Initial Environmental Examination

Project Number: 46919
March 2013

IND: 75 MW Wind Farm Project, Chilarewadi, Maharashtra

Prepared by AECOM India Private Limited for NSL Renewable Power Private Limited

Final Report

Environmental and Social Impact Assessment Report for 75 MW Wind Farm Project, Chilarewadi, Maharashtra, India

March, 2013

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Abbreviations

ATS	Agreement to Sale
ADB	Asian Development Bank
APPL	Atlanta Power Private Limited
OBC	Other Backward Classes
CEA	Central Electricity Authority
CPCB	Central Pollution Control Board
CSR	Corporate Social Responsibility
EMF	Electromagnetic Fields
ESIA	Environmental and Social Assessment
ESMP	Environmental and Social Management Plan
ESZ	Ecologically Sensitive Zone
CEO	Executive Officer
FGD	Focus Group Discussions
FCCC	Framework Convention on Climate Change
GRM	Grievance Redressal Mechanism
IFC	International Finance Corporation
IMD	India Meteorological Department
ICNIRP	International Commission on Non-Ionizing Radiation Protection
MPCB	Maharashtra Pollution Control Board
MSEB	Maharashtra State Electricity Board
MSETCL	Maharashtra State Electricity Transmission Company Limited
MSIHC	Manufacture Storage & Import of Hazardous Chemicals
MSL	Mean Sea Level
MSK	Medvedev-Sponheuer-Karnik
MoEF	Ministry of Environment and Forests
NAAQS	National Ambient Air Quality Standards
NRPPL	NSL Renewable Power Private Limited
OSHA	Occupational Safety and Health Administration
O&M	Operation and Maintenance
PPE	Personal Protection Equipment
PESO	Petroleum and Explosives Safety Organisation
SPS	Safeguard Policy Statement
SEMS	Social and Environmental Management System
SEIAA	State Environment Impact Assessment Authority
SC	Scheduled Caste
SCADA	Supervisory Control And Data Acquisition System
TDS	Total Dissolved Solids
WGEEP	Western Ghats Ecology Expert Panel
WPR	Work Participation Ratio

Executive Summary

E.1 Introduction

NSL Renewable Power Private Limited (NRPPL) is a fully owned subsidiary of NSL Power Private Limited established for implementation of renewable power projects across the country. NRPPL intends to set up wind power project of 75 MW in Man Taluka (also known as Dahivadi Taluka) in Satara District of Maharashtra. The project area falls in three villages viz. Chilarewadi, Puklewadi and Virli of Man Taluka. The wind farm will be located on a table top plateau at an elevation of 890-905m above mean sea level (MSL) with a total area of 68.10 hectares (ha).

NRPPL is seeking financial assistance from the Asian Development Bank (ADB), for setting up the wind power project. The proposed project is categorised as Category B project as per ADB's Safeguard Policy Statement (SPS), 2009. NRPPL has appointed AECOM India Private Limited to revise and update the existing Environmental and Social Assessment (ESIA) report, prepared in March 2011, as per the requirements of ADB's SPS, 2009. The report also considers the requirements under Performance Standards and guidelines of International Finance Corporation. This study has been based on reconnaissance visit to the site, available information, baseline surveys, analysis, consultations and discussions with relevant stakeholders.

E.2 Project Components

The proposed project shall comprise of the following major components:

Wind Turbines

A wind turbine consists of three major mechanical components: tower, nacelle, generator and rotor. The proposed turbines will be of ReGeN make (V87 model) with 1.5 MW rated capacity. It will have a rotor diameter of 87m and a hub height of 85m. The tower will be tubular.

Power Evacuation System

The power generated by the respective wind turbines will be transmitted to a 33/220 KV Pooling Substation, located at Hiwarwadi village to the west of the site, through a 5 to 12 km long single/ double circuit 33 kV transmission lines. The power will then be stepped up from 33kV to 220 kV at the Pooling Substation and transmitted through a double circuit 220 kV transmission line to Maharashtra State Electricity Transmission Company Limited's (MSETCL) interconnection point located at about 8 to 10 km distance. NRPPL has proposed to construct three 33kV feeders at site, each with capacity of 25 MW in order to transmit power from the wind turbines to the Hiwarwadi pooling substation.

Access Roads

Two approach roads, with length of 3 km each, have been proposed for accessing the wind turbine locations. Besides the approach roads there will be 24 km of internal roads for access to each turbine location and associated facilities within the wind farm area.

E.3 Project Construction

Land Requirement

The total area required for the project including erection of wind turbines and associated facilities such as access roads, transmission line pooling substation and switchyard is approximately 78.10 ha. About 10 ha has been acquired by M/s ReGen Powertech on willing buyer willing seller basis for construction of pooling substation and switchyard/administrative building which are common facilities. Remaining 68.10 ha of land, comprising of 46.50 ha of private land and 21.6 ha of revenue land, are being acquired by NRPPL through Atlanta Power Private Limited (APPL) for the project. About 50 ha of land will be used for setting up the wind turbines. Remaining 20.6 ha will be used for construction of associated facilities.

Civil Works

The supply and erection & commissioning contracts will be signed between ReGen Powertech Private Limited (the supplier of equipment) and NRPPL (or its SPV Company for supply, erection and commissioning of the turbines). The major civil work involves wind turbine foundations, erection, switch yard structure and equipment foundations including power transformer and control room cum administration building. Minor works involve security kiosks, collection substation, fencing, roads and drainage.

Labour

During construction stage man power ranging from 80 to 100 will be required during normal functions while peak construction activities will require 150-200 workers. The unskilled labour required for construction activities will be locally hired and therefore labour camp will not be required to be set up except for when skilled workers are hired from outside.

Water

About 220m^3 of water will be required daily for construction on an average while the peak demand is estimated to be 450m^3/day. The water required for construction will be arranged by the construction contractors through authorised tanker water suppliers.

Waste and Waste Water

Construction waste will be limited to packaging and crafting material of turbines, construction debris, waste oil, gearbox oil, hydraulic oil, lubricant, cleaning fluids, paints, degreasers and other similar substances. Waste water generation from the construction activities will be limited to washing and cleaning activities related to construction activities. Portable toilet with septic tank soak pits will be provided at construction site to facilitate the disposal of sewage generated.

E.4 Project Operation

Wind projects require a dedicated Operation and Maintenance (O&M) facility for storing equipment and supplies required during operation. An O&M agreement has been signed with ReGen Powertech which entrusts them with responsibility of maintenance and repairs. The typical maintenance and repair activity during operation phase involves preventive and breakdown maintenance of Wind turbines and/or the related equipment in accordance with the safety management plans and procedures as applicable and/or in accordance with accepted industry practices.

The site will have 20-25 personnel's at site including maintenance, monitoring and security staff during the operation phase.

E.5 Description of the Environment (Baseline)

Site Settings - The site is spread across a distance of approximately 5 km from North West to South East and also spread across a distance of approximately 1.5 km from South West to North East. The area is rural with sparsely located villages amongst undulating terrain. Vegetation at the site and its surrounding areas are open/barren land with scattered agricultural area. There is no forest land in the project site. The nearest wild life sanctuary is Mayni Bird Sanctuary located at about 10 km towards southwest of the western edge of the project site. Continuous stretch of reserve forest borders the plateau from north east to the northwest extending further to the west.

Topography – The study area is geographically a part of the Deccan Plateau of Maharashtra, lying between the Upper Krishna and the Lower Bhima valleys. It is dominated by the hills and ridges separating the valleys of the Yerla River, a tributary of the Krishna, to the west, and the Maan River, a tributary of the Bhima, to the east. The terrain is mildly hilly, shaped by the seasonal streams and rivulets that contribute to the water resources of either the Yerla or the Maan River. The entire land of the district belongs to the larger drainage system of the Krishna River.

Geology and Seismicity - Significant portion of the district is covered by the basaltic and amygdular lavas of the Tertiary or Cenozoic Era, nearly 60 to 100 million years ago. Because of their tendency to form plateaux and their dominantly basic composition, the lava flows are generally called "Plateau basalts." Seismically the project site region falls within Zone III (as per IS: 1893 (part-I):2002), which is moderate damage risk zone, i.e. it may experience minor to moderate seismic activity.

Hydrogeology- The ground water in the study area occurs under phreatic, semi-confined and confined conditions. Generally the shallower zones down to the depth of 20 m bgl form phreatic aquifer. The water bearing zones occurring between the depths of 20 and 40 m are weathered interflow or shear zones and yield water under semi-confined conditions. Deep confined aquifers occur below the depth of 40 m.

Climate - The study area experiences a dry tropical type of climate. The mild and unpredictable monsoon extends from May to November, followed by a cool winter-period from November-end to mid-February. Hot summer is experienced from mid-February to May. Afternoon thunder-showers are experience in summer-heat. Rain is received chiefly from the retreating north-east monsoon, first between mid-May and mid-June, and later over October and November. The air is dry throughout the year except during the monsoon periods.

The secondary data on surface meteorology based on data of Sangli (nearest IMD observatory located at 70km from the site) has been considered in absence of information for Satara district. According to the meteorological data for Sangli, the daily mean minimum temperature annually varies from 12.9°C in January to 22.5° C in May and the daily mean maximum temperature varies from 28.5° C in July-August and to 38.3°C in April. The minimum humidity of 29% is recorded in March during evening hours and the maximum relative humidity of 87% is experienced in August-September during morning hours. The annual mean wind speed is 8.7km/ hr, the wind speed is highest in June –July at 14.4 km/hr

while it is the lowest in January at 4.5 km/hr. The rainfall data obtained from IMD for Satara district from 2006-10 indicates the mean annual rainfall to be 1220mm. The heaviest rainfall is observed in the month of July and August contributing to more than 45% of the annual rainfall.

Ambient Air Quality – Ambient air quality was monitored at 4 locations during March 2011. The ambient air quality observed in the area is good and all the monitored parameters (SPM, RSPM, SO_2 and NOx) were observed to be well within the National Ambient Air Quality Standards. The site and surrounding is predominantly rural with no identified source of pollution in the area. The movement of traffic was also observed to be limited in the area.

Water Quality - Water samples were collected from four ground water sources with the study area. The water samples collected were analyzed for parameters as per IS: 10500 standards. Observations of the water quality indicate that the water quality of the area is within the IS limits for most of the parameters.

Soil Quality – Most of the study area is covered by a light-colored rocky soil, which is locally described as ‗murmaal' or ‗maalraan' land. Soil samples were collected from four locations in the study area. The soil texture in the study area is Sandy loam and Loamy Sand with over 70% of Sand. The pH of the soil indicates neutral to slight alkalinity in nature. The region is rich in Manganese ore and is reflected in the soil sample analysis.

Ambient Noise Quality – Ambient noise was monitored at six locations in the study area. All monitoring locations were in rural residential areas. The monitored noise levels at all locations were within the prescribed limits of the CPCB and IFC values of 45 dB(A) and 55 dB(A) for day and night respectively.

Traffic - Traffic density was monitored at the Mhaswad –Mayani which is the main connecting road to the project site and will be significant for the traffic movement to the project. The traffic density along the road was observed to be low. As per observations, the traffic peaks during the morning hours between 7:00 and 9:00 hours and in the evening hours between 17:00 and 19:00 hours.

Biological Environment - A primary ecological assessment and survey was undertaken at the project site and the study area of 10km radius to understand the existing flora and fauna in March 2011. Quadrat and quartile method of assessment was undertaken in a total of 28 locations. The natural vegetation of the study area is mostly in the form of an open, low forest in which thorny, mostly hard-wooded, species predominate and shape the overall character of the vegetation. Crops such as wheat, maize, sugarcane, pulses, vegetables etc. are cultivated in agricultural areas. According to the Champion and Seth Classification of Indian Forests, the natural vegetation of the study area represents four different forest types.

Due to the short duration of the survey many of the wild animals were not observed. The population sizes of the observed species were also low. A separate avifaunal survey was carried out by NRPPL which shows that the study area does not fall in the migratory route of bird species. Bat species were observed in the study area. The proposed project area falls within the migration route of the unique multi-species Milkweed butterfly group. The biodiversity indices calculated for the study area is 86.

The Ministry of Environment and Forests constituted a Western Ghats Ecology Expert Panel (WGEEP) in the year 2010 to assess the current status of ecology of the Western Ghats region. The Panel submitted its recommendations to the Ministry in 2011. The project area falls in Man taluka which has been classified under the ESZ – 3, the least sensitive zone. Conditional implementation of infrastructure projects is recommended by the panel in such areas.

Socio-economic Environment – The three villages of Man Taluk from where land has been acquired for the project comprises of total population of 3927. According to Census of India 2001, sex ratio within project area is 1070 which is significantly higher than district average of 995. Average literacy rate of project area is 49.66% which is slightly lower than the district literacy rate i.e. 68%. The social composition in the project area is numerically and economically dominated by the Maratha community (General Class), followed by the Backward Classes (OBC) and the Scheduled Castes (SC). The project area does not report the presence of indigenous people like tribes, ethnic minorities, aboriginals etc.

Agricultural use of land is not dominated in project area villages because of its undulating geographical condition and most of available agricultural land comprises of unirrigated land. Average land holding was 6 to 10 acres across the households of project area villages as per Census of India, 2001. Agriculture based livelihoods and Livestock rearing are the predominant occupational activities in the area subsequent with other non-farm based and ancillary livelihoods.Work participation ratio (WPR) of the project area is 33% which is significantly lower than the WPR of district.

Status of Women - Women are consulted during decision making processes regarding sale and purchase of land and property, marriage, education of children etc. In addition to household chores women also participate in agricultural work and livestock rearing that are principal sources of livelihood in the area.

E.6 Anticipated Impacts and Mitigation Measures

E.6.1 Construction Phase

Procurement of Land – The land identified for the project is predominantly private land with parts of revenue land. Private land has been acquired on willing seller-willing buyer basis by Atlanta Power Private Limited (APPL), the land aggregator. The land is mainly used as grazing area for cattle and other livestock. Grazing activities are limited to the post monsoon months only when adequate vegetation is available. NRPPL has paid compensation to the affected land holders. It was observed during the stakeholder consultation that the compensation paid for the land was acceptable to affected families.

Site Clearing - The site clearing activities such as removal of vegetation, grading, leveling and related activities will majorly impact the ecology and soil resources and quality at site. The activities will result in removal of vegetation and lead to loose soil at site. Removal of vegetation will also result in loss of habitat for small mammals and birds. However the ecological survey carried out at site established that the site does not support any significant ground vegetation. The impact on ecology is assessed to be minor for the project. Mitigation measures such as localized sprinkling of water, stockpiling of excavated materials, planning of staging areas etc. will be implemented to minimize the impacts.

Labour Engagement - All labour for the construction phase will be hired locally, therefore no influx of migrant workers are envisaged. However increased expectation for local recruitment and greater involvement by the locals can cause rift and differences between the local community and the workers already engaged. Community expectations for employment and other local benefits need to be addressed and managed by NRPPL. Adequate representation for local labour shall be decided by the NRPPL management and conveyed to the community. NRPPL shall identify employment opportunities based on skill set requirement for people whose land plots have been impacted and for engagement of women.

Material Handling and Storage – The construction activities will require transportation of construction material and turbine components to the site. Ground transportation and traffic impacts associated with wind energy projects typically include impacts on the transportation system itself (e.g., the physical properties of the road system) and impacts on traffic that uses the transportation system. The community will also be disturbed due to such activities. NRPPL shall undertake a detailed analysis to assess the feasibility of transportation of turbine and associated components. Local administration and village Panchayat will be informed in advance about the movement of heavy and oversized components of turbines. Adequate health and safety measures shall also be implemented.

Concrete Work, Erection and Installation Activities – Excavation activities and earthworks during construction might result in chance find of cultural and historical artifacts of heritage value. Noise will be generated due to blasting, excavation and movement of construction machinery and vehicles. Hazardous waste generation will lead to contamination of soil and water resources. Stringing of transmission lines can lead to damage of agricultural crops. NRPPL shall ensure that proper procedures are in place to mitigate such impacts.

Construction demobilization –One of the key issues related to construction demobilization will be loss of job of the workers after construction activities are over. Improper disposal of construction waste and debris will lead to contamination of soil and discontent of community. NRPPL shall ensure that the workers and local community are informed about the duration of work. Reduction of worker will be done in phase wise and corresponding to completion of each activity.

E.6.2 Operation Phase

Visual Intrusion – Wind energy development projects would be clearly visible because of the height and large size of turbine components. It is critical to recognize that wind turbines cannot be adjusted to meet visual criteria alone. The turbines must be located in the areas with appropriate wind resources in order for the project to be viable. In all the directions it was observed that not more than 5-6 towers will be visible from the base of the plateau. An anti-reflective paint coating will be applied to the turbine towers and blades to mitigate the possible impacts of light reflection/blade glint.

Noise Quality – During operation, major noise sources will be mechanical and aerodynamic noise from turbines, transformer and switchgear noise from substations, corona noise from transmission lines, vehicular traffic noise, and noise from O&M facility. A noise modelling exercise was carried out for the turbines using WindPRO software. The results indicate that

the incremental noise at the receptor locations (villages Virali, Chilarewadi, Puklewadi, Katrewadi and Kukudwad) will be in the range of 31 – 39.3 dB(A). The resultant noise will however remain well within the IFC Noise level guidelines and CPCB Standards for Ambient Noise of 55 dB(A) for day time and 45 dB(A) for night time. Although noise impacts are anticipated to be minor, based on the location and model output, mitigation measures will be considered.

Shadow Flicker – The villages aligned along the east west axes of the proposed project site are Puklewadi and Chilarewadi. There is one small temple on the plateau above Chilarewadi which falls within the project area. There is however no potential for Shadow flicker from the proposed project as the wind turbines are located on the elevated plateau. All turbines located along the edges close to habitation will have a minimum set off of 500m, which will negate the spread of any distinct shadow at the village.

Ecology – The principal risk to birds believed to be posed by turbines, is the potential to be killed as a result of collision with moving rotors. The species that are most likely to be impacted include raptor species and water birds. As per available data, it can only be stated that no avian migratory flyway coincides with the region in which the proposed project-site is located. The general vegetation in the site is also poor and does not have micro habitats to attract large populations of birds. The bird mortality risk is thus considered to be low. However adequate mitigation measures have been proposed for further minimizing the risks to birds.

Water Resources – . It is estimated that about $2m^3$ of water will be required for cleaning of each turbine as part of the annual maintenance schedule. Besides requirement for cleaning of blades there is no other significant requirement of water. Water required for cleaning will be sourced from authorised tankers suppliers.

Hazardous Waste – Hazardous waste generated from operation of wind farms is limited to small quantities of waste oil from use of lubricant oil and transformer oil. The waste requires adequate disposal measures as per the requirements of Hazardous Waste Management Handling and Transboundary Movement Rule 2008.

Occupational Health and Safety – Health and safety impacts are associated with working at heights, electrical and fire hazards, and structural failures. All activities pertaining to operation will require adherence to precautions and safety measures. ReGen shall provide instructions and procedures to all the workers involved in service repair of wind turbines, which will consider wind speeds and other external conditions in such a manner that service, maintenance and repair work on the wind turbine can be performed safely. Access to areas containing exposed electrical equipment (such as transformers) shall be fenced and locked. Warning signs shall be posted at hazardous locations.

Cultural/ Archaeological Impacts – No major archaeological sites are present within the study area. There is one small temple on the plateau above Chilarewadi which falls within the project area which hosts important festivals three or four times a year. The wind turbines location as identified by NRPPL is at a significant distance from the temple and will not restrict access to the temple in any manner.

Community/ Social Issues – These include impacts due to electromagnetic fields (EMF), restriction of use of project area for grazing activities, and impacts on community functions in the area. Electromagnetic fields emanate from any wire carrying electricity and have possible short term and long term effects on the health of people. There are no specific standards or guidance on EMF in India, however International Commission on Non-Ionizing Radiation Protection (ICNIRP) standards will be considered and complied with. The land on the plateau is primarily used for grazing activities in the post monsoon season and NRPPL shall ensure that the area is not restricted for the villagers and livestock. Access to the temple on Chilarewadi plateau which hosts important rituals and functions will also not be restricted due to the project operations.

Communications – Wind turbines and their associated transmission lines can generate electromagnetic noise, which can interfere with telecommunications services. The area was surveyed for presence of mobile transmission towers in the immediate vicinity and no mobile towers are present within 1.5-2.0 km of the proposed site. Thus the potential for any such interference is minimized.

E.6.3 Decommissioning Phase

Decommissioning activities involve removal of infrastructure (e.g. turbines, substations, roads) and reclamation of the project site. NRPPL shall prepare a detailed decommissioning plan at least one year prior to the commencement of decommissioning. The community and stakeholders shall be informed about the process. All precautions related to health and safety, waste disposal etc. will be ensured by NRPPL.

E.6.4 Cumulative Impacts

There are other projects that have been proposed in the vicinity. The potential cumulative impacts identified for the project and their mitigation have been discussed.

Socio-economics – Since the land being acquired for the project is barren and not considered as a source of income, community is willing to sell the land. People can buy more productive land or invest in livestock. Overall cumulative impact will be positive for the project.

Migrant Workers - Although the proposed project will not engage any migrant labour, other upcoming projects in the vicinity might result in the influx of migrant population. This will support the local economy in terms of sale of consumable items, food items, accommodation etc. However the influx of large number of outsiders can potentially lead to cultural conflicts.

Impact on Infrastructure - The road connectivity in the area is good therefore transportation of turbine components will not lead to any disturbances to the habitations.

Impact on air quality, water quality and soil characteristics – Wind energy projects are considered as clean, hence operation phase will not have any adverse impacts on the environment.

Noise – Noise modelling exercise was undertaken using WindPRO software, for assessing the cumulative impacts of noise generation due to all the projects in the vicinity. The cumulative noise impact of the other turbines on the proposed project is marginal and will be within the acceptable norms of ambient noise.

E.7 Analysis of Alternatives

An analysis of alternatives for the proposed wind power project was undertaken as part of the study. The variables that have been analysed include No Project Scenario, alternate location for the proposed project, alternate methods of power generation and alternate routes to transmission lines. It was concluded from the analysis that there is a significant gap in demand and supply of power in the state of Maharashtra which can be bridged by the proposed project up to some extent. Also, considering the ecological sensitivity of the location because of the Western Ghats, conventional sources of power generation are not suitable for the proposed site as they will lead to green house gas emissions and destruction to the natural habitats. Thus, it is proposed to develop a wind power project at the site because of wind resource availability, incentives being offered by the government and low pollution levels associated with wind power generation.

E.8 Information Disclosure, Consultation and Participation

The ADB Safeguard Policy requires the project proponent to undertake consultation with affected land losers and other concerned stakeholders and facilitate their informed participation in the project. The land required for the project involves both revenue and private land. The revenue land is purchased from the government Revenue Department while private land acquisition has been undertaken by the land aggregator Atlanta Power Private Limited (APPL). The details of stakeholder consultation have been discussed below:

Stakeholder Engagement Process Undertaken by NRPPL/APPL (2008) - Informal consultations and discussions were undertaken at the three villages Puklewadi, Chilarewadi and Virali by the land aggregator Atlanta Power Private Limited (APPL) in 2008. The village Panchayat and village elders were briefed about the project and the proposed compensation. They were also informed about myths and benefits of wind farm.

Social Survey and Consultation by AECOM (2011) – AECOM conducted discussions with members of Panchayat and local community members at all the three villages. The process of consultation included identification of relevant stakeholders, imparting information about the project and recording their issues and concerns. Focus group discussions were also held with the randomly selected villagers and land owners. Natural group discussions were also conducted, where ever possible. The stakeholders and community were questioned about their awareness of the project, occupation and livelihood, compensation rates and other issues. All concerns raised by the community and their expectations from the project were noted and are presented in this report.

E.9 Stakeholder Engagement and Grievance Redressal

Stakeholder Engagement - NRPPL shall constitute a Social Management Team which will manage all the human resource issues, contractor and training issues and also all grievance issues. The team shall also formalize the stakeholder engagement process which is informally managed by the land aggregator, i.e. Atlanta Power Private Limited and is limited to liaisoning with local authorities and the Panchayat. CSR activities shall be identified and undertaken with prime focus on education, health care, and enhancement of livelihood sources.

Grievance Redressal - The grievance redressal mechanism at present is not structured and undertaken in an informal manner. NRPPL will constitute a formal Grievance Redressal Mechanism (GRM) for the community, which will be managed by the Social Management

Team. There will be two levels of redressal system functional at Site and Corporate office of NRPPL. The purpose of the GRM will be to record the grievances of the community and other stakeholders and find mutually acceptable solutions for problems like employment, disputes with project activities, damages to private property, community development needs, socio-economic development of villages etc.

E.10 Environmental Management Plans

The Environment and Social Management Plan has been prepared to delineate management measures to minimize the environment and social impacts identified by allocating management responsibility for implementation of these measures during construction and operation phase. The Environment and Social Management Plan also provides for instruments for compliance with ADB Safeguards. The ESMP will follow the concept of continual development, incorporating systematic monitoring, reporting, and corrective action as an integral part of environmental management and shall ensure a continuous communication process between the project proponent, workers (including contractors), local community and other key stakeholders.

E.10.1 Organizational Structure

The overall management and coordination of the project will be through the Chief Executive Officer (CEO) of NRPPL, who will be supported by the Head-Wind power and Head-EHS. The Head-EHS, in close association with the Head-Wind power will overview, monitor and control the EHS activities at project site. During construction phase, the contractors will be controlled by the Site Manager. The project site will have an EHS Supervisor for handling EHS issues and Community Officer to interact with local community. The construction contractor will also be required to have an EHS Supervisor in their team.

The entire EHS team will be responsible for the effective implementation of the Environmental and Social Management Plan (ESMP) through review and periodic updation, ensuring availability of resources and institutional arrangements, imparting training and awareness program in a scheduled manner, complying with ADB Safeguards and national legislative requirements and prepare and maintaining requisite documents related to EHS.

E.10.2 Management Plans

The following plans have been prepared for the project:

- *Environment and Social Management Plan (ESMP)* - Environmental and Social Management Plan lists out mitigation measures and management strategies for construction and operation phases of the proposed Project.
- *Contractor's Management Plan* – The contractor‘s management plan details the criteria and procedures to be followed for engagement and management of construction and operation contractors for the project. NRPPL shall ensure that each contractor satisfies the EHS requirements of NRPPL and ADB. All conditions stipulated in the ADB Social Protection Requirements shall be contractually binding upon the contractors and NRPPL shall ensure compliance hereunder.
- *Traffic management Plan* - The Traffic Management Plan aims to reduce the impacts of construction traffic movements in relation to disruption and delay to traffic and to reduce the risk of road traffic accidents in relation to the project activities. It identifies the potential traffic impacts of the project and suggests appropriate measures and procedures to mitigate the impacts.

- *Crane Safety Plan* – The Crane Safety Plan details the inspection requirements and qualification requirement for crane operation during the construction phase of the project. Roles and responsibilities of the primary employer as well as crane operator are also discussed in the plan.

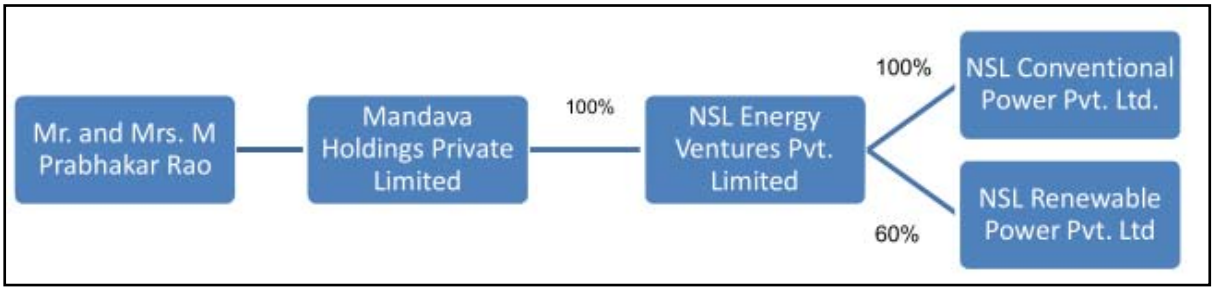
E.11 Conclusion and Recommendations

Based on the impact assessment study, it is inferred that the proposed 75 MW Chilarewadi wind power project has very few adverse environmental impacts that are generally site specific and can be readily addressed through the proposed mitigation measures. Hence the project can be categorised as an **Environment Category B** project. Major issues related to dust generation, increase in noise levels, traffic congestion etc. will be limited to construction phase and could be addressed by standard construction techniques. The land for the proposed project also comprises of fallow land and no physical or economic displacement is involved with the project. The operation of turbines will also have limited impact on the habitation in terms of noise and shadow flicker. An Environmental and Social Management Plan including the management responsibilities and cost estimates, has been prepared for the project and NRPPL shall effective and timely implementation of the management plan.

1 Introduction

NSL Renewable Power Private Limited (NRPPL) is a fully owned subsidiary of NSL Power Private Limited established for implementation of renewable power projects across the country. NRPPL has so far successfully implemented wind based power project with a total capacity of 147.40 MW in the state of Karnataka and Tamil Nadu. NRPPL now intends to set up wind power project of 75 MW in Chilarewadi village of Man Taluka (also known as Dahivadi Taluka) in Satara District of Maharashtra.

NRPPL is seeking financial assistance from the Asian Development Bank (ADB), for setting up the wind power project in Satara, District. NRPPL has appointed AECOM India Private Limited to undertake the Environmental and Social Assessment (ESIA) of the project as per the requirement of ADB's Safeguard Policy Statement (SPS), 2009. The report also considers the requirements under Performance Standards and guidelines of International Finance Corporation. This ESIA report has been prepared on the basis of a reconnaissance visit to the site, environmental monitoring, analysis and consultations, discussions with relevant stakeholders. The organization chart for NSL group has been provided below:



1.1 Project Brief

NRPPL has formed a Special Purpose Vehicle (SPV), which is known as NSL Wind Power Company (Satara) Private Limited to develop 75MW Wind Power Project. The project area falls in three villages viz. Chilarewadi, Puklewadi and Virli of Man Taluka in Satara District of Maharashtra State, India. The wind farm will be located on a table top plateau at an elevation of 890-905m above mean sea level (MSL) with a total area of approximately 68.10 hectares (ha).

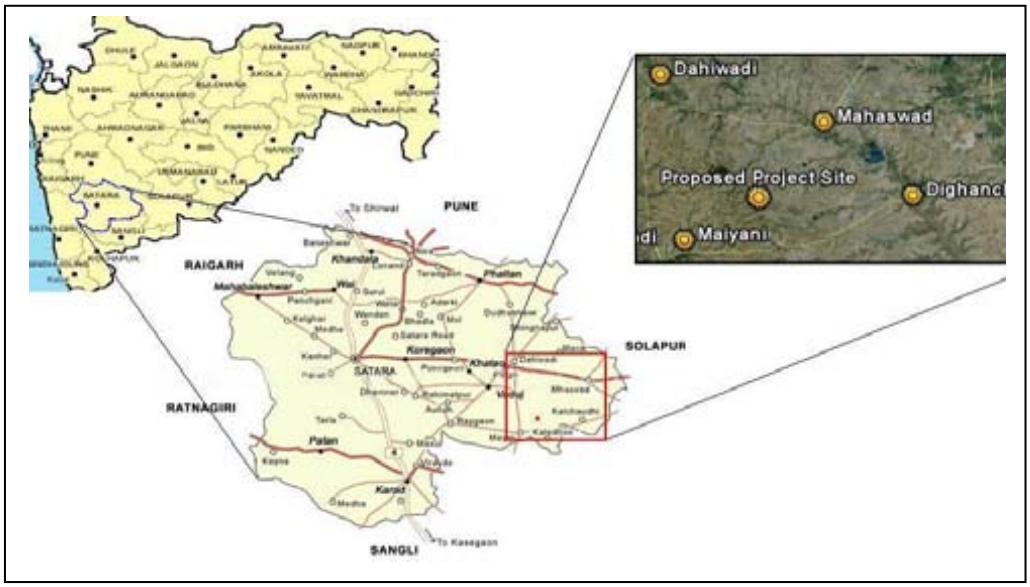
The project will involve:

- Construction of 50 wind turbines with a unit generating capacity of 1.5MW each, total generation capacity in the range of 75MW;
- Electrical connection will require feeder underground cable from the turbines, to the distribution transformers and a connection to the substation.

NRPPL undertook a micro-siting activity and estimation of annual energy based on which the number of turbines have been arrived at 50. The wind turbines for the proposed project will be installed and commissioned by M/s ReGen Powertech Private Limited through their Vensys 87/1500 kW make turbines, totalling to a capacity of 75MW. ReGen Powertech will also be responsible for operation and maintenance of the project. The power generated will be transmitted to Maharashtra State Electricity Board (MSEB) as per a Power Purchase

Agreement, for which a proposal has been submitted to MSEB. The negotiations and land acquisition for private land for the project is being undertaken through a land Aggregator M/s Atlanta Power Private Limited (APPL).

Figure 1.1 Indicative Project location



1.2 Project Categorization

Initial screening of the proposed project suggests that the project does not have any major adverse environmental or social impacts. All potential impacts can be mitigated through implementation of adequate mitigation measures. Therefore the project is categorized under **Category B** as per the ADB Safeguard Policy Statement.

However, in order to understand the scale, sensitivity and magnitude of its potential environmental impacts, a detailed environmental impact assessment study is being undertaken for the project.

1.3 Scope of Work

This study is being undertaken as per the requirements of the ADB Safeguard Policy Statement, 2009 to understand the Environmental and Social impacts associated with the proposed 75MW wind farm project. The study will also suggest appropriate mitigation measures and management plans to prevent and minimize all adverse impacts identified.

The scope of work included the following activities:

- Reconnaissance survey and primary site assessment to collect and review baseline environmental and social conditions;
- Collection of additional secondary environmental, social and demographic information;
- Collection of information on forestry, flora and fauna, and natural habitats through ecological assessment of the study area;

- Social surveys and review of land acquisition and compensation process;
- Identification and review of the applicable standards and identification of key issues;
- Assessment of potential environment and social impacts of the project and its components;
- Suggesting mitigation measures and plans to maximize project benefits in consultation with affected communities and
- Preparation of Environmental and Social Management Plan (ESMP) based on the ESIA and suggest procedures for mitigation and monitoring of environment and social impacts on an ongoing basis as well as to identify any requirements that may occur subsequent to the completion of the ESIA.

1.4 Approach and Methodology

The approach and methodology applied for the execution of the impact assessment study is as provided:

- The relevant project document and detailed project report was reviewed to understand the project requirements
- Regulatory review was undertaken to understand the applicable, local and national legislation and regulatory frameworks as well as international treaties and agreements signed by India. The review includes the relevant IFC Environment, Health and Safety Guidelines, ADB's SPS 2009, Social Protection Strategy, Gender Policy requirements, and ADB's Operations Manuals on safeguards and social protection.
- A detailed social and environmental assessment of site and surround areas was undertaken through:
    - Reconnaissance surveys to understand site specific issues
    - Discussions with the local community and identification key issues;
    - Baseline data collection of the site and study area with respect to water and soil quality, ambient air and noise quality;
    - Ecological assessment on flora and fauna of the site and study area through primary and secondary surveys.
- Collation of secondary information on social aspect of the site, supplemented by consultations with the local communities to understand community perception with regard to the project and its activities. The approach included:
    - Stakeholder mapping and Identification;
    - Focused group consultations with selected land losers and other impacted groups;
    - Field surveys and data compilation;
    - Group/Community Consultations: Group meetings and consultations with local and community representatives; and
- Assessment of impacts based on understanding of the project activities and existing baseline status;
- Preparation of Environment and Social Management Plan.

1.5 Agencies contacted

The following agencies were contacted during the course of the study:

- Forest Department

- Survey of India
- Atlanta Power Private Limited
- Netel India Limited
- Local Panchayats
- Mayani Bird Sanctuary

1.6 Limitations of the Study

The study undertaken is structured around the project information as provided by the project proponent, any change in the proposed activities may result in variation of outcome. The environmental and social study is based on baseline monitoring and survey undertaken. Professional judgement and subjective interpretation of facts has been applied for this study. All information's and inferences presented herein are based on the specifics currently available within the limits of the scope of work, information provided by the client or its representative, existing secondary data, budget and schedule.

1.7 Layout of the Report

The remaining sections of the report include the following:

Section 2: Policy, Legal and Administrative Framework;
Section 3: Description of Project;
Section 4: Description of Environment (baseline);
Section 5: Anticipated Impacts and Mitigation Measures;
Section 6: Analysis of Alternatives;
Section 7: Information Disclosure, Consultation and Participation
Section 8: Stakeholder Engagement and Grievance Redressal Mechanism
Section 9: Environmental Management Plans
Section 10: Conclusion and Recommendation

Annexes to the report include the following:

Annex A: Photo-documentation of the study area
Annex B: Traffic Management Plan
Annex C: Re-vegetation Plan
Annex D: Crane Safety Plan
Annex E: NOC obtained from Panchayats
Annex F: Detailed Results of Noise Modelling
Annex G: List of Land Owners
Annex H: Additional Biological Survey of the Site (undertaken by NSL)
Annex I: Community Development Plan

2 Policy, Legal and Administrative Frame Work

This section highlights the environmental and social regulations applicable to the proposed wind power project. The section broadly focuses on the institutional framework, applicable environment, health and safety and social legislative requirements, ADB Safeguard Policies, IFC performance Standards and Enforcement Agencies

2.1 Enforcement Agencies

A brief description of the relevant enforcement agencies with respect to the institutional framework is described in the following sub-sections.

2.1.1 Ministry of Environment and Forests

The Ministry of Environment and Forests (MoEF) is responsible for the implementation and enforcement of the Environment Protection Act, 1986, and Rules issued under the Act. Under sections 3 and 5 of the EP Act, 1986, the Ministry retains enormous powers to issue directions in the interests of environment protection.

The primary concerns of the Ministry are implementation of policies and programmes relating to conservation of the country's natural resources including its lakes and rivers, its biodiversity, forests and wildlife, ensuring the welfare of animals, and the prevention and abatement of pollution. While implementing these policies and programmes, the Ministry is guided by the principle of sustainable development and enhancement of human well-being.

The specific functions of MoEF are as follows:

- Environmental policy planning;
- Effective implementation of legislation;
- Monitoring and control of pollution;
- Environmental Clearances for industrial and development projects covered under EIA notification;
- Promotion of environmental education, training and awareness; and
- Forest conservation, development, and wildlife protection.

2.1.2 Central Pollution Control Board (CPCB)

The Central Pollution Control Board (CPCB) was established in September 1974, for the purpose of implementing provisions of the Water (Prevention and Control of Pollution) Act, 1974. The executive responsibilities for the industrial pollution prevention and control are primarily executed by the CPCB at the Central level, which is a statutory body, attached to the MoEF. CPCB works towards control of water, air and noise pollution, land degradation and hazardous substances and waste management.

The specific functions of CPCB are as follows:

- Prevent pollution of streams and wells;
- Advise the Central Government on matters concerning prevention, control and abatement of water and air pollution;
- Co-ordinate the activities of SPCB‘s and provide them with technical and research assistance;

- Establish and keep under review quality standards for surface and groundwater and for air quality;
- Planning and execution of national programme for the prevention, control and abatement of pollution through the Water and Air Acts; and
- The CPCB is responsible for the overall implementation and monitoring of air and water pollution control under the Water Act, 1974, and the Air Act, 1981.

2.1.3 Maharashtra Pollution Control Board (MPCB)

Maharashtra Pollution Control Board (MPCB) implements various environmental legislations in the State of Maharashtra, mainly including Water (Prevention and Control of Pollution) Act, 1974, Air (Prevention and Control of Pollution) Act, 1981, Water (Cess) Act, 1977 and some of the provisions under Environmental (Protection) Act, 1986 and the rules framed there under like, Biomedical Waste (M&H) Rules, 1998, Hazardous Waste (M&H) Rules, 2000, Municipal Solid Waste Rules, 2000 etc. MPCB is functioning under the administrative control of Environment Department of Government of Maharashtra. Some of the important functions of MPCB are:

- To plan comprehensive program for the prevention, control or abatement of pollution and secure executions thereof,
- To collect and disseminate information relating to pollution and the prevention, control or abatement thereof,
- To inspect sewage or trade effluent treatment and disposal facilities, and air pollution control systems and to review plans, specification or any other data relating to the treatment plants, disposal systems and air pollution control systems in connection with the consent granted,
- Supporting and encouraging the developments in the fields of pollution control, waste recycle reuse, eco-friendly practices etc.
- To educate and guide the entrepreneurs in improving environment by suggesting appropriate pollution control technologies and techniques
- Creation of public awareness about the clean and healthy environment and attending the public complaints regarding pollution.

It is to be noted that State Pollution Control Boards (SPCB) such as the Maharashtra Pollution Control Board, are authorized to provide consents for construction and operation of projects, under the Air Act and Water Act at state levels. The overall implementation and monitoring of air and water pollution at national level falls under the purview of the Central Pollution Control Board (CPCB).

2.1.4 Maharashtra Forests Department

Article 48A obligates the Union and the State Governments to endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country. Similarly, Article 51A(g) lays stress on protection and improvement of the natural environment including forests, lakes, rivers and wildlife, and to have compassion for living creatures as a fundamental duty of every citizen of this country.

Maharashtra Forest Department is entrusted with the role of conservation and development of the State's forests spread over about 20 percent of its geographical area. The key primary objectives of the Maharashtra Forests Department include the following:

- To recommend to the State and Central government, policies which will provide an enabling environment for various non-governmental players to play and active role in this sector
- To generate and disseminate knowledge and information relevant to the sector to various stakeholders and provide Research and Development support to the sector.
- To regulate the activities of various players involved in forestry sector development.
- To undertake co-ordinated planning along with the other government departments and agencies.
- To develop a pro-active interface with political and executive arm of the government and public
- To act as a nodal agency at the grass-root levels in the forest lands.

