Wind Farm

Type of Hazard	Source	Intensity
Seismicity	Bureau of Indian Standards (BIS 1893-1 2002)	Lies in Zone-II, Low damage risk
Wind	Building Materials & Technology Promotion Council (BMTPC)	47m/s, High Damage Risk Zone
Flood	Building Materials & Technology Promotion Council (BMTPC)	Not liable to Flooding

Based on site visit, it is of ERM's understanding that the WTG lying in lower elevation of undulating land is prone to a risk of flash flood fury due to low vegetation cover in the highlands. Further, due to lying in high damage risk zone of wind hazard. Hence, the stability of the Wind Towers should be ascertained after installation.

4.4.8 Climate and Meteorology

The climate of the region is classified as hot summer and general dryness except during the south west monsoon season as per Köppen Climate classification, with following four main seasons:

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

Regional Meteorology

The long term meteorology (period 1961- 1990) of the region based on data recorded at the nearest observatory station of India Meteorological Department (IMD) at Shajapur is presented in ***Table 4.5*** and ***Table 4.6*** and described in subsequent sections.

Table 4.5 Climatology of Shajapur (1961 -1990): *Ambient Air Temperature, Relative Humidity and Vapor pressure*

Month	Ambient Air temperature (°C)				Relative Humidity (%)		Vapor Pressure (hPa)	
	Highest	Daily Max. Mean	Daily Min. Mean	Lowest	8.30 hrs	17.30 hrs	8.30 hrs	17.30 hrs
January	30.1	25.9	8.5	3.7	65	39	9.7	11.2
February	33.2	28.2	10.3	4.7	55	30	9.8	10.1
March	38.5	33.6	15.1	8.9	41	23	10.5	10.1
April	41.7	38.4	21.4	15.6	31	16	12.2	10.0
May	43.3	40.6	25.9	21.4	40	20	18.1	13.4
June	42.0	36.9	25.5	22.1	66	45	25.7	22.3
July	35.3	31.4	23.7	21.6	81	65	27.1	26.1
August	33.5	29.2	23.0	21.6	87	77	27.3	27.5
September	34.6	31.3	22.0	19.5	80	63	25.8	25.1
October	35.2	32.7	17.6	12.4	63	45	18.9	18.3
November	32.7	29.8	11.5	7.3	56	40	12.7	13.8
December	30.0	26.6	8.7	4.6	64	43	10.6	12.3
Average	42.6	32.0	17.8	3.4	61	42	17.4	16.7

Source: Climatological normals 1961-1990, India Meteorological Department; Observatory Coordinates: 23°26' N, 76°19' E

Table 4.6 Climatology of Shajapur (1961 -1990): *Predominant Wind Directions*

Month	Morning Time Predominant Winds			Evening Time Predominant Winds		
	I	II	III	I	II	III
January	Calm	NE	SE	Calm	NE	N
February	Calm	NE/W	N/SE/NW	W	NE	NW
March	Calm	W	NW	W	NW	NE
April	W	NW	Calm	W	NW	N
May	W	NW	SW	W	NW	N
June	W	NW	SW	W	NW	SW
July	W	SW	NW	W	SW	NW
August	W	NW	SW	W	NW	SW
September	W	NW	Calm	W	NW	Calm
October	Calm	NW	W	Calm	NE	N/ NW

Month	Morning Time Predominant Winds			Evening Time Predominant Winds		
	I	II	III	I	II	III
November	Calm	SE	NE/E	Calm	NE	N
December	Calm	SE	E/NE	Calm	NE	E

Source: Climatological Normals 1961-1990, India Meteorological Department; Observatory Coordinates: 23°26' N, 76°19' E

Temperature: As per the data recorded at meteorological station, Shajapur, the temperature begins to increase from February till May. May and June are the hottest months with highest temperature of 43.3°C and 42°C respectively. The lowest temperature of 3.4°C was recorded in month of December. The daily mean minimum temperature varies from 13.8°C in January to 22.6°C in May, whereas the daily mean maximum temperature varies from 26.0°C in August to 36.1°C in April.

Relative Humidity: The relative humidity is generally high during the period of monsoon from July to September. On an average, relative humidity is about 84% during morning hours and 76% during evening hours during monsoon. The minimum humidity of 30% is recorded in March and maximum relative humidity of 84% is experienced in July.

Rainfall: The total rainfall in the region is about 908.6 mm spreading over 60 days. The southwest monsoon sets in the end of May and attains the high intensity in month of July. The monsoon withdraws towards the end of the October contributing about 91% of the annual average rainfall i.e., about 827 mm. The remaining months of year also experience the sporadic rains. The maximum rainfall occurs during month of July (240 mm) and minimum during the month of January (0.5 mm).

Wind Speed and Direction: The normal wind speed range in the region is 1- 19 kmph which prevails during 50% of each month.

The predominant wind direction is recorded to be from W/ SW during the summer (March-May) and monsoon season (June – September). Post monsoon (October- November) receives wind predominantly from N/ NE/E and winter season (December – February) experiences calm conditions during most of the time.

4.2 AMBIENT NOISE LEVEL

The baseline noise monitoring in the study area was carried from 14th to 17th of April, 2015 with the objective of assessing the background noise level in the study area.

Details of noise measurement locations in the study area are given in ***Table 4.7*** and shown in ***Figure 4.8.*** The recorded noise levels in the study area are summarised in ***Table 4.8*** and detailed results are given in ***Annex C.***

Table 4.7 Details of Noise Sampling Locations

S No.	Sampling Location	Station Code	Type of Activity	Geographical Coordinates	Justification for Selection of Location
1.	Imlikheda	NQ 1	Residential	23°24'16.75"N 76°19'52.90"E	The stations noise quality data captures the baseline for settlements that located in the village of Imlikheda as few WTG's will be set near to this village and receptors might be impacted. WTG would be set up in the surrounding and will be impacted as a consequence of construction related activities.
2.	Gandhigram	NQ 2	Residential	23°23'57.45"N 76°20'47.07"E	The stations noise quality data captures the baseline for settlements that located in the village of Gandhigram. WTG would be set up in the surrounding and will be impacted as a consequence of construction related activities.
3.	Kheda	NQ 3	Residential	23°24'50.03"N 76°19'56.27"E	The stations noise quality data captures the baseline for settlements that located in the village of Kheda. WTG would be set up in the surrounding and will be impacted as a consequence of construction related activities.
4.	Rajput Mohalla	NQ 4	Residential	23°26'57.66"N 76°20'17.85"E	The stations noise quality data captures the baseline for settlements that located in the village of Rajput Mohalla. WTG would be set up in the surrounding and will be impacted as a consequence of construction related activities.
5.	Naya samaj Kheda	NQ 5	Residential	23°20'5.92"N 76°21'10.90"E	The stations noise quality data captures the baseline for settlements that located in the village of Naya Samaj Kheda WTG would be set up in the surrounding and will be impacted as a consequence of construction related activities .
6.	Dillod	NQ 6	Residential	23°22'23.11"N 76°16'21.67"E	The stations noise quality data captures the baseline for settlements that located in the village of Dillod. WTG would be set up in the surrounding and will be impacted as a consequence of construction related activities.

Figure 4.8 Air and Noise Monitoring Locations

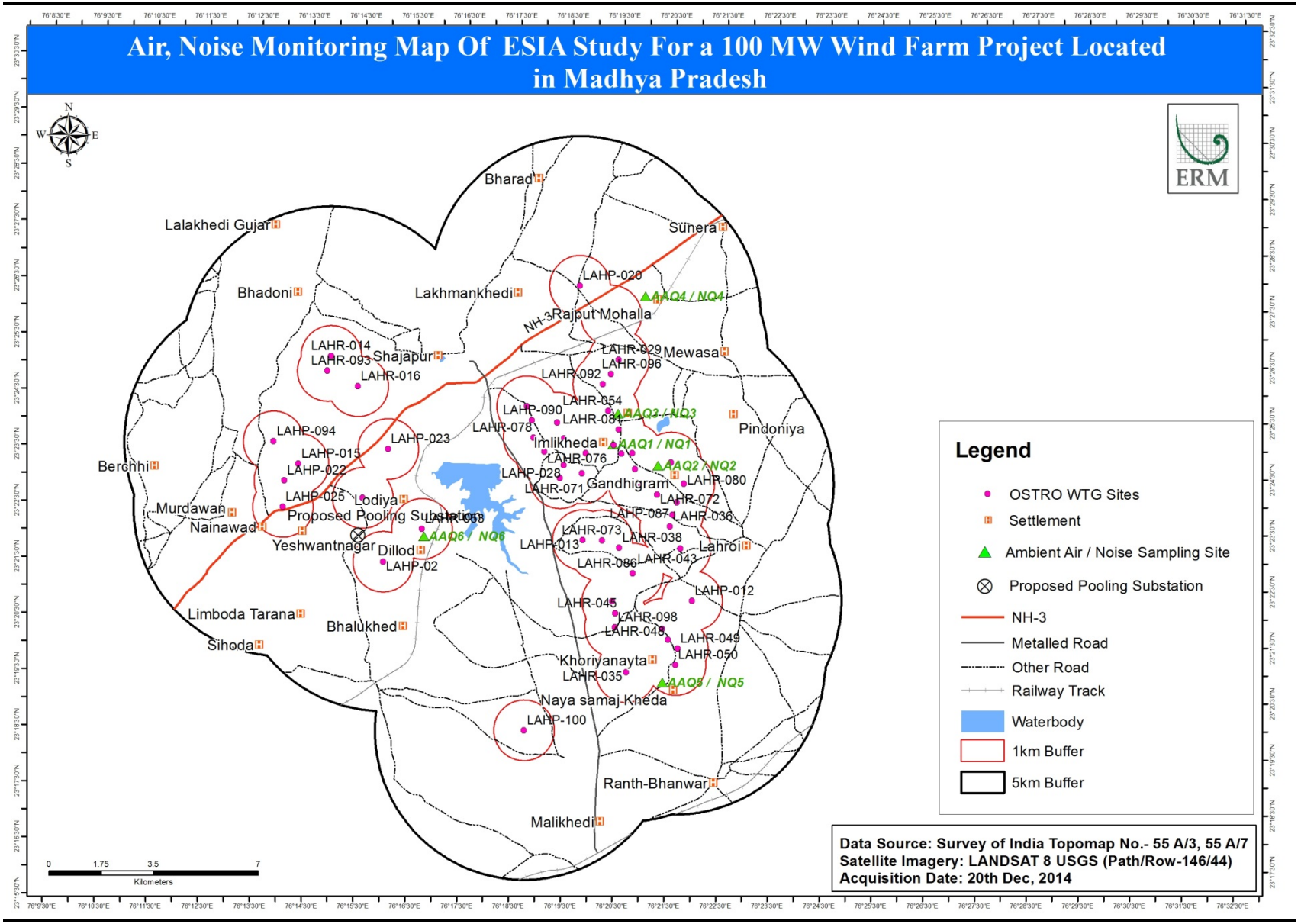


Table 4.8 Noise Levels in the Study Area

S No.	Locations	Noise level (dB(A))					Applicable CPCB Standard (dB(A))	
		Leq Daytime	Leq Nighttime	L eqdn	L minimum	L maximum	Day time	Night time
1	NQ1	49.4	40.1	47.3	35.7	52.4	55	45
2	NQ2	50.5	37.4	47.9	34.0	55.5	55	45
3	NQ3	53.0	38.1	50.3	34.2	57.2	55	45
4	NQ4	54.0	40.5	51.3	35.5	58.3	55	45
5	NQ5	53.2	43.0	50.9	35.5	57.1	55	45
6	NQ6	53.1	41.2	50.6	36.0	58.9	55	45

Source: Baseline Monitoring Survey-April'2015

Ambient daytime noise level (Leq day) was recorded in the range of 49.4 to 54.0 dB (A). Whereas, ambient night time noise level (Leq night) in the study area were 37.4 - 43.0 dB (A). Hence, the equivalent ambient noise level for day time (Leq day) and night time (Leq night) at the six locations were observed to be within the corresponding prescribed limits of CPCB and WHO, for residential areas.

Figure 4.9 Daytime Noise Level Recorded in the Study Area

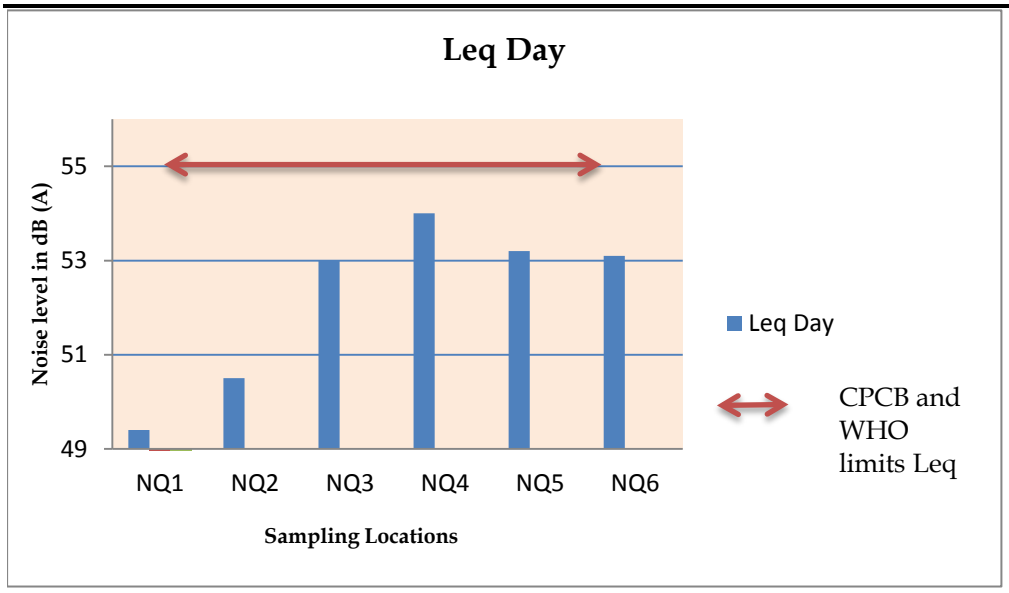
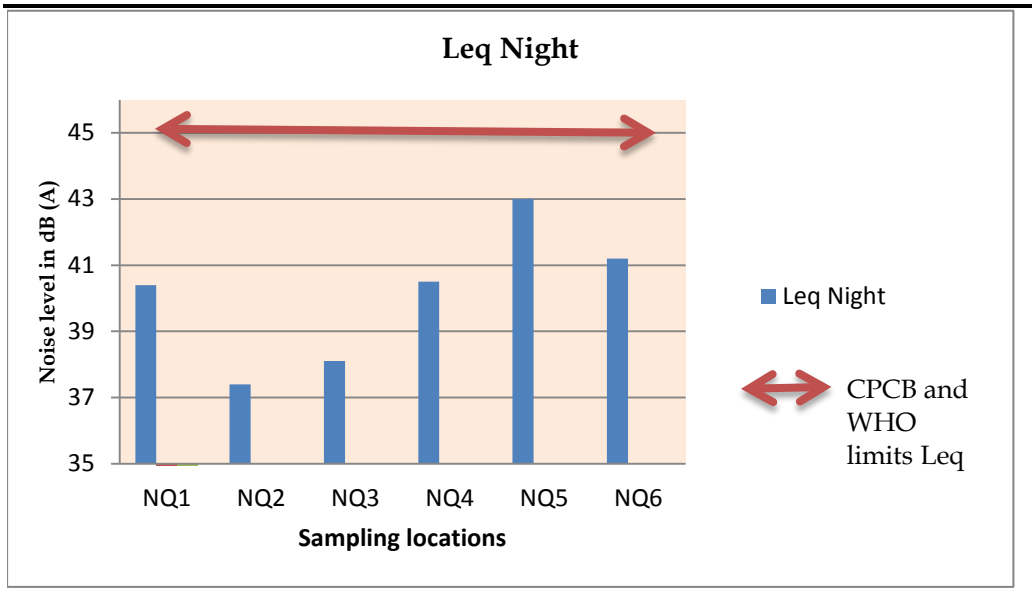


Figure 4.10 Nighttime Noise Level Recorded in the study area



The above recorded noise level was reported due to normal village activities such as noise from the agricultural activities, school activities, etc. in and around the monitoring locations. Some small and heavy vehicle movement has also contributed to the above recorded baseline noise level.

Conclusion

Based on the results mentioned above, it can be concluded that ambient noise level in the study area is within the prescribed limit, which is 45 dB for night time and 55 dB for day time in rural areas. LeqDay and LeqNight noise levels recorded at all the locations are within the prescribed noise limits under Ambient Noise Level Standards, stipulated by the CPCB and WHO.

4.5 GROUND WATER QUALITY

Ground water in Shajapur District occurs in different lava flows. Shallow ground water is found in the weathered vescicular, jointed fractured zones of basaltic flows generally under unconfined conditions at some places under the semi confined to confined condition due to the presence of thickly silty clays overlying the jointed rocks in the case s of deeper aquifer.

Groundwater levels vary from 6.68 m bgl at Shajapur to 23.40 m bgl at Agar in pre-monsoon period in Shajapur.

Sampling and Analysis Methodology

Water sampling and analysis of ground water was undertaken to understand the overall baseline water quality conditions of the study area. Samples were taken from representative selected sources representing different parts of the

study area. The details of the sampling locations identified in the study area for water quality monitoring are as given in ***Table 4.9.***

Table 4.9 **Details of Ground Water Sampling Locations**

S.No.	Sampling Location	Station Code	Type of Sample	Type of source	Geographical Coordinates
1	Kheda Village	GW1	Ground Water	Well water	23°24'57.56"N 76°21'0.67"E
2	Gandhi Gram village	GW2	Ground Water	Well water	23°24'21.97"N 76°20'38.53"E
3	Naya Samaj Kheda	GW3	Ground Water	Well water	23°20'10.29"N 76°20'59.32"E
4	Dillod village	GW4	Ground Water	Well water	23°22'22.50"N 76°16'7.27"E

The samples were analysed for physical, chemical and bacteriological characteristics according to Bureau of Indian Standards, Drinking Water Standards (IS: 10500, 2012) and Standard Method for Examination of Water and Wastewater Edition 20, published by American Public Health Association (APHA).

Ground water Quality Analysis

The results of the groundwater quality monitoring conducted are presented below in ***Table 4.10.***

Table 4.10 Groundwater Quality observed during the Monitoring Period (Samples collected in April 2015)

S. No.	Parameters	Unit	Ground Water				Test Methods	Acceptable Limits	Detection Limits
			GW1	GW2	GW3	GW4			
1	pH	-	6.87	6.93	7.04	6.98	IS : 3025 (P-11)	6.5-8.5	
2	Temperature	^oC	28.3	27.9	28.1	27.5	APHA 2550 B	-	
3	Turbidity	NTU	<1	<1	<1	<1	IS : 3025 (P-10)	1 Max.	1
4	Conductivity	µS/cm.	614	920	443	512	APHA 2510 B	-	
5	Colour	Hazen	<1	<1	<1	<1	IS : 3025 (P-4)	5 max.	5
6	Total Dissolved Solids	mg/L	399	598	288	333	IS : 3025 (P-16)	500 max.	
7	Total Suspended Solids	mg/L	20.9	33.5	15.7	19.1	APHA 2540 D	-	
8	Magnesium Hardness	mg/L	165.58	198.69	56.58	64.69	APHA 2340 C	-	
9	Total Alkalinity	mg/L	80	140	120	100	IS : 3025 (P-23)	200 max.	
10	Total Hardness (as $CaCO_3$)	mg/L	230	410	250	270	APHA 2340 B	200 max.	
11	Chloride	mg/L	94.97	119.96	14.99	34.99	IS : 3025 (P-32)	250 max.	
12	Sulphate	mg/L	7.2	15.1	5.7	6.4	IS : 3025 (P-24)	200 max.	
13	Nitrate (as $NO_{3)}$	mg/L	0.41	0.63	0.31	0.51	IS : 3025 (P-34)	45 max.	0.2
14	Fluoride (as F)	mg/L	0.71	0.93	0.42	0.61	IS : 3025 (P-60)	1 max.	0.1
15	Salinity	ppt	0.2979	0.4519	0.2136	0.2474	APHA 2520 B	-	
16	Total Nitrogen	mg/L	2.38	2.52	1.26	1.82	APHA 4500 N-org	-	
17	Total phosphorus	mg/L	0.42	0.62	0.35	0.41	APHA 4500 P-D	-	
18	DO	mg/L	2.9	2.5	2	2.2	IS : 3025 (P-38)	-	
19	BOD	mg/L	BDL	BDL	2.5	2	IS : 3025 (P-44)	-	0.1
20	COD	mg/L	16	24	52	48	IS : 3025 (P-58)	-	4
21	Phenolic Compound (as C_6H_5OH)	mg/L	BDL	BDL	BDL	BDL	IS : 3025 (P-43)	0.001 max.	0.001
22	Sodium (Na)	mg/L	65.28	40.53	15.11	12.88	APHA 3111-B	-	
23	Potassium	mg/L	0.62	0.72	BDL	BDL	APHA 3111-B	-	0.1
24	Arsenic (As)	mg/L	BDL	BDL	BDL	BDL	IS : 3025 (P-37)	0.01 max.	0.01
25	Mercury (Hg)	mg/L	BDL	BDL	BDL	BDL	IS : 3025 (P-48) Mercury Analyzer	0.001 max.	0.001
26	Lead (Pb)	mg/L	BDL	BDL	BDL	BDL	IS : 3025 (P-47)	0.01 max.	0.01
27	Cadmium (Cd)	mg/L	BDL	BDL	BDL	BDL	IS : 3025 (P-41)	0.003 max.	0.002
28	Chromium Hexavalent (Cr^{+6})	mg/L	BDL	BDL	BDL	BDL	APHA 3500- Cr- B	-	0.1
29	Total Chromium (Cr)	mg/L	BDL	BDL	BDL	BDL	IS : 3025 (P-52)	0.05 max.	0.01
30	Copper (Cu)	mg/L	BDL	BDL	BDL	BDL	IS : 3025 (P-42)	0.05 max.	0.01
31	Zinc (Zn)	mg/L	BDL	BDL	BDL	BDL	IS : 3025 (P-49)	5 max.	0.2
32	Selenium (Se)	mg/L	BDL	BDL	BDL	BDL	IS : 3025 (P-56)	0.01 max.	0.01
33	Iron (Fe)	mg/L	BDL	BDL	BDL	BDL	IS : 3025 (P-53)	0.3 max.	0.3

42	Total Coliform	MPN/100 mL	900	1600	8	1600	IS 1622 - 1981 (2003)	Shall not be detectable in any 100 ml sample	2
43	Faecal Coliform	MPN/100 mL	34	1600	8	500	IS 1622 - 1981 (2003)	Shall not be detectable in any 100 ml sample	2
44	Zooplankton	Present-Absent/Cu.meter	Absent	Absent	Absent	Absent	APHA 10200 G	-	

(Groundwater samples have been collected in April, 2015)

4.5.2 *Results and discussion*

Physico - Chemical Parameters

- pH of the groundwater samples were found in the range of 6.87 to 7.04 as against the drinking water norm of 6.5 to 8.5. The pH of the samples was found to be within the permissible limit;
- Turbidity concentrations are within the permissible limits for all the GW samples;
- Total hardness (as $CaCO_3$) in the groundwater samples of the study area ranges from 230 mg/l to 410 mg/l and hence exceeds the permissible limit of 200 max.
- Arsenic (As), Mercury (Hg), Lead (Pb), Cadmium (Cd), Chromium Hexavalent (Cr^{+6}), Total Chromium (Cr), Copper (Cu), Zinc (Zn), Selenium (Se), Iron (Fe) are found to be below detectable limit in all the GW samples.
- Nitrates concentration for all the samples were found to be higher than the detectable limit and found within acceptable limit.
- Flouride concentration for all the samples was found to be within the acceptable limit and above the detectable limit.
- Total Alkalinity was observed to be within the acceptable limit in all the samples.
- Phenolic compounds were observed to be below detection limit in all the ground water samples.
- The level of dissolved solids in the GW1 sample was observed to be high while that of GW2 was observed to be within the permissible limit.
- Total coliform concentration was found to be highest in GW2 and GW4 followed by GW1 while total faecal coliform was found to be highest in GW2 followed by GW4. The prevalence of total and faecal coliforms in the groundwater is due to exposed surface of the wells. The contamination is perhaps due to bird droppings or unhygienic human practices.

4.6 *BIOLOGICAL ENVIRONMENT*

4.6.1 *Introduction*

Ecological surveys were undertaken from 8th to 13th April, 2015 and further from 5th May to 7th May 2015 for the Lahori Wind Farm project to understand and establish the ecological baseline within core area (500 m from the WTG location) and buffer area (of 5 km from the WTG location) of the study area and to understand impacts of the project on the species and habitats in surrounding areas. The weather was hot during the survey. Temperature varied from maximum of 36°C to the minimum of 18°C during survey in April and maximum of 42°C to the minimum of 23°C during survey in May

4.6.2 *Approach and Methodology*

The methodology followed for floral and faunal analysis is given in ***Table 4.11***

Table 4.11 Methodology for ecological survey

Particular	Methodology
Floral Analysis	The major vegetation habitats identified in the wind farm area and 5 km buffer area include vegetation on plateau, open scrub, grasslands and agricultural lands. Habitat specific vegetation survey was undertaken to enumerate the trees, shrubs and herbs in the study area.
Faunal Analysis	
Herpetofauna	Intensive search was made along the hedges of all the aquatic habitats and open wells located in the study area were checked to identify and list the amphibians. Status of reptiles was assessed using Intensive Time Constrained Search Methods (1) (2) covering different micro habitats surveyed within the core and buffer zones of the study area.
Avifauna	Avifaunal species were enumerated by habitat surveys at the sample plots. Avian nomenclature followed Standard field guides (3)
Mammals	Habitat survey for mammals was conducted. Identification was followed by standard literature (4) (5)

Secondary literature from published books and research publications were also consulted for the flora and fauna of the study area. Discussions were held with the officials of State Forest department. The enumerated list of faunal species assessed with the IUCN Red data list (2015 v 2) and schedule 1-6 of Wildlife Protection Act, 1972 to confirm their conservation status.

4.6.3 Study area

The study area falls in Shajapur District of Madhya Pradesh. The wind farm is located all around the Shajapur city as shown in ***Figure 4.1.*** The study area is marked with a large waterbody Chiller Lake in the centre with small waterbodies in surroundings. The study area does not have any forest land and is entirely on a revenue and private land.

(1) Welsh, H.H., jr. 1987. Monitoring herpetofauna in woodlands of north western California and south west Oregon: a comparative strategy. Pp. 203-213. In. Multiple – Use Management of Califirnia's hardwood resources. T.R. Plumb, N.H. Pillisbury (eds. Gen. Tech. Regional Environmental Planning. PSW – 100) US Department of Agriculture, Forest Service

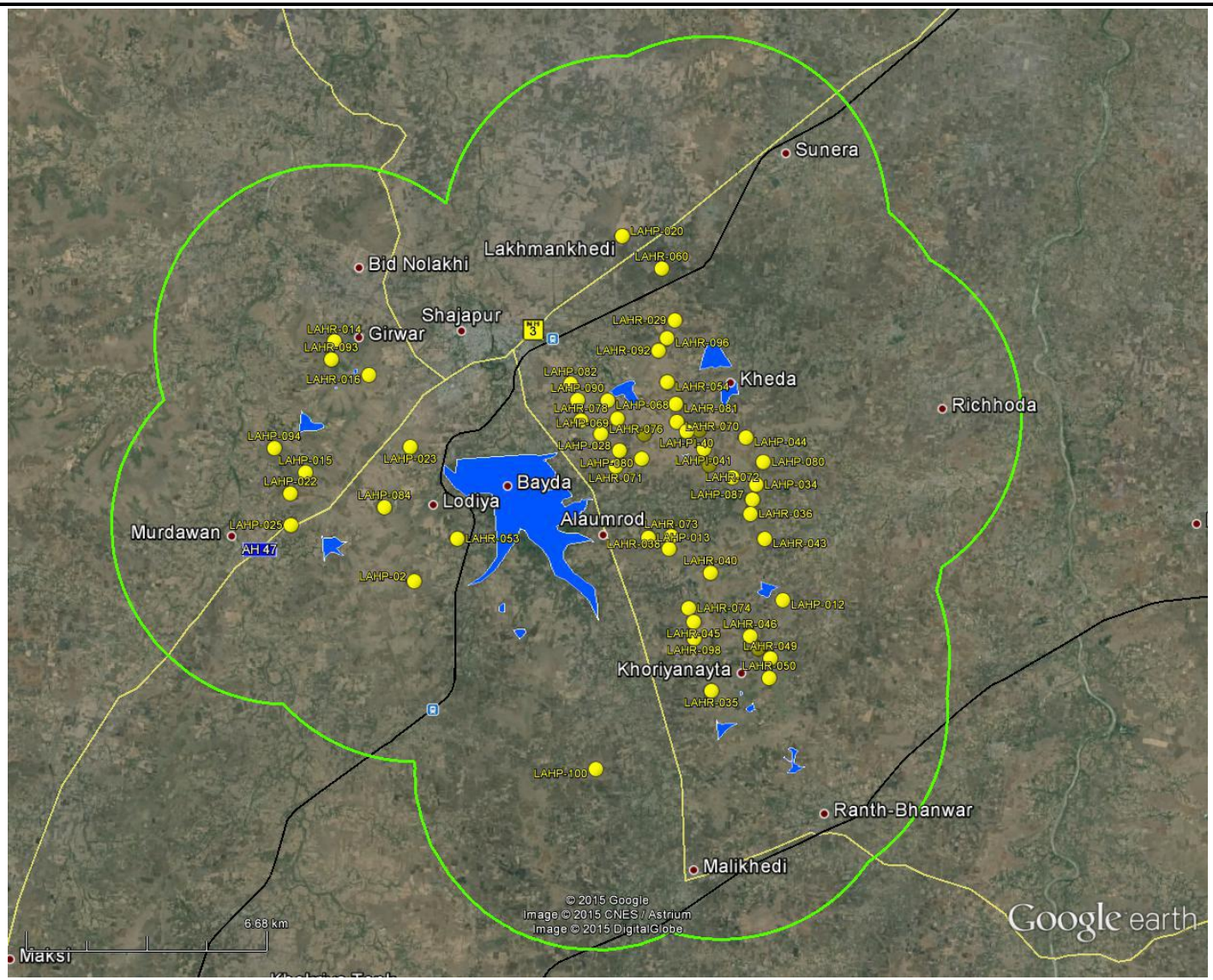
(2) Welsh, H.H. Jr. and Lind, A. 1991. The structure of the herpetofaunal assemblage in the Douglas-fir/hardwood forests of northwestern California and south western Oregon. Pp: 395-411. In: Wildlife and vegetation of unmanaged Douglas-fir forests. (Tech.Coords). L.F. Ruggiero, K.B. Aubry, A.B. Carey and M.H. Huff. Ge. Tech. Rep. PNW-GTR-285. Portland, OR: US. Department of Agriculture, Forest Service.

(3) Birds of India, Srilanka, Pakistan, Nepal, Bhutan, Bangladesh and Maldives. 2000. Krys Kazmeierczak and Ber Van `Perlo. Om Field Guides.

(4) Prater. S. H. 2005. The Book of Indian Animals. Bombay Natural History Society and Oxford University press 12th Edn. pp. 316.

(5) Menon, V. 2003. A field guide to Indian Mammals. Dorling Kindersley (India) Ltd. New Delhi. 201 p.

Figure 4.11 Map of the Study Area showing Lahori Wind Farm and surrounding 5 km buffer area



Source: Google earth Satellite Imagery Dated April 3, 2014 accessed on 30th June 2015

The study area falls in the Malwa plateau region. The topography of the WTG locations are undulating terrain with majority of vegetation on the slopes and scrub vegetation on the top of the plateau. The vegetation is tropical dry forest, with scattered teak (*Tectona grandis*) forests. The main trees are *Butea*, *Bombax*, *Anogeissus*, *Acacia*, *Buchanania* and *Boswellia*. The shrubs or small trees include species of *Grewia*, *Ziziphus mauritiana*, *Casearia*, *Prosopis*, *Capparis*, *Woodfordia*, *Phyllanthus*, and *Carissa*. The vegetation in the area is classified as per Champion and Seth classification (1)

- Group 5:- Tropical Dry Deciduous Forest
  - Southern Tropical Dry Deciduous forest
  - Degradation Stage
    - DS1:- Dry deciduous scrub forest;
    - DS3:- Dry grasslands.

The vegetation classification of the area is given in Table 4.12.

Table 4.12 Vegetation Classification of the Region

Area Type	Classification
Plant Diversity Centers of India[1]	4: Semi Arid
Biogeographic Province of India[1]	4B: Semi Arid Gujarat Rajputana
Agro Ecological Sub Region (Indian Council of Agricultural Research) [3]	Sub region No.13,AE Sub region 5.2, Agro ecological region :I5D2& I5 C3
Agro-Climatic Region (Planning Commission)[2]	Sub Zone 24, ACZ 9.3,Region : Central Plateau, PCS3
Agro Climatic Zone (National Agricultural Research Project)[3]	Malwa Plateau Agroecological Zone(X)

Source: [1]Wildlife Institute of India, [2]Agriculture Contingency Plan-Shajapur, Department of Agriculture and Cooperation, Ministry of Agriculture, Govt. of India

4.6.4 Habitats in the Study Area with Representative Vegetation

The various habitats in the area are described in the table below

Agriculture and Farms Lands

The plain areas in the study area and some areas on the top of the plateau area are been utilized as agriculture and farmlands. The tree species in the area are represented by *Acacia nilotica, Albizzia amara, Buchnania lanzan, Butea monosperma, Cassia siamea, Erythrina suberosa, Lagerstroemia parviflia, Pongamia pinnata, Prosopis juliflora, Mangifera indica, Azadirachta indica, Syzygium hayneanum, Phoenix sylvestris* etc. The medium sized shrubs include *Ricinus cummunis, Ziziphus mauritiana, Ziziphus nummularia.* The shrubs are represented by *Achyranthes aspera, Calotropis procera, Capparis zelancia, Datura stromonium, Jatropha curcas, Solanum indicum.* The under storey shrubs are represented by *Asparagus racemosus, Cassia occidentalis, Datura metel.* The herbs species have mostly dried up due to the extreme weather conditions. The notable species of herbs were represented by *Argemone mexicana, Cassia tora, Chlorophyllu borvillianum* and *Solanum nigrum*. Some farm lands growing

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

Oranges (*Citrus sinensis*) were also seen within study area. The agricultural and farmlands habitats are shown in ***Figure 4.12.***

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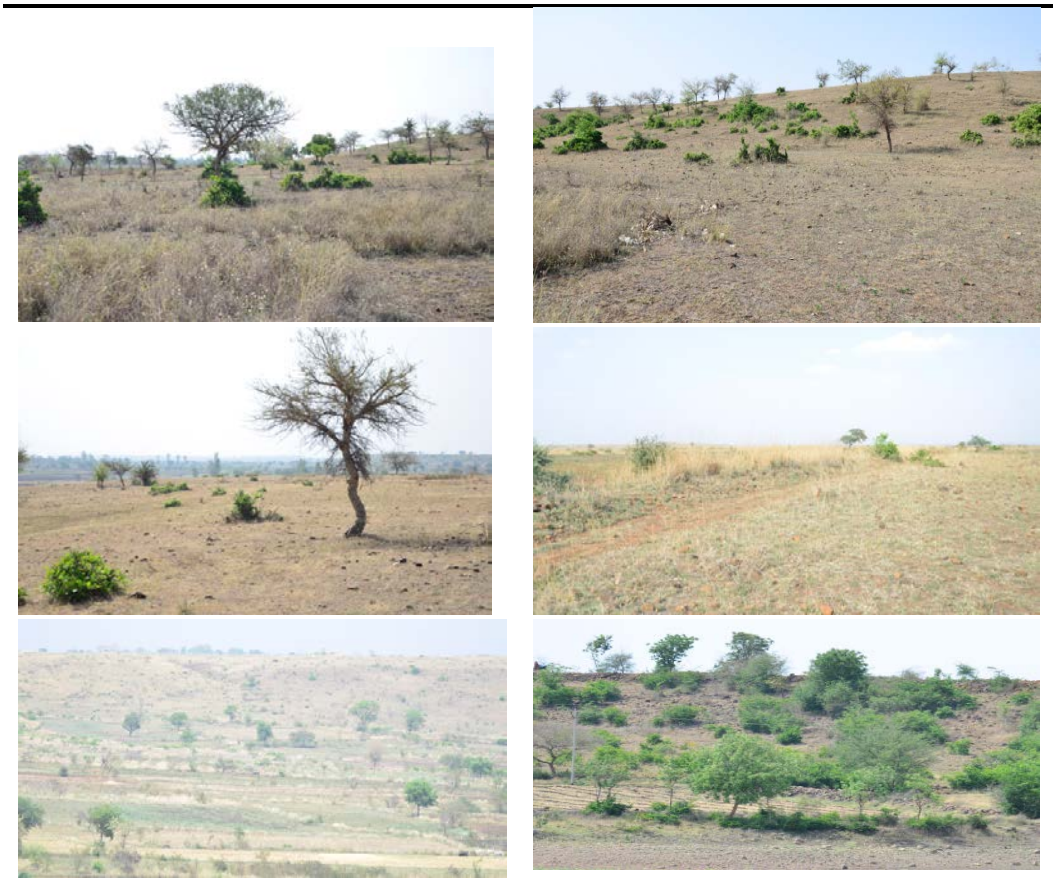
Figure 4.12 ***Agriculture and Farmlands***

Source: ERM Ecological Survey April May 2015

Scrub Vegetation and Grasslands

The scrub vegetation is predominantly present on all plateau areas. The common tree species representing scrub vegetation are *Madhuca latifolia, Phoenix sylvestris, Emblica officinalis, Butea monosperma, Accacia nilotica*, *Kydia calycina, Pongamia pinnata, Prosopis juliflora.* The shrubs are more dominantover the scrub vegetation in the landscape and represented predominantly by *Carissa spinarum* followed by *Ziziphus nummularia, Capparis zelanica, Jatropha curcas, Tribulus terrestris, Cassia tora, Cassia occidentalis, Xanthium strumarium.* Most of the herbs are parched due to the dry weather conditions. Notable herb species are represented by *Argemone mexicana, Solanum nigrum.* The grasslands are represented by species of *Cynodon daetylon*, *Dichanthuium annulatum, Heteropogon contortus, Phragmites karka, Themeda quadrivalvis, Chrysopgon montanus.* The scrub vegetation in the study area are represented in Figure 4.13.

Figure 4.13 Scrub vegetation and Grasslands in the Study area



Source: ERM Ecological Survey April May 2015

Water Bodies

Most of the smaller water bodies in the study area have dried up due to extreme weather conditions. Larger water bodies such as Chiller lake was only holding water. Not much floral was seen due the reduced level. One water body near Naya Samaj Khera village was also holding water. These water bodies with water had good diversity of avifaunal species. Some of the dried waterbodies near Kheda village support large migratory bird numbers , during the migratory season, as confirmed by the local villagers.

4.6.5 *Faunal species within Study Area*

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

Herpetofauna

The Herpetofaunal (amphibian and reptilian) species found in the study area are discussed below and given in ***Figure 4.14***

Figure 4.14 Herpetofaunal Species observed within the Study Area

Flap Shell Turtle (*Lissemys punctate)*

Hardwicke's bloodsucker (*Brachysaura minor*)

Indian Skipper Frog (*Euphlyctis cyanophlyctis)*

Garden Lizard (*Calotes vesicular)*

Source: ERM Ecological Survey April May 2015

Amphibians

A total of four (04) species belonging to 2 families were observed from the study area. None of the species have any conservational significance. The details of the species are given in ***Table 4.13.***

Table 4.13 Amphibians observed/recorded from the Study Area

Sn	Common Name	Zoological Name	Family	Occurrence	WPA Schedule / IUCN Status
1	Indian Skipper Frog	*Euphlyctis cyanophlyctis*	Dicroglossidae	Frequent	LC /Not Listed
2	Common Indian Toad	*Duttaphrynus melanostictus*	Bufonidae	Common	-/ LC
3	Indian Pond Frog	*Euphlyctis hexadactylus*	Dicroglossidae	Common	-/LC
4	Indian Bull Frog	*Hoplobatrachus tigerinus*	Dicroglossidae	Frequent	-/LC

Notes: LC-Least Concern,

Reptiles

A total of sixteen (16) species belonging to 9 families were observed from the study area. One (01) species Flapshell Turtle (*Lissemys punctata*) is listed as Schedule I species of Indian Wildlife Protection Act (1972). The details of reptiles are shown in *Error! Reference source not found.* ***Table 4.14***

Table 4.14 Reptiles observed/reported from the Study Area

Sn.	English / Popular Name	Scientific Name	Family	Occurrence	WPA Schedule / IUCN 2015.2 Status

Sn.	English / Popular Name	Scientific Name	Family	Occurrence	WPA Schedule / IUCN 2015.2 Status
1	Flap Shell Turtle	*Lissemys punctata*	Pythonidae	Rare	I / LC
2	Beaked Worm Snake	*Tyhlops acutus*	Tylopidae	Rare	IV/LC
3	Common Sand Boa	*Eryx conica*	Uropeltidae	Frequent	IV/LC
4	Black Cobra	*Naja naja oxiana*	Elapidae	Rare	II/LC
5	Common Indian Krait	*Bungarus fasciatus*	Elapidae	Common	IV/LC
6	Rat snake	*Ptyas mucosa*	Colubridae	Frequent	IV/LC
7	Buffed-striped Keelback	*Amphiesma stolata*	Colubridae	Frequent	IV/LC
8	Common Indian Trinket Snake	*Elaphe helena helena*	Colubridae	Frequent	IV/ LC
9	Checkered Keelback Water Snake	*Xenchrophis piscator*	Colubridae	Frequent	II/ LC
10	Common Wolf Snake	*Lycodon aulicus*	Colubridae	Frequent	IV/ LC
11	Russell's Viper	*Daboia russelii*	Viperidae	Frequent	IV/ LC
12	Saw-scaled viper	*Echis carinata*	Viperidae	Frequent	IV/LC
13	Keeled Grass Skink	*Eutropis carinata*	Scincidae	Frequent	-/ LC
14	Indian Garden Lizard	*Calotes versicolor*	Agamidae	Common	-/-
15	Hardwicke's bloodsucker	*Brachysaura minor*	Agamidae	Rare	-/DD
16	Flat tailed Gecko	*Hemidactylus platyurus*	Gekkonidae	Frequent	-/-

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

Avifauna

A total of 92 species were observed/reported from the study area. The details of species are given in ***Table 4.15*** and photographic representation is provided in ***Figure 4.15***

The Egyptian Vulture (*Neophron percnopterus*) listed as Endangered as per IUCN 2015 ver.2 was observed in the area.