2.1.5 Petroleum and Explosives Safety Organisation (PESO)

The PESO is under the Department of Industrial Policy & Promotion, Ministry of Commerce and Industry, Government of India. The Chief Controller of explosives is responsible to deal with provisions of

- The Explosive Act 1884 and Rules, 1983,
- The Petroleum Act 1934 and the Rules 2002,
- The Static and Mobile pressure vessels {Unfired} Rules, 1981 and amendment 2000, 2004;
- Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 and amendment 2000.

2.1.6 Transport Department, Maharashtra

The Motor Vehicles Department has been established under section 213 (1) of the Motor Vehicles Act, 1988. This is a Central Act applicable throughout the country. Motor Vehicles Department is mainly responsible for enforcing various provisions of this Act. Motor Vehicles Department is headed by the Transport Commissioner.

The main functions of the Motor Vehicles Department are as follows:

- Enforce the provisions of the Motor Vehicles Act, 1988, the Central Motor Vehicles Rules, 1989 and the Maharashtra Motor Vehicles Rules, 1989.
- Ensure a co-ordinated development of Road Transport through the regime of permit.
- Levy and collection of tax on Motor Vehicles under the Bombay Motor Vehicles Tax Act, 1959 and on Passengers under the Bombay Motor Vehicles (Transportation of Passengers) Act, 1958.

2.1.7 Maharashtra State Electricity Distribution Co. Ltd

Erstwhile Maharashtra State Electricity Board was looking after Generation, Transmission & Distribution of Electricity in the State of Maharashtra barring Mumbai. But with enactment of Electricity Act 2003, MSEB was unbundled in to 3 Companies viz. Maharashtra State Electricity Distribution Co. Ltd., Maharashtra State Power Generation Co. Ltd. and Maharashtra State Electricity Transmission Co. Ltd.

The MSEDCL supplies electricity to consumers across the categories all over Maharashtra excluding the island city of Mumbai.

2.1.8 District Administration for Acquisition of Land

The private land required for the project is being purchased on willing- buyer-willing seller basis. The District administration will be involved in the diversion of revenue land for the proposed project.

2.1.9 Director Industrial Safety and Health

The main objective of the Director, Industrial Safety and Health is to ensure safety, health, welfare and working conditions of workers working in factories and in construction works by effectively enforcing the provisions of the Factories Act, the Building & Other Construction Workers Act and others labour legislations. It is also to ensure the protection of rights of workers and to redress their grievances.

2.2 Applicable National Laws and Regulations on Environment and Social

The relevant national acts and rules pertaining to the project are summarised as below:

Table 2.1: Environment

1.	***The Environment (Protection) Act; 1986 and Environment (Protection) Rules 1986 and amendments***
	The salient provisions of the Act include but not limited to the following: • Restrict or prohibit industries, operations or processes in specified areas; • Undertake environmental impact assessment for certain categories of industries to inform the decision making in approval of new or expansion projects; • Restrict or prohibit handling of hazardous substances in specified areas; • Protect and improve the quality of the environment and prevention, control and abatement of environmental pollution; • Lay down standards for the quality of the environment, emissions or discharges of environmental pollutants from various sources; • Lay down procedures and safeguards for the prevention of accidents, which may cause environmental pollution; • Bar on filling of any suit or legal proceedings against the Government or officials empowered by it for action taken in good faith, in pursuance of the Act; and • Bar of jurisdiction to Civil Court to entertain any suit or proceedings in respect of anything done, action taken or directions issued by the Central Government or any other authority empowered by it, in pursuance of the Act.
	Applicability: NRPPL shall ensure compliance under the rules to maintain stipulated standards and environmental management through various supporting rules promulgated under the Act.
2	***EIA Notification 2006 as amended till 2009***
	• As per schedule to the notification, projects or activities are categorised as i.e. A or B, based on their threshold and likely spatial extent of potential impacts on human health and natural and manmade resources.

	• All ‗Category A' projects or activities require Environmental Clearance from Environmental Impact Assessment Authority (EIAA) constituted at MoEF, Government of India. • The EIAA will issue Environmental Clearance based on recommendations of the Expert Appraisal Committee (EAC), while projects under Category ‗B1' (Category B is subdivided into B1 and B2 categories as per description given below under *Stage I - Screening*) require prior Environmental Clearance from State /Union territory Environment Impact Assessment Authority (SEIAA), based on recommendations of a State level Expert Advisory Committee (SEAC).
	Applicability: Wind power projects are exempted from environmental clearance.
3	***Manufacture Storage & Import of Hazardous Chemicals (MSIHC) Rules 1989 and Amendment 2000***
	• These rules apply to the activities, which involve handling, storage and import of hazardous chemicals as specified in Schedule 1 of the Rules. The indicative criteria are specified in the Part 1 of the same schedule. • The rule also applies to the industrial activity involving isolated storage in the quantities mentioned in Schedule 2. • The MSIHC Rules also require provision for the proper storage and handling of chemicals. Definition and classification of the chemicals as dangerous/hazardous is specified under the MSIHC Rules and listed in Schedules 1, 2 & 3. • The information on various requirements and clearances under the MSIHC Rules has to be furnished to the SPCB office.
	Applicability: The project site will require limited quantity of explosives during construction activities. In case there is storage of explosive at site, the details of requirement under the license from Chief Controller of Explosives will be provided to the Maharashtra Pollution Control Board.
4	***Ozone Depleting Substances (Regulation) Rules, 2000 as amended in 2005***
	• As a party to the Vienna Convention on the protection of the ozone layer and the Montreal Protocol, India has released the Ozone Depleting Substances (Regulation) Rules 2000 pursuant to the Environment (Protection) Act, 1986. • Rules regulate production, consumption, export, import, sale, purchase and use of ozone depleting substances in specified time bound programme in line with the Montreal Protocol. • The Rules subject many activities to prior registration or to obtaining a license from the relevant authorities. Of the 20 chemicals controlled under the amended Montreal Protocol, India uses and produces seven (7) ODSs. These include – Chlorofluorocarbons (CFC-11, CFC-12, and CFC-113), Carbon tetrachloride (CTC), Methyl Chloroform (MCF), and Halons (H-1211, and H-1301).
	Applicability: NRPPL to ensure that all insulation material used for wiring and electrical units, solvents and degreasing substances used in the welding, preparatory works for metals parts prior to painting and corrosion protection are free of ozone depleting substances.

Table 2.2: Pollution Control

1	***The Air (Prevention and Control of Pollution) Act, 1981 Including Rules 1982 and 1983***

	• The Act assigns powers and functions to the CPCB and the SPCBs for prevention and control of air pollution and all other related matters. • The State Government, in consultation with the SPCB has the powers to set standards for emissions from automobiles, impose restrictions on use of certain industrial plants and prohibit emissions of air pollutants in excess of the standards laid down by the SPCB. It can also make an application to the court for restraining persons from causing air pollution • In addition, it also has the power of entry and inspection, power to obtain information and power to take samples of air emissions and conduct the appropriate follow up. The CPCB, as well as the SPCBs are eligible for contributions from the Central as well as the State Government, respectively, to perform their functions appropriately. • The Act also allows for appropriate penalties and procedures for non-compliance. • The Act prohibits the construction and operation of any industrial plant without the consent of SPCBs.
	Applicability: The project shall obtain Consent to Establish from Maharashtra Pollution Control Board before the construction Phase under article 21 of the act.
2	***Noise Pollution (Regulation and Control) Rules, 2000***
	• As per the Noise Pollution (Regulation and Control) Rules 2000, every operating facility is required to take all possible steps to meet the ambient noise level standards prescribed in the Rules. The rules prescribe maximum permissible values of day and night time noise levels for zones A, B, C and D representing industrial, commercial, residential and silence zone respectively.
	Applicability: NRPPL shall ensure compliance to the Noise standards for the residential area in the proximity of the project.
3	***The Water (Prevention and Control of Pollution), Act, 1974 including Rules, 1975 (as amended up to 1988)***
	• The Act assigns functions and powers to the CPCB and SPCBs for prevention and control of water pollution and all related matters. Subject to the provisions of the Act, the functions and powers of CPCB as well as the SPCBs have been delineated individually and with respect to each other. • This Act provides for the prevention and control of water pollution and maintaining or restoring good water quality for any establishment.
	Applicability: The project shall obtain Consent to Establish from Maharashtra Pollution Control Board before the construction Phase and Consent to Operate prior to commissioning under the article 25/26 of the act.
4	***Hazardous Waste Management, Handling and Trans Boundary Movement Rules 2008 as amended.***
	The rule states the requirement for handling and managing wastes categories as hazardous under the schedule. It lays down requirement for: • Authorisation for collection, reception, storage, transportation and disposal of hazardous wastes • Filing of annual return under the rules • Other compliance under the rules • Authorisation by Central Pollution Control Boards to vendors accepting waste/used oil • Liability of the occupier, transporter and operator of a facility: The occupier, transporter and operator of a facility shall be liable for damages caused to the environment resulting due to improper handling and disposal of hazardous waste listed in schedules to the Rules; • The occupier and operator of a facility shall also be liable to reinstate or restore

	damaged or destroyed elements of the environment; • The occupier and operator of a facility shall be liable to pay a fine as levied by the State Pollution Control Board with the approval of the Central Pollution Control Board for any violation of the provisions under these rules.
	Applicability: The proposed project will generate waste oil (lubricant, hydraulic, etc) from construction machinery and equipment during construction phase. It will generate transformer oil during operation phase. The project will require authorisation from Maharashtra Pollution Control Board under the above rules.

Table 2.3: Forests & Wildlife Resources

1	***Forests (Conservation) Act, 1980 and Rules 1981***
	The Act restricts the powers of the State in respect of de-reservation of forests and the use of forestlands for non-forest purposes. An advisory committee has been created to oversee the implementation of the statute. The FCA is relevant for the power the project, and for passage of transmission through forest areas, since it would involve use of forestland for "non-forest" purposes. According to Section 2 of the Act " prior approval of the Central Government is required for: • De-reservation of a reserved forest • Use any forest land for any non -forest purpose • Assign any forest land to any private person or entity not controlled by the Government • Clear any forest land of naturally grown trees for the purpose of using it for reforestation
	Applicability: The proposed project does not involve any diversion of forest land.
2	***The Wildlife (Protection) Act, 1972***
	• T he Act provides for protection to listed species of flora and fauna and establishes a network of ecologically important protected areas. • It empowers the Central and State Governments to declare any area to be a Wildlife Sanctuary, National Park or a closed area. • There is a blanket ban on carrying out any industrial process or activity inside any of these protected areas. • In case forestland within the protected areas network is to be diverted for any non-wildlife use, a no objection has to be obtained from the Indian Board of Wildlife and the State Legislature, before the final consideration by MoEF. • The schedules categorize animals, birds, and plants. Schedule I lists endangered species of mammals, reptiles, amphibians, birds, crustaceans and insects. Any possession, transportation etc. of these species without prior permission is offence under the Act.
	Applicability: The project area does not involve any Wildlife Sanctuary or National Park. However there is Bird Sanctuary within 10 km from the Project site and may require a No Objection Certificate from the Chief Wild Life Warden.

Table 2.4: Land and Social

1	***The Land Acquisition Act, 1894***
	The Act lays down procedures for acquisition of land, including notification, payment for damages, hearing of objections, declaration of the intended acquisition, enquiry into measurement, values and claims and award by the competent authority and finally taking possession of the land. The key features include:

	• Preliminary notification for land proposed for acquisition; • Clearing of objection within 30 days of the notification and the provision for hearing of all objections; • Declaration of intended acquisition award; • Reference to court if award is not accepted and hearing in court; • Apportionment of compensation and dispute settlement regarding the same; and • Payment of compensation for land value, trees and structures
	Applicability: The private land acquired for the project is through direct purchase. The revenue land will be diverted through the relevant department. Land acquisition act is not triggered. The 220 kv transmission line proposed to be used for Chilarewadi project is already established and is being used by other neighboring wind farms projects. The internal transmission line (WTG to substation) will be laid along with the internal roads in the diverted revenue land so invoking of the LA Act 1894 does not arise. For any unavoidable pole locations on Private land necessitated due to alignment will be addressed by paying suitable compensation through negotiations.
2	***The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act 2006 & rules 2007***
	The act vests the forest rights and occupation in forest land in forest dwellers (ST and other traditional forest dwellers) who have been residing in forests for generations but whose rights could not be recorded. The act provides a framework for recognising the forest rights and the nature of evidence required for such recognition and vesting of forest land.
	Applicability: The site does not include any forest area.

Table 2.5: Health and Safety

1	***Explosives Act, 1884 and Explosives Rules, 1983***
	This is an act to regulate manufacture, use, sale and transport of explosives. A license is granted for manufacture, trade and/or use of explosives under the Explosives rules 1983 only after a NOC from District Administration.
	Applicability: NRPPL to ensure that the construction contractor obtains required license and NOC prior to any blasting activity (if any).
2	***The Petroleum Act, 1934 and the Petroleum Rules***
	Provide procedures and safety measures to be taken up for handling, storage and transportation of petroleum products. The Rules define the quantity and class of petroleum for which prior permission from the concerned authorities are required. The storage requiring prior licences are as following: • Petroleum class A (having flash point less than 23ºC) not intended for sale of the total quantity in possession does not exceed 30 litres. Petroleum Act, 1934, Section 8); • Petroleum class B (having flash point from 23 to 65ºC) if the total quantity in possession at any one place does not exceed 2,500 litres and none of it is contained in a receptacle exceeding 1,000 litres; (Petroleum Act, 1934, Section 7); • Petroleum class C (having flash point above 65 to 93ºC) if the total quantity in possession at any one place does not exceed 45,000 litres (Petroleum Act, 1934, Section 7).
	Applicability: Fuel storage at site for operation of machinery beyond the mentioned quantity will trigger

	the act.
3	***Gas Cylinder Rules and Static and Mobile Pressure Vessels (Unfired) Rules, 1981***
	The rules were framed to restrict handling and transportation of gas cylinders and provide procedures and approvals for manufacturing detail of the cylinder including the reference of safety relief devices, its manufacturing and usage specification. The rules also describe labelling of cylinders by colour to identify the type of gas present in the cylinder.
	Applicability: Welding activities will require use of gas cylinders at site. However, the quantities at site at any time will be limited. NRPPL shall ensure safe handling of cylinders as per the rules
4	***The Indian Factories Act, 1948 and State Rules***
	The Indian Factories Act was promulgated in 1948, to ensure general welfare of the industrial workers. It requires that a general policy with respect to H&S of the workers at work in the form of a written statement and which has to be brought to the notice of the workers. The Act defines factory as any premises including the precincts thereof- (i) whereon ten or more workers are working, or were working on any day of the preceding twelve months, and in any part of which a manufacturing process is being carried on with the aid of power, or is ordinarily so carried on, or (ii) whereon twenty or more workers are working, or were working on any day of the preceding twelve months, and in any part of which a manufacturing process is being carried on without the aid of power, or is ordinarily so
	Applicability: Wind farm will fall in the definition of factory as the number of employees proposed will be more than 20 (direct and indirect). NRPPL shall approve the layout and obtain factories license prior to commencement of operations.

Table 2.6: Labour

1	***The Child Labour (Prohibition and Regulation) Act, 1986***
	• A child is defined as a person who has not completed 14years of age. The Act prohibits employment of children in certain occupation and processes (part II, Section 3). • The Act also specifies conditions of work for children, if permitted to work. These include a working day of maximum of 6 hours a day (including rest), no work period exceeding 3 hours at a stretch, and no overtime (Section 7). The Act requires maintenance of a register for employed children (Section 11). • The Constitution of India (Part III, Article 24 - Fundamental Rights) describes that no child below the age of fourteen years shall be employed to work in any factory or engaged in any other hazardous employment
	Applicability: NRPPL to ensure that no child labour is engaged at site for construction or operation works either directly or by the sub contractors.
2	***The Bonded Labour (Abolition) Act 1976***
	• The act states that all forms of bonded labour stands abolished and every bonded labourer stands freed and discharged from any obligations to render any bonded labour (Ch II, Section 4).
	Applicability: NRPPL to ensure that no bonded labour is engaged at site for construction or operation works.
3	***The Trade Union Act, 1926***
	• Provides procedures for formation and registration of Trade Unions and lists their rights and liabilities. It encompasses any combination, permanent or temporary, that gets formed to regulate relationship between workmen and their employers.

	Applicability: NRPPL to ensure that there is no policy restricting association of workers.
4	***Minimum Wages Act, 1948***
	• Minimum Wages Act, 1948 requires the Government to fix minimum rates of wages and reviews this at an interval of not more than 5 years. The Payment of Wages Act, 1936, amended in 2005. Every employer shall be responsible for the payment to persons employed by him of all wages required to be paid under this Act. • As per the Equal Remuneration Act 1976, it is the duty of an employer to pay equal remuneration to men and women workers for same work or work of a similar nature.
	Applicability: NRPPL to ensure payment of minimum wages as fixed by the government without any gender bias.
5	***Workmen's Compensation Act, 1923***
	The Act requires that, if personal injury is caused to a workman by accident arising out of and in the course of his employment, his employer shall be liable to pay compensation in accordance with the provisions of this Act.
	Applicability: NRPPL to ensure compensation for personal injury caused to any worker by accident arising out of and in the course of his employment as per the act.
6	***Maternity Benefit Act, 1961***
	• The act states that no employer shall knowingly employ a woman in any establishment during the six weeks immediately following the day of her delivery or her miscarriage. • No pregnant woman shall, on a request being made by her in this behalf, be required by her employer to do during the period any work which is of an arduous nature or which involves long hours of standing, or which in any way is likely to interfere with her pregnancy or the normal development of the foetus, or is likely to cause her miscarriage or otherwise to adversely affect her health.
	Applicability: NRPPL to ensure that engagement of female workers during their pregnancy follows the requirement of the act.
7	***Other Legislations***
	Other labour related legislations applicable for the Project include the following: • The E.P.F. and Miscellaneous Provisions act, 1952 • Payment of Bonus Act, 1965 and Amendment Act No.43 of 1977 and No.48 of 1978 and amendments • Payment of Gratuity Act, 1972 • Public Provident Fund Act, 1968 • ESI Act , 1948 (Employees State Insurance Act, 1948) • The Contract Labour (Regulation & Abolition) Act, 1970 and Rules • Employer's Liability Act, 1938 (as amended). • The Industrial Employment (Standing Orders) Act, 1946 (as amended). • The Industrial Disputes Act, 1947 (as amended). • The Personal Injuries (Compensation Insurance) Act, 1963 (as amended). • Building and Other Construction Workers Rules include: • Contract Labour (Regulation & Abolition) Central Rules, 1971 • Industrial Disputes (Central) Rules, 1957

	• Minimum Wages (Central) Rules, 1950 • Payment of Bonus Rules, 1975 • The Personal Injuries (Compensation Insurance) Rules

Table 2.7: Other Relevant Legislations

1	***The Electricity Act 2003***
	• Generating Company shall be deemed to require a Licence under the Indian Electricity Act, 2003 to obtain sanction of the State Government for the purpose of carrying on any of its activities. • General safety requirements as specified in Rule 29 to 46 of Indian Elecetricity Act, 2003 under Chapter-IV shall be met to acquire the license and remain operational. • The Electricity Act, 2003 requires that no person shall be engaged in the generation, transmission, distribution, supply or use of electricity, in any way injure any railway, highway, airports, tramway, canal or water-way or any dock, wharf or pier vested in or controlled by a local authority, or obstruct or interfere with the traffic on any railway, airway, tramway, canal or water-way. • It also provides that every person generating, transmitting, distributing, supplying or using electricity (hereinafter in this section referred to as the "operator") shall take all reasonable precautions in constructing, laying down and placing his electric lines, electrical plant and other works and in working his system, so as not injuriously to affect, whether by induction or otherwise, the working of any wire or line used for the purpose of telegraphic, telephone or electric signalling communication, or the currents in such wire or line.
	Applicability: NSRPPL shall obtain license under the electricity act and ensure that the Health and Safety requirements specified under the rules are complied to.

2.3 Applicable National Policies

Various policies released by the Government of India from time to time needs to be addressed while undertaking the projects. Some of the policies (including sector specific) have been discussed briefly in the subsequent sections.

Table 2.8: Applicable National Policies

1	***National Policy for Resettlement and Rehabilitation, 2007***
	• NRRP apply to all projects where involuntary displacement takes place; • Principles may also apply to affected persons displaced due to any other reason; • Recognizes directly and also indirectly affected persons and admits plight of non-title affected persons; • Threshold: A new project or expansion of an existing project, which involves involuntary displacement of 400 or more families en masse in plain areas, or 200 or more families en masse in tribal or hilly areas, DDP blocks or areas mentioned in the Schedule V or Schedule VI to the Constitution of India; and • NRRP-2007 provides the basic minimum requirements for *Resettlement and Rehabilitation*. • State Govt., public sector undertakings or agencies, and other requiring bodies may place greater benefit levels for R&R.
	Applicability: The project envisages no resettlement or relocation as it is located on an uninhabited table top (plateau). Hence this policy is not applicable for the proposed project.

2	***National Environmental Policy 2006***
	• Government of India released the National Environment Policy in 2006. The present national policies for environmental management are contained in the National Forest Policy, 1988, the National Conservation Strategy and Policy Statement on Environment and Development, 1992; and the Policy Statement on Abatement of Pollution, 1992. Some sector policies such as the National Agriculture Policy, 2000; National Population Policy, 2000; and National Water Policy, 2002; have also contributed towards environmental management. All of these policies have recognized the need for sustainable development in their specific contexts and formulated necessary strategies to give effect to such recognition. • The dominant theme of this policy is that while conservation of environmental resources is necessary to secure livelihoods and well-being of all, the most secure basis for conservation is to ensure that people dependent on particular resources obtain better livelihoods from the fact of conservation, than from degradation of the resource.
	Applicability: The proposed project being a renewable power project upholds the requirements of the policy.
3	***National Forest Policy, 1988***
	The present Forest Policy of 1988 was formulated with the following basic objectives: • Maintenance of environmental stability through preservation and, where necessary, restoration of the ecological balance that has been adversely disturbed by serious depletion of the forests of the country; • Conserving the natural heritage of the country by preserving the remaining natural forests with the vast variety of flora and fauna, which represent the remarkable biological diversity and genetic resources of the country; • Checking soil erosion and denudation in the catchment areas of rivers, lakes, and reservoirs in the interest of soil and water conservation, for mitigating floods and droughts and for the retardation of siltation of reservoirs. • Checking the extension of sand dunes in the desert areas of Rajasthan and along the coastal tracts; • Increasing the sustainability of the forest/tree cover in the country through massive afforestation and social forestry programmes, especially on all denuded degraded and unproductive lands; • Meeting the requirements of fuel wood, fodder, minor forest produce and small timber of the rural and tribal populations; • Increasing the productivity of forests to meet essential national needs; • Encouraging efficient utilization of forest produce and maximising substitution of wood; and • Creating a massive people's movement with the involvement of women for achieving these objectives and to minimise pressure on existing forests.
	Applicability: There is no diversion of forest land for the proposed project.
4	***Wildlife Conservation Strategy 2002***
	Conservation of wildlife, involves the protection of entire ecosystems. No diversion of forest land for non-forest purposes from critical and ecologically fragile wildlife habitat shall be allowed. Lands falling within 10 km of the boundaries of National Parks and Sanctuaries are notified as eco-fragile zones under the Environment (Protection) Act.
	Applicability: The proposed project does not require diversion of any forest land; however potential impacts on the biodiversity of the forest areas adjacent to the site will be appropriately mitigated through mitigation measures.
5	***Maharashtra New Policy for Power Generation from Non-Conventional Sources of***

	Energy - 2008
	The new policy for power generation from non conventional sources of energy promotes encouraging policies for power generation from renewable energy sources. The policy empowers the State Electricity Boards to purchase power from renewable energy generators at preferential tariff.
	Applicability: The proposed project being a renewable energy project can obtain benefits of the policy. NRPPL shall enter into a Power Purchase Agreement with MSEDCL for selling power at preferential feed in tariff determined by MERC from time-to-time.

2.4 IFC Performance Standards

The Performance Standards (PS), 2006, established stipulates that the project shall meet the following throughout the life of an investment by IFC or other relevant financial institution:

- Performance Standard 1: Social and Environmental Assessment and Management System;
- Performance Standard 2: Labour and Working Conditions;
- Performance Standard 3: Pollution Prevention and Abatement;
- Performance Standard 4: Community Health, Safety and Security;
- Performance Standard 5: Land Acquisition and Involuntary Resettlement;
- Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management;
- Performance Standard 7: Indigenous Peoples; and
- Performance Standard 8: Cultural Heritage.

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. A brief on the requirements as laid down in the performance standards is described in the following subsections.

2.4.1 PS 1: Social and Environmental Assessment and Management Systems

The PS-1 requires Social and Environmental Assessment and Management Systems for managing social and environmental performance throughout the life cycle of the Project and runs through all subsequent PSs. The main elements of PS - 1 include:

- A Social and Environmental Assessment to understand the social and environmental impacts and risks;
- A Management Program for mitigating the impacts and minimizing the risks identified in the assessment;
- Establishing and ensuring organizational capacity and requisite trainings to the staff to implement the Management Programme;
- Engagement with the community to ensure constructive relationship all through the project life cycle; and
- Adequate monitoring and reporting systems to measure and report the effectiveness of the Management Programs.

The social and environmental performance is a continuous process to be initiated by the management and would involve communication between organisation, its workers and local

communities directly affected by the Project. The PS requires that Project proponent initiate regular assessment of the potential social and environmental risks and impacts and consistently mitigate and manage strategy on an ongoing basis.

Where social or environmental impacts are anticipated, NRPPL is required to manage them through its Social and Environmental Management System (SEMS) consistent with PS 1.NRPPL shall establish and maintain an SEMS appropriate to the nature and scale of the project and commensurate with the level of social and environmental risks and impacts. The Management System shall incorporate the following elements:

- Environmental and Social Impact Assessment (ESIA);
- Management program;
- Organisational capacity;
- Training;
- Community engagement;
- Monitoring; and
- Reporting.

Applicability

Wind Power projects are clean source of energy with less environmental risk. However, operation and maintenance activities will generate limited quantity of wastes which necessitate the applicability of PS1. There is requirement of screening and appraisal for potential environmental and social risks. A management system to address these risks is also required.

NRPPL is required to develop a project specific Social and Environmental Management System (SEMS) consistent with PS 1. The Management System shall incorporate the following elements:

- Environmental and Social Action Plan
- Management program;
- Identified EHS staff;
- Training for security and safety workers;
- Community engagement/grievance redressal;
- Monitoring; and
- Reporting.

2.4.2 PS 2: Labour and Working Conditions

The economic growth through employment creation and income generation is recognised and balanced protecting the basic rights of workers. The PS 2 is guided by the various conventions of International Labour Organization (ILO) and outlines the minimum requirements of working conditions, protection to the workforce (including issues of child and forced labour) and ensuring occupational health and safety of both its ‗employees' as well as ‗non employees' working through contractors. The PS requires:

- Establishment of a sound worker-management relationship;
- Encouraging equal opportunity and fair treatment of workers;
- Promoting compliance with national labour and employment laws; and

- Promoting healthy and safe working conditions for workers.

As per PS 2, the project proponent shall conduct its activities in a manner consistent with the four core labour standards (child labour, forced labour, non discrimination, and freedom of association and collective bargaining). In addition, PS 2 also addresses other areas such as working conditions and terms of employment, retrenchment, and occupational health and safety issues.

Some of these requirements are covered under the above mentioned National laws. Whereas national law establishes standards that are less stringent than those in PS 2, or are silent, NRPPL is expected to meet the requirements of PS 2.

Applicability

The applicability of PS 2 will be more important during the construction phase as operation phase will only have limited number of staff. It not only covers the main plant employees, but all employees/workers, even those working through contractors. No migrant workers will be engaged for the project, therefore standards pertaining to campsites will not be applicable. NRPPL shall provide adequate provisions access to clean water, sanitary facilities and other necessary facilities at the construction sites.

NRPPL shall ensure measures to prevent child labour, forced labour, and discrimination. Freedom of association and collective bargaining shall be provided. Wages, work hours and other benefits shall be as per the national labour and employment laws.

2.4.3 PS 3: Pollution Prevention and Abatement

The PS 3 outlines approach to resource efficiency and pollution prevention in line with internationally disseminated technologies and practices with objectives to a) avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from activities; and b) promote the reduction of emissions that contribute to climate change. The PS 3 requires a project to avoid, minimize, or reduce adverse impacts on human health and environment by adopting pollution preventive and control technologies throughout the Project life cycle.

Applicability

NRPPL shall plan and implement pollution control measures right from the conception stage. Practices like minimal release of waste, handling of hazardous waste, safe disposal of waste, waster water management etc. shall be considered prior to each phase.

Generation of waste from the project will be limited mainly to construction phase. This would include construction waste water, waste oil, construction debris etc. Operation phase will have very small quantity of waste from used waste oil/transformers oil. Increase in noise with age of turbines can also lead to noise pollution and needs to be monitored.

Impacts and risks associated with the generation, use, storage, release, and/or disposal of pollutants shall be identified during the ESIA, planned as part of the SEMS, and implemented as part of the Action Plan.

2.4.4 PS 4: Community Health, Safety and Security

The PS 4 concentrates on the responsibility that must be undertaken by the client to avoid or minimize the risks and impacts to the community's health, safety and security that may arise from project activities. The PS 4 requires a project to evaluate risks and impacts to the health and safety of the affected community during the project life cycle and establish measures to avoid, minimize and reduce risks and impacts from the Project.

PS 4 recognises that project activities, equipment, and infrastructure often bring benefits to communities including employment, services, and opportunities for economic development. However, projects can also increase the potential for community exposure to risks and impacts arising from equipment accidents, structural failures, and releases of hazardous materials.

The performance standard details out the proponents responsibility to avoid or minimise the possible risks and impacts to community health, safety and security that may arise from project activities.

Applicability

The applicability of this PS shall be established during the ESIA process, resulting in preparation of an Action Plan to be disclosed to the community.

The Applicability will be limited to construction period with movement of heavy machinery / vehicles. The project being on an elevated plateau has no impact from Shadow flicker. Noise levels at adjoining villages are also evaluated to be within the acceptable norms. Labour and security staff will be engaged from local community.

The Action Plan and any other relevant project-related information is to enable the affected communities and relevant government agencies to understand these risks and impacts, and will engage the affected communities and agencies on an ongoing basis consistent with the requirements of PS 1.

2.4.5 PS 5: Land Acquisition and Involuntary Resettlement

The objectives of this PS are to:

- Avoid or at least minimize the involuntary resettlement wherever feasible by exploring alternative project designs;
- Mitigate adverse social and economic impacts from land acquisition or restrictions on affected persons' use of land by:
- Providing compensation for loss of assets at replacement cost; and
- Ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected.
- Improve or at least restore the livelihoods and standards of living of displaced persons;
- Improve living conditions among displaced persons through provision of adequate housing with security of tenure at resettlement sites.

The PS 5 requires a project to consider various processes and systems to avoid /minimise social and economic impacts related to land acquisition and resettlement. This PS applies to physical or economic displacement resulting from the following types of land transactions:

- Type I: Land rights for a private sector project acquired through expropriation or other compulsory procedures.
- Type II: Land rights for a private sector project acquired through negotiated settlements with property owners or those with legal rights to land, including customary or traditional rights recognised or recognisable under the laws of the country, if expropriation or other compulsory process would have resulted upon the failure of negotiation.

This PS does not apply to resettlement resulting from voluntary land transactions (i.e., market transactions in which the seller is not obliged to sell and the buyer cannot resort to expropriation or other compulsory procedures if negotiations fail). The impacts arising from such transactions shall be dealt with as under PS1, though sometimes, when risks are identified, the project proponent may decide to adhere to PS 5 requirement even in willing buyer-seller cases.

Applicability

This PS does not apply as the procurement of land was through direct negotiations between owners and land aggregators with no obligation on the seller. The community was informed in advance, and each land owner negotiated on the cost of land and other compensation as part of land take. The land will be acquired through a willing buyer and seller agreement.

There is no loss of assets or access from the project. The impacts arising from the transactions, if any shall be dealt with as under PS1. There will be no physical resettlement and relocation of people as the project area is not inhabited.

2.4.6 PS 6: Biodiversity Conservation & Sustainable Natural Resources Management

The PS 6 aims at protecting and conserving biodiversity, the variety of life in all its forms, including genetic, species and ecosystem diversity and its ability to change and evolve, is fundamental to sustainable development. The components of biodiversity, as defined in the Convention on Biological Diversity, include ecosystems and habitats, species and communities, and genes and genomes, all of which have social, economic, cultural and scientific importance. This PS addresses how clients can avoid or mitigate threats to biodiversity arising from their operations as well as incorporate sustainable management of renewable natural resources.

PS 6 recognises that protecting and conserving biodiversity—the variety of life in all its forms, including genetic, species and ecosystem diversity—and its ability to change and evolve, is fundamental to sustainable development. It reflects the objectives of the Convention on Biological Diversity to conserve biological diversity and promote use of renewable natural resources in a sustainable manner.

Applicability

The applicability of this PS shall be established during the ESIA, while implementation of the actions necessary to meet the requirements of this PS shall be managed through the

NRPPL's ESMS. The operation phase of the proposed project shall ensure protection of fauna and flora of the site and surrounding.

The proposed project falls in the Western Ghats. The Ministry of Environment and Forests constituted a Western Ghats Ecology Expert Panel (WGEEP) in the year 2010 to assess the current status of ecology and make recommendations for conservation, protection and rejuvenation of Western Ghats region. The WGEEP through its report submitted in the year 2011, has recommended the entire Western Ghats to be considered as ecologically sensitive area and has demarcated the area in three zones of varying sensitivity. The project taluka falls in the ESZ – 3, the least sensitive zone, however the project may not fall in the final delineation which has not been undertaken. The Panel recommends that large scale wind power projects shall be developed in this zone only after undertaking a cumulative impact assessment study. These recommendations are yet to be accepted by the Ministry of Environment and Forest.

The region is also identified to have a bird sanctuary at about 10km from the site (at Mayani). The exact migratory route of birds is not established. Preliminary consultations and limited data available suggest that the project area do not attract significant bird population. However a detailed two-three season bird survey is required to establish the same.

2.4.7 PS 7: Indigenous Peoples

The PS 7 acknowledges the possibility of vulnerability of indigenous people owing to their culture, beliefs, institutions and living standards, and that it may further get compromised by one or other project activity throughout the life cycle of the project. The PS underlines the requirement of avoiding / minimizing adverse impacts on indigenous people in the project area, respecting the local culture and customs, fostering good relationship and ensuring that development benefits are provided to improve their standard of living and livelihoods.

Applicability

As defined by the PS 7, Indigenous communities like tribes, ethnic minorities, aboriginals etc are not present in the area. PS 7 is therefore not applicable for the proposed project.

2.4.8 PS 8: Cultural Heritage

The PS 8 aims to protect the irreplaceable cultural heritage and to guide clients on protecting cultural heritage in the course of their business operations. In addition, the requirements of this Performance Standard on a project's use of cultural heritage are based in part on standards set by the Convention on Biological Diversity.

PS 8 recognises the importance of cultural heritage with an objective to:

- Protect cultural heritage from the adverse impacts of project activities;
- Support its preservation; and
- Promote the equitable sharing of benefits from the use of cultural heritage in business activities.

Applicability

PS 8 is relevant as there are identified cultural and religious structures in the immediate vicinity of the project site. There is one small temple on the Chilarewadi plateau which is of

cultural significance for adjoining villages. Important religious functions of the community which are undertaken at the temple annually which needs to be retained/improved by the project.

2.5 EHS Guidelines of IFC

The Equator Principle 3 requires follow up of the environmental, health and safety requirements as per the following guidelines released by IFC on 30 April 2007:

1. Environmental, Health, and Safety General Guidelines
2. Environmental, Health, and Safety Guidelines for Wind Energy.

The key requirements stated in the EHS guidelines have been discussed in Table 2.9.

Table 2.9: Key Requirements as per EHS Guidelines of IFC

S.N	Relevant Requirements as Stated in EHS Guidelines
CONSTRUCTION PHASE	
1.	**Noise and vibrations**
a.	Planning activities in consultation with local communities to minimise disturbance.
b.	Avoiding or minimizing project transportation through community areas.
2.	**Soil Erosion**
i.	*Sediment mobilization and transport*
a.	Scheduling to avoid heavy rainfall periods (i.e., during the dry season) to the extent practical.
b.	Contouring and minimizing length and steepness of slopes
C.	Re-vegetating areas promptly
ii.	*Clean runoff management*
a.	Segregating or diverting clean water runoff to prevent it mixing with water containing high solids content, to minimize the volume of water to be treated prior to release.
iii.	*Road design*
a.	Limiting access road gradients to reduce runoff-induced erosion
b.	Providing adequate road drainage based on road width, surface material, compaction, and maintenance.
3.	**Air Quality**
a.	Implementing dust suppression techniques such as applying water or non-toxic chemicals to minimize dust from vehicle movements.
b.	Avoiding open burning of solid waste
i.	*Mobile Sources*
a.	Implementation of manufacturer recommended engine maintenance programs by vehicle operators.
b.	Instructions to drivers on safe and efficient driving practices.
4.	**Solid Waste**
a.	Avoiding or minimizing the generation waste materials, as far as practicable.
5.	**Hazardous Materials**
a.	Providing adequate secondary containment for fuel storage tanks and for the temporary storage of other fluids such as lubricating oils and hydraulic fluids.
6.	**Wastewater Discharges**
a.	Water use efficiency to reduce the amount of wastewater generation.
b.	Compliance with national or local standards for sanitary wastewater discharges.

S.N	Relevant Requirements as Stated in EHS Guidelines
7.	**Occupational Health and Safety**
i.	*Over-exertion*
a.	Training of workers in lifting and materials handling techniques including the placement of weight limits.
b.	Planning work site layout to minimize the need for manual transfer of heavy loads.
c.	Implementing administrative controls into work processes, such as job rotations and rest or stretch breaks.
ii.	*Slips and Falls*
a.	Implementing good house-keeping practices, such as the sorting and placing loose construction materials or demolition debris in established areas away from foot paths.
b.	Cleaning up excessive waste debris and liquid spills regularly.
iii.	*Work in Heights*
a.	Training and use of temporary fall prevention devices
b.	Training and use of personal fall arrest systems
iv.	*Stuck by Objects*
a.	Maintaining clear traffic ways to avoid driving of heavy equipment over loose scrap.
b.	Wearing appropriate PPE, such as safety glasses with side shields, face shields, hard hats, and safety shoes.
v.	*Moving Machinery*
a.	Planning and segregating the location of vehicle traffic, machine operation, and walking areas, and controlling vehicle traffic through the use of one-way traffic routes, establishment of speed limits, and on-site trained flag-people wearing high-visibility vests or outer clothing covering to direct traffic.
b.	Using inspected and well-maintained lifting devices that are appropriate for the load, such as cranes, and securing loads when lifting them to higher job-site elevations.
vi.	*Dust*
a.	Implementation of Dust suppression techniques such as applying water
8.	**Community Health and Safety**
i	*Disease Prevention*
a.	Providing surveillance and active screening and treatment of workers.
ii	*Traffic Safety*
a.	Adoption of safety measures that are protective of project workers and of road users, including those who are most vulnerable to road traffic accidents.
c.	Regular maintenance of vehicles and use of manufacturer approved parts.
OPERATION PHASE	
1.	**Visual Impacts**
a.	Consider the landscape character during turbine siting;
b.	Consider the visual impacts of the turbines from all relevant viewing angles when considering locations
c.	Maintain uniform size and design of turbines (e.g. direction of rotation, type of turbine and tower, and height);
d.	Paint the turbines a uniform colour, typically matching the sky (light gray or pale blue), while observing marine and air navigational marking regulations;
2.	**Noise**
a.	Proper siting of wind farms to avoid locations in close proximity to sensitive noise receptors
b.	Adherence to national or international acoustic design standards for wind turbines
3.	**Species Mortality or Injury and Disturbance**

S.N	Relevant Requirements as Stated in EHS Guidelines
a.	Implement appropriate storm water management measures to avoid creating attractions such as small ponds which can attract birds and bats for feeding or nesting near the wind farm.
4.	**Shadow Flicker and Blade Glint**
a.	Site and orient wind turbines so as to avoid residences located within the narrow bands, generally southwest and southeast of the turbines, where shadow flicker has a high frequency
5.	**Occupational Health and Safety - Working at Heights**
a.	Prior to undertaking work, test structure for integrity;
b.	Implementation of a fall protection program that includes training in climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment; and rescue of fall-arrested workers;
c	Install fixtures on tower components to facilitate the use of fall protection systems;
d.	Avoid conducting tower installation or maintenance work during poor weather conditions and especially where there is a risk lightning strikes;
7.	**Community Health and Safety**
i	Public Access
a.	Fence the wind farm site, or individual turbines, to prohibit public access close to the turbine;
b.	Prevent access to turbine tower ladders;

2.6 Applicable ADB Policies and Requirements

2.6.1 Safeguard Policy Statement (SPS), 2009

Built upon the three previous safeguard policies on the Involuntary Resettlement Policy (1995), the Policy on Indigenous Peoples (1998) and the Environment Policy (2002), the Safeguard Policy Statement was approved in 2009. The safeguard policies are operational policies that seek to avoid, minimize or mitigate adverse environmental and social impacts including protecting the rights of those likely to be affected or marginalized by the developmental process. ADB's safeguard policy framework consists of three operational policies on the environment, indigenous peoples and involuntary resettlement. A brief detail of all three operational policies have been mentioned below:

Environmental Safeguard: This safeguard is meant to ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision making process.

Applicability:

The proposed project involves generation of power from wind energy which is one of the cleanest sources of energy. However the construction and operational activities of the project might result in some adverse impacts on the environment which can be mitigated through implementation of appropriate mitigation measures. The Environmental Safeguard is thus applicable to the proposed project.

Involuntary Resettlement Safeguard: This safeguard has been placed in order to avoid involuntary resettlement whenever possible; to minimize involuntary resettlement by exploring project and design alternatives; to enhance, or at least restore, the livelihoods of all

displaced persons in real terms relative to pre- project levels; and to improve the standards of living of the displaced poor and other vulnerable groups.

Applicability:

The proposed project involves procurement of private land falling under the three villages of Puklewadi, Chilarewadi and Virali. No physical displacement is involved in the process. The procured land is fallow agricultural land and not a source of livelihood for the people. The land procured is on willing buyer willing seller basis and compensation paid is higher than the market value hence the project does not entail economic displacement. Therefore the Involuntary Resettlement Safeguard is not applicable for the project.

Indigenous Peoples Safeguard: This safeguard looks at designing and implementing projects in a way that fosters full respect for Indigenous Peoples' identity, dignity, human rights, livelihood systems and cultural uniqueness as defined by the Indigenous Peoples themselves so that they receive culturally appropriate social and economic benefits; do not suffer adverse impacts as a result of projects; and participate actively in projects that affect them.

Applicability:

The proposed project area does not report any indigenous tribes, minorities or aboriginals. Hence the Indigenous Peoples Safeguard and the requirements there under are not applicable for this project.

Information, Consultation and Disclosure: Consultation and participation are essential in achieving the safeguard policy objectives. This implies that there is a need for prior and informed consultation with affected persons and communities in the context of safeguard planning and for continued consultation during project implementation to identify and help address safeguard issues that may arise. The consultation process begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle. It provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people and is undertaken in an atmosphere free of intimidation or coercion. In addition, it is gender inclusive and responsive and tailored to the needs of disadvantaged and vulnerable groups and enables the incorporation of all relevant views of affected people and other stakeholders into decision making. ADB requires the borrowers/clients to engage with communities, groups or people affected by proposed projects and with civil society through information disclosure, consultation and informed participation in a manner commensurate with the risks to and impacts on affected communities. For projects with significant adverse environmental, involuntary resettlement or Indigenous Peoples impacts, ADB project teams will participate in consultation activities to understand the concerns of affected people and ensure that such concerns are addressed in project design and safeguard plans.

A series of consultations were carried out with the land losers, community and other stakeholders involved in the proposed project by NRPPL. Details pertaining to the consultation process are provided in relevant section of this report.

2.6.2 Social Protection Strategy, 2001

ADB has designed a set of policies and programs for social protection in 2001, that is, to reduce poverty and vulnerability by promoting efficient labour markets, diminishing people's exposure to risks, and enhancing their capacity to protect themselves against hazards and interruption/loss of income. The basic aim of the Social Protection Strategy (SPS) is to assist individuals to break the cycle of poverty and enhance the quality of growth through adequate and developed social protection systems in the member countries of ADB. The type of risks covered through the SPS may be economic, environment or social/governance related.

The proposed project shall ensure that the requirements of the ADB's SPS are complied with. Priority shall be given to any identified vulnerable groups. Based on the gender analysis and status of women in the project area, measures for ensuring their overall development shall be taken up by the project proponent. NRPPL shall comply with applicable labor laws in relation to the Project. NRPPL shall also take the following measures to comply with the core labor standards[1] for the ADB financed portion of the Project;

(a) carry out its activities consistent with the intent of ensuring legally permissible equal opportunity, fair treatment and non discrimination in relation to recruitment and hiring, compensation, working conditions and terms of employment for its workers (including prohibiting any form of discrimination against women during hiring and providing equal work for equal pay for men and women engaged by the Borrower);

(b) not restrict its workers from developing a legally permissible means of expressing their grievances and protecting their rights regarding working conditions and terms of employment;

(c) engage contractors and other providers of goods and services:

  (i) who do not employ child labor[2] or forced labor[3];

  (ii) who have appropriate management systems that will allow them to operate in a manner which is consistent with the intent of (A) ensuring legally permissible equal opportunity and fair treatment and non discrimination for their workers, and (B) not restricting their workers from developing a legally permissible means of expressing their grievances and protecting their rights regarding working conditions and terms of employment; and

  (iii) whose subcontracts contain provisions which are consistent with paragraphs (i) and (ii) above.

[1] The core labor standards are the elimination of all forms of forced or compulsory labor; the abolition of child labor; elimination of discrimination in respect of employment and occupation; and freedom of association and the effective recognition of the right to collective bargaining, as per the relevant conventions of the International Labor Organization.

[2] Child labor means the employment of children whose age is below the statutory minimum age of employment in the relevant country, or employment of children in contravention of International Labor Organization Convention No. 138 'Minimum Age Convention" (www.ilo.org)

[3] Forced labor means all work or services not voluntarily performed, that is, extracted from individuals under threat of force or penalty

2.6.3 Public Communications Policy 2011

The Public Communications Policy (PCP) of ADB, originally formulated in 2005 and revised in 2011, is aimed at promoting improved access to information about ADB's operations related to funded projects. It endorses greater transparency and accountability to stakeholders involved in a project. The PCP establishes the disclosure requirements for documents and information related to projects. It mandates project-related documents normally produced during the project cycle to be posted on the web.

2.7 Environment Categorization of Projects

As part of its review of a project's expected social and environmental impacts, ADB uses a classification system. This classification is used to reflect the significance of potential environmental impacts understood as a result of the client's impact assessment and to establish ADB's safeguard requirements. The categories used by ADB are:

- Category A Projects: Projects which are likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented.
- Category B Projects: Projects with potential adverse environmental impacts that are less in number, generally site-specific, mostly reversible and readily addressed through mitigation measures;
- Category C Projects: Projects with minimal or no adverse environmental impacts;
- Category FI Projects: Projects which involve investment of ADB funds to or through a financial investment.

2.8 Applicable Environmental Standards

The Central Pollution Control Board (CPCB) has specified National Ambient Air Quality Standards (NAAQS) for residential, commercial, industrial and sensitive zones for the country as a whole. Ambient air quality will be a concern only for the construction phase of the project.

In case of wind farm project as there are no specific standards, general wastewater discharge is to be followed.

2.8.1 Ambient Air Quality

National Ambient Air Quality Standards (NAAQS), as notified under Environment (Protection) Rules 1986 and revised through Environment (Protection) Seventh Amendment Rules, 2009 are given in **Table 3.8.**

Table 2.10: National Ambient Air Quality Standards

Pollutant	Time Weighted Average	Concentration in Ambient Air	
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (notified by Central Government)
Sulphur Dioxide (SO_2), $\mu g/m^3$	Annual*	50	20
	24 Hours**	80	80

Nitrogen Dioxide (NO_2) , µ g/m^3	Annual*	40	30
	24 Hours**	80	80
Particulate Matter (size less than 10 µm) or PM_{10}, µg/m^3	Annual*	60	60
	24 Hours**	100	100
Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$, µg/m^3	Annual*	40	40
	24 Hours**	60	60
Ozone (O_3), µg/m^3	8 Hours**	100	100
	1 Hour**	180	180
Lead (Pb), µg/m^3	Annual*	0.5	0.5
	24 Hours**	1	1
Carbon Monoxide (CO) , mg/m^3	8 Hours	2	2
	1 Hour**	4	4
Ammonia (NH_3), µg/m^3	Annual*	100	100
	24 Hours**	400	400
Benzene (C_6H_6), µg/m^3	Annual*	5	5
Benzo (O) Pyrene (BaP), particulate phase only, ng/m^3	Annual*	1	1
Arsenic (As), ng/m^3	Annual*	6	6
Nickel (Ni), ng/m^3	Annual*	20	20

** Annual arithmetic mean of minimum 104 measurements in a year taken twice a week, 24 hourly at uniform interval*

*** 24 hourly or 8 hourly or 01 hourly values as applicable shall be complied with 98% of the time in a year. 2% of the time they may exceed, but not on 2 consecutive days. Note: Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigation.*

As per the EHS guidelines of IFC of December 2008, ~~the~~ the ambient air quality standards are ambient air quality levels established and published through national legislative and regulatory processes and ambient quality guidelines refer to ambient quality levels primarily developed through clinical, toxicological, and epidemiological evidence (such as those published by the World Health Organization)".

2.8.2 Water Quality Standards

The designated best use classification as prescribed by CPCB for surface water is as given in **Table 3.9.**

Table 2.11 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 OrganismMPN/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 (Organised)	B	• Total Coliforms Organism MPN/100ml shall be 500 or less • pH between 6.5 and 8.5

Designated-Best-Use	Class	Criteria
		• Dissolved Oxygen 5mg/l or more • Biochemical Oxygen Demand 5 days 20°C 3mg/l or less
Drinking water source after conventional treatment and disinfection	C	• Total Coliforms Organism MPN/100ml shall be 5000 or less • pH between 6 to 9 • Dissolved Oxygen 4mg/l or more • Biochemical Oxygen Demand 5 days 20°C 3mg/l or less
Propagation of Wild life and Fisheries	D	• pH between 6.5 to 8.5 • Dissolved Oxygen 4mg/l or more • Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	• pH between 6.0 to 8.5 • Electrical Conductivity at 25oC 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

As per the IFC EHS guidelines, the treated sewage discharge shall meet the following guidelines:

Table 2.12: Treated Sewage Discharge Guideline IFC

S N	Parameter	Guideline Value
1	pH	6-9
2	BOD	30 mg/l,
3	COD	125 mg/,
4	Total Nitrogen	10 mg/l
5	Total Phophorus	2 mg/l
5	Oil and Grease:	10 mg/l,
6	Total Suspended Solids:	50 mg/l
7	Total Coliform bacteria:	400 MPN/100 ml

Notes: MPN = Most Probable Number

2.8.3 Ambient Noise Standards

Noise standards notified by the MoEF vide gazette notification dated 14 February 2000 based on the *A- weighted* equivalent noise level (L_{eq}) are as presented in **Table 3.11.**

Table 2.13 Ambient Noise Standards

Area Code	Category of Area	Limits in dB(A) Leq	
		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: * Day time is from 6 am to 10 pm, Night time is 10 pm to 6.00 am; ** Silence zone is defined as area up to 100 meters around premises of hospitals, educational institutions and courts. Use of vehicle horns, loud speakers and bursting of crackers are banned in these zones.*

As per EHS guidelines of IFC, for residential, institutional and educational area, the one hourly equivalent noise level (Leq hourly) for day time is 55 dB(A) while the Leq hourly for night time is prescribed as 45 dB(A).

2.8.4 Noise Standards for Occupational Exposure

Noise standards in the work environment are specified by Occupational Safety and Health Administration (OSHA-USA) which in turn are being enforced by Government of India through model rules framed under the Factories Act.

Table 2.14 Standards for Occupational Noise Exposure

Total Time of Exposure per Day in Hours (Continuous or Short term Exposure)	Sound Pressure Level in dB(A)
8	90
6	92
4	95
3	97
2	100
3/2	102
1	105
¾	107
½	110
¼	115
Never	>115

- *No exposure in excess of 115 dB(A) is to be permitted.*
- *For any period of exposure falling in between any figure and the next higher or lower figure as indicated in column (1), the permissible level is to be determined by extrapolation on a proportionate scale.*

2.9 Applicable International Conventions

Environmental problems which migrate beyond the jurisdiction (Transboundary) require power to control such issues through international co-operation by either becoming a Contracting Party (CP) i.e. ratifying treaties or as a Signatory by officially signing the treaties and agreeing to carry out provisions of various treaties on environment and social safeguards. The relevant international conventions are as provided.

Montreal Protocol on Substances That Deplete the Ozone Layer (and subsequent Amendments)

India signed the Montreal Protocol along with its London Amendment on 17-9-1992 and also ratified the Copenhagen, Montreal and Beijing Amendments on 3rd March, 2003.

UN (Rio) Convention on Biological Diversity

India is a party since: 1994-02-18 by: Ratification; Protocol - Party since: 2003-09-11

The Convention on Wetlands of International Importance Especially as Waterfowl Habitat, 1971 (Ramsar Convention)

This convention was signed by India in 1981 and ratified in February 1982. The convention requires protection of identified wetlands of international importance as identified under Ramsar convention.

Conventions on the Conservation of Migratory species of wild animals and migratory species

India is contracting party to the convention on conservation of migratory species of wild animals and migratory species.

Kyoto Protocol

The Kyoto protocol was signed by India in August 2002 and ratified in February 2005. The convention pertains to the United Nations framework on Climate Change.

The 3rd Conference of the Parties to the Framework Convention on Climate Change (FCCC) in Kyoto in December 1997 introduced the Clean Development Mechanism (CDM) as a new concept for voluntary greenhouse-gas emission reduction agreements between industrialized and developing countries on the project level.

The Rotterdam Convention on the Prior Informed Consent (PIC) Procedure

The Rotterdam Convention on the Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals & Pesticides in international Trade was adopted by India at the Conference of Plenipotentiaries at Rotterdam in 1998

International Labour Organization conventions

India has also ratified many of the International Labour Organization conventions that are relevant to the Project including:

- C1 Hours of Work (Industry) Convention, 1919 (14:07:1921, ratified);
- C5 Minimum Age (Industry) Convention, 1919 (09:09:1955, ratified):
- C11 Right of Association (Agriculture) Convention, 1921 (11:05:1923, ratified):
- C14 Weekly Rest (Industry) Convention, 1921 (11:05:1923, ratified);
- C29 Forced Labour Convention, 1930 (30:11:1954, ratified) & C105 Abolition of Forced Labour Convention, 1957 (18:05:2000, ratified);
- C100 Equal Remuneration Convention, 1951 (25:09:1958, ratified);
- C107 Indigenous and Tribal Populations Convention, 1957
- C111 discrimination (Employment and Occupation) Convention, 1958 (03:06:1960, ratified)

3 Description of the Project

This section of the report presents information related to various attributes of the proposed Wind Power Project and the associated infrastructure facilities.

3.1 Project Location

The proposed site is located at a distance of approximately 85 km from Satara town on the south east border of Satara district. The site lies at a distance of approximately 350 km south east of Mumbai. The nearest state highway is the SH–58 connecting Satara to Pandharpur and is at a distance of approximately 25 km from the site. The base of the site is approachable by a village road (from Virali village) connecting Vadjal to Gondavle, which is located at a distance of 60 km from Satara town on SH–58.

The site is spread across a distance of approximately 5 km along the North West to South East direction and across a distance of approximately 1.5 km along the South West to North East direction. The site is located on Jire Pathar Plateau which is elevated by about 150 meters from the nearby region and has an average elevation of 890 meters above MSL. The project falls under the following three villages of Man Taluka.

- Chilarewadi
- Virali
- Puklewadi

The proposed geographic coordinates of the turbines is as provided in **Table 3.1.**

Table 3.1: Geographic Coordinates of the Turbines

S.N	Revised Coordinates		Land Type	Village	Survey No.
	Easting (m)	Northing (m)			
Phase I – 23 Locations (34.5 MW)					
1	466688	1937263	Private	Chilarewadi	511
2	467391	1937106	Private	Chilarewadi	597 & 598
3	465966	1937514	Private	Chilarewadi	511
4	466122	1937376	Private	Chilarewadi	511
5	466403	1937255	Private	Chilarewadi	511
6	466423	1936796	Private	Chilarewadi	515
7	466668	1936792	Private	Chilarewadi	523,524,536 & 538
8	466944	1937247	Private	Chilarewadi	565
9	467670	1937225	Private	Chilarewadi	605
10	467905	1937132	Private	Virali	1819, 1820 & 1821
11	468182	1937023	Private	Virali	1822
12	465520	1937816	Private	Puklewadi	71 & 72
13	464411	1939111	Private	Puklewadi	28
14	464903	1938896	Private	Puklewadi	35
15	465983	1938624	Private	Puklewadi	44 & 43
16	464129	1939502	Private	Puklewadi	18
17	464311	1939241	Private	Puklewadi	12

S.N	Revised Coordinates		Land Type	Village	Survey No.
	Easting (m)	Northing (m)			
18	464684	1938927	Private	Puklewadi	31
19	464876	1939708	Private	Puklewadi	20
20	465232	1938526	Private	Puklewadi	36
21	465421	1938452	Private	Puklewadi	40
22	465774	1938047	Private	Puklewadi	50
23	469248	1934534	Parampoke	Virali	1653
Phase II – 27 Locations (44.5 MW)					
1	464723	1936868	Gairan	Puklewadi	233
2	465147	1936700	Gairan	Puklewadi	233
3	465536	1934200	Parampoke	Puklewadi	178
4	465810	1934116	Parampoke	Chilarewadi	178
5	466080	1933937	Parampoke	Chilarewadi	165
6	466341	1933813	Parampoke	Chilarewadi	165
7	466508	1933668	Parampoke	Chilarewadi	165
8	466743	1933547	Parampoke	Chilarewadi	165
9	465026	1935728	Parampoke	Chilarewadi	179
10	465280	1935266	Parampoke	Chilarewadi	179
11	465606	1935105	Parampoke	Chilarewadi	179
12	465661	1935654	Parampoke	Chilarewadi	179
13	466275	1934315	Parampoke	Chilarewadi	165
14	466325	1934647	Parampoke	Chilarewadi	165
15	466384	1935875	Parampoke	Chilarewadi	179
16	466906	1933569	Parampoke	Chilarewadi	165
17	468413	1935217	Private	Virali	1575
18	468285	1935523	Private	Virali	1571 & 1572
19	468545	1934744	Private	Virali	1585
20	468907	1934405	Private	Virali	1639 & 1641
21	469064	1934978	Private	Virali	1652
22	469143	1934829	Private	Virali	1652
23	467502	1935049	Private	Virali	1512
24	467768	1935033	Private	Virali	1544
25	467990	1935626	Private	Virali	1545
26	468807	1935085	Private	Virali	1600 & 1601
27	469338	1934814	Private	Virali	1652

3.2 Land

The total area required for erection of turbines and associated facilities such as access roads, pooling substation and switchyard is approximately 78.10 ha. Out of the total 50 wind turbine generators proposed, 33 will be installed on private land and rest 17 on revenue land.

3.2.1 Land Requirement

The total area required for the project including erection of wind turbines and associated facilities such as access roads, transmission line pooling substation and switchyard is approximately 78.10 ha. Out of the total area about 10 ha required for transmission line pooling substation and switchyard/administrative building is been acquired prior to the proposed project on willing buyer willing seller basis by M/s ReGen Powertech and the facility is already been created which will be used as common facility along with the neighboring wind farms.

The remaining area of about 68.10 ha is being acquired by NRPPL for Chilarewadi Project and constitutes 46.50 ha of Private Land and 21.6 ha of Revenue Land. Out of the land acquired 50 ha (1ha/turbine) will be used for setting up of wind turbines and the remaining will be used for access roads and meteorological tower. A total of 50 wind turbine generators are proposed, 33 will be installed on private land and rest 17 on revenue land.

The detailed breakup of the private and revenue land required for each component the project, along with the status and mode of acquisition is as provided in **Table 3.2** below.

Table 3.2: Details of Land Requirement

S.N	Project Facilities	Land Area Required (in ha)		Land Use Classification	Status of Acquisition	Mode of Acquisition
		Revenue Land	Private Land			
1	Wind Turbines (50 nos.)	12.0	38.0	**Private Land:** Fallow Land **Revenue Land:** Barren Land	**Private Land:** Out of the total 25.85 ha is already procured and 12.15 ha is under Procurement **Revenue Land:** Procurement from the government sources is under process	**Private Land:** Direct Purchase through willing buyer-willing seller agreements **Revenue Land:** Allotted from State Revenue Department
2	Access Roads (3 nos.)					
	to Chilarewadi Village (3km)	3.0	-	Barren Land	Under Process	Allotted from State Revenue Department
	to Virali Village (3km)	3.6	-	Barren Land	Procured	Allotted from State Revenue Department
	Internal Access Roads (24km)	3.0	8.0	**Private Land:** Fallow Land	**Private Land:** Out of the total 4.65 ha is already procured and 3.35	**Private Land:** Direct purchase through Willing buyer-willing

				Revenue Land: Barren Land	ha is under procurement **Revenue Land:** Procurement from the government sources is under process.	seller agreement **Revenue Land:** Allotted from State Revenue Department
3	Meteorological Towers Installations	-	0.5		Procured	Direct purchase through willing buyer-willing seller agreement
	Sub Total	**21.6**	**46.5**			
4	Switchyard/Administration Building	-	3.0	Fallow Land	Procured by ReGen Powertech	Direct purchase through willing buyer-willing seller agreement
5	Transmission Line to Pooling Substation (3 – 4 km)	-	7.0	Fallow land	Procured by ReGen Powertech	Direct purchase through willing buyer-willing seller agreement
	Sub Total	**-**	**10**			
	Total Land Requirement	**21.6**	**56.5**			

3.2.2 Process of Land Procurement

The land procurement was undertaken through a local land aggregator agency M/s Atlanta Power Private Limited (APPL). APPL was responsible for obtaining both private as well as revenue land. The role of AAPL was as following:

- APPL undertook community consultation and individual negotiations with the land owners about the project.
- An agreement to sale based on negotiations was arrived at and all aspects for purchase were discussed with land owners.
- APPL was also involved in obtaining all the required permissions/approvals from government.
  Obtaining Right of Way in Private Land for accessing the locations and for constructing the Transmission Lines was also undertaken by APPL.

The list of land owners for private land is provided as **Annex G.**

The Process for transfer of private land involved the following process:

- Identification of land required for the project.
- Due diligence of land through verification of VII/XII Extracts, Revenue Records of past 33 years, etc.

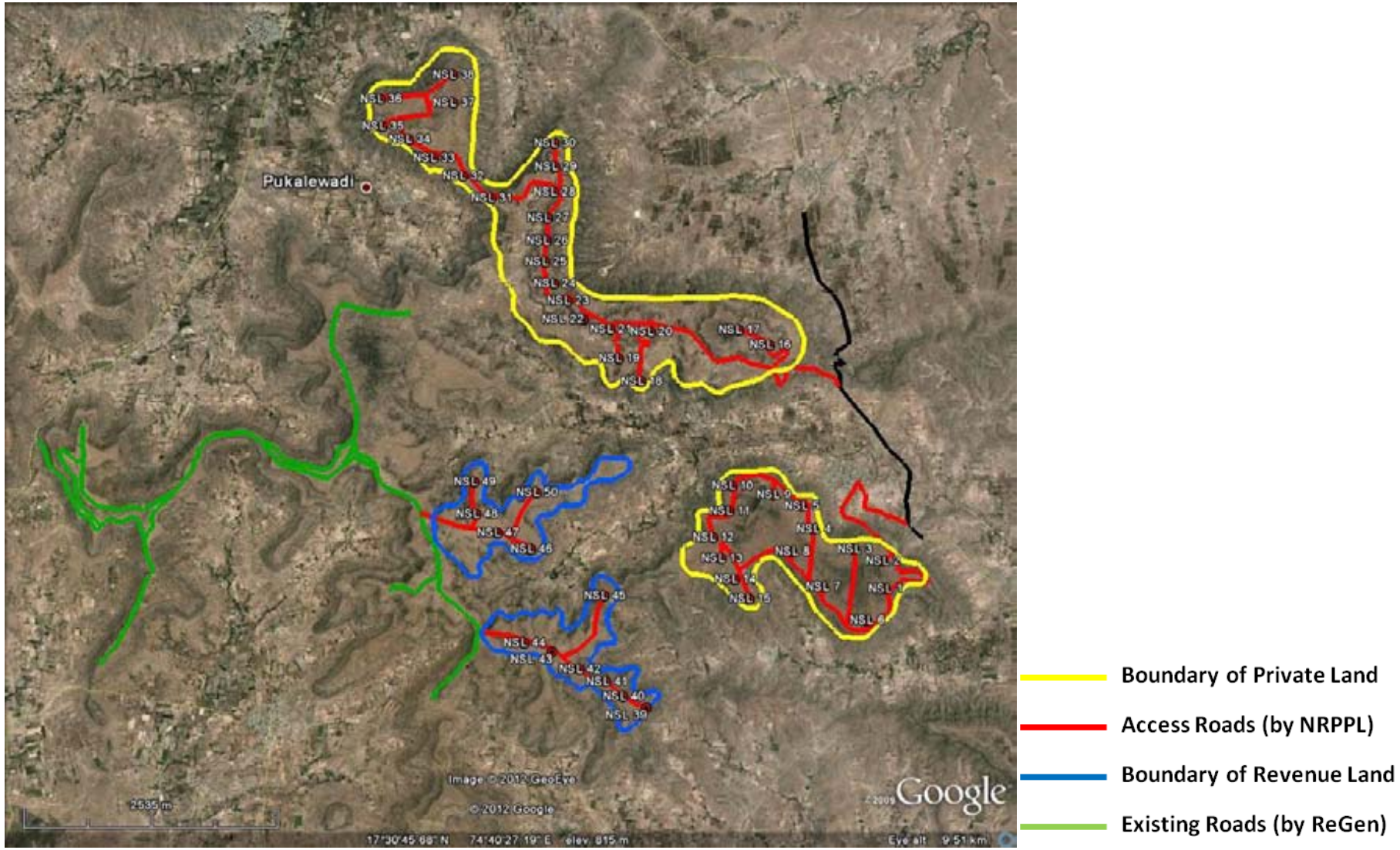
- Registered Power of Attorney (POA) and Registered Agreement to Sale (ATS) is obtained
- Paper Notification is issued for a period of 2 weeks
- Transfer to Client (End User)

The revenue land being acquired is barren with no livelihood dependence on it. The process of transfer of revenue land involved the following:

- A proposal for diversion of land required for the project is submitted to the District Collector as per the prescribed format.
- The District Collector reviews the proposal and forwards it to the Revenue Collector. The proposal is verified and assessed at various level from Revenue Collector down to Tehsildar and then to Circle Officer.
- The observations and conclusion then are forwarded back from Circle Officer to Revenue Collector through the Tehsildar and Sub Divisional Officer.
- The Revenue Collector then forwards the observations to District Collector, who in turn sends it to the Department of Revenue, Govt. of Maharashtra.
- Once the approval is received, mutation from the Department of Revenue, Govt. of Maharashtra is undertaken at the Tehsildar level.

The following map in **Figure 3.1** shows the location of all turbines, access roads and boundaries of revenue and private land.

Figure 3.1: Layout of Proposed Turbines and Access Roads



3.3 Project Overview

The project details and overview of the proposed wind power project is detailed in the following sub sections. All technical details, designs and dimensions mentioned are based on information currently available from NRPPL. There is a potential for some alteration during the execution stage. Those changes are not expected to alter the impacts assessed in this report.

A typical wind power project comprises of the following components:

- Wind turbines mounted on towers,
- An electrical collection system, and
- Transmission /interconnection facilities.

Besides these the associated facilities may include access roads, Operation and Maintenance facilities, and Meteorological tower(s).

3.3.1 Wind Turbines

A wind turbine[4] consists of three major mechanical components: tower, nacelle, generator and rotor. These are described in the following subsections:

Rotor

The rotor generally consists of three fiberglass blades that extend out of the hub. In most cases the rotor is mounted to a driveshaft within the nacelle (as defined below) to operate upwind of the tower. In some cases, the rotor is located behind the tower and nacelle. The rotor attaches to the drive train emerging from the front of the nacelle. Hydraulic motors within the rotor hub feather each blade according to the wind conditions, which enables the turbine to operate efficiently at varying speeds.

Nacelle

The nacelle is a large housing that sits on top of the tower behind the rotor. It houses the main mechanical components of the wind turbine: drive train, yaw system and its accessories, etc. The nacelle is generally externally equipped with anemometer and a wind wane that signals wind speed and direction information to an electronic controller. The nacelle is mounted over yaw gear, which constantly positions the rotor upward of the tower. The selected turbine type i.e. ReGen V87 is gearless.

Tower

The tower supports the nacelle and rotor. Towers are generally made of steel and can either tubular or lattice. Most tubular will have an access door and an internal safety ladder and/or elevator to access the nacelle.

3.3.2 Technical Details

The proposed Wind Farm Project being set up for 75 MW consists of 50 turbines of ReGeN make (V87 model) with 1.5 MW rated capacity. It will have a rotor diameter of 86.6m and a hub height of 85m. The tower will be tubular. The key technical details of the wind turbine are as provided in **Table 3.4.**

[4] Wind Energy Siting Handbook February 2008, American Wind Energy Association

Table 3.3: Technical Details of the Proposed Turbines and related Components

General	
Wind Turbine Class	GL III B
Hub Height	85 m
Type	Direct Drive Horizontal Axis Wind Turbine with variable Rotor Speed
Power Regulation	Independent electromechanical pitch system for each blade
Rated Power	1500 kW
Rotational Speed	Variable, 9 - 17.3 rpm
Design Life Time	20 years
Wind Conditions	
Air Density	1.225 kg / cu.m
Annual Average Wind Speed	7.5 m/s
Wind shear	0.16
Cut-in wind speed	3 m/s
Cut-out wind speed	22 m/s
Re cut-in wind speed	< 22 m/s (10 min. avg.)
Rated wind speed	approx. 13 m/s
Survival wind speed	52.5 m/s
Maximum in-flow angle	8 Deg
Rotor	
Diameter	86.6 m
No. of Blades	3
Swept Area	5890 sq. m
Orientation	Up-wind
Direction of Rotation	Clockwise (from up-wind side)
Cone Angle	-3 Deg
Tilt Angle	3 Deg
Blade	
Type	LM 42.1 P2
Material	Glass Fibre Reinforced Plastic
Profile	LM08
Starting	Self-starting
Lightening Protection	Provided
Hub	
Hub Type	Rigid - Star
Material	EN-GJS-400-18U-LT
Pitch System	
Blade Bearing	Ball Slew Bearing (without gearing)
Mechanism	Toothed Belt Drive
Drive	Planetary geared AC motor
Backup power	Ultra capacitor
Braking System	

Primary Brake System	Aerodynamic Brake, Individual full 90 deg. blade pitch and control for each blade
Maintenance	Hydraulic Brake Caliper at Generator Rotor
Generator	
Type	Synchronous, Variable Speed
Cooling	Passive Air Cooled
Excitation	Permanent Magnet
Rated Power	1500 kW
No. of poles	88
Winding	Medium Voltage, Fractional Slot
Rated Voltage	690 V
Frequency	Variable
No. of phases	6
Insulation Class	F
Protection Class	IP 23
Generator Protection	2 x Circuit Breaker Switches at Nacelle
Main Shaft and Bearing	
Main Shaft Type	Hollow Shaft and Main Axle
Material	EN-GJS-400-18U-LT
Bearing Type	Cylindrical Roller / Taper Roller
Location	Inside the generator
Lubrication	Manual
Nacelle	
Material	EN-GJS-400-18U-LT
Maintenance Hoist	1 x 250kg SWL
Wind Measuring Devices	1 x Anemometer + 1 x Wind Vane
Top Box	Provided
Tower	
Type	Tubular Steel Tower with Embedded Steel Can in Foundation - Cylindrical+Conical
Material	S 355
No. of Sections	4
Assembly	Bolted Connection
No. of Platforms and Type	5, Chequered Plates
Ascent	Ladder inside Tower with safety harness
Ventilation	Air Inlet at Tower Top and Exhaust Fan at Tower Bottom
Corrossion Protection	
Corrossion class (outside)	DIN EN ISO 12944-C5
Colour	RAL 7035
Foundation	
Type	Floating Foundation

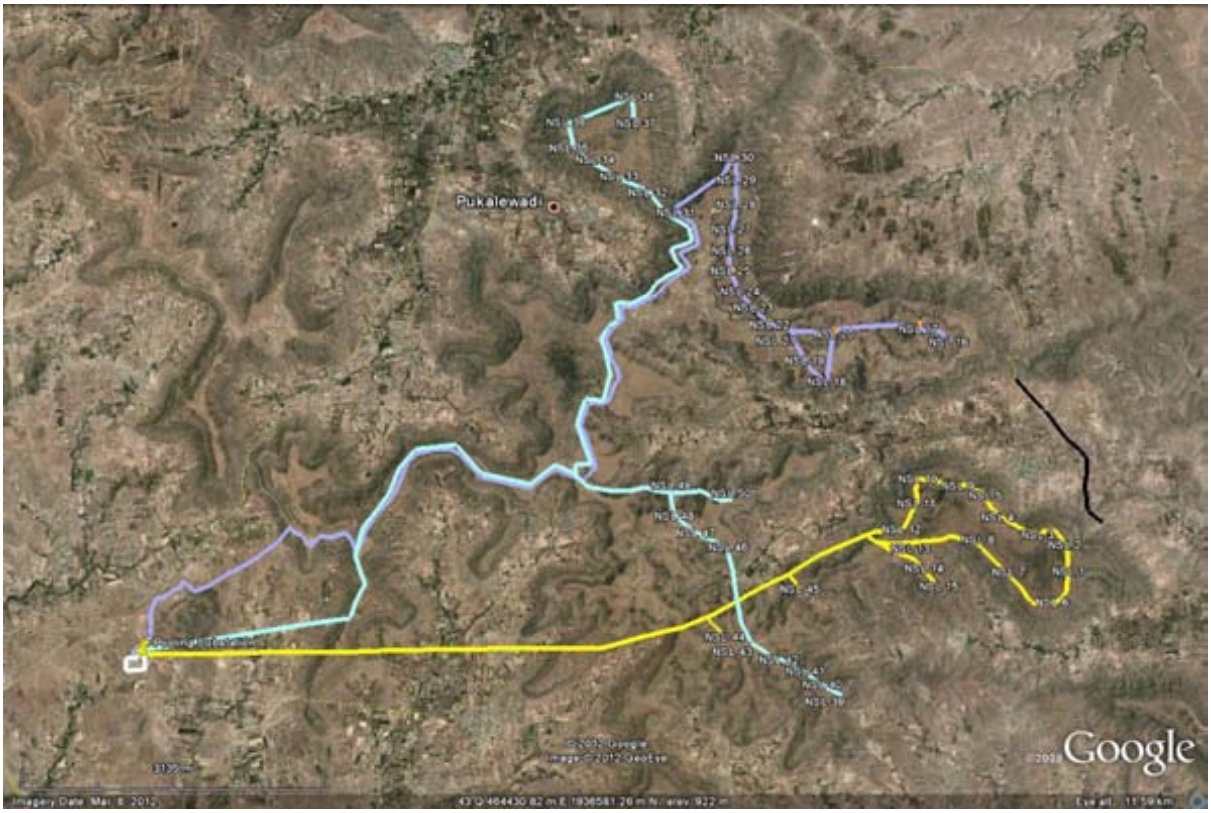
3.3.3 Power Evacuation System

The power generated by the respective wind turbines will be transmitted to a 33/220 KV Pooling Substation, located at Hiwarwadi village to the west of the site, through a 5 to 12 km

long single/ double circuit 33 kV transmission lines. The power will then be stepped up from 33kV to 220 kV at the Pooling Substation and transmitted through a double circuit 220kV transmission line to Maharashtra State Electricity Transmission Company Limited's (MSETCL) interconnection point located at about 8 to 10 km distance. NRPPL has proposed to construct three 33kV feeders at site, each with capacity of 25MW in order to transmit power from the wind turbines to the Hiwarwadi pooling substation.

The 220 kV Transmission Line from the pooling substation to MSETCL interconnection point has already been constructed by ReGen Powertech, the construction contractor for the project. Apart from NRPPL, this transmission line is also being used to evacuate 125MW power from another wind power plant by Bhilwara Energy Limited (BEL) located adjacent to the proposed project site. The 220 kV Transmission Line and Hiwarwadi Pooling Substation are thus shared facilities with the adjacent wind power plant and other customers of ReGen. **Figure 3.2** shows the proposed layout of transmission lines.

Figure 3.2: Proposed Layout of Transmission Lines



Apart from the proposed power evacuation system, NRPPL will also explore the possibility of adding more conductors to the existing transmission lines of the adjacent wind farms. However this option has not yet been finalized.

3.4 Construction Activities

3.4.1 Access Roads

Establishment of access to site will be one of the preliminary activities that will be undertaken as part of construction process. Two approach roads, with length of 2.5 km and 3.1 km each, have been proposed for accessing the wind turbine locations. Besides the

approach roads there will be internal roads for access to each turbine location and associated facilities within the wind farm area. The roads will be planned with a width of 6m to 9m along the normal course and of 25m to 40m along the curves to enable movement of large wind turbine components.

The total length of the roads to be constructed has been provided in **Table 3.5.**

Table 3.4: Length of Roads to be constructed

S.No	Road Type	Length (km)/ width (m)
1	Approach Road 1 to Virali plateau	2.5 km / 9m
2	Approach Road 2 to Chilarewadi plateau	3.1 km/ 9m
3	Internal Roads - between turbines, control room, stores, site office, substation etc	24 km/ 6 to 9m
	Total Length	**29.6 km**

ReGen has constructed approach roads for accessing the wind power plant of Bhilwara Energy Limited located to the west of the project area. NRPPL has been given access rights for using these roads during construction and operation phases of the project. Required widening and expansion of other existing roads have also been undertaken by ReGen as part of development of other wind power projects in the vicinity.

3.4.2 Site Development

The erection of wind turbines will require development of site which will involve soil investigation, site survey, site levelling, construction of internal roads etc. The proposed site is an undulating terrain on an elevated plateau; it may not require extensive levelling of the entire area but each turbine location will require clearing and grading of a diameter of 50 to 80m around the tower site. There will be removal of ground vegetation, removal of trees and larges shrubs will be however limited and avoided wherever possible.

3.4.3 Civil Works

The supply and erection & commissioning contracts will be signed between ReGen Powertech Private Limited (the supplier of equipment) and NRPPL (or its SPV Company for supply, erection and commissioning of ReGen make V 87/1500 kW Wind Electric Converters). NRPPL will also sign contracts with different suppliers and contractors for rest of the scope of supplies/works, which is not included in the scope of ReGen Powertech Private Limited.

The civil work would involve the following activities:

- Installation of temporary and/or permanent meteorological towers.
- Installation of wind turbine and associated facilities
- Construction of underground and/or overhead electrical collection lines to connect turbines to the collection substation.

The major civil work involves wind turbine foundations, erection, switch yard structure and equipment foundations including power transformer and control room cum administration building. Minor works involve security kiosks, collection substation, fencing, roads and drainage.

The wind turbine towers proposed to be of about 85m height would require substantial foundations which would extend to a depth of about 2.5 to 3m. The depth of foundation will be dependent on soil and surface conditions. The foundation structure will be floating type which is essentially a gravity foundation that relies upon soil overburden and concrete to provide sufficient weight to resist overturning of the foundation at extreme wind loads.

The towers will be initially segmented (about 18-23m at the time of arrival at site and will require bolting works to put the tower together during installation. The erection of tower would require cranes and preparation of platforms for installing cranes. Crane platform will require an area of 0.4 to 0.5 ha which will be prepared soil, rock and gravel to support the weight of the equipment. The crane will undertake the lifting activities to erect the turbines; the nacelle will be installed atop the tower first followed by installation generator, rotor and blades.

Construction of related structures will involve civil and steel work for installation of pooling stations, transformers, substation, and electric cables and signal wires.

3.4.4 Labour

During construction stage man power ranging from 80-100 will be required during normal functions while peak construction activities will require 150-200 workers. The unskilled labour required for construction activities will be locally hired and therefore labour camp will not be required to be set up except for when skilled workers are hired from outside. Skilled workers for crane operation and electrical works will be brought in from outside, which will be limited to 15-20 individuals. The workers coming from outside will be lodged in rented accommodation in nearby towns. Adequate facility for drinking water and sanitation will be provided at the construction site.

Table 3.5 below gives the estimated labour requirement during various stages of construction phase.

Table 3.5: Estimated Labour Requirement during Construction Phase

Activities	Normal Period	Peak Period
Foundation and Civil Works	45	75
Transportation of turbine components (drivers of construction vehicles and project vehicles)	18 to 20	30 to 32
Stock yard (security and staff)	7 to 8	10 to 12
Site Office	2	3

3.4.5 Water Requirement

About 220m^3 of water will be required daily for construction on an average while the peak demand is estimated to be 450m^3/day depending on various stages of the process. The

water required for construction will be arranged by the construction contractors through authorised tanker water suppliers.

3.4.6 Construction Waste

Construction waste will be limited to packaging and crafting material of turbines and construction debris. Earthmoving activities and construction of wind energy facilities will require use of heavy machinery /equipment which would generate waste oil, gearbox oil, hydraulic oil, lubricant, cleaning fluids, paints, degreasers and other similar substances, these substances are categorised as hazardous waste and shall be dealt with as per the Hazardous Waste Management Handling and Trans-boundary Movement Rules 2008 and its amendments. As per the rules the hazardous waste generated shall be supplied to an approved vendor.

3.4.7 Waste Water Generation

Since no labour campsites will be set up during the construction phase of the project, waste water generation from the construction activities will be limited to washing and cleaning activities related to construction activities. Portable toilet with septic tank soak pits will be provided at construction site to facilitate the disposal of sewage generated.

3.4.8 Construction Schedule

The proposed project will be implemented in two phases of 34.5 MW and 44.5 MW. The construction activities will require a period of 10-12 months for erection, installation and commission works. The peak construction period will be for about 6-8 months. Table 3.6 below provides the implementation schedule for the project:

Table 3.6: Expected Construction Schedule

Activities	Expected date of commencement	Expected date of completion
Procurement of Land (including private and revenue land)	Commenced	▪ Procurement of Private Land - expected to be completed by end of March 2013 ▪ Acquisition of Revenue Land - expected to be completed by end of April 2013
Site Development	Commenced	July 2013 (It is a parallel activity)
Construction of internal access roads	Commenced	July 2013 (It is a parallel activity)
Civil Works	Commenced	July 2013 (It is a parallel activity)
Erection of turbine components	15th March 2013	August 2013
Commissioning of turbines	15th May 2013	31st August 2013
Laying of transmission lines	Commenced	June 2013
Installation of switchyard/administration building	Commenced	Completed
Installation of pooling	Commenced	Completed

substation		
Community development activities	Commenced	Ongoing

The estimated budget for remaining land procurement is given in Table 3.7.