Species such as Oriental Honey Buzzard (*Pernis ptilorhynchus*), Brahminy Kite (*Haliastur indus*), Shikra (*Accipiter badius*), White Eyed Buzzard (*Butastur teesa*), Indian peafowl (*Pavo cristatus*), Indian Grey Hornbill, (*Ocyceros birostris*) were listed as Sch. I as per Wildlife Protection Act, 1972 and are of conservational significance as per national regulations.

Eight (08) species migratory species and thus bears protection from killing under Convention of Migratory Species (CMS) to which India is a signatory (1) .

(1) The Convention on Conservation of Migratory Species (CMS) or Bonn Convention aims to conserve migratory species throughout their range. The Convention came into force in 1979. India is a signatory to the convention since 1983.

Table 4.15 Avifavunal species observed in Study Area

Sn	Common Name	Scientific Name	Family	Migratory Status	A/T	Conservation Status	
						IUCN 2015 ver. 2	IWPA,72
1	Rosy Starling	*Pastor roseus*	Sturnidae	Migratory	T	LC	IV
2	Asian Pied Starling	*Gracupica contra*	Sturnidae	Resident	T	LC	IV
3	Grey Francolin	*Francolinus pondicerianus*	Phasianidae	Resident	T	LC	IV
4	Large Grey Babbler	*Turdoides malcolmi*	Leiothrichidae	Resident	T	LC	IV
5	Little Cormorant	*Microcarbo niger*	Phalacrocoracidae	Resident	A	LC	IV
6	Indian Courser	*Cursorius coromandelicus*	Glareolidae	Resident	T	LC	IV
7	Chestnut-bellied Sandgrouse	*Pterocles exustus*	Pteroclididae	Resident	T	LC	IV
8	Cotton-pygmy Goose	*Nettapus coromandelianus*	Anatidae	Resident	A	LC	IV
9	Great Egret	*Ardea alba*	Ardeidae	Resident	A	LC	IV
10	Intermediate Egret	*Mesophoyx intermedia*	Ardeidae	Resident	A	LC	IV
11	Little Egret	*Egretta garzetta*	Ardeidae	Resident	A	LC	IV
12	Cattle Egret	*Bubulcus ibis*	Ardeidae	Resident	T	LC	IV
13	Indian Pond Heron	*Ardeola grayii*	Ardeidae	Resident	A	LC	IV
14	Desert Wheatear	*Oenanthe deserti*	Muscicapidae	Resident	T	LC	IV
15	Spotted Owlet	*Athene brama*	Strigidae	Resident	T	LC	IV
16	Black Winged Stilt	*Himantopus himantopus*	Recurvirostridae	Resident	A	LC	IV
17	Short toed Snake Eagle	*Circaetus gallicus*	Accipitridae	Resident	T	LC	I
18	Black Kite	*Milvus migrans*	Accipitridae	Resident	T	LC	I
19	Indian Eagle Owl	*Bubo bengalensis*	Strigidae	Resident	T	LC	IV
20	Common Kestral	*Falco tinnunculus*	Falconidae	Migratory	T	LC	IV
21	Black Shouldered Kite	*Elanus axillaris*	Accipitridae	Resident	T	LC	I
22	Common Myna	*Acridotheres tristis*	Sturnidae	Resident	T	LC	IV
23	Brahminy Starling	*Sturnia pagodarum*	Sturnidae	Resident	T	LC	IV
24	Long tailed Shrike	*Lanius schach*	Laniidae	Resident	T	LC	IV
25	Green Bee-eater	*Merops orientalis*	Meropidae	Resident	T	LC	IV
26	House Sparrow	*Passer domesticus*	Passeridae	Resident	T	LC	IV
27	Greater Coucal	*Centropus sinensis*	Cuculidae	Resident	T	LC	IV
28	House Crow	*Corvus splendens*	Corvidae	Resident	T	LC	IV
29	Jungle Crow	*Corvus macrorhynchos*	Corvidae	Resident	T	LC	IV
30	Eurasian Thick knee	*Burhinus oedicnemus*	Burhinidae	Resident	T	LC	IV
31	Yellow-eyed babbler	*Chrysomma sinense*	Sylviidae	Resident	T	LC	IV
32	Spot Billed Duck	*Anas poecilorhyncha*	Anatidae	Resident	A	LC	IV
33	Oriental Honey Buzzard	*Pernis ptilorhynchus*	Accipitridae	Resident	T	LC	I
34	Brahminy Kite	*Haliastur indus*	Accipitridae	Resident	T	LC	I

Sn	Common Name	Scientific Name	Family	Migratory Status	A/T	Conservation Status	
						IUCN 2015 ver. 2	IWPA,72
35	Shikra	*Accipiter badius*	Accipitridae	Resident	T	LC	I
36	White Eyed Buzzard	*Butastur teesa*	Accipitridae	Resident	T	LC	I
37	Yellow legged Buttonquail	*Turnix tanki*	Turnicidae	Resident	T	LC	IV
38	Indian peafowl	*Pavo cristatus*	Phasianidae	Resident	T	LC	I
39	White breasted Water hen	*Amaurornis phoenicurus*	Rallidae	Resident	A	LC	IV
40	Common Coot	*Fulica atra*	Rallidae	Resident	A	LC	IV
41	Red Wattled Lapwing	*Vanellus indicus*	Charadriidae	Resident	T	LC	IV
42	Yellow Wattled Lapwing	*Vanellus malabaricus*	Charadriidae	Resident	T	LC	IV
43	Wood Sandpiper	*Tringa glareola*	Scolopacidae	Migratory	A	LC	IV
44	Green Sandpiper	*Tringa ochropus*	Scolopacidae	Migratory	A	LC	IV
45	Red collared Dove	*Streptopelia tranquebarica*	Columbidae	Resident	T	LC	IV
46	Spotted Dove	*Spilopelia chinensis*	Columbidae	Resident	T	LC	IV
47	Eurasian Collared Dove	*Streptopelia decaocto*	Columbidae	Resident	T	LC	IV
48	Laughing Dove	*Spilopelia senegalensis*	Columbidae	Resident	T	LC	IV
49	Rose ringed Parakeet	*Psittacula krameri*	Psittaculidae	Resident	T	LC	IV
50	Plum headed Parakeet	*Psittacula cyanocephala*	Psittaculidae	Resident	T	LC	IV
51	Plain Prinia	*Prinia inornata*	Cisticolidae	Resident	T	LC	IV
52	Asian Koel	*Eudynamys scolopaceus*	Cuculidae	Resident	T	LC	IV
53	Indian Nightjar	*Caprimulgus asiaticus*	Caprimulgidae	Resident	T	LC	IV
54	Asian Palm Swift	*Cypsiurus balasiensis*	Apodidae	Resident	T	LC	IV
55	House Swift	*Apus nipalensis*	Apodidae	Resident	T	LC	IV
56	Indian Roller	*Coracias benghalensis*	Coraciidae	Resident	T	LC	IV
57	Common Kingfisher	*Alcedo atthis*	Alcedinidae	Resident	T	LC	IV
58	Pied Kingfisher	*Ceryle rudis*	Cerylidae	Resident	A	LC	IV
59	White Throated Kingfisher	*Halcyon smyrnensis*	Halcyonidae	Resident	A	LC	IV
60	Common Hoopee	*Upupa epops*	Upupidae	Resident	T	LC	IV
61	Coppersmith Barbet	*Megalaima haemacephala*	Megalaimidae	Resident	T	LC	IV
62	Indian Grey Hornbill	*Ocyceros birostris*	Bucerotidae	Resident	T	LC	I
63	Black-naped Oriole	*Oriolus chinensis*	Oriolidae	Resident	T	LC	IV
64	Rufous Tailed Lark	*Ammomanes phoenicura*	Alaudidae	Resident	T	LC	IV
65	Ashy crowned Sparrow Lark	*Eremopterix griseus*	Alaudidae	Resident	T	LC	IV
66	Oriental Skylark	*Alauda gulgula*	Alaudidae	Resident	T	LC	IV
67	Red rumped Swallow	*Cecropis daurica*	Hirundinidae	Resident	T	LC	IV
68	Black Drongo	*Dicrurus macrocercus*	Dicruridae	Resident	T	LC	IV
69	Red vented Bulbul	*Pycnonotus cafer*	Pycnonotidae	Resident	T	LC	IV
70	Red Whiskered Bulbul	*Pycnonotus jocosus*	Pycnonotidae	Resident	T	LC	IV
71	Red Throated Flycatcher	*Ficedula albicilla*	Muscicapidae	Resident	T	LC	IV

Sn	Common Name	Scientific Name	Family	Migratory Status	A/T	Conservation Status	
						IUCN 2015 ver. 2	IWPA,72
72	Zitting Cisticola	*Cisticola juncidis*	Cisticolidae	Resident	T	LC	IV
73	Common Tailer Bird	*Orthotomus sutorius*	Cisticolidae	Resident	T	LC	IV
74	Indian Robin	*Saxicoloides fulicatus*	Muscicapidae	Resident	T	LC	IV
75	Great Egret	*Ardea alba*	Ardeidae	Resident	A	LC	IV
76	Egyptian Vulture	*Neophron percnopterus*	Accipitridae	Resident	T	EN	IV
77	Sarus Crane	*Grus antigone*	Gruidae	Resident	A/T	VU	IV
78	River Tern	*Sterna aurantia*	Sternidae	Resident	A	NT	IV
79	Red napped Ibis	*Pseudibis papillosa*	Threskiornithidae	Resident	A	LC	IV
80	Greator Flamingo	*Phoenicopterus roseus*	Phoenicopteridae	Migratory	A	LC	IV
81	Red wattled Lapwing	*Vanellus indicus*	Charadriidae	Resident	A	LC	IV
82	Spotted Redshank	*Tringa erythropus*	Scolopacidae	Migratory	A	LC	IV
83	Little Grebe	*Tachybaptus ruficollis*	Podicipedidae	Resident	A	LC	IV
84	Gargany	*Anas querquedula*	Anatidae	Migratory	A	LC	IV
85	Ruddy Shelduck	*Tadorna ferruginea*	Tadorninae	Migratory	A	LC	IV
86	Pied Bush Chat	*Saxicola caprata*	Muscicapidae	Resident	T	LC	IV
87	Paddyfield Pipit	*Anthus rufulus*	Motacillidae	Resident	T	LC	IV
88	Purple Sunbird	*Cinnyris asiaticus*	Nectariniidae	Resident	T	LC	IV
89	Purple rumped Sunbird	*Leptocoma zeylonica*	Nectariniidae	Resident	T	LC	IV
90	Indian Silverbill	*Lonchura malabarica*	Estrildidae	Resident	T	LC	IV
91	White Wagtail	*Motacilla alba*	Motacillidae	Resident	T	LC	IV
92	Western Yellow Wagtail	*Motacilla flava*	Motacillidae	Resident	T	LC	IV

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

Figure 4.15 Avifaunal species observed in the Study Area

Syke's Lark

Indian Courser

Long-tailed Shrike

Indian Hoopoe

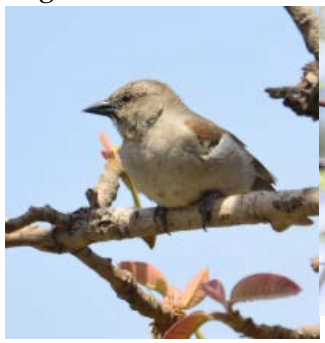
Ashy crowned sparrow Lark

Short Toed Snake Eagle

Rufous tailed Lark

Red vented Bulbul

Greater Short Toed Lark



Chestnut shouldered Petronia

Laughing Dove

Yellow wattled Lapwing

Greater Coucal

Indian Peafowl

Blue Rock Thrush

Indian Roller

Purple Sunbird

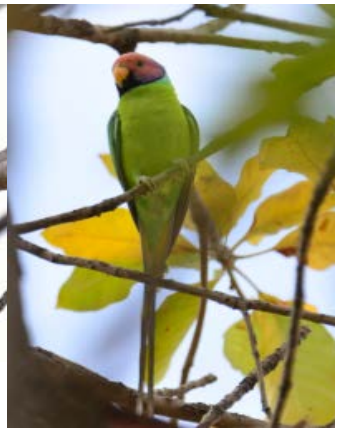
Chestnut-belled Sand grouse

Spotted Dove

Bonelli's Eagle

Asian Pied Starling

Spotted Owlet



Plum headed Parakeet

Intermediate Egret

River Tern

Spot billed Duck

Ruddy Shellduck

Black Ibis

Wood Sandpiper

Green Sandpiper

Pied Kingfisher

Greater Flamingo

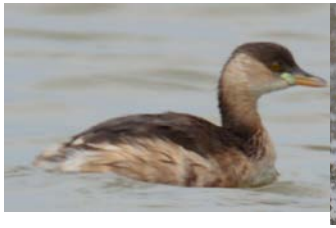
Great Egret

Grey Heron

Sarus Crane

Red wattled Lapwing

Spotted Redshank



Little Grebe

Garganey

Little Cormorant

Indian Pond Heron

Cattle Egret

White throated Kingfisher

Source: ERM Ecological Survey April May 2015

Mammals

A total of 13 species of 12 genera belonging to 10 families were observed/ reported from the study area. One (01) species Blackbuck (*Antilope cervicapra*) is categorized as Near Threatened as per IUCN (2015 v2) and also listed as Sch. I species as per Indian Wildlife Protection Act, 1972. Indian Wolf (*Canis lupus pallipes*) is also listed as Sch. I species in the Indian Wildlife Protection Act, 1972 and nationally listed as Endangered. A list of species observed/reported from the study area are given in ***Table 4.16*** and represented in ***Figure 4.16***.

Table 4.16 Details of Mammals observed/ reported from the Study area

Sn.	English Name	Scientific Name	Family	Occurrence	IWPA Schedule / IUCN Status
1	Jackal	*Canis aureus*	Canidae	Frequent	II/LC
2	Common Fox	*Vulpes bengalensis*	Canidae	Frequent	II/LC
3	Bonnet Macaque	*Macaca radiata*	Cercopithecidae	Common	II/LC
4	Common Langur	*Semnopithecus entellus*	Cercopithecidae	Rare	II/LC
5	Blue Bull	*Boselaphus tragocamelus*	Bovidae	Common	III/LC
6	Blackbuck	*Antilope cervicapra*	Bovidae	Rare	I/ NT
7	Indian Grey Mongoose	*Herpestes edwardsii*	Herpestidae	Frequent	II/LC
8	Jungle Cat	*Felis chaus*	Felidae	Frequent	II/LC
9	Five Striped Squirrel	*Funambulus pennantii*	Sciuridae	Common	IV/LC
10	Bandicoot rat	*Bandicota indica*	Muridae	Common	V/LC
11	Indian Flying Fox	*Pteropus giganteus*	Pteropodidae	Common	V/LC
12	Indian Hare	*Lepus nigricollis*	Leporidae	Common	IV /LC
13	Grey Wolf	*Canis lupus*	Canidae	Rare	I/LC

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

Figure 4.16 Mammalian Species observed within the Study Area

Golden Jackal

Blue Bull

4.6.6 Protected Area

The study area is devoid of any forest land however some species like Blackbuck (*Antilope cervicapra*)and Blue bull (*Boselaphus tragocamelus*) roam in the revenue lands mostly on the plateau ridge areas. No Important Bird Areas (IBAs) designated by Birdlife International (BI) and Indian Bird Conservation Network (IBCN) and Bombay Natural History Society, Mumbai (BNHS).

4.6.7 Habitats for Migratory and Endangered species

Important Bird Habitat within Study Area

The important bird habitat is Chiller lake which can be considered as the main foraging area. During the survey 6 out of 8 migratory species were observed within (late migrants) suggests the possible use of the Chiller lake during winter season by migratory birds.

In addition to Chiller lake there are many small to medium size water bodies all around the wind farm area which may also serve as an alternative foraging ground to these migratory birds. These waterbodies are man-made structure used for irrigation and accumulate the surface runoff. These are usually shallow in nature hence provides good habitat to migratory water birds and ducks. During consultation with villagers of Khera village they confirmed that migratory birds flock in the two nearby water reservoirs during December and January..

Grasslands

There could be a possibility of presence of Pallid Harrier species during winter over the grasslands in the study area which use this habitat as their hunting grounds.

Habitat for Egyptian Vulture

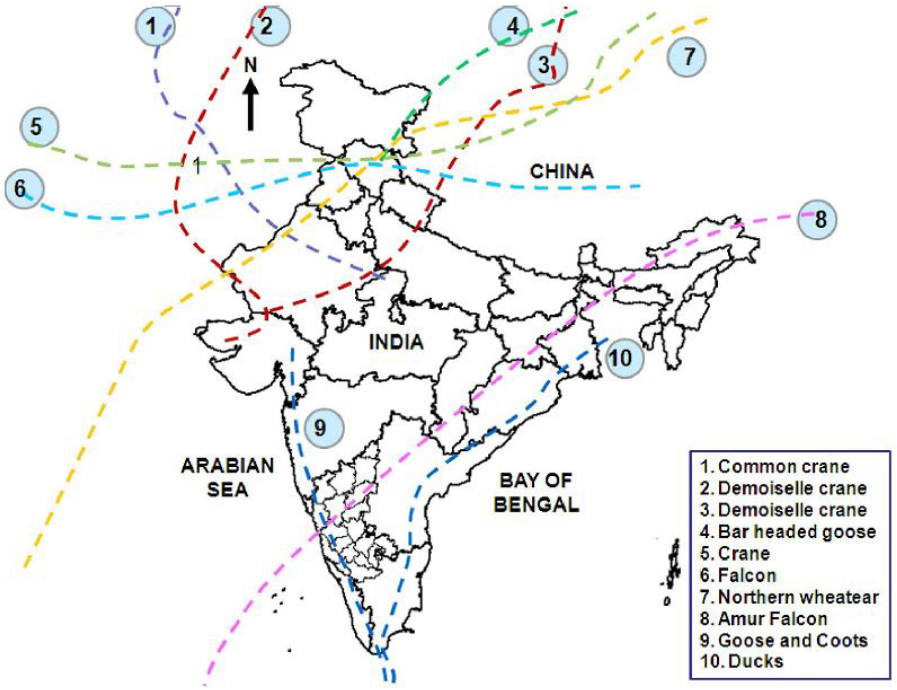
Egyptian vulture (*Neophron percnopterus)* was observed in the outskirts of the Shajapur city areas. There are number of poultry farms in the study area which may attract them for food.

4.6.8 Bird Migratory Route

The primary surveys were undertaken during from 8th to 13th April, 2015 and 5th May to 7th May 201. The migratory season in India is between October-February. The available migratory routes passing through India is provided in ***Figure 4.17.*** The figure confirms no major migratory routes of avifaunal species through the wind farm area. The primary survey reported eight (08) migratory species (Late Migrants) from the Study area. During the consultations it was reported that the migratory birds (mainly ducks and

geese) visit the area. Further assessment is required to identify the migratory bird presence during the migratory season.

Figure 4.17 Major Avifaunal Migratory routes through India



Source: Ramachandra T.V, Durga Madhab Mahapatra, M. Boominathan, K. Sankara Rao and Harish R. Bhat, 2011. Environmental Impact Assessment of the National Large Solar Telescope Project and its ecological impact in Merak area., CES Technical Report : 123, Energy & Wetlands Research Group, Centre for Ecological Sciences, Indian Institute of Science, Bangalore 560 012. doi: http://wgbis.ces.iisc.ernet.in/biodiversity/pubs/ces_tr/TR123/index.htm

5 SOCIO ECONOMIC BASELINE

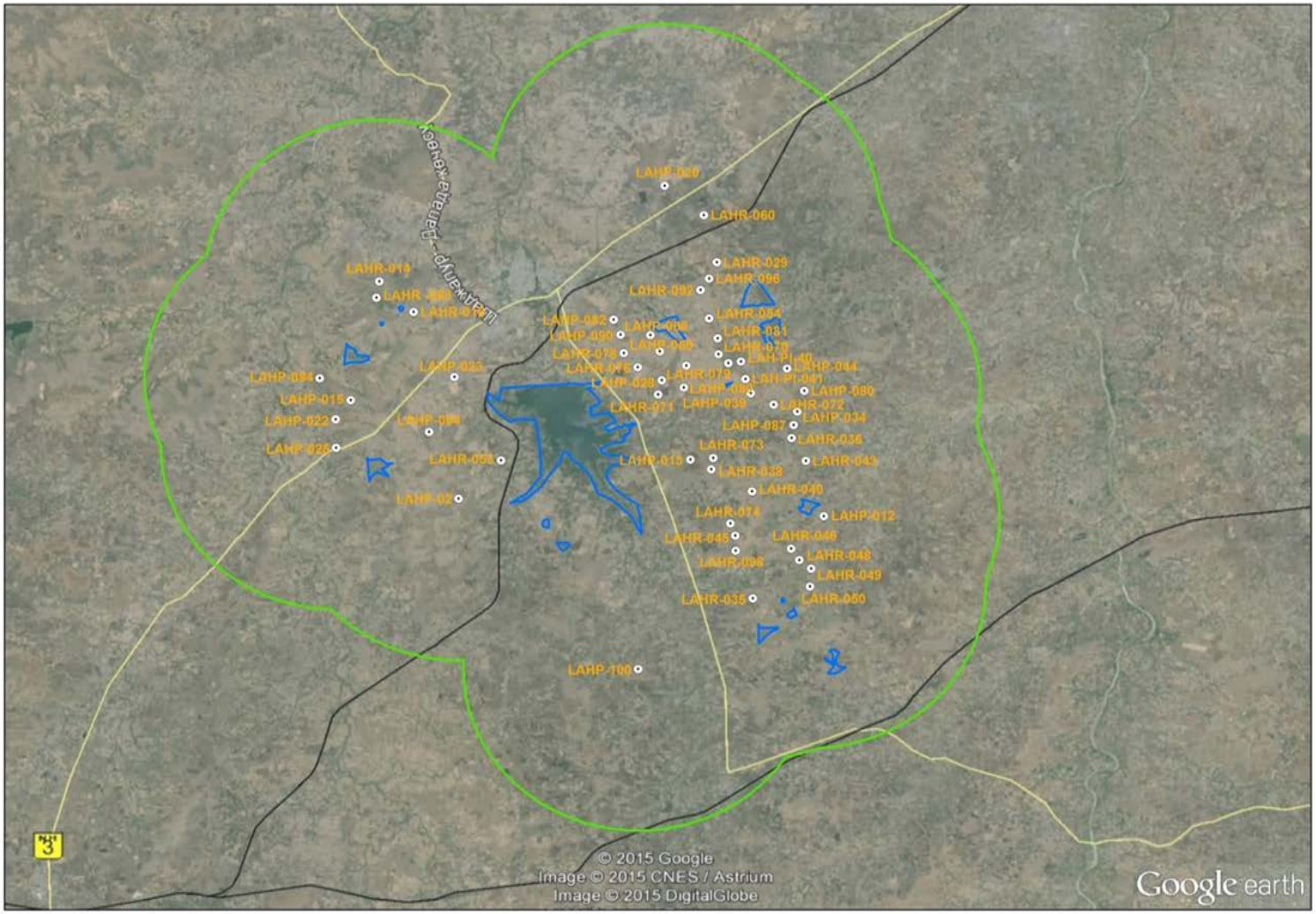
This section provides an understanding of the administrative set up of the district. It gives the demographic profile of the villages in the project area and identifies the social groups and vulnerable groups. The section presents data on the land use pattern in the area along with the common property resources and irrigation methods. It also provides data regarding the social and physical infrastructure available and operational in the study area in terms of the health, sanitation, water and education. The purpose of this section is to allow for an increased understanding of the key issues and analyse them.

The understanding of socio-economic components presented in this Section is based upon both the secondary information collected from the public domain as well as the field consultations undertaken by the ERM team during the site visit. The following discussion will be concentrated on the project area, with comparisons being drawn to the block and district where appropriate.

5.1 STUDY AREA

The study area for the social baseline of the project is defined to be bifurcated into core and buffer zones. The core zone of the study is considered as the wind farm area, which is the total encompassing area after joining all the WTGs. Most of the stakeholder consultations have been conducted in the core zone. The buffer zone of the project stretches 3 km more from the core zone radius. The study area for the social impact assessment is shown in the ***Figure 5.1.***

Figure 5.1 Study Area for Social Baseline



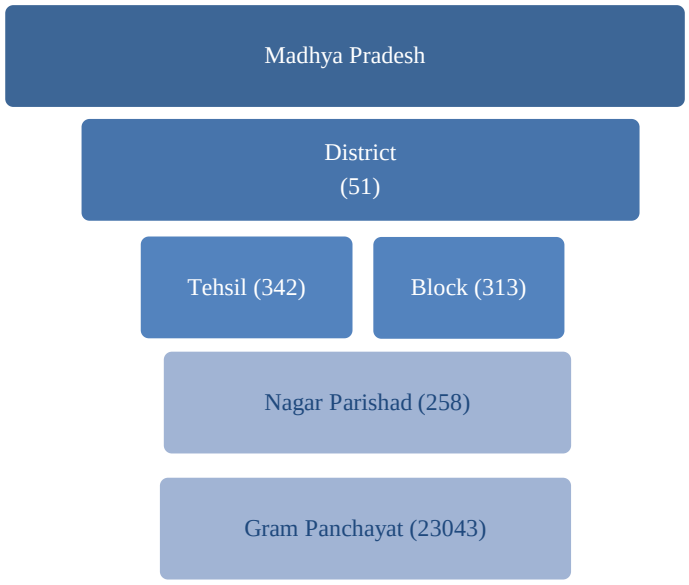
Source: Developed based on site reconnaissance (Google Earth Pro Imagery)

5.2 ADMINISTRATIVE STRUCTURE

State of Madhya Pradesh

As the name denotes, Madhya Pradesh literally means Central Province. The state of Madhya Pradesh is located centrally surrounded by five other states like Rajasthan in the North West, Uttar Pradesh at its North East, Chhattisgarh towards the stretch from East to South East, Gujrat at the West and Maharashtra spread over the South and South West. The state is mostly covered under plateaus, valleys and hills. For example there are five popular plateaus in the state viz, Kaimur, Vindhyan, Satpura, Malwa and Nimar. The administration of the State is set up as illustrated in the ***Figure 5.2***.

Figure 5.2 Administrative Framework of Madhya Pradesh

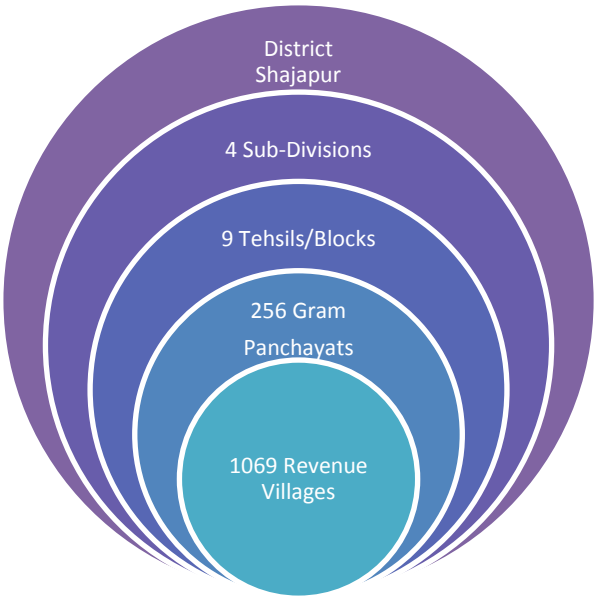


Source: Census of India, 2011

Shajapur District

Shajapur is one of the 51 Districts and falls under the Ujjain Division of Madhya Pradesh. For administrative purposes Shajapur is divided into 4 sub divisions viz, Shajapur, Shujalpur, Kalapipal and Mohan badodiya. There are 42 wards spread over 2 towns, Shajapur and Maksi. The study area for the project is fully covered under the Shajapur Block. The number of Revenue Villages capped under this Block is 143, forming 13% of the total Revenue Villages in the District. The structure of administration in the District is as illustrated in the ***Figure 5.3*** below:

Figure 5.3 Administrative Structure of Shajapur District



Source: Government of India, 2011

5.3 DEMOGRAPHIC PROFILE OF STATE AND DISTRICT

Madhya Pradesh is reported to be the second largest state of the India with an area of 308,252 sq.km. The population density in Madhya Pradesh is 236 per sq. km. which is less than the India's population density of 382 per square km. The rural population of the state accounts more than the urban population, similar to the Indian scenario. The rural areas of Madhya Pradesh contribute 5.32% of the India's rural population and the urban areas contribute by 4.23% to the country's urban population.

Table 5.1 Comparative Demographic Indicators

Indicators	Madhya Pradesh	India
Total Population	7,26,26,809	121,01,93,422
Percentage Decadal Population Growth (2001-2011)	16.90 %	17.64 %
Percentage of Rural Population	44380878	8,33,500,000
Percentage of Urban Population	15967145	3,77,100,000
Percent Decadal Urban Population Growth (2001-2011)	20.44 %	12.18 %
Percentage Decadal Rural Population Growth (2001-2011)	15.55 %	31.80 %
Population Density (per square kilometer)	236	382

Source: 2011 Primary Census Abstract, India

5.3.1 Demographic Profile

As visible from the Census data, provided in the ***Table 5.1***, population of Scheduled Tribes in the Shajapur District as well as in the Shajapur Block is marginal with 2.5 % and 2.2 % of the total block population respectively; compared to the State of Madhya Pradesh with 21.08 % of Scheduled Tribes. Wherein, the Scheduled Caste population is higher at the District (23.39 %) and Block (24.53 %) level than that of the Madhya Pradesh with 15.61 %.

Table 5.2 ***Comparative Demographic Indicators***

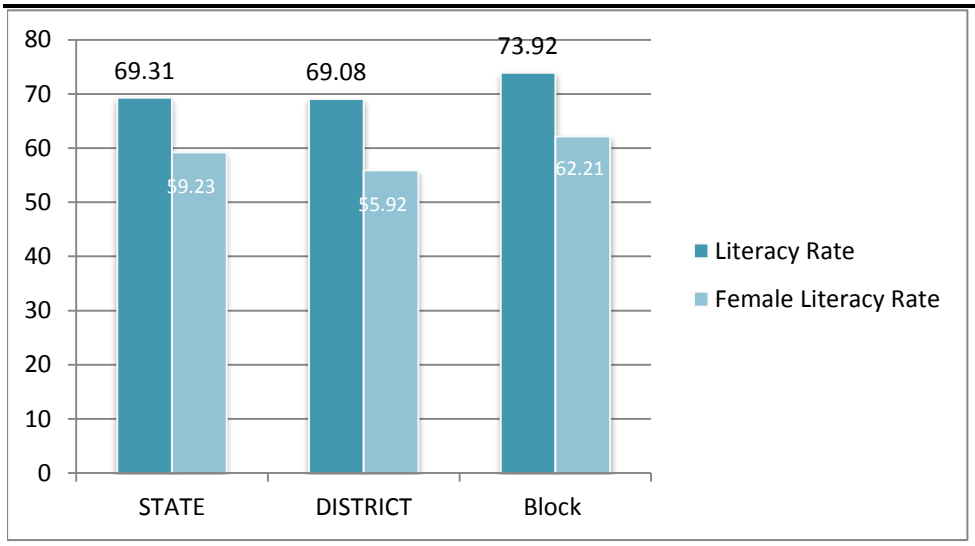
Attributes	Madhya Pradesh	Shajapur District	Shajapur Block
Population	72626809	1512681	251782
% of SC population	15.61	23.39	24.53551
% of ST population	21.08	2.5	2.205082
Sex Ratio	931	938	934
% total literacy rate	69.31	69.08	73.92
% female literacy rate	59.23	55.92	62.21

Source: 2011 Primary Census Abstract, India

The Sex Ratio at all three levels is nearly the same with Madhya Pradesh having an average of 931 females per thousand males; 938 females in the District and 934 females at the Block level for each thousand males. In contrast with the Sex Ratio the Female Literacy at all three levels is uniformly low with 59.23 % at the State level, 55.92 % at the District level and 62.21 % at the Block level. The female literacy rates are again consistently lower, at all three levels, when compared to the general literacy rates, with the Block rates being little better comparatively. The exact proportions are illustrated in the ***Table .5.3*** as below.

Literacy Rate

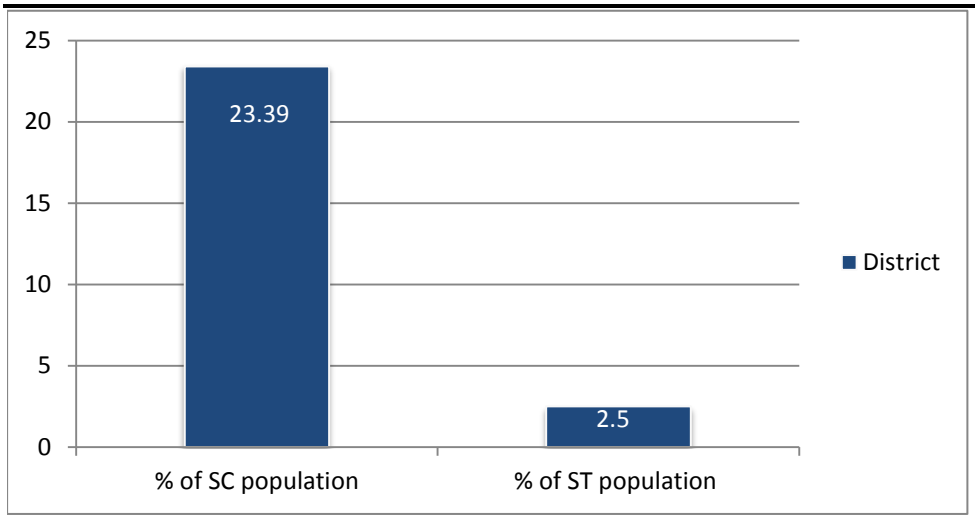
Table 5.3 ***Comparative Levels of General and Female Literacy Rates***



Scheduled Caste and Schedule Tribe Population

The Scheduled Castes in Madhya Pradesh account for for 15.61% of the total population which is lesser compared to the 23.39 % of the Scheduled Caste population in the District. The Scheduled Tribes form 21.08% of the total population of 7,26,26,809 in the State. Madhya Pradesh has 10 Schedule Five areas viz. Jhabua, Mandla, Dhar, Khargone, East Nimar (khandwa), Sailana tehsil in Ratlam district, Betul, Seoni, Balaghat and Morena. Shajapur District not being one of them, consist only 2.5 % of Scheduled Tribes.

Figure 5.4 SC and ST Population in the District



Land Use Pattern

The total geographical area of the Shajapur District is 6,18,000 ha. Out of which the largest area is 1,02,000ha under *non-agricultural area*. The second largest area of land is occupied under *Permanent Pastures* with 50 thousand hectares followed by *Cultivable Waste land* of 10 thousand hectares of land. Comparatively the least occupied land in the district comes under *Forest area* with 6 thousand hectares; leaving very less of *Barren land* with thousand hectares amongst all other land types.

Box 5.1 Land Use Definitions

Forest Area

- All land classified either as forest under any legal enactment, or administered as forest, whether State-owned or private and whether wooded or maintained as potential forest land. The area of crops raised in the forest and grazing lands or areas open for grazing within the forest remain included under the ''forest area''

Non agricultural area

- All land occupied by buildings, roads and railways or under water e.g. rivers and canals, other land put to uses other than agriculture

Permanent Pastures

- All of a village's common grazing land whether meadows or pastures

Cultivable/Culturable Wasteland

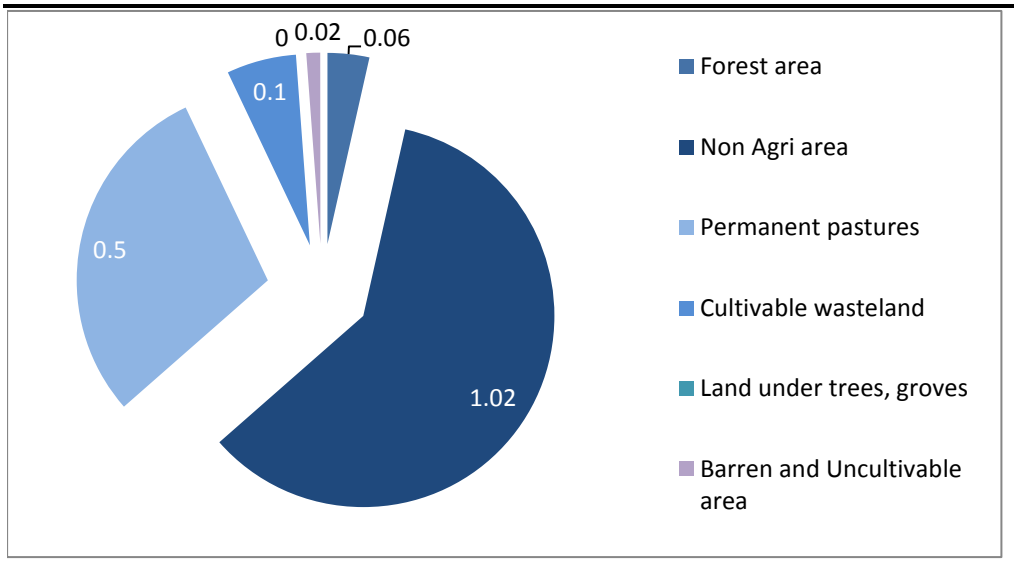
- Land which is available for cultivation, whether or not taken up for cultivation once, but not cultivated for the last five years or more in succession including the current year for some reason or the other

Barren land

- All covered by mountains and deserts etc. This land cannot be brought under cultivation except at an exorbitant cost is classified as unculturable whether such land is in isolated blocks or within cultivated holdings. Such land may either be fallow or covered with shrubs and jungles, which are not put to any use

Source: Census of India, 2011

Figure 5.5 Land Use Pattern in Shajapur District



Source: Agriculture Contingency Plan, Shajapur District, 2011

Cultivable land in the District, is primarily used by the farmers to produce variety of pulses, vegetables, fruits and spices. Soya bean is grown on almost 312,000 ha of , Gram is grown on 152,000 ha , and Maize on 46,000 ha. In vegetables, Green Peas is grown on 2,540 ha. of area and Potatoes are cultivated on 69,200 ha of land.

Cropping Pattern and Irrigation System Coriander is one of the major spices with sizeable area (16,27,000 ha) being diverted for Coriander , followed by chilly and garlic which occupy relatively lesser area presently under production in the district.

Table 5.4 Area under Major Crops in District

Crops	**Total area** (Area ('000 ha)	Crops	**Total area** (Area ('000 ha)
Pulses		**Horticulture crops - Vegetables**	
Soybean	312	Tomato	0.99
Jowar	25	Potato	6.92
Maize	46	Ladys Finger	1.37
Gram	152	Brinjal	0.83
Wheat	96	Green Peas	2.54
Horticulture crops – Fruits		Cauliflower	0.82
Mango	0.56	Cabbage	0.54
Guava	0.45	Kaddu Vargoya	0.96
Orange	22.05	Bitter guard	0.26
Sweet Lime	1.67	Others	1.47
Lemon	0.31	**Horticulture crops - Spices**	
Grapes	0.01	Coriander	16.27
Pomegranate	0.16	Chilly	1.68
Aamla	1.54	Garlic	6.14
Custard Aple	0.61		
Papaya	0.25		
Others	1.25		

Source: Agriculture Contingency Plan, Shajapur District, 2011

Similarly land under use for Orange production is higher compared to other horticulture fruit crops with 22,05,000 ha of area

Table 5.5 Sources of Irrigation in the District

Sources of Irrigation	Number of sources	Area (ha)
Canals	67	10,400
Tanks	109	7,300
Open wells	61759	145,000
Bore wells	18657	86,800
Lift irrigation	-	31,000
Other sources	-	281,000
Total	69506	-
Pump sets	-	-
Micro-irrigation	22	-

Source: *Agriculture Contingency Plan, Shajapur District, 2011*

The maximum area covered under a categorized source of irrigation, *Open Wells* is 145,000 ha covered through 6,1,759 wells . The second most used source of water in the District is *Bore Wells* with 86,800 hectares of land covered through 1,8,657 bore wells. Sources such as *Lift Irrigation, Canals* and *Tanks* come next to these main resources with 67 Canals and 109 Water Tanks. According to latest information collected in the year 2013 the ground water

level in Shajapur block was 8.42c in the month of January, which declined in the month of May to 6.85c, which further declined in the month of November of the same year till 4.13c. The average water level of the Shajapur district was reported to be 7.34 c in the year 2013, by the Central Ground Water Board of India.