Table 3.7: Estimated Budget for Remaining Land Procurement

S.N.	Type of Land	Amount of Remaining Land to be procured (ha)	Estimated Budget (INR)
1	Private Land	15.5	INR 4 million
2	Revenue Land	18	INR 50.6 million (As per MOU signed with Developer)

3.5 Project Operation Activities

Wind projects require a dedicated Operation and Maintenance (O&M) facility for storing equipment and supplies required during operation. An O&M agreement has been signed with ReGen Powertech which entrusts them with responsibility of maintenance and repairs. ReGen PowerTech is ISO14001 and OSHA 18001 certified and will accordingly establish EHS requirement. The site shall undertake 24 hours on site monitoring under the supervision of technically skilled and experienced staff to look after the O&M requirements of the entire Wind Farm. There shall be a workshop facility available at site to take care of regular maintenance requirement of the Wind Turbines. A tool room with sufficient stock of tools and spares as well as critical components will be maintained at the site.

There will be an off remote O&M facility involving the supervisory control and data acquisition (SCADA) system. This system provides two-way communication with each wind turbine. A SCADA system allows a central computer system to monitor and control each turbine‘s operation.

The typical maintenance and repair activity during operation phase involves preventive and breakdown maintenance of Wind turbines and/or the related equipment in accordance with the safety management plans and procedures as applicable and/or in accordance with accepted industry practices.

3.5.1 Preventive Maintenance

Preventive Maintenance involves labour as well as use of materials and consumables such as lubricants and oils, minor/low value electrical and mechanical parts etc, for preventive maintenance and upkeep of the equipment including but not limited to,

- Transformer Yard Electrical Maintenance
- High Tension Line Maintenance
- Greasing of Main Bearings, Yaw Bearing, Blade Bearings and Rotor Bearing.
- Topping up of hydraulic and topping up of Transformer Oil.
- Painting of equipment.

- Test of oil samples once in 6 months.
- Brake pads for Main Brakes and Yaw Brakes.
- Oil Filters.
- Dry Filters.
- Batteries.
- Carbon Brushes
- Coolant
- Cleaning Detergents and solvents.
- Pitch Capacitors
- All Electrical Panels, etc.
- Maintenance of Wind Vane and anemometer installed on the Wind Turbine
- Maintenance of SCADA System
- Checking the high tension switch gears and associated protections

3.5.2 Breakdown Maintenance

The breakdown repair work involves labour and use of sub-assemblies/equipments, components, spares and consumables in the event of any breakdown or suspected breakdown due to any reasons. Major breakdown maintenance anticipated for wind farms include (but not limited to):

- Repairs/replacement of Generator and Motors
- Repairs/Replacement of Nacelle, Rotor Unit, Hub
- Rewinding/Repairs of Transformers
- Repairs/replacement of transformer Yard Equipments
- Repairs/replacement of Blades
- Repairs/replacement of Frequency Converter Panels and Control Panels
- Repairs/replacement of Tower Components and Electricals
- Replacement of oil in Transformers
- Servicing of Anemometer, Wind vanes, wind sensors and other sensors, Limit switches, etc.

3.5.3 Other activities

Routine operational Services

Routine activities during operation phase include cleaning and upkeep of the equipment such as:

- Tower Torquing
- Blade Cleaning
- Nacelle and Tower head torquing and cleaning
- Transformer Oil Filtration
- Frequency Converter Panel and Low Tension Panel Maintenance
- Site and Transformer Yard Maintenance
- Checking oil levels in transformers

Security

Adequate security arrangements will be required to watch and ward the Wind Farm and the Equipment. About 15-20 security staff will be available at site to undertake watch and ward activities. The security staff will be locally hired.

Monitoring and reporting

The following records will be maintained during operational phase:

- Data logging records for power generation, Wind Speeds, grid availability, machine availability, Machine breakdown, etc. Shall be prepared
- Daily and Monthly performance reports will be made on daily basis.
- Monthly meter reading for State Electricity Board
- Visual observation record of wind farm and its components.

3.5.4 Staff

The operation and maintenance of wind turbines will be outsourced to the equipment suppliers. The site will have 20-25 personnel's at site including maintenance, monitoring and security staff during the operation phase. Most of the staff will be residing in rented accommodation in the nearest town of Karad. Table 3.8 below gives the break-up of the staff requirement during O&M phase.

Table 3.8: Estimated Staff Requirement

Staff	Normal Period	Peak Period
Security Staff	12	-
O&M staff	12	15

4 Description of the Environment (Baseline)

The following section describes the relevant physical, biological and socio-economic conditions within the study area of 10km radius around the site. The baseline data is generated through primary baseline monitoring, social survey, reconnaissance survey and available secondary information about the site and surroundings.

AECOM undertook a reconnaissance survey of the proposed site (at Chilarewadi) and surroundings in order to understand the environmental and social setting of the proposed wind farm project. The reconnaissance survey was followed by primary baseline data generation for environment and social aspects of the study area. The photo-documentation of the study is presented as **Annex A**.

4.1 Physical Environment

4.1.1 Site Settings

The project site area falls in villages of Chilarewadi, Puklewadi and Virali located in Man Taluka of Satara District, Maharashtra. The site is spread across a distance of approximately 5 km from North West to South East and also spread across a distance of approximately 1.5 km from South West to North East. The site is located on Jire Pathar Plateau which is elevated by more than 150 meters from the nearby region and has an average elevation of 890 meters above MSL.

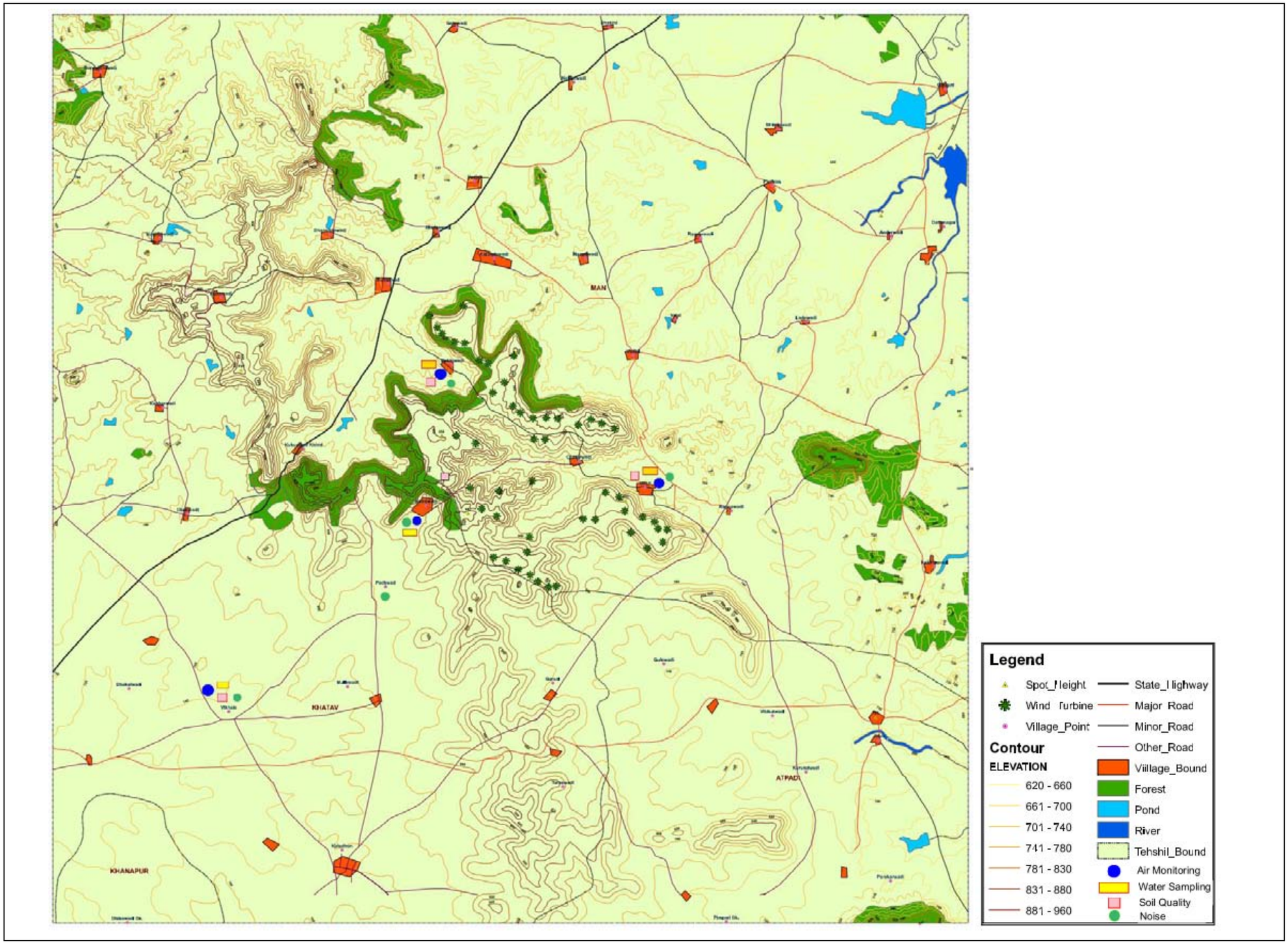
The area is rural with sparsely located villages amongst undulating terrain. The site is located at a distance of approximately 85 km from Satara town along the south east border of Satara district. The site lies at a distance of approximately 350 km south east of Mumbai. The project area is undulating terrain with plateaus and elevated patches of land with few scattered cultivated patches. Vegetation at the site and its surrounding areas are open/barren land with scattered agricultural area. There is no forest land in the project site. The nearest wild life sanctuary is Mayni Bird Sanctuary located at about 10 km towards southwest of the western edge of the project site. The various features observed around the site area are as provided in **Table 4.1.**

Table 4.1: Site Settings

Direction	Observed Features
North	• One of the meteorological towers is located at the northern end of the site. • To the north of site is village Karandewadi (1.5 km) and to the northwest is village Kukudvad (1.0 km) and Puklewadi (500m). • Continuous stretch of reserve forest borders the plateau from north east to the northwest extending further to the west.
East	• Towards the eastern edge of the site are the villages of Chilarewadi and Virali surrounded by the plateau on three sides.
South	• Towards south west are the villages of Katrewadi (1.2km) and Pachwad (3.5km)
West	• Towards the west lies the village Kukudvad Khind • The extension of reserve forest from north-west spreads along the west of site.

A detailed map of the site and its physical features is presented in **Figure 4.1.**

Figure 4.1: Physical Features around the Site and Sampling Locations



The location of turbines from the nearby villages is as provided below:

Table 4.2: Distance of Turbines from Nearby Villages

S. No.	Plateau Name	Village Virali	Village Chilarewadi	Village Puklewadi
1	Virali Plateau (15 Locations)	0.7 km	1.6 km	5.2 km
2	Chilarewadi Plateau (15 Locations)	2.9 km	1.3 km	2.3 km
3	Puklewadi Plateau (8 Locations)	5.2 km	3.8 km	0.76 km
4	Revenue Land (12 Locations)	3.6 km	2.3 km	3.2 km

4.1.2 Topography

The study area is geographically a part of the Deccan Plateau of Maharashtra, lying between the Upper Krishna and the Lower Bhima valleys. It is dominated by the hills and ridges separating the valleys of the Yerla River, a tributary of the Krishna, to the west, and the Maan River, a tributary of the Bhima, to the east.

The terrain is mildly hilly, shaped by the seasonal streams and rivulets that contribute to the water resources of either the Yerla or the Maan River. The hills are low, rugged and barren. The land is undulating, with rills, gullies, knolls, hillocks and plateaus. Two major roads, the Satara-Pandharpur state highway and the Karad-Bijapur inter-state highway, both run west-east, to the north and south respectively, of the study area. A few minor metalled roads and a number of cobbled roads, cart-tracks and foot-tracks cut across the study area.

Water bodies in and around the study area comprise of a few large lakes, a number of percolation-tanks and farm-ponds, and innumerable dug-wells and bore-wells.

4.1.3 Drainage Pattern

The entire land of the district belongs to the larger drainage system of the Krishna River. The drainage of the study area is directed to three river basins: the Krishna draining the major portion to the south, the Yerla also draining to the south the mid-east portions and the Man draining the eastern parts to join the Bhima River.

The area immediately around the site is a part of the catchment of Devapur Lake (manmade lake) located about 17km from the site near Mhaswad.

4.1.4 Geology

Significant portion of the district is covered by the basaltic and amygdular lavas which have come to the surface and spread over very vast areas of the then Central India configuration of land at the commencement of the Tertiary or Cenozoic Era, nearly 60 to 100 million years ago.

These lavas are spread in the form of horizontal sheets or beds. Because of their tendency to form plateaux and their dominantly basic composition, the lava flows are generally called "Plateau basalts." As these basaltic lava flows cover almost the entire Deccan region and

frequently present a step-like or terraced feature on the hills, they are termed as "Deccan basalts" or more commonly the "Deccan traps."

The Deccan traps, as mentioned earlier, cover almost the whole of the district and constitute the innumerable rugged and bold, flat-topped hills, forming extensive plateaux of the entire Western Ghats. Besides, lava flows also blanket the plains with a soil covering of varied thickness.

4.1.5 Hydrogeology

The ground water in the study area occurs under phreatic, semi-confined and confined conditions. Generally the shallower zones down to the depth of 20 m bgl form phreatic aquifer. The water bearing zones occurring between the depths of 20 and 40 m are weathered interflow or shear zones and yield water under semi-confined conditions. Deep confined aquifers occur below the depth of 40 m. The vesicular portion of different lava flows varies in thickness from 8 to 10 m and forms the potential aquifer zones. However the nature and density of vesicles, their distribution, inter-connection, depth of weathering and topography of the area are the decisive factors for occurrence and movement of ground water in vesicular units. The massive portion of basaltic flows are devoid of water, but when it is weathered, fractured, jointed or contain weaker zones ground water occurs in it.

4.1.6 Seismicity

Seismically about 53.6% of Satara district in Zone IV while the remaining portion fall in the Zone III as per IS: 1893 (part-I):2002. This project site region falls within Zone III, which is moderate damage risk zone, i.e. it may experience minor to moderate seismic activity, where a maximum intensity of Medvedev-Sponheuer-Karnik (MSK) scale VII can be expected.

4.2 Meteorological Information

The study area experiences a dry tropical type of climate. The mild and unpredictable monsoon extends from May to November, followed by a cool winter-period from November-end to mid-February. Hot summer is experienced from mid-February to May. Afternoon thunder-showers are experience in summer-heat. Rain is received chiefly from the retreating north-east monsoon, first between mid-May and mid-June, and later over October and November. The air is dry throughout the year except during the monsoon periods.

Climatic conditions in the project area have been established from meteorological data collected from the Climatological data published by India Meteorological Department (IMD). The secondary data on surface meteorology based on data of Sangli (nearest IMD observatory located at 70km from the site) has been considered in absence of information for Satara district The data for ambient temperature, atmospheric pressure, relative humidity and wind speed for the period 1968-1978 is summarised in ***Table 4.3.*** Only the rainfall data for Satara has been presented for a period from 2006 – 2010 (details summarised in ***Table 4.4).***

4.2.1 Temperature

According to the meteorological data for Sangli, the daily mean minimum temperature annually varies from 12.9°C in January to 22.5° C in May and the daily mean maximum temperature varies from 28.5° C in July-August and to 38.3°C in April.

The cold weather starts by about the end of November and continues to about the middle of February, with December being the coldest month. In this season the mean daily maximum temperature is 30.3°C while the mean daily minimum temperature is 13.3°C. The period from the middle of February to the end of May is one of continuous increase in temperatures. In April, the hottest month in the year, the mean daily maximum temperature is 38.3°C. The heat is sometimes relieved by afternoon thunder showers. The onset of the south-west monsoon in the first or second week of June brings down the day temperatures appreciably. The day temperatures in the south-west monsoon months are even lower than in the cold season. After the withdrawal of the south-west monsoon, day temperatures show an increase in October. Thereafter, both day and night temperatures begin to drop. Except during the south-west monsoon season the daily range of temperature is large and is about 12 to 15°C at Satara.

4.2.2 Relative Humidity

The relative humidity is generally high during the morning period and moderate low in the evening. The minimum humidity of 29% is recorded in March during evening hours and the maximum relative humidity of 87% is experienced in August-September during morning hours. In the south-west monsoon months the air is highly humid but in the summer and the cold seasons the air is dry particularly in the afternoons.

Table 4.3 Meteorological Data (1968-1978) for Sangli

Month	Station Level Pressure (hpa)	Daly Mean		Relative Humidity (%)	Monthly Rainfall mm	Cloud Amount (Oktas)	Mean Wind Speed (Kmph)
		Max (°C)	Min (°C)				
Jan I	952.8	31.10	12.9	67	0.00	1.1	4.5
II	948.7			36		1.3	
Feb I	951.9	33.40	15	64	1.40	1.1	5.3
II	947.5			35		1.7	
Mar I	950.7	36.60	18.6	62	4.80	1.1	6.5
II	946			29		2.8	
Apr I	948.9	38.30	21.5	68	30.30	2.2	8.4
II	943.9			33		4.1	
May I	946.9	37.10	22.5	76	44.40	3.3	11.9
II	942.5			42		4.5	
June I	944.7	31.40	22	83	86.50	6.1	14.4
II	942.2			69		6.1	
July I	944.4	28.50	21.5	87	98.90	6.9	14.4
II	942.5			77		6.8	
Aug I	945.4	28.50	21	87	72.80	6.5	13.4
II	943.2			75		6.6	
Sep I	947.6	30.10	20.4	87	139.20	5.7	9.4
II	944.4			68		5.9	
Oct I	950.1	32.00	19.8	77	163.60	3.6	6
II	946.4			53		4.6	

Nov I	951.9	30.80	16	69	9.20	2.3	5.1
II	948.2			44		2.8	
Dec I	953.3	30.50	13.3	67	0.10	1.7	5
II	949.4			38		2.1	
Annual Total/ MeanI	**949.1**	**32.40**	**18.7**	**75**	**649.80**	**3.5**	**8.7**
Mean II	**954.4**			**50**		**4.1**	
Number of Years	**11**	**11**	**11**	**11**		**11**	**10**

Source: IMD

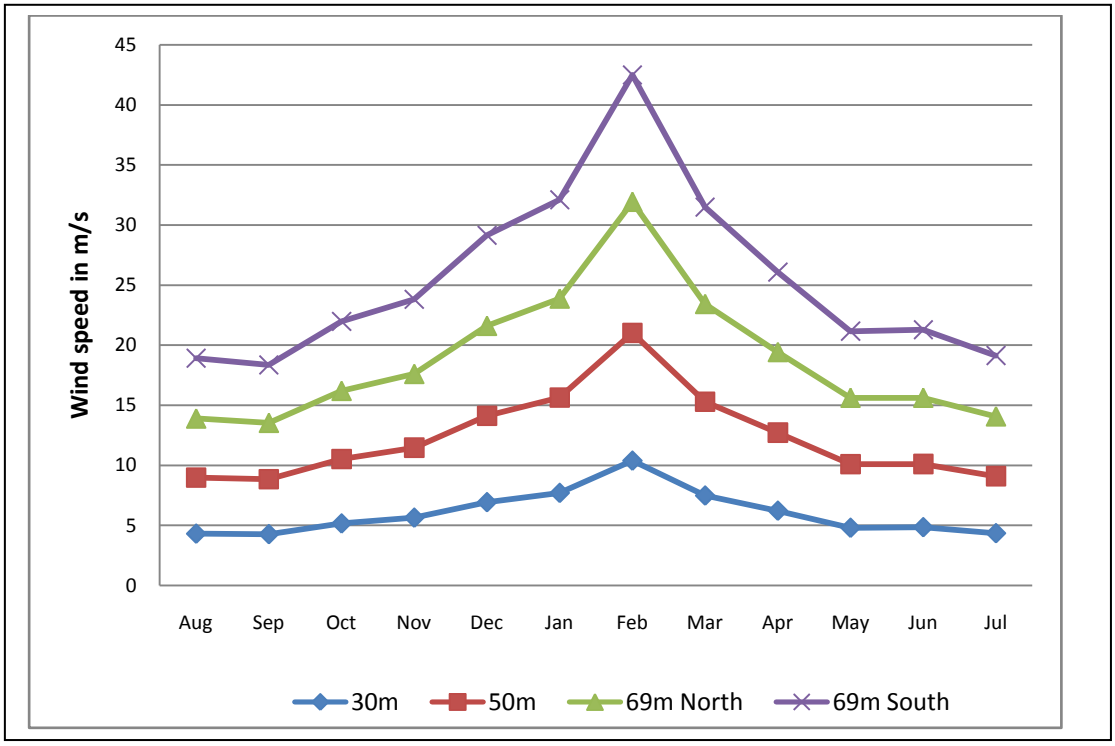
4.2.3 Wind Speed/Direction

Winds are strong during the south-west monsoon season. In the rest of the year they are light to moderate. South-westerly or westerly winds prevail in the south-west monsoon months. In the post monsoon months, they are predominantly north-easterly or easterly, but in the afternoon northerly winds blow on some days.

During the cold season, winds are from directions between north-east and south-east in the mornings and between south-west and north-west in the afternoons. Northerly or north easterly winds are common in the mornings during the hot season, while in the afternoons winds are mainly north-westerly and sometimes westerly.

The annual mean wind speed is 8.7km/ hr, the wind speed is highest in June –July at 14.4 km/hr while it is the lowest in January at 4.5 km/hr. The wind speed was assessed at different heights for a period of one year during August 2008 and July 2009. The observations are presented in **Figure 4.2.**

Figure 4.2: Wind Speed Observations



4.2.4 Rainfall

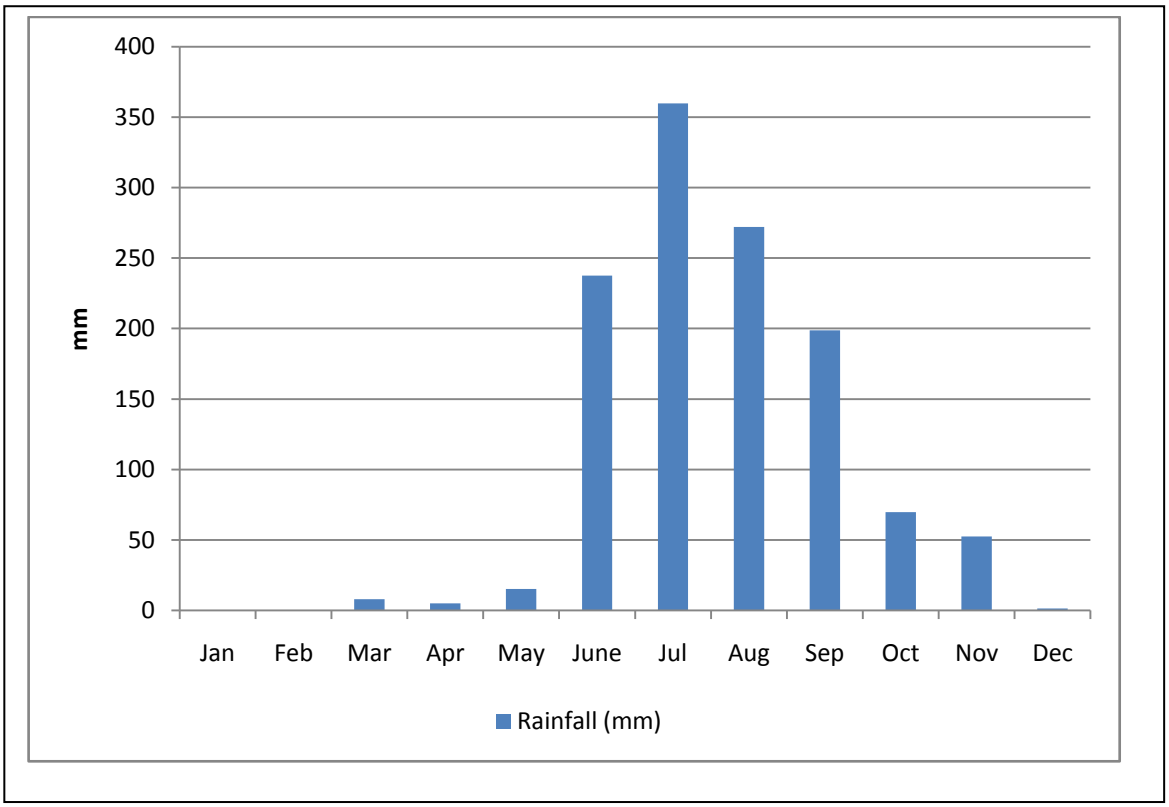
The rainfall data for Satara district from 2006-2010 as provided by India Meteorological Department is presented in **Table 4.4**. The mean annual rainfall observed for the district in the period 2006-2010 is 1220 mm. The heaviest rainfall is observed in the month of July and August contributing to more than 45% of the annual rainfall.

Table 4.4: Rainfall (in mm) for Satara District

Year	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
2006	0.0	0.0	2.9	0.0	32.4	253.1	477.9	381.1	153.5	48.3	12.9	0.0
2007	0.0	0.0	0.0	7.8	1.7	386.6	303.7	261	175.8	1.3	4.6	0.0
2008	0.0	0.0	31.4	2.4	17.6	160.6	99.3	265.1	216	62.2	4.9	2.6
2009	0.0	0.0	3.2	0.6	15.6	81.1	540.1	221.3	201.8	122.3	171.7	0.9
2010	0.0	0.0	2.6	14.3	8.4	306.2	378.3	232.1	246.9	114.6	68.7	3.0

The average monthly rainfall observed during period 2006-2010 is graphically represented in **Figure 4.3.**

Figure 4.3: Rainfall Pattern: Satara District



4.2.5 Ambient Air Quality

Ambient air quality was monitored at four locations near the proposed site in the study area during March 2011. The selection of the sampling locations was based on the consideration of predominant wind direction, topography of the area, habitation locations and their accessibility. The ambient air monitoring locations selected and the distance of the monitoring station from the site has been provided in the **Table 4.5.**

Table 4.5: Ambient Air Quality Sampling Locations

S.N	Sampling Station	Station Code	Geographical Coordinates	Direction w.r.t. Project Site	Distance from Project Site (km)
1	Katrewadi	AQ1	17°30‘ 15.04” 74°39‘37.36”	S	1.2
2	Padal	AQ2	17°27‘ 39.95” 74°37‘14.45”	SW	3.6
3	Virali	AQ3	17°30‘ 28.83” 74°42‘18.88”	E	0.5
4	Puklewadi	AQ4	17°31‘ 59.89” 74°39‘49.57”	NNW	1.0

The following air pollution parameters were monitored during the sampling period.

- Particulate Matter (10 micron and above): PM10
- Particulate Matter (2.5 micron and above): PM2.5
- Sulphur dioxide : (SO_2)
- Oxides of nitrogen : (NOx)
- Carbon Monoxide: (CO)

Analytical results of the air monitoring is given in **Table 4.6** and discussed in further sub-sections.

Table 4.6: Ambient Air Quality in the Study Area (in µg/m^3)

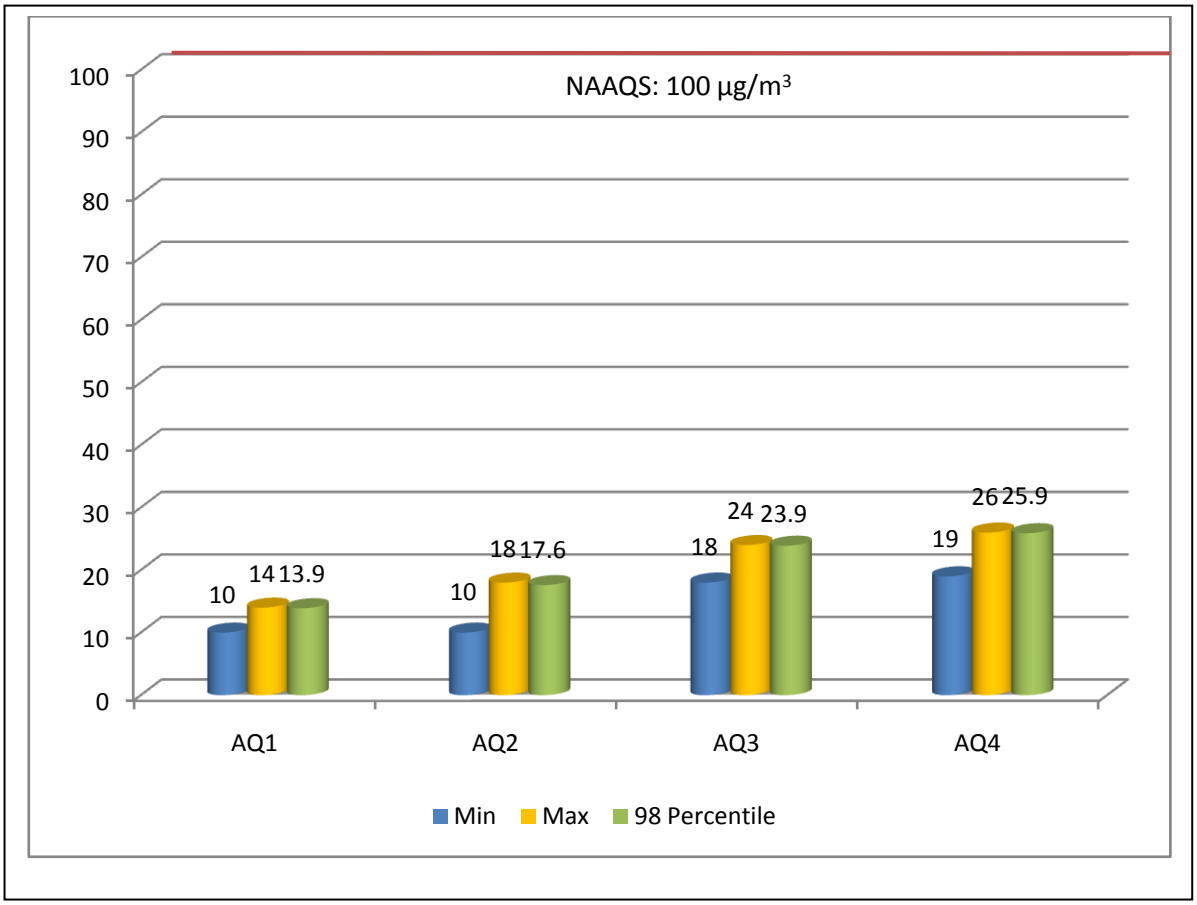
	Observed	AQ1	AQ2	AQ3	AQ4
PM10 : 24 Hourly µg/m^3	*NAAQS*	*100*	*200*	*200*	*200*
	Min	10.0	10.0	18.0	19.0
	Max	14.0	18.0	24.0	26.0
	98 Percentile	13.9	17.6	23.9	25.9
PM 2.5 : 24 Hourly µg/m^3	*NAAQS*	*60*	*60*	*60*	*60*
	Min	BDL	7.0	9.0	11.0
	Max	8.0	10.0	15.0	16.0
	98 Percentile	8.0	9.9	14.9	15.9
SO_2 : 24 Hourly µg/m^3	*NAAQS*	*80*	*80*	*80*	*80*
	Min	2.8	3.5	4.3	3.1
	Max	5.1	6.2	8.1	8.2
	98 Percentile	5.1	6.1	7.9	8.1
NO_x : 24 Hourly µg/m^3	*NAAQS*	*80*	*80*	*80*	*80*
	Min	5.3	6.2	7.9	5.1
	Max	9.2	10.2	14.9	15.1

	98 Percentile	9.1	10.2	14.7	14.9
CO: 8 hourly mg/m^3	*NAAQS*	2000	2000	2000	2000/
	Min	98.0	95.0	88.0	91.0
	Max	152.0	251.0	271.0	112.0
	98 Percentile	151.9	245.7	267.2	115.0

PM-10

The PM-10 concentration observed in the study area varied from 10.0µg/m^3 to 26.0µg/m^3. The minimum value was recorded at Katrewadi and Padal (Site- AQ-1) and the maximum was recorded at Puklewadi (AQ-4). The 98 percentile values ranged from 13.9µg/m^3 to 25.9µg/m^3. The PM-10 values were within the prescribed norms of 100µg/m^3 as per NAAQS. The observations of PM-10 are presented graphically in **Figure 4.4.**

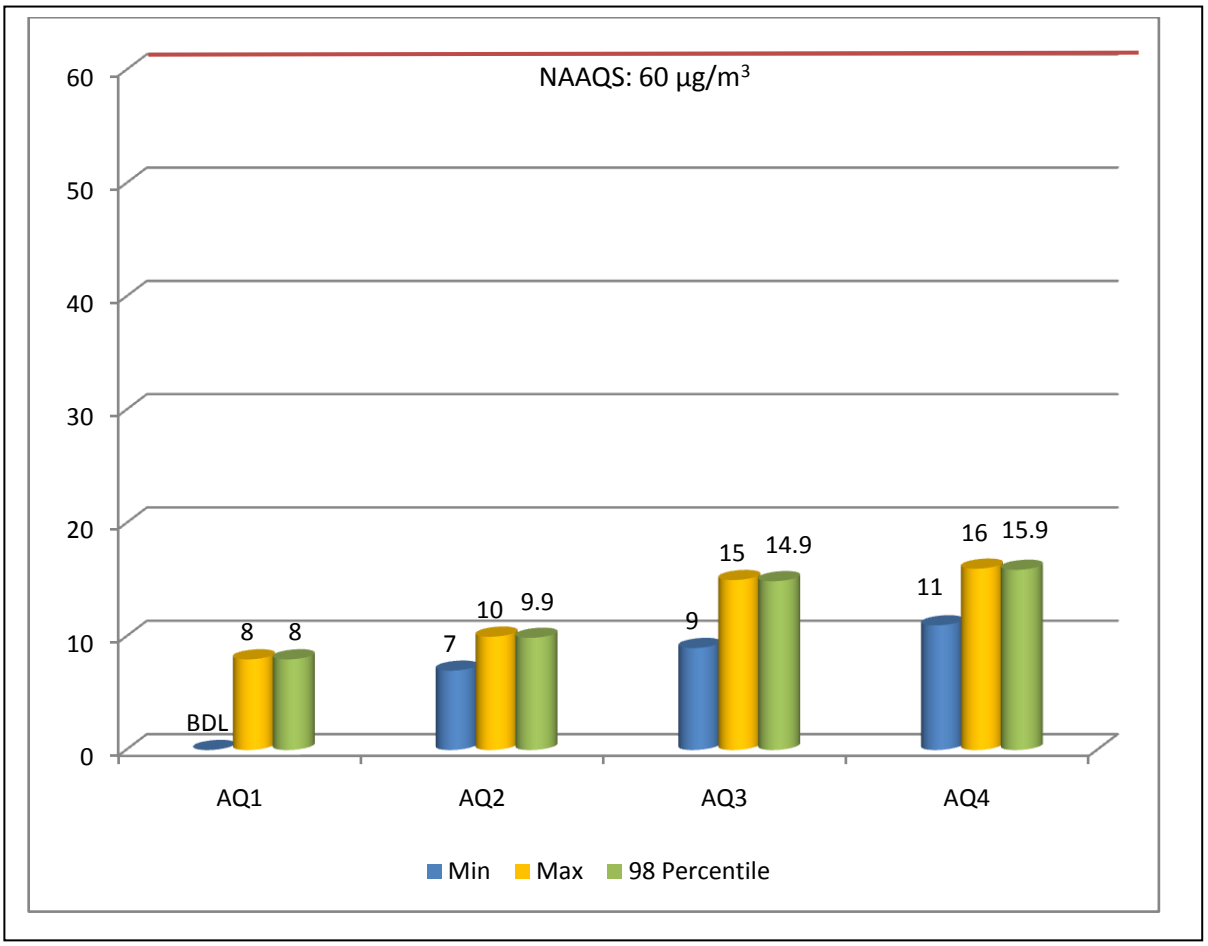
Figure 4.4: PM-10 Observed in Study Area



PM-2.5

The PM-2.5 concentration observed in the study area varied from BDL to 16.0µg/m^3. The minimum value was recorded at Katrewadi (Site- AQ-1) and the maximum was recorded at Puklewadi (AQ-4). The 98 percentile values ranged from 8.0µg/m^3 to 15.9µg/m^3. The PM-2.5 values were within the prescribed norms of 60 µg/m^3 as per NAAQS. The observations of PM-2.5 are presented graphically in **Figure 4.5.**

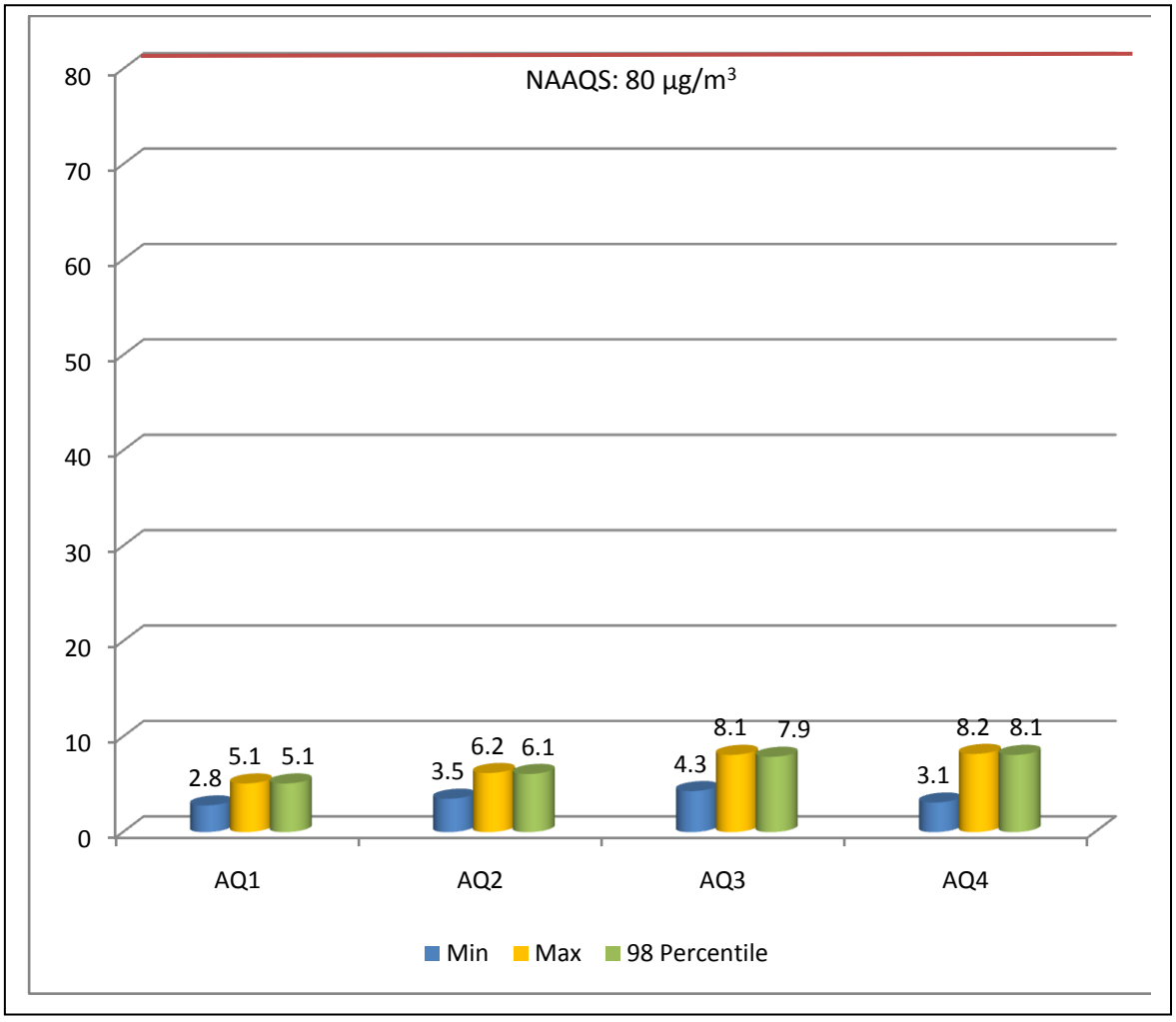
Figure 4.5: PM-2.5 Observations in the Study Area



SO_2

The SO_2 concentration ranged from 2.8µg/m^3 to 8.2µg/m^3. The maximum SO_2 concentration observed was 8.28µg/m^3 at Puklewadi (AQ-4). The minimum value was recorded was 2.8µg/m^3 at Katrewadi (AQ-1). The 98 percentile values ranged from 5.1µg/m^3 to 8.1µg/m^3. The SO_2 values were within the prescribed norms of 80µg/m^3 as per NAAQS. The observations of SO_2 are presented graphically in **Figure 4.6.**

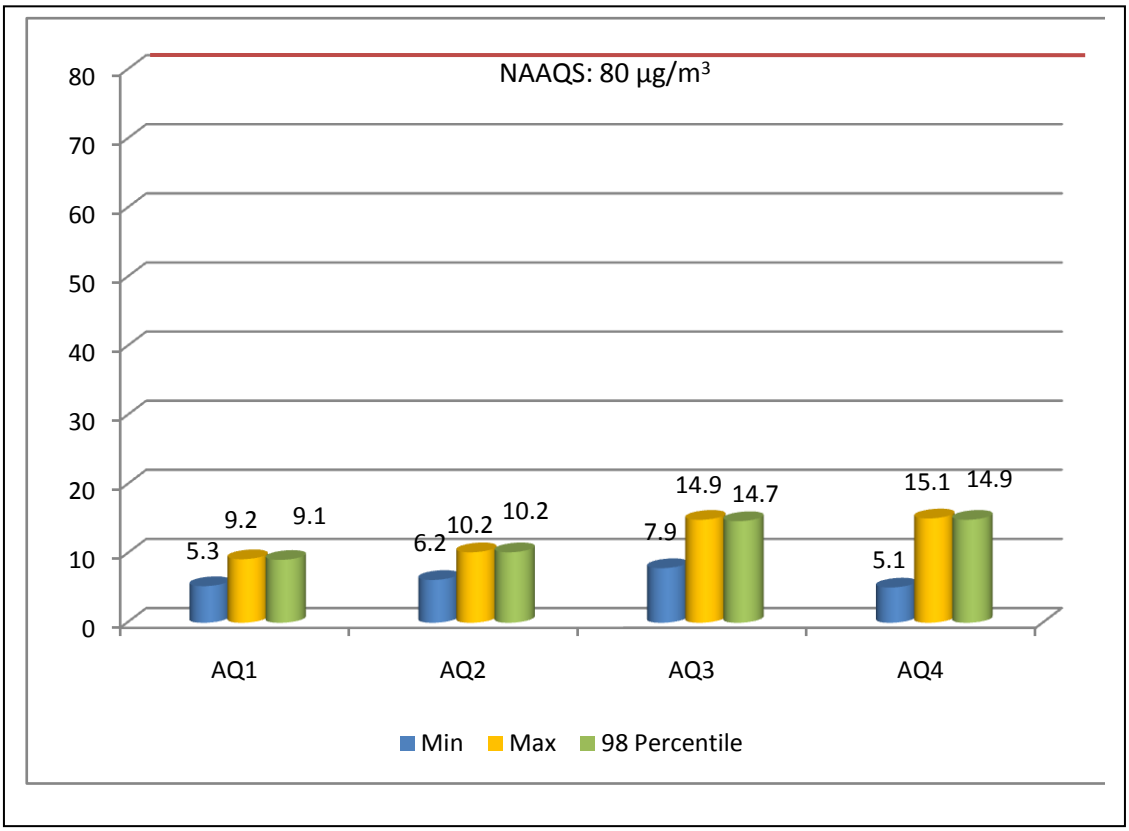
Figure 4.6: SO_2 Observed in the Study Area



NOx

The maximum NO_x concentration observed was 15.1µg/m^3 at Puklewadi (AQ-4). The minimum value was recorded was 5.1µg/m^3 also at Puklewadi (AQ-1). The 98 percentile values ranged from 9.1µg/m^3 to 14.9µg/m^3. The NOx values were within the prescribed norms of 80 µg/m^3 as per NAAQS. The observations of NOx are presented graphically in **Figure 4.7.**

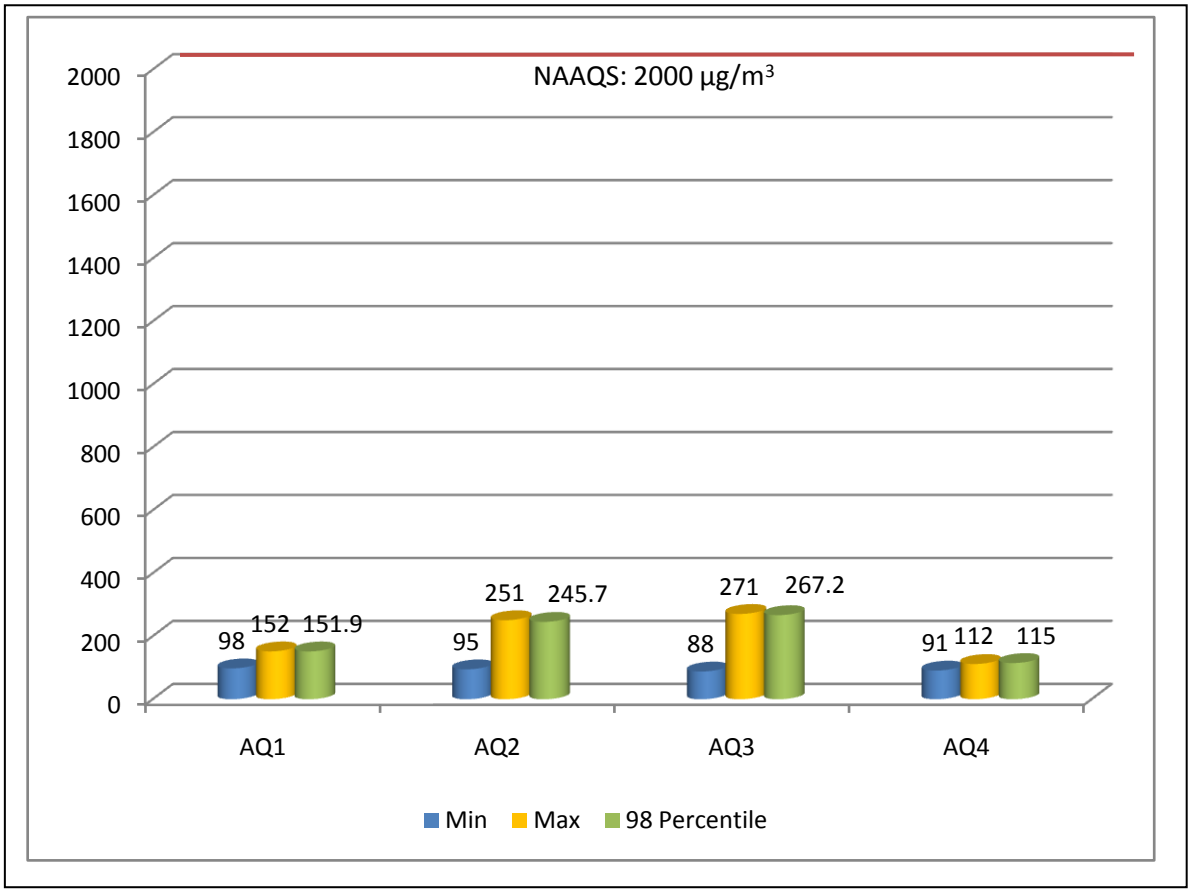
Figure 4.7: NOx Observed in the Study Area



CO

The maximum CO concentration observed was 271.0µg/m^3 at Viirali (AQ-3). The minimum value was recorded was 88.0µg/m^3 also at Virali (AQ-3). The 98 percentile values ranged from 115.0µg/m^3 to 267.2µg/m^3. The CO values were within the prescribed norms of 2000 µg/m^3 as per NAAQS. The observations of CO are presented graphically in **Figure 4.8.**

Figure 4.8: CO Observed in the Study Area



The ambient air quality observed in the area is good as all the parameters observed are considerably below the required standards and guideline values. The site and surrounding is predominantly rural with no identified source of pollution in the area. The movement of traffic was also observed to be limited in the area.