Villages under the Wind Farm Area

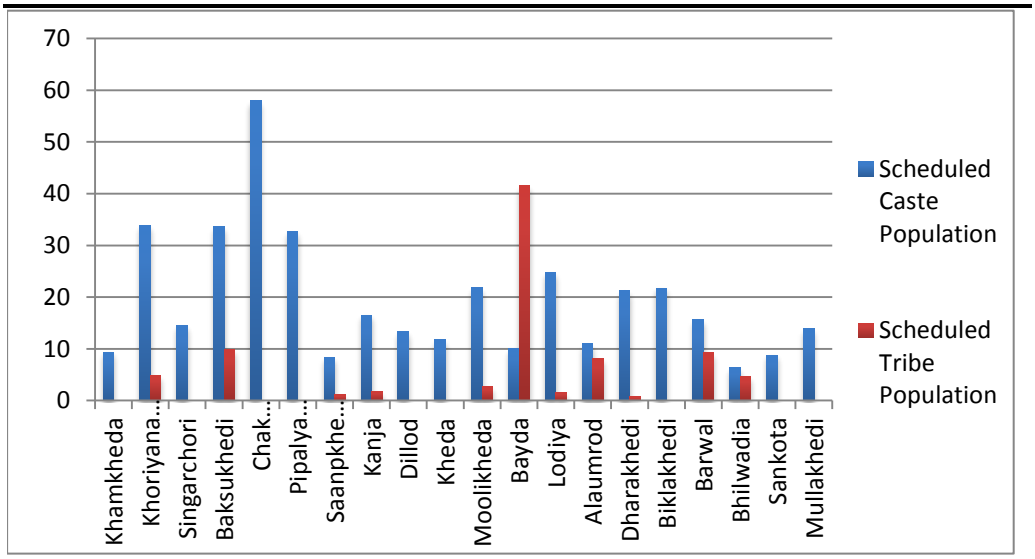
There are 46 villages within the total study area, out of which 20 fall under the core zone. The total population of the core zone area is 22,987 persons according to the 2011 Census of India. The largest villages with highest population are Alaumrod with 1957 inhabitants and Dharakhedi with 1973 inhabitants. The data suggests that 7 out of 20 villages viz. Khamkheda, Khoriyanayata, Baksukhedi, Saanpkheda, Kheda, Alaurmod, Lodiya, Bhilwadiya and Dharakhedi have Sex Ratio above 950 each. The average sex ratio of the wind farm area becomes 948 females per thousand males.

Table 5.6 Demographics of the Core Zone Villages

Name of Village	No of Households	Population	Sex Ratio	Scheduled Caste Population	Scheduled Tribe Population	Literacy Rate
Khamkheda	103	457	1067	9.4	0	49.47
Khoriyanayta	165	864	959	33.91	4.86	68.83
Singarchori	99	371	922	14.55	0	40.12
Baksukhedi	129	673	991	33.72	9.8	44.09
Chak Jiyajipur Pipalya	51	262	926	58.01	0	88.03
Gopal	403	1630	891	32.76	0	69.08
Saanpkheda	395	1696	965	8.43	1.17	61.42
Kanja	372	1853	918	16.56	1.78	67.95
Dillod	207	1273	911	13.35	0	65.19
Kheda	320	1729	963	11.74	0	66.99
Moolikheda	301	1426	983	21.87	2.66	27.79
Bayda	20	120	1307	10	41.66	15.38
Lodiya	211	1076	952	24.72	1.57	17.94
Alaumrod	432	1957	960	10.98	8.12	26.84
Dharakhedi	377	1973	965	21.33	0.76	32.74
Biklakhedi	309	1515	910	21.78	0.06	24.71
Barwal	244	1200	898	15.66	9.25	30.31
Bhilwadia	232	1158	969	6.47	4.66	28.06
Sankota	72	272	902	8.82	0	15.62
Mullakhedi	265	1482	976	13.96	0	19.09
Total	4707	22987	948	35.39	5.13	42.9825

Scheduled Caste and Scheduled Tribe

Figure 5.6 Proportion of SC and ST Population in the Wind Farm Area



As presented in the ***Figure 5.6*** the Scheduled Caste(SC) population is higher with 35.39% than the Scheduled Tribe(ST) population which is only 5% of the total population of both the core and buffer zones. The pattern is similar to that of the District where people belonging to SC are 23.39% and those belonging to ST are only 2.5% of the total population in the Shajapur. But the scenario is different from the State statistics where the ST populace in higher with 21.08% than the SCresidents who are 15.61% in strength out of the total population in Madhya Pradesh. The village is Bayda is the only exception in the wind farm area, with higher population of Scheduled Tribes with 41.66 % than Schedule Caste population.

Land Use Pattern

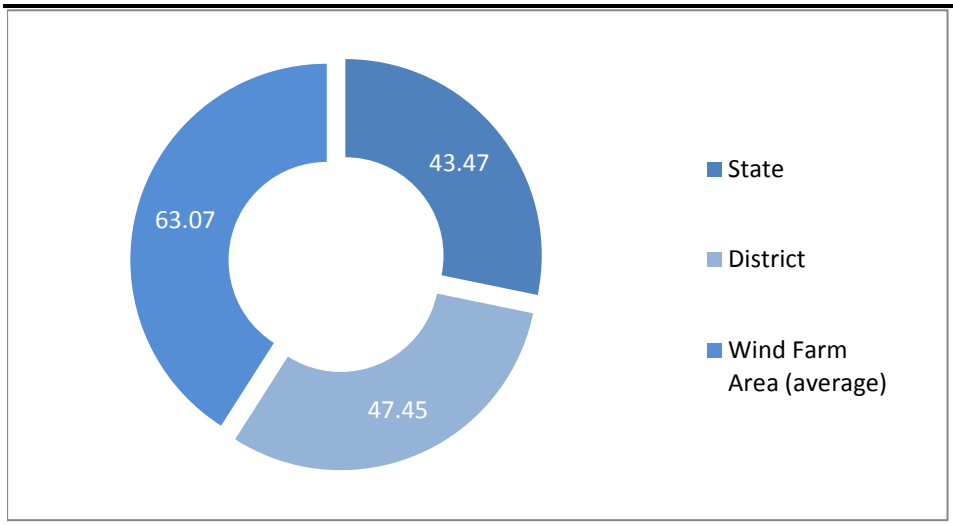
The land in the wind farm area can be mainly categorized as: *barren*, *cultivable/culturable waste*, *agricultural* and that covered under water bodies. As reported in the community consultations, 3.5 bigha (0.68 ha) can be considered as the average land holding of families in the wind farm area. There is a possibility that like the District scenario, a considerable proportion of land in the wind farm area falls under permanent pastures

Employment Profile Madhya Pradesh is known to be an agrarian economy, since around 74.73% of rural people of Madhya Pradesh are directly or indirectly, dependent on agriculture for their livelihood. The agriculture and allied services contribute about 44% share in the state's economy.

Census of India provides statistics of working population in each village of the country. These 'workers' are defined as all those persons engaged in 'work' defined as participation in any economically productive activity with or without compensation, wages or profit are workers(1). The total workers, in the wind farm area are 14,498 out of the total population of 22,987, which accounts

for a higher proportion of workers than the District and the State percentage of total workers, as shown in the ***Figure 5.7***.

Figure 5.7 Total workers



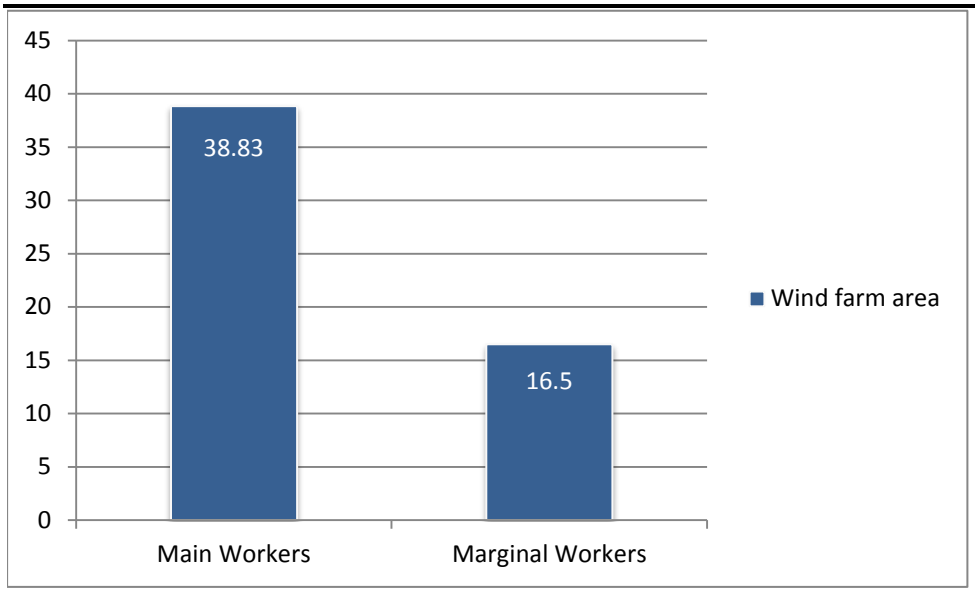
The total number of males from the wind farm area, engaged in work is 58.27%, while the rest are females. This scenario is similar to that of District's statistics where the total female workers are 39.48% compared to male workers who are 60.15%. The pattern again continues to be the same at the State level too; with 36.19% of female workers against 63.8% of male workers. With this kind of a difference in gender composition in workforce at all three levels, the population of male workers is uniformly higher than that of the female workers. As it was found from the community consultations, both the women and men were engaged in both agricultural and labour work, this was seen especially among the families at the bottom of the pyramid in terms of poor economic backgrounds.

These workers are further divided into two categories called as Main(1) and Marginal(2). As provided in the figure below, the population of main workers in the wind farm area is on the higher side with 5631 people, than that of the marginal workers with 2393 people.

(1) Main Workers are those workers who had worked for the major part of the reference period i.e. 6 months or more in a year. Census of India Defnitions and Concepts.

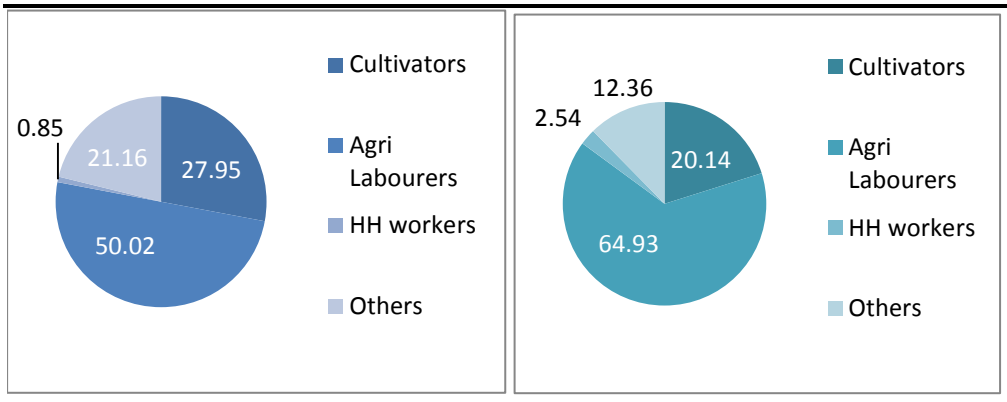
(2) Marginal Workers are those workers who had not worked for the major part of the reference period i.e. less than 6 months in a year. Census of India Definitions and Concepts

Figure 5.8 ***Main and Marginal Workers***



As is evident from the data presented in the ***Figure 2.9*** both in Main and Marginal categories, the *agricultural labourers* are more in the wind farm area as compared to the c*ultivators*. Amongst the Main workers, the *cultivators* are 27.95% while the rest are *agricultural labourers* while amongst the Marginal workers, the *agricultural labourers* are 64.93% while a small portion is of c*ultivators* again. This data supports the findings of the field visit, according to which the marginal and small land holders (1) who are more in the proportion to the large land holders lack water sources of their own for practicing agriculture. This leads to them opting for alternate livelihood options in the peak summer seasons when the general water availability in the area drops down considerably.

Figure 5.9 ***Categorised Proportion of Main Workers and Marginal Workers Respectively***



The population of workers engaged in *household Industry work* is marginally less than those of the workers engaged in Industry, Business and Services who are classified as *other workers*. As it is illustrated in the ***Figure 2.9*** the *household workers* in the Main category is hardly 0.85% while the *other workers* count for

(1) According to the Census of India definitions and concepts, Marginal land holders are those who possess land below 1 ha and Small land holders are those who possess land that varies from 1 ha to 2 ha

21.16% and similarly in the case of Marginal workers, the *household workers* are merely 2.54% while there are 12.36% of *other workers*.

Migration

Through community consultations, it was observed that many people living in the wind farm area avail livelihood opportunities through migration.. People migrate to other districts within Madhya Pradesh, like.g. Betul and Chindawda. They also migrate to other States like Rajasthan, Andhra Pradesh, Gujrat and Karnataka as daily wage labourers especially for construction of houses and other infrastructures. Most of the contractors providing migrant opportunities to the local villagers are themselves not local to these villages. People do not migrate with their families; as it was understood form the community consultations. The children and older adults in the families generally tend to stay back in their hometowns (within the wind farm area) while the male and female adults of the family migrate for a period of 4 months on an average. This departure usually takes place once in a year, after the celebration of Diwali festival when the monsoon rains are over. The reason being that, the *Kharif* crop (the monsoon crop) is harvested in the October, till when the landless as well as the marginal and small land owners can find work in their respective or nearby villages, on others' or own farm respectively. But the *Rabi* crop (the winter crop) is a difficult one to cultivate for those lacking personal water sources as the water level goes down in this period. The employment opportunities again open up in the month of May when the harvest session of *Rabi* crop begins, when especially the landless individuals return to their hometowns in the wind farm area.

Water Sources

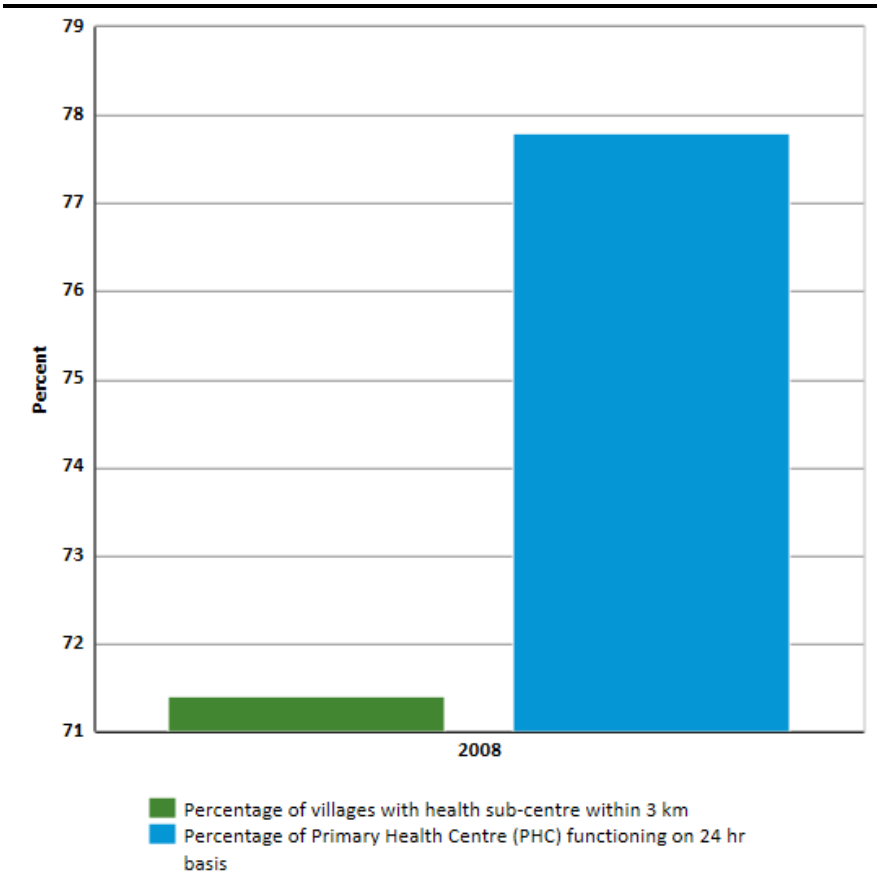
Water availability is a major issue in the wind farm area as the key rivers such as Kalisindh and Kundalaya at approximately 9 to 12 km of distance from different villages within the study area, run dry in the summers generally from the end of March till end of June. Water both for drinking and irrigation is provided by bore wells which are as deep as 700 ft. in some villages near 1km of the study area. People from Indira Awas Colony from Lahori Panchayatbring tankers for drinking water; mostly in the 4 months of extended summers and also during other seasons in the villages where the common water sources provide hard water which is not potable as shared by the villagers during consultations. This has reportedly created frequent stomach problems especially amongst the children in the area.

There are few hand-pumps located in the study area but most of them were found to be dry when the ERM team visited them in the month of April and May 2015. The villages generally face water availability crisis in the summer season, as told by the villagers during consultations. Most of the water sources in the village or vicinity dry up for almost four months starting from end of March till end of July.. Drinking water becomes a major issue during this season.

Health

The availability of public health institutions in the wind farm area was not highlighted as a key issue of the inhabitants as reported through the community consultations. Primary Health Centers (PHCs), Sub centers are available at distance of 4-6km from the villages with smaller populations. Every village was reported to have an Anganwadi. But availability of operational infrastructure within these institutions was stated to be a major issue by the community's consulted. There is a Primary Health Centre located in Lahori panchayat. As the district headquarter i.e. Shajapur located close by, most of the villagers access the district hospital and other private medical practitioners located in Shajapur. It was reported that Ambulance service is provided by the Health Department.

Figure 5.10 Primary Health Centres and Sub centres in district and state respectively



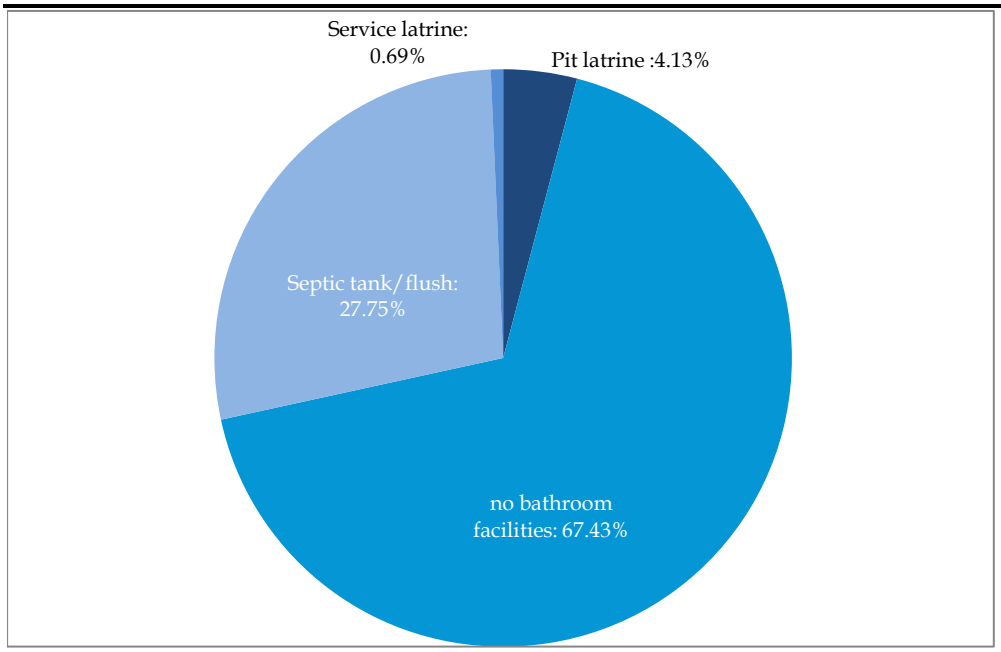
Source: India Development Indicators, 2012

Out of the total Primary Health Centers available at the District, not all remain operational for 24 hours a day. 77.8 % of the PHCs at the Shajapur District level, 73.1 % in Madhya Pradesh operate on 24 hours a day basis.

According to the Indian Public Health Standards (IPHS) there shall be one Sub Centre established for every 5000 population in plain areas and for every 3000 population in hilly/tribal/desert areas. There were total 71.4 % of villages who had sub centers within 3km of the village boundary in Shajapur District similar to the country's rate. In Madhya Pradesh this rate was 57 %, 2008.

There has been a recent progress in building of toilet facilities in the wind farm area; especially with the government's new scheme of Swatch Bharat Mission through which the government pays Rupees 12,000/- for each toilet to be built. In many villages people were seem to be availing this scheme for building personal toilets. In 2001 67.43 % of households in Madhya Pradesh, did not have any toilet facility. 27.75 % have septic tank/flush facility; 4.13 % of the households had pit latrines and 0.69 % of the households used service latrines.

Figure 5.11 ***Proportion of households by type of toilet facilities in the State***

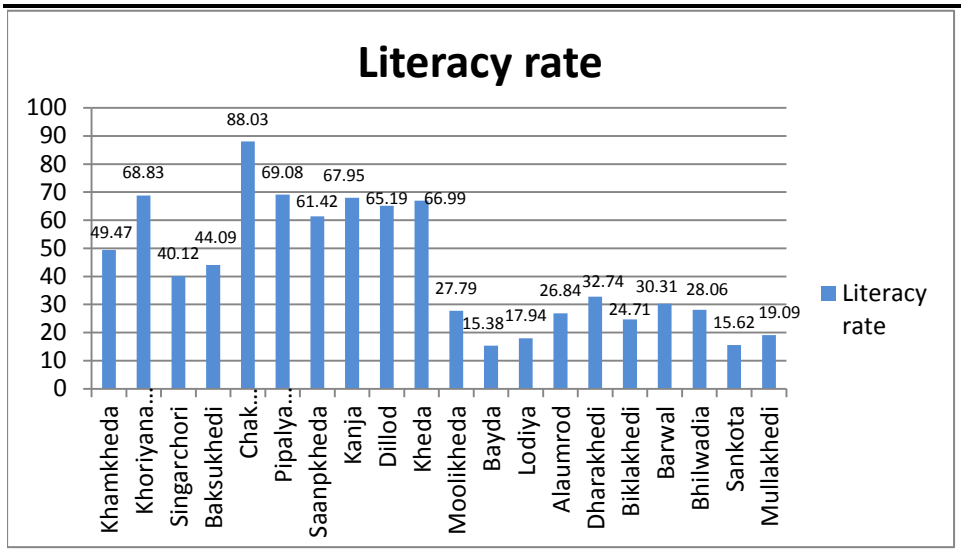


Source: *India Development Indicators, 2001*

Education

The average literacy rate in the wind farm area is 43 % which is below the State literacy rate of 69.31 %, District literacy rate of 69.08 % and the Block literacy rate of 73.92 %. While there are 10 villages in the wind farm area having literacy rate less than 40%. These villages as illustrated in the ***Figure 5.14*** are Moolikheda, Bayda, Lodiya, Alaumrod, Dharakhedi, Biklakhedi, Barwal, Bhilwadiya, Sankota and Mulakhedi. From the rest 10 villages with more than 40 % of literacy rate, Chak Jiyajipur is the one with the highest literacy rate of 88.03 %.

Figure 5.12 Literacy Rate in the wind farm area



Source: Census of India, 2001

The number of formal educational institutions in the Block has increased over a period of 12 years now. District statistics based on census 2001 suggest that that there are 1525 primary government schools in the district, 654 upper primary government schools, 804 private primary schools and 236 private middle schools in Shajapur district.

Table 5.7 Educational Facilitates in Shajapur District

Sr. No.	Institutions	Number of Institutions
1	No. of Colleges	7
2	Total no. of Government Schools Primary	1525
3	Total No. of Government Schools Upper Primary	654
4	Total no. of Private Schools Primary	804
5	Total no. of Private Schools Middle	236

Source: Census of India, 2001

At the block level, there are 280 government run primary schools, out of which 69 are upgraded from Educational Guarantee Schools (EGS) schools to primary schools. There are no government aided schools at the primary level. But unaided private primary schools are 125 in number out of the 405 total primary schools, at the Shajapur tehsil level.

Table 5.8 Enrolment Ratio at Shajapur District

Enrolment Ratio at different standards	Total	Male	Female
Primary gross enrolment ratio	108	108.4	107.6
Upper Primary gross enrolment Ratio	109.8	110	109.6
Elementary gross enrolment ratio	108.5	108.8	108.1
Primary dropout rate (%)	-	10.9	14.2
Ratio literate women to men (15-24 years)	0.7	-	-
Persons age 15+ completed primary education (%)	37.6	54.1	20

Source: Rajya Shiksha Kendra, Shajapur District, 2011

As evident from the figures above from ***Table 5.8*** the enrolment ratio of females in the District is almost equal to the enrolment ratio of the males at primary, upper primary and elementary level of formal education. At the primary level, 107.6 females and 108.4 males get enrolled. Out of these 14.2 % of females, dropout at the primary level itself wherein 10.9 % of males get dropped out of the school. 109.6 females and 110 males get enrolled at the upper primary level. Till the elementary level, the ratios almost match to be 108.8 for males and 108.1 for females for enrollment at schooling.

5.4 TOURISM

There are three sites in Madhya Pradesh declares by United Nations of Education, Scientific and Cultural Organisation (UNESCO) as World Heritage Sites. They are, Rock Shelters of Bhimbetka at approx. 135 meters from the project site, Buddhist Monuments at Sanchi at approx. 139 meters from the project site and group of Monuments in Khajurao at approx. 394 meters from the project site.

6 STAKEHOLDER CONSULTATIONS AND DISCLOSURE REQUIREMENT

The disclosure of project information and consultations with stakeholders has been increasingly emphasised by project finance institutions and government regulatory bodies. A brief overview of the requirements of public disclosure and stakeholder consultation applicable to this project is provided below.

Table 6.1 Overview of Disclosure and Stakeholder Consultation Requirements

Reference Regulation/ Standard	Requirements
IFC PS-1 Assessment and Management of Environmental and Social Risks and Impacts	• In keeping with this PS, community engagement is to be undertaken with the affected communities and must be free of external manipulation, interference, or coercion, and intimidation. • Furthermore, in situations where an affected community may be subject to risks or adverse impacts from a project, the proponent must undertake a process of consultation so as to provide the affected communities with an opportunity to express their views on the project risks, impacts, and mitigation measures, as well as allow the proponents to consider and respond to them. • *Informed participation:* For projects with significant adverse impacts on affected communities, the consultation process must ensure that free, prior and informed consultation with affected communities occurs and that processes exist to facilitate participation by those affected. • Apart from such a consultation process, the project proponents are also to establish a Grievance Redressal Mechanism, which will allow the affected communities' concerns and grievances about the project proponent's environmental and social performance to be received and allow for steps to be taken to resolve the same • *Broader stakeholder engagement:* The proponent must identify and engage with stakeholders that are not directly affected by the Project but those that have established relationships with local communities and/or interest in the Project – local government, civil society organisations, etc. – and establish a dialogue.

6.1 CATEGORIZATION OF STAKEHOLDERS

A stakeholder is 'a person, a group, or an organization that has direct or indirect stake in a project, because it can affect or be affected by the project actions, objectives and policies'. Stakeholders vary in terms of degree of interest, influence and control they have over the project. While those stakeholders who have a direct impact on the project or are directly impacted by the project are known as **Primary Stakeholders,** those who have an indirect impact on the project or are indirectly impacted by the project are known as **Secondary Stakeholders**. Keeping in mind the nature of the project and its setting, the stakeholders have been identified and listed in the table given below.

Table 6.2 Stakeholder Group Categorization

Stakeholder Groups	Primary Stakeholders	Secondary Stakeholders
Community Stakeholders	• Local Labourers	• Local community • Agricultural Labourers • Vulnerable Community
Company's Project Stakeholders	• Sub-contractors	•
Institutional Stakeholders	• Gram Panchayats • Project investors	• Village Institutions (schools, anganwadis and health centres)
Government Bodies	• Regulatory Authorities; • District Administration	
Other Groups		• Media • Other industries/projects

6.2 ON-GOING STAKEHOLDER ENGAGEMENT

It is understood that the project is in its planning stage thus the number of ongoing activities with the stakeholders are limited. The details of the ongoing consultations are provided in the following table.

Table 6.3 On Going Stakeholder Engagement

Stakeholder	Purpose of engagement
Madhya Pradesh Power Transmission Company Ltd. (MPPTCL)	• Principle Land Allotment Letter for the Pooling Sub Station.
Madhya Kshetra Vidyut Vitaran Company Ltd. (MKVVCL)	• Power Evacuation Approval.
Local Community	• Identification of land and encroachers on revenue land, Social acceptability of the Project, Negotiations for purchase and easement of identified land.

Source: Discussions with the Inox and Ostro Project team

Ostro has focused on the 'employment' aspect for continued engagement with local community. Ostro will ensure the maximum number of workers getting engaged in the project activities beginning with the construction phase, are hired from local communities; at least for security, guarding of wind masts, semi-skilled construction work etc. Employment will be provided subsequently against the discussions with the village level committees about the available skill base for wind energy project development, in order to make the process transparent and consultative.

6.3 STAKEHOLDER ANALYSIS

The table below (*Error! Reference source not found.*) provides the profile of the key stakeholders who might have certain direct or indirect impact. These stakeholders have also been classified in accordance with the level of influence they might have over the project as well as their priority to the project

proponent in terms of importance. The influence and priority have both been primarily rated as:

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

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

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

6.4 LIMITATIONS

Some essential data for identifying the social and legal risks related to the project's development, remained inaccessible to the ERM team and hence there are limitations in specific inquiry of a few imperative parameters of the Impact Assessment which are land and indigenous peoples. For example, information of the land owners was not revealed by the Inox's land team. As the company did not wish to share any intimation of land purchase to the land owners before approaching them for negotiations; because that might lead to raise in the land rates, costing more money to the project. This causes a major limitation while assessment of impacts of the project on the directly affected people. One cannot perceive if the land take for the project can generate any landless households; is there any tribal land involved in the process; which kind of land has been mainly taken for the project varying from barren to agricultural to cultivable waste to non-agriculture etc.

Moreover, the structure of land team of the Inox who is the developer for Ostro in this project, was not shared. Though as shared by Inox's during

consultations, local people appointed for identification of interested land sellers in the area, are not permanent or temporary employees of Inox.

Table 6.4 Stakeholder Analysis

	Stake-holder Category	Relevant Stake-holders	Profile/Status	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinion, Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
1	Primary	Local Labourers	• The local area/wind farm area has adequate workforce in unskilled category. Most of the working population of the local area is of cultivators/ agriculture labourers; • There are very few and small-scale industries in the surrounding area where some of the people from the wind farm area are employed; • Also there are significant numbers of people migrating to neighbouring districts and states every year for construction work.; • Hence there is immediate availability of unskilled youth for labour purpose; • The local availability of wage earners is however linked to the agricultural season.	• The proportion of locals being employed will only be limited to the construction phase; though the local wage earners have high expectation of employment from the project; • There might be an overall positive perception associated with local employment generation by the project; • The employment of local labourers might positively influence the project operations, in strengthening project relations with the local community and building a positive rapport.	• The stakeholder group will play an important role during the project construction phase. Aspects such as timely payments for work undertaken, other support for conducive work conditions etc. will lead to either a positive or negative impact on the project	• The primary concerns for these stakeholders pertain to the timely payment of wages and dues for the work completed, continued employment and non-farm vocational training for the local labourers and an emphasis on the health and safety aspects of the work conditions on site.	Low to Medium
2	Primary	Migrant Workforce	• There will be a substantial migrant workforce working in the construction phase primarily related to the	• The project might have an overall positive impact over the migrant workforce by generating employment	• Retaining migrant workforce is quite critical for the project as there is a large dependence over them, especially during the construction phase of the	• Timely payment of wages; • Safe working conditions; • Health benefits and support when required; • Security to minimize any	Low

	Stake-holder Category	Relevant Stake-holders	Profile/Status	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinion, Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
			civil construction works; • This workforce will be employed by Inox; • Typically, for 1 location, the work involves 2-3 days and about 25 men to complete the task.	opportunities for them; • The accommodation facilities inclusive of room, drinking water, toilets, kitchen and lights etc. facilities will need to be ensured by the Contractors and found to be satisfactory according to the IFC requirements and Ostro Accommodation Guidelines.	project; • The migrant workforce resides in a rented accommodation provided by the company and is dependent upon the company for all basic facilities. Therefore better accommodation of the labourers, timely payments of the wages will result in building good understanding of the company in the labourers.	problems with the host community.	
3	Primary	Gram Panchayats	• The Panchayat is the lowest levels of local governance and consists of one or more revenue villages. This body of local governance was accorded with a number of responsibilities and powers as part of the 73rd Amendment to the Constitution. • As part of this, most of the rural development schemes and funds for central schemes are channeled through this body of governance. • Also, it is the Panchayat who are bestowed with the decision making authority for economic development	• The project is expected to have a positive impact over this stakeholder group through extending support in community development activities and by strengthening their role in this entire process of facilitation through CSR activities.	• GPs play an important role in overall mobilization and shaping the perception and opinions of the people in the project area. • They play a role even in demanding community development works for social welfare purpose. • Consultation with GP has also been made for permissions regarding traffic flow, road diversions, if any etc.	• Key concern is of the nature of minimal livelihood impacts, if any, due to the project purpose. • Key expectation will include: local employment generation and support through adequate CSR activities.	Medium to High

	Stake-holder Category	Relevant Stake-holders	Profile/Status	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinion, Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
			and social justice. Thus in order for the smooth and proper functioning of the project, the Consent of the Panchayat is imperative.				
4	Primary	Regulatory Authorities	• The primary authorities in Madhya Pradesh for renewable energy (wind power) are MPPTCL and MKVVCL.	• The project has ensured compliance with the relevant guidelines and policy recommendations as per the State Govt. • The project needs permission and coordination with the District Trade and Industries Centre (DTIC) for local infrastructure and other supports required for smooth industrial operation.	• The MPPTCL has given the project its land allotment letter for the Pooling Sub Station, which will be required for other project components too. • The MKVVCL has provided the PEA to the project, which will need to be renewed on annual bases.	• The key expectations of the regulatory authorities is ensuring that the project proponent meets all the statutory compliances and that the project operations are undertaken as per the conditions put forth by the authorities and after having obtained all the necessary permits.	Medium
5	Primary	District/ Tehsil Admin	• The project area is administered by government bodies at three levels: at the district level, at the block/tehsil level and at the Panchayat level in each village/or cluster of villages. • The local administration in this regard refers to the district and block level administration comprising of the offices of the Tehsildaar, District Collectors, and Revenue	• The District/Tehsil Administration play a critical role in facilitating the land registration process which is still ongoing; • The project is expected to have a positive influence over the local administration by extending support through these authorities or by collaborating to undertake any community development	• The construction phase requires a number of permissions and support from the local administration. • The procedural complication can cause significant project delay. • The land-matters can give rise to unnecessary litigations (especially pertaining to lack of records or encroachment issues in case of access roads etc.). • Also the examination of the land identified for the project is carried out by the	• The overall opinion of the local authorities is positive towards the project owing to the fact that it may trigger some local employment and other opportunities in the form of local contractors, hiring local vehicles, dependence on local products/goods etc. • The key concern would however remain that the project operations are carried out smoothly with minimal negative impact on the local community.	Medium to High

	Stake-holder Category	Relevant Stake-holders	Profile/Status	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinion, Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
			officer etc. The revenue department (sub registrar) is responsible for registration of land sale, mutation, updating and recording and transfer of land. • The allotment of Govt. land for project purpose is provided by the District Collector on the basis of which the lease land is provided for 30 years.	activities.	Commissioner of Land Records for giving a go ahead with the construction phase. Identification of appropriate parcels of land should thus be done in order to avoid delays and more compliance requirements to be fulfilled.		
6	Secondary	Local Community	• These stakeholders are comprised of the communities residing within the wind farm area (formed by joining the boundaries of all WTG locations). • The area comprises of Hindu and Muslim religious groups. The most dominant sub-group among these includes Patidars (OBC). • Of the total, an average of 35.39 % and 5.13 % of the total population in the study area comprise of SC and ST population respectively. • The community in the study area is primarily	• There is anticipation that the project will generate adequate local employment. However, most of the local employment will be limited to the construction phase. • There are several from the community member who have been indirectly dependent on the land sold to the project, and hence have to be compensated through adequate entitlements. • In addition, the CSR activities focused on education and health, among others will also be targeted at the	• The local community plays an important role in facilitating, supporting and ensuring smooth operations of the project at a day to day level. • During construction phase, the labourers will be mostly provided from the local community.	• The primary expectation would be adequate employment generation at the local level. • In addition, contributing positively through targeted community development activities would be also among the key expectations.	Medium

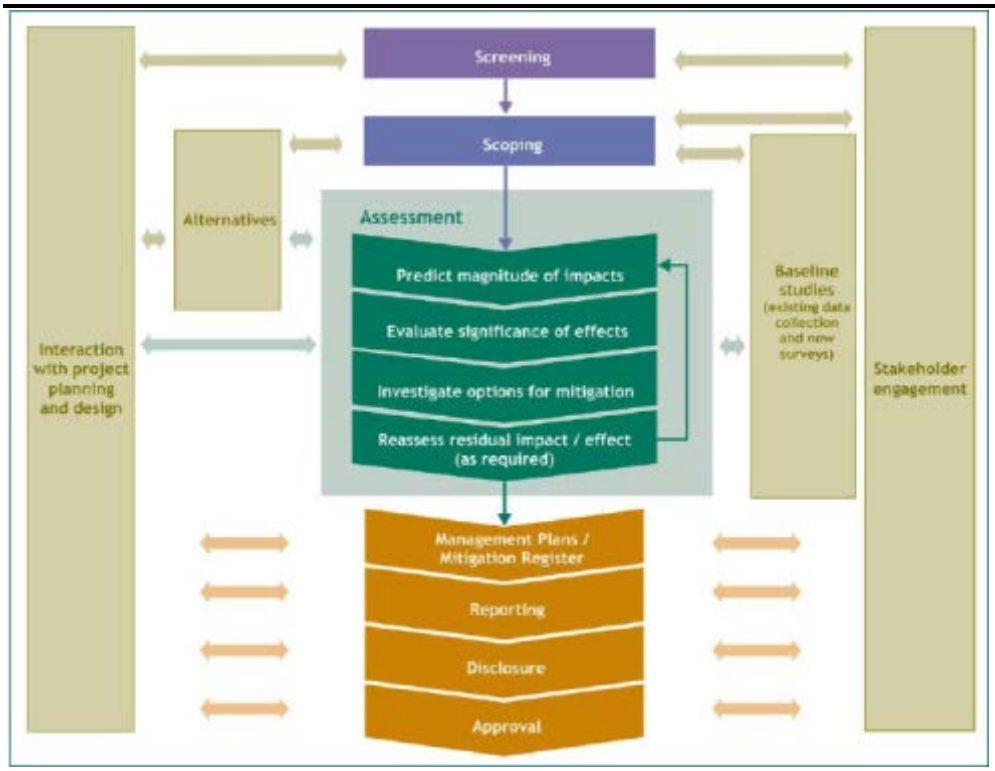
	Stake-holder Category	Relevant Stake-holders	Profile/Status	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinion, Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
			dependent on agriculture and livestock rearing for their livelihood, followed by wage labour and other activities etc.	neighboring villages and the immediate local community which will lead to improvement in livelihood.			
7	Secondary	Vulnerable Community	• This stakeholder group comprises of the socially backward and marginalized castes/communities such as SC, Muslims, women, differently abled people, aged, infirm and BPL families.	• The project proponent may be required to focus on providing employment opportunities to the vulnerable community members as part of their CSR activities; • Preference could be given to these families for hiring local workers and providing skill based trainings if any such opportunities come up.	• The stakeholder group will have a limited or negligible impact on the project.	• Key concerns and expectations would range from targeted support to vulnerable families, involving them in the ambit of beneficiaries through community development activities.	Low
8	Secondary	Civil Society/Local NGOs	• There are NGOs based in Shajapur focused on improving the livelihood of the rural communities by supporting the various facets of their social life; • There are however limited NGOs that are directly active in livelihood projects in the study area villages;	• The project might directly collaborate or indirectly extend support to any of the ongoing activities being carried out or initiate newer ones in the study area for community development etc.	• The stakeholder group often plays a significant role in representing the interests of the vulnerable sections and related socio-economic issues. There are organisations like Kisan Sangharsh Samiti and Bargi Bandh Visthapit Sangh, who have mobilized themselves against some major nuclear projects and land issues in Madhya Pradesh in the past. • Also some local NGOs might	• The opinion of this stakeholder group may vary depending on whether the project operations have had any negative or positive impact over the community. With respect to Shajapur District, years long encroachment over revenue land might have developed into the CPRs which should be considered while providing compensations. • The expectations of this group might align with the vulnerable	Medium to High

Stake-holder Category	Relevant Stake-holders	Profile/Status	Impact/Influence of the Project on this Stakeholder Group	Impact/Influence of the Stakeholder Group on the Project	Expectations, Opinion, Key Concerns of Stakeholders	Overall Rating of Stakeholder Influence
				see the wind farm project as an opportunity for future such projects bringing short and long term livelihood options, especially for the marginal land owners and the landless households in Shajapur.	sections of the population. • To involve the village level committees in the process than directly dealing with such small dispute cases could help avoid any unnecessary delays and issues in the project development.	

Impact Assessment Methodology

The ESIA study being undertaken by ERM follows the standard Impact Assessment Approach (IA) comprising of stages of Screening, Scoping, Assessment and Management. ERM's approach and methodology for the Project is illustrated in ***Figure 7.1***. The ESIA has been undertaken following a systematic process that predicts and evaluates the impacts the Project could have on aspects of the physical, biological, social/ socio-economic and cultural environment, and identifies measures that the Project will take to avoid, minimise/reduce, mitigate, offset or compensate for adverse impacts; and to enhance positive impacts where practicable. The stages of the ESIA process are summarized below.

Figure 6.1 ***Approach adopted by ERM for the project***



6.5 SCREENING

At the initial stage of the ESIA process, preliminary information was provided to aid in the determination of what legal and other requirements apply to the Project. This step was conducted utilising a high level description of the Project and its associated facilities.

The screening process involved the following:

- Reviewing of applicable regulatory framework for proposed Wind Power Project;
- Reviewing of available project related activities and their impacts on various components of environment;

- Collection and compilation of available secondary baseline data from different sources; and
- Categorization of Project as per ADB/IFC guidelines.

6.5.1 Kick-off Meeting

The ERM team had a brief kick-off meeting with the Ostro team prior to site reconnaissance visit. A discussion was also held with regard to the expectations from this assessment in terms of scope of work, deliverables, timeline and the methodology to be followed for the same.

6.5.2 Document Review

Desk based review of the relevant documents of the project site and its surroundings were carried out to have a clear understanding of the Project and its impacts.

Review of secondary information

A review of the secondary information available on the project area, the administrative block, the district and the state was undertaken so as to allow for the primary data to be substantiated and complimented.

6.5.3 Site Visit

ERM undertook eight days site visit that is from 8th to 12th April, 2015 and then 5th to 7th May 2015 (revisited for the WTG profiling of the substituted WTG locations) to understand the site setting, environmental and social sensitivities and to identify the relevant local stakeholders.

The site visit included a walkover of the site and associated facilities with Ostro team. Limited consultation with the local community, local community representatives, local NGOs and local government officials was conducted to understand the local environmental and social issues in the area and to receive feedback from stakeholder on these issues. During the visit, following was identified:

- Key social and environmental risks/receptors in the Project influence area;
- Issues of environmental pollution and resource usage;
- Prevailing community engagement processes;
- Aspects of community health and safety, if any, linked to the operations;
- Significance of impacts on biodiversity and natural resource management;
- Discussions with the local communities in the vicinity to understand their views of the project.

6.5.4 *Categorisation*

ERM has categorised the Project by following the IFC[1] categorisation criteria based on the screening assessment, site visit, environmental and social sensitivities and limited consultation. Based on site specific environmental and social impacts identified, the project is categorized as 'B'.

6.6 *SCOPING*

The main objective of the Scoping is to ascertain the environmental issues associated with the Project on which ESIA study will be focused by reviewing the Project information and ascertaining likely environmental issues associated with the Project activities through matrices. Scoping process determines terms of reference for ESIA study to be conducted for the proposed Project activities. This process helps in ensuring that all the relevant issues are identified and addressed in an appropriate manner in the ESIA study.

For this ESIA study, scoping has been undertaken to identify the potential Area of Influence for the Project (and thus the appropriate Study Area), to identify potential interactions between the Project and resources/receptors in the Area of Influence and the impacts that could result from these interactions, and to prioritize these impacts in terms of their likely significance.

This stage is intended to ensure that the impact assessment focuses on issues that are most important decision-making and stakeholder interest.

6.7 *PROJECT DESCRIPTION*

In order to set out the scope of the Project features and activities, with particular reference to the aspects which can impact on the environment, a Project Description is prepared. This is based on information as provided by the Project Proponent. The project description is provided in *Section 2* of this ESIA report.

6.8 *BASELINE CONDITIONS*

Environmental baseline data has been collected through primary monitoring and surveys of the study area of 5 km distance from Project area. Secondary information through literature surveys was also collected for the study area. The detailed baseline characterisation for the Project is provided in *Section 4* of this ESIA report.

[1] Definitions of project categories as per IFC (http://www1.ifc.org/wps/wcm/connect/corp_ext_content/tobedeleted/definitionofprojectcategories/projectcategories definitions)

6.8.1 Study Area

The study area considered for ESIA will include an area within 5 km radius from farthest of WTGs based on Project Footprint area and Area of Influence that has been described below:

Project footprint Area

The Project Footprint is the area that may reasonably be expected to be physically touched by Project activities, across all phases. The wind farm site covers xxx hectares of land (excluding roads, and internal OH Transmission Line) situated in Lahori and other villages in Tehsil and District Shajapur of Madhya Pradesh State. Physically, there is no boundary or fencing for the Project Site boundary and hence it is contiguous with the rest of the area.

Project Area of Influence (AOI)

The effects of the Project and Project activities on a particular resource or receptor will have spatial (distance) and temporal (time) dimensions, the scale of which is dependent on a number of factors. These factors are incorporated in the definition of the Project's *Area of Influence (AoI)*.

Box 6.1 Area of Influence- IFC, 2012

For the ESIA, the definition of AoI used in the Performance Standards was applied (IFC, 2012):

This area of influence encompasses, as appropriate:

The area likely to be affected by: (i) the project and the client's activities and facilities that are directly owned, operated or managed (including by contractors) and that are components of the project; (ii) impacts from unplanned but predictable developments caused by the project that may occur later or at a different location; or (iii) indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent.

Associated facilities, which are facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable.

Cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted.

Source: IFC Performance Standards on Environmental and Social Sustainability, 2012

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

- **Environmental parameters:** Project site boundary, immediate vicinity, access road and surroundings, i.e. a study area of approximately 5 km distance from project line has been used to depict these parameters;
    - **Air Quality:** Dust emissions, fugitive dust –typically up to 100 m from operations and maintenance area;

- **Noise:** Noise impact area (defined as the area over which an increase in environmental noise levels due to the Project can be detected) –typically 1 km from operations (this includes a distance of 10 times the size of the rotor diameter of the WTG);
- **Land environment:** The impacts on soil and land- typically upto 100 m from project foot print area;
- **Flora and Fauna (Terrestrial and Aquatic):** This includes: (a) the direct footprint of the project comprising the wind farm; (b) The areas immediately adjacent to the project footprint within which a zone of ecological disturbance is created through increased dust, human presence and project related activities (e.g., trampling, transportation activities). This kind of disturbance has been estimated to occur within 2 km of the project footprint;

- **Social and Cultural:** The project footprint is spread across Lahori and other villages. This is taken as the area of influence, as social impacts largely remained confined to these villages.

6.9 STAKEHOLDER ANALYSIS AND CONSULTATIONS

An effective ESIA Process requires engagement with relevant stakeholders throughout the key stages. This assists in understanding stakeholder views on the Project and in identifying issues that should be taken into account in the prediction and evaluation of impacts.

ERM identified/profiled the various stakeholders of the project, such as the affected families, the village-level key informants, the line departments (revenue, land, agriculture, forest), state/district administration and civil society organisations as well as developed an understanding of their stakes, interests and influences on the project. Details of the Stakeholder Engagement activities undertaken for this Project to date are presented in *Section 6* of this ESIA report.

6.10 IMPACT IDENTIFICATION/PREDICTION

Impact identification and assessment starts with scoping and continues through the remainder of the ESIA Process. The principal IA steps are summarized in ***Figure 7.2*** and comprise of:

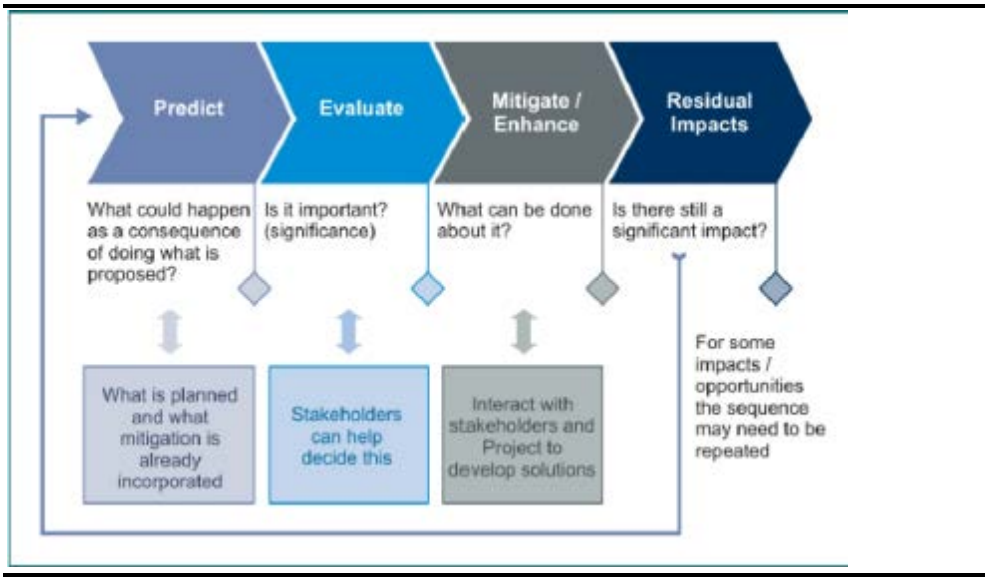
Impact prediction: to determine what could potentially happen to resources/receptors as a consequence of the Project and its associated activities;

Impact evaluation: to evaluate the significance of the predicted impacts by considering their magnitude and likelihood of occurrence, and the sensitivity, value and/or importance of the affected resource/receptor;

Mitigation and enhancement: to identify appropriate and justified measures to mitigate negative impacts and enhance positive impacts;

Residual impact evaluation: to evaluate the significance of impacts assuming effective implementation of mitigation and enhancement measures.

Figure 6.2 Impact Assessment Process



Details of the Impact Assessment undertaken for this Project are presented in *Section 7* of this ESIA report. The details on terminology used to describe impact characteristics are provided Table 5.1.

Table 6.5 Impact Characteristic Terminology

Characteristic	Definition	Designation
Type	A description indicating the relationship of the impact to the Project (in terms of cause and effect)	Direct Indirect Induced
Extent	The "reach" of the impact (e.g. confined to a small area around the Project Footprint, projected for several kilometres, etc).	Local Regional International
Duration	The time period over which a resource/receptor is affected.	Temporary Short-Term Long-Term Permanent
Scale	The size of the impact (e.g. the size of the area damaged or impacted , the fraction of a source that is lost or affected, etc.)	No fixed designations; intended to be a numerical value or a qualitative description of "intensity"
Frequency	A measure of the constancy or periodicity of the impact	No fixed designations; intended to be a numerical value or a qualitative description

6.10.1 *Impact Significance*

Impact significance is designated to various impacts using the matrix shown in ***Figure 7.3***

Figure 6.3 ***Impact Significance***

		Sensitivity/Vulnerability/Importance of Resource/Receptor		
		Low	Medium	High
Magnitude of Impact	Negligible	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

The matrix applies universally to all resources/receptors and all impacts to these resources/receptors, as the resource/receptor-specific considerations are factored into the assignment of magnitude and sensitivity/ vulnerability/ importance designations that enter into the matrix. *Error! Reference source not found.***2** provide a context for what the various impact significance ratings signify.

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

Table 6.6 ***Impact Significance Rating***

Impact Significance Rating	Details
Negligible	Where a resource/receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations.
Minor	Where a resource/receptor will experience a noticeable effect, but the impact magnitude is sufficiently small and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. In either case, the magnitude should be well within applicable standards.
Moderate	An impact of moderate significance has an impact magnitude that is within applicable standards, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does

Impact Significance Rating	Details
	not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.
Major	Where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of IA is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual impact of a facility. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the Project.

6.10.2 Cumulative Impacts

A cumulative impact is one that arises from a result of an impact from the Project interacting with an impact from another activity to create an additional impact. Potential cumulative impacts are discussed in the relevant assessment Sections. How the impacts and effects are assessed is strongly influenced by the status of the other activities (e.g. already in existence, approved or proposed) and how much data is available to characterize the magnitude of their impacts.

The approach to assessing cumulative impacts in this ESIA is to screen potential interactions with other projects on the basis of:

- Projects that are already in existence and are operating; and
- Projects that are approved but are not constructed or operating.

Since, this is a greenfield site – located in a rural area that has few, scattered industrial facilities, cumulative impact assessment has not been conducted.

6.10.3 Identification of Mitigation and Enhancement Measures

The evaluation of significance of impacts will lead to proposition of mitigation and enhancement measures. ERM adopts the following mitigation hierarchy that is outlined below:

- **Avoid at source, Reduce at Source**: the design of the project should encompass methods for avoiding and reducing at source (e.g siting or re-routing activity away from sensitive areas or reducing by restricting the working area or changing the time of the activity).
- **Abate on site:** Addition to the design to reduce impact (pollution control equipment, traffic controls, perimeter and screening and landscaping).
- **Abate at Receptor**: If an impact cannot be abated on-site, then control measures can be implemented off-site (e.g. noise barriers to reduce impact at a nearby residences)

- **Repair or Remedy:** For impacts that is inevitable (eg storage of raw materials or WTG components on agricultural land), they can be addressed through repair, restoration or reinstatement measures.
- **Compensation:** Mitigation measure adopted for loss, damage and disturbance that is proportionately compensated (eg. Planting to replace for tree felling, financial and livelihood compensation for loss of agricultural land.

6.10.4 Impact Assessment Matrix for Ecological Assessment

The impact assessments for assessing impacts on ecology were undertaken based on following impact assessment matrix as presented in ***Table 6.7*** for Habitats and ***Table 6.8.***

Table 6.7 Habitat-Impact Assessment Criteria

Habitat Sensitivity/ Value	Magnitude of Effect on Baseline Habitats			
	Negligible	Small	Medium	Large
Negligible	Not significant	Not significant	Not significant	Not significant
Low	Not significant	Not significant	Minor	Moderate
Medium	Not significant	Minor	Moderate	Major
High	Not significant	Moderate	Major	Critical

Description of Magnitude of Effect on Baseline Habitats (In columns)

Negligible	Effect is within the normal range of natural variation
Small	Affects only a small area of habitat, such that there is no loss of viability / function of the habitat
Medium	Affects part of the habitat, but does not threaten the long-term viability / function of the habitat.
Large	Affects the entire habitat, or a significant proportion of it, and the long-term viability / function of the habitat is threatened.

Description of Habitat/Sensitivity/Value (in rows)

Negligible	Habitats with negligible interest for biodiversity.
Low	Habitats with no, or only a local designation / recognition, habitats of significance for species listed as of Least Concern (LC) on IUCN Red List of Threatened Species, habitats which are common and widespread within the region, or with low conservation interest based on expert opinion.
Medium	Habitats within nationally designated or recognised areas, habitats of significant importance to globally Vulnerable (VU) Near Threatened (NT), or Data Deficient (DD) species, habitats of significant importance for nationally restricted range species, habitats supporting nationally significant concentrations of migratory species and / or congregatory species, and low value habitats used by species of medium value.
High	Habitats within internationally designated or recognised areas; habitats of significant importance to globally Critically Endangered (CR) or Endangered (EN) species, habitats of significant importance to endemic and/or globally restricted-range species, habitats supporting globally significant concentrations of migratory species and / or congregatory species, highly threatened and/or unique ecosystems, areas associated with key evolutionary species, and low or medium value habitats used by high value species.

Table 6.8 Species-Impact Assessment Criteria

Baseline Species Sensitivity/ Value	Magnitude of Effect on Baseline Habitats			
	Negligible	Small	Medium	Large
Negligible	Not significant	Not significant	Not significant	Not significant
Low	Not significant	Not significant	Minor	Moderate
Medium	Not significant	Minor	Moderate	Major
High	Not significant	Moderate	Major	Critical
Description of Magnitude of Effect on Baseline Habitats (in column)				
Negligible	Effect is within the normal range of variation for the population of the species.			
Small	Effect does not cause a substantial change in the population of the species, or other species dependent on it.			
Medium	Effect causes a substantial change in abundance and / or reduction in distribution of a population over one, or more generations, but does not threaten the long term viability / function of that population, or any population dependent on it.			
Large	Affects entire population, or a significant part of it causing a substantial decline in abundance and / or change in and recovery of the population (or another dependent on it) is not possible either at all, or within several generations due to natural recruitment (reproduction, immigration from unaffected areas).			
Description of Baseline Species Sensitivity/Value (In Row)				
Negligible	Species with no specific value or importance attached to them.			
Low	Species and sub-species of LC on the IUCN Red List, or not meeting criteria for medium or high value.			
Medium	Species on IUCN Red List as VU, NT, or DD, species protected under national legislation, nationally restricted range species, nationally important numbers of migratory, or congregatory species, species not meeting criteria for high value, and species vital to the survival of a medium value species.			
High	Species on IUCN Red List as CR, or EN. Species having a globally restricted range (ie plants endemic to a site, or found globally at fewer than 10 sites, fauna having a distribution range (or globally breeding range for bird species) less than 50,000 km2), internationally important numbers of migratory, or congregatory species, key evolutionary species, and species vital to the survival of a high value species.			
Negligible	Species with no specific value or importance attached to them.			

6.11 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

The results of ESIA study will form the basis of developing ESMP incorporating measures and procedures for the short and long-term environmental and social management of the Project during its various stages.

The Environmental and Social Management Plan (ESMP) is developed for the Project and is presented in *Section 9* of ESIA report.

7 IMPACT ASSESSMENT AND MITIGATION MEASURES

7.1 INTRODUCTION

This section assesses the manner in which the Project will interact with elements of the physical, ecological or social environment to produce impacts to resources/ receptors. This has been organised as per the various stages of the project lifecycle to understand the risks and impacts associated with each of these individual stages.

7.1.1 Phases of Project Life Cycle

A typical windfarm project consists of following key activities falling under four distinguished phases:

- Pre-construction/ Planning phase;
- Construction phase;
- Operation and maintenance phase; and
- Decommissioning phase.

The activities involved under different phases are provided in ***Section 2.4.***

7.2 IMPACT ASSESSMENT

Based on the Potential Interactions Matrix for Project activities and likely impacted resources/ receptors for construction phase of the proposed project as shown in ***Table 7.1*** following areas of impacts have been identified:

- Land use;
- Ambient Air Quality;
- Water Resources;
- Soil;
- Ambient Noise Level;
- Visual;
- Community health and safety impacts;
- Social impacts;
- Ecological; and
- Occupational Health and Safety

7.2.1 Environmental Impacts

Table 7.1 Identified Environmental Impacts through Wind Project Life Cycle

Project Phase and Activity \ Environmental and Social Resources/ Receptors	Land use	Soil/Land Environment	Ambient Air Quality	Water Environment	Ambient Noise Quality	Ecology	Visual / Aesthetics	Occupational Health and Safety	Demography (Influx and Displacement	Local Economy and Employment	Natural /Common Property Resources	Land based Livelihoods	Community Health and Safety	Labor and Human Rights	Social Infrastructure and Services	Culture and heritage
Pre-construction Phase																
Micro-siting planning of WTGs																
Land Purchase																
Construction Phase																
Clearance of vegetation from identified activity areas																
Establishment of Labour camp, batching plant, storage areas for WTG parts and other equipment and construction materials																
Upgrading/construction of access roads																
Mobilization of labour and equipment																
Internal road construction (connecting WTGs) within Wind farm site																
WTG components and raw material transportation to site																
Site clearance, foundation excavation and construction at each of WTG sites																
Construction of Substation complex and SCADA complex																
Erection of internal electrical lines inside wind farm site																
WTGs erection and substation installations																
WTG commissioning																
Transmission Line Erection																
Operation Phase																

Environmental and Social Resources/ Receptors / Project Phase and Activity	Land use	Soil/Land Environment	Ambient Air Quality	Water Environment	Ambient Noise Quality	Ecology	Visual / Aesthetics	Occupational Health and Safety	Demography (Influx and Displacement	Local Economy and Employment	Natural /Common Property Resources	Land based Livelihoods	Community Health and Safety	Labor and Human Rights	Social Infrastructure and Services	Culture and heritage
Regular remote monitoring of operations					■											
Scheduled maintenance activities (WTGs, sub-station, electrical lines, storage yard, SCADA building)		■		■				■					■			
Decommissioning Phase																
Replace WTG turbines with new ones		■	■		■			■		■			■			
Remove WTG parts and ancillary facilities		■	■		■		■	■		■			■	■		
Remove internal electrical lines		■	■		■		■	■		■			■	■		
Restoration of wind farm site land	■	■				■					■	■				

White Box: "Scoped out" – will not be further dealt with
Grey Box:"Scoped out" – Discussion that includes the evidence base should be provided to justify the basis on which this decision was made
Black Box: Retained for further discussion

Table 7.2 Interactions resulting into significant impacts

Interaction (between Project Activity and Resource/Receptor)	Justification for Expectation of Potentially Significant Impacts
Land and soil Environment	• Permanent change in land use at WTG sites and ancillary facilities; • Removal of top soil could lead to loss of good quality soil; • Erosion of loose soil especially during windy periods; • Impact on soil and land environment due to improper management of domestic solid waste generated; • Storage and handling of hazardous materials (e.g., fuel and lubricant) and waste generated from operation of construction equipment and machinery and their maintenance may lead to soil contamination due to leaks/ spillage;
Ambient Air Quality	• Dust emissions due to movement of machinery and vehicles; • Fugitive dust emissions due to operation of batching plant, excavation and back filling activities etc.; • Air emissions due to operations of DG sets.
Ambient Noise Quality	• Noise generation due to movement of vehicles and heavy earth moving machineries; • Generation of noise during operation of batching plant, DG Sets (though if equipped with acoustic enclosures, noise impact would not be significant); • Generation of noise due to operation of Wind Turbines.
Water Environment	• Surface water contamination due to improper disposal of sewage at wind farm site; • Impact on surface water quality due to runoff from storage area during monsoon. Though during the assessment most of the ponds were dry, however it might not be the case throughout the year.
Ecology	• No forest land will be diverted for the project; • Removal of vegetation causing impact on ecology of the area; • Habitat destruction during temporary laying of wires adjacent to the ROW of internal electrical lines; • The operation of wind farm may result in collisions of birds and bats with wind turbine rotor blades, potentially causing bird and bat mortality or injury.
Visual Landscape	• The project Lahori is located on undulated land with few hillocks. The visual landscape of the area will be altered due to the WTGs and supporting facilities.
Occupational health and safety	• Occupational health hazards due to dust and noise pollution; • Safety risk due to wrong handling of construction machinery, working at height; • Exposure of workers to Electromagnetic field (EMF) while working in proximity to charged electric power lines during operation and maintenance.
Demographics	• Influx of people for employment opportunity. • Presence of Transient Population.
Social and cultural fabric	• Impacts on cultural aspects due to differences in customs of outside workers and local residents.
Economy and Employment	• Job opportunities due to project specially unskilled labour like drivers, helpers and security; • Indirect impact on local economy through development of secondary facilities.

Land based Livelihood	• The diversion of the cultivable land for non-agricultural use will reduce the availability of land for land based livelihood practices.
Community health and safety	• Potential for introduction of communicable disease due to outside labour in the area; • Transportation of WTG components, other construction materials and increased vehicular movement will lead to traffic hazards for community residing close to the access roads though it should be noted the population is located sparsely in this area; • During the detailed WTG profiling, the habitations were observed within 300 m; thus impacts of shadow flicker effect is anticipated from Lahori project and results are dealt in detail in subsequent sections.
Social Infrastructure and Services	• The social infrastructures and services such as road usage and transport services, education and health services etc. will be shared by Inox and its sub-contractors.
Labour and Human Rights	• The construction activities are expected to employ a considerable number of labour, local and migrant. In keeping with this, specific attention will have to be paid for ensuring that the project meets the requirements of the applicable rules and regulations, such as the Inter State Migrant Workmen (Regulation of Employment and Conditions of Service) Act 1979 and the Contract Labour (Regulation and Abolition) Act 1970 • The wind farm assets will be guarded by security personnel who would be armed. Such armed security workforce will have the potential for human rights violation.
Natural Hazards	As per earthquake hazard map, wind and cyclone and Flood hazards of India prepared by Building Materials and Technology Promotion Council (BMTPC) the project site and Jaisalmer regions falls in: • *Zone II:* Low damage risk zone for earth quake, • High damage risk zone (Vb= 47m/s) for wind and cyclone and; • Area not susceptible to flood

Table 7.3 Scoped-out social and community health impacts in construction phase

S. No.	Impact Title	Reason for Scoping-out
1	Impact on cultural resources and heritage structures	There are no reported archaeological or heritage site in project footprint area. Based on the site assessment, no local shrines, graveyards, mosques or cultural attachment could be identified or falling within the WTG footprint area, except for one Hanuman Temple The consultations with local people also did not reveal any cultural significance of any natural landscape that would be modified in construction activities of the project.

7.2.2 *Change in Land Use*

Source and Impact Assessment

The WTGs have been proposed in agricultural land, barren/fallow land. The major anthropogenic activities observed in the study area were agricultural and quarrying of stone chips. The project would result in change of the land use wherein the WTGs, PSS and the internal roads are proposed. About a hectare of land will be required per WTG totalling up to 50 ha for the project and further land will be required for internal roads that is yet to be firmed up. Land will also be required for installation of transmission towers. During the construction phase, additional land will be temporarily required for labour camp (1500 sq. m.), storage yards, batching plants (1000 sq. m.) and site office.

Impact Assessment-Project

The project activity that may alter the land use of the area during the Project life cycle for over a period of time is given below:

Table 7.4 Periodic alteration of Landuse

S. No.	Activity	% of total project footprint	Duration
1	Siting of site office, labour camp, batching plant, storage yard	-	Temporary (10-11 months)
2	Access road construction/strengthening and its consequent usage	-	Permanent
4	WTG erection, PSS, transmission towers with transmission lines	-	Permanent

The land that is used for agrarian activities or grazing purpose will be converted for industrial purpose (WTG and PSS) for a minimum of 30 years. This will lead to a long term change in land use. The labour camps will be sited at 2-3 locations consequently during the construction period. It has been reported that agricultural areas will be avoided for siting of temporary facilities.

Embedded Mitigation Measures

The temporary facilities will not be sited on agricultural lands.

Suggested Mitigation Measures

The following mitigation measures will be implemented to minimize potential impacts on land use:

- The land procured for the Wind farm should be minimized to optimum level[1]

[1] Letter No. D.O.No. 61/20/2011-WE dated 15th May, 2012

- The land utilized for temporary project activities should be restored to original state.

Impact Significance

The significance of impact on change in land use is evaluated on the basis of the change in land use being directly associated with conversion from agriculture or fallow land to industrial land, wherein the duration of the impact will be for long term since the average life span of a wind farm is 30 years. But the extent of the impact will be local and limited to the area procured by the developer. Since the change in land use will continue from construction until operational phase the impact has been assessed together. This impact will occur inevitably and cannot be avoided. Assuming that the land procured for the WTGs are not marginal landholders, the impact will be low.

Table 7.5 Impact on change in Land use

Impact	Change in Landuse				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to project footprint				
Frequency	During Construction and operation phase of Project				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low	Medium	High		
Impact Significance before adopting mitigation measure	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Minor.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impacts is considered **Negligible**				

7.2.3 Landscape Alteration- Visual

Source and Impact Assessment – Construction Phase

The project will involve transportation of WTG components in long trailers siting of batching plants, movement of excavators, storage of construction materials, erection of WTGs with cranes during construction phase. These activities will be visibly attractive for passer byes and inhabitants in a rural set up and draw unnecessary attention.

Embedded Mitigation Measures

None reported

Suggested Mitigation Measures

The mitigation measures adopted during construction phase are the following:

- The access for the WTGs and transportation of the WTG components should not be through any villages.
- The batching plant should be barricaded and located in the downwind direction away from inhabitation at least 300 m from habitation
- Restoration of the land to its original condition upon completion of construction works.

Impact Significance – Construction Phase

The construction activities will be temporary in nature (8-10months) and will shift along with sequential WTG construction. The impact significance has been evaluated for construction phase.

Table 7.6 Impact due to Landscape – Visual Alteration during Construction Phase

Impact	Landscape Visual Alteration				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to land footprint and beyond				
Frequency	Construction phase of Project				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low	Medium	High		
Impact Significance before adopting mitigation measure	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Minor.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impacts is considered **Negligible**				

Source and Impact Assessment – Operation Phase

The terrain for the proposed WTG is undulating. The WTGs are primarily proposed in the upward slope or the top of the slope. The villages are in the lower elevation and will have a full view of the WTGs. The landscape will be

altered and dotted with tall towers (hub height-92m with a rotor diameter of 100 m) with rotating blades. The shadow flicker effect caused due to rotating blades in the operation phase has been dealt in detail in ***Section 8.3***. There has been no official study in India on capturing perception of people where WTGs have been installed. The general perception of the people could not be captured through consultation since this is a greenfield project. The PSS is a permanent structure located in the vicinity of Fruit orchard – Pomegranate. The base zero EHV tower (minimum ht-20m[1]) will be located within 200 m of PSS. The EHV transmission towers of minimum 20 m will be located in between existing EHV towers; hence will add to the existing landscape.

Embedded Mitigation Measure

The WTGs will be located 300 m away from sensitive location and National Highways.

Suggested Mitigation Measures

- The PSS area should be landscaped with medium shrubs that will help blend with the surrounding fruit orchards.
- The study area is pre-dominantly an open scrubland. Hence, top or middle canopy trees should be provided in the periphery of the villages to reduce the visual impact.
- Neutral colour and anti-reflective paint for towers and blades should be selected

Significance of Impact after adopting mitigation measures

Since, the WTGs are proposed in an open scrubland, that has very few tall trees, hence it will be a visual intrusion for the inhabitants. The significance of the impact has been evaluated to be minorbased on the receptor sensitivity and impact magnitude.

Table 7.7 Impact due to Landscape – Visual Alteration during Operation Phase

Impact	Landscape Visual Alteration				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term		Long-term	Permanent
Impact Extent	Local		Regional		International
Impact Scale	Extends beyond land footprint				
Frequency	Operation phase of Project				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large

[1] http://www.slideshare.net/rssraaz/ehv-ac-transmission-line

Resource /Receptor Sensitivity	Low		Medium		High
Impact Significance before adopting mitigation measure	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Moderate.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impacts is considered **Minor**				

7.2.4 *Change in Topography*

Sources and Impact Assessment – Construction and Operation Phase

The terrain is undulating where the elevation where WTGs have been proposed, ranges from 401 m to 535 m. The footprint of land proposed for WTG and the internal roads will be levelled by slope cutting. The internal roads will be prepared to access the WTG sites from the approach roads. The internal roads have to be prepared keeping in mind that there will be movement of heavy vehicles transporting WTG components, Crane components, EHV tower components, etc. The levelling of land may result in change in slope of the area that may impact upon the drainage of the area. Since cultivation is practised in and around the proposed WTG land parcels, hence there is a risk of drainage in adjoining cultivable area leading to soil erosion resulting into loss of fertile soil or loss of standing crops.
Improper construction of roads might lead to slope failures. Few WTGs are proposed at the base of hillocks like LAHP-93, 14 and 16. They remain under the risk of flash flood.

Embedded Mitigation Measures

The geotechnical study conducted during internal road assessment will help determine the extent to which the internal roads have to be strengthened. It is reported that slope stabilization will also be conducted in this study.

Suggested Mitigation Measures

The levelling of WTG should not lead to alteration of the slope of the area. This should be taken care in the designing stage itself and implemented properly while doing earthworks.

The soil excavated during levelling of land to be used for backfilling of the WTG footprint in excess of foundation area. The remaining soil can be used for backfilling in internal roads.

Storm water drains of adequate depth (considering maximum rainfall in past 10 years) have to be constructed around the periphery of the abovementioned WTGs to contain the sudden heavy flow of water.

Significance of Impact on Topography - Construction and Operation phase

The significance of impact without mitigation measure is moderate since loss of soil fertility or loss of crops will create a sensitive issue and after adopting mitigation measure\ impact is expected to be minor.

Impact	Change in Topography				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Adjoining land of WTG and internal roads				
Frequency	Construction and operation phase of Project				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low	Medium	High		
Impact Significance before adopting mitigation measure	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Moderate.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impacts is considered **Minor**				

7.2.5 *Change in Soil Environment*

Sources and Impact Assessment –Construction Phase

Loss of soil fertility

The land parcels used for installing project facilities will involve groundwork, requiring removal of top soil. The topsoil is the fertile zone ranging from 3-4 inches in the Project area. Topsoil will be lost if not conserved properly, thus resulting into loss of fertility. Excavators will be used for digging the pits (3m depth) for WTGs. There will be movement of heavy vehicles, movement of construction workers and storage of construction materials like Steel Bars, sand, cement and stone chips, establishment of temporary facilities and foundation laying. Further activities like WTG erection, EHV tower erection and stringing of electrical wires will involve workers walking over adjacent land beyond the facility footprint. This will result in soil compaction and impact on soil fertility, particularly in case of agricultural soil.

Embedded Mitigation Measures

The aspect of loss of Topsoil and its re-use has been identified and methods for its prevention has been outlined in IWISL's Environment, Health and Safety Manual.

Suggested Mitigation Measures

The mitigation measures to be adopted during construction phase are following:

- Use of top soil in PSS and wherever required for plantation or agricultural activity.
- The routes for movement of heavy machinery shall be designated to avoid the soil compaction in other areas
- Scheduling the erection of WTG, EHV tower erection and stringing of wires in non-agricultural season
- Compacted soil to be ploughed after completion of work.
- Topography should be restored to the extent possible and re-vegetated for slope stabilization and to prevent soil erosion;

Impact significance on soil environment – Construction Phase

The significance of impact after adopting mitigation measure impact is expected to be **negligible.**

Table 7.8 Impact on Soil Environment during Construction Phase

Impact	Loss of Soil Fertility				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Project and its adjoining areas				
Frequency	Construction phase of Project				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low	Medium	High		
Impact Significance before adopting mitigation measure	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Minor.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impacts is considered **Negligible**				

Source and Impact Assessment - Waste Generation during construction

General construction waste generated onsite will comprise of surplus or off-specification materials such as concrete, wooden pallets, steel cuttings/filings, packaging paper or plastic, wood, metals etc. Municipal domestic wastes consisting of food waste, plastic, glass, aluminium cans and waste paper will also be generated by the construction workforce and labour camp site. A small proportion of the waste generated during construction phase will be hazardous and may include used oil, hydraulic fluids, waste fuel, grease and waste oil containing rags. If improperly managed, solid waste could create impacts not only to land but also to local air quality, water quality, and human health.

The construction contractors will have control over the amount and types of waste (hazardous and non- hazardous) produced at the site. The municipal waste from the labour camp will only be routed through proper collection and handover to local municipal body for further disposal. The hazardous wastes will be temporarily stored in labelled drums on impervious surface at designated area onsite and will be disposed of through approved vendors in accordance to Hazardous Wastes Rules, 2008.

Table 7.9 Waste generated, their sources and method of disposal

S. No.	Waste Type	Source	Estimated Quantity	Method of Disposal
Non-hazardous waste				
1	Domestic solid waste	Labour activities	100 kg/day	Waste will be segregated onsite and will be disposed of at site as approved by local authority.
2	Construction Debris (excavated earth)	Construction of WTG, Access road, substation, Storage yard etc.	0.5 – 1.0 tonne/day	Back soil will be returned to the farmers through Gram Panchayats; Remaining excavated materials to be used for backfilling and levelling and other debris shall be used for construction of small check dams according to water shed development plan.
3	Packaging waste containing wood, cardboard and other recyclables	Packing material for WTGs and Accessorises	~10 kg per WTG	Return back to the suppliers
4	Sludge from Wastewater Septic Tanks	Labour Camp	15 kg/month	Collected and disposed off through contractors
5	All non-recyclables	Construction activities and Labour camps	5- 10 kg/day	Collected and disposed off by the contractor at designated landfill sites.

S. No.	Waste Type	Source	Estimated Quantity	Method of Disposal
Hazardous waste				
1	Used oil/ waste oil	DG set, construction machinery	5-10 litres/month	Collected and disposed off through approved recyclers in accordance to Hazardous Waste Rules, 2008.
2	Oil contaminated rags	Cleaning activities	10 kg/month	Collected and disposed off through approved vendors in accordance to Hazardous Waste Rules, 2008.

Embedded Mitigation Measures

Procedure of waste management in maintaining store safety, housekeeping, conservation of top soil has been outlined in the IWISL Safety Manual.

Mitigation Measures

- Implementation of procedures outlined and strict supervision of compliance to waste management procedures
- Construction contractor should ensure that no unauthorized dumping of used oil and other hazardous wastes is undertaken from the site;
- Construction contractor should ensure daily collection and periodic (weekly) disposal of construction waste generated debris, concrete, metal cuttings wastes, waste/used oil etc.;
- Ensure daily collection and disposal of domestic waste;
- Ensure hazardous waste is properly labelled, stored onsite at a location provided with impervious surface, shed and secondary containment system;

Impact Significance

During construction phase, the impacts will be localised and mainly confined to the areas of waste generation and their storages. As mentioned above, the hazardous waste will be stored in drums on impervious surface onsite and disposed of as per Hazardous Wastes Rules, 2008. The significance of impacts is assessed as **negligible** after adopting mitigation measures..

Table 7.10 Waste generation during construction phase

Impact	Waste generation (hazardous and non- hazardous)			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Limited to Project area			
Frequency	Construction phase			
Likelihood	Likely			

Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/Receptor Sensitivity	Low		Medium		High
Impact Significance before adopting mitigation measure	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Minor.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impacts is considered **Negligible**				

Soil Contamination

Diesel will be stored in 3-4 barrels totalling to 200litre. Other materials such as oil, paints and solvents will be stored in drums in storage area having impervious floors.

Soil contamination during the construction phase may result from leaks and spills of oil, lubricants, or fuel from heavy equipment, improper handling of chemical/fuel storage and wastewater. Such spills could have a long-term impact on soil quality, but are expected to be localised in nature. Storm water run-off from the contaminated area can pollute the downstream soil and water quality of receiving water body.

Embedded Mitigation Measures

The method for storage of Oil and lubricants in a contained area has been mentioned in the IWISL EHS Manual.

Suggested Mitigation Measures

Spill control measures such as the storage and handling of chemicals and fuel in concrete areas with secondary containment will be implemented to minimize impacts in the event of a spill. The sewage generated onsite will be treated and disposed through septic tanks and soak pits as per specifications given in IS 2470: 1995 (Part I and II).

Apart from the embedded controls to be included in project design, the following mitigation measures will reduce the negative impacts of construction activities on soil environment:

- Transport vehicles and equipment should undergo regular maintenance to avoid any oil leakages;
- An unloading and loading protocols should be prepared for diesel, oil and used oil respectively and workers trained to prevent/contain spills and leaks ; and
- Use of spill control kits to contain and clean small spills and leaks.

Impact Significance

The likelihood of direct negative soil contamination impacts is 'unlikely' and will mainly be confined to the WTG land parcels and along access/internal roads and camp site.

Table 7.11 Soil Contamination during construction phase

Impact	Soil Contamination				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to Project activity area				
Frequency	Construction phase				
Likelihood	Unlikely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance before adopting mitigation measure	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Minor.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impacts is considered **Negligible**				

Impact Assessment-Operation phase

The main sources which can impact soil during operation phase are:

- Spillage of chemicals or oil during maintenance work such as lubricating oils from gearbox systems, hydraulic systems of the turbine;
- Spillage of oil from activities in the substation area e.g. transformer oil;
- Other wastes as oil, grease, rags, and used oil generated from the substation area.
- Solid waste (food and office waste) generated at substation & administrative building (about 5 – 10 kg/day).

Significance of Impact

The spillages/leaks may contaminate the soil at the WTG and substation location. Storm water run-off from the contaminated area can pollute the downstream soil.

The probability of the impact is only during WTG maintenance and therefore occasional. Each WTG requires about 20 litres per annum of hydraulic as well as gear oil for the gearbox and generator maintenance activities. The waste oil generated is about 325 litres of gear oil and 45 litres of hydraulic oil which is

generated after every 5 years. Initially, the first service check for the maintenance is done twice after 3 months called as Class A services and the second service is done after 3 months again and is called Class B service. This service is carried out quarterly after 1st year of commissioning and eventually it is carried out half yearly every year. As the quantities are not massive any oil contamination may be limited to minor spills. The chances of storm water run-offs contaminating the downstream soils are also moderate especially during the rainy season and the post monsoon season as the area received good amount of rainfall during June to September.

The waste/used oil generated for the maintenance activities yearly is insignificant and would be sold to the nearest Treatment, Storage, and Disposal facility. The waste and sewage from the sub-station complex would be routed through proper collection and treatment/containment. There will be storage facility for oil and unloading of the same will be carried out at designated area.

Mitigation Measures

In accordance with best practice, any works including foundations for the turbine and substation would be a minimum of 20 m from any watercourse.

The other measures include:

- Soil stockpiles should be protected from wind or water erosion through placement, vegetation or appropriate covering;
- Proper drainage controls such as culverts, cut-off trenches would be used to ensure proper management of surface water runoff to prevent erosion;
- Monitor the soil quality at least once in 2 years near yard location and close to scrap storage points and other possible soil contamination points such as fuel storage, e-waste storage, waste battery storage, transformer oil storage, DG set, below transformer location at WTG sites, yards, stores and at all places where top soil discolouration is found.
- If soil contamination is found at a particular location, then ground water/surface water quality also needs to be checked if not done earlier under water quality monitoring program; and
- Cleared or disturbed areas would be rehabilitated as soon as possible to prevent erosion.

Based on the above the impact on land and soil during operation phase is assessed to be **negligible**.

Table 7.12 Impact Significance on Soil Environment during Operation & Maintenance Phase

Impact	Soil Contamination		
Impact Nature	Negative	Positive	Neutral

Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to WTG locations, substation and storage yard				
Frequency	Operation phase				
Likelihood	Unlikely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High		
Impact Significance before adopting mitigation measure	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Negligible.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impacts is considered **Negligible**				

Impact Assessment - Decommissioning Phase

The decommissioning activities will cause following impacts on soil:

- Soil compaction due to the increased vehicular and workforce movement, dismantling and storage of WTG components on the adjacent land, removal of internal electric lines/ poles etc.
- Waste will be generated in form of dismantled WTG components and demolition debris from WTG foundations, storage yard and SCADA complex. Electric components such as transformers, insulators, wires will be generated. The waste will be mainly of inert nature;
- The possibility of soil contamination during decommissioning phase is very less and will be due to leakage from machinery and transportation vehicles and during collection of remaining oil/ lubricants in the WTGs.

The decommissioning of the wind farm will be carried out in a planned manner. During decommissioning phase, the quantity of waste generated will be high. The waste will be routed through proper collection, storage and disposal. The waste will be evaluated for its recycling/ reuse/ scrap value and disposed of accordingly.

Embedded Mitigation Measures

None Reported

Mitigation Measures

Following mitigation measures are proposed to reduce the impacts of wind farm decommissioning activities on soil environment:

- The vehicular movement during decommissioning activities should be restricted to the designated route path;
- The demolition/ dismantling waste should not be left over in whole project area and to be collected and stored at designated area only for further segregation and disposal.