4.2.6 Water Quality

Water samples were collected from four ground water sources with the study area. The geographic coordinates and location of the source is provided in **Table 4.7.**

Table 4.7: Locations for Water Sampling

Sample code	Geographic Coordinates	Village
WQ-1	17°30‘ 15.01” 74°39‘37.34”	Katrewadi
WQ-2	17°30‘ 28.83” 74°42‘18.86”	Virali
WQ-3	17°31‘ 59.83” 74°39‘49.57”	Puklewadi
WQ-4	17°27‘ 39.95” 74°37‘14.46”	Padal

The water samples collected were analyzed for parameters as per IS: 10500 standards and the results are presented in the **Table 4.8.** The analysis was undertaken as per IS 3025 and relevant APHA standard methods.

Table 4.8: Results of Water Quality Monitoring in the Study Area

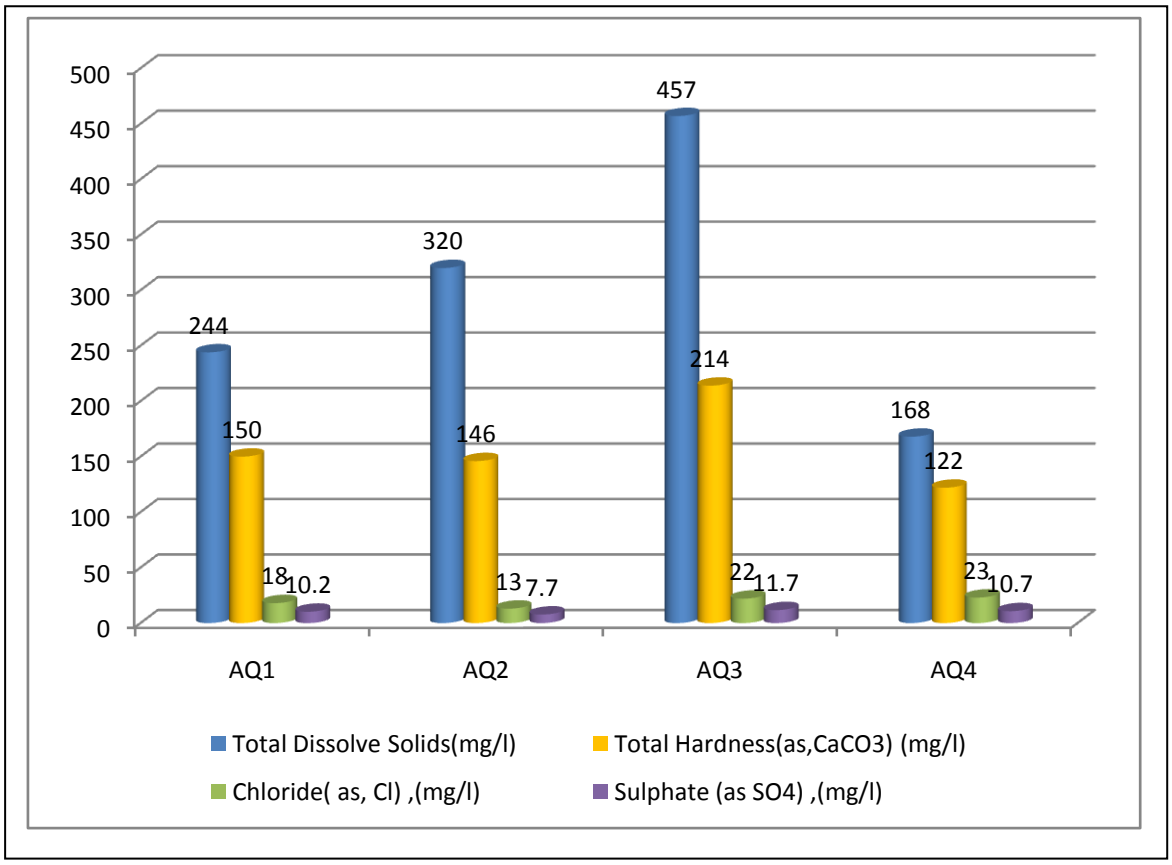
S.N	Parameters	IS: limit*	Katrewadi	Virali	Puklewadi	Padal
1	pH	6.5-8.5	7.69	7.54	7.94	8.02
2	Temperature(^{0}C)	-	26	26	27	26
3	Conductivity,(mS/cm)	-	0.449	0.456	0.654	0.329
4	Turbidity,(NTU)	5 (10)	<0.1	0.2	<0.1	<0.1
5	Colour, Hazen	5 (25)	<5	<5	<5	<5
6	Alkalinity(As ,$CaCO_3$) ,(mg/l)	200 (600)	196	206	278	122
7	Total Dissolve Solids(mg/l)	500 (2000)	244	320	457	168
8	Total Suspended Solids (mg/l)	-	4	6	6	5
9	Salinity	-	<0.1	<0.1	<0.1	<0.1
10	Oil and Grease, (mg/l)	-	<0.01	<0.01	<0.01	<0.01
11	COD, (mg/l)	-	16	24	<5	<5
12	BOD, (mg/l)	-	9	11	<1	<1
13	Dissolved Oxygen, (mg/l)	-	2.8	1.4	1.8	1.2
14	Chloride(as, Cl) ,(mg/l)	250 (1000)	18	13	22	23
15	Sulphate (as SO4) ,(mg/l)	200 (400)	10.2	7.7	11.7	10.7
16	Fluoride(as, F) ,(mg/l)	1 (1.5)	0.23	0.35	0.44	0.32
17	Total Hardness(As,$CaCO_3$) (mg/l)	300 (600)	150	146	214	122
18	Ca (as,$CaCO_3$) ,(mg/l)	75 (200)	8.8	46.4	52	5.6
19	Mg (as,$CaCO_3$)) ,(mg/l)	30 (100)	1.92	7.2	20.16	1.92
20	TPH, ppm	-	<0.01	<0.01	<0.01	<0.01
21	Anionic detergents	0.2 (1.0)	<0.1	<0.1	<0.1	<0.1
22	Manganese,(mg/l)	0.1 (0.3)	<0.01	<0.01	<0.01	<0.01
23	Nitrate,(mg/l)	45 (100)	1.44	0.68	1.16	0.91
24	Phosphate,(mg/l)	-	0.75	0.62	0.5	0.72
25	Iron(as Fe),(mg/l)	0.3 (1.0)	<0.02	<0.02	<0.02	<0.02
26	Copper(as ,Cu) ,(mg/l)	0.05 (1.5)	<0.02	<0.02	<0.02	<0.02
27	Barium,(mg/l)	0.7	<0.1	<0.1	<0.1	<0.1
28	Arsenic,(mg/l)	0.05	<0.001	<0.001	<0.001	<0.001
29	Zinc(as, Zn) ,(mg/l)	5 (15)	0.092	0.111	0.149	0.076
32	Cadmium (as, Cd) ,(mg/l)	0.01	<0.005	<0.005	<0.005	<0.005
33	Chromium(as ,Cr) ,(mg/l)	0.05	<0.02	<0.02	<0.02	<0.02
34	Phenolic Compounds,(mg/l)	0.001 (0.002)	<0.001	<0.001	<0.001	<0.001
35	Total Coliforms,(Nos/100 ml)	Nil	0	0	0	0
36	Faecal Coliforms,(Nos/100 ml)	Nil	0	0	0	0

** IS:10500 - 2004, values in bracket indicate the permissible limits*

Observations of the water quality indicate that the water quality of the area is within the IS limits for most of the parameters. The TDS levels are within the desirable limits of 500 mg/l at all locations monitored. Total hardness of the all the water samples were within the desirable limit of 300 mg/l. The Chloride and Sulphate levels were also observed to be below their respective desirable limits at all locations sampled. Fluoride levels were observed to be within the desirable limit of 1.0mg/l at at all locations.

All heavy metals analyzed except Zn were found to be below the respective detection limit. Zn levels were observed to be within the desirable limits at locations. The groundwater sampled is observed to have no bacteriological contamination in any of sample.

Figure 4.9: TDS, Hardness, Chloride and Sulphate Observations



4.2.7 Soil Quality

Most of the study area is covered by a light-colored rocky soil, which is locally described as ‗murmaal' or ‗maalraan' land. However, shallow to medium black soil is to be found in the valleys of streams and rivers. Large patches of reddish-brown soil are encountered in the hills and ridges. Soil samples were collected from four locations in the study area. The details of sampling locations are given **Table 4.9.**

Table 4.9: Soil Sampling Locations in the Study Area

Sample code	Geographic Coordinates	Village
SQ-1	17°30‘34.07” 74°39 48.38”	At site
SQ-2	17°30‘28.05” 74°42‘l8.88”	Virali
SQ-3	17°31‘59.81” 74°39‘49.57”	Puklewadi
SQ-4	17°27‘39.8” 74°37‘14.51”	Padal

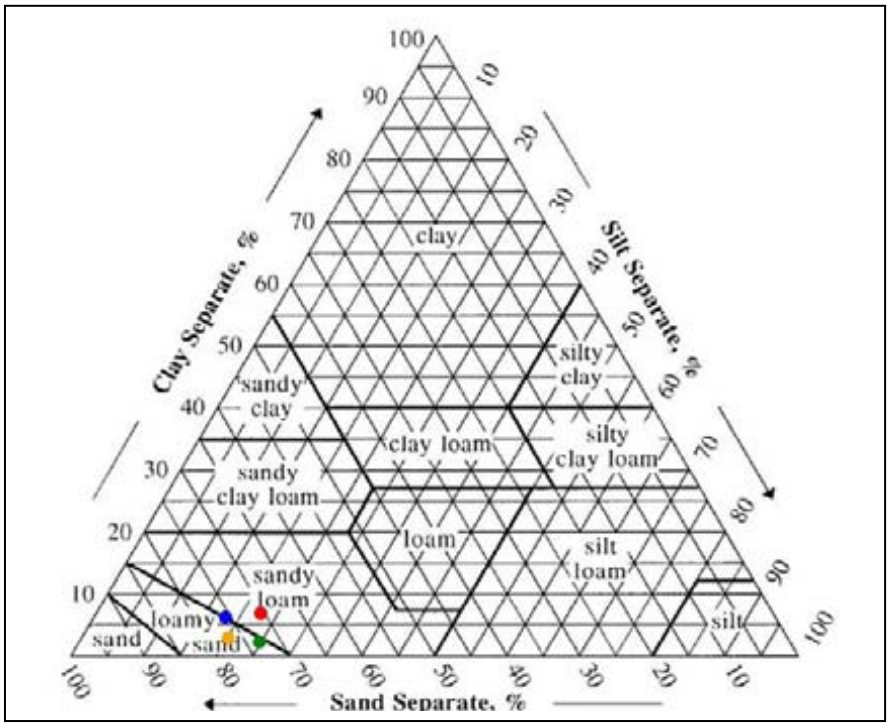
The results from soil analysis are presented in **Table 4.10.**

Table 4.10: Results of Soil Quality Monitoring

S.N.	Parameters	SQ-1	SQ-2	SQ-3	SQ-4
1	Texture	Sandy Loam	Sandy Loam	Loamy Sand	Loamy Sand
2	I) Sand, %	70.59	75.84	73.06	77.13
3	II) Silt, %	22.17	17.5	24.28	19.65
	III) Clay, %	7.24	6.66	2.66	3.22
	pH (1:10 suspension)	7.05	7.26	7.58	7.18
4	Porosity,%	32.56	18.41	30.87	15.61
5	Conductivity, mS/cm	0.03	0.089	0.105	0.023
6	Permeability, cm/sec	0.06	0.027	0.047	0.053
7	Nitrite, mg/kg	0.22	0.52	0.67	0.35
8	Nitrate, mg/kg	1.22	2.05	2.98	1.06
9	Phosphate, mg/kg	302	387	411	283
10	TPH, ppm	<0.01	<0.01	<0.01	<0.01
11	Mercury as Hg, ppm	<0.001	<0.001	<0.001	<0.001
12	Cation exchange capacity, Meq/100 g	15.06	17.11	15.56	16.64
13	Cadmium as Cd, ppm	1.498	1.632	1.035	0.466
14	Zinc as Zn, ppm	71.05	50.63	54.76	18.25
15	Copper as Cu, ppm	72	37.3	11.3	80.9
16	Iron as Fe, ppm	186.1	212.7	193.7	223.1
17	Lead as Pb, ppm	<0.05	0.929	<0.05	<0.05
18	Chromium as Cr ,ppm	14.2	9.883	3.028	<0.02
19	Manganese as Mn ppm	354.9	273.2	274.9	231.9
20	Arsenic as As, ppm	<0.001	<0.001	<0.001	<0.001
21	Barium as Ba, ppm	<0.01	<0.01	<0.01	<0.01
22	Nickel as Ni, ppm	42.92	30.51	32.75	23.82

The soil texture in the study area is Sandy loam and Loamy Sand with over 70% of Sand. The pH of the soil indicates neutral to slight alkalinity in nature. The soil texture classification is as presented in **Figure 4.10.**

Figure 4.10: Soil Texture Classification



Heavy metals Cadmium, Manganese, Nickel, Zinc, Copper and Iron were observed in the soil samples analyzed at all locations. The region is rich in Manganese ore and is reflected in the soil sample analysis.

4.2.8 Ambient Noise Level

Ambient noise was monitored at six locations in the study area. The locations identified were rural/residential areas. The areas identified for monitoring with details are provided in **Table 4.11**.

Table 4.11: Noise Monitoring Locations in the Study Area

Sample code	Geographic Coordinates	Village
NL-1	17°30‘34.08” 74°39‘48.38”	Site
NL-2	17°30‘28.35” 74°42‘I8.45”	Virali
Nl-3	17°27‘39.18” 74°37‘14.51”	Padal
NL-4	17°31‘59.81” 74°39‘49.57”	Puklewadi
NL-5	17°30‘19.57” 74°39‘37.51”	Katrewadi
NL-6	17°29‘10.47” 74°39‘02.34”	Pachwad

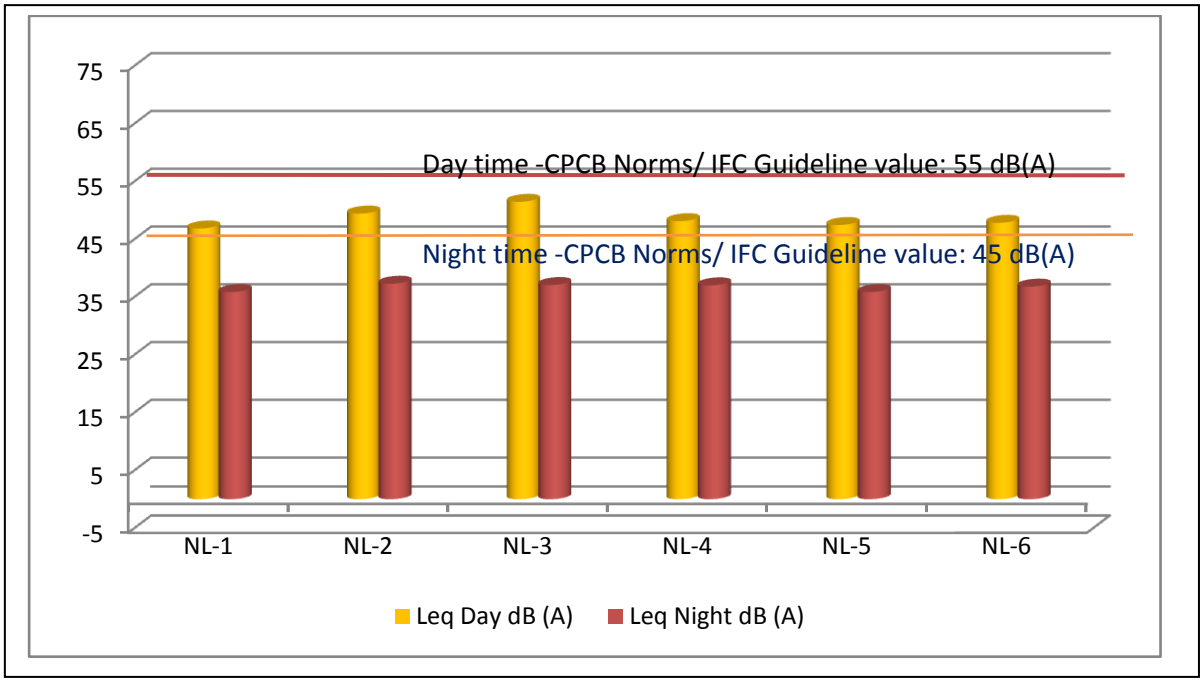
The observations of noise monitoring were calculated as Leq_{Day} and Leq_{Night}. The results are presented in the **Table 4.12.**

Table 4.12: Results of Ambient Noise Monitoring

Location Code	CPCB norm/ IFC guideline	NL-1	NL-2	NL-3	NL-4	NL-5	NL-6
Leq Day dB (A)	55	46.85	49.43	51.46	48.11	47.45	47.83
Leq Night dB (A)	45	35.86	37.29	37.06	37.01	35.86	36.79

The prescribed standard for equivalent noise levels at rural and residential areas are 55 dB(A) for day time (0600 to 2200 hours) and 45 dB(A) for night time (2200 to 0600 hours). The monitored noise levels were within the prescribed limits of the CPCB norms and the IFC guideline value with respect to noise at all locations. The noise levels are depicted in **Figure 4.11.**

Figure 4.11: Observations of Noise Level in the Study Area



4.2.9 Traffic Density

Traffic density was monitored at the Mhaswad –Mayani which is the main connecting road to the project site and will be significant for the traffic movement to the project.

Observations

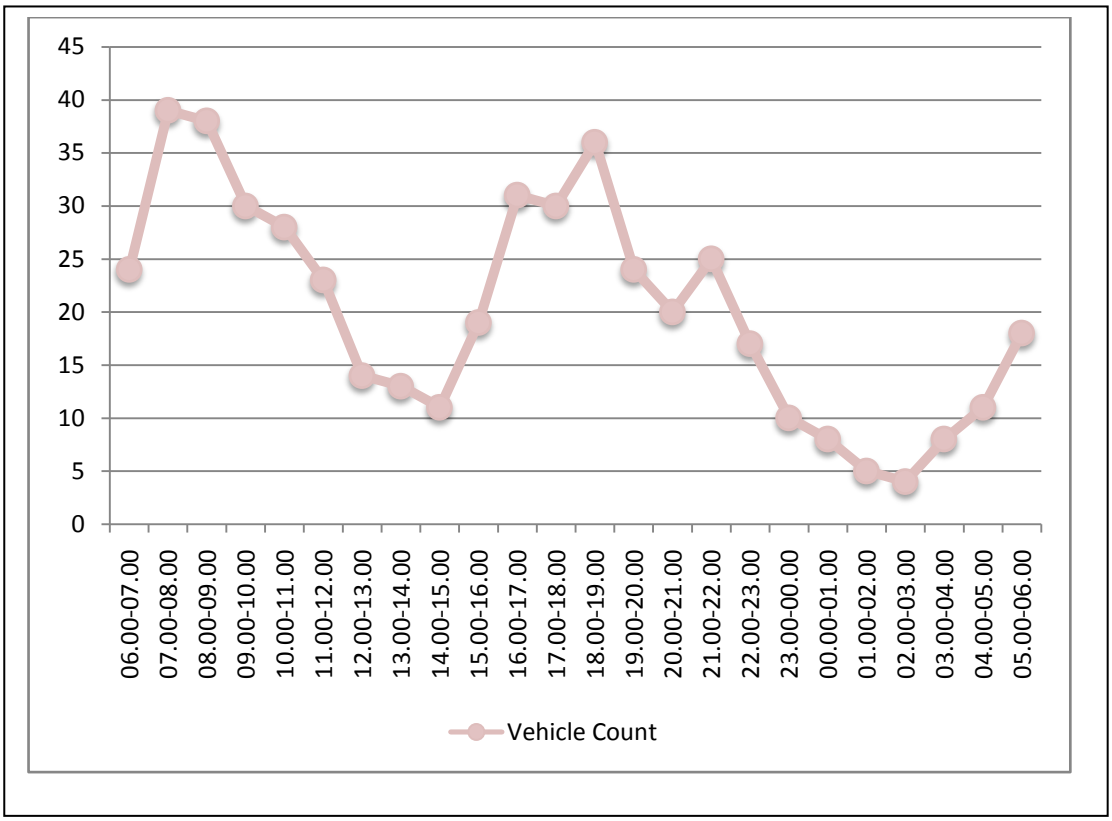
The traffic density along the road was observed to be low. The total Passenger Car Units Equivalents for traffic movement (to & fro) at the monitored location was 559. The summarised details of the traffic survey are given in **Table 4.13.**

Table 4.13: Existing Traffic Volumes in the Study Area

Description	Passenger Car Units Equivalents
Total PCU/24 Hours	559
Average Traffic Flow/Hr	23.3
Max Traffic Flow(Nos)/Hr	34.5 (18.00-19.00)
Min Traffic Flow(nos)/Hr	6 (2.00-03.00)

As per observations, the traffic peaks during the morning hours between 7:00 and 9:00 hours and in the evening hours between 17:00 and 19:00 hours. The traffic flow is graphically depicted in the **Figure 4.12**.

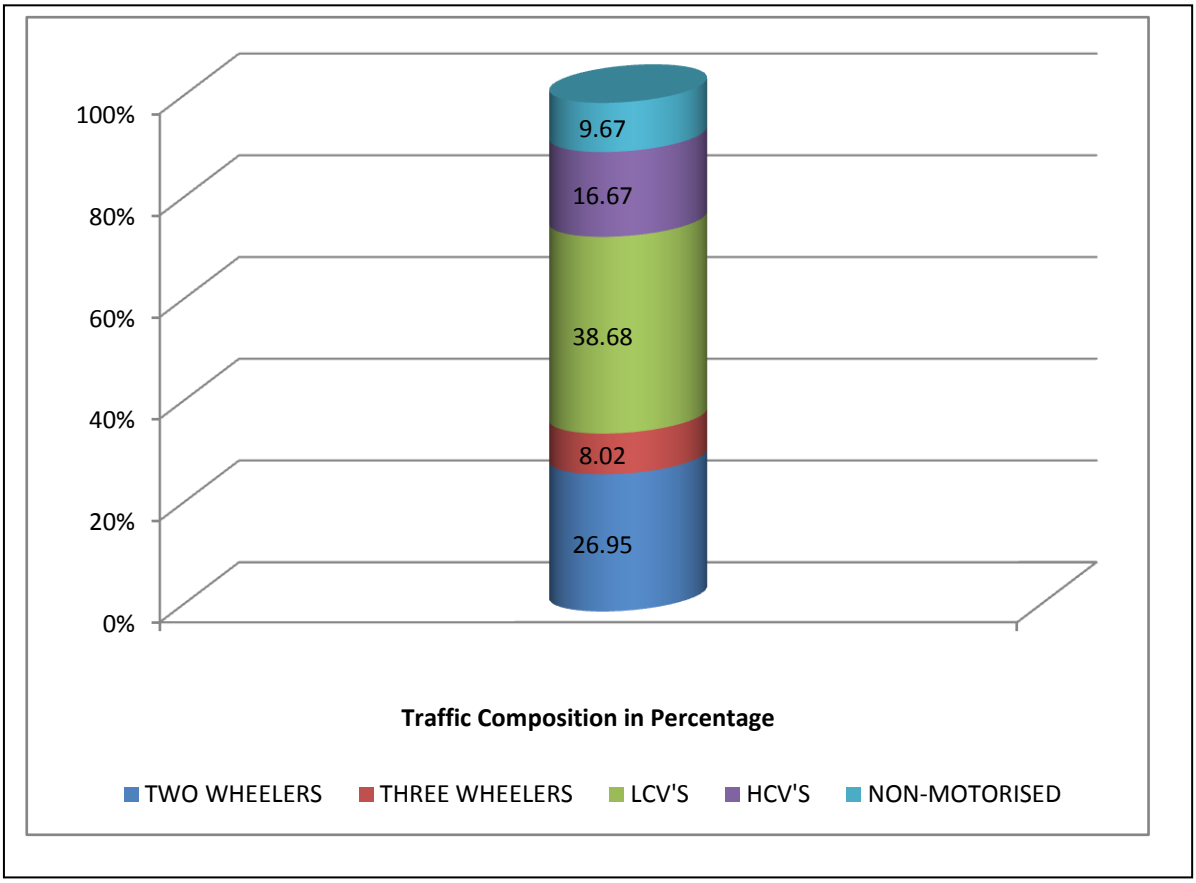
Figure 4.12: Traffic Observations



Traffic composition

The traffic composition observed for the surveyed road had significant volume (38.7%) of Light commercial Vehicle (LCV) followed by two wheelers (26.9%). The vehicle composition observed is graphically depicted as **Figure 4.13.**

Figure 4.13: Traffic Composition Observed



4.3 Biological Environment

A primary ecological assessment and survey was undertaken at the project site and the study area of 10km radius to understand the existing flora and fauna. The primary survey was conducted in the month of March 2011.

4.3.1 Overview of the Project Site

The proposed project site is located on a sprawling ridge-top forming a large nine-armed plateau. The south-western part of the expanse is locally referred to as ‚Jire Pathaar' and has the highest point on the plateau, at an elevation of approximately 956 m above the mean sea-level. The slopes of the ridge are fairly steep and deeply gullied, such that the sides of the ridge are carved into several small catchments, with seasonal streams forming in each.

The ridge-slopes are designated as Reserve Forests coming under the purview of the State Forest Department. The natural vegetation of the forests comprise of hardier species of shrubs and seasonal herbs, relatively inaccessible to humans and their domestic animals. The vegetation is supported only by loose rocky soil. Herbaceous species such as *Lepidagathis cristata* and *Striga densiflora*, shrub-species such as *Canthium coromandelicum* and tree-species such as *Bauhinia racemosa* were observed growing on the plateau. Two groups of Indian Coursers were sighted foraging on the plateau, while a pair of Painted Sandgrouse was sighted at the edge of the plateau.

A number of hamlets and villages, like Katrewadi, Manewadi, Puklewadi, Bhakrewadi, Karandewadi, Valai and Virle, dot the lower slopes and base of the ridge, located strategically along one or the other of the many streams originating from the ridge. These streams are important channels transporting water, soil and nutrients from the ridge to these human habitations and their farmlands. The ridge-top plateau itself acts as a pastureland for the villagers‘ cattle, sheep and goats.

4.3.2 Vegetation in the Study area

Natural Vegetation

The natural vegetation of the study area is mostly in the form of an open, low forest in which thorny, mostly hard-wooded, species predominate and shape the overall character of the vegetation. The trees tend to have short boles and low-branching crowns that meet only rarely, resulting in little or no canopy-formation. There is a very loosely-defined lower storey, composed of small trees and large shrubs, many of which are thorny/ spiny or show other xerophytic characters. The ground-cover is diverse, varying from penetrating herbs and grasses, in areas of relatively deep and moist soil-conditions, to annuals and ephemerals, in areas of dry, shallow, gravelly soil.

- *Pongamia pinnata* and *Syzigium cumini* are typically found in the beds or on the banks of streams and rivulets.
- *Ailanthus excelsa, Azadirachta indica, Dalbergia sissoo* and *Ficus bengalensis* line the bigger roads, while *Acacia nilotica, Ficus sp, Holoptelea integrifolia, Tamarindus indica* and *Thespesia populnea* are common along interior roads, on field boundaries and around village-houses.
- *Prosopis juliflora*, introduced into the region through social forestry schemes as an alternative fuel-wood, has invaded large tracts.
- A number of smaller exotic plants, notably, *Amaranthus sessilis* and *Parthenium hysterophorus*, are seen to have become ubiquitous - the former, was observed along most paths and field edges, and the latter, in and around most of the farmland. Patches of *Opuntia dillenia,* an exotic cactus now considered naturalized in the region were also observed.
- Water-logged soil is invariably found infested with *Ipomoea carnea*, an exotic weed associated with artificial wetlands.

Vegetation of Habitations, Farmlands, Orchards and Plantations

Species cultivated around homesteads include mainly fruit-trees like *Annona reticulata, Annona squamosa, Carica papaya, Cocos nucifera, Mangifera indica, Moringa oleifera* and *Psidium guyava*, shrubs like *Ricinus communis*, climbers/creepers of various gourds used as vegetables like *Coccinea indica, Cucurbita maxima* and *Momordica charantia,* and shrubs and herbs cultivated for their flowers, such as *Canna indica, Hibiscus rosa-sinensis* and *Ixora coccinea.*

- Farmlands held crops of mainly winter-cereals like Wheat (*Triticum aestivum*), Maize (*Zea mays*), Great millet (*Sorghum halapense*) and Pearl millet (*Pennisetum typhoideum*). Sugarcane (*Saccharum officinale*) crops were observed in irrigated farmlands.

- Pulses like Pigeon pea (*Cajanus cajan*) and Chick pea (*Cicer arietinum*); oil-seeds like Sunflower (*Helianthus annuus*) and Castor (*Ricinus communis*) were observed to a lesser extent.
- Vegetables like Brinjal (*Solanum melongena*), Cabbage (*Brassica oleracea capitata*), Capsicum/ Chili (*Capsicum frutescens*), Tomato (*Lycopersicum esculentum*) and Onion (*Allium cepa*) also observed in limited areas.
- An occasional floricultural farm of Marigold (*Calendula officinalis*) was observed.
- Other observations include rchards of Banana (*Musa sapientum*), Coconut (*Cocos nucifera*), Grape (*Vitis vinifera*), Mango (*Mangifera indica*), Papaya (*Carica papaya*) and Pomegranate (*Punica granatum*).
- Plantations in the area comprise trees like *Acacia auriculiformes, Dalbergia sissoo, Eucalyptus sp., Gliricidia sepium, Leucaena latisiliqua* and *Tectona grandis*.

4.3.3 Classification of the Vegetation

According to the Champion and Seth Classification of Indian Forests, the natural vegetation of the study area represents the following different forest-types:

Type 5A/C1a (Sub-group 5A – Southern Tropical Dry Deciduous Forest, Sub-division C1a - Very Dry Teak Forest)

These forests occur where there is rainfall of less than 900 mm, dry and infertile soil, scanty ground-cover, annual fires and heavy grazing. It is a very open forest supported by shallow, stony soils.

- Species associated with such forests include: Trees like *Acacia leucophloea, Aegle marmelos, Anogeissus latifolia, Azadirachta indica, Bombax ceiba, Boswellia serrata, Butea monosperma, Cassia fistula, Cochlospermum religiosum, Cordia dichotoma, Dalbergia latifolia, Diospyros melanoxylon, Emblica officinalis, Flacourtia indica, Hardwickia binata, Holoptelea integrifolia, Lannea coromandelica, Madhuca indica, Phoenix sylvestris, Tamarindus indica, Tectona grandis, Terminalia tomentosa, Wrightia tinctoria and Zizyphus spp.;*
- Bamboos like *Dendrocalamus strictus*;
- Shrubs *like Carissa congesta, Euphorbia spp., Helicteres isora, Holarrhena pubescens, Lantana camara, Maytenus spp., Securinega leucopyrus, Woodfordia fruticosa and Zizyphus spp*.
- Herbs like species of *Acanthaceae family, Atylosia spp., Cassia spp., Ocimum spp., Sida spp., Spermacoce spp. and Tridax procumbens;* and
- Grasses like Apluda mutica, Aristida spp., Chrysopogon fulvus, Dicanthium annulatum, Eragrostis spp., Heteropogon contortus and Themeda quadrivalvis.

Type 5A/C3 (Sub-group5A – Southern Tropical Dry Deciduous Forest, Sub-division C3 – Southern Dry Mixed Deciduous Forest)

These forests are characterized by the occurrence of thorny plants which increases in proportion to the extent of grazing to which the area is subjected. Bamboos are often absent, and of poor quality when present. Climbers are generally few. Grass is very conspicuous unless it is grazed down or burnt.

- Species associated with such forests include: Trees like *Acacia leucophloea, Acacia nilotica, Aegle marmelos, Albizzia spp., Anogeissus latifolia, Azadirachta indica,*

Balanites aegyptica, Bauhinia spp., Boswellia serrata, Butea monosperma, Cochlospermum religiosum, Dolichandrone falcata, Flacourtia indica, Heterophragma quadriloculare, Ixora arborea, Lannea coromandelica, Melia azedarach, Morinda tinctoria, Santalum album, Stereospermum personatum, Syzigium cumini, Tectona grandis, Terminalia bellerica, Terminalia tomentosa and Vitex negundo;

- Bamboos like *Dendrocalamus strictus;*
- Shrubs like *Capparis decidua, Carissa congesta, Grewia spp., Helicteres isora, Holarrhena pubescens, Justicia adhatoda, Lantana camara, Maytenus spp., Randia dumetorum, Woodfordia fruticosa and Zizyphus spp.;*
- Herbs like *Achyranthes aspera, Abutilon spp., Cassia spp., Corchorus spp. and Indigofera spp*.; and
- Grasses like *Apluda sp., Aristida sp., Chloris sp., Chrysopogon fulvus, Dicanthium annulatum, Eragrostis spp., Heteropogon contortus, Iseilema sp., Panicum sp. and Themeda quadrivalvis.*

Type 5/DS4 (Group 5 – Tropical Dry Deciduous Forests, Degradation Stage DS4 – Dry Grassland)

The dominant grass-cover in dry deciduous forests is the *Sehima-Dicanthium* type. Characteristic species associated with this type include *Chrysopogon fulvus, Cymbopogon spp., Eremopogon foveolatus, Heteropogon contortus, Sehima nervosum* and *Themeda sp.* on hills and hill-slopes, while the deeper soils of plateaus and valleys support *Bothriochloa pertusa, Cynodon dactylon* and *Dicanthium annulatum*.

Deteriorated grasslands are characterized by the presence of far more annual species like *Aristida spp., Andropogon pumilus, Chloris spp., Eragrostis spp., the annual form of Heteropogon contortus* and *Melanocenchris royleana*.

Type 6A/C1 (Sub-group 6A - Southern Tropical Thorn Forest, Sub-division C1 – Southern Thorn Forest)

These forests are met with on shallow dry soil, or deep but sandy soil. The ground is usually flat or in the form of low undulating hills and plateaux.

- Species associated with this type include:Trees like *Acacia leucophloea, Acacia latronum, Acacia nilotica, Aegle marmelos, Ailanthus excelsa, Albizzia spp., Anogeissus latifolia, Azadirachta indica, Balanites aegyptica, Bauhinia racemosa, Capparis decidua, Capparis divaricata, Cassia fistula, Cordia dichotoma, Dichrostachys cinerea, Dolichandrone falcata, Ficus spp., Flacourtia indica, Gardinia gummifera, Grewia tiliaefolia, Ixora arborea, Phoenix sylvestris, Prosopis spicigera, Randia spp., Santalum album, Strychnos spp. and Zizyphus mauritiana;*
- Shrubs like *Calotropis spp., Canthium spp., Carissa congesta, Cassia auriculata, Dodonaea viscosa, Euphorbia spp., Lantana camara, Maytenus spp., Mimosa hamata and Zizyphus spp.;*
- Herbs like *Cardiospermum halicacabum, Opuntia elatior and Pergularia daemia*; and
- Grasses like *Aristida spp., and Heteropogon contortus.*

Ecologically, such thorny woodlands and grasslands are considered to be the effect of excessive cutting and browsing, and thus, not a true climatic formation. Protection of such an area is likely to lead to the regeneration of elements of a tropical dry deciduous forest.

4.3.4 Methodology of Assessment

A total of 28 locations were identified within the study area such that a range of ecosystem and land-use types were represented. These identified sites fall into four quartiles depending on the direction in which they lie with reference to the project site. Seven locations each are located within the south-west, north-west, north-east and south-east quartiles, respectively, considering the project site as the centre.

Three more quadrats sites were identified within the project-site itself, representing relatively different micro-habitats. At each site, a study of floral diversity was carried out in the following manner:

- A quadrat of approximately 20 m x 20 m was marked. The species of trees, shrubs and large climbers, as well as the number of individuals of each species, falling within this area were noted.
- A quadrat of approximately 5 m x 5 m was marked within this larger quadrat. The species of herbs, both grasses and forbs, and the number of individuals of each species, falling within this area were noted.
- Smaller quadrats of 1m x 1 m, for the more prolifically-growing larger herbs, and 10 cm x 10 cm, for prolifically-growing minute herbs, were employed when required.
- At each site, faunal diversity was studied through direct evidence, in the form of visual sightings, and indirect evidence, such as calls, nests, burrows, droppings, scats, moults, tracks, etc.