Impact Significance

The overall significance of impacts on soil environment due to decommissioning activities is assessed as **minor** before adopting mitigation measure.

Table 7.13 Soil environment during decommissioning phase

Impact	Soil environment				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to Project area				
Frequency	Decommissioning phase				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource/Receptor Sensitivity	Low	Medium	High		
Impact Significance before adopting mitigation measure	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Minor.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impacts is considered **Negligible**				

7.2.6 Ambient Air Quality

Source and Impact Assessment –Construction Phase

Vehicular transportation is imperative for any phase of the project be it during site visit at planning stage, material transportation in construction phase and routine inspection during operation stage. Further, Batching plant will be used during construction phase. DG sets will be used in construction and operation phase. Soil excavated for levelling of WTG Footprint and internal roads will be a major source of air pollution if left piled near its source. The project is located in rural environment. The addition of vehicular pollutants to the rural atmosphere will be temporary in nature. Dust generated due to vehicular movement on *kutcha* road has been generally reported to settle down at a

distance of 250m. The particulates and the concoction of pollutants emitted in the air have deleterious health effect if exposed for a long duration.

Embedded Mitigation Measures

Water will be sprinkled on road surfaces in the vicinity of inhabitation or any busy road.
DG set will be provided with stack of adequate height.

Mitigation Measures

Adequate mitigation measures should be adopted to control the emissions. The mitigation measures are as such:

- Plying of maintained vehicles that have PUC certificates
- The foundation pits should be covered at the earliest. The materials excavated should be reused at the earliest
- The Batching plant should be located away from human habitation in the downwind direction
- The stockpiles should be kept in covered areas
- DG sets fitted with stacks of adequate heights
- Parking of vehicles at designated area
- Idling of vehicles restricted
- Proper housekeeping should be maintained and there should be no concrete mix leftovers in project areas.

Impact Significance – Construction Phase

The evaluation of significance of impacts for construction phase is given below.

Table 7.14 Impact Significance on Air Quality during Construction Phase

Impact	Air Quality during construction phase				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Project and its adjoining areas				
Frequency	Construction phase of Project				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low	Medium	High		
Impact Significance before adopting mitigation measure	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Minor**				

Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impacts is considered **Negligible**				

Source and Impact Assessment –Operation Phase

It is to be noted that during operation phase the major impact on air quality is the emissions due to vehicular transportation for normal and emergency situations, operation of DG sets in emergency, maintenance of access roads.

Embedded Mitigation Measures

DG set with adequate stack height in compliance with CPCB standards.

Suggested Mitigation Measures

The vehicles deployed will be regularly maintained. The internal roads will be properly maintained.

Impact Significance – Operation Phase

These activities are low in occurrence and of small magnitude.

Impact	Air Quality during operation phase				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Project and its adjoining areas				
Frequency	Operation phase of Project				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low	Medium	High		
Impact Significance before adopting mitigation measure	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Minor**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
	Negligible	Minor	Moderate	Major	
Residual Impact Significance	Significance of impacts is considered **Negligible**				

Source and Impact Assessment – Decommissioning Phase

Decommissioning will involve demolition of structure that will lead to fugitive dust emission. Further there will be vehicular movement for removing dismantled project components and demolished materials. This will lead to air pollution.

Embedded Mitigation Measures

None reported.

Suggested Mitigation Measures

The area of demolition is to be covered with jute/cotton cloths of adequate height to act as screen.

Impact Significance – Operation Phase

These activities will occur in most probability thirty years from now. Any unforeseen incident could also lead to dismantling of WTG that will be of low scale compared to decommissioning.

Impact	Air Quality during decommissioning phase				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Project and its adjoining areas				
Frequency	Decommissioning phase of Project				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low	Medium	High		
Impact Significance before adopting mitigation measure	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Minor**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
	Negligible	Minor	Moderate	Major	
Residual Impact Significance	Significance of impacts is considered **Negligible**				

7.2.7 *Sharing of Water Resources*

Context

Water will be required for producing concrete mix in the batching plant and for curing in the foundation work of WTGs and PSS. Further water will be required for labour camp. In operation phase water will be required for domestic purpose.

Impact Assessment- Construction Phase

As per CGWB[1], Shajapur district has been notified as a semi-critical category with a negative ground water balance where withdrawal is more than recharge. The water level in the study area on average is below 300ft. The rain water from the elevated zones is embanked in lower elevation. The embanked water remains until November-January. It was observed during field visit, women in villages travel long distances to collect water for domestic purposes. It has been estimated; approximately 83,000m^3 water will be required for construction activities that have been reported to be met through supply of surface water. Chillar dam lies within 5km of the WTG clusters and has a live capacity of 31.11 million cubic meter[2] Chillar Dam will be the major source of water during construction. However, the local community is also dependent on Chillar Dam for their water sourcing. Hence, there might be a conflict in common resources.
Drinking water will be met through packaged supply from the local market.

Embedded Mitigation Measures

None reported.

Suggested Mitigation Measures

Since the requirement of water is for short term, and Chillar Dam closer to the proposed wind Farm will be preferred, it is necessary for the Project Proponent to discuss with the relevant authority in the Shajapur to resolve the issue of conflict on sharing of common resources wherein the focus of the discussion should be following:

- The disclosure of correct information about the approximate quantity of water that will be required
- Schedule of the construction activities

Further mitigation measures are proposed for conservation of water resources of the area:

- Water should be used optimally during construction phase
- Construction laborers should be made aware of the scarcity of water in the area

Significance of Impacts

The water abstracted from Chillar Dam will be low in quantity compared to the live capacity of the Chillar Dam. Moreover the duration is for short term.

[1] http://cgwb.gov.in/District_Profile/MP/Shajapur.pdf

[2] http://www.india-wris.nrsc.gov.in/Publications/BasinReports/Ganga%20Basin.pdf

Table 7.15 Impact on Sharing of Water Resources during Construction Phase

Impact	Sharing of Water resources during construction phase				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Chillar Dam in the study area				
Frequency	Construction phase of Project				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low	Medium	High		
Impact Significance before adopting mitigation measure	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Moderate**.				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
	Negligible	Minor	Moderate	Major	
Residual Impact Significance	Significance of impacts is considered **Minor.**				

7.2.8 *Change in Water Quality*

Context

The estimated wastewater generation is 80% of the total water consumption i.e. 2640m^3 during construction phase and further 0.8KLD during operation phase. There is a potential for ground and surface water contamination especially microbiological if the wastewater is not properly managed. The hydrogeology of the area shows that shallow ground water occurs in the weathered vescicular, jointed fractured zones of basaltic flows generally under unconfined conditions at some places under semi-confined to confined conditions due to the presence of thickly silty clays overlying the jointed rocks in the cases of deeper aquifer. The terrain is undulating and water is embanked in lower elevations.

The storage water will be provided with secondary containments for storing oil and used oil/chemicals. Spill control plan will be followed to prevent soil and ground water contamination.

The waste water generated from labour camps and PSS will contaminate the groundwater if improperly managed. The storm water runoff from storage yards, PSS may contaminate the surface waterbodies that are in vicinity.

Embedded Mitigation Measures

It has been reported that the labour camps will be provided with toilets with soak pits. Storm water drains will be constructed in PSS.

Mitigation Measures

The following precautionary measures should be adopted in the project designing stage:

- The toilets with soak pits have to be designed, built and managed as per IS 2470 Part I 1985 and Part II 1990.
- Licensed contractors will be employed for management and disposal of waste sludge.
- Storm water drains have to be designed considering maximum High Flood level of the area.
- Oil to be stored in stored in embanked, covered area of the buildings to have water harvesting fcailities
- All permanent buildings

Impact Significance

There will be no direct open discharge of wastewater from the project facility. Since, the terrain is rocky that is fractured and fissured, shallow aquifers may be impacted if the septic tanks are improperly designed or constructed with fault. The impact will be negative as the water will be polluted. The surface waterbody can be polluted by direct discharge and groundwater may be contaminated indirectly from septic tanks. Since the project design has embedded mitigation measures, the impact will be of rare occurrence only in case of design failure.

Table 7.16 Impact on Change in Water Quality during Construction and Operation Phase

Impact	Water Quality of surface waterbodies and Shallow aquifers				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term		Long-term	Permanent
Impact Extent	Local		Regional		International
Impact Scale	Impact on surface water bodies and local aquifers				
Frequency	Construction and Operation phase of Project				
Likelihood	Rare				
Impact Magnitude	Positive	Negligible	Small	Medium	Large

Resource /Receptor Sensitivity	Low		Medium		High
Impact Significance before adopting mitigation measure	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Moderate.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impacts is considered **Minor.**				

7.2.9 Occupational Health and Safety

Source and Impact Assessment – Construction

Construction phase of Wind Farm entails transportation of components of Wind Turbines, erection of the Wind turbines, transportation of EHV towers and their erection. Cranes, derricks and hoists are used for moving large, heavy loads during wind turbine construction. The towers will be sourced from Ahmedabad (Gujarat) and hubs and nacelles from Una (Himachal Pradesh) approximately 400km and 900km respectively. The components qualify as Over Dimensional Consignment (ODC)[1] nature of cargo and trailers are required to transport them. Workers involved with erection of wind turbines are exposed to fall hazards. Fatalities and serious injuries have been reported to occur in case of failure in hoisting of heavy loads. The drivers transporting the components over long distances run the risk of weariness leading to accidents. The ODC nature of the consignment creates the risk of toppling of trailers that has been reported earlier[2]. As per BMTPC's Wind Hazard classification, the wind farm lies in high damage risk zone (47m/s), hence it is to be noted that the towers will be hoisted in a windy condition and further the nacelle will be assembled at 92m hub height which will not be a congenial condition for working.

Embedded/In-Built Control

IWISL has prepared a manual pertaining to Health, Safety and Environment. The prevention and control of hazards associated with height, travel and transportation, civil works, lifting and movement of heavy items, etc have been identified and addressed in the manual. The manual has also identified PPE to be used during climbing towers.

Mitigation Measures

The mitigation measures to be implemented during construction stage are the following:

[1] http://www.windworldindia.com/logistics.jsp

[2] http://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB0QFjAAahUKEwi_obXN2N3GAhWQBY4KHeMbAWA&url=http%3A%2F%2Fwww.iwea.com%2Findex.cfm%2Fpage%2Ftransportation%3Ftwfid%3D834%26download%3Dtrue&ei=gpymVb_YOpCLuATjt4SABg&usg=AFQjCNHPjl-NPF8VmBCW9YM5rtnxGs1JxA&bvm=bv.97949915,d.c2E

- The workers should be aware of the job role and responsibilities
- Adequate job training to be provided by IWISL
- Semi-skilled workers to be engaged after pre-employment medical check – up and medical fitness test.
- A dedicated person to be employed during construction phase for overlooking the occupational health, safety and environment.
- There should be strict supervision on compliance of safety measures for each process and employee
- Emergency Response Procedure should be explained to each worker.
- Further, as Good Industrial Practice, IF C guidelines on Environment, Health and Safety Guidelines on Wind Energy is to be referred.

Significance of Impacts

The evaluation of significance of impacts is given below.

Table 7.17 Impact on Occupational Health and Safety during Construction Phase

Impact	Occupational health and safety during construction phase				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Employees engaged in the construction phase				
Frequency	Construction phase of Project				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low	Medium	High		
Impact Significance before adopting mitigation measure	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Major.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impacts is considered **Minor.**				

Source and Impact Assessment – Operation Phase

It is to be noted that nacelle houses the mechanical and electrical components of the WTG. The nacelle is placed 92m above ground. In routine maintenance period and emergency situations, the workers have to climb that height for resolving the problem. There is winding staircase and in few there are winch lifts. The tower has an entrance at the ground level and an emergency exit at the hub. The tower tapers to a narrow space with height from approximately from 2.5 sq m at base to about 1.5 sq m at the top. The space within the tower and the nacelle is a confined space and does not provide a comfortable

working space. The workers are at a risk of electrocution, physical injury while working at the nacelle.

Embedded/In-Built Control

The manual pertaining to Health, Safety and Environment prepared by IWISL has identified risks during emergency situation. The prevention and control of hazards associated with commissioning, height, lifting and movement of heavy items, etc have been identified and addressed in the manual. Also hazards have been identified for normal and emergency situations and the action to be taken in those situations have been outlined.

Mitigation Measures

The mitigation measures to be implemented during construction stage are the following:

- The workers should be aware of the job role and responsibilities
- Adequate job training to be provided by IWISL
- Semi-skilled workers to be engaged after proper scrutiny
- A dedicated person to be employed during construction phase for overlooking the occupational health, safety and environment.
- There should be strict supervision on compliance of safety measures for each process and employee
- Emergency Response Procedure should be explained to each worker.
- Further, as Good Industrial Practice, IF C guidelines on Environment, Health and Safety Guidelines on Wind Energy is to be referred.

Significance of Impacts

The evaluation of significance of impacts is given below.

Impact	Occupational health and safety during operation phase				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Employees engaged in the construction phase				
Frequency	Operation phase of Project				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource /Receptor Sensitivity	Low	Medium	High		
Impact Significance before adopting mitigation measure	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **Major.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large

Residual Impact Significance	Negligible	Minor	Moderate	Major
	Significance of impacts is considered **Minor.**			

7.3 *SHADOW FLICKER ASSESSMENT*

Overview

Shadow flicker is a term used to describe the pattern of alternating light intensity observed when the rotating blades of a wind turbine cast a shadow on a receptor under certain wind and light conditions. Shadow flicker occurs under a limited range of conditions when the sun passes behind the hub of a wind turbine and casts an intermittent shadow over neighbouring properties.

Indian energy planning and environmental policies and legislation contains no specific shadow flicker requirements and recommendations. At present, only Germany has detailed guidelines on limits and conditions for calculating shadow impact.[1]

Box 7.1 International Guidelines for Shadow Flicker Assessment

According to the German guidelines, the limit of the shadow is set by two factors:
- The angle of the sun over the horizon must be at least 3 degrees;
- The blade of the WTG must cover at least 20% of the sun.

The maximum shadow impact for a neighbour to a wind farm according to the German guidelines is:
- Maximum 30 hours per year of astronomical maximum shadow (worst case);
- Maximum 30 minutes worst day of astronomical maximum shadow (worst case); and
- If automatic regulation is used, the real shadow impact must be limited to 8 hours per year.

In Sweden and Denmark there are no official guidelines as yet on shadow flickering, but for practical purposes, 10 hours (Denmark) and 8 hours (Sweden) real case (weather-dependent) shadow impact is used as the limit. In the UK, no official limits are in force, however an assessment must be made at all dwellings within ten rotor diameters of the turbine locations (PPS22 (2004) for England( ), TAN8 for Wales). In Ireland, a worst-case 30 hours per year, 30 minutes per day limit has been set.

Shadow flicker is most pronounced at sunrise and sunset when shadows are the longest, and at high wind speeds (faster rotating blades leading to faster flicker). A UK government report recommends that for inhabitants near wind turbines, shadow flicker should be limited to 30 hours in a year and 30 minutes in a day[2]. There is anecdotal evidence internationally that shadow flicker could lead to stress and headaches. There is also a fear that shadow flicker, especially in the range of 2.5-50 Hertz (2.5-50 cycles per second) could lead to seizures in epileptics and may also scare away livestock.

[1] These are found in "Hinweise zur Ermittlung und Beurteilung der optischen Immissionen von Windenergianlagen" (WEA-Shattenwurf-Hinweise).

(2) Draft EIA Guidelines Wind Power Sector, prepared by Centre for Science and Environment, New Delhi

An analysis of those conditions that may lead to shadow flicker and the location of potential sensitive receptors (residential and community properties) is provided in this section. The timing and duration of this effect can be theoretically calculated from the geometry of the wind turbines, their orientation relative to nearby houses and the latitude of the potential site, using specialised software such as WindPro 2.9.

The results provide the total number of hours in a year when a theoretical shadow flicker will occur. This is most pronounced during sunrise and sunset when the sun's angle is lower and the resulting shadows are longer. However the actual shadow flicker could be substantially lower compared to theoretical values because shadow flicker does not occur where there is vegetation or other obstructions between the turbines and the shadow receptors; if windows facing a turbine are fitted with blinds or shutters; or if the sun is not shining brightly enough to cause shadows.

The theoretical calculations done by WindPro does take into account the reduction in shadow flicker due to topographic features, however it does not take into account the reduction in shadow flicker due to these onsite factors i.e. vegetation. Simple geometry relating to the position of the sun and the angle of the turbine blades can also eliminate or significantly reduce the effects of shadow flicker. In addition, shadow flicker will only occur inside buildings where the flicker is occurring through a narrow window opening.

In India, at present there is no standard in case of non-forest land diversion for wind power projects. However, as per Ministry of Environment and Forests (MoEF) guidelines, a minimum distance of 300 m is recommended between windmill and highways or village habitation.

Weather conditions at the site, such as bright sunshine, will greatly enhance the occurrence and intensity of shadow flicker, whereas cloud density, haze or fog will cause a reduction. Receptors further away from the turbines which may have experienced a shadow flicker effect under bright sunshine conditions will, as a result of these weather conditions, experience either no effect or one which is greatly reduced in intensity.

The distance between receptors and turbines has a large effect on the intensity of shadow flicker. Shadow flicker intensity can be defined as the difference in brightness between the presence and absence of a shadow at any given location. This study does not examine variations in intensity but rather the occurrence in number of hours shadow flicker may occur, whether or not this is clearly distinct or barely noticeable. The assessment assumes a conservative worst case of bright sunshine conditions in all periods when flicker may occur.

Considering all of the above points, the likelihood of shadow flicker occurring is greatest when the circumstances listed below exist simultaneously.

- The receptor is at a position which is between 130° clockwise (1) and anticlockwise from north and located within 10 turbine rotor diameters of the wind turbine (~1000 m).
- The sun is shining and visible in the sky in line with the monthly mean sun-shine hours at nearby location.
- The wind speeds are between 3 m/s and 20 m/s and the turbine is therefore in operation.
- The turbine blades are perpendicular to the line between the sun and the observer or receptor most of time as per reported wind mast data.

Due to lack of data regarding epilepsy rates in India and operation levels below of 1 Hz for modern turbines, seizures caused by shadow flicker are considered to be extremely unlikely. The WindTec DF/2000 turbines (proposed to be used in the Project) being considered operate at a frequency outside the range where negative health effects may result (2). Potential effects on people are likely to be limited to nuisance.

Potential Significant Impacts

In India at present, there is no agreed level of shadow flicker identified as causing a significant effect. However, the Danish Wind Industry Association note on their website that in Germany, the rule of thumb is that 30 hours shadow flicker a year received at a property is acceptable (3). The 'Wind Energy Development Guidelines, 2006' published by the Irish Government Department of the Environment, Heritage and Local Government recommend that shadow flicker at neighbouring offices and dwellings within 500 m should not exceed 30 hours per year or 30 minutes (0.5 hours) per day. A threshold of 30 hours per year has therefore been considered and applied for this assessment.

Assessment Methodology and Modelling

Shadow flicker calculations have been made using WindPro software. The model used in this analysis is very conservative and assumes the following conditions:

- the mean monthly sunshine hours have been taken from the India Meteorological Department (IMD) station at Ahmedabad covering the data period (1969 – 1993)[4];

(1) It is acknowledged by this assessment however that India is at a lower latitude than the European countries and therefore angles of shadow flicker may be narrower.
(2) See Health and Safety Executive/Local Authority Enforcement Liaison Committee (HELA) circular, entitled 'Disco Lights and Flicker Sensitive Epilepsy' (available at http://www.hse.gov.uk/lau/lacs/51-1.htm). It provides medical details on flicker frequencies likely to give rise to epileptic effects. It states: 'In 1971 the Greater London Council banned the use of flicker rates greater than 8 fps but to be effective the above figures show that any advice on restriction of flicker rate has to limit the frequency to below 5 fps.'
(3) www.windpower.org
(1) [4] Available in WindPro database of climatological data

- the wind turbines have been considered operational with wind speed more than 3 m/s and for the same wind mast data has been considered, which indicates that about 90% time of the year, the wind turbines will be operational;
- the blades of the wind turbines are perpendicular with northwest - southeast orientation have been considered based on the predominant wind direction available from the wind mast data at site, which could result in maximum possible size circular/ elliptical;
- there are no trees, buildings or vegetation on the surface which may obscure the line of sight between shadow receptor and turbine;
- the sun can be represented as a single point;
- Flicker is ignored if sun is less than 3° above horizon (due to atmospheric diffusion/ low radiation/ sheltering);
- straw huts as well as concrete structures within settlements are considered as shadow receptors[1]; and

The following data inputs were used in this study:
- a digital elevation model of the site (National Aeronautic and Space Administration (NASA) Shuttle Radar Topography Mission (SRTM) Data at 90 m resolution);
- latitude and longitude at centre of the site used to calculate the position of the sun (calculated in GIS using WGS84);
- mean monthly sun-shine hours recorded over a period of 25 years at a nearby IMD solar radiation station (Ahmedabad);
- wind mast data at site for wind class and frequency distribution;
- turbine locations – coordinates (identified in GIS);
- turbine rotor diameter for WindTec DF/2000 turbines is 100 m;
- height to bottom of Turbine hub for WindTec DF/2000 turbines is 92 m;
- tilt angle of the 'window' (always assumed vertical);
- shadow receptors contain on openings measuring 0.9 m by 1.2 m facing towards the closest wind turbines; and
- height above ground level of the 'window' 0.9 m.

Receptors

The maximum horizontal distance between a receptor affected by shadow flicker and turbine location for example has been identified as being equal to the diameter of the turbine multiplied by ten. In this instance, turbine rotor diameter is 100 m; and therefore an area envelope of 1000 m from the nearest turbine is used in shadow flicker analyses. However, the shadow receptors have been taken into consideration falling within 1000 m from each of the WTG as the impact of shadow flicker reduces with distance.

Figure 7.1 shows the study area of the assessment (within 1000 m) of each of the existing turbine location and the surrounding nearby settlements. A total

(1) [1] It is likely that some of these straw huts are also used as shaded structure for cattle and storage areas.

of 14 structures[1] have been identified as being within the study area of the wind farm (See *Error! Reference source not found.*). All the shadow receptors considered in this study are scattered hutments located within 500 m from any of the WTG location. Project data overview has been presented in ***Annex A*** which provides the details of WTGs in the study area as well as location details of the shadow receptors considered in this study.

The Model – WindPro Shadow

SHADOW is the WindPRO calculation module that calculates how often and in which intervals a specific neighbour or area will be affected by shadows generated by one or more WTGs. These calculations are worst-case scenarios (astronomical maximum shadow, i.e. calculations which are solely based on the positions of the sun relative to the WTG). Shadow impact may occur when the blades of a WTG pass through the sun's rays seen from a specific spot (e.g. a window in an adjacent settlement). If the weather is overcast or calm, or if the wind direction forces the rotor plane of the WTG to stand parallel with the line between the sun and the neighbour, the WTG will not produce shadow impacts, but the impact will still appear in the calculations. In other words, the calculation is a worst-case scenario, which represents the maximum potential risk of shadow impact. A calendar can be printed for any specific point of observation, which indicates the exact days, and time periods where shadow impact may occur.

Apart from calculating the potential shadow impact at a given neighbour, a map rendering the iso-lines of the shadow impact can also be printed. This printout will render the amount of shadow impact for any spot within the project area.

The calculation of the potential shadow impact at a given shadow receptor is carried out simulating the situation. The position of the sun relative to the WTG rotor disk and the resulting shadow is calculated in steps of 1 minute throughout a complete year. If the shadow of the rotor disk (which in the calculation is assumed solid) at any time casts a shadow reflection on the window, which has been defined as a shadow receptor object, then this step will be registered as 1 minute of potential shadow impact. The following information is required:

- The position of the WTGs (x, y, z coordinates)
- The hub height and rotor diameter of the WTGs
- The position of the shadow receptor object (x, y, z coordinates)
- The size of the window and its orientation, both directional (relative to south) and tilt (angle of window plane to the horizontal).
- The geographic position (latitude and longitude) together with time zone and daylight saving time information.

[1] Where any settlement was noticed within the study area, only 1 or 2 shadow receptors close to the WTGs were considered as shadow receptors. The vacant hutments around the WTGs were not being taken into consideration in this study.

- A simulation model, which holds information about the earth's orbit and rotation relative to the sun.

Figure 7.1 Study Envelope for Shadow Flicker

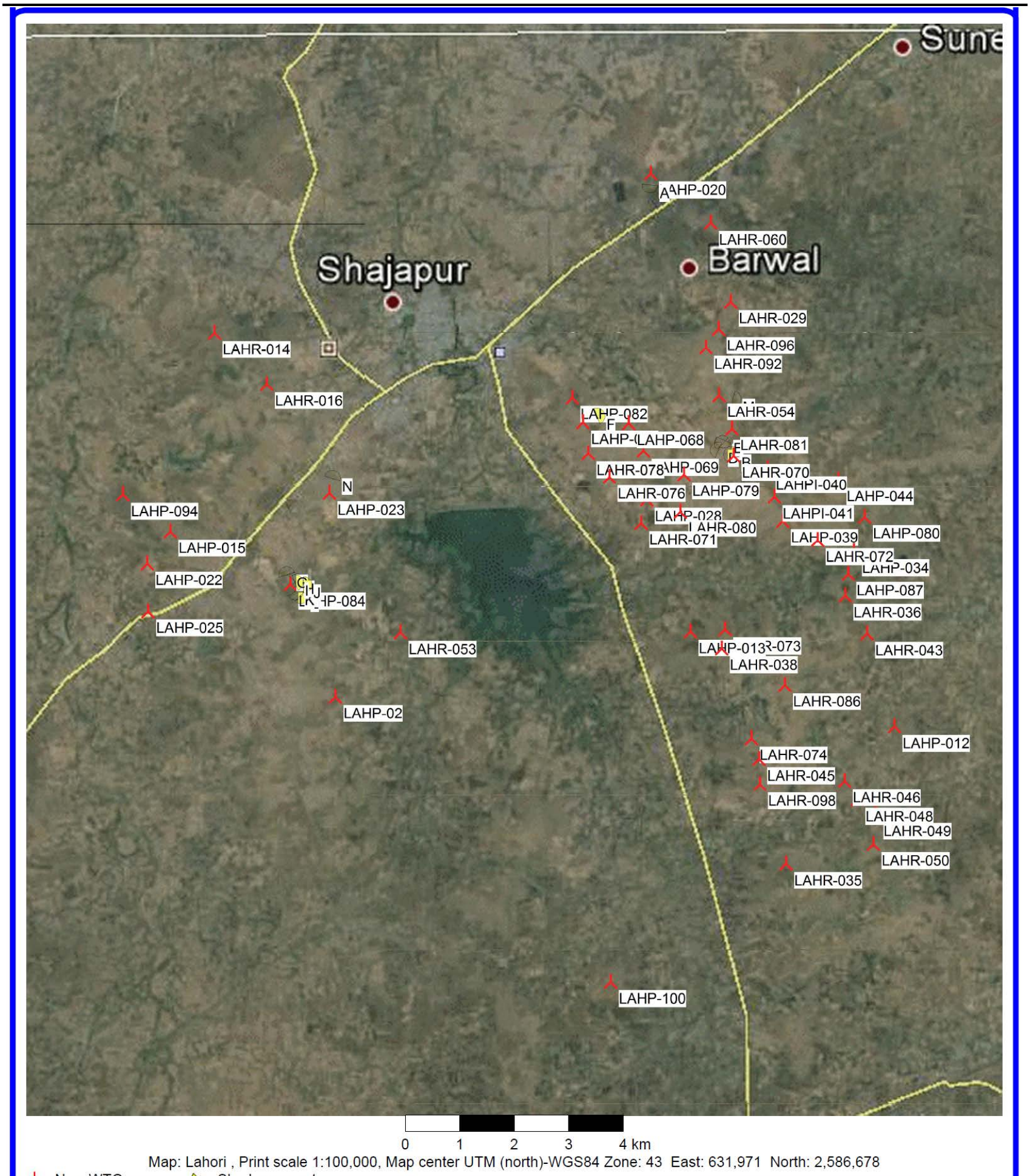
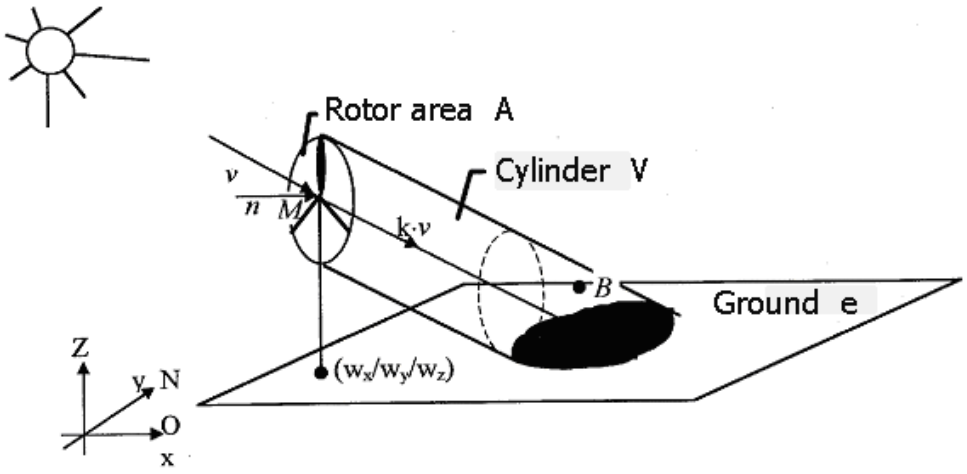


Figure 7.2 An illustration of shadow effect from WTG



Impact Assessment

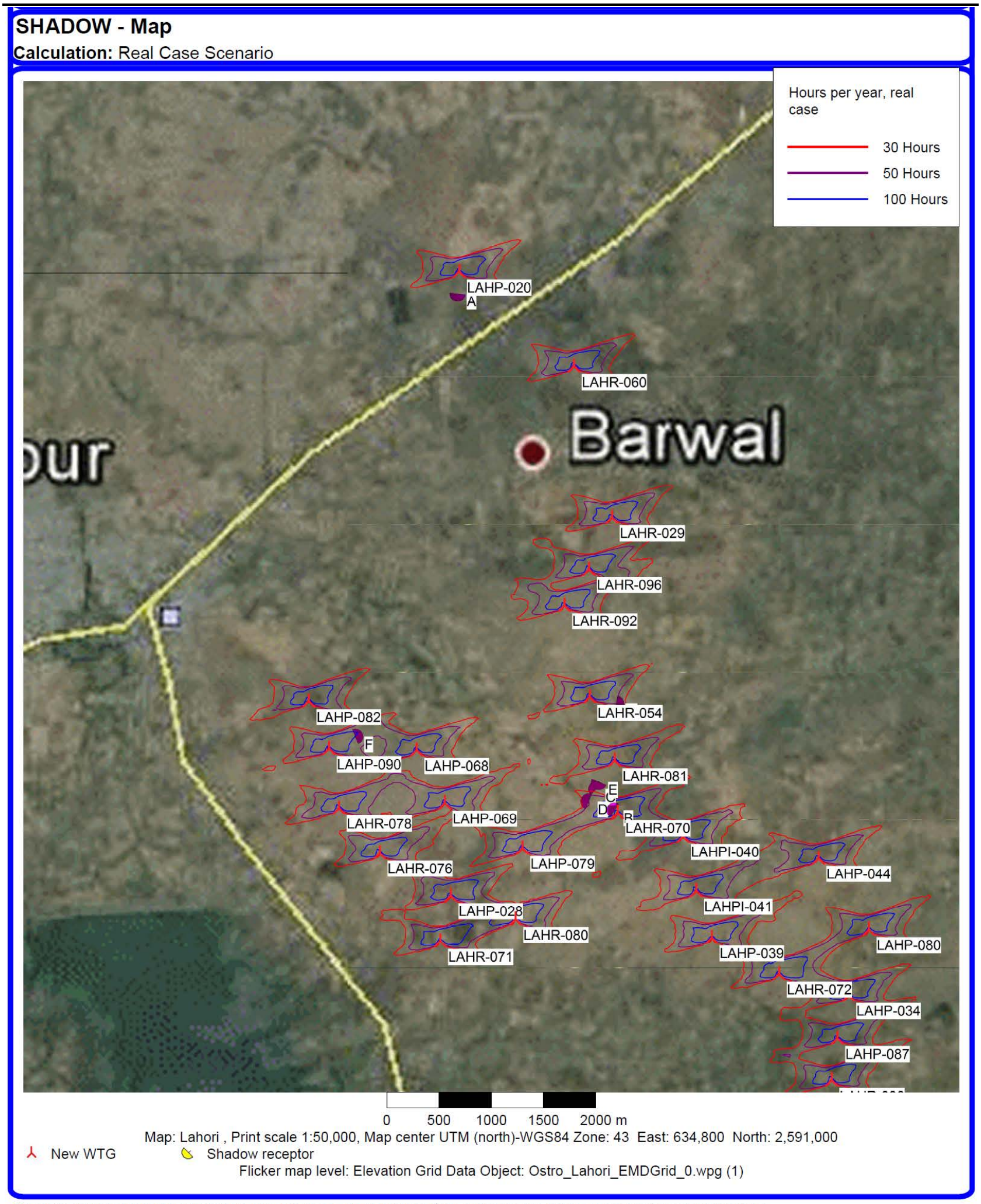
The results of the shadow flicker assessment are presented in ***Table 7.18***and in ***Figure 7.3*** and ***Figure 7.4*** below. The supporting graphs provided in ***Annex E***. The graphs shown in ***Annex E*** illustrate the times of the year at each of the 14 receptors in the analysis where theoretical shadow flicker was predicted to occur.

Table 7.18 Shadow Flicker Analysis at Each Receptor

Shadow Receptor	Receptor Type	UTM Co-ordinates**			Nearest WTG	Distance from Nearest WTG [m]	Direction from WTG [degree]	Real Case Scenario
		X (m E)	Y (m N)	Z (m)				Shadow hours per year [hr/year] *
A	Settlement	634500	2593856	460.2	LAHR-20	200	185	0:00
B	Settlement	636045	2588942	502.4	LAHR-70	40	301	**114:51**
C	Settlement	635870	2589144	499.7	LAHR-70	300	317	10:54
D	Settlement	635796	2589024	497.5	LAHR-70	300	290	**49:33**
E	Settlement	635894	2589212	498.4	LAHP-81	260	216	0:00
F	Settlement	633558	2589619	489.2	LAHP-90	280	66	**82:38**
G	Settlement	627896	2586669	508.1	LAHP-84	190	341	0:00
H	Series of Building	628032	2586559	507.1	LAHP-84	100	47	**308:19**
I	Settlement	628045	2586524	507.5	LAHP-84	90	65	**263:53**
J	Industry	628204	2586486	502.2	LAHP-84	250	91	**57:08**
K	Settlement	628045	2586358	505.8	LAHP-84	160	147	0:00
L	Settlement	628157	2586299	500.4	LAHP-84	280	135	0:00
M	Settlement Cluster	636054	2589962	499.2	LAHP-54	280	135	**52:36**
N	Settlement	628715	2588439	498.8	LAHP-23	280	15	0:00

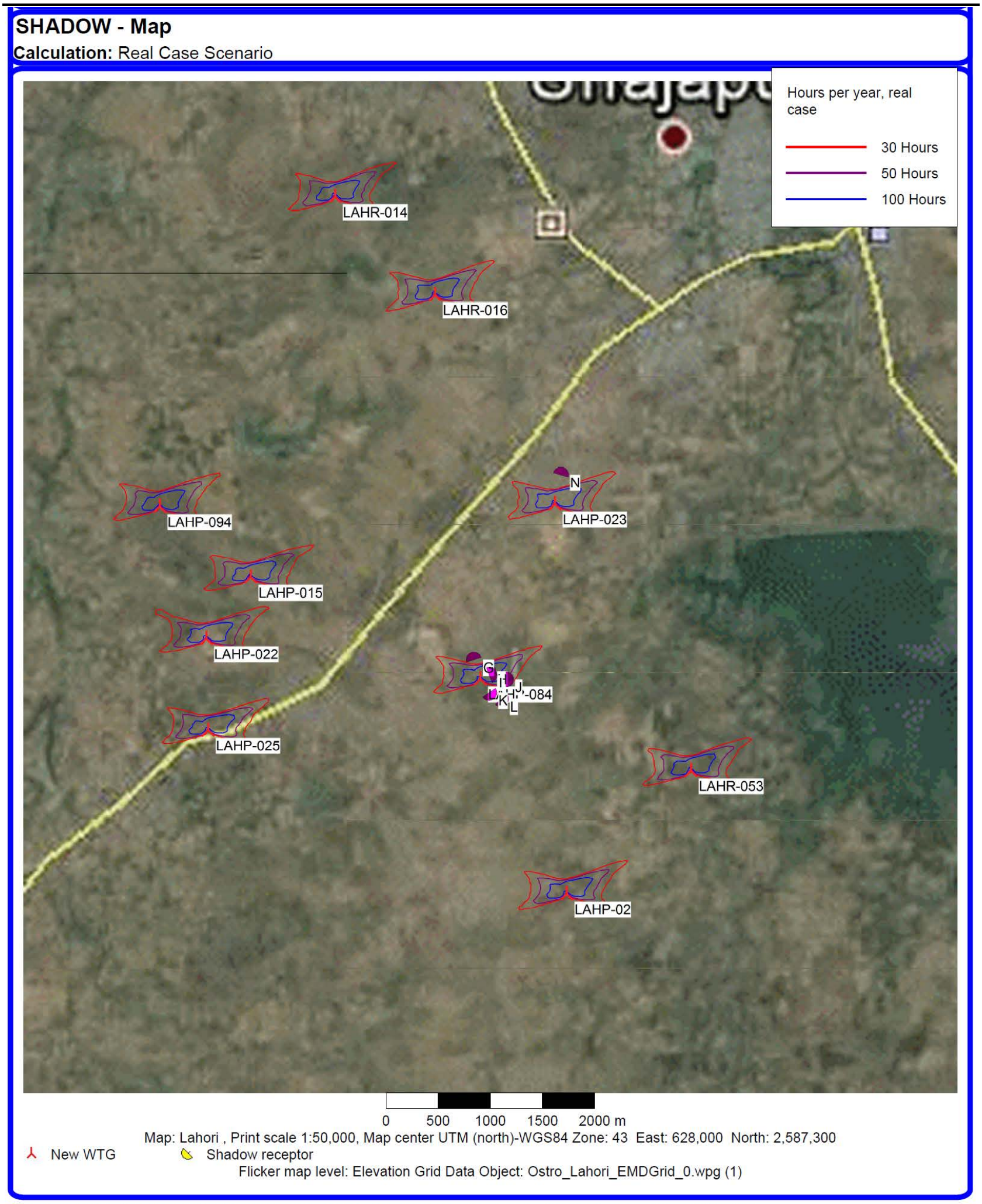
*Figures highlighted and bold represent greater than 30 hours per year of shadow flicker
** WGS84 Zone: 43

Figure 7.3 Shadow Flicker Map (A)



WindPRO is developed by EMD International A/S, Niels Jernesvej 10, DK-9220 Aalborg Ø, Tel. +45 96 35 44 44, Fax +45 96 35 44 46, e-mail: windpro@emd.dk

Figure 7.4 Shadow Flicker Map (B)



WindPRO is developed by EMD International A/S, Niels Jernesvej 10, DK-9220 Aalborg Ø, Tel. +45 96 35 44 44, Fax +45 96 35 44 46, e-mail: windpro@emd.dk

Given the guidelines of 30 hours or less per year is considered to be acceptable, the operation of the wind farm theoretically results in shadow flicker impacts that could be considered as significant for the purposes of this study. The results show that theoretical shadow flicker in real case scenarios occur at only one shadow receptor. In the real case scenario, the maximum shadow flicker occurs at shadow receptor 'H', located close to the WTG LAHP-84, with a maximum of 308:19 hr/year. Shadow flickering greater than 30 hr/year is observed at 7 receptors out of total 14 receptors, whereas 6 shadow receptors are not having any impact of shadow due to their orientation with respect to the WTGs. It has further been noted that there will be no shadow flicker impact on the major settlements which are located beyond the study envelope.

It is relevant to emphasise that predicted hours of shadow flicker effects are real case scenarios with certain assumptions. Assumptions made during the analysis include optimal meteorological, natural light and geometrical conditions for the generation of shadow flicker. The assessment does not account for trees or other obstructions that intervene between receptor and turbine during times when effects may occur. The assessment calculation is therefore an over estimation in the probability of effects. It should also be noted that for shadow effects to occur, properties need to be occupied, with blinds or curtains open and views to the wind turbine unobstructed. However, for the purposes of assessment, it has been assumed that all worst-case circumstances apply.

Table 7.19 Impact Significance of Shadow Flickering

Impact	Shadow Flickering during the Operation Phase			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Within 400 m from the WTGs on the receptors located in the SE-NE and SW-NW orientation from the WTG/s			
Frequency	during sunny days			
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Vulnerability of Social Receptors	Low	Medium	High	
	Out of the 14 shadow receptors selected in the study within 500 m 7 receptors were observed exceedence from the guideline value with 3 receptors having more than 100 hr/year of shadow flickering. Considering that no obstruction is considered in the study, the vulnerability of the receptor is medium for 3 receptors (B, H and I).			
Impact Significance	Negligible	Minor	Moderate	Major
	Considering the overall impact magnitude and vulnerability of social receptors, the impact significance is assessed as **minor to moderate**.			

Mitigation Measures

It is suggested to check the possibility of either shifting the WTG locations, which are within 100 m of the receptors (B, H and I) or shifting of the receptors, whatever would be more feasible, in order to avoid the shadow flickering impact as well as other impacts during the construction phase in particular. Furthermore, there will be close monitoring through engagement with residents during the operational phase where there are predicted impacts from shadow flicker. The likelihood of direct line of sight to the location of proposed turbine locations can be assessed visually and the potential for using screening like higher fencing and planting trees can be explored at problem locations. The use of curtains can also be explored. If these prove effective and the impacts mitigated, the shutting down of turbines during certain environmental conditions, which meet the physical requirements for theoretical shadow flicker to occur, will not be required.

7.4 NOISE

7.4.1 Operation Phase

Sources of Wind Turbine Sound

The sources of noise emitted from operating wind turbines can be divided into two categories: (a) mechanical noise, from interaction of turbine components; and (b) aerodynamic noise, produced by the flow of air over blades.

Mechanical sounds originate from the relative motion of mechanical components and the dynamic response among them. Sources of such sounds include:

- Gearbox
- Generator
- Yaw drives
- Cooling fans
- Auxiliary equipment (e.g. hydraulics)

Aerodynamic sound is typically the largest component of wind turbine acoustic emissions. It originates from the flow of air around the blades. Aerodynamic sound generally increases with rotor speed.

The Project will have 50 WTGs (out of total 53 WTGs considered in this study) of Windtec DF/2000 WEC with hub height of 92 m. The noise generation from the Windtec turbines have been taken into consideration during strong wind conditions (with wind velocity > 8 m/s at 10 m height) and normal wind conditions (with wind velocity 4 m/s at 10 m height) for the noise assessment. Based on the available information from the turbine manufacturers, following are the noise generation due to the wind turbines:

Table 7.20 Noise Generation from WTGs

Turbine	Noise Generation [dB(A)] at Hub Height	
	Strong Wind Condition [wind speed > 8 m/s at 10 m height]	Normal Wind Condition [wind speed 4 m/s at 10 m height]
Windtec DF/2000 WEC	104.5	97.0

Receptors

No major settlement is located within 500 m of the WTGs. However, there are scattered settlements and hutments in the area. A total of 6 locations were selected during the baseline survey for noise monitoring and their locations with respect to the WTGs have been presented in ***Figure 7.5***.

Criteria

Noise standards notified by the MoEF vide gazette notification dated 14 February 2000 as amended in 2010 based on the *A* weighted equivalent noise level (L_{eq}) for residential areas will be followed (***Table 7.21***), which are similar to the noise emission criteria specified in the WB/IFC EHS Guidelines, as presented in ***Table 7.22***, has been used for assessment of noise impacts. In order to assess the significance of the impact, noise impact should not exceed the levels presented in ***Table 7.22***, or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.

Table 7.21 Ambient Air Quality Standards in respect of Noise[1]

Area Code	Category of Area	Limits in dB(A) L_{eq}*	
		Day Time	Night Time
(A)	Industrial Area	75	70
(B)	Commercial Area	65	55
(C)	***Residential Area***	***55***	***45***
(D)	Silence Zone	50	40

Note:

1. *Day time shall mean from 6.00 a.m. and 10.00 p.m.*
2. *Night time shall mean from 10.00 p.m. and 6.00 a.m.*
3. *Silence zone is an area comprising not less than 100 metres around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority.*
4. *Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.*

** dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing. A "decibel" is a unit in which noise is measured. "A", in dB(A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear. Leq: It is an energy mean of the noise level over a specified period.*

[1] *[Source: Schedule of The Noise Pollution (Regulation and Control) Rules, 2000 vide S. O. 123(E), dated 14.2.2000 and subsequently amended vide S.O. 1046(E), dated 22.11.2000, S.O. 1088(E), dated 11.10.2002, S.O. 1569 (E), dated 19.09.2006 and S.O. 50 (E) dated 11.01.2010 under the Environment (Protection) Act, 1986.)]*

Table 7.22 Noise Emission Criteria[1]

Location	Noise Level Limit (dB(A)	
	Daytime (0700 – 2200 hrs)	**Night-time (2200 – 0700 hrs)**
Industrial; commercial	70	70
Residential; institutional; educational	55	45

[1] Guidelines values are for noise levels measured out of doors. Source: Guidelines for Community Noise, World Health Organisation (WHO), 1999.

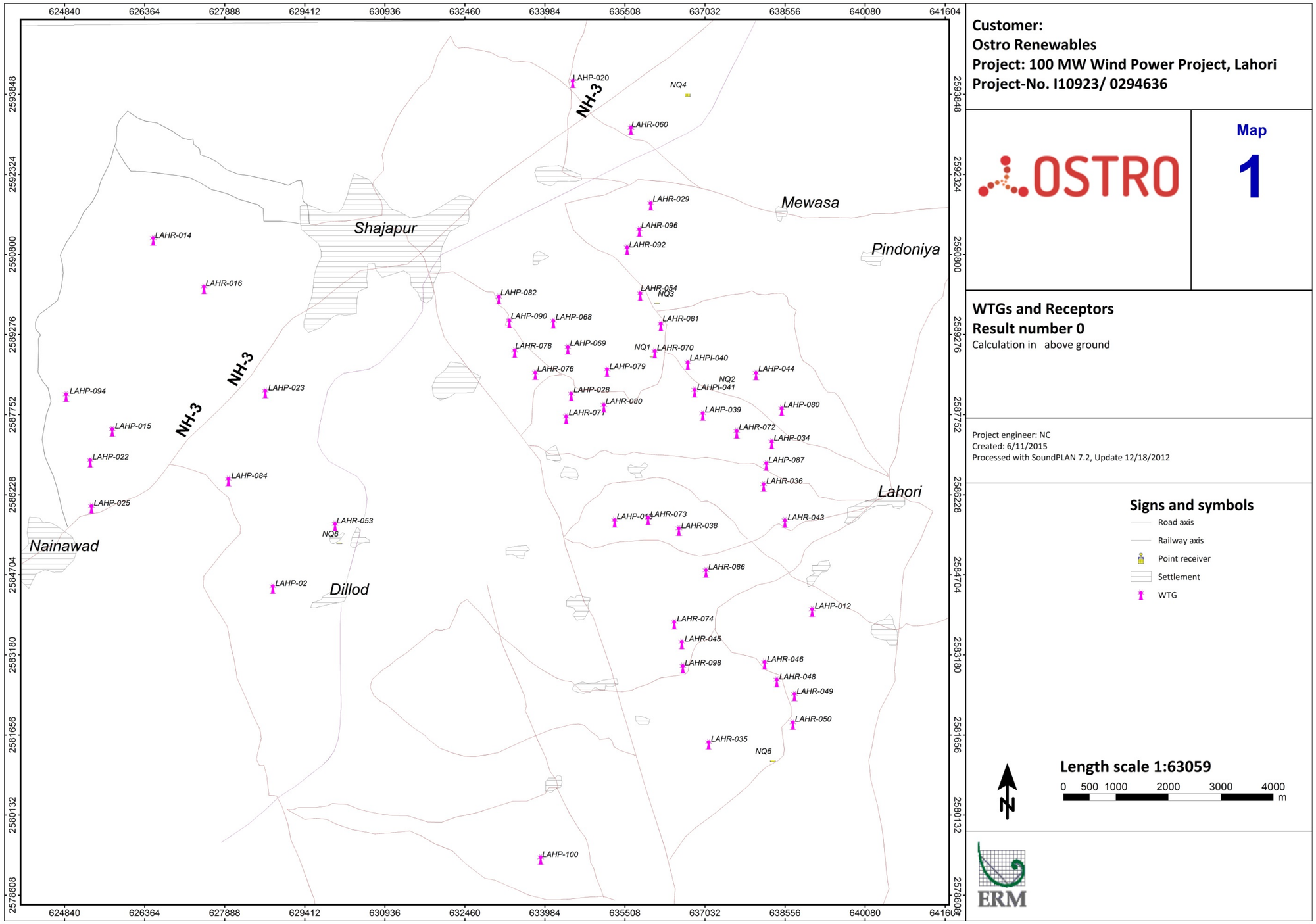
Prediction of Impacts

Methodology: The environmental noise prediction model SoundPlan 7.2 was used for modelling noise emissions from the WTGs. In order to consider worst case scenario (with strong wind conditions), it has been assumed that the WTGs are operational at standardised wind speed of ≥ 8 m/s at 10 m height. Operating of WTGs with 100% usage scenario was modelled to cover the operation phase of the Project. In addition, to represent a worst-case scenario for the assessment, all WTGs were assumed to be operating simultaneously and for 24 hours. Noise generation had been considered at the hub height of 80m above ground. As a conservative approach to the assessment, atmospheric absorption during sound transmission was not included in the assessment. Local terrain has been considered for putting noise sources as well as receptors in the model.

Another scenario has been modelled with the normal wind conditions, with an assumption that the WTGs are operational at standardised wind speed of 4 m/s at 10 m height. All other assumptions were considered similar to the worst case scenario.

Predicted Noise Levels at Receptors: The predicted noise levels within the study domain during daytime with standardised wind velocities (at 10 m height) of ≥ 8 m/s (strong wind conditions) and 4 m/s (normal wind conditions), are presented in ***Figure 7.6*** and ***Figure 7.7***, respectively. Predicted noise levels at 6 receptors within the study domain during strong and normal wind conditions have been presented in ***Table 7.23*** and ***Table 7.24***, respectively.

Figure 7.5 Project Wind Turbines and Noise Sensitive Receptors



Customer:
Ostro Renewables
Project: 100 MW Wind Power Project, Lahori
Project-No. I10923/ 0294636

OSTRO

Map
1

WTGs and Receptors
Result number 0
Calculation in above ground

Project engineer: NC
Created: 6/11/2015
Processed with SoundPLAN 7.2, Update 12/18/2012

Signs and symbols
- Road axis
- Railway axis
- Point receiver
- Settlement
- WTG

Length scale 1:63059
0 500 1000 2000 3000 4000 m

N

ERM

C:\Users\Naval.Chaudhary\Documents\Noise Modeling\Ostro_Lahori\Sheet1.sgs

Figure 7.6 Predicted Operation Phase Noise Levels of Project with Strong Wind Conditions during Daytime (Leq $_d$)

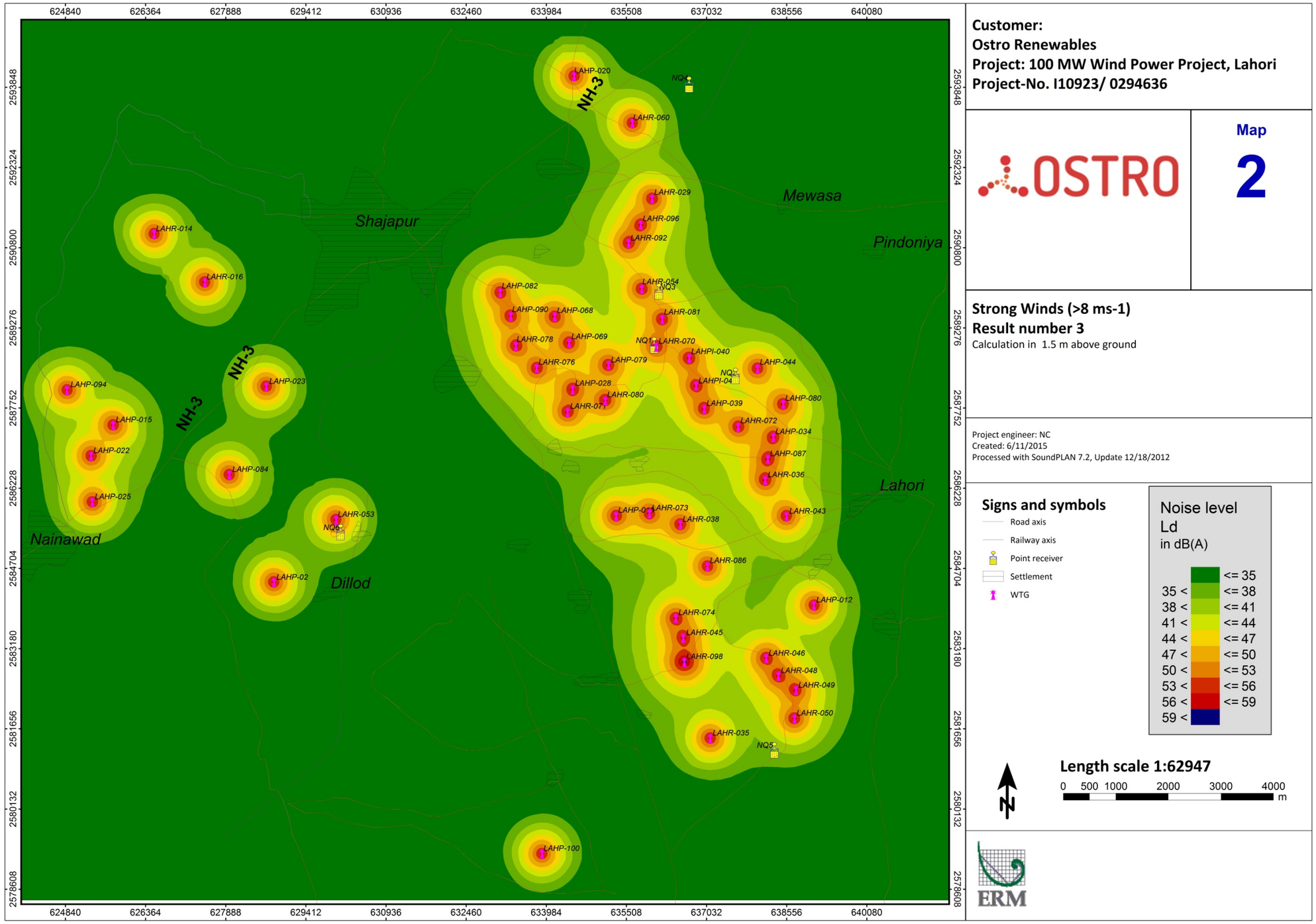
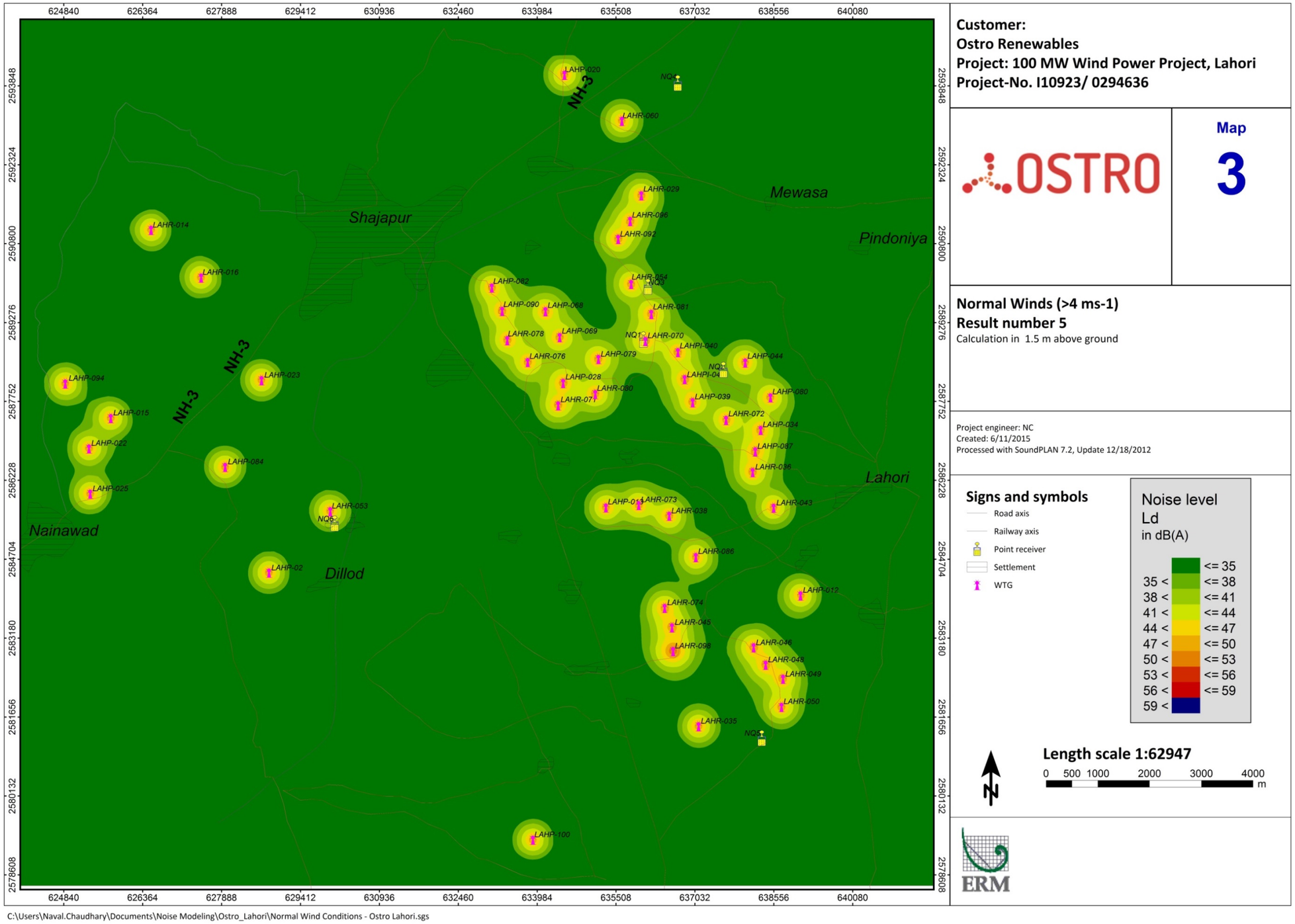


Figure 7.7 Predicted Operation Phase Noise Levels of Project with Normal Wind Conditions during Daytime (Leq $_d$)



C:\Users\Naval.Chaudhary\Documents\Noise Modeling\Ostro_Lahori\Normal Wind Conditions - Ostro Lahori.sgs

Table 7.23 Predicted Noise Levels at Noise Receptors during Operation Phase of Project with Strong Wind Conditions

Noise Receptor	Nearest WTG	Distance from WTG (m)	Background Noise[1]		with Vs ≥ 8m/s (Worst Case Scenario)		Overall Noise (worst case scenario) [Background Noise + Predicted Noise]		WB/IFC Guidelines(3) and MoEF Standard(4)	
			Leq day [dB(A)]	Leq night [dB(A)]	Predicted Leq day [dB(A)][2]	Predicted Leq night[dB(A)][2]	Leq day [dB(A)]	Leq night [dB(A)]	Day	Night
NQ1	LAHR-070	40	49.4	40.1	56.3	56.3	57.1	56.4	*55*	*45*
NQ2	LAHP-044	430	50.5	37.4	43.9	43.9	51.4	44.7	*55*	*45*
NQ3	LAHP-054	320	53.0	38.1	46.7	46.7	53.9	47.3	*55*	*45*
NQ4	LAHR-060	1100	54.0	40.5	30.3	30.3	54	40.9	*55*	*45*
NQ5	LAHR-050	650	53.2	43.0	37.9	37.9	53.3	44.2	*55*	*45*
NQ6	LAHR-053	250	53.1	41.2	47.2	47.2	54.1	48.2	*55*	*45*

(1) Predicted noise levels during day and night time will be same as the operation of WTGs has been considered 24 hours and no variation of wind speed during day and nighttime is considered in this assessment.
(2) IFC/WB EHS Guidelines: Noise Management dated April 30, 2007 gives, Noise level guidelines for Residential; institutional and educational receptors in daytime (07:22:00) and night time (22:00-7:00) as 55 and 45 one hour Leq dB(A) respectively. For industrial and commercial receptors it is 70 one hour Leq dB(A) for both night and day time.
(3) Noise standards notified by the MoEF vide gazette notification dated 14 February 2000 as amended in January 2010 based on the *A* weighted equivalent noise level (L_{eq}) for residential areas

Table 7.24 Predicted Noise Levels at Noise Receptors during Operation Phase of Project with Normal Wind Conditions

Noise Receptor	Nearest WTG	Distance from WTG (m)	Background Noise[1]		with Vs ≥ 4m/s (Normal Scenario)		Overall Noise (normal scenario) [Background Noise + Predicted Noise]		WB/IFC Guidelines(3) and MoEF Standard(4)	
			Leq day [dB(A)]	Leq night [dB(A)]	Predicted Leq day [dB(A)][2]	Predicted Leq night[dB(A)][2]	Leq day [dB(A)]	Leq night [dB(A)]	Day	Night
NQ1	LAHR-070	40	49.4	40.1	48.8	48.8	52.1	49.3	*55*	*45*
NQ2	LAHP-044	430	50.5	37.4	36.4	36.4	50.7	39.9	*55*	*45*
NQ3	LAHP-054	320	53.0	38.1	39.2	39.2	53.2	41.7	*55*	*45*
NQ4	LAHR-060	1100	54.0	40.5	22.8	22.8	54	40.6	*55*	*45*
NQ5	LAHR-050	650	53.2	43.0	30.4	30.4	53.2	43.2	*55*	*45*
NQ6	LAHR-053	250	53.1	41.2	39.7	39.7	53.3	43.5	*55*	*45*

(1) Predicted noise levels during day and night time will be same as the operation of WTGs has been considered 24 hours and no variation of wind speed during day and nighttime is considered in this assessment.
(2) IFC/WB EHS Guidelines: Noise Management dated April 30, 2007 gives, Noise level guidelines for Residential; institutional and educational receptors in daytime (07:22:00) and night time (22:00-7:00) as 55 and 45 one hour Leq dB(A) respectively. For industrial and commercial receptors it is 70 one hour Leq dB(A) for both night and day time.
(3) Noise standards notified by the MoEF vide gazette notification dated 14 February 2000 as amended in January 2010 based on the *A* weighted equivalent noise level (L_{eq}) for residential areas

It is evident from ***Table 7.23*** that in strong wind conditions ambient noise levels due to operation of the project will be well within the MoEF and WB/IFC guideline values for daytime at all the noise sensitive receptors except at one receptor, which is located within 50 m from the WTG location, whereas in normal wind conditions, ambient noise levels at all the receptors will be well within the applicable standards. The night time noise levels during the strong wind conditions will be exceeding the standard at 3 receptors out of total 6 receptors considered in this study and the impact zone will be upto 400 m from the WTG location; whereas with normal wind conditions only one receptor indicate noise levels higher than the standards and the impact zone will be upto 150 m from the WTG location. It is to be noted that all these receptors are close to the WTGs and are scattered in nature. Therefore, the impact of noise on the nearest receptor due to operation of WTGs during day time has been estimated as **moderate**, whereas during night time it has been estimated as **negligible** to **minor,** since the assessment has been done considering worst case conditions and maximum noise throughout the day and no barrier has been considered between the source and receptors.

Mitigation Measures

To mitigate operational noise impacts following measures are proposed:

- Minimum distance of any WTG from the sensitive receptor shall be maintained about 150m, in order to avoid any exceedance during normal wind conditions;
- Regular maintenance of WTGs;
- Periodic monitoring of noise near to the sources of generation to ensure compliance with design specification; and
- In case of complaints of higher noise levels and uncomforting received from the inhabitants of nearby settlements, possibility of putting noise barriers near to the receptor need to be considered.

Impact Significance

Table 7.25 Noise quality during operation phase (Daytime)

Impact	Noise generation from operation of the WTGs – Day time				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to within 400 m of WTGs.				
Frequency	Entire Operation phase of Project				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	

	Significance of impact is considered **Moderate.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impacts is considered **Minor.**				

Table 7.26 Noise quality during operation phase (Night time)

Impact	Noise generation from operation of the WTGs – Night time				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to within 150 m of WTGs.				
Frequency	Entire Operation phase of Project				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **negligible to minor depending upon the wind conditions.**				
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impacts is considered **Minor.**				

7.5 IMPACTS ON ECOLOGY

7.5.1 Impacts during construction Phase

The wind farm area is devoid of any forest area or large vegetation patch. The construction area is private agricultural land and revenue lands, the associated ecological impacts of the construction phase are due to following construction activities;

i. clearance of vegetation for storage yards;
ii. laying of WTG foundation and WTG installation
iii. laying of transmission lines and transmission towers
iv. laying of approach roads

Impact due to Vegetation Clearance

The land clearance activities for the construction activities lead to removal of vegetation at the WTG location and access roads. Vegetation clearance may reduce the fodder for wild animals such as Blackbuck (*Antilope cervicapra*- IUCN 2015 ver.2-NT/IWPA Sch-I) as well as disturb their habitat. This may

also expose the species to venture to new areas and expose to poaching and hunting.

Significance of Impact

The vegetation removal in the region may impact the habitat of herpetofaunal species, resident avifaunal species and mammals. The vegetation removal will also impact the grassland specific bird species which use this shrubby habitat as shelter.

The impacts of vegetation clearance will be both direct and indirect and limited to construction phase of the project. Overall impact significance (refer to ***Table 7.27***) of the vegetation clearance is assessed as ***minor***.

Mitigation Measures

Following mitigation measures will further reduce the impact significance on the habitat and species to negligible.

- Vegetation clearance shall be limited to the project activity area;
- No tree species should be removed, alternate route should be planned in case any tree is falling within access road alignment;
- Top soil should be stored separately for restoration of the habitat;
- Strict prohibition on use of fuel wood and shrubs from nearby areas as kitchen fuel;
- Local grass species should be seeded in disturbed areas during monsoon period.

Table 7.27 Impact due to Clearance of Vegetation

Impact	Clearance of vegetation				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to Wind Farm area (specifically construction areas)				
Frequency	Construction phase				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity (Habitat)	Low	Medium	High		
Resource Sensitivity (Species)	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor.**				

Impact due to construction of WTG foundation and installation

The WTG foundation laying and WTG component installation will require camping/ of work force on site, movement of vehicles for transportation of man and material, construction noise due to excavation etc.

Significance of Impact

These activities will cause habitat disturbance for Blackbuck (*Antilope cervicapra*-IUCN 2015 ver.2-NT/IWPA Sch-I) and they tend to avoid such area. The habitat alteration may also lead to fresh man-animal conflict and exposure to fresh predators. Noise generated by construction activities and vehicle movement may further disturb the wild life movement in the nearby areas.

The impacts of construction of WTG foundation and installation of WTG will be both direct and indirect and limited to construction phase of the project. Overall impact significance of the vegetation clearance (Refer to ***Table 7.28***) is assessed as ***minor***.

Mitigation measures

Following mitigation measures will further reduce the impact significance on the habitat and species to negligible.

- It is suggested to start the project in phased manner;
- Good housekeeping should be followed for construction activities, waste packaging material should be properly disposed;
- Efforts should be made to minimize construction noise should be made;
- Labour movement should be restricted between construction camps and construction sites;
- Proper training shall be provided to construction staff for handling of reptilian species;
- Camp and kitchen waste should be collected and disposed in a manner that it does not attract wild animals;
- Temporary barriers should be installed on excavated areas;
- The footprint of the construction activities should be kept to the minimum to reduce disturbance to flora and fauna.
- General awareness regarding wildlife should be enhanced through trainings, posters etc. among the staff and labourers;
- Proper sanitation facilities should be provided at the labour camps; and
- Anti -poaching/hunting policy should be strictly enforced.

Table 7.28 Impact due to construction activities

Impact	Construction activities			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	

Impact Scale	Limited to Project area (specifically construction areas)				
Frequency	Construction phase				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity (Habitat)	Low		Medium	High	
Resource Sensitivity (Species)	Low		Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **minor.**				

Impact due to laying of approach roads

Approach roads are integral part of any wind farm projects as they are established usually away from habitation and main commutation routes. These approach roads are solely used for project related activities. These are generally unpaved and contribute to the dust deposition on the nearby vegetation.

Significance of Impacts

Movement of vehicles in unpaved roads often leads to dust deposition on nearby vegetation areas and which may affect photosynthesis, respiration, transpiration and overall affect the productivity. In addition, the construction of new approach roads will lead to reduction in native species diversity of the area and may facilitate introduction of exotic and invasive species and subsequently their range expansion.

Unregulated vehicle speed on such roads also leads to road kills of herpetofauna and moving wildlife such as Blackbuck (*Antilope cervicapra*- IUCN 2015 ver.2-NT/IWPA Sch-I) which will impact their movement areas.

The impacts of laying of approach road will be both direct and indirect and limited to construction phase of the project. Overall impact significance of the construction of approach roads (Refer to ***Table 7.29***) is assessed as ***moderate***.

Mitigation measures

The suggestive mitigation measures for minimization of impacts due to construction activities are;

Based on the ecological assessment as well as impact significance, the following mitigation measures have been suggested:

- Construction activities should be planned and undertaken in a phased manner;
- Project related activities should be avoided during the night time.
- Damage to the natural topography and landscape should be minimized;

- Strict prohibition should be implemented on trapping, hunting or injuring wildlife within the subcontractors and should bring a penalty clause under contractual agreements;
- A minimum possible number of routes should be authorized for use during construction by the labourers and staff, speed limit of the vehicles plying in these routes should be kept 20-25 km/hr to avoid road kill;
- Where natural drainage crossing is envisaged at approach roads, culverts should be provided for crossing of herpetofaunal species;

Significance of Residual Impact

With the implementation of the suggestive measures, the residual impacts will be **minor**.

Table 7.29 Impact due to construction of approach road

Impact	Construction of Approach roads				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to approach roads and construction areas				
Frequency	Construction phase				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity (Habitat)	Low	Medium	High		
Resource Sensitivity (Species)	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **moderate.**				

7.5.2 Impacts during Operation Phase

Wind farm operation has direct and indirect impacts on the bird and bat communities. The impact during operation phase of the wind farm is discussed in the sections below.

Impact on Avifaunal and bat species

The general impacts of operation phase on the avifaunal and bat species are discussed in the sections below;

Mortality of avifauna due to collision risk

A total of 92 species of birds were identified. Egyptian Vulture (*Neophron percnopterus* IUCN 2015 ver. 2-EN) is observed in the study area. A total of eight (08) migratory species (late migrant) were observed in the study area.

As the survey was undertaken in the non-migratory season impacts on the migratory birds visiting the area during migratory season (October-February) was not captured in the present study. Further survey is required during migratory season (mainly December) to understand the migratory bird status of the study area.

Bird Mortality due to electrocution

The transmission line to be used for power evacuation from the WTG to sub-station may pose threat of electrocution to passing bird species. Some bird species tend to use these wires and poles for roosting can get electrocuted.

Based on above the impact due to movement of blades resulting into collision risk of birds and electrocution (Refer to ***Table 7.30***) is assessed as **minor**.

Mitigation Measures

Following measures to be undertaken for reduction in bird and bat collision:
Additional Monitoring

- Requirement of baseline data generation for bird species visiting the study area during migratory season, The said monitoring would give probable flight path of migratory birds during their daily movement;
- The study will also involve survey of bird species specific to water bodies (ducks and geese) along with terrestrial migratory species which may also be under threat of collision risk; and
- Based on the outcome of the study additional mitigation measures shall be suggested;

Avoidance

Following measure can be considered for avoidance of bird collision with wind turbine blades and electrocution with transmission lines :

- Flash lamps on the WTGs will prevent bird collision at nights.
- Regular checking of the vacuums or holes in the towers to avoid nesting by any of the birds;
- The transmission poles should be raised with suspended insulators in order to reduce the electrocution of bird species; and
- Bird-safe strain poles require insulating chains at least 60 cm in length should be adopted;
- Marking overhead cables using diffractors and avoiding use over areas of high bird concentrations, for species vulnerable to collision.

Significance of Residual Impacts

After implementation of mitigation measures, the significance of the impacts will be reduced to minor.

Table 7.30 Impact due to construction of approach road

Impact	Bird Collision Risk and Electrocution -Operation Phase				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Limited to Project Boundary (specifically WTG locations, substation, Across ROW of internal and external transmission line)				
Frequency	Operation phase				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity (Species)	Low	Medium	High		
Resource Sensitivity (Habitat)	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered **moderate** for the Habitat while it is **Major** for Species				

7.6 SOCIAL IMPACTS

This section discusses socio-economic impacts in the pre-construction, construction, operation and maintenance, and decommissioning phase of the project. The overview of key impacts identified in these stages of project life-cycle is provided below.

Loss of access to cultivation on revenue land

Source of Impact and Overview of Baseline Conditions

As mentioned previously, revenue land is involved in the project for 34 WTG locations and possibly for Access Roads too. On the reconnaissance visit to the field, ERM team observed some encroachment of cultivation over the revenue land parcels identified for the project. Since the company could not arrange consultations with the land owners, it cannot be known if these encroachments are mere squatters or users of the land parcels for many years. This aspect might not involve any legal rights except for in case any informal user rights, recognised locally, which might have developed over a period of time.

Possible Consequences

The encroached revenue land involved for the project purpose will cause (limited) economic loss to those land users who would not be able to access the land henceforth for cultivation.

Embedded Controls

The terms and conditions for payment of compensation against project related use of the revenue land currently under informal use; has to be mutually agreed upon by both the company and the villagers of the concerned villages involving the above mentioned revenue land parcels. Since the villagers understand the situation better, the compensation could be provided to the village level committees to be further distributed to the respective land users based on the period of encroachment.

Impact Significance

The summary of the impact assessment is provided in the *Table 8.31*

Table 8.31 Significance of impact due to loss to access to cultivation on revenue land

Impact	Loss of access of cultivation on revenue land				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term		Permanent
Impact Extent	Local		Regional		International
Impact Scale	The revenue land is involved for 34 WTG locations and in future more of it can be used for the Access Roads as reported by Ostro.				
Frequency	This will be a one-time impact				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	The impact magnitude will be small if the proportion of loss will be relatively small in comparison to the total landholdings of these landowners, assuming these encroachers are not marginal land owners or landless people. But in case these encroachers are landless otherwise or marginal land holders then the magnitude will be larger on their economic lives.				
Resource/Receptors Sensitivity	Low		Medium		High
	The user rights of the cultivators will be identified by the Panchayat members (along with village elders) and compensated as per the agreed terms with the local villagers.				
Impact Significance	Negligible	Minor	Moderate		Major
	Significance of impact is considered **Minor.**				

Mitigation Measures

Considering the small working population in the wind farm area, this wind project will create a major temporary economic opportunity for the local labourers. Keeping this in mind we recommend the following measures to be adopted:

- Providing preference of employment to the families, whose user rights were identified on the revenue land parcels; for livelihood opportunities during the construction and operational phase of the project;
- Identifying the levels of vulnerability among these households and if any particular family requires targeted support and ensuring provision of the same; that should be done to some extent at least;

- Providing training and assistance related to agriculture to help these families improve their farm yield, if they have land otherwise from the encroached parcels.
- Providing training and assistance related to non-farm activities to help these families improve their socio-economic condition even after losing of the encroached land parcels.

7.6.2 Social Impacts in the construction phase

The construction phase of the project will involve intense construction activities which require site preparation, transportation of construction material and rapid mobilisation of the labour force etc.

The characteristics and magnitude of these impacts are assessed in the subsequent sections.

Creation of Local Employment Opportunities

Source of Impact and Baseline Condition

It is understood that no construction activity has started for the project yet.

The workers and employees (semi-skilled/ skilled/ highly skilled) engaged for project activities such as construction of the WTGs, Pooling Sub Station, Switching Sub Station, the Batching plant, Transmission towers, Electrical and Civil works; will be employed by Inox and would mostly be migrant from other parts of country outside of Madhya Pradesh. Ostro should play a role to monitor that majority of the workers are hired from the local communities depending upon their skill levels.

Possible Consequences

With the beginning of the construction phase, many men and women from the local communities having skills of construction and work related to steel required for the wind , will be possibly impacts in the following manners:

- Short-term economic benefits to the families of the identified workers;
- Development in the local skills related to wind farm construction for future wind farm project opportunities.

Embedded Efforts

It is understood that there might be a lack of labourers skilled in the steel works required for some major parts of the project's construction. But as evident from the community consultations, a considerable number of people from the wind farm area migrate to neighbouring districts and states for construction works every year. Therefore proper identification of the local skills should be done to incorporate maximum number of workers from the wind farm area.

Impact Significance

The summary of the impact assessment is provided in ***Table*** below.

Table 8.32 Significance of Impact of Labour In-Migration

Impact	Creation of short-term local employment opportunities			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	In case the required skill-set not being available at the local level, not more than 180 workers will be employed through sub-contractors during the construction phase of the project for over a period of 10-12 months.			
Frequency	The impact would continue till the construction work is over.			
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	The impact magnitude will be medium as even though the total number of migrant workers will be small and limited mainly to the construction period.			
Vulnerability/ Sensitivity of Social Receptors	Low	Medium	High	
	The local community is predominantly engaged in cultivation but seem to possess the required skill set to undertake construction work, as there is migration happening to other districts as well as states, for such works was reported during the community consultations.			
Impact Significance	Negligible	Minor	Moderate	Major
	Significance of impact is considered **minor.**			

Adoptive Measures

The recommended mitigation/management measures to address efforts towards the impact in order to encourage local employment will include:

- Identify local skilled people suitable for the construction activities with the help MGNREGA workers records from the concerned Gram Panchayats;
- Focus on choosing the most socio-economically vulnerable.

Labour Influx Related Impacts

Source of Impact and Overview of Baseline Conditions

There will be migrant workers and employees (semi-skilled/skilled/highly skilled) working for project activities such as WTGs/Substation/Batching Plant/Pooling station/Transmission line tower erection/Civil foundation works and Electrical works amongst others.

These migrant labourers will be contracted by Inox from outside of the Madhya Pradesh. Due to lack of the required skill base (especially in

undertaking the steel work for WTG foundation), the migrant labourers will be employed during the construction work and particularly in civil works. The local labourers will be employed as and when required. The Ostro personnel have confirmed that before employing any worker on site local skill base will be identified post which maximum number of workers will be attempted to be employed from the local areas.

It is understood that no construction activity has started for the project yet.

Possible consequences

The in-migration of a number of labourers might result in the following key consequences:

- Additional demand on resources (such as food supply, water and sanitation facilities etc.);
- Privacy issues inside the labour camps, in case female migrant workers are employed too (possibility of employing women workers is reported by the Ostro personnel);
- Spread of contagious diseases and communicable diseases such as STDs and HIV/AIDS.

Embedded Controls

Compliance to national labour laws, with the work order containing details regarding the safety and labour law requirements; should be ensured to be fulfilled. Additionally, the labour camp should have adequate provisions for water and kitchen facilities, ventilation, basic items such as mattress/floor mat etc. along with all other things mentioned in the Labour Accommodation Guidelines prepared by Ostro with the help of IFC Accommodation Standards for Labourers.

Impact Significance

The summary of the impact assessment is provided in ***Table*** below.

Table 8.33 Significance of Impact of Labour In-Migration

Impact	Labour in-migration issues			
Impact Nature	Negative	Neutral		
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	In case the required skill-set not being available at the local level, not more than 180 workers will be employed through sub-contractors during the construction phase of the project for over a period of 10-12 months.			
Frequency	The impact would continue till the construction work is over.			
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	The impact magnitude will be medium as even though the total number of migrant workers will be small and limited mainly to the construction period.			

Vulnerability/ Sensitivity of Social Receptors	Low	Medium	High	
	The receptor vulnerability is medium as the accommodation as reported will be provided with adequate facilities with particular attention to water, cooking and sanitation requirements, however aspects such as electricity, ventilation, floor mats/mattresses require additional attention. The local community are predominantly engaged in cultivation but seem to possess the required skill set to undertake construction work, as migration to other districts as well as states, for such works was reported during the community consultations.			
Impact Significance	Negligible	Minor	Moderate	Major
	Significance of impact is considered **minor.**			

Mitigation/Management Measures

The recommended mitigation/management measures to address the impacts related to Labour In-migration will include:

- Health awareness sessions before beginning of the construction work by the contractor/ sub-contractor;
- Quarterly health screening of all the employed labourers at the project site by the contractor/sub-contractor;
- Maintenance of hygiene and separate rooms for males and females at the labour camp;
- Provision of all the materials mentioned in the Labour Accommodation Guidelines;
- Providing recreational facilities to the labourers on their off-days.

Loss of free access to grazing land on both the revenue land

Source of Impact

As mentioned previously, revenue land is involved in the project for 34 WTG locations and possibly for Access Roads too. The communities residing nearby these land parcels have been grazing their livestock and goats on this land for many years now. Because of the construction activities along with the repairing of the access roads and transportation of material, the communities will not be able to access the grazing plots for free at least till the completion of the construction phase.

This aspect might not involve any legal rights except for one case. If any informal user rights (which are locally recognised) of these shepherds might have developed over a period of time, under the common property resources (CPR).

Possible Consequences

The revenue land involved in the project, used for grazing animals by people will cause lack of availability and accessibility of grazing plots for at least 10-12 months while the construction phase is completed.

Embedded Controls

There could be an agreement between the company and the communities, with particulars of timings in a day for transportation of construction material and construction hours. As a result the rest of the time could still be utilised by the shepherds for grazing their animals for free on their usual plots.

Impact Significance

The summary of the impact assessment is provided in ***Table*** below.

Table 8.34 Significance of Impact of Loss of free access to the grazing land

Impact	Short-term loss of free access to the grazing land				
Impact Nature	Negative			Neutral	
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term		Long-term	Permanent
Impact Extent	Local		Regional		International
Impact Scale	The construction phase will not take more than 12 months to complete. But the free access to grazing of animals on the usual land will be an issue.				
Frequency	The impact would continue till the construction work is over.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	The impact magnitude will be small and limited mainly to the construction phase.				
Vulnerability/ Sensitivity of Social Receptors	Low		Medium		High
	The receptor vulnerability is low since the shepherds might find grazing plots in other areas of the wind farm area for the time being of the construction phase which is not more than 10-12 months.				
Impact Significance	Negligible	Minor		Moderate	Major
	Significance of impact is considered **minor.**				

Mitigation/ Management Measures

Considering that there might be CPR involved with the grazing activities and even in case of no legal rights involved following measures could be adopted for mitigation of the impact:

- Identifying the levels of vulnerability among these households and if any particular family requires targeted support and ensuring provision of the same; that should be done to some extent at least;
- Agreeing upon particular time frames for the construction activities for the shepherds to bring their animals to the field for grazing during the free hours;
- Identify the socio-economically vulnerable families among these shepherds and provide free access of grazing land to them.

7.6.3 *Social Impacts during Decommissioning Phase*

Retrenchment and loss of employment

Source of Impact

The decommissioning of the wind farm will result in staff retrenchment and loss of livelihood for others who are economically dependent on wind farm.