The biodiversity of the study area was then evaluated in terms of:

- species richness of the woody and non-woody florae, and the avifauna,
- percentage frequency, abundance and density of each floral species, and
- percentage frequency of each bird species

The details of the sites surveyed are provided in **Table 4.14.**

Table 4.14: Locations Surveyed for Ecological Assessment

Quadrat no.	Location	Elevation (m)	Nearest village(s)	Description of site
South-west Quartile				
1	N 17° 27‘ 07.8, E 74° 34‘ 50.3	716	Mayni	Foot-track. Farmland. Well.
2	N 17° 27‘ 10.6, E 74° 36‘ 19.9	730	Vikhle	Dry stream.
3	N 17 °27‘ 47.4, E 74° 38 52.8	772	Mulikwadi	Cart-track. Fallow fields.
4	N 17 °28‘ 36.8, E 74° 36 42.2	758	Dhokalwadi	Gullied slope. Open scrub.
5	N 17 °30‘ 38.0, E 74° 37 46.9	822	Kukudwadi	Hillside. Valley.
6	N 17 °29‘ 41.7, E 74° 35 43.3	750	Padal, Hivarwadi	Drying stream. Shallow pools.
7	N 17 °30‘ 26.0, E 74° 34 47.3	777	Padal, Datewadi	Open scrub. Fallow fields.
North-west Quartile				
8	N 17 °31‘ 47.2, E 74° 34‘ 29.3	771	Khatwal	Light forest. Dry stream. Well.
9	N 17 °33‘ 50.0, E 74° 35‘ 03.0	780	Yenkul	Cart-track. Ditches.

Quadrat no.	Location	Elevation (m)	Nearest village(s)	Description of site
				Fallow fields.
10	N 17 °34‘ 46.5, E 74° 35‘ 38.8	819	Yenkul, Yalmarwadi	Ridge-top. Gullied slope. Dry pasture.
11	N 17 °31‘ 52.7, E 74° 36‘ 04.3	798	Kanharwadi	Dry stream. Culvert.
12	N 17 °32‘ 29.2, E 74° 36‘ 53.9	886	Agaswadi	Plateau-top. Contour-trenched slope.
13	N 17 °33‘ 22.4, E 74° 38‘ 47.4	734	Dhanavdewadi	Cart-track. Farmland. Well.
14	N 17 °32‘ 36.5, E 74° 38‘ 09.3	749	Maskarwadi	Bund. Groves. Farmland.
North-east Quartile				
15	N 17 °31‘ 43.6, E 74° 40‘ 01.0	771	Puklewadi	Foot of ridge. Farmland.
16	N 17 °34‘ 54.6, E 74° 40‘ 44.1	693	Vadlaj	Lake. Islands.
17	N 17 °32‘ 56.4, E 74° 41‘ 12.4	740	Margalwadi	Plateau-top. Dry pasture.
18	N 17 °31‘ 29.2, E 74° 42‘ 13.8	733	Valai, Virali	Slope. Ditch. Tar-road.
19	N 17 °32‘ 59.4, E 74° 43‘ 01.9	674	Ramoswadi	Drying stream. Banks.
20	N 17 °34‘ 03.0, E 74° 44‘ 10.0	649	Panwan	Plateau-top. Open-scrub. Cart-track.
21	N 17 °34‘ 10.8, E 74° 45‘ 46.8	629	Jambhulni	Dry stream. Cobbled road.
South-east Quartile				
22	N 17° 26‘ 56.4, E 74°40‘ 10.9	808	Kaledhon	Ridge. Open scrub.
23	N 17 °27‘ 12.6, E 74°40‘ 54.2	829	Taraskhind, Vaghuba	Valley-head. Steep slopes.
24	N 17°28‘ 51.9, E 74°40‘ 41.9	802	Garudi (Garwadi)	Valley-floor. Farmland.
25	N 17° 28‘ 15.5, E 74°41‘ 57.5	753	Garudi (Garwadi), Gulewadi	Dry stream. Foot-track. Farmland.
26	N 17° 27‘ 43.1, E 74°43‘ 03.5	734	Vibhutwadi	Fallow fields. Tar road.
27	N 17 °29‘ 52.1, E 74°43‘ 11.9	740	Korewadi, Landewadi	Open scrub. Dry pasture.
28	N 17 °27‘ 27.9, E 74° 42‘ 18.6	748	Taraswadi	Knoll. Lake.
29	N 17 °30‘ 36.1, E 74° 39‘ 42.9	935	Katrewadi	Plateau-top. Open scrub.
30	N 17° 30‘ 45.7, E 74° 39‘ 49.8	940	Katrewadi	Plateau-edge. Rocky patch.
31	N 17° 30‘ 56.4, E 74° 39‘ 44.8	951	Katrewadi	Plateau-edge. Gentle slope. Drying ditches.

4.3.5 Observed Floristic Diversity

Three phyto-sociological parameters, viz. frequency, density and abundance are measured to determine the distribution and ecological aspects of the species.

- Frequency is expressed in percentage and indicates dispersion of species in a community. It is calculated by dividing the number of quadrats of occurrence of a species by the total number of quadrats taken and multiplying it by 100 to express as a percentage.
- Density indicates numerical strength of plants in a community and implies number of plants in a unit area. It is expressed as individuals per hectare for woody species and climbers and as individuals per sq meter for the herbaceous species. The total number of individuals encountered in the area studied is converted into individuals

per hectare (10000sqm) for woody plants and per one square meter for herbaceous species.

- Abundance is a reflection of how evenly the species is distributed within the sampled area. It is calculated by dividing the total number of individuals of a species by the total number of quadrats in which that species occurs. The quadrats, in which the species is not found, are not considered at all for obtaining the abundance value. It is an absolute value without any units. The formulae used for calculation of the three parameters are based upon Misra (1974).

Table 4.15: Floristic Diversity - Woody Flora

Species	Habit	% frequency	Abundance	Density per ha
Acacia farnesiana	Tree	3.23	1	0.81
Acacia leucophloea	Tree	22.58	1.29	7.29
Acacia nilotica	Tree	80.65	1.64	33.21
Ailanthus excels	Tree	12.90	0.75	2.43
Albizzia lebbek	Tree	3.23	1	0.81
Anogesisus latifolia	Tree	6.45	1	1.62
Anona reticulate	Tree	6.45	1	1.62
Anona squamosa	Tree	3.23	1	0.81
Azadirachta indica	Tree	70.97	1.91	34.02
Balanites aegyptica	Tree	9.68	1.67	4.05
Bauhinia racemosa	Tree	3.23	1	0.81
Butea monosperma	Tree	9.68	2.67	6.48
Calotropis gigantean	Shrub	16.13	1.4	5.67
Calotropis procera	Shrub	9.68	1	2.43
Canthium coromandelicum	Shrub	6.45	9.5	15.39
Capparis deciduas	Shrub	3.23	1	0.81
Carissa congesta	Shrub	3.23	1	1.29
Cassia auriculata	Shrub	61.29	1.58	38.7
Cassia siamea	Tree	6.45	1	1.62
Cocos nucifera	Tree	3.23	1	0.81
Cordia dichotoma	Tree	3.23	1	0.81
Cryptostegia grandiflora	Shrub	38.71	1.66	16.2
Dalbergia sissoo	Tree	16.13	1.8	7.29
Dendrocalamus strictus	Bamboo	9.68	5.33	12.96
Eucalyptus sp.	Tree	9.68	1	2.43
Ficus arnottiana	Tree	35.48	1.72	15.39
Ficus glomerata	Tree	9.68	1.33	3.24
Ficus heterophylla	Shrub	3.23	1	0.81
Ficus retusa	Tree	3.23	1	0.81
Ficus rumphii	Tree	3.23	1	0.81
Flacourtia sp.	Tree	3.23	1	0.81
Holoptelea integrifolia	Tree	3.23	1	0.81

Species	Habit	% frequency	Abundance	Density per ha
Ipomoea carnea	Shrub	25.81	3	30.96
Jatropha curcas	Tree	16.13	1	4.05
Justicia adhatoda	Shrub	3.23	1	0.81
Kirganellia reticulate	Shrub	3.23	2	1.62
Lannea coromandelica	Tree	16.13	1	4.05
Lantana camara	Shrub	64.52	2.7	69.66
Leucaena latisiliqua	Tree	22.58	1	5.67
Mangifera indica	Tree	9.68	2	4.86
Maytenus rothiana	Shrub	3.23	4	3.24
Melia azedarach	Tree	3.23	1	0.81
Moringa oleifera	Tree	9.68	1	2.43
Nerium indicum	Shrub	3.23	1	0.81
Phoenix sylvestris	Tree	3.23	1	0.81
Pithecolobium dulce	Tree	6.45	2.5	4.05
Pongamia pinnata	Tree	45.16	3.43	38.88
Prosopis juliflora	Tree	32.26	2.4	19.44
Prosopis spicigera	Tree	6.45	1.5	2.43
Santalum album	Tree	9.68	1.33	3.24
Securinega leucopyrus	Shrub	3.23	1	1.29
Sesbania grandiflora	Tree	3.23	1	0.81
Syzigium cumini	Tree	9.68	1.33	3.24
Tamarindus indica	Tree	6.45	1.5	2.43
Tarenna asiatica	Tree	3.23	1	0.81
Terminalia tomentosa	Tree	3.23	2	1.62
Vitex negundo	Tree	38.71	2.5	24.3
Woodfordia fruticosa	Shrub	3.23	1	1.29
Zizyphus mauritiana	Tree	19.35	1.83	8.91
Zizyphus nummularia	Shrub	48.39	1.4	27.09
Zizyphus oenoplia	Shrub	6.45	1.5	2.43

Table 4.16 : Floristic Diversity –Non woody flora

Species	Habit	% frequency	Abundance	Density per m^2
Achyranthes aspera	Herb	3.22	3	0.09
Aerua lanata	Herb	3.22	1	0.03
Agave americana	Herb	19.35	1.66	0.3
Aloe vera	Herb	3.22	1	0.03
Alternanthera sessilis	Herb	12.90	1	0.12
Amarantus spinosus	Herb	6.45	2	0.12
Apluda sp.	Grass	16.13	2.2	0.33
Argemone mexicana	Herb	25.80	2	0.48

Species	Habit	% frequency	Abundance	Density per m^2
Aristida sp.	Grass	29.03	11.78	3.18
Asclepias curassavica	Herb	3.22	3	0.09
Atylosia scarabioides	Climber	3.23	1	0.03
Blumea lacera	Herb	41.94	2.61	1.02
Canscora diffusa	Herb	9.68	4	0.36
Cardiospermum halicacabum	Climber	3.23	1	0.03
Celosia argentea	Herb	3.23	2	0.06
Cenchrus sp.	Grass	6.45	2	0.12
Chloris sp.	Grass	32.26	1.8	0.54
Chrysopogon fulvus	Grass	25.81	1.75	0.42
Cocculus hirsutus	Climber	3.23	1	0.03
Cyathocline purpurea	Herb	3.23	1	0.03
Cymbopogon sp.	Grass	6.45	1	0.06
Cynodon dactylon	Grass	51.61	24.56	11.79
Cyperus sp.	Herb	9.68	1.33	0.12
Dicanthium annulatum	Grass	6.45	1.5	0.09
Echinops echinatus	Herb	16.13	1	0.15
Eclipta alba	Herb	3.23	1	0.03
Eragrostis sp.	Grass	6.45	3	0.18
Euphorbia hirta	Herb	6.45	1.5	0.09
Exacum pedunculatum	Herb	3.23	1	0.03
Hemidesmus indicus	Herb	3.23	1	0.03
Heteropogon contortus	Grass	35.48	2.54	0.84
Hyptis suaveolens	Herb	3.23	2	0.06
Indigofera cordifolia	Herb	12.90	15.5	1.86
Ipomoea obscura	Climber	3.23	1	0.03
Justicia sp.	Herb	3.23	1	0.03
Launaea procumbens	Herb	3.23	1	0.03
Lavandula bipinnata	Herb	16.13	1.2	0.18
Lepidagathis cristata	Herb	3.23	1	0.03
Leucas aspera	Herb	16.13	1.6	0.24
Lophopogon tridentatus	Grass	3.23	1	0.03
Melanocenchris royleana	Grass	3.23	3	0.09
Ocimum canum	Herb	3.23	1	0.03
Ocimum sanctum	Herb	3.23	2	0.06
Opuntia elatior	Herb	3.23	8	0.24
Parthenium hysterophorus	Herb	48.39	2.66	1.2
Pergularia daemia	Climber	3.23	2	0.06
Peristrophe paniculata	Herb	3.23	1	0.03
Phyla nodiflora	Herb	3.23	9	0.27
Plectranthus sp.	Herb	6.45	2.5	0.15

Species	Habit	% frequency	Abundance	Density per m^2
Polygala elongata	Herb	9.68	1	0.09
Rungia repens	Herb	6.45	2	0.12
Scoparia dulcis	Herb	3.23	1	0.03
Senecio edgeworthii	Herb	9.68	1.66	0.15
Sesbania bispinosa	Herb	3.23	1	0.03
Sida acuta	Herb	3.23	1	0.03
Solanum surratense	Herb	3.23	1	0.03
Spermacoce pusilla	Herb	3.23	1	0.03
Striga densiflora	Herb	3.23	1	0.03
Themeda sp.	Grass	3.23	7	0.21
Tridax procumbens	Herb	61.29	1.73	0.99
Triumfetta rhomboidea	Herb	3.23	1	0.03
Typha angustata	Herb	12.90	1.75	0.21
Vernonia cinerea	Herb	22.58	1.43	0.3
Xanthium indicum	Herb	3.23	1	0.03

4.3.6 Useful Plants in the Study Area

The direct dependence of the local populace upon the plants observed within the study area takes essentially three forms – utilization as food, for traditional medicinal purposes and a range of secondary uses

Uncultivated Food Plant

Uncultivated food-plants in the area include: *Acacia nilotica (tender pods), Amarantus spinosus (tender shoots, leaves), Azadirachta indica (ripe fruits), Capparis decidua (raw fruits), Celosia argentea (tender shoots, leaves), Cordia dichotoma (fruits), Euphorbia hirta (tender shoots, leaves), Leucas aspera (tender shoots, leaves), Mangifera indica (fruits), Moringa oleifera (leaves, flowers, pods), Opuntia elatior (fruits), Phoenix sylvestris (sap, pith, fruits), Pithecolobium dulce (fruits), Prosopis spicigera (pods), Solanum surratense (tender leaves), Syzigium cumini (fruits), Tamarindus indica (tender leaves, fruits), Zizyphus mauritiana & Z. oenoplia (fruits).*

Medicinal Plants

Medicinal Plants in the area comprises of *Achyranthes aspera* (roots, seeds), *Alternanthera sessilis* (plant), *Azadirachta indica* (leaves, seeds), C*alotropis gigantea* (latex), *Euphorbia hirta* (plant), *Leucas aspera* (leaves), *Melia azedarach* (leaves, seeds), *Pongamia pinnata* (seeds), *Santalum album* (wood), *Sida acuta* (roots, leaves), *Solanum surratense* (roots), *Typha angustata* (seed-fibre), *Vernonia cinerea* (roots, leaves, seeds), *Vitex negundo* (leaves).

Secondary-use Plants

Secondary use plants in the area consists of *Agave americana* (plant-fibre for rope), *Cryptostegia grandiflora* (plant for rubber, bark-fibre for fishing-lines), *Gliricidia sepium* (leaves for manure), *Ipomoea carnea* (twigs for fishing-net floats), *Pongamia pinnata* (seed-

oil for lamps), *Sesbania bispinosa* (leaves for manure), *Sida acuta* (stem-fibre for rope), *Vitex negundo* (leaves as pest-repellant).

4.3.7 Faunal Survey of the Area

Any animal species or their markings were observed and recorded at each of the four zones. Due to the short duration of the survey many of the wild animals were not observed. The population sizes of the observed species were also low. Animal presence was measured both through direct sightings and by indirect measures, such as scats etc. Visual observations were recorded in the quadrates.

Avifauna

The detailed avifaunal study has been done by Dr. Bharat Jethva and the report is annexed as **Annex H**.

Vertebrate Fauna

The other vertebrate fauna observed in the area includes both mammals and reptiles. The list of species has been provided below. Besides these, shoals of fish and amphibious life were observed in the waters of the lakes and ponds.

Mammals: such as Hanuman Langur (*Semnopithecus entellus*), Grey Mongoose (*Herpestes edwardsii*), Three-striped Palm Squirrel (*Funambulus palmarum*), as also, two types of bats - Indian Flying Fox (*Pteropus giganteus*) and Pipistrelles (*Pipistrellus sp.*);

Reptiles: such as Indian Garden Lizard (*Calotes versicolor*), Fan-throated Lizard (*Sitana ponticeriana*), Keeled Grass Skink (*Mabuya carinata*) and Bengal Monitor (*Varanus bengalensis*).

Villagers interviewed reported the presence of following mammal and reptile species:

Mammals: such as Indian Gazelle (*Gazella bennettii*)(locally called ‗Hareen‘), Striped Hyena (*Hyaena hyaena*)(locally called ‗Toros‘), Wolf (*Canis lupus*)(locally called ‗Laandga‘), Indian Fox (*Vulpes bengalensis*)(locally called ‗Kolha‘), Jungle Cat (*Felis chaus*)(locally called ‗Khokad‘), Indian hare (*Lepus nigricollis*)(locally called ‗Sasa‘) and Indian Porcupine (*Hystrix indica*)(locally called ‗Salindar‘);

Reptiles: such as Indian Rock Python (*Python molurus*)(locally called ‗Ajgar‘), Indian Rat Snake (*Ptyas mucosa*)(locally called ‗Dhaaman‘), Indian Krait (*Bungarus caeruleus*)(locally called ‗Manyaar‘), Spectacled Cobra (*Naja naja*)(locally called ‗Naag‘) and Russell‘s Viper (*Daboia russelii*)(locally called ‗Ghonas‘).

Bat Diversity

Secondary data suggests the possible presence of the following bat-species in the area:

Indian Flying Fox (Pteropus giganteus), Fulvous Fruit Bat (Rousettus leschenaultia), Lesser Dog-faced Fruit Bat (Cynopterus brachyotis), Greater Mouse-tailed Bat (Rhinopoma microphyllum), Lesser Mouse-tailed Bat (Rhinopoma hardwickii), Blyth's Horseshoe Bat (Rhinolophus lepidus), Least Horseshoe Bat (Rhinolophus pusillus), Dusky Leaf-nosed Bat (Hipposideros ater), Schneider's Leaf-nosed Bat (Hipposideros speoris), Fulvous Leaf-nosed Bat (Hipposideros fulvus), Cantor's Leaf-nosed Bat (Hipposideros galeritus), Greater False

Vampire (Megaderma lyra), Lesser False Vampire (Megaderma spasma), Egyptian Free-tailed Bat (Tadarida aegyptica), Asiatic Greater Yellow House Bat (Scotophilus heathii), Indian Pipistrelle (Pipistrellus coromandra), Indian Pygmy Bat (Pipistrellus tenuis), Kelaart's Pipistrelle (Pipistrellus ceylonicus) and Dormer's Bat (Pipistrellus dormeri).

Invertebrate Fauna

Invertebrate fauna observed within the study area was plentiful and diverse, including a variety of butterflies, dragonflies, damselflies, grasshoppers, pond-skaters, bugs, beetles, wasps, bees, ants, spiders and molluscs.

Tortoise-shell beetles were spotted on many *Ipomoea carnea* plants. Ant-nests and termite-hills were commonly seen, the latter, usually at the bases of isolated trees. So were tunnel-spider webs, amidst the drying grass. A bee-hive was spotted in a large *Azadirachta indica* tree near Vikhle. Wasps buzzed around the spring flowers. Bag-worm cases were suspended from, and insect-cocoons plastered to, twigs of shrubs and trees. Crab-burrows could be observed in the damp soil around the lakes, ponds and drying streams. Ant-lion traps were spotted in the soft, fine dust left exposed by steadily shrinking pools. Pond-skaters, water-beetles and insect-larvae were sighted in most water-bodies.

Butterflies sighted during the survey include Common Mormon, Lime Butterfly, Common Grass Yellow, Common Emigrant, Common Wanderer, Tiny Grass Blue, Striped Tiger, Plain Tiger, Common Crow, Baronet, Angled Castor and Lemon Pansy.

Butterfly Diversity and Migration

Dry tracts of thorn forests dominated by *Acacia sp*., and accompanied by scrub and grasslands, are known to be ideal for butterflies like Grass Blue, Grass Jewel, Painted Lady, Joker, Blue Pansy, Danaid Eggfly, Mottled Emigrant, Pioneer, Common Gull, Crimson Tip, Silverlines, Large Oakblue, Indian Oakblue, Red Flash, Rounded Pierrot, Salmon Arab, Crimson Rose, Spot Swordtail and Lime Butterfly.

The proposed project area falls within the migration route of the unique multi-species Milkweed butterfly group. Several hundreds of these fly southwest-northeast towards the Eastern Ghats and Plains, and back. En route, they are known to congregate and breed wherever there is a good stock of their food-plants. The food plants include *Calotropis gigantean*, *Calotropis procera, Cryptostegia grandiflora* and *Pergularia daemia* that are found in abundance in the study area.

Protection Status of Higher Fauna

The following faunal species from Wildlife Protection Act Schedules I and II are associated with the region in which the study area is located:

Table 4.17: Protection Status

Name	IUCN Status/WPA Schedule Number
Bonnet Macaque	*Lower Risk / II*
Hanuman Langur	*Lower Risk / II*
Blackbuck	*Vulnerable / I*
Four-horned Antelope	*Vulnerable / I*
Indian Gazelle	*Lower Risk / I*
Sloth Bear	*Vulnerable / I*

Name	IUCN Status/WPA Schedule Number
Jackal	*Lower Risk / II*
Wolf	*Data Deficient / I*
Indian Fox	*Lower Risk / II*
Common Leopard	*Lower Risk / I*
Jungle Cat	*Lower Risk / II*
Rusty-spotted Cat	*Vulnerable / I*
Honey Badger	*Lower Risk / I*
Smooth-coated Otter	*Vulnerable / II*
Small Indian Civet	*Lower Risk / II*
Grey Mongoose	*Least Concern / II*
Indian Pangolin	*Lower Risk / I*
Indian Bustard	*Endangered / I*
Lesser Florican	*Endangered / I*
Osprey	*Least Concern / I*
Egyptian Vulture	*Endangered / I*
White-Rumped Vulture	*Critically Endangered / I*
Long-Billed Vulture	*Critically Endangered / I*
Red-Headed Vulture	*Critically Endangered / I*
Shikra	*Least Concern / I*
Red-necked Falcon	*Least Concern / I*
Eurasian Spoonbill	*- / I*
South Asian Chameleon	*- / II*
Bengal Monitor	*Least Concern / II*
Indian Rock Python	*Near Threatened / II*
Indian Rat Snake	*- / II*
Spectacled Cobra	*- / II*
Russell's Viper	*- / II*

4.3.8 Endemic Flora and Fauna

Endemism observed in the Dry Deciduous and Thorn Forests of the Deccan Plateau is very little. The few endemic or near-endemic species associated with the region in which the study area is located include:

- *Kondana Rat (Millardia kondana) – endemic to the Pune district of Maharashtra,*
- *Schneider's Leaf-nosed Bat (Hipposideros speoris) and Fulvous Leaf-nosed Bat (Hipposideros fulvus) – both endemic to the Indian sub-continent,*
- *Indian Bustard (Ardeotis nigriceps) – endemic to India,*
- *Lesser Florican (Sypheotides indica) – endemic to the Indian sub-continent,*
- *Bristled grassbird (Chaetornis striatus) – endemic to the Indian sub-continent and*
- *Syke's Lark (Galerida deva) – endemic to the central and north-western Deccan Plateau.*

4.3.9 Biodiversity Indices

The biodiversity indices were calculated for all the four quartiles. As indicated by the biodiversity indices, the south-western quartile of the survey area has the comparatively richer plant-diversity.

Table 4.18: Biodiversity Indices

Quartile	Quadrat Nos	Species Richness (Woody flora)	Species Richness (Non-woody flora)	Shannon Index (Woody flora)	Shannon Index (Non-woody flora)
SW	1 - 7	45	45	3.40882	2.87918
NW	8 - 14	32	24	2.97941	1.84206
NE	15 - 21	27	28	2.95725	1.77802
SE	22 - 28	24	24	2.78276	2.30226

The Species richness of avifauna was calculated as eighty six (**86**).

4.3.10 Ecologically Important Sites

Western Ghats

The proposed project area falls in the Western Ghats. The Ministry of Environment and Forests constituted a Western Ghats Ecology Expert Panel (WGEEP) in the year 2010 to assess the current status of ecology and make recommendations for conservation, protection and rejuvenation of Western Ghats region. The WGEEP through its report submitted in the year 2011, has recommended the entire Western Ghats to be considered as ecologically sensitive area and has demarcated the area in three zones of varying sensitivity. The criteria used for classification included parameters such as Biodiversity richness, Species Rarity, Habitat Richness and biomass productivity. The project area falls in Man taluka (also known as Dahivadi taluka) which has been classified under the ESZ – 3, the least sensitive zone.

The Mayni Bird Sanctuary

It is located at an aerial distance of approximately 10 km to the south-west of the proposed project-site; this 65-hectare protected area was established in 1985 as a haven for wetland birds. Recorded sightings here comprise a wide range of avian species, including ducks, kingfishers, terns, ibises and storks.

It is known to act as either a wintering area or a staging-point for large numbers of migratory birds, including large migratory avian species such as Sarus Crane (*Grus antigone*), Demoiselle Crane (*Grus virgo*) and Greater Flamingo (*Phoenicopterus rubber*), and is home to the globally-threatened rare non-breeding resident Lesser Florican (*Sypheotides indica*).

Lake at Vadlaj

It is located at an aerial distance of approximately 4 km to the north-east of the proposed project-site. This is a sprawling water-body, with small and large islands formed within. Its relatively shallow waters make it an excellent habitat for wetland birds. The islands, with trees like Acacia nilotica and fringed by reed-beds, provide habitats and safe nesting sites for diverse wetland fauna, greatly enhancing its ecological value.

A number of wetland avian species, both resident and migratory, were sighted here, including Lesser Whistling Duck, Pied Kingfisher, Common Greenshank, Common Sandpiper, Pied Avocet, Little Ringed Plover, River tern, Black-headed Ibis, Black Ibis, Eurasian Spoonbill, Painted Stork and Woolly-necked Stork.

Lake near Taraswadi

Located at an aerial distance of approximately 8 km to the south-east of the proposed project-site, this is a fairly large water-body, a part of its banks bounded by a small earthen ledge, providing shade and shelter.

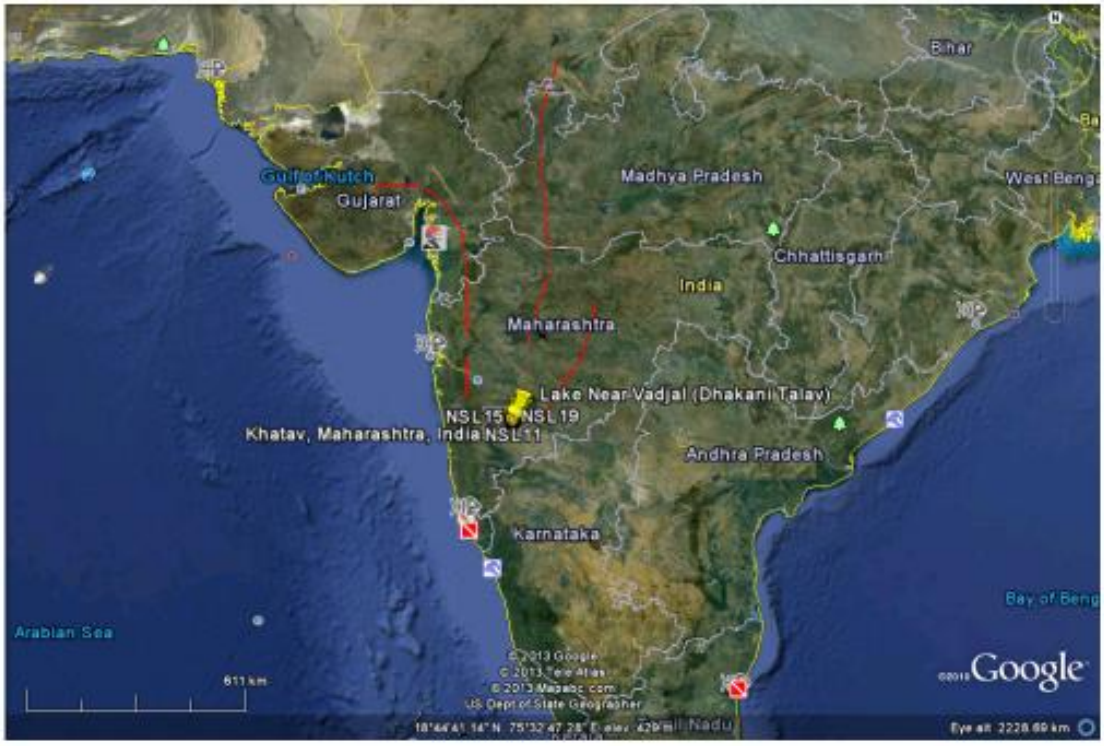
Large flocks of Spot-billed Duck were observed, in its waters and huddled around the sheltered bank, as were a few Garganeys, winter-visitors to the region. Other birds sighted here include migratory species such as Barn swallow and Yellow Wagtail.

Significance of these Areas

The lakes and Mayani sanctuary provides good habitats for winter passing migrants and resident birds. However these water bodies remain dry for most part of the year as they fall in rain shadow area. The main route of bird migration into Indian subcontinent is through Indus and Brahmaputra Flyway. The bird movement once the birds move into Indian subcontinent is not adequately mapped for all species. Many of the bird species identified in the project area are resident species and their movement is not adequately mapped. The resident birds do move around in all the existing lakes in the area in all directions.

Only the migratory route of Greater Flamingoes which is passing migrant at Mayani is roughly available and provided.

Figure 4.14: Indicative Winter Migration Route Greater Flamingo



4.3.11 Inference

The project area can thus be categorized as a mix of modified and natural habitats. The plateau on which the wind turbines will be located has limited human interference, however the vicinities at the foot of the plateau comprise of agricultural land and settlements. The immediate surroundings of the project area does not comprise of any no critical habitats. The

WGEEP report also classifies the study area as the least environmentally sensitive zone (ESZ-3) and allows conditional implementation of projects.

As per the ***ADB Safeguard Requirements for Environment***, projects set up in natural habitats need to design appropriate mitigation measures in order to negate any adverse impacts on the biodiversity of the area. The impacts of the proposed project and mitigation measures are discussed in upcoming sections in this report.

4.4 Socio-economic Environment

The baseline study of the villages falling in the area of influence of the project was conducted to understand the socio-economic setup of the area. The information related to the socio-economic context of the area was collected through:

- Review of secondary literature
- Demographic details from census of India 2001
- Consultation with local community
- Unstructured interviews with affected families
- Interaction with village Panchayat and influential persons
- Consultation with others stakeholders

4.4.1 District and Project area Profile

Satara district is located in the western part of Maharashtra. It is bounded by Pune district to the north, Solapur district to the east, Sangli district to the south and Ratnagiri district to the west. Raigad district lies to its north-west.

District headquarters Satara is located on N.H.4 (Pune-Bangalore highway) at distance of approximately 100 km from Pune. Satara, the seat of Chhatrapati dynasty of Maharashtra, is the highest sugar--producing district in the State, catering to the 12 cooperative sugar factories functioning in its jurisdiction. The district has taken a quantum leap in dairy production and development. The massive Koyna hydroelectric project or the dams at Dhom, Kanheri, Urmodi and Tarali have made the district fertile though some tehsils are still awaiting irrigation. Satara is called the ***District of Power due to a chain of windmills***, which dot its mountain ranges.

The district occupies a total geographical area of 10, 484 sq. km. Satara district is divided into 11 Tehsils and 11 Panchayat Samitis namely Satara, Karad, Wai, Mahabaleshwar, Phaltan, Man, Khatav, Koregaon, Patan, Jaoli and Khandala. There are 8 Nagar Palikas (Municipalities) in Satara that include Satara, Karad, Wai, Mahabaleshwar, Panchgani, Rahimatpur, Phaltan and Mhaswad.

The Satara district is most famous for its religious aspects. There are numerous pilgrimages of various religions located in the district. Another important aspect of the Satara district is its well planned educational system. The Satara district is considered one of the prominent administrative districts in the state of Maharashtra. The district has is rich in its culture, history, economy, education, health and is also counted amongst the largest contributors to the tourism sector of Maharashtra.

The proposed wind farm is located at a distance of about 85 km from district headquarters. The details of the villages falling under the project area influence have been presented in **Table 4.19.**

Figure 4.15: Villages in the Study Area

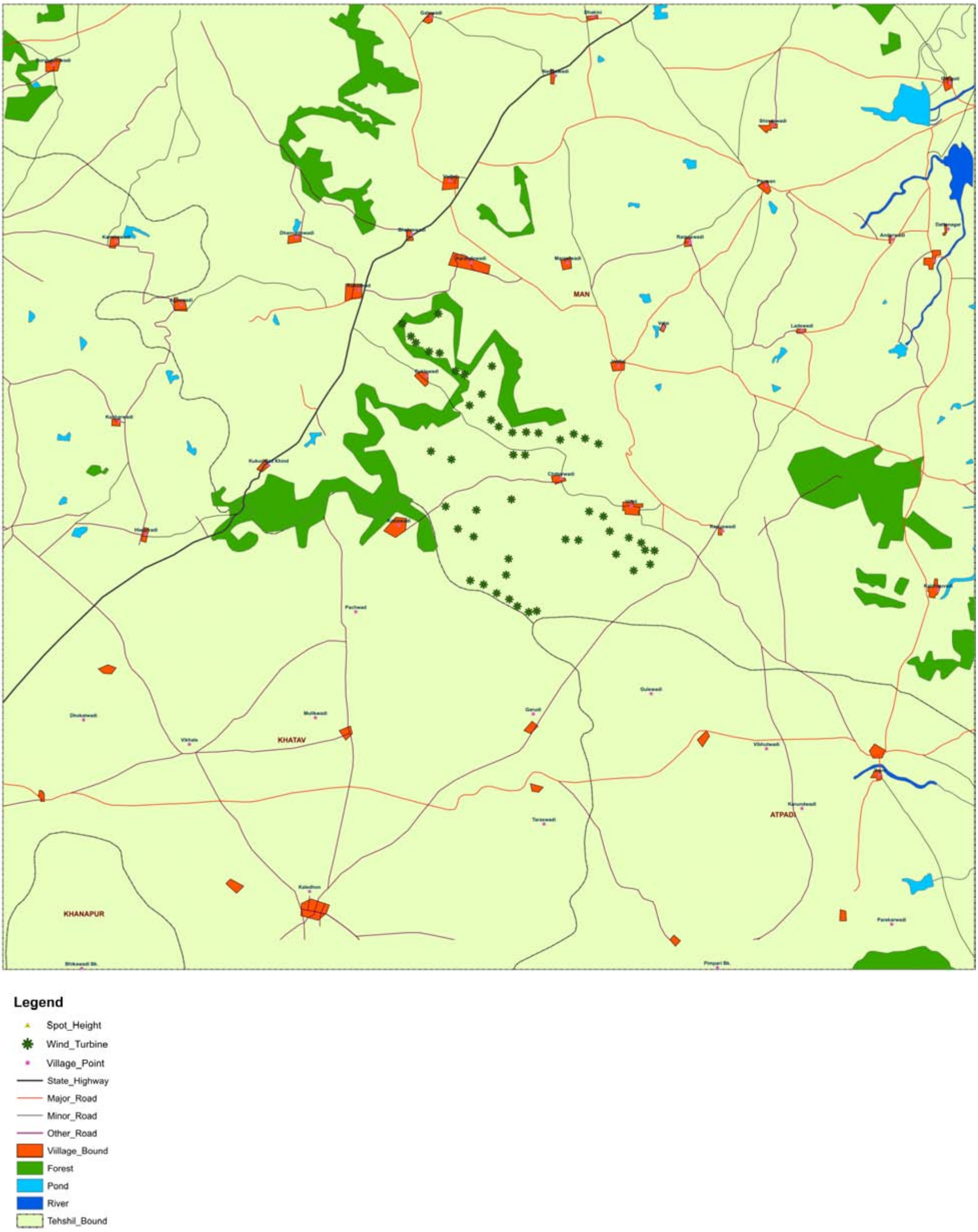


Table 4.19 Project's Area of Influence

S.N.	Name of Village	Tehsil	Distance from Project site	Key Influences from Project
1.	Chilarewadi	Man	~1 Km.	• Land Acquisition revenue village • Location of the Wind Farm
2.	Virali	Man	~1-2 Km.	• Land Acquisition revenue village • Location of the Wind Farm
3.	Puklewadi	Man	~4 Km.	• Land Acquisition revenue village • Location of the Wind Farm

There are a total of 63 land sellers involved for this project. People will be directly affected by land take in only these three villages.

4.4.2 Demographic Profile

The area of influence (AOI) of the project is sited in three villages of Man Tehsil. Rural population comprises approximate 90% of total population of Man Tehsil. However Man tehsil covers only 7% of total population in Satara district.

According to Census of India 2001, sex ratio within project area is 1070 which is significantly higher than district average of 995 (for 1000 male). **Table 4.20** illustrates the demographic profile of the project's area of influence in comparison with the district.

Table 4.20: Demographic Profile of Project's area of influence

Village/ Tehsil/District	Total Population	Sex Ratio	Average HH Size	SC (%)	ST (%)	Literacy Rate (%)
Chilarewadi	490	1,076	5	0	0	45
Virali	2,487	1,151	5	10	0	50
Puklewadi	950	984	6	0	0	54
Man	199,598	995	5	11	1	59
Satara	2,808,994	995	5	9	1	68

Source: Census of India, 2001

Average literacy rate of project area is 49.66% which is slightly lower than the district literacy rate i.e. 68%. Villagers of project area are willing to provide equal education opportunities to the girl and boy child due to ease of access to Government and private schools and colleges. Several government schemes promoting education like Sarve Siksha Abhiyan, especially girl child education are also an important factor for this change. It can be observed in literacy levels of the villages which range between 50% to 55% for males and 40% to 45% for females.

4.4.3 Settlement Pattern in Project Area

The wind farm site is located on flat-topped hills and the concerned villages are located around the base of the plateau along State highway-76 and other district roads. Chilarewadi and Virali villages are adjacent and have a radial settlement pattern wherein the main village road connects both villages. Pukalewadi village is situated along the state highway.

Chilarewadi and Virali villages have mixed settlement pattern of general class and backward class castes. Backward casts community inhabits largely in Puklewadi village like *Shelke and Pukade*.

Structures are mostly built with burnt bricks and have a stone foundation. The walls are plastered and painted with distempers that give them a variegated appearance of stone and cement structures, some with an asbestos / tin sheets or tiles for a roof while others have a *pucca* (concrete) roof.

4.4.4 Social Fabric (Religion/Caste)

Out of the total population in the project area, 95% is dominated by Hindu population while remaining 5% covers Muslim, Jain and others. The social composition in the project area is numerically and economically dominated by the Maratha community (General Class), followed by the Backward Classes (OBC) and the Scheduled Castes (SC). Caste composition observed during consultation and survey of project villages is given in **Table 4.21**.

Table 4.21: Caste distribution of Project Villages

Villages	General Castes (%)	Backward Castes (%)	Scheduled Castes (%)
Chilarewadi	55	45	0
Virali	50	40	10
Puklewadi	5	90	5
Project Area (Average)	**36.6**	**58.3**	**5**

Source: Survey and Consultation in Project area

General and backward classes are almost equally distributed in total project villages. However schedule class caste population is limited to 5% to 10% only. Marathas constitute the biggest group in general class and Dhankars (Sheep/Goat Farmers) are the largest backward class group in the project area.

4.4.5 Vulnerable Community

Vulnerability of families has been considered based on different factors like below poverty line (BPL) families as identified with the concerned state government, women headed households, family with members who are mentally or physically challenged, small land holdings (less than minimum land holding status of concerned district), families with principal earning members above the age of sixty years and SC and ST families.

The Satara district of Maharashtra records significant figures on poverty incidence. According to data gathered by the Department of Economics and Statistics, Government of Maharashtra, the incidence of poverty in Satara district in year 1993-1994 was 24.84% (Rural – 22.64%; Urban – 39.75%)[5]. In 1997-98, about 16.23% of families out of the total

[5] Human Development Report Maharashtra 2002

population of the district were recorded to be below poverty line[6]. The percentage of families below poverty line in rural areas of Satara district in 2002 was estimated to be 15.5%[7].

The preliminary survey and consultation with concerned project affected community, gram panchayat and authorities revealed that extent of the vulnerability (SC and ST families) by the project based on above mentioned parameters is negligible and it is less than 3% of total affected families.

The project area does not report the presence of indigenous people like tribes, ethnic minorities, aboriginals etc. as defined by the ***ADB's Indigenous Peoples Safeguards***. Hence the applicability of the safeguard on indigenous peoples and its relevant clauses/special concessions like the Indigenous Peoples Plan (IPP) are not applicable for the project.

4.4.6 Land Use in Project area

Agricultural use of land is not dominated in project area villages because of its undulating geographical condition and most of available agricultural land comprises of unirrigated land. The cultivated area in project vicinity falls under two categories, *jirayat* and *bagayat.* The *jirayat* land (unirrigated or dry land) which forms nearly 85% of the total cultivated area is cropped only once with the help of rainwater, whereas the *bagayat* land (irrigated land) which forms 15% of the total cultivated area is cropped with the help of irrigation.

This only indicates the greater dependence of agriculture on monsoons. Area of land under forest land is categorized as reserved and protected. The major portion of this area is under the Revenue Department. The land use in project area that shows in **Table 4.22** follows the similar pattern.

Table 4.22: Land use in Project area (Village wise)

Villages	Agricultural land			Land not available for cultivation	Culturable waste land	Revenue
	(% of total area)	Irrigated (% of agricultural land)	Unirrigated (% of agricultural land)	(% of total area)	(% of total area)	(% of total area)
Chilarewadi	31	50	50	6	13	50
Virali	38	11	89	19	20	23
Puklewadi	39	9	91	7	4	50

Source: Census of India, 2001

Average land holding was 6 to 10 acres across the households of project area villages as per Census of India, 2001. During consultation with landowners of concerned villages it was noticed that less significant change has been noticed in average land holding pattern in past three to four years because of the land acquisition happening for other adjacent wind farm sites (operational at present time) in vicinity of project villages.

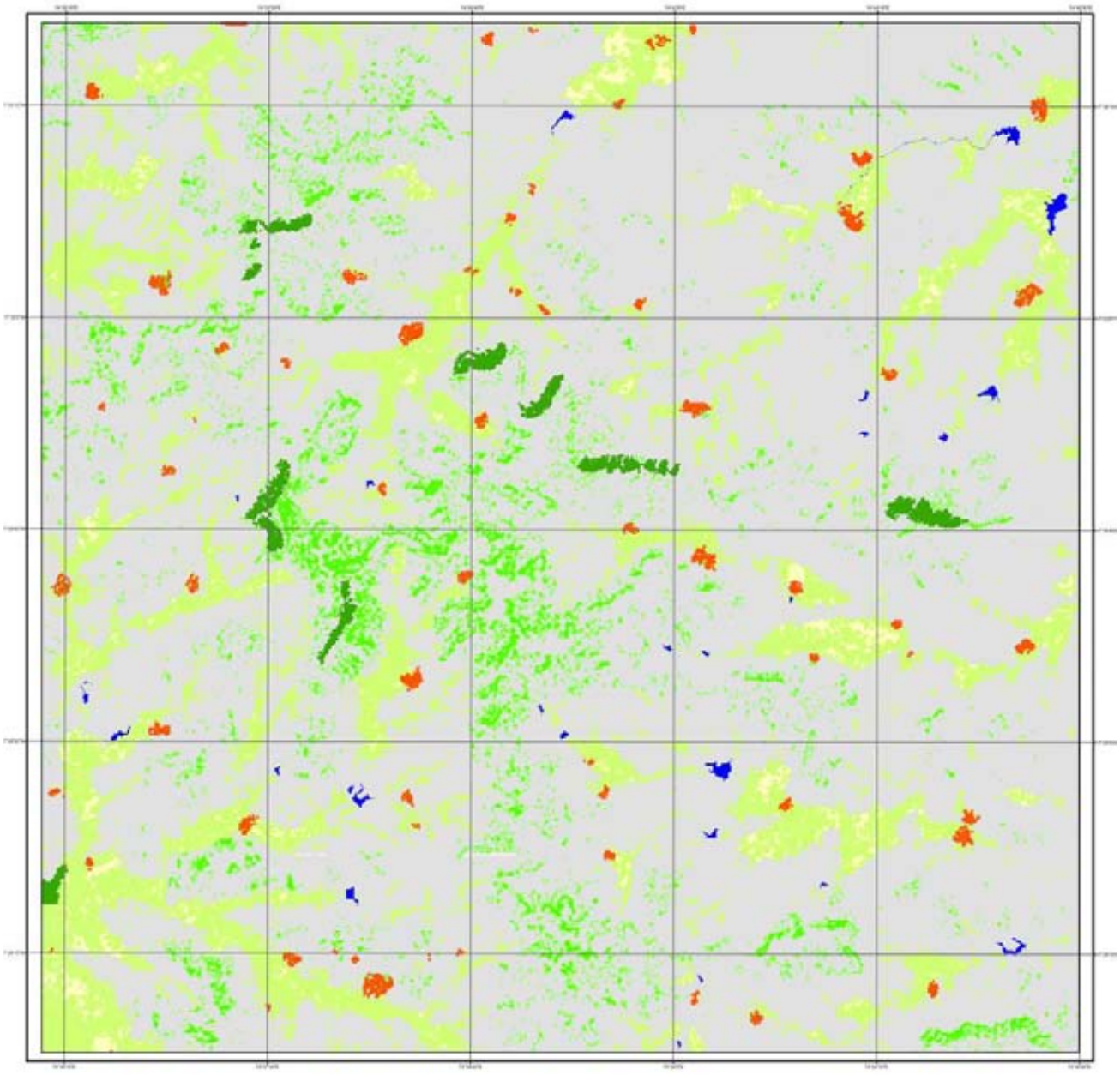
[6] Below Poverty Line Survey for 1997-98 by Rural Development Department, Mantralaya, Mumbai
[7] Economic Survey 2010-11, Directorate of Economics and Statistics, Government of Maharashtra

The land use of the area (20 x20 km) as obtained from the satellite imagery is as provided in **Table 4.23**.

Table 4.23: Land Use of Study Area

Category	Land use (%)
Water bodies	0.29
Fallow Land	2.82
Agriculture Land	18.55
Open/ Barren Land	72.95
Forest	0.57
Open Scrub	4.28
Built-up	0.54

Figure 4.16: Land Use of the study Area



4.4.7 Agriculture in Project Area

Most of cultivable land in project villages falls under the category of *jirayat* or dry land. The early monsoon crops are called *kharif* crops and the late monsoon crops, *rabi* crops. The *kharif* crops are brought to maturity by the showers of south-west monsoon, whereas *rabi* crops are dependent upon dew irrigation and the occasional fair weather showers between November and March.

The *kharif* season which commences in June-July and terminates in September-October gets its rainfall primarily from the south-west monsoon and from the occasional ante-monsoon showers in May. Usually, *kharif* crops are sown from the first week of June to mid July and harvested in mid-September and sometimes even up to the end of November. The sowing and reaping of these crops roughly coincides with the commencement and termination of the monsoon. In project villages, most of cultivable area covers only one season cropping pattern of *Kharif* crops based on rain water (monsoon) irrigation.

Rabi season commences from the middle of October and terminates in mid-February or in the first week of March. *Rabi* crops are taken with the help of irrigation and occasional fair weather showers due in November. Sowing of *rabi* crops generally takes place in November, whereas they are harvested in March. These are grown in adjacent low lying areas where irrigation is managed through tube well water, as rainfall in this season is very scanty.

Jowar, Bajra, Maize, Pulses like Matki and Moong are major crops of *Kharif* seasons cultivated in project villages.

4.4.8 Common Property Resource (CPR)

Land is an important natural resource of fodder and fuel wood for villagers in project area. Almost every household has livestock as an important source of livelihood in project area. Crop residue and grazing fields near forest area are the main source of fodder for livestock. Villagers get dried leaves and firewood from forest areas for their fuel needs. The proposed project does not impact the common property resources of the villagers.

4.4.9 Livelihood Pattern of Project area

Agriculture based livelihoods (cultivators, share croppers and agricultural labourers) and Livestock rearing are the predominant occupational activities subsequent with other non-farm based livelihoods (private and government service) and ancillary livelihoods (trading, contracting etc.) occupational activities in the project area.

As per Census of India, 2001, total agriculture and allied agriculture based working population of Satara district is 53% of total working population. However in project area this proportion is slightly more than 64%. **Table 4.24** presents the working and non working population composition of project area.

Table 4.24: Composition of Working and Non- Working population

Village/ Taluka/ District	Main Workers[8] (%)				Marginal Workers (%)	Non-Workers (%)	WPR[9]
	Cultivators	Agricultural Labour	Household Industry	Other Workers			
Chilarewadi	42	2	1	2	1	52	48
Virali	31	5	0	5	3	56	44
Puklewadi	26	5	1	17	4	47	53
Man	23	8	1	8	7	53	47
Satara	18	7	1	11	9	54	46

Source: Census of India, 2001

Work participation ratio (WPR) of district is 46% which is significantly higher than the WPR of project area i.e. approx. 33%. The proportion of working population and the non-working population are nearly equal and it shows a significant dependency ratio of non earning members to earning members in each household.

Livelihood based on household industries, other industrial activities and other ancillary livelihood activities are restricted, it may be because of lack of proper educational and skill level in working population.

As mentioned earlier, the project area has one season cropping pattern because of lack of irrigation sources as agriculture is completely depend on rain (monsoon). In project area agriculture as a main source of livelihood is restricted because of poor productivity, lack of irrigation sources, increasing input costs, poor credit and market linkages etc. It was observed that major part of crop production is being used up for household consumption.

Share cropping is also limited in the project area because of one season cropping pattern although large proportion of working population in the project area comprises of agricultural labourers. These facilities are available and two season cropping are in practise. A large proportion of the marginal agricultural labourers find work in adjacent areas where proper irrigation facilities are available and two season cropping are in practise. A large proportion of the marginal workers in the project area are agricultural labourers, which indicate that they get less than 188 man days of work in a year. However, demand for agricultural labour often exceeds the supply in some villages during the peak harvest season (monsoon season).

The livestock continues to be a valuable possession of the farm and holds an important source of livelihood in the project villages. Almost every household has livestock including cow, buffaloes, poultry birds, sheep and goats. Sheep/goat farming is one of predominant occupation in the project area.

4.4.10 Migration of Sheep/goat Farmers for Grazing

During the dry season, grazing fields in the project area are limited and because of it sheep/goat farmers migrate after *Dipawali* festival in the month of October-November with a

8 Main workers are those people who had worked for at least 183 days in the preceding year, while marginal workers are those who had worked for more than one day but less than 183 days.

9 WPR is the ratio of working population (both main and marginal workers) to the total population (both working and non working population) of the town/village.

herd of 50 to 55 sheep and goats to adjacent tehsils and districts where appropriate grazing areas are available. Usually two male and one female member travels with every herd of goat and sheep. They travel from one grazing area to another and return during monsoons in the month of June, since adequate grazing fields are available during the monsoon season in the vicinity of villages. During consultation it was reported by the villagers that farmers earn from INR 100,000 - 150,000 from trade of 50 to 55 sheep and goats.

Non-farm based livelihood has very limited avenues or options in the project area. This comprises of non-agricultural labour, limited production of commodities as well as private and government service. Most of non agricultural labourers migrate to nearby areas of Satara and Karad mostly as industrial and construction labourers. However for employment in private sectors villagers prefer to go Pune and Mumbai.

4.4.11 Status of Women

Government schemes promoting girl child education are active in the project area. More and more girls in the current generation are going to school and pursuing higher education. Some of the educated women also avail job opportunities in the nearby towns. Women are consulted during decision making processes regarding sale and purchase of land and property, marriage, education of children etc.

In addition to household chores women in the project villages participate in agricultural work and livestock rearing that are principal sources of livelihood in the area. It was observed that working of women is not restricted to caste; women from all castes are engaged in work irrespective of the caste. There are skilled women in the project villages engaged as a school teachers and anganwadi workers/helpers also. The figures shown in **Table 4.25** reflect the working women participation in project area.

Table 4.25: Work Participation of Women in project villages

Project Villages	Main workers (%)	Marginal workers (%)	Non workers (%)
Chilarewadi	25	1	27
Virali	20	2	32
Puklewadi	24	4	21

Source: Census of India, 2001

4.4.12 Existing Infrastructure Facilities

The social infrastructure indicates the development pattern of the area and the details of the existing infrastructure available in the project area which is presented in **Table 4.26**.

Table 4.26: Existing infrastructural facilities available in the project villages

Project Villages	Approach Roads	Communication Facilities	Power Supply	Sources of Water Supply	Educational Facilities	Medical Facilities	Postal and Telecommunication Facilities
Puklewadi	1	0	Available for all purposes	3	1	0	0
Virali	1	1		2	7	0	1
Chilarewadi	1	0		3	1	0	0

Source: Census of India, 2001

Roads and Communication Facilities

The road network and connectivity in the project area was observed to be good. The project area is connected by two State Highways, SH-58 to the north of the site and SH-76 to the south. As per Census 2001 data, paved approach roads to the villages of Puklewadi and Virali are available. Chilarewadi village is accessible by mud roads. Public bus services are available from village Virali only. For Chilarewadi and Puklewadi, villagers have access to bus services from 5 to 10km distance from the village. The nearest railway station is also at a distance of more than 10km for the villages. People are mostly dependant on private modes of transport.

Power Supply

According to Census 2001, electricity is available for all purposes (domestic and agriculture) in the project area.

Water Supply

The Census 2001 data records the presence of tanks, wells and hand pumps that serve as drinking water sources in the project villages. People of Virali village use tap water and hand pumps for drinking purposes while wells are present in the other two villages.

Educational Facilities

The literacy rate in the project area (49%) is lower that the district level. This might be attributed to the fewer number of schools in the project villages. Virali village records the highest number of educational centers in the Census 2001 database. There is one primary school each in Puklewadi and Chilarewadi. Virali village has four primary schools, one middle school, one secondary school and one adult literacy center. For higher education, students go to Satara or other nearby towns in the area.

Medical Facilities

As per Census 2001, there are no medical facilities in the project villages. The nearest allopathic hospital and primary health center is at a distance of more than 10km from the villages.

5 Anticipated Impacts and Mitigation Measures

This chapter describes various positive and negative environmental and social impacts identified and assessed for the construction and operation phases of the wind power project. These impacts have been identified through review of available project information; discussions with the local community; representatives of the project proponents and other sector specific professionals.

The chapter identifies and assesses the range of potential impacts and extent of their severity on environment, ecology, socio-economic resources, demographics, livelihoods, as well as access and infrastructure issues. Mitigation measures for the identified impacts are also presented in this section

5.1 Impact Appraisal Criteria

The criterion which has been employed to appraise impacts on various social and environmental components is as presented as **Table 5.1** below.

Table 5.1: Impact Appraisal Criteria

Criteria	Sub-Classification	Defining Limit	Remarks
Spread: refers to area of direct influence from the impact of a particular project activity.	Insignificant / Local spread	• Impact is restricted within the foot prints of the Project boundary • For transmission line it will be within the right of way	except for ecology (which is defined as loss of vegetation only at site) or within the base of pylon and under the conductors
	Medium Spread	• Impact is spread from up to 2 km from the boundary of the Project • within 500m on either side of transmission line	except for ecology (which is defined as loss of vegetation at site including large trees with limited disturbance to adjoining flora & fauna)
	High spread	• Impact is spread up to 2 km to 5 km from footprint boundary of the Project • beyond 500m on either side of transmission line	except for ecology (which is defined as loss of vegetation at site and/or damage to adjoining flora and fauna
Duration: based on duration of impact and the time taken by an environmental component to recover back to current state	Insignificant / Short Duration	when impact is likely to be restricted for duration of less than 1 year;	the anticipated recovery of the effected environmental component within 2 years
	Medium Duration	when impact extends up to	With an anticipated

Criteria	Sub-Classification	Defining Limit	Remarks
		3 years	recovery of the effected environmental component within 6 years
	Long Duration	when impact extends beyond 3 years;	with anticipated recovery of prevailing condition to happen within 6 years or beyond or upon completion of the project life
Intensity: defines the magnitude of Impact	Insignificant intensity	when resulting in changes in the environmental baseline conditions is up to 10%	However, it shall be reconsidered where the baseline values are already high.
	Low intensity	when resulting in changes in the baseline conditions up to 20%	for ecology it refers to minimal changes in the existing ecology in terms of their reproductive capacity, survival or habitat change
	Moderate intensity	when resulting in changes in the baseline conditions for up to 30%	for ecology, it refers to changes that are expected to be recoverable
	High intensity	when change resulting in the baseline conditions beyond 30%	While for ecology, high intensity refers to changes that result in serious destruction to species, productivity or their habitat.
Nature: refers to whether the effect is considered beneficial or adverse	Beneficial		Useful to Environment and Community
	Adverse		Harmful to Environment and Community

A significance assessment matrix was developed to assess the impacts based on the appraisal criteria developed above, which is as given in **Table 5.2.**

Table 5.2: Impact Significance Criteria

Spread	Duration	Intensity	Overall Significance	
			Adverse	Beneficial
Local	Short	Low	Insignificant	Insignificant
Local	Short	Moderate	Minor	Minor
Local	Medium	Low		

Spread	Duration	Intensity	Overall Significance	
			Adverse	Beneficial
Local	Medium	Moderate		
Medium	Short	Low		
Local	Long	Low		
Local	Short	High	Moderate	Moderate
Local	Medium	High		
Local	Long	Moderate		
Medium	Short	Moderate		
Medium	Medium	Low		
Medium	Medium	Moderate		
Medium	Long	Low		
Medium	Long	Moderate		
High	Short	Low		
High	Short	Moderate		
High	Medium	Low		
High	Medium	Moderate		
High	Long	Low		
Local	Long	High	Major	Major
Medium	Short	High		
Medium	Long	High		
High	Short	High		
High	Medium	High		
High	Long	Moderate		
High	Low	Low		
High	Low	High		

The impacts for the proposed project are covered under the following subsections:

- Construction Phase
- Operational Phase
- Decommissioning Phase

5.2 Impacts during Construction Phase

Based on the activities involved, an impact interaction matrix for construction phase was prepared for of the project. The impact identification matrix is presented in **Table 5.3:**

Table 5.3: Impact Identification Matrix for Construction Phase

S.N	Main Activities	Environmental and Social Components									
		Land	Ecology	Water Resources	Ambient Air Quality	Soil Resources	Ambient Noise Quality	Water Quality	Traffic / Transport	Social/ Livelihood	Occupational Health and Safety
1	Site Preparation										
	Procurement of land		■							■	
	Site Clearing Grading	■	■			■					
	Vegetation clearance		■								
	Staging area	■				■					
2	Labour Engagement										
	Employment of workers								■	■	■
	Water requirement			■							
	Power requirement				■						
	Waste handling and disposal					■					
	Sewage disposal					■		■			
3	Material Handling and Storage										
	Transportation and Unloading of construction material								■		■
	Transportation of Turbine components								■		■
	Storage and Handling of turbine components	■									■
	Storage and Handling of construction material, explosives, hazardous materials, etc.			■	■						■
4	Construction activities										
	Preparation/Mixing of construction material				■		■				
	Supply of water, power, sanitation etc			■	■	■					
	Operation of construction machinery, foundation, pads access road, offices etc,				■		■		■		■
	Handling and Disposal of construction wastes		■	■		■					
	Construction of new access roads and widening of existing roads	■			■	■	■		■		
5	De-mobilisation of Construction Equipment										
	Dismantling of temporary support construction structures /equipments									■	■
	Removal of construction machinery								■		
	Transportation of Construction/Dismantled wastes			■	■	■	■				

The construction activity will comprise of following activities which will impact the environment and social aspects, as described in sections below:

- Procurement of Land
- Site Clearing
- Labour Engagement
- Material Handling and storage
- Concrete work, Erection and Installation Activities (construction of roads, erection of turbines, setting up of transmission lines etc.)
- Construction Demobilization

5.2.1 Procurement of Land

The land identified for the project is predominantly private land with parts of revenue land. An Agreement to Sale (ATS) document has been signed between each of the land owner and Atlanta Power Private Limited (Land Aggregator) for the private land to be acquired. The land is mainly used as grazing area for cattle and other livestock. Grazing activities are limited to the post monsoon months only when adequate vegetation is available. Agriculture is not undertaken on the plateau because of the difficult terrain and lack of water. The area is drought prone and large portion of agricultural land is classified as un-irrigated land.

For construction of approach roads to the site and internal roads within the site, both private and revenue land is being acquired and the process of acquisition is currently ongoing. Other facilities such as switchyard, admin building etc. will also be constructed on private land that has been acquired.

The pooling substation at Hiwarwadi village will be constructed on private land that has already been acquired. Land requirement for transmission lines will be limited to the area required for the foundation of pylons. NRPPL has proposed to construct 5-12lm long sing/double circuit 33kV transmission lines via three feeders of 25MW capacity each.

Impacts

Land procurement for wind turbines will have limited adverse impact as the land acquired is un-irrigated and no agricultural activity has been reported in recent years. The land is currently used for grazing of animals but that is also restricted to some areas only as the terrain is difficult for animals to approach. Construction activities will scare away animals and will also restrict their movement across terrain for grazing.

The compensation paid for land will benefit the affected families economically, as they will be able to acquire better land (agricultural land) in adjoining areas, or utilize it in suitable income generating purposes. The land was procured after prior consultation and finalization of rates at a village level meeting.

In last 3 to 4 years many wind farms have been implemented /proposed in vicinity of the project area. It was observed during consultation with different stakeholders that development of wind farms has increased the demand for land, leading to increase in land value. This has resulted in increase in bargaining for compensation and at times renegotiation of previously agreed rates. Procurement of additional land for transmission line

and access road will therefore need enhanced compensations as per current market prices or more.

Mitigation Measures

The procurement of private land through ATS is mostly completed and it was observed during the stakeholder consultation that the compensation paid for the land was acceptable to affected families. However the project proponent shall ensure:

- Grazing areas are left accessible for cattle and other animals after the construction activities are completed.
- Details of transmission line and access road shall be shared with the affected families and the community
- All land procurements for associated facilities considers the increase in land rates and compensate proportionate to the increase in price
- All remaining land procurement shall involve counseling of the affected families on beneficial investment and optimum utilization of compensation amount.

Impact Value

The impact on environment and social components from land procurement will have a localised impact with medium duration and a low intensity after mitigation measures are employed.

Table 5.4: Impact Value – Land Procurement

Aspect	Scenario	Spread	Duration	Intensity	Overall
Site Preparation	Without Mitigation	Medium	Short	Moderate	Moderate
	With Mitigation	Local	Medium	Low	Minor

5.2.2 Site Clearing

Wind farm projects require relatively less clearing of vegetation as compared to conventional power projects. Clearing of site will be required for the following activities.

- Access to site;
- Storage of construction material;
- Clearing for staging;
- Movement of machinery;
- Radius of 20m around each tower;
- Intra-farm underground cables;
- Pooling substation; and
- Area for maintenance office

Impacts

The site clearing activities such as removal of vegetation, grading, leveling and related activities will majorly impact the ecology and soil resources and quality at site. The following impacts are envisaged due to site clearing:

Soil Quality

- The activities associated with site clearing will result in removal of vegetation and lead to loose soil at site. The area being a high wind zone will result in loss of soil and generation of dust.
- Movement of heavy vehicles can enhance compaction of soil; as well disturb the original stability along the terrain, this can further add to soil erosion.
- Disturbance of ground surface can also result in increased loss of soil with surface run offs leading to nutrient loss.
- Preparation of access roads, staging areas, holding areas etc will require excavation and filling of sand /gravel etc for preparing a stable base.
- There will be requirement for removal trees for crane staging area, intervening areas, overhead clearance for suspended turbine components.

Ecology

Removal of vegetation will result in loss of habitat for small mammals and birds. However the ecological survey carried out at site established that the site does not support any significant ground vegetation. Also the clearance of vegetation shall be carried out along a radius of 20 m around each wind turbine site and the entire area procured for each wind turbine may not be cleared. The locations identified for the wind turbine generators does not comprise of any trees in the immediate vicinity. The project may however involve removal of few trees for crane staging area, intervening areas, overhead clearance for suspended turbine components. The impact on ecological environment is assessed to be minor for the project.

Mitigation Measures

The following mitigation measures will be employed during site clearance:

Soil Quality

- Any existing tracks and access route shall be made use of wherever possible. Access road shall be planned to cause minimal disturbance to the terrain topography.
- Existing surface drainage pattern shall be retained to the extent possible.
- Localized sprinkling of water at areas where vegetation is removed shall be undertaken for the entire duration of construction.
- Movement of vehicles shall be restricted to planned roads to avoid unwanted disturbance to soil.
- Excavated material will be stock piled and used for backfilling of foundations, trenches etc.
- Depending on the orientation of the towers, staging area shall be planned to enable erection of more than one tower from one staging area.

Ecology

- The site clearance for tower erection, access road and ancillary facilities will be restricted to the necessary footprint area.
- Vegetation shall not be removed from areas falling in land not required for any construction activity.

- The crane staging area, intervening areas, overhead clearance for suspended turbine components shall be planned in such a way that minimum tree felling is required.
- Disturbed areas shall be re-vegetated as soon as the activities in the immediate surroundings are complete.
- NRPPL shall ensure that the plant species such as *Calotropis gigantean, Calotropis procera, Cryptostegia grandiflora* and *Pergularia daemia*, which are food plants for the Milkweed butterfly group are not removed during site clearance. In case removal is unavoidable, the same species shall be re-vegetated after completion of construction activities.

Impact Value

The impact on environment and social components from site preparation will have a localised impact with medium duration and a low intensity after mitigation measures are employed.

Table 5.5: Impact Value – Site Clearance

Aspect	Scenario	Spread	Duration	Intensity	Overall
Site Clearance	Without Mitigation	Medium	Medium	Moderate	Moderate
	With Mitigation	Local	Medium	Low	Minor

5.2.3 Labour Engagement

The construction stage will require 100 to 125 during normal functions while during peak construction activities will require 200-300 workers. An additional labour of 40-50 workers will be required for erection of transmission line, as some part of this will coincide with the concluding phase of wind turbine erection. All labour will be hired locally, therefore no influx of migrant workers are envisaged.

Impacts

Engagement of workers can result in the following potential impacts:

- The increased expectation for local recruitment and greater involvement by the locals can cause rift and differences between the local community and the workers already engaged.
- Recruitment of staff lacking skill sets required for operation of construction machinery, use of construction tools etc under pressure from community can lead to delay in project activities.
- There is a positive impact of labour engagement to the small shops and traders in the region as there will be an increase in sale of daily-use products for the workers and drivers bringing material to the site.
- Impact on women from influx of migrant workers, safety and opportunity for employment

Mitigation Measures

- Community expectations for employment and other local benefits need to be addressed and managed by the project proponent. Adequate representation for local

labour shall be decided by the NRPPL management and conveyed to the community. Regular updates on opportunities and skill requirements shall be provided to the community.

- NRPPL shall identify employment opportunities based on skill set requirement for people whose land plots have been impacted. At least one individual from each of the project affected family shall be offered with employment during the construction work. Employment opportunities shall consider vulnerable section of the society such as economically weaker class, families with small land holding etc.
- NRPPL through the contractor agreement shall ensure that the construction contractor commits and adheres to social obligations including community relations, handling complaints and grievances, adherence to labour laws and international commitments etc. The contractor shall provide adequate training on social behaviour and community interaction to the workers engaged by them. The contractor shall undertake medical test of the workers engaged for the project to identify any communicable disease prior to engagement.
- NRPPL to ensure that the construction site shall have adequate sanitation, drinking water and waste disposal facilities. Portable toilet with septic tank soak pits will be provided at site to facilitate the sewage generated.
- There will a limited number of migrant workers engaged for the project; these workers and their contractors will be adequately briefed about the code of conduct to be maintained and to respect local customs and women.
- Women in the area were not keen on labour intense work during construction, however NRPPL will however explore the possibility of engaging women for documentation related work based on their skill sets. Documentation related work will include maintaining records on wages, attendance register, incident reports, legal register, etc.

Impact Value

The impact on environment and social components from labour engagement will have a localised impact with medium duration and a low intensity after mitigation measures are employed.

Table 5.6: Impact Value – Labour Engagement

Aspect	Scenario	Spread	Duration	Intensity	Overall
Labour Engagement	Without Mitigation	Medium	Short	Moderate	Moderate
	With Mitigation	Medium	Short	Low	Minor

5.2.4 Material Handling and Storage

Material handling and storage will include transportation of turbine components, transmission tower structure, conductors, transformers, switch yard components, construction material etc. The impacts identified from this activity are:

Impacts

Transportation and Traffic

The construction activities will require transportation of construction material and turbine components to the site. Ground transportation and traffic impacts associated with wind energy projects typically include impacts on the transportation system itself (e.g., the physical properties of the road system) and impacts on traffic that uses the transportation system. Such impacts arise almost entirely during the construction period.

- Transportation of heavy and large components of turbines can cause damage to the road infrastructure, culverts, bridges, drainage structure, poles, signboards etc.
- Movement of oversize structures will be slow and shall lead to blockade of traffic and congestions at crossing and turns.
- Protrusions and edges of components being transported can lead to damage of road side structures and can lead to accidents.
- Break down of vehicles and unplanned halt along the road can lead to traffic blockade and discomfort to community.
- Transportation of construction material in open trucks / tippers can lead to dust generation along the route.

Health and Safety

Storage and handling of various wind farm components and construction material will require specific emphasis on health and safety. Inadequate planning and implementation can lead to the following issues:

- Physical injury during loading and unloading of turbine components
- Accident and injury from crane failure during handling of wind turbines
- Trip and fall hazards due to improper storage and placing of components
- Accident and injury due to vehicle collision/slip along terrain etc
- Potential risk for cattle and livestock moving around the project road

Community and Social

Community and social impact from material handling and storage will include:

- Traffic congestion along the village/minor roads due to movement of heavy vehicles and other construction related vehicles
- Disturbance from traffic movement during night time
- Potential for accidents to livestock and people
- Damage to village roads and related structures
- Stacking of transmission line components in field and private lands along the ROW
- Parking of vehicles in open fields and other non-project locations
- Movement of vehicle along transmission line through land not designated as ROW

Soil and Water

Environmental concerns from material handling and storage will include:

- Dispersal of construction material due to wind, leading to contamination of soil in the areas in proximity of the proposed wind farm and along the transmission line
- Run off from construction material which can flow along the slopes and contaminate the water bodies downstream.

- Oil spills from construction machinery and vehicles during refuelling at construction site can contaminate the soil
- Oil leaks from vehicles and machinery operating at site also cause contamination to soil

Mitigation Measures

The transportation trips will be limited to 2-3 trips for pickup trucks, 5-10 trips for construction supervisors/campsite workers. The local staff will use the public transport. Movement of heavy vehicles will be slow and require about 400-600 trips spread over a period of six to eight months.

The mitigation measures to be considered during material transport and handling for construction shall include:

Transportation and Traffic

There are existing operational wind farms in the area, which suggests that there are existing roads capable of handling the size and load of wind turbine and its components. However, NRPPL shall undertake a detailed analysis to assess the feasibility of transportation of turbine and associated components. This includes identifying the origin of the components and the most efficient route to the location of the site. The analysis will also review the general conditions of the road, width, horizontal curvature, vertical curves, intersection geometry, drainage structures, height restrictions, load restrictions of existing bridges and culverts, and any locally significant features.

The mitigation of the transportation routes will vary from minor modifications to the existing roadway to partial reconstruction, depending on the specific situation. Wherever possible, rerouting of construction traffic to wider, less-restrictive road will be preferred. A transportation plan shall be developed based on the route finalised prior to commencement of transportation of heavy machinery.

Where road widths are insufficient, either temporary widening of the road with gravel or full depth widening of the pavement structure will be undertaken. All construction and modification activities will be undertaken after prior approval / permission from local administration.

Local administration and village Panchayat will be informed in advance about the movement of heavy and oversized components of turbines. Pilot vehicles will be provided with trucks carrying large components to manage traffic and assist the movement without any damage or accident to structures along the road. All vehicles engaged for transportation will be verified for fitness. Any incidence of breakdown will be attended immediately to ensure smooth flow of vehicle along the road.

The traffic movement planned is kept significantly away from most of the villages. No movement is proposed on village roads. The drivers will be asked to maintain a minimal speed limit in the area to avoid accidents to people and livestock

Health and Safety

Loading-Unloading Activities:

Operation of loading –unloading equipment shall be undertaken under the guidance/ supervision of trained professional. All lifting appliances shall be thoroughly examined by a competent person, prior to engagement with the project.

The contractor shall ensure that no person is engaged in driving or operating lifting appliances unless he is sufficiently competent and reliable, possess the knowledge of inherent risks involved in the operation and is medically examined periodically. As per Section 23 of the Factories Act, 1948, as amended, young persons (below 18 years of age) must not allowed to work at any dangerous machine (including cranes) unless they have been fully instructed about the dangers arising pertaining to the machine and the precautions to be observed, and have received sufficient training in work at the machine, or are under adequate supervision by a person who has a thorough knowledge and experience of the machine.

The contractor shall ensure that machinery is equipped with a legible, durable load chart that shows the manufacturer's recommended load configurations and maximum load weights. The chart must be securely attached to the cab and easily visible to operators when they are seated at the control station.

Storage of turbine components and associated facilities:

Storage of turbine components will be made in an identified location at site. The storage area will be fenced and guarded. Storage area will be provided with proper lighting and space for access of lifting equipments.

All material will be arranged in a systematic manner with proper labeling and without any protrusion or extension onto the access corridor. The construction material for transmission tower will be kept at site and carried to individual towers as per requirement.

Community and Social

The village Panchayat and local administration will be consulted prior to moving of large components. Information about transportation will be conveyed in advance.

Any concerns regarding damage to roads and associated structures (if any) will be addressed prior to use of village roads. Widening of shoulders and development of new roads will be discussed with the community and undertaken only after all concerns and compensations (if applicable) are addressed.

Movement of vehicle will be restricted to the identified routes. In case of transmission lines all vehicles will use the ROW. No vehicle will be parked on any other land other than thes designated parking at site. While moving on village roads, all vehicles including smaller vehicles will follow a speed limit of 30km/hr. Only trained and experienced drivers will be engaged for the project. The drivers will be briefed about the specific precautions and social commitments to be considered while driving on village roads.

Soil and Water

All construction material stored at site will be covered and or kept wet on surface to avoid dispersal with wind. All vehicles carrying construction material will be covered while travelling on public roads.

The drainage pattern of the area shall not be disturbed during construction to the extent possible. Culverts or water conveyances shall be provided for all permanent and temporary roads to be constructed for the project. Run off control measures such temporary bunding around storage of construction material, silt traps etc. shall be employed.

Impact Value

The impact on environment and social components from labour engagement will have a localised impact with medium duration and a low intensity after mitigation measures are employed.

Table 5.7: Impact Value –Material Handling and Storage

Aspect	Scenario	Spread	Duration	Intensity	Overall
Material Handling and Storage	Without Mitigation	Medium	Short	Moderate	Moderate
	With Mitigation	Medium	Short	Low	Minor

5.2.5 Concrete Work, Erection and Installation Activities

Construction activities will be spread over duration of one year, the peak activity will be executed over a period of 6-8 months. The main construction activities will be:

- Construction of access roads
- Construction of foundation of tower
- Construction of transformer pad
- Wielding of tower components, erection of tower and Installation of turbine components
- Laying of underground cables
- Construction of pooling substation and switchyard
- Erection of transmission pylons and stringing of conductors

Impacts

The impacts identified from construction activities will comprise of the following:

- Excavation activities and earthworks during construction might result in chance find of cultural and historical artifacts of heritage value.
- Road construction work will involve operation of hot mix plants and activities that generate noise and air pollution.
- Mixing of construction material and setting up of batching unit will generate dust, which will be carried downwind to villages and habitation.
- Blasting activities for foundation will generate noise and vibration; although small in nature it will scare birds and grazing cattle around the site. Noise will also be generated from operation of construction machinery.
- Construction activities can cause contamination of soil and water resources through oil spill from storage of fuel at site. Fuel will be stored at site for operation of machinery. It is estimated that about 2KL of diesel will be stored at site for operation of construction machinery. Contamination can also result from leaks and drips from machinery and vehicles at site.

- Working at heights may be required during construction activities, including the assembly of wind tower components, transmission towers etc. Working at heights is associated with hazards of fall and slip and can lead to fatal injuries. Uses of wielding and electrical operation are also prone to fire and electric hazards.
- Random disposal of excavated soil and construction debris can lead to contamination of soil in the area along with potential for sediment to flow into water bodies. Improper disposal of package material, boxes, plastics, ropes etc can lead to littering in the area.
- Hazardous wastes such as waste oil, lubricants, hydraulic oil etc can cause contamination of soil and water bodies if adequate precautions for management and handling are not undertaken. Use of chemicals such as paints, curing chemicals can lead to contamination of soil.
- Stringing for transmission lines can lead to damage to agricultural crop, especially prior to harvest season. Stringing across roads can lead to traffic congestion tower crossing areas. Stinging activities close to habitations can lead to noise and disturbance to the local community.

Mitigation Measures

The mitigation measures during masonry, erection and installation shall include the following:

- A procedure for reporting chance find shall be developed by NRPPL. In case of any chance find NRPPL and its contractors will:
  - Halt all work in progress at the site
  - Ensure that the area is cordoned off
  - Ensure that the District administration and nearest office of archaeological survey is informed
  - Facilitate the inspection by relevant authorities
  - Restart the work only after receiving go ahead from the relevant authority
- Generation of dust during from batching plant and excavation activities will be controlled through sprinkling of water. Batching unit shall be located away from the edges of plateau and away from habitations. Loose soil will be kept covered or kept wet to prevent dust generation.
- All blasting activities (if required) will be controlled. The intensity will be small to generate any significant noise and vibration. Adequate precautions and information will be provided prior to execution of any blasting activity. Portions of site will be fenced temporarily during construction to avoid movement of grazing animals and local people.
- Stone aggregates shall be sourced only from licensed existing quarries
- Hot mix plants shall be at least 500 m away from human settlements and preferably located on leeward side of most dominant wind direction. Consent/permits to establish and operate will be obtained from State Pollution Control Board and all permit conditions shall be implemented/complied.
- Appropriate traffic diversion schemes shall be implemented during bitumen paving is under progress and all works shall be planned and swiftly completed to avoid inconvenience to road users.
- Storage of oil will be undertaken on paved impervious surface. Fuel storage will be located at a significant distance from electrical works and panel. Re-fuelling of

machinery at site will be undertaken over paved surface. In case of any accidental spill the soil will be cut and stored securely for disposal with hazardous waste.

- Vehicles and machinery will be maintained and repaired immediately for leaks. Drip pan will be provided to vehicles with leaks to prevent contamination of soil. Hazardous waste generated from machinery and equipments will be stored at site in a secure location. The hazardous waste will be sold to vendors approved by Maharashtra Pollution Control Board (MPCB), at an interval of three months. Painting of panels, switchyard structures will be undertaken after covering the land beneath with a sheet of impervious material. Empty paint container will be stored at a secured area identified for scrap and sold to vendors.
- Work permit system shall be implemented for working at height (typically when working over 2 m above) and for hot jobs. Prior to undertaking work, integrity of structures shall be inspected. Only workers trained in climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment shall be engaged for work at height.
- Construction debris and excavated material will used for filling up of low lying areas and for foundation works of pooling station and maintenance room. All packaging material will be collected at the storing area and sold to vendors.
- Appropriate fall-protection system will be provided as per the requirement, along with compatible with the tower components. Safety belts will be mandatory and shall be monitored for wear and tear on regular basis. While operating power tools at height, workers will be provided with a second (backup) safety strap. All workers will be trained about use of Personal Protection Equipment, which will be mandatory to be worn at site during construction. Hard hat areas will be marked and informed to all workers.
- Stringing activities will have limited impact on agriculture as the land use is mostly fallow and barren. Agricultural land will be avoided wherever alternate site options will be available. Stringing activity will be undertaken after considering harvest period and will be scheduled to keep loss of crop if any to minimum. Prior information and adequate signs will be provided at all locations of transmission pylons falling near road crossings and habitations.

Impact Value

The impact on environment and social components from concrete work, erection and installation activities will have a localised impact with short duration and a low intensity after mitigation measures are employed.

Table 5.8: Impact Value – Concrete Work, Erection and Installation Activities

Aspect	Scenario	Spread	Duration	Intensity	Overall
Concrete Work, Erection and Installation Activities	Without Mitigation	Local	Short	Moderate	Moderate
	With Mitigation	Local	Short	Low	Minor

5.2.6 Construction Demobilisation

Construction demobilisation will require removal of machinery, workers, campsite and other temporary structures.

Impacts

The key issues associated with demobilisation are:

- Loss of job will be an issue when the workers will be asked to leave after construction because wind farm project will not require more than 8-10 individual for operations phase.
- Improper disposal of construction waste and debris from deconstruction of storage area, etc will lead to contamination of soil and discontent of community.
- Deconstruction activity will lead to generation of dust which can be carried downwind to habitations
- Deconstruction activities are associated with health and safety issues such as structural collapse, trip and fall, electrical hazard etc.

Mitigation Measures

The mitigation measures for demobilisation shall include:

- The contractor shall inform the workers and local community about the duration of work. The workers shall be clearly informed about the expected schedule and completion of each activity.
- Reduction of worker will be done in phase wise and corresponding to completion of each activity. The reduction in workers shall be done based only on the requirement of his/her skill set and not guided by any other factor.
- A transparent mechanism shall be prepared wherever choice is to be made between individuals of similar capability.
- All waste generated from demobilisation shall be collected and disposed off at the nearest municipal disposal site at Karad. Structures that can be reused will be carried back by the contractors or sold to vendors.
- All necessary Personal Protection Equipment (PPE) shall be used by the workers during demobilisation.
- Workers will be briefed about the use and requirements of PPE.

Impact Value

The impact value due to construction demobilization will be minor after mitigation measures are implemented.

Table 5.9: Impact Value – Construction Demobilization

Aspect	Scenario	Spread	Duration	Intensity	Overall
Demobilization	Without Mitigation	Local	Short	Moderate	Moderate
	With Mitigation	Local	Short	Low	Insignificant

5.3 Impacts during Operation Phase

The major activity of wind farm operation will be power generation. Power generation from wind farm project has minimal environmental and social concerns as compared to any other source of power generation. However several other impacts are associated with wind power operations. The major issues of concern during operation of turbines are as provided below:

- Visual impacts due to wind turbines
- Impacts due to noise generation from turbines and transmission lines
- Impacts due to shadow flicker
- Ecological impacts
- Impacts on water resources
- Impacts due to generation of hazardous waste
- Health and safety impacts
- Community and social impacts
- Impacts due to electromagnetic interference of transmission lines
- Cultural and archaeological impacts
- Impacts on communication signals

Based on the activities involved, an impact interaction matrix for operation phase was prepared for of the project. The impact identification matrix is presented in **Table 5.10:**

Table 5.10 Impact Identification Matrix for Operation Phase

S.N	Environmental and Social Components	Main Activities		
		Power Generation	Maintenance of turbines	Corporate Social Activities
	Visual/Aesthetics			
	Ecology			
	Water Resources			
	Noise			
	Cultural /Archaeological			
	Health and Safety			
	Hazardous Waste			
	Shadow Flicker			
	Community/Social			
	Communication facilities			

The above impacts associated with operation phase of the proposed project and their mitigation measures are provided in the following subsections.