The retrenchment would also result from reduction of staffing requirements or due to downsizing operation or restructuring of the workforce.

Possible Consequences

The decommissioning will therefore result in job-losses and consequently loss of income for their families. In a scenario of downsizing or partial retrenchment the process may lead to loss of involvement, low morale, legal and reputational risks.

Impact Significance

Table 8.35 Significance of impact of retrenchment and loss of employment

Impact	Retrenchment and loss of employment				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	The retrenchment will affect staff members of Ostro and Inox and the security staff deployed at site through sub-contractor.				
Frequency	Once				
Likelihood	Low				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Vulnerability of Social Receptors	Low	Medium	High		
	The skilled workforce will get alternate jobs, however, the local un-skilled workforce would find it difficult for a change of job and ensure alternative earning source. As the area has limited industrial presence, it acts as a further constraint in finding an alternative source of employment.				
Impact Significance	Negligible	Minor	Moderate	Major	
	The impact significance is assessed as minor.				

Mitigation/Management Measures

Following recommendations are made to manage the retrenchment process if it becomes necessary.

- Adopt a retrenchment policy which clearly states the conditions on which preparation of a retrenchment triggers and entitlements thereof;
- Alternatives to job-losses to be explored before retrenchment is initiated;
- Key-stakeholders will be consulted at an early stage and their views to be incorporated in the process to the extent feasible; and

- A retrenchment plan is prepared as per IFC good practice note and is implemented.

No consultations with the land owners or losers involved or to be involved in the project could be arranged by Ostro and Inox thus any change of type of land to be used for different project components is not known. Therefore impacts related to the same cannot be anticipated.

This section outlines the potential adverse impacts, mitigation measures, monitoring and management responsibilities during operation phase of the Project.

The purpose of ESMP is to:

- Provide an institutional mechanism with well-defined roles and responsibilities for ensuring that measures identified in ESIA designed to mitigate potentially adverse impacts, are implemented;
- List all suggested mitigation measures and control technologies, safeguards identified through the ESIA process;
- Provide Project monitoring program for effective implementation of the mitigation measures and ascertain efficacy of the environmental management and risk control systems in place; and
- Assist in ensuring compliance with all relevant legislations at local, state and national level for the Project.

In order to minimize adverse impacts during different phases of project lifecycle, mitigation measures, monitoring plan and responsibilities for its implementation are given in ***Table 9.1***.

Table 8.1 Environmental Management and Monitoring Plan for Lahori Wind Farm Project- Construction Phase

S. No	Project Activities/Commitment	Aspect/Potential Impact/Issue	Mitigation measures	Responsible person for ensuring commitment implementation	Means of verification that commitment has been met	Timing and frequency of monitoring (routine, how often, continuous or in emergency situations only)	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
1.1	**Land Use**								
1.1.1	Disturbance to be restricted to the footprint of the Project components and remaining area will be kept undisturbed to the extent possible	Change in Land use	• Foot print for project facilities to be demarcated before initiating site clearanve activities • Removal of vegetation to be done only for the project site locations such as WTG land parcels, proposed internal roads substation area and Transmission line ROW	IWISL	Site Inspection	Weekly	EHS IWISL	EHS Ostro	To be included in the weekly progress report
1.1.2	Restoration of disturbed area to original form after completion of construction work	Change in Land use	Plantation activities to be initiated simultaneously in the highly disturbed areas	IWISL	Site Inspection	Monthly	EHS-IWISL	EHS Ostro	Monthly progress report
1.2	Soil								
1.2.1	Stripping of topsoil	Loss of fertile soil Soil Erosion	• Maintain vegetation cover for as long as possible on areas that will stripped of top soil • Identify areas where topsoil could be utilized for landscaping • Inspect for contamination through leakage, seepage, soil discoloration signs indicating soil contamination and pollution as part of routine inspection process especially from the following locations: fuel oil, lubricants, paints, other chemicals storage/usage/transport areas	IWISL	Site Inspection	Monthly	EHS-IWISL	EHS Ostro	Monthly Progress report
1.2.2	Compaction of top soil by movement of heavy vehicles,	Loss of fertility	Heavy machinery movement will be restricted to designated route	IWISL	Site Inspection	Daily	EHS-IWISL	EHS Ostro	Monthly Progress Report
1.2.3	Spillage of oil or leakage	Contamination of soil leading to generation of hazardous waste	Prohibit and apply zero-tolerance towards leaks, spills, seepages (of fuel, oil, lubricants, grease, bitumen and other hazardous materials) Contaminated sites should be immediately attended and cleaned off by scraping off entire contaminated soil layer and disposing it with other hazardous waste generated	IWISL	Site Inspection	Daily	EHS-IWISL	EHS Ostro	Monthly Progress Report
1.2.3	Improper management of solid and hazardous waste	Soil contamination	Proper Housekeeping • Construction site should be maintained free of wastes, excavation debris, concrete waste, wood, litter, plastics and metal scraps by periodically collecting, segregating, storing, transporting and disposing them appropriately • All hazardous wastes (such as used fuel/paint/chemical containers, waste oil, lubricants, oil rags, contaminated, used batteries, etc should be segregated at	IWISL	Quantification of waste generated	Quarterly	EHS-IWISL	EHS-Ostro	Quarterly EHS Report

S. No	Project Activities/Commitment	Aspect/Potential Impact/Issue	Mitigation measures	Responsible person for ensuring commitment implementation	Means of verification that commitment has been met	Timing and frequency of monitoring (routine, how often, continuous or in emergency situations only)	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
			source and stored in secure and leak proof containers before transporting and disposing them through Madhya Pradesh Authorized waste management agencies						
1.3	Air Quality								
1.3.1	Generation of fugitive dust emissions	Impact on health due to dust emissions	• Vehicles or equipment's that is compliant to prevailing emissions standards of CPCB/Central Motor Vehicle Act/Rule is to be used • Periodical maintenance of vehicles and equipment • Siting of batching plant 300m away from habitation in the downwind direction • DG sets that are compliant to prevailing CPCB regulations (air and noise levels) to be used • Water sprinkling on roads near and within habitation.	IWISL	Site Inspection; Record Keeping; Visual Assessment	Monthly	EHS-IWISL	EHS-Ostro	Monthly Progress Report
1.4	Noise levels and Emissions								
1.4.1	Incremental noise due to vehicle movement, batching plant operation, DG set operation	Noise pollution	• Vehicles and equipment's such as DG sets that are compliant to prevailing emissions standards of CPCB/Central Motor Vehicle Act/Rule is to be used • PPE to be used by workers at sites of high noise continuous noise generation (like concrete vibrators, crane operations, concrete mixing unit	IWISL	Site Inspection; Record Keeping; Visual Assessment	Monthly	EHS-IWISL	EHS-Ostro	Monthly Progress Report
1.5	Water Resource and Quality								
1.5.1	Groundwater use for construction purposes	Groundwater depletion	Ostro has reported that groundwater will be used to the minimum for construction or labour camp.	IWISL				EHS-Ostro	
1.5.2	Improper management of construction waste	Water contamination	Refer 1.2.3	IWISL	Quantification of waste generated	Quarterly	EHS-IWISL	EHS-Ostro	Quarterly EHS Report
1.6	Ecology								
1.6.1	Disturbance in Wildlife Movement	Impact on wildlife. The land clearance activities for the construction activities lead to removal of vegetation, habitat disturbance for reptiles, resident birds, and mammals	• Scheduling of project activities: All pre project development activities (road construction and widening) and main project activities need to be carried out in a phased manner; • Mammals get free space to move along the undisturbed area without dispersing/moving down into the buffer zone, where there will be lot of disturbance and thus may move into agriculture area causing man – animal conflicts. The phased approach will give opportunity to the animals to get used to the project activities and they may not shift their range permanently into the buffer or other areas. • Project related activities should be avoided during the night time. • Removal of vegetation should be limited to the extent possible; • Damage to the natural topography and	Inox	Site Inspection; Training records; Visual Assessment by experts	Once during the project phase	EHS- Inox	EHS- Ostro	Weekly during project phase

S. No	Project Activities/Commitment	Aspect/Potential Impact/Issue	Mitigation measures	Responsible person for ensuring commitment implementation	Means of verification that commitment has been met	Timing and frequency of monitoring (routine, how often, continuous or in emergency situations only)	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
			landscape should be minimized; • General awareness regarding wildlife should be enhanced through trainings, posters etc. among the staff and labourers; • Strict prohibition should be imposed on trapping, hunting or injuring wildlife by subcontractors and a penalty clause should be included in contractual agreements; • Camp and kitchen waste should be collected and disposed in a manner that does not attract wild animals; • A minimum possible number of routes should be authorized for use during construction by the labourers and staff, speed limits of the vehicles plying in these routes should be kept 20-25 km/hr to avoid road kills; • Where natural drainage crossing is envisaged at approach roads, culverts should be provided for crossing of herpetofaunal species; • Strict prohibition on use of fuel wood and shrubs from nearby areas as fuel; • Temporary barriers should be installed on excavated areas;						
1.6.2	Habitat alteration at the wind farm site	Impact on wildlife	• Engage an experienced ecologist either in full time capacity or as an external support during construction and operation phase. Engage them to prepare detailed ecological conservation and protection plan and to monitor its effective implementation; • Baseline studies to look at the effects of displacements of birds;. • Minimize vegetation removal or trimming to the extent possible at WTG locations, EHV transmission line alignments, internal/ external access roads, substation area, yards, CMS facility and other ancillary facilities; • Strict prohibition should be implemented for cutting of trees, shrubs for kitchen fuel and trapping and hunting of birds by labours; • The topsoil removed during construction of roads, other related structures and installation of the WTGs, should be used to reclaim disturbed areas upon completion of construction activities; • Stage wise re-vegetation with local grass species should be undertaken immediately after construction phase is completed; • Restore the construction site and other disturbed areas through afforestation by	Inox	Site Inspection; Training records; Visual Assessment by experts	Once during the project phase	EHS- Inox	EHS- Ostro	Once during project phase

S. No	Project Activities/Commitment	Aspect/Potential Impact/Issue	Mitigation measures	Responsible person for ensuring commitment implementation	Means of verification that commitment has been met	Timing and frequency of monitoring (routine, how often, continuous or in emergency situations only)	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
			using native vegetation of local ecotypes (local plant species); • All areas of disturbed soil should be reclaimed or covered using weed-free native shrubs, grasses, and forbs, and the vegetation cover, composition, and diversity should be restored to values commensurate with the ecological setting as quickly as possible, during or immediately after construction; • Construction noise should be minimized by usage of acoustic enclosures and lubrication of equipment's where feasible; • The transmission poles should be raised with suspended insulators in order to reduce the electrocution of bird species; • Where possible poles with the middle suspended insulator in a triangle- or vault-shaped frame should be avoided as they offer a dangerous perching site for birds; • Bird-safe strain poles require insulating chains at least 60 cm in length should be adopted.						
1.7	Road safety and Traffic								
1.7.1	Traffic management along access road due to increase in project construction traffic	Impact on traffic movement in the project area	• The road capacity assessment based on the route survey options for the transportation of the WTG parts as well as identifying the height clearance and increase in turning point radius has to be conducted • The sustainability parameters such as diesel consumption, distance travelled, loads hauled in terms of tonnage etc. as part of annual auditing systems and compare them to sector equivalent benchmarks. • Project management team especially the fleet operating teams from IWISL shall be provided with training programs on project specific Traffic Management Plan as part of the inception/initial program.	IWISL	Site Inspection, Training records	Monthly	EHS-IWISL	EHS-Ostro	Monthly Progress Report
1.7.2	Vehicle movement	Impact on local traffic flow	• Avoid peak traffic periods to operate project vehicular traffic especially on main access roads in Shajapur – Nainawad road • Avoid putting any restrictions on local community/ traffic movement/ access through construction stretches unless any H&S issues are involved. Alternate access arrangements should be made or undertake work during lean traffic flow periods • The road condition should be inspected						

S. No	Project Activities/Commitment	Aspect/Potential Impact/Issue	Mitigation measures	Responsible person for ensuring commitment implementation	Means of verification that commitment has been met	Timing and frequency of monitoring (routine, how often, continuous or in emergency situations only)	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
			during heavy monsoon season and repaired accordingly • Any accidents and incidents involving vehicle fleets should be reported and documented						
1.8	Community, Health and Safety								
1.8.1	Movement of heavy vehicles		• Avoid plying of heavy vehicles in community during peak traffic hours	IWISL	Site Inspection, Training records	Monthly	EHS-IWISL	EHS-Ostro	Monthly Progress Report
1.8.2	Health and Safety issues		• Project will communicate about the technical aspects of the construction and operations along with their community safety and nuisance implications	IWISL	Site Inspection, Training records	Monthly	EHS-IWISL	EHS-Ostro	Monthly Progress Report
1.8.3	Influx of workers – Establishment of labour camps Stress on local infrastructure and resources		• IWISL is expected to ensure that the main contractors are committed to health and safety of workers as well as the community and their property • IWISL to develop a "Code of Conduct" for the construction phase which will take into account a) pre-dominantly rural communities in the vicinity b) health and safety aspects c) restrictions on activities- Do's and Don't's d)labour camp regulations e) briefing on the local area/immediate vicinity, etc) zero tolerance of illegal activities by construction personnel including : unlicensed prostitution; illegal sale or purchase of alcohol; sale, purchase or consumption of drugs; illegal gambling or fighting which will be shared with all contractors for induction of their employees/supervisors/workers • Labour camps is to be located away from village settlements and they should be provided with basic amenities and sanitation facilities to avoid pressure on local natural resources (water bodies, fire wood) and infrastructure (drinking water, health care, etc) • The project will, conduct routine medical check-up, health and safety training and sensitization programmes to raise awareness about STDs. These trainings will also have sessions on maintaining behaviour standards while moving in the community, knowing and respecting prevalent socio-cultural systems of host community, etc. • The project will, where possible, maximize procurement of goods and supplies catering to the labour camps from the local markets. This will ensure that the project catalyses the local economy. • Monitor contractors for compliance on	IWISL	Site Inspection, Training records	Monthly	EHS-IWISL	EHS-Ostro	Monthly Progress Report

S. No	Project Activities/Commitment	Aspect/Potential Impact/Issue	Mitigation measures	Responsible person for ensuring commitment implementation	Means of verification that commitment has been met	Timing and frequency of monitoring (routine, how often, continuous or in emergency situations only)	Responsibility for implementation of monitoring	Supervision responsibility	Reporting Requirements
			labour laws as well as PS2. • Training of all supervisors, workers and labourers on community health & safety aspects.						

Table 8.2 Environmental and Social Management and Monitoring Plan for Lahori Wind farm project- Operation Phase

S. No.	Project Activities/ Commitment	Aspect/ Potential Impact/Issue	Mitigation measures	Responsible person for ensuring commitment implementation	Means of verification that commitment has been met	Timing and frequency of monitoring (routine, how often, continuous or in emergency situations only)	Responsibility for implementation of monitoring	S. No.	Project Activities/ Commitment
1.1	Soil								
1.1.1	Municipal domestic waste generated at PSS and site office	Generation of domestic waste; Soil contamination.	To be segregated onsite and disposed through local Municipal authority.	EHS-IWISL	Record keeping	Monthly	EHS-IWISL	EHS Ostro	None
1.1.2	Generation of hazardous waste due to the maintenance activities	Generation of hazardous waste; Soil contamination.	Ensure oil/lubricants are stored on impervious floor in the storage area having secondary containment Ensure hazardous waste oil and rags are properly labelled and stored onsite provided with impervious surface, shed and secondary containment system. Ensure collection and disposal of hazardous waste to be done in accordance with Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008 Ensure routinely disposal of hazardous waste (within 90 days) through approved vendors and records are properly documented Use of spill control kits to contain and clean small spills and leaks during O&M activities	EHS-IWISL	Quantification of waste Record keeping; Site Inspection	Quarterly	EHS-IWISL	EHS Ostro	To be included in Quarterly EHS report
1.2	Noise quality								
1.2.1	Cumulative impact	Noise Pollution	Regular maintenance of WTGs Periodic monitoring of noise near to the sources of generation to ensure compliance with design specification Noise monitoring at receptors where the receptor is at less than 300m in all possible scenarios	EHS-IWISL	Record keeping	Quarterly	EHS-IWISL	EHS Ostro	To be included in Quarterly EHS report
				EHS-IWISL	Record keeping	Quarterly	EHS-IWISL	EHS Ostro	To be included in Quarterly EHS report
				Community Relation Officer	Record keeping	Quarterly	EHS-IWISL	EHS Ostro	To be included in Quarterly EHS report
1.3	Activity/ Topic: Water resource and quality								
1.3.1	Operation of wind turbines	Avifauna mortality	Regular checking of the vacuums or holes in the towers to avoid nesting facility of any of the birds	EHS-IWISL	Record keeping	Quarterly	EHS-IWISL	EHS Ostro	To be included in Quarterly EHS report
		Avifauna mortality	Bird mortality count in the immediate vicinity is proposed to establish a strong link between the wind turbines and birds mortality for two years starting from the commissioning of the wind farm	EHS-IWISL	Record keeping	Monthly	EHS-IWISL	EHS Ostro	To be included in Quarterly EHS report
		Collision risks to avifauna	A detail bird monitoring study is recommended to be undertaken to assess the impact of resident and	EHS-IWISL	Record keeping	Continuous monitoring for one year	EHS-IWISL	EHS Ostro	Detailed separate report

S. No.	Project Activities/ Commitment	Aspect/ Potential Impact/Issue	Mitigation measures	Responsible person for ensuring commitment implementation	Means of verification that commitment has been met	Timing and frequency of monitoring (routine, how often, continuous or in emergency situations only)	Responsibility for implementation of monitoring	S. No.	Project Activities/ Commitment
			migratory bird movement in the area on full scale						
		Avifauna mortality	A procedure to be introduced in the operating manual where the Caracas dumping sites are to be identified/removal of Caracas near to wind farm area is ensured in consultation with the local villagers.	Community Relation Officer	Record keeping	Continuous	EHS-IWISL	EHS Ostro	To be included in Quarterly EHS report
		Avifauna mortality	Bird-safe strain poles require insulating chains at least 60 cm in length should be adopted.	EHS-IWISL	Record keeping	Once	EHS-IWISL	EHS Ostro	None
	Shadow Flicker								
	Operation of WTGs	Impact on communities within 300m	Identify the WTG locations that could cause shadow flickering on nearby sensitive receptors (such as habitation, individual dwelling units, schools, temple etc that are located closer to rural habitations; Consult the concerned stakeholders to formulate appropriate mitigation measures such as installing vegetative screens and integrate the same as part of project design and implement the same; Monitor and implement additional mitigation measures in addition to those recommended in the Planning and Construction phase EMPs to mitigate shadow flicker issue at individual WTG locations, if necessary. Regularly consult and obtain affected stakeholder feedback to formulate appropriate corrective action. During inception of construction phase, train the IWISLProjects team and sub-contractor staff on shadow flicker and cumulative noise impact; Monitor and review shadow flicker management strategies at WTG locations that are identified and categorised for priority shadow flicker management at least once in 6 months; A detailed shadow flicker assessment shall be carried out as a part of the ESIA study.	IWISL	Site Inspection, Training records	Monthly	EHS-IWISL	EHS-Ostro	Monthly Progress Report
		Blade Throw	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 turbines	IWISL	Site Inspection, Training records	Monthly	EHS-IWISL	EHS-Ostro	Monthly Progress Report
	Ecology								
	Ecological Monitoring with special emphasis on bird and bats during the Operations Phase	Impact on Bird/bats movement and Interference	Detail long term Bird and bat monitoring study to be conducted post operation of wind farm site to record the movement pattern of birds all through the year in terms of distance and time based in case the outcome of Migratory season survey suggest high sensitivity; This monitoring would give probable flight path of birds and bats for day to day activity; Flash lamps on the WTGs will prevent bird collision at nights. Regular checking of the vacuums or holes in the towers to avoid nesting facility of any of the birds; and Bird and bat mortality count in the immediate vicinity is proposed to establish a strong link between the wind turbines and bird and bat mortality for two years starting from the commissioning of the wind farm; Requirement of baseline data generation with respect to migratory birds during the migratory season. Based on the outcome, if the sensitivity is found high birdand bat monitoring is to take place of duration at least 3 months and maximum of 6 months covering	Inox	Site Inspection; Training records; Visual Assessment by experts	Once during the project phase	EHS- Inox	EHS- Ostro	Once during project phase

S. No.	Project Activities/ Commitment	Aspect/ Potential Impact/Issue	Mitigation measures	Responsible person for ensuring commitment implementation	Means of verification that commitment has been met	Timing and frequency of monitoring (routine, how often, continuous or in emergency situations only)	Responsibility for implementation of monitoring	S. No.	Project Activities/ Commitment
			migratory season and breeding season in order, to assess the actual impacts on the birds and bats in the area by wind farm. If any of the WTG location shows significant sensitivity with respect to the bird and bat species and likely collision impact during the operation phase; then option of shifting the WTG should be considered by Inox; Primary data also need to be generated with respect to bird populations using nearby water bodies as their habitats and intermigration between the water bodies ;						
	Activity/ Topic: Local Employment								
	Operation of wind turbines	Avifauna mortality	Regular checking of the vacuums or holes in the towers to avoid nesting facility of any of the birds	EHS-IWISL	Record keeping	Quarterly	EHS-IWISL	EHS Ostro	To be included in Quarterly EHS report
		Avifauna mortality	Bird mortality count in the immediate vicinity is proposed to establish a strong link between the wind turbines and birds mortality for two years starting from the commissioning of the wind farm	EHS-IWISL	Record keeping	Monthly	EHS-IWISL	EHS Ostro	To be included in Quarterly EHS report
		Collision risks to avifauna	A detail bird monitoring study is recommended to be undertaken to assess the impact of resident and migratory bird movement in the area on full scale	EHS-IWISL	Record keeping	Continuous monitoring for one year	EHS-IWISL	EHS Ostro	Detailed separate report
		Avifauna mortality	A procedure to be introduced in the operating manual where the Caracas dumping sites are to be identified/removal of Caracas near to wind farm area is ensured in consultation with the local villagers.	Community Relation Officer	Record keeping	Continuous	EHS-IWISL	EHS Ostro	To be included in Quarterly EHS report
		Avifauna mortality	Bird-safe strain poles require insulating chains at least 60 cm in length should be adopted.	EHS-IWISL	Record keeping	Once	EHS-IWISL	EHS Ostro	None
	Shadow Flicker								
	Operation of WTGs	Impact on communities within 300m	Identify the WTG locations that could cause shadow flickering on nearby sensitive receptors (such as habitation, individual dwelling units, schools, temple etc that are located closer to rural habitations; Consult the concerned stakeholders to formulate appropriate mitigation measures such as installing vegetative screens and integrate the same as part of project design and implement the same; Monitor and implement additional mitigation measures in addition to those recommended in the Planning and Construction phase EMPs to mitigate shadow flicker issue at individual WTG locations, if necessary. Regularly consult and obtain affected stakeholder feedback to formulate appropriate corrective action. During inception of construction phase, train the IWISLProjects team and sub-contractor staff on shadow flicker and cumulative noise impact; Monitor and review shadow flicker management strategies at WTG locations that are identified and categorised for priority shadow flicker management at least once in 6 months; A detailed shadow flicker assessment shall be carried out as a part of the ESIA study.						
		Blade Throw	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 turbines	IWISL	Site Inspection, Training records	Monthly	EHS-IWISL	EHS-Ostro	Monthly Progress Report
	Ecology								

S. No.	Project Activities/ Commitment	Aspect/ Potential Impact/Issue	Mitigation measures	Responsible person for ensuring commitment implementation	Means of verification that commitment has been met	Timing and frequency of monitoring (routine, how often, continuous or in emergency situations only)	Responsibility for implementation of monitoring	S. No.	Project Activities/ Commitment
	Ecological Monitoring with special emphasis on bird and bats during the Operations Phase	Impact on Bird/bats movement and Interference	Detail long term Bird and bat monitoring study to be conducted post operation of wind farm site to record the movement pattern of birds all through the year in terms of distance and time based in case the outcome of Migratory season survey suggest high sensitivity; This monitoring would give probable flight path of birds and bats for day to day activity; Flash lamps on the WTGs will prevent bird collision at nights. Regular checking of the vacuums or holes in the towers to avoid nesting facility of any of the birds; and Bird and bat mortality count in the immediate vicinity is proposed to establish a strong link between the wind turbines and bird and bat mortality for two years starting from the commissioning of the wind farm; Requirement of baseline data generation with respect to migratory birds during the migratory season. Based on the outcome, if the sensitivity is found high birdand bat monitoring is to take place of duration at least 3 months and maximum of 6 months covering migratory season and breeding season in order, to assess the actual impacts on the birds and bats in the area by wind farm. If any of the WTG location shows significant sensitivity with respect to the bird and bat species and likely collision impact during the operation phase; then option of shifting the WTG should be considered by Inox; Primary data also need to be generated with respect to bird populations using nearby water bodies as their habitats and intermigration between the water bodies ;	Inox	Site Inspection; Training records; Visual Assessment by experts	Once during the project phase	EHS- Inox	EHS- Ostro	Once during project phase
	Activity/ Topic: Local Employment								
	Ecological Monitoring with special emphasis on bird and bats during the Operations Phase	Impact on Bird/bats movement and Interference	Detail long term Bird and bat monitoring study to be conducted post operation of wind farm site to record the movement pattern of birds all through the year in terms of distance and time based in case the outcome of Migratory season survey suggest high sensitivity; This monitoring would give probable flight path of birds and bats for day to day activity; Flash lamps on the WTGs will prevent bird collision at nights. Regular checking of the vacuums or holes in the towers to avoid nesting facility of any of the birds; and Bird and bat mortality count in the immediate vicinity is proposed to establish a strong link between the wind turbines and bird and bat mortality for two years starting from the commissioning of the wind farm; Requirement of baseline data generation with respect to migratory birds during the migratory season. Based on the outcome, if the sensitivity is found high birdand bat monitoring is to take place of duration at least 3 months and maximum of 6 months covering migratory season and breeding season in order, to assess the actual impacts on the birds and bats in the area by wind farm. If any of the WTG location shows significant sensitivity with respect to the bird and bat	Inox	Site Inspection; Training records; Visual Assessment by experts	Once during the project phase	EHS- Inox	EHS- Ostro	Once during project phase

S. No.	Project Activities/ Commitment	Aspect/ Potential Impact/Issue	Mitigation measures	Responsible person for ensuring commitment implementation	Means of verification that commitment has been met	Timing and frequency of monitoring (routine, how often, continuous or in emergency situations only)	Responsibility for implementation of monitoring	S. No.	Project Activities/ Commitment
			species and likely collision impact during the operation phase; then option of shifting the WTG should be considered by Inox; Primary data also need to be generated with respect to bird populations using nearby water bodies as their habitats and intermigration between the water bodies ;						
	Activity/ Topic: Local Employment								
	Operation and maintenance of Wind Farm	Local Employment	Inox should demonstrate transparency in employment and adopt policy of non-discrimination and equal opportunities	HR/Admin Officer	Record Keeping	Once before engaging new labour	HR Manager		None
		Local Employment	The employment policy may adopt an affirmative action policy which gives preference to families who sold land to the project	HR/Admin Officer	Record Keeping	Once	HR Manager		None
	Activity/ Topic: Community Health and Safety Issues								
	Operation and maintenance of Wind Farm	Community Health and Safety	Sign boards in local language warning local people of danger should be installed at all sites	EHS Manager	Internal Audit	Once	EHS Head		None
		Community Health and Safety	Education campaign and guided tours to wind farm should be facilitated for school children to educate them on wind farm and to address their curiosity	EHS Manager	Internal Audit	Once	EHS Head		None
		Community Health and Safety	Safety issues related to public safety should be communicated to nearby communities	EHS Manager	Internal Audit	Once	EHS Head		None
	Activity/ Topic: Health and Safety								
	Electromagnetic Interference	Health and Safety of workers	Site the turbine away from the line-of-sight of the broadcaster transmitter	Site Manager	Document Keeping	As Required	EHS Head		To be included in Quarterly EHS report
			Install higher quality or directional antenna	Site Manager	Document Keeping	As Required	EHS Head		To be included in Quarterly EHS report
			Install an signal amplifier, If a wide area is affected, consider the construction of a new repeater station	Site Manager	Document Keeping	As Required	EHS Head		To be included in Quarterly EHS report

Table 8.3 Environmental and Social Management and Monitoring Plan for Lahori Wind farm project- Decommissioning Phase

Project Activities/ Commitment	Aspect/ Potential Impact/Issue	Responsible person for ensuring commitment implementation	Means of verification that commitment has been met	Timing and frequency of monitoring (routine, how often, continuous or in emergency situations only)	Responsibility for implementation of monitoring (Responsibility for supervision of monitoring)	Reporting requirements
Activity/ Topic :Removal of Equipment and Site Rehabilitation			•			
A decommissioning plan to be prepared. It should cover the following: • Removal of above ground structures; • Removal of below-ground structures; • Restoration of topsoil; • Re-vegetation and seeding; and • Implementation of a two year monitoring and remediation period.	Removal of Equipment and Site Rehabilitation	Site Manager	On-site Verification	As Required	EHS Head	Written Report to Management

Project Activities/ Commitment	Aspect/ Potential Impact/Issue	Responsible person for ensuring commitment implementation	Means of verification that commitment has been met	Timing and frequency of monitoring (routine, how often, continuous or in emergency situations only)	Responsibility for implementation of monitoring (Responsibility for supervision of monitoring)	Reporting requirements
The disclosure of the decommissioning plan to the stakeholders	Removal of Equipment and Site Rehabilitation	Site Manager	On-site Verification	As Required	EHS Head	Written Report to Management
Adopt a retrenchment policy which clearly states the conditions on which preparation of a retrenchment triggers and entitlements thereof	Retrenchment	HR Manager	Document Verification	Once	Chairman	None
Alternatives to job-losses to be explored before retrenchment is initiated	Retrenchment	HR Manager	Document Verification	Once	Chairman	None
Key-stakeholders will be consulted at an early stage and their views to be incorporated in the process to the extent feasible	Retrenchment	HR Manager	Document Verification	Once	Chairman	None
A retrenchment plan is prepared as per IFC good practice note and is implemented	Retrenchment	HR Manager	Document Verification	Once	Chairman	None

9 IMPACT SUMMARY AND CONCLUSION

9.1 INTRODUCTION

This Environmental and Social impact assessment has been conducted to evaluate the impacts associated with the proposed wind farm project of 100 MW capacity at Lahori and other village in Tehsil and District Shajapur, Madhya Pradesh by Ostro. The impact assessment has been conducted in compliance with the Administrative Framework identified herein, including relevant national legislative requirements, international conventions, and Ostro's requirements.

9.2 IMPACTS REQUIRING DETAILED ASSESSMENT

Following a Scoping exercise, this ESIA was focused on interactions between the Project activities and various resources/receptors that could result in significant impacts. The table below presents the outcomes of the comprehensive assessment of identified impacts as a result of the various phases of the Project.

Table 9.1 Impact Assessment Summary

Impact Description	Impact nature	Significance of Impact	
		Before Mitigation	With Mitigation
Pre -construction Phase			
Economic loss due to selling of land Loss of access of cultivation on revenue land	Negative	Moderate	Minor
Construction and Operation Phase			
Change in land use (Construction and operation)	Negative	Minor	Negligible
Visual (Construction)	Negative	Minor	Negligible
Visual (Operation)	Negative	Moderate	Minor
Topography (Construction and Operation)	Negative	Moderate	Minor
Loss of Soil Fertility	Negative	Minor	Negligible
Waste Generation	Negative	Minor	Negligible
Soil contamination (construction)	Negative	Minor	Negligible
Soil contamination (operation)	Negative	Minor	Negligible
Air Quality (Construction)	Negative	Minor	Negligible
Air Quality (Operation)	Negative	Minor	Negligible
Noise quality	Negative		
Sharing of Water resources & quality	Negative	Moderate	Minor
Change in Water Quality	Negative	Moderate	Minor
Collision risks to birds/ bats	Negative		
Shadow Flicker	Negative	Medium	Minor to Moderate
Noise Pollution (Construction)		Moderate	Minor
Noise Pollution (Operation)		Minor to negligible	Negligible

Local employment opportunity	Positive		
Occupational Health and Safety (Construction)	Negative	Major	Minor
Occupational Health and Safety (Operation)	Negative	Major	Minor
Community Health and safety issues	Negative		
Welfare Benefits for Local Communities	Positive		
Decommissioning Phase			
Impact on soil environment	Negative	Minor	Negligible
Impact on ambient air quality	Negative	Minor	Minor
Retrenchment and loss of employment	Negative	Negligible	Negligible

9.3 *CONCLUSION*

The proposed project is a green energy project comprising of 50 WTGs to generate 100 MW power through wind energy. Impacts due to wind energy projects are short term, generally limited to construction phase and operation phase have negligible adverse environmental and social impacts.

The Project and its key components such as access road, substation, site office building, internal and external transmission lines, are likely to have some adverse environmental impacts on baseline parameters such as land use, ambient air quality, noise quality etc. in the immediate vicinity of WTGs. The social impacts from the project are assessed to be generally beneficial in terms of local employment and overall local area development.

The key mitigation measures implemented at project site include the following:

- The Project will require ~8650 m^3 /day of fresh water during construction phase– planned to be sourced from tanker water;
- The project will have negligible air emissions during operation phase, mostly due to occasionally vehicular movement and DG operations in emergency;
- The negligible quantity of sewage will be generated at site office, which will be disposed through septic tanks and soak pit;
- There will be no industrial wastewater generation from the project;
- The hazardous waste will be disposed of as per authorization from MPPCB. The storage, handling, transportation and disposal will be strictly as per the requirement of authorization by MPPCB and Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008. The waste will be stored into closed containers under covered area with concrete flooring and sent for disposal to TSDF;
- The project doesn't include any forest land and limited private land is purchased from local villagers;
- The proposed project will have no significant negative impacts on the nearby communities as there will be no physical displacement of people.

The project will employ mainly local people. Only skilled people who may not be locally available will be sought from outside.

The Environmental and Social Management Plan (ESMP) describes mitigation measures for impacts specific to project activities and also discuss implementation mechanism. Project specific management plans are also provided for certain project activities such as waste management, bird/ bat management, stakeholder consultation etc.

To conclude, the implementation of ESMP/ Management plans will help OSTRO in complying with national/ state regulatory framework as well as to meet IFC/ ADB reference framework requirements.

Annex A

List of approvals obtained for Lahori Project

INOX WIND
INFRASTRUCTURE SERVICES LIMITED

To,
The Chief Engineer (Planning & Design),
MPPTCL, Block No. 3,
Shakti Bhawan, Rampur, Jabalpur, MP

IWISL/MPPTCL/ Lahori/2014-15/22.12.14 22.12.2014

Dear Sir,

Sub: Intimation regarding Substation land development activities for our proposed 200 MW Wind Power Project at Lahori and other villages, Tehsil/District Shajapur, M.P.

Ref: 1. In Principle Letter of Allotment, Letter No.-NRE/Wind-396/2013-14/1099, dated 31.8.2013.
2. In Principle Letter of Allotment, Letter No.-NRE/Wind-396/2013-14/1198, dated 4.10.2013.
3. Project Registration, Letter No.-NRE/Wind-396/2013-14/027, dated 4.1.2014.
4. Your Letter No.- 04-02/LFS/PSP-64/139, dated 10.1.2014.

With reference to the letters cited above, we IWISL (Inox Wind Infrastructure Services Limited) had received Inter connection/Power Evacuation approval from your good office dated 10.1.2014 for our proposed 200 MW wind power project at Lahori and other village, Tehsil/District Shajapur. This permission is valid upto 31.12.2014.

Now, in the context of the same we would like to bring to your notice that we have already purchased the land for Substation to be build at Lahori Site for our proposed wind power project. Further the land development activities are in process in order to start the project at the earliest. We request your good office to kindly secure the Inter Connection/Power Evacuation approval allotted for us so that we can start the project activities soon.

Thanking you for your anticipated cooperation.

This is submitted for taking further necessary action.

Thanking You,

For Inox Wind Infrastructure Services Limited,

Authorized Signatory

22/12/14
S.E. (Plg.&Design)
S.E. (Plg.)
S.E. (PS) / (Design)
S.E. (PSS)
S.E. (SSD/MTLD)/(PS)
E.E. (Plg. I) / (Plg. II)
E.E. (EA) / (La...

INOX WIND INFRASTRUCTURE SERVICES LTD. Plot No. 17, Sector 16 A, Noida-201 301, U.P., INDIA. Tel : +91-120-6149 600, Fax: +91-120-6149 610
Registered Office : Survey No. 1837 & 1834, At Moje Jetalpur, ABS Tower, 2nd Floor, Old Padra Road, Vadodara-390 007, Gujarat, INDIA
Tel : +91-265-6198111 / 2330057, Fax : +91-265-2310312, CIN : U45207GJ2012PLC070279, E-mail: contact@iwisl.com, Web: www.inoxwind.com

Annex B

Environmental Standards

1 APPLICABLE ENVIRONMENTAL STANDARDS

1.1 AMBIENT AIR QUALITY STANDARDS

1.1.1 National Ambient Air Quality Standards (NAAQS)

National Ambient Air Quality Standards (NAAQ Standards), as prescribed by MoEF vide, *Gazette Notification dated 16th November, 2009* are given below in ***Table 1.1***

Table 1.1 National Ambient Air Quality Standards

Pollutant	Time Weighted Avg.	Concentration in Ambient Air	
		Industrial, Residential, Rural & Other Areas	Ecologically Sensitive Areas (notified by Central Government)
Sulphur dioxide (SO_2) µg/m³	Annual Average*	50	20
	24 Hours**	80	80
Oxides of Nitrogen (NO_x) µg/m³	Annual Average*	40	30
	24 Hours**	80	80
Particulate Matter (PM 10) µg/m³	Annual Average*	60	60
	24 Hours**	100	100
Particulate Matter (PM 2.5) µg/m³	Annual Average*	40	40
	24 Hours**	60	60
Ozone (O_3) µg/m³	8 Hours**	100	100
	1 Hour**	180	180
Lead (Pb) µg/m³	Annual Average*	0.50	0.50
	24 Hours**	1.0	1.0
Carbon monoxide (CO) mg/m³	8 Hours**	02	02
	1 Hour**	04	04
Ammonia (NH_3) µg/m³	Annual*	100	100
	24 Hours**	400	400
Benzene (C_6H_6) µg/m³	Annual*	05	05
Benzo(α)Pyrene-particulate phase ng/m³	Annual*	01	01
Arsenic (As) ng/m³	Annual*	06	06
Nickel (Ni) ng/m³	Annual*	20	20

Note: *Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform interval.

** 24 hourly/8 hourly/1 hourly monitored values, as applicable shall be complied with 98% of the time in a year. 2% of the time, it may exceed but not on two consecutive days of monitoring.

As the project is in rural/residential set up, NAAQS for rural/residential area will be applicable for the project.

IFC/WB Air Emissions and Ambient Air Quality Standards

The IFC/WB General EHS guidelines on Air emissions and ambient air quality, specifies that emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislated standards, or in their absence World Health Organization (WHO) Ambient Air Quality guidelines as represented in ***Table 1.2.***

Table 1.2 WHO Ambient Air Quality Guideline

Pollutant	Averaging Period	Guideline Value in µg/m^3
Sulphur Dioxide	24-hour	24-hour
	10 minute	10 minute
		125 (Interim target-1)
		50 (Interim target-2)
Nitrogen Oxide	1 year	40 (guideline)
	1 hour	200 (guideline)
Particulate Matter 10	1 year	70 (Interim target-1)
		50 (Interim target-2)
		30 (Interim target-3)
		20 (guideline)
	24 hour	150 (Interim target-1)
		100 (Interim target-2)
		75 (Interim target-3)
		50 (guideline)
Particulate Matter 2.5	1 year	35 (Interim target-1)
		25 (Interim target-2)
		15 (Interim target-3)
		10 (guideline)
	24 hour	75 (Interim target-1)
		50 (Interim target-2)
		37.5 (Interim target-3)
		25 (guideline)
Ozone	8-hour daily	8-hour daily
	Maximum	Maximum

Source: IFC/WB General EHS Guidelines: Air emissions and ambient air quality, 30 April 2007
Interim target means Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines.

1.1.2 Water Quality Standards

As per the Bureau of Indian Standards, (IS 10500: 2012) drinking water shall comply with the requirements given in ***Table 1.3***.

Table 1.3 Indian Drinking Water Standard (IS 10500: 2012)

S.N	Substance/ Characteristics	Requirement (Acceptable limit)	Permissible limit in absence of alternate source
1.	Colour, Hazen units, max	5	15
2.	Odour	Unobjectionable	-
3.	Taste	Agreeable	-
4.	Turbidity, NTU, max	5	5
5.	pH value	6.5 - 8.5	No Relaxation
6.	Total hardness (as $CaCO_3$) mg/l, max	200	600
7.	Iron (as Fe) mg/l, max	0.3	No relaxation

S.N	Substance/ Characteristics	Requirement (Acceptable limit)	Permissible limit in absence of alternate source
8.	Chlorides (as Cl) mg/l, max	250	1000
9.	Free residual chlorine, mg/l, min	0.2	1
10.	Dissolved solids mg/l, max	500	2000
11.	Calcium (as Ca) mg/l, max	75	200
12.	Magnesium (as Mg) mg/l, max	30	100
13.	Copper (as Cu) mg/l, max	0.05	1.5
14.	Manganese (as Mn) mg/l, max	0.1	0.3
15.	Sulphate (as SO_4) mg/l, max	200	400
16.	Nitrate (as NO_3) mg/l, max	45	No relaxation
17.	Fluoride (as F) mg/l, max	1.0	1.5
18.	Phenolic compounds (as C6H6OH) mg/l, max	0.001	0.002
19.	Mercury (as Hg) mg/l, max	0.001	No relaxation
20.	Cadmium (as Cd) mg/l, max	0.003	No relaxation
21.	Selenium (as Se) mg/l, max	0.01	No relaxation
22.	Arsenic (as As) mg/l, max	0.01	0.05
23.	Cyanide (as CN) mg/l, max	0.05	No relaxation
24.	Lead (as Pb) mg/l, max	0.01	No relaxation
25.	Zinc (as Zn) mg/l, max	5	15
26.	Anionic detergents (as MBAS) mg/l, max	0.2	1.0
27.	Total Chromium (as Cr) mg/l, max	0.05	No relaxation
28.	Polynuclear aromatic hydrocarbons (as PAH) g/l, max	0.0001	No relaxation
29.	Mineral Oil mg/l, max	0.5	No relaxation
30.	Pesticides mg/l, max	Absent	0.001
31.	Radioactive materials: a) Alpha emitters Bq/l, max b) Beta emitters pci/l, max	 0.1 1.0	 No relaxation No relaxation
32.	Total Alkalinity (as CaCO3), mg/l, max	200	600
33.	Aluminium (as Al) mg/l, max	0.03	0.2
34.	Boron, mg/l, max	0.5	1.0
35.	Ammonia (as total ammonia-N). mg/l, max	0.5	No relaxation
36.	Barium (as Ba), mg/l, max	0.7	No relaxation
37.	Chloramines (as Cl_2), mg/l, max	4.0	No relaxation
38.	Silver (as Ag), mg/l, max	0.1	No relaxation
39.	Sulphide (as H2S), mg/l, max	0.05	No relaxation
40.	Molybdenum (as Mo), mg/l, max	0.07	No relaxation
41.	Nickel (as Ni), mg/l, max	0.02	No relaxation
42.	Polychlorinated biphenyls, mg/l, max	0.0005	No relaxation
43.	Trilomethanes: a) Bromoform, mg/l, max b) Dibromochloromethane, mg/l, max c) Bromodichloromethane, mg/l, max d) Chloroform, mg/l, max	 0.1 0.1 0.06 0.2	 No relaxation No relaxation No relaxation No relaxation
	Bacteriological Quality		
1.	All water intended for drinking: a) E. coli or thermotolerant coliform bacteria	Shall not be detectable in any 100 ml sample	-
2.	Treated water entering the distribution system: a) E. coli or thermotolerant coliform bacteria b) Total coliform bacteria	Shall not be detectable in any 100 ml sample; Shall not be detectable in any 100 ml sample.	-

S.N	Substance/ Characteristics	Requirement (Acceptable limit)	Permissible limit in absence of alternate source
3.	Treated water in the distribution system: a) E. coli or thermotolerant coliform bacteria b) Total coliform bacteria	Shall not be detectable in any 100 ml sample; Shall not be detectable in any 100 ml sample.	-

Source: Central Pollution Control Board

General Standards for discharge

The general standards for discharge are as prescribed under the Environment Protection Rules, 1986 and amendments. The project intends to treat the domestic waste water in septic tanks and soak pits. The general standards for discharge of environmental pollutants are detailed in ***Table 1.4.***

Table 1.4 General Standards for Discharge of Environmental Pollutants

S. N	Parameter	Standards		
		Inland surface water	Public sewers	Land for Irrigation
1.	Colour and odour	Refer to Note 1	-	Refer to Note 1
2	Suspended solids mg/l, max.	100	600	200
3	Particle size of suspended solids	Shall 850 micron IS sieve	-	-
4	PH value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
5	Temperature	Shall not exceed 5^0 C above the receiving water temperature	-	-
6	Oil and grease, mg/l max,	10	20	10
7	Total residual chlorine, mg/l max	1.0	-	-
8	Ammonical nitrogen (as N), mg/l max.	50	50	-
9	Total Kjeldahl nitrogen (as N); mg/l max	100	-	-
10	Free ammonia (as NH3), mg/l max	5.0	-	-
11	Biochemical oxygen demand (3 days at 27^0 C), mg/l max	30	350	100
12	Chemical oxygen demand, mg/l max	250	-	-
13	Arsenic (as As) mg/l, max	0.2	0.2	0.2
14	Mercury (As Hg) mg/l max.	0.01	0.01	-
15	Lead (as Pb) mg/l, max	0.1	1.0	-
16	Cadmium (as Cd) mg/l, max	2.0	1.0	-
17	Hexavalent chromium (as Cr +6) mg/1 max	0.1	2.0	-
18	Total chromium (as Cr) mg/1 max	2.0	2.0	-
19	Copper (as Cu) mg/1, max	3.0	3.0	-
20	Zinc (as Zn)	5.0	15	-
21	Selenium (as Se)	0.05	0.05	-
22	Nickel (as Ni) mg/1,max	3.0	3.0	-
23	Cyanide (as CN) mg/1,max	0.2	2.0	0.2
24	Fluoride (as F) mg/1,max	2.0	15	-
25	Dissolved phosphates (as P) mg/1,max	5.0	-	-
26	Sulphide (as S) mg/1,max	2.0	-	-
27	Phenolic compounds (as C_6H_5OH) mg/1,max	1.0	5.0	-

S. N	Parameter	Standards		
		Inland surface water	Public sewers	Land for Irrigation
28	Radioactive materials: (a) Alpha emitters micro curie mg/1,max (b) Beta emitters micro curie mg/1	10^{-7} 10^{-6}	10^{-7} 10^{-6}	10^{-8} 10^{-7}
29	Bio-assay test	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent
30	Manganese	2 mg/1	2 mg/1	-
31	Iron (as Fe)	3mg/1	3mg/1	-
32	Vanadium (as V)	0.2 mg/1	0.2 mg/1	-
33	Nitrate Nitrogen	10 mg/1	-	-

Source: as per G.S.R 422 (E) dated 19.05.1993 and G.S.R 801 (E) dated 31.12.1993 issued under the provisions of E (P) Act 1986.

Designated Best Use Classification of Surface Water

The designated best use classification as prescribed by CPCB for surface water is as given in ***Table 1.5*** below:

Table 1.5 ***Primary Water Quality Criteria for Designated-Best-Use-Classes***

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

Source: Central Pollution Control Board

IFC/WB Guidelines for treated sanitary sewage discharges

Indicative values for treated sanitary sewage discharges are given in ***Table 1.6***. These are applicable to meet national or local standards or in the absence of national standards for sanitary wastewater discharges and where either a septic system or land is used as part of treatment system.

Table 1.6 Indicative values for treated sanitary wastewater discharges

Pollutants	Units	Guideline Value
pH	pH	6-9
BOD	mg/l	30
COD	mg/l	125
Total Nitrogen	mg/l	10
Total Phosphorous	mg/l	2
Oil and grease	mg/l	10
Total suspended solids	mg/l	50
Total Coliform bacteria	MPN*/100ml	400

Source: General EHS Guidelines, World Bank Group, April 2007
*MPN = Most Probable Number

1.1.3 Noise Standards

Noise standards specified by the MoEF vide gazette notification dated 14th February, 2000 based on the *A* weighted equivalent noise level (L_{eq}) are as presented in ***Table 1.7.***

Table 1.7 Ambient Noise Standards

Area Code	Category of Area	Limits in dB(A) Leq	
		Day time*	
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone**	50	40

Note:*Day time is from 6 am to 10 pm, Night time is10.00 pm to 6.00 am;**Silence zone is an area comprising not less than 100 meters around premises of hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority. Use of vehicle horns, loud speakers and bursting of crackers are banned in these zones. Source: Noise Pollution (Regulation and control)Rules,2000)

As the project is in rural/residential set up, noise standards for residential area will be applicable for the project.

IFC/WB Noise Standards

As per the IFC/WB, General EHS Guidelines on noise management, noise impacts should not exceed the levels presented in *Error! Reference source not found.* or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.

Table 1.8 Noise Level Guidelines

Receptor	One Hour LAeq (dBA)	
	Daytime 07:00 - 22:00	Night time 22:00 - 07:00

Receptor	One Hour LAeq (dBA)	
Residential; Institutional; Educational	55	45
Industrial; Commercial	70	70

Source: IFC/WB, General EHS Guidelines on noise management, 30 April, 2007

Annex C

Noise Monitoring Report

Ambient Noise Level

Location : Imli Kheda Village (NQ-01)
23°24'16.75"N 76°19'52.90"E

DATE : 14/04/2015 - 15/04/2015

TIME : 14 hr. - 14 Hr.

S.No.	Date	Time (Hr.)		Horly Leq (dB)
		from	To	
1	14/04/2015	14	15	48.4
2	14/04/2015	15	16	49.1
3	14/04/2015	16	17	49.6
4	14/04/2015	17	18	50.4
5	14/04/2015	18	19	49.4
6	14/04/2015	19	20	49.6
7	14/04/2015	20	21	48.5
8	14/04/2015	21	22	48.0
9	14/04/2015	22	23	42.0
10	14/04/2015	23	0	42.7
11	15/04/2015	0	1	41.0
12	15/04/2015	1	2	39.9
13	15/04/2015	2	3	39.1
14	15/04/2015	3	4	38.0
15	15/04/2015	4	5	35.7
16	15/04/2015	5	6	40.5
17	15/04/2015	6	7	46.7
18	15/04/2015	7	8	49.1
19	15/04/2015	8	9	46.7
20	15/04/2015	9	10	49.3
21	15/04/2015	10	11	50.5
22	15/04/2015	11	12	52.4
23	15/04/2015	12	13	51.4
24	15/04/2015	13	14	49.7
Leq Day				49.4
Leq Night				40.1
Leq Day-Night				47.3

Ambient Noise Level

Location : Gandhigram Village (NQ-02)
23°23'57.45"N 76°20'47.07"E

DATE : 14/04/2015 - 15/04/2015

TIME : 14 hr. - 14 Hr.

S.No.	Date	Time (Hr.)		Horly Leq (dB)
		from	To	
1	14/04/2015	14	15	50.4
2	14/04/2015	15	16	48.9
3	14/04/2015	16	17	49.0
4	14/04/2015	17	18	51.5
5	14/04/2015	18	19	55.5
6	14/04/2015	19	20	50.8
7	14/04/2015	20	21	49.4
8	14/04/2015	21	22	46.8
9	14/04/2015	22	23	38.9
10	14/04/2015	23	0	39.2
11	15/04/2015	0	1	39.9
12	15/04/2015	1	2	38.0
13	15/04/2015	2	3	36.1
14	15/04/2015	3	4	35.4
15	15/04/2015	4	5	34.0
16	15/04/2015	5	6	35.9
17	15/04/2015	6	7	44.8
18	15/04/2015	7	8	50.2
19	15/04/2015	8	9	50.8
20	15/04/2015	9	10	51.1
21	15/04/2015	10	11	49.6
22	15/04/2015	11	12	51.3
23	15/04/2015	12	13	53.7
24	15/04/2015	13	14	49.7
Leq Day				50.5

Leq Night	37.4
Leq Day-Night	47.9

Ambient Noise Level

Location : Kheda Village (NQ-03)
23°24'50.03"N 76°19'56.27"E

DATE : 15/04/2015 - 16/04/2015
TIME : 16 hr. - 16 Hr.

S.No.	Date	Time (Hr.)		Horly Leq (dB)
		from	To	
1	15/04/2015	16	17	54.4
2	15/04/2015	17	18	50.5
3	15/04/2015	18	19	53.3
4	15/04/2015	19	20	54.4
5	15/04/2015	20	21	53.2
6	15/04/2015	21	22	48.9
7	15/04/2015	22	23	40.4
8	15/04/2015	23	0	40.0
9	16/04/2015	0	1	38.7
10	16/04/2015	1	2	39.2
11	16/04/2015	2	3	35.7
12	16/04/2015	3	4	36.3
13	16/04/2015	4	5	34.2
14	16/04/2015	5	6	38.6
15	16/04/2015	6	7	40.9
16	16/04/2015	7	8	51.1
17	16/04/2015	8	9	49.7
18	16/04/2015	9	10	55.7
19	16/04/2015	10	11	50.0
20	16/04/2015	11	12	50.3
21	16/04/2015	12	13	55.7
22	16/04/2015	13	14	56.4
23	16/04/2015	14	15	55.1

24	16/04/2015	15	16	57.2
Leq Day				53.0
Leq Night				38.1
Leq Day-Night				50.3

Ambient Noise Level

Location : Rajput Mohalla (NQ-04)
23°26'57.66"N 76°20'17.85"E

DATE : 15/04/2015 - 16/04/2015

TIME : 16 hr. - 16 Hr.

S.No.	Date	Time (Hr.)		Horly Leq (dB)
		from	To	
1	15/04/2015	16	17	52.9
2	15/04/2015	17	18	50.1
3	15/04/2015	18	19	57.0
4	15/04/2015	19	20	56.9
5	15/04/2015	20	21	55.8
6	15/04/2015	21	22	54.3
7	15/04/2015	22	23	46.9
8	15/04/2015	23	0	40.3
9	16/04/2015	0	1	39.9
10	16/04/2015	1	2	39.0
11	16/04/2015	2	3	36.7
12	16/04/2015	3	4	36.6
13	16/04/2015	4	5	35.5
14	16/04/2015	5	6	42.9
15	16/04/2015	6	7	44.9
16	16/04/2015	7	8	51.8
17	16/04/2015	8	9	54.2
18	16/04/2015	9	10	52.3
19	16/04/2015	10	11	55.1
20	16/04/2015	11	12	50.9
21	16/04/2015	12	13	51.7

22	16/04/2015	13	14	53.3
23	16/04/2015	14	15	55.5
24	16/04/2015	15	16	58.6
Leq Day				54.0
Leq Night				40.5
Leq Day-Night				51.3

Ambient Noise Level

Location : Naya Samaj Kheda (NQ-05)
23°20'5.92"N 76°21'10.90"E

DATE : 16/04/2015 - 17/04/2015

TIME : 18 hr. - 18 Hr.

S.No.	Date	Time (Hr.)		Horly Leq (dB)
		from	To	
1	16/04/2015	18	19	56.8
2	16/04/2015	19	20	57.1
3	16/04/2015	20	21	54.1
4	16/04/2015	21	22	51.1
5	16/04/2015	22	23	49.9
6	16/04/2015	23	0	48.6
7	17/04/2015	0	1	45.5
8	17/04/2015	1	2	38.9
9	17/04/2015	2	3	37.3
10	17/04/2015	3	4	36.0
11	17/04/2015	4	5	35.5
12	17/04/2015	5	6	38.3
13	17/04/2015	6	7	51.7
14	17/04/2015	7	8	50.0
15	17/04/2015	8	9	51.8
16	17/04/2015	9	10	52.2
17	17/04/2015	10	11	53.7
18	17/04/2015	11	12	50.8
19	17/04/2015	12	13	52.2

20	17/04/2015	13	14	50.9
21	17/04/2015	14	15	54.2
22	17/04/2015	15	16	55.5
23	17/04/2015	16	17	53.3
24	17/04/2015	17	18	51.1
Leq Day				53.2
Leq Night				43.0
Leq Day-Night				50.9

Ambient Noise Level

Location : Dillod (NQ-06)

23°22'23.11"N 76°16'21.67"E

DATE : 16/04/2015 - 17/04/2015
TIME : 18 hr. - 18 Hr.

S.No.	Date	Time (Hr.)		Horly Leq (dB)
		from	To	
1	16/04/2015	18	19	55.8
2	16/04/2015	19	20	58.9
3	16/04/2015	20	21	55.5
4	16/04/2015	21	22	50.3
5	16/04/2015	22	23	45.0
6	16/04/2015	23	0	44.8
7	17/04/2015	0	1	44.3
8	17/04/2015	1	2	40.1
9	17/04/2015	2	3	38.3
10	17/04/2015	3	4	36.0
11	17/04/2015	4	5	36.6
12	17/04/2015	5	6	39.3
13	17/04/2015	6	7	52.2
14	17/04/2015	7	8	52.1
15	17/04/2015	8	9	52.0

16	17/04/2015	9	10	51.8
17	17/04/2015	10	11	52.2
18	17/04/2015	11	12	53.1
19	17/04/2015	12	13	52.0
20	17/04/2015	13	14	51.7
21	17/04/2015	14	15	50.9
22	17/04/2015	15	16	53.5
23	17/04/2015	16	17	52.1
24	17/04/2015	17	18	50.4
Leq Day				53.1
Leq Night				41.2
Leq Day-Night				50.6

Annex D

Photo documentation

Photo-documentation

Photo 1: Rolling terrain in study area

Photo 2: Landuse – Grazing Land at WTG LAHR-72

Photo 3: Access road to WTG LAHR-69

Photo 4: Proposed Pooling Sub-Station

Project :

Client :

ERM India Private Limited
Building 10, 4th Floor,
Tower A, DLF Cyber City
Gurgaon – 122 002, India
Board: +91- 0124 4170300
Fax: + 91-0124 - 4170301

Photo-documentation

Photo 5: Cluster of Settlements close to proposed WTG LAHR-54

Photo 6: Cluster of Settlements close to proposed WTG LAHR-70

Photo 7: WTG LAHP-23 proposed on helipad

Photo 8: WTG LAHP -25 proposed close to NH-3

Project :

Client :

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Annex E

Shadow Flicker Report

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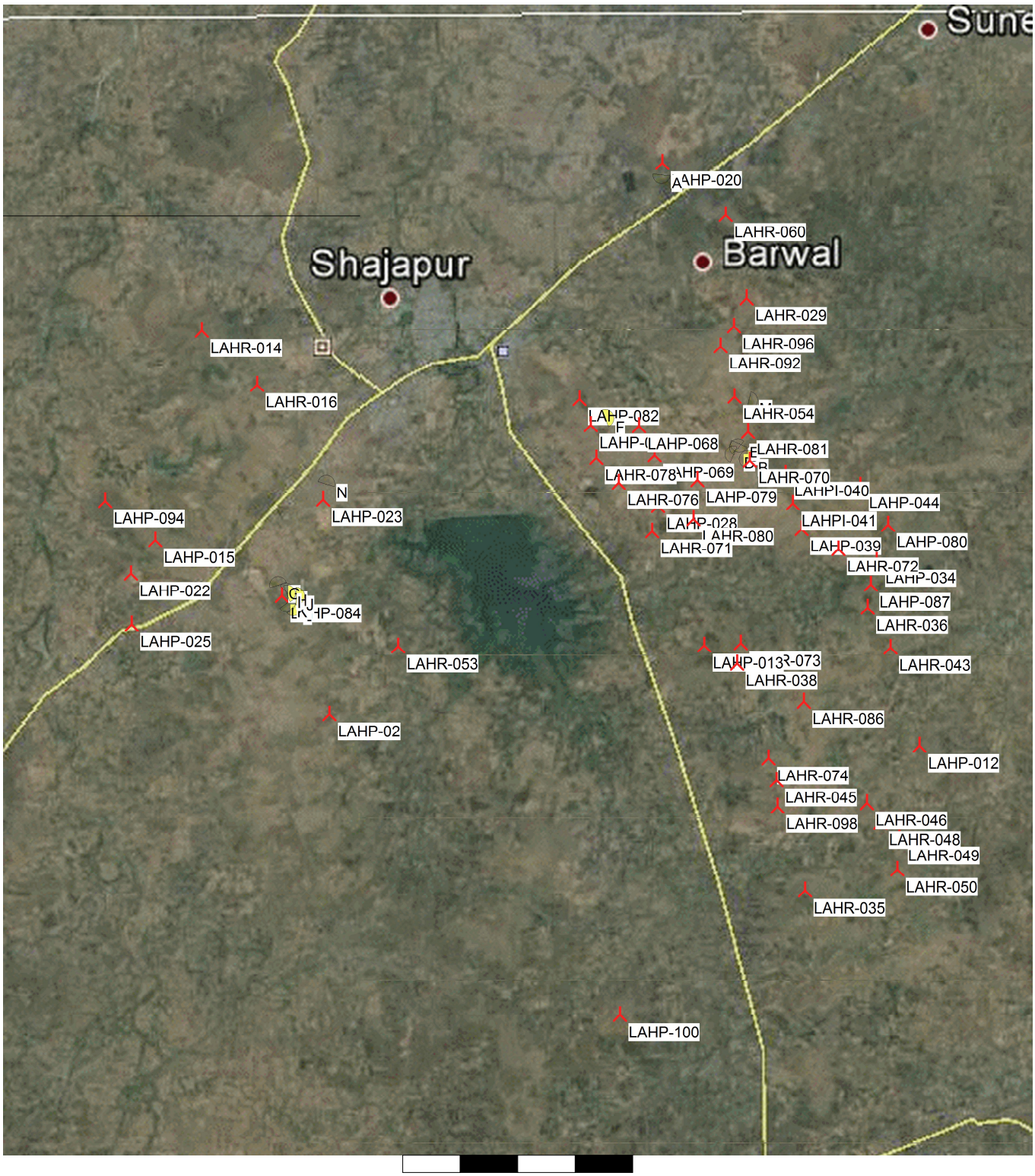
BASIS - Map

Calculation: BASIS



Map: Lahori , Print scale 1:100,000, Map center UTM (north)-WGS84 Zone: 43 East: 631,971 North: 2,586,678

New WTG Shadow receptor

Project:
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Naval Chaudhary / naval.chaudhary@erm.com

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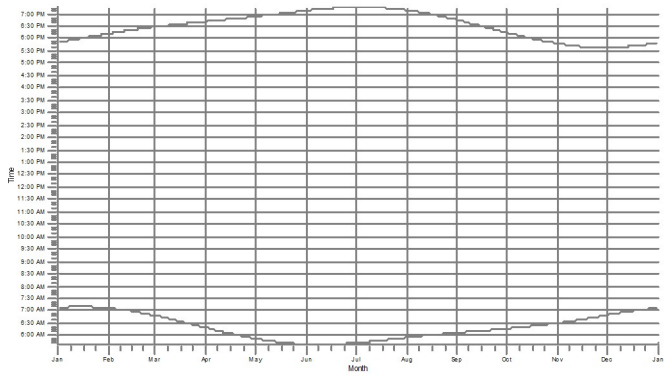
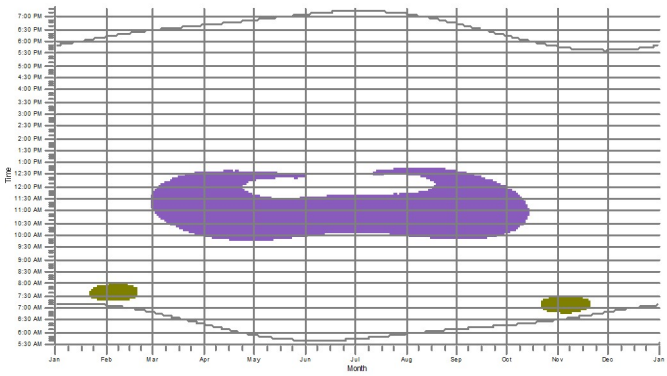
SHADOW - Calendar, graphical

Calculation: Real Case Scenario

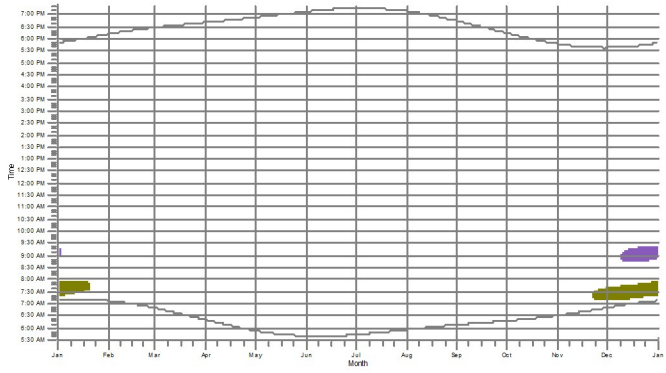
A: Shadow Receptor: 0.9 × 1.2 Azimuth: -173.3° Slope: 90.0° (1)



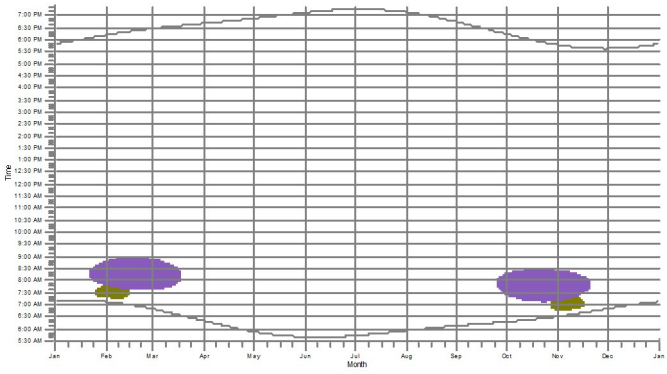
B: Shadow Receptor: 0.9 × 1.2 Azimuth: -56.8° Slope: 90.0° (2)



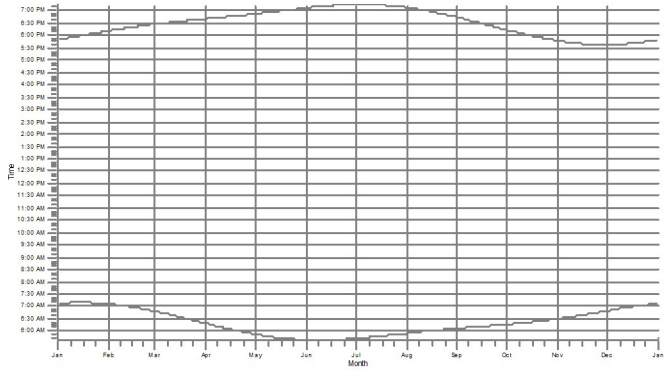
C: Shadow Receptor: 0.9 × 1.2 Azimuth: -46.5° Slope: 90.0° (3)



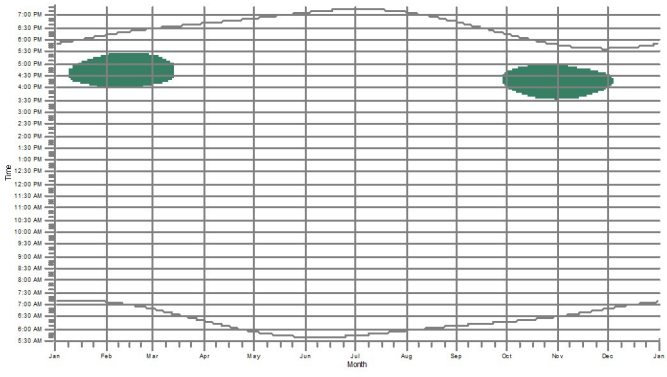
D: Shadow Receptor: 0.9 × 1.2 Azimuth: -67.1° Slope: 90.0° (4)



E: Shadow Receptor: 0.9 × 1.2 Azimuth: -156.4° Slope: 90.0° (5)



F: Shadow Receptor: 0.9 × 1.2 Azimuth: 68.4° Slope: 90.0° (6)



WTGs

LAHPI-040: WINDTEC WT2000DF 2000 100.0 IO! hub: 92.0 m (TOT: 142.0 m) (10)

LAHP-090: WINDTEC WT2000DF 2000 100.0 IO! hub: 92.0 m (TOT: 142.0 m) (29)

LAHR-070: WINDTEC WT2000DF 2000 100.0 IO! hub: 92.0 m (TOT: 142.0 m) (45)

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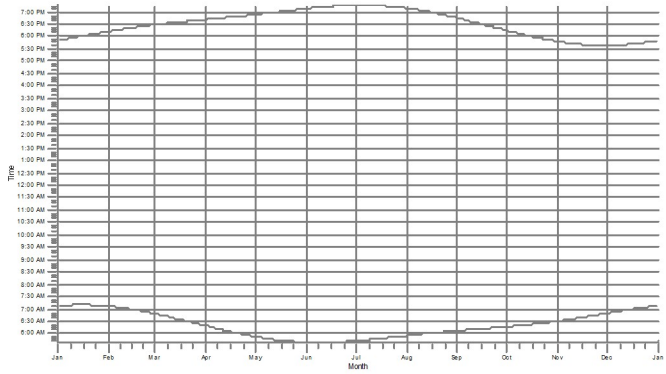
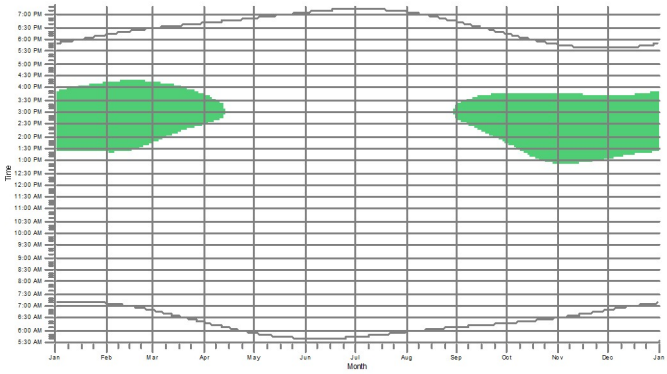
SHADOW - Calendar, graphical

Calculation: Real Case Scenario

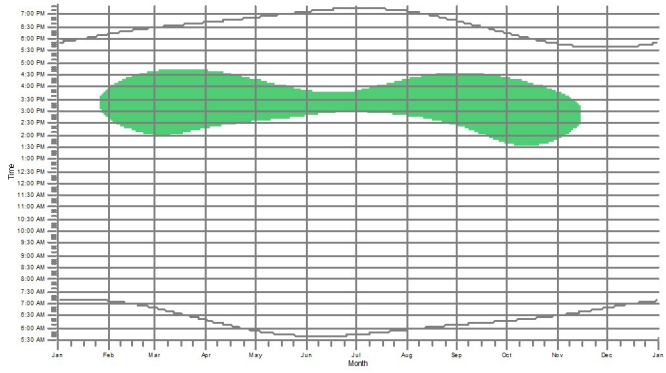
G: Shadow Receptor: 0.9 × 1.2 Azimuth: -17.8° Slope: 90.0° (7)



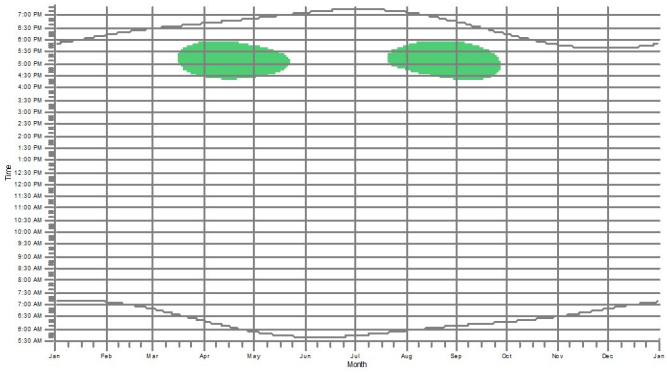
H: Shadow Receptor: 0.9 × 1.2 Azimuth: 45.6° Slope: 90.0° (8)



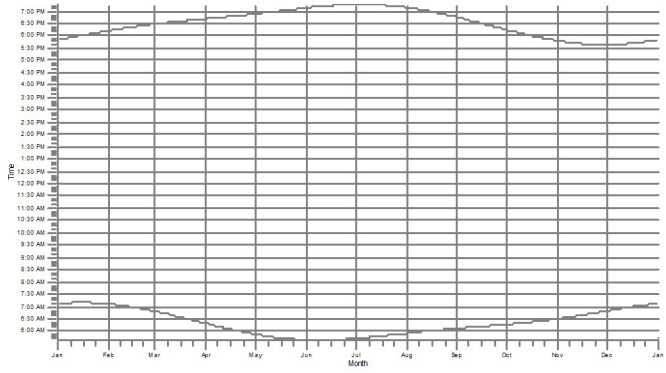
I: Shadow Receptor: 0.9 × 1.2 Azimuth: 67.8° Slope: 90.0° (9)



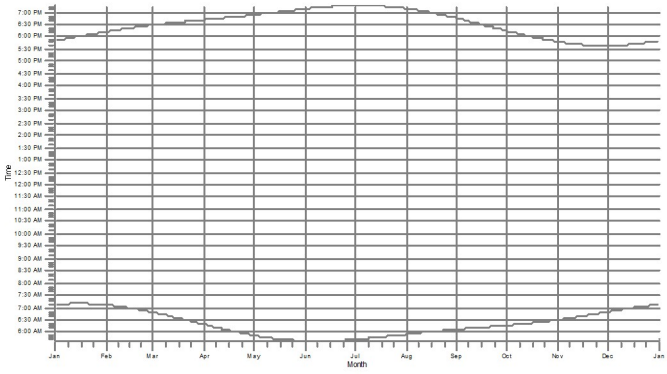
J: Shadow Receptor: 0.9 × 1.2 Azimuth: 90.2° Slope: 90.0° (10)



K: Shadow Receptor: 0.9 × 1.2 Azimuth: 145.1° Slope: 90.0° (11)



L: Shadow Receptor: 0.9 × 1.2 Azimuth: 134.5° Slope: 90.0° (12)



WTGs

LAHP-084: WINDTEC WT2000DF 2000 100.0 IO! hub: 92.0 m (TOT: 142.0 m) (28)

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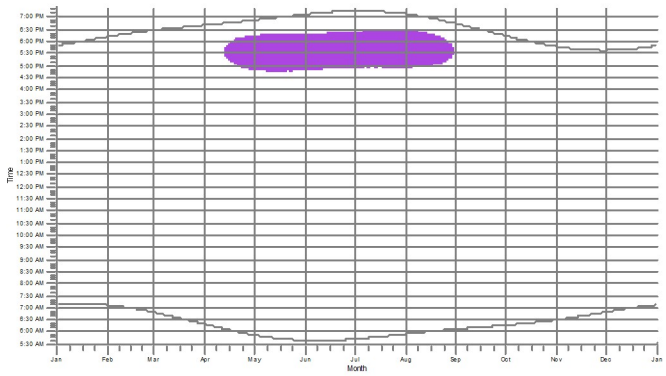
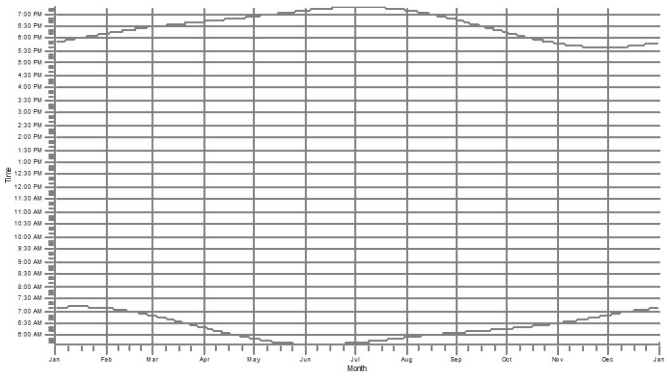
SHADOW - Calendar, graphical

Calculation: Real Case Scenario

M: Shadow Receptor: 0.9 × 1.2 Azimuth: 103.6° Slope: 90.0° (13)



N: Shadow Receptor: 0.9 × 1.2 Azimuth: 16.0° Slope: 90.0° (14)



WTGs

LAHR-054: WINDTEC WT2000DF 2000 100.0 IO! hub: 92.0 m (TOT: 142.0 m) (43)

Annex F

MPPTCL permission for construction of 22KV Transmission line

MADHYA PRADESH POWER TRANSMISSION CO.LTD.
(A wholly owned Govt. of Madhya Pradesh Undertaking)
CIN: U40109MP2001SGC014880
Block No.3 Shakti Bhawan, Rampur, Jabalpur (M.P.)482008
Phone : (0761) Phone No. 0761 –2702132, 2702160 Fax No. 0761-2660908 e-mail: ceps321@gmail.com

No. 04-02/B-3094/P&D-TLD/ 2291. Date: 01.9.15

To

M/s Inox Wind Infrastructure Services Ltd.
Plot No.17, Sector-16A,
Noida-201301 (U.P.).

Fax No. 0120-6149610

Sub:- Construction of Detailed estimate for construction of 220kV DCDS line from 220kV S/s Shajapur to proposed 200MW Wind Power Plant of M/s Inox Wind Infrastructure Service Ltd. Noida proposed at Lohari Distt. Shajapur for connecting the plant with MP Grid under consumer contribution works.

Ref:- i. Your letter dated 29.6.2015.

***

Please refer to the communications cited under reference regarding interconnection of your 200MW Wind Power Plant with MPPTCL at 220kV S/s Shajapur on 220kV. The construction of 220kV DCDS line for interconnection has to be organized by M/s Inox Wind Infrastructure Service Ltd. at their own resources and cost under supervision of MPPTCL. M/s Inox Wind Infrastructure Service Ltd. have earlier deposited an amount of ₹14520/- towards supervision charges on survey work.

The detailed survey of the above 220kV line has since been completed and accordingly tentative cost estimate for construction of 220kV DCDS line amounting to ₹1119.52 lac has been prepared on the basis of approved profile. The construction of above 220kV DCDS line has to be organized by M/s Inox Wind Infrastructure Service Ltd. at their own resources and cost under supervision of MPPTCL. Accordingly, M/s Inox Wind Infrastructure Service Ltd. is required to deposit an amount totaling to ₹ 91.47 lac as detailed below: -

i. Supervision charges	- ₹ 52,91,366/-
ii. Engg. & Design charges	- ₹ 30,36,000/-
iii. Cost of spares	- ₹ 8,33,390/-
iv. Total (i+ii+iii)	- ₹ 91,60,756/-
v. Amt. already deposited	- ₹ 14,520/-
vi. Balance Amt. required for line(iv – v)	- ₹ 91,46,236/-
	Say ₹ 91.47 lac

Further the following may please be noted:-

a. To deposit ₹ 91.47 lac in MPPTCL's Bank Account No. 552901110050000, IFS Code-UBIN0555291 of Union Bank of India, Branch - Madan Mahal, Jabalpur (Branch code-55290) through RTGS/NEFT under intimation of the details including **UTR number** of the transaction to all concerned. The amount may also be deposited to Deputy Director(B&CM) O/o CFO, MPPTCL, Jabalpur through demand draft drawn in favour of "**M.P. Power Transmission Co. Ltd.**" (bank charges to your account) payable at Jabalpur. However, deposition of payment through RTGS/NEFT would be preferred.

b. The sum of cost of material, erection charges etc. in the above demand in case of consumer contribution/deposit work is towards the cost of assets etc. and it is not contract within the meaning of provision of section 194C of Income Tax 1961 and its amendments. Hence, this amount is not liable for TDS under the provisions of Section 194C. Similarly, the survey supervision & design and procurement & contract related charges are in the form of grant towards reimbursement of expenses. These

charges are not in the form of fee for technical services of the Company and hence are not liable for TDS under the provision of section 194J of I.T. Act 1961.

c. The estimated amount intimated is the minimum base cost worked out on the basis of present day prevailing rates which shall be payable by M/s Inox Wind Infrastructure Service Ltd. However, in case due to any reason the cost of certain equipment, material, duties/taxes or activity increases then consequent additional cost will also be payable by M/s Inox Wind Infrastructure Service Ltd.

d. The ROW problem during construction shall be resolved by M/s Inox Wind Infrastructure Service Ltd. and cost for the same shall be borne by them. They shall ensure payment of compensation towards damages of crops/trees simultaneously during construction of line and ensure payment of entire compensation prior to charging and taking over of the line by MPPTCL. Apart from this, a certificate regarding payment of all types of compensation shall be provided by M/s Inox Wind Infrastructure Service Ltd. to MPPTCL before charging of the line. MPPTCL shall not be responsible for any delay in construction due to ROW problem or any other reasons.

e. All the necessary clearance including forest, PTCC and Right of Way for construction of line shall have to be arranged by M/s Inox Wind Infrastructure Service Ltd. and any expenditure incurred in this regards, shall have to be M/s Inox Wind Infrastructure Service Ltd. All the line construction activities including supply of towers, conductors, hardwares, accessories etc. would be organized by M/s Inox Wind Infrastructure Service Ltd. after collecting the necessary details from O/o CE(Proc.). The towers and required stringing material shall be procured as per MPPTCL Specifications for which necessary information may be obtained from O/o CE(Proc.). Further, since work is to be done under MPPTCL's supervision, foundation drawings of towers and other required drawings may also be obtained. The work shall be commenced only after approval of drawings and test certificates of materials (to be procured by M/s Inox Wind Infrastructure Service Ltd.) from O/o CE(Proc.).

f. The validity of above mentioned cost of line work shall be upto 31.3.2016. If the requisite amount is not deposited within the validity period, the demand would be revised on the basis of the prevailing Schedule of Rates and M/s Inox Wind Infrastructure Service Ltd. shall deposit the revised cost.

Further, the terms & conditions as per enclosed annexure shall have to be observed before / during execution of work. If required M/s Inox Wind Infrastructure Service Ltd. shall have to execute an agreement with MPPTCL.

Further necessary action for depositing requisite amount of ₹ 91.47 lac may please be taken and this office may please be informed. It may please be noted that M/s Inox Wind Infrastructure Service Ltd. shall be permitted to initiate construction of the above 220kV Line shall be organized by MPPTCL only after receipt of requisite amount of ₹ 91.47 lac with MPPTCL.

Encl: As above.

CHIEF ENGINEER(PLG. & DESIGN)
MPPTCL:JABALPUR

Copy to:-

1. The Chief Engineer (EHT-Const), MPPTCL, Jabalpur.
2. The Chief Engineer (EHT-M&I), MPPTCL, Jabalpur.
3. The Chief Engineer (Procurement), MPPTCL, Jabalpur.
4. The Deputy Director (B&CM), O/o Chief Finance officer, MPPTCL, Jabalpur.
   - It is requested to issue letter of confirmation on receipt of the amount in the account so that further action in the matter could be initiated by this office.
5. The Superintending Engineer (EHT-Const) Circle, MPPTCL, Ujjain.
6. The Superintending Engineer (PSS) of this office.
7. The Executive Engineer (SSD), of this office.
8. The Executive Engineer (EHT-Const) Division, MPPTCL, Ujjain.
9. The RAO, MPPTCL, Indore.
10. Demand note file.

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Ireland	USA
Italy	Venezuela
Japan	Vietnam
Korea	
Malaysia	
Mexico	

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