5.3.1 Visual Intrusion

Visual resources refer to all objects (man-made and natural, moving and stationary) and features (e.g. landforms and water bodies) that are visible on a landscape. They contribute to the scenic and visual appeal of the landscape. An adverse visual impact is defined as an unwelcome visual intrusion that diminishes the visual quality of an existing landscape. Changes that can be perceived as visual intrusions generally result from the introduction of visual contrast to the existing scene, based on differences in form, line, color, and/or texture.

Visual and aesthetic impacts are among the most commonly expressed concerns about the development of wind energy projects. Determination of what constitutes an adverse visual impact is highly subjective because it depends on the values, beliefs, and experiences of individual viewers. Opinions about the aesthetic qualities of wind energy facilities can vary greatly among different segments of the population and from one location to another.Visual contrast with the existing landscape is often unavoidable because of the size and typical location of wind farms. Nevertheless, there are some measures that can be incorporated into the design of the project facilities to limit the degree of visual contrast and reduce the

prospect that the contrast would be widely perceived as an adverse visual effect, or at least reduce the degree of the effect.

Impacts

The project will have the following impacts related to visual intrusion:

- Wind energy development projects would be clearly visible because of the height and large size of turbine components.
- Shadow flicker is the most significant impact related to visual intrusion.
- All above ground ancillary structures would potentially produce visual contrasts due to their design and result in glare due to reflectivity of their surfaces.

Mitigation Measures

It is critical to recognize that wind turbines cannot be adjusted to meet visual criteria alone. The turbines must be located in the areas with appropriate wind resources in order for the project to be viable.

A visual assessment of the proposed site with respect to the identified tower locations was undertaken. It was observed that the plateau being elevated and spread along nine elongated arms prevents the direct view of all the towers. An average elevation difference of 100m further diminishes the potential for viewing the towers against the existing landscape.

In all the directions it was observed that not more than 5-6 towers will be visible from the base of the plateau. It was also observed that visibility of tower from villages in close proximity will be further limited. It is therefore assessed that the visual intrusion will be limited and more based on individual perception.

The wind turbine towers and blades will be painted white in order to avoid any differing contrast to the landscape and thereby minimize visual discomfort. An anti-reflective paint coating will also be applied to the turbine towers and blades to mitigate the possible impacts of light reflection/blade glint.

Impact Value

The visual impacts on environment and social components due to operation of the wind turbines will be localised with short duration and low intensity after mitigation measures are employed. Hence the overall significance of the impact with mitigation measures will be insignificant.

Table 5.11: Impact Value – Visual Intrusion

Aspect	Scenario	Spread	Duration	Intensity	Overall
Visual Intrusion	Without Mitigation	Local	Short	Moderate	Minor
	With Mitigation	Local	Short	Low	Insignificant

5.3.2 Noise Generation

During operation, major noise sources will be mechanical and aerodynamic noise from turbines, transformer and switchgear noise from substations, corona noise from transmission lines, vehicular traffic noise, and noise from O&M facility.

Impacts due to Noise from Turbine Operation

The sounds that most turbines emit are caused by the passage of the blades through the air – the aero-acoustic ‗swoosh". This sound is similar to the sound made by the wind passing through trees or across the ears of a listener. It is, however, distinct from such sounds in that it can occur in pulses corresponding to the passage of the turbine‗s blades as the rotor turns. It tends to be most noticeable in the middle range of turbine operating wind speeds, when the masking sounds of the wind are not at their highest level. The noise caused by this process is unavoidable.

The proposed wind farm will comprise of 50 wind turbine generators of ReGen make V87 model, 1.5 MW rated capacity. A noise modelling exercise using WindPRO software available for the design and planning of wind farms has been carried out to assess the incremental noise levels generated due to the operation of the wind farm. WindPPO contains pre-configured noise calculation models in order to calculate predicted noise levels at each noise sensitive area plus a ready built catalogue of wind turbines and noise emission data. ReGen has collaborated with Vensys for technical knowledge sharing and therefore the data available for the Vensys 87-1,500 wind turbines from the wind catalogue was used for the noise assessment.

The proposed wind turbines have an estimated noise generation of 90-100 dB(A) at the turbine level, while at base of the tower the noise is around 85-90 dB(A). At a house 500m away, the equivalent sound pressure level would be 25-35 dB(A) when the wind is blowing from the turbine towards the house. Ten such wind turbines, all at a distance of 500 m would create a noise level of 35-45 dB(A) under the same conditions. With the wind blowing in the opposite direction the noise level would be about 10 dB(A) lower.

The results of the modelling exercise have been presented in **Table 5.12** and **Figure 5.1**.

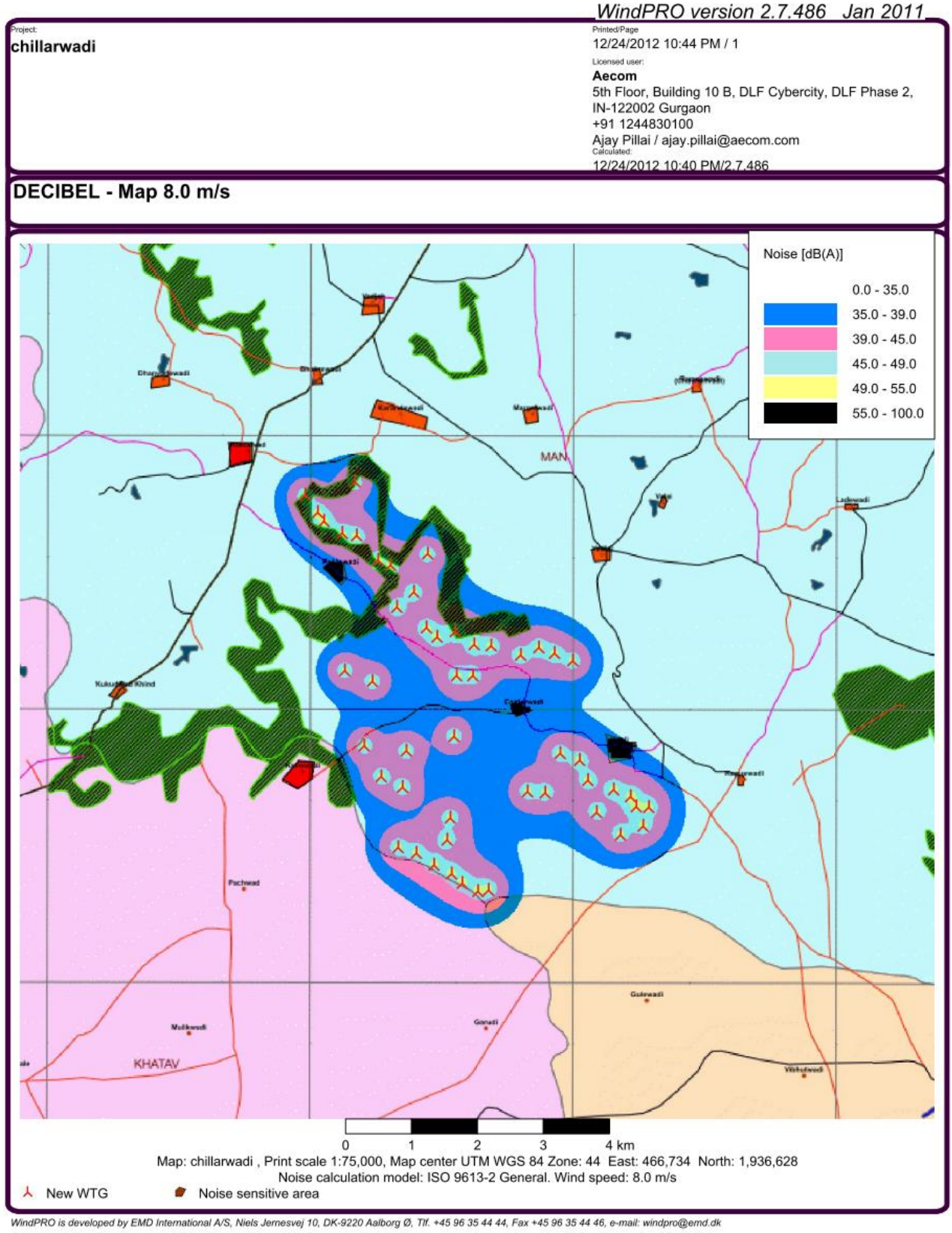
Table 5.12: Resultant Noise Levels in the study area

Village/ Receptor	Baseline dB(A)		Incremental	Resultant dB(A)	
	Day	Night		Day	Night
Virali (A)	49.4	39.3	39.3	49.8	42.3
Katrewadi (B)	47.4	35.8	31.6	47.5	37.2
Puklewadi (C)	48.1	37	38.1	48.5	40.6
Chilarewadi (D)	46.8	35.8	35.9	47.1	38.9
Kukudvad (E)	48.1	37	28.9	48.2	37.6
CPCB Prescribed Limits				**55**	**45**

The results indicate that the incremental noise at the receptor locations will be in the range of 31 – 39.3 dB(A). The resultant cumulative impact of all the turbines was observed to have a marginal increase to the daytime noise levels of the area however during night time there will be an increase of 0.6-3.6 dB(A). The resultant noise will however remain well within the IFC Noise level guidelines and CPCB Standards for Ambient Noise of 55 dB(A) for day time and 45 dB(A) for night time. The results have been presented for noise at wind speed of

8m/s, which is the annual average wind speed in the area. The detailed results of the noise modelling have been presented in **Annex F**.

Figure 5.1: Noise Levels generated due to turbine operation



Impacts due to Noise from Transmission lines

Once operational, noise from energised overhead lines can be produced by a phenomenon known as ‗Corona Discharge' (a limited electrical breakdown of the air). Conductors are designed and constructed to minimise corona effects, although, under certain conditions this can be audible as a ‗*hissing*' sound, sometimes accompanied by a low frequency hum. However, noise due to Corona Discharge is negligible for transmission lines up to 220 kV grade. It is highly unlikely that the corona discharge noise will exceed the normal background noise levels in the area and furthermore, such noises are restricted to certain weather conditions, altitude and temperature.

Mitigation Measures

Although noise impacts are anticipated to be minor, based on the location and model output, the following mitigation measures could be considered to further limit any concerns of habitations in the vicinity.

- Siting turbines shall consider a minimum setback distance to all residential structures.
- Limit the cutting/clearing of vegetation surrounding the proposed substation.
- Keep turbines in good running order throughout the operational life of the project through routine maintenance.
- Implement a complaint resolution procedure to assure that any complaints by the local community regarding operational noise are promptly and adequately investigated and resolved.

Impact Value

The noise related impacts due to project operation will have a localised impact with long duration and low intensity after mitigation measures are employed. Hence the overall significance of the impact with mitigation measures will be minor.

Table 5.13: Impact Value – Noise

Aspect	Scenario	Spread	Duration	Intensity	Overall
Noise	Without Mitigation	Local	Long	Moderate	Moderate
	With Mitigation	Local	Long	Low	Minor

5.3.3 Shadow Flicker

Shadow flicker is the term used to describe the effect caused by the shadows cast by moving wind turbine blades when the sun is visible. This can result in alternating changes in light intensity perceived by viewers. Since wind turbines are usually located relatively far from potential shadow receptors, shadow flicker typically occurs only at times and locations of low sun angles; this is most common just after sunrise and just before sunset, and in relatively higher. Shadow flicker does not occur when the sun is obscured by clouds or fog, or when wind turbines are not operating, or when the blades are at a 90° angle to the receptor. While shadow flicker can be perceived outdoors, it tends to be more noticeable in rooms with windows oriented to the shadows. A wind turbine's shadow flicker impact area is

generally located within approximately 300 meters of the turbine and typically lasts for less than 20 minutes.

Impacts

The villages aligned along the east west axes of the proposed project site are Puklewadi and Chilarewadi. There is one small temple on the plateau above Chilarewadi which falls within the project area. There is however no potential for Shadow flicker from the proposed project as the wind turbines are located on the elevated plateau. During the low sun angle at morning hours, the shadow will be towards the west direction and will fall along the plateau or along the slopes of the plateau and will therefore have no impact on the receptor villages. During sunset, the shadow source will be at a lower elevation than the wind turbines and will not have an impact.

Mitigation Measures

All turbines located along the edges close to habitation will have a minimum set off of 500m, which will negate the spread of any distinct shadow at the village. Also the elevation difference of 100m with vegetation along the slope will further diminish any possibility of impact.

The turbine that will be located close to the temple will maintain a set off of more than 700m to avoid any impact of shadow. Any impact if observed will be addressed through plantation in the line of impact.

Impact Value

The impacts due to shadow flicker will be minor with long duration and low intensity after mitigation measures are employed.

Table 5.14: Impact Value – Shadow Flicker

Aspect	Scenario	Spread	Duration	Intensity	Overall
Shadow Flicker	Without Mitigation	Local	Long	Moderate	Moderate
	With Mitigation	Local	Long	Low	Minor

5.3.4 Ecology

Impacts

The following ecological impacts are envisaged due to the operation of the project:

- Fatalities of birds and bats due to possibility of collisions with wind turbines blades, meteorological towers, and transmission lines; electrocution from transmission lines
- Barrage effect for migrating birds, causing a change of flight route;
- Habitat loss for small mammals and birds due to setting up of turbines and associated facilities;
- Some birds keep distance to wind turbines resulting in habitat alteration;
- Increased risk of fires at the site due to failure of machinery or transmission line.

The principal risk to birds believed to be posed by turbines, is the potential to be killed as a result of collision with moving rotors. The probability of a bird being hit, when making a transit through a rotor, depends on the size of the bird (both length and wingspan), the

breadth and pitch of the turbine blades, the rotation speed of the turbine, and the flight speed of the bird. The species that are most likely to be impacted include raptor species and water birds.

As of early 2010[10], the American Birding Association estimated that approximately 100,000 birds are killed by wind turbines each year in the U.S., based on an average of about 3+ birds per turbine per year for 30,000 turbines. This number of fatalities does not appear to be causing significant impacts to populations of the species involved.

Box 5-1: Bird Death and Cause - United States

The number of bird deaths from wind farms is relatively small compared to other causes. According to the most recent figures from the American Bird Conservancy, the number of birds killed in the United States every year because of striking windmills is relatively small compared to other causes:

CAUSE	BIRTH DEATHS
Building strikes	100 million - 1 billion
Car strikes	200 - 300 million
Communication towers	4 - 50 million
Power lines	~75 million
Cats	365 million (1 million per day)
Wind farms	100,000 - 300,000

An ecological survey of the project site was undertaken in March 2011 in order to understand the potential ecological impacts due to the proposed project. The proposed project falls in the Western Ghats under the Ecologically Sensitive Zone – 3 as per the WGEEP report. The north western boundary of the project site is bordered by reserved forests. The proposed project is also located at a distance of about 10 km from the Mayani Bird Sanctuary, which is the nearest identified location of migratory birds. Two lakes, Lake Vadlaj and Lake Taraswadi, are also located at respective distances of 4km and 8km from the project site. However, due to poor rainfall, there are no water bodies of significance in the immediate vicinity of proposed project site area, which would serve as staging points. Therefore very limited number of birds is diverted towards the proposed project site area. There is no data available regarding flight-paths taken by birds to and from the Mayani, Vadlaj and Taraswadi wetlands. As per available data, it can only be stated that no avian migratory flyway coincides with the region in which the proposed project-site is located.

The study area is also known to have presence of bat species. A carcass survey was conducted in the study area near existing wind turbines, no bird or bat carcass was observed during the survey. The general vegetation in the site is also poor and does not have micro habitats to attract large populations of birds. There is no bat feeding or nesting areas identified in the site area and immediate vicinity. The bird mortality risk is thus considered to be low.

The barrage effect of wind parks can prevent migrating birds from following their airways. This is only critical, however for birds flying within the range of the turbines. After

[10] Understanding Bird collision at communication towers and wind farms, Birdie January 2011, American Birding Association

construction, local birds can become accustomed to the turbines, but some of the guest or migration birds, which stay temporarily, avoid the area completely.

The proposed project area falls within the migration route of the unique multi-species Milkweed butterfly group. Several hundreds of these fly southwest-northeast towards the Eastern Ghats and Plains, and back. En route, they are known to congregate and breed wherever there is a good stock of their food-plants. The common food plants of this butterfly group that are found in abundance in the project area include *Calotropis gigantean, Calotropis procera, Cryptostegia grandiflora* and *Pergularia daemia*.

Mitigation Measures

The following measures shall be adopted in order to minimize any impacts on the ecology and biodiversity of the area:

- Most of the turbines are planned to be installed in single row but few turbines occur in two rows. However, the distance of 5 times of the diameter of the turbine will be maintained between two rows wherever such scenario is occurring. The layout provides adequate spaces between each turbine for movement of birds which would reduce the potential for accidental collision.
- The smaller birds do not pose a significant threat from the turbine owing the diminished probability of collision due to their size. The larger birds such as raptors and water birds are more prone to collision risk. However as dicussed above the lack of any food source and availability of many small lakes with suitable habitats in the near by area limit these birds from descending on the project area.
- Most of the Birds at Mayani are resident birds however passage migrants like Greater Flamingos area lso reported. These birds normally prefer wetlands and water bodies for stop over.
- Intra-farm wiring will be kept underground which will further reduce the hindrance to birds. Above ground wiring, if any will be insulated to avoid any chance of electrocution.
- Daytime visual markers will be provided on any guy wires used to support towers to enhance visibility of towers for birds.
- Visibility enhancement objects such as marker balls, bird deterrents, or diverters shall also be installed along the transmission line to avoid avian collision.
- Habitat loss will be limited for small mammals or reptiles in the areas cleared for construction activities. The losses are insignificant and with re-vegetation of these areas will restore the habitats. No fragmentation of habitat is identified from the proposed wind farm project.
- Appropriate storm water management measure shall be implemented to avoid creating attractions such as small ponds which can attract birds and bats for feeding or nesting near the wind farm.
- The food plants of the Milkweed butterfly species shall not be cleared during construction and re-vegetation of such plant species shall be carried out during operation phase.
- It is suggested to have monitoring of bat colonies for initial three years of project operations since some bat colonies have been identified.
- NRPPL shall obtain a No Objection Certificate from the Chief Wildlife Warden, Maharashtra in case any endangered species of birds or bats are identified during operation phase of the project.

In case injured birds/ bird hit is observed, the site staff shall:

- Handle the bird quietly and calmly to avoid adding to its stress. Keep the bird quiet and warm (to help prevent or treat shock).
- If the wound is bleeding, apply direct pressure with cotton gauze, but do not restrict breathing. Transport the bird to your veterinarian immediately.
- Check for broken bones. If a wing is broken, wrap both wings loosely to the body with gauze and then tape to prevent further injury from flapping the wing.
- Do not tape tightly or the bird will not be able to breathe. If other bones (skull, leg) are broken, do not attempt to treat at site as further damage may occur.
- Keep information about nearest veterinary clinic at the site.
- Identify the bird species and maintain documented record of the bird hit.

Impact Value

The impacts on ecology of the project area will be minor with short duration and moderate intensity after mitigation measures are employed.

Table 5.15: Impact Value – Ecology

Aspect	Scenario	Spread	Duration	Intensity	Overall
Ecology	Without Mitigation	Local	Short	High	Moderate
	With Mitigation	Local	Short	Moderate	Minor

5.3.5 Water Resources

Impacts

The most significant use of water during wind project operation in areas of low rainfall is cleaning of wind turbine rotor blades. The purpose of blade cleaning is to eliminate dust and insect build up, which otherwise deforms the shape of airfoil and degrades performance. It is estimated that about $2m^3$ of water will be required for cleaning of each turbine as part of the annual maintenance schedule. Besides requirement for cleaning of blades there is no other significant requirement of water.

Mitigation Measures

Water required for cleaning will be sourced from authorised tankers suppliers. The use of water will be minimal as cleaning of all turbines will not be undertaken simultaneously. No waste water generation is envisaged from the process.

Impact Value

The impact value on water resources will be insignificant with mitigation measures. The impacts will be localised with short duration and low intensity.

Table 5.16: Impact Value – Water Resources

Aspect	Scenario	Spread	Duration	Intensity	Overall
Water Resources	Without Mitigation	Local	Short	Moderate	Minor
	With Mitigation	Local	Short	Low	Insignificant

5.3.6 Hazardous Waste

Impacts

Hazardous waste generated from operation of wind farms is limited to small quantities of waste oil from use of lubricant oil and transformer oil. The waste requires adequate disposal measures as per the requirements of Hazardous Waste Management Handling and Transboundary Movement Rule 2008. Improper disposal of hazardous waste can lead to contamination of soil and ground water, which could result in indirect impacts to humans, flora and fauna.

Mitigation Measures

The following mitigation measures will be employed for hazardous waste generation:

- Waste oil generated shall be stored in a secure location at the maintenance room.
- Waste oil will only be sold to authorized vendors approved by the Maharashtra Pollution control Board (MPCB).
- Transformer oil shall be returned to the manufacturers as per the agreement of purchase.

Impact Value

The impacts due to hazardous waste generation will be localised with low intensity. The impact value will be minor with implementation of adequate mitigation measures.

Table 5.17: Impact Value – Hazardous Waste

Aspect	Scenario	Spread	Duration	Intensity	Overall
Hazardous Waste	Without Mitigation	Local	Long	Moderate	Moderate
	With Mitigation	Local	Long	Low	Minor

5.3.7 Occupational Health and Safety

Impacts

The health and safety aspects to be considered during operation of wind farm include:

- Working at height - The maintenance activities for the turbines will involve working at heights. The operation and maintenance activities will be carried out by ReGen.
- Electrical/Fire Hazards - The operation and maintenance activities will include electrical/fire hazards such as electric shock, and thermal burn hazards. The hazard is associated with use of tools and equipment that can contact power lines.
- Structural failures due to natural hazards – The project site falls in seismic Zone III which is moderate damage risk zone and may experience minor to moderate seismic activity. Earthquakes can result in structural failure of the blades or fire in the generator.

Mitigation Measures

Working at height for cleaning and maintenance of turbines will require adherence to precautions and safety measures as provided:

- ReGen shall provide instructions and procedures to all the workers involved in service repair of wind turbines, which will consider wind speeds and other external conditions in such a manner that service, maintenance and repair work on the wind turbine can be performed safely.
- Ensure use of safety belt and need for safety net as required
- All work at height to be undertaken during daytime with sufficient sunlight
- Work permit system shall be implemented for working at height (typically when working over 2 m above) and for hot jobs.
- Prior to undertaking work, integrity of structures shall be inspected.
- Fixtures shall be installed on tower components to facilitate the use of fall protection systems;
- Only workers trained in climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment shall be engaged for work at height.
- Workers handling electricity and related components will be provided with shock resistant gloves, shoes and other protective gears. Adequate training regarding health and safety will be provided to the workers.
- The switchyard building will be provided with fire extinguishers and sand buckets at all strategic locations to deal with any incident of fire.
- Safety incidents will be recorded and monitored. The objective shall be to gradually reduce and attain zero incidences.

The following safety measures shall be adopted to minimise the risk of electrical/fire hazards:

- Wind turbines shall be equipped with an earthing system;
- Access to areas containing exposed electrical equipment (such as transformers) shall be fenced and locked. Warning signs shall be posted at hazardous locations;
- Fire fighting equipments such as fire extinguishers and sand buckets shall be provided at appropriate locations;
- Workers involved in electric operations shall be provided with Protective Equipment such as rubber gloves etc;
- Employees involved in electrical works shall be trained in and familiar with the safety-related work practices, safety procedures, and other safety requirements that pertain to their respective job assignments.

Impact Value

The impact value of health and safety related aspects during operation will be minor with implementation of adequate mitigation measures.

Table 5.18: Impact Value – Health and Safety

Aspect	Scenario	Spread	Duration	Intensity	Overall
Health and Safety	Without Mitigation	Local	Short	Moderate	Moderate

Aspect	Scenario	Spread	Duration	Intensity	Overall
	With Mitigation	Local	Short	Low	Minor

5.3.8 Cultural /Archaeological

Impacts

There is one small temple on the plateau above Chilarewadi which falls within the project area. This temple is reported to host important rituals and functions at least three-four times a year (including Dusshera Magh Purnima, Gudiparva and Maha Shivratri). Villagers from the surrounding villages are reported to collect at this temple during the festival season. The temple is free of visitors for most part of the years besides these festivals.

The community is aware that the wind farm project will not prevent their access to the temple; however they would like the turbines to be sufficiently distant to the temples. The wind turbines location as identified by NRPPL is at a significant distance from the temple and will not restrict access to the temple in any manner. The community also expects the existing access route to be retained and improved.

Mitigation Measures

- The siting and location of towers has taken into consideration the proximity to temple and access to the temple.
- NRPPL shall incorporate development of temple and access routes as part of their corporate social responsibility to meet the expectation of community.
- All electrical facilities and transformer will be adequately fenced to avoid any electrical hazards during festival seasons.
- Noise levels at the temple are expected to be within the day time noise guideline, however night time levels may exceed. There are no visitors during night hours, except during festival season and therefore the impact will be negligible.

Impact Value

The cultural impacts during operation will be minor with implementation of adequate mitigation measures.

Table 5.19: Impact Value – Cultural/archaeological

Aspect	Scenario	Spread	Duration	Intensity	Overall
Cultural	Without Mitigation	Local	Long	Moderate	Moderate
	With Mitigation	Local	Long	Low	Minor

5.3.9 Community/ Social Issues

The impacts on the community and the social fabric of the surrounding region will include the following:

- Impacts due to noise and shadow flicker
- Impacts due to electromagnetic fields;
- Restriction of use of project area for grazing activities;
- Impact on community functions in the area.

The issue of noise and show flicker has already been discussed in the above section. The other community issues are presented below.

Impacts due to Electromagnetic Fields

Electromagnetic Fields (EMF) emanate from any wire carrying electricity. Members of the general public are routinely exposed to these fields in their everyday lives. Possible effects associated with the electric and magnetic fields from transmission lines (or similar electrical sources) fall into two categories:

- short-term effects that can be perceived and may represent a nuisance
- possible long-term health effects.

The issue of whether there are long-term health effects associated with exposure to fields from transmission lines and other sources has been investigated for several decades. There is little evidence that electric fields cause long-term health effects. Estimates of magnetic-field exposures have been associated with certain health effects in studies of residential and occupational populations. Research in this area is continuing to determine whether such associations might reflect a causal relationship.

Mitigation Measures

The lists of exposure limits for general public/occupational exposure to electric and magnetic fields published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) is as given in **Table 5.20** and **Table 5.21.**

Table 5.20: ICNIRP exposure limits for general public exposure

Frequency	Electric Field (V/m)	Magnetic Field (μT)
50 Hz	5000	100
60 Hz	4150	83

Source: ICNIRP (1998) : "Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz).

Table 5.21: ICNIRP exposure limits for occupational exposure

Frequency	Electric Field (V/m)	Magnetic Field (μT)
50 Hz	10,000	500
60 Hz	8300	415

There are no specific standards or guidance on EMF in India however the Indian Electricity Act and Rules clearly stipulate the minimum clearances required for setting up of transmission lines and substations. Hence the ICNIRP standards and guidelines have been considered and will be complied with. For the general public (up to 24 hours a day) an exposure level of 1,000 mG or 100 μT is suggested. The EMF generated by the proposed 220KV substation unit and transmission lines will be lesser than the suggested value.

The recommendations applicable to the management of EMF exposures (as per IFC) as given below will be followed by the project:

- Evaluation of potential exposure to the public against the reference levels developed by the ICNIRP will be studied. Average and peak exposure levels will remain below the ICNIRP recommendation for General Public Exposure.

- If EMF levels are confirmed or expected to be above the recommended exposure limits, application of engineering techniques will be considered to reduce the EMF produced by the transmission lines, substation or transformers. Examples of these techniques include:
    - Shielding with specific metal alloys
    - Increasing height of transmission towers
    - Modifications to size, spacing, and configuration of conductors
- The 33 kV transmission lines and 220 kV transmission lines are proposed to be located away from houses, schools and hospitals, at a minimum distance of 6.6 m and 44 m respectively.

Impacts on Grazing Activities and Community Functions

The proposed site comprises of grazing land which is used by the local villagers during the post monsoon season. There is a likelihood of loss of grazing land if the access to the project area is restricted. The temple on the Chilarewadi plateau hosts important rituals and functions at least three-four times a year during major festivals when people from the local villages and surrounding areas visit the temple. However the wind farm project will not restrict access to the temple since the turbines will be located at sufficient distance from the temple.

Mitigation Measures

NRPPL will not fence/barb wire the entire area and shall allow normal movement of goats and sheep in most part of the site. NRPPL shall ensure that all transformers are fenced and cables insulated to avoid any electrical hazards. Access to turbine tower ladders shall be restricted.

The area has a shortage of fodder for livestock, especially in summers. The local administration arranges cattle camps where fodder is provided. NRPPL shall try and contribute to the same.

All community functions associated with the temple will be allowed to function as existing. NRPPL will also try and be a part of such celebrations through their CSR activities. NRPPL shall also explore the possibility of not operating the wind turbines close to the temple during major festivals or community functions.

Impact Value

The impact on community/social issues is expected to be of local spread, long duration and low intensity with mitigation measures and the overall impact is assessed to be minor.

Table 5.22: Impact Value – Community/Social Issues

Aspect	Scenario	Spread	Duration	Intensity	Overall
Community/ Social Issues	Without Mitigation	Local	Long	Moderate	Moderate
	With Mitigation	Local	Long	Low	Minor

5.3.10 Communications

Impacts

Wind projects may impact communications signals in two ways. Wind turbines and their associated transmission lines can generate electromagnetic noise, which can interfere with telecommunications services, or, more commonly, wind turbines create physical obstructions that distort communications signals. The types of communications systems that may be affected include off-air TV broadcast signals, and mobile telephone services.

Off-air stations are television broadcasters that transmit signals that can be received from terrestrially located broadcast facilities on a television receiver. Off-air television signals are subject to distortion by the reflections from the turbine blades and by the attenuation of the signal passing through the wind turbines. The reflections may cause multipath distortion and ghosting. Blade motion may cause the contrast and brightness of the signal to vary.

Mitigation Measures

The area was surveyed for presence of mobile transmission tower in the immediate vicinity. It was observed that there are no mobile towers within about 1.5-2.0 km of the proposed site. Thus the potential for any such interference is minimized.

These effects on off air television apply to analogue modulated television signals and do not affect digital signals in the same way. Almost all of the television operators including the national broadcast makes use of digital signals and hence will have little impact due to wind farm.

Impact Value

The operation of the wind farm will have localised impacts of low intensity on the communication signals in the area.

Table 5.23: Impact Value - Communications

Aspect	Scenario	Spread	Duration	Intensity	Overall
Communication Signals	Without Mitigation	Local	Long	Low	Minor
	With Mitigation	Local	Long	Low	Minor

5.4 Decommissioning Phase

Decommissioning activities depend on the proposed subsequent use of the site, but they typically consist of removal of infrastructure (e.g. turbines, substations, roads) and reclamation of the project site, which may include re-vegetation wherever required.

NRPPL shall prepare a detailed decommissioning plan at least one year prior to the commencement of decommissioning. Removal of turbines and associated facilities shall ensure the following:

- Inform the community and relevant stakeholders about decommissioning plan and proposed subsequent actions
- Removal of all structures including foundations to the extent possible

- Removal of all waste collected at site, including the demolition debris
- Noise and dust emissions to be kept low during the decommissioning
- Roads and culvert to be retained after consultation with the community
- Heavy vehicle movement to be planned and informed to the community

5.5 Cumulative Impacts

During the survey period, land being sold for other projects was observed as

- Virali reported no sale of land for other projects during the site survey
- About 4- 5 turbines of other projects are planned near Chilarewadi which require 10-12 acres land on the barren plateau area.
- Similarly 3 other turbines are planned near Puklewadi, which requires 7 acres of land on the barren plateau area.

The potential cumulative impacts identified for the project and their mitigations are provided in the following sub sections.

Socio-economics

The land being acquired for the project is barren land with difficult terrain for agriculture in most of the cases. It is not considered as source of income and the community is willing to sell. The cumulative impact if any is positive as the people can now offer to buy more productive land or invest in livestock. The advent of wind farms in the area will ensure more avenues for local employment and continuous engagement within the area.

Overall the cumulative impact will be positive, leading to improvement in the income levels of the people with increase in value of land.

Migrant Workers

Although the proposed project will not engage any migrant labour, other upcoming projects in the vicinity might result in the influx of migrant population. This will support the local economy in terms of sale of consumable items, food items, accommodation etc. However the influx of large number of outsiders can potentially lead to cultural conflicts.

Most of the civil works being small in nature will be handled by the local contractors from Satara or nearby regions. This would ensure that the workers are largely from within Maharashtra. Only skilled workers for erection of turbines and operation cranes will be sourced from outside states and their numbers will be relatively less.

The local contractors and labours will be engaged during construction to avoid migration of labour from far off places. This will not have any stress on the local and moreover provide job opportunities to the local population.

Impact on Infrastructure

The road connectivity in the area is good therefore transportation of turbine components will not lead to any disturbances to the habitations. There will be no disturbance to habitations as the turbines are erected on isolated plateaus.

Impact on air quality, water quality and soil characteristics

During operation of the project no fuel of any kind will be burnt. Therefore the impact on air quality is not considered. There is no wastewater generation from the wind turbine. The domestic wastewater may be generated from office of the O&M team. Septic tanks will be provided to treat sewage during operation phase. There is no solid waste generation during operation phase. Therefore the impact on soil is not envisaged.

Noise

The noise from existing turbines has been captured in the baseline recorded for the project; the resulted predicted with proposed project is with the acceptable limits. The turbines proposed as part of future developments are located at more than 500 m from the Virali and Chilarewadi Villages. The location of other turbines from Puklewadi is more than a kilometre away and only a group of two turbines.

The impact of noise generation on Chilarewadi and Virali from all turbines within 1500m was assessed using the WindPro software and the resultant obtained is detailed in the section below. There are 16 wind turbines (including all proposed) within 1500m of Virali village and 18 turbines (including all proposed) within 1500m of Chilarewadi village.

The resultant cumulative noise from all the turbines in the vicinity of the villages Virali, Chilarewadi and Puklewadi is as provided in **Table 5.24 and Figure 5.2.**

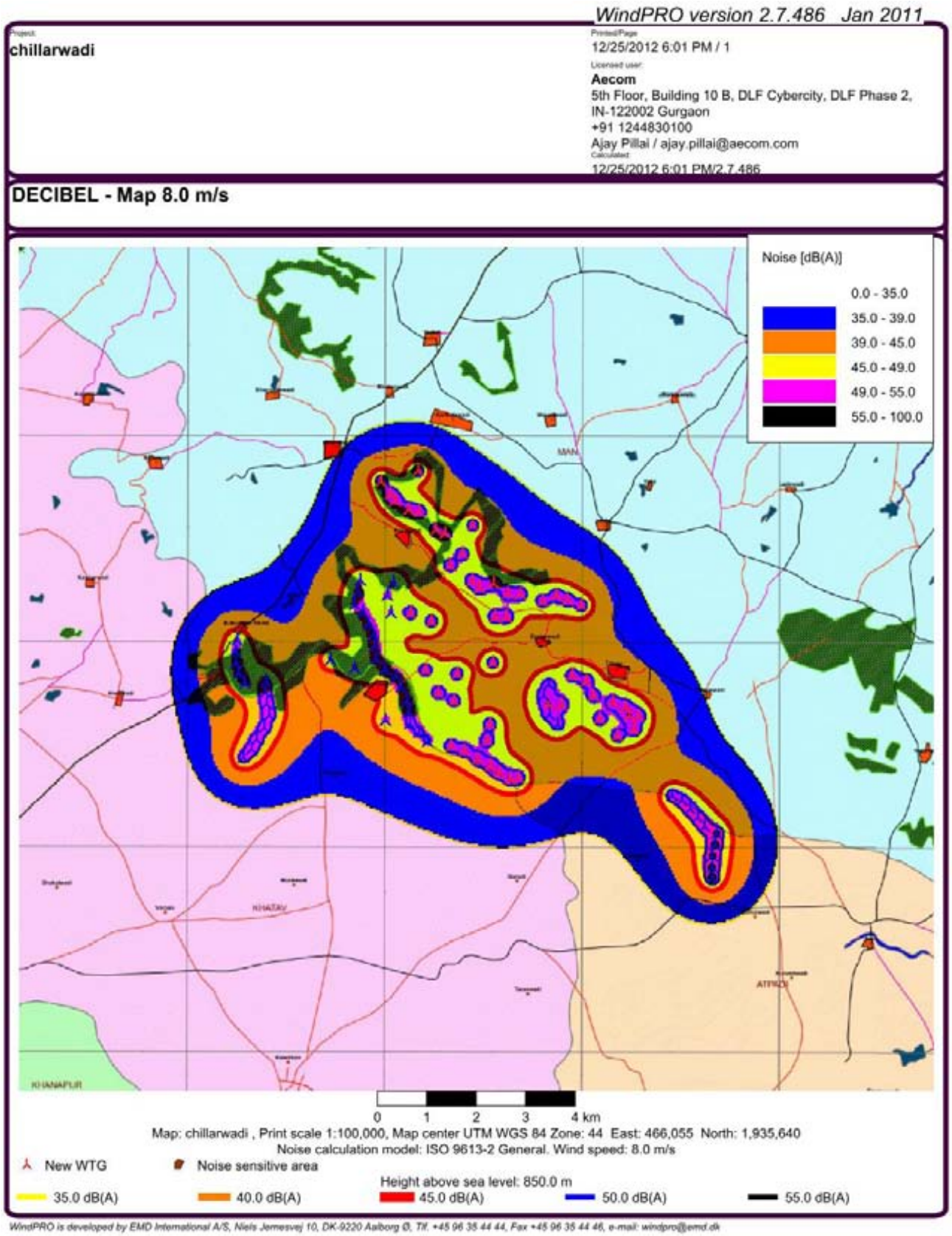
Table 5.24: Resultant Noise cumulative dB(A)

Village/ Receptor	Baseline dB(A)		Incremental	Resultant dB(A)	
	Day	Night		Day	Night
Virali	49.4	39.3	44.8	50.7	45.9
Puklewadi	48.1	37	44	49.5	44.8
Chilarewadi	46.8	35.8	42.4	48.1	43.3
CPCB Prescribed Limits				**55**	**45**

The results indicate that the incremental noise at the receptor locations will be in the range of 42.4 – 44.8 dB(A). The resultant noise levels will increase marginally for daytime and will be within the prescribed limits. The night-time noise levels will increase by 6 – 7 dB(A) at the receptor locations. However the levels will be within the prescribed limits for noise. The results have been presented for noise at wind speed of 8m/s, which is the annual average wind speed in the area.

The cumulative noise impact of the other turbines on the proposed project is marginal and will be within the acceptable norms of ambient noise.

Figure 5.2: Cumulative Noise Modelling



6 Analysis of Alternatives

An analysis of alternatives for the proposed wind power project is discussed in the following section. The variables that have been analysed include:

- No Project Scenario;
- Alternate location for the proposed Project ;
- Alternate methods of power generation; and
- Alternate routes to transmission lines.

6.1 No Project Scenario

As per Central Electricity Authority (CEA), India has a total installed capacity of 209,276 MW, till the end of October 2012, generated from both conventional and non-conventional sources. The total electricity generation in the country is approximately 877 Tera Watt Hours (TWh) during the year 2011-12. The 17th Electric Power Survey (EPS) report has projected electrical energy demand of 1392 TWh for 2016-17 and peak electricity demand of 219GW entailing capacity addition of 10,000 MW by 2016-17.

The total installed capacity of Maharashtra upto October 2012 is around 26,500 MW. The peak power demand forecast for Maharashtra in 2016-17 as per the 17th Electric Power Survey (EPS) report is 28,347 MW while the electrical energy requirement will be 167,226 GWh. Details of energy growth and capacity requirement up to the end of 12th Five Year Plan (2016-17) and further is given in **Table 6.1.**

Table 6.1: Power Demand Forecast - Maharashtra

State/Region	Electrical Energy Requirement (GWh)			Peak Electric Load (MW)		
	2011-12	2016-17	2021-22	2011-12	2016-17	2021-22
Maharashtra	125,661	167,226	219,910	21,953	28,347	35,944
All India	968,658	1,392,066	1,914,508	152,746	218,208	298,253

Source: 17th Electric Power Survey

In order to meet the gap in the demand and supply renewable/non conventional sources of power will be required to supplement the conventional sources. The proposed project being a non conventional source of power generation intends to contribute towards bridging the demand supply deficit as projected. As per the 11th Five Year Plan (2007-2012) the target proposed for power generation from renewable is as provided in **Table 6.2** below.

Table 6.2: Target proposed for Power Generation from Renewable

S. No.	Target	Achievement in 2007-08	Expected Achvt. in 2008-09	Expected Achvt. in 2009-010	Expected Achvt. in 2010-11	Expected Achvt. in 2011-12	Cumul. Achvt. Upto 31st March, 2012
1	Wind Energy Power Projects (MW)	268.15	600	600	600	600	2668.15
2	Biomass Power	4.00	150	157.5	165.38	177	653.88

S. No.	Target	Achievement in 2007-08	Expected Achvt. in 2008-09	Expected Achvt. in 2009-010	Expected Achvt. in 2010-11	Expected Achvt. in 2011-12	Cumul. Achvt. Upto 31st March, 2012
	Project (MW)						
3	Bagasse Co-generation (MW)	45.36	150	200	250	300	945.36
4	Municipal Solid Waste, Industrial Solid Waste (MW)	0.00	100	125	150	187	562.00
5	Small Hydro (MW)	4.26	40	40	70	75	229.26
	Total (MW)	**321.77**	**1040**	**1122.5**	**1235.38**	**1339**	**5058.65**

Source: 11th Five Year Plan (2007-2012)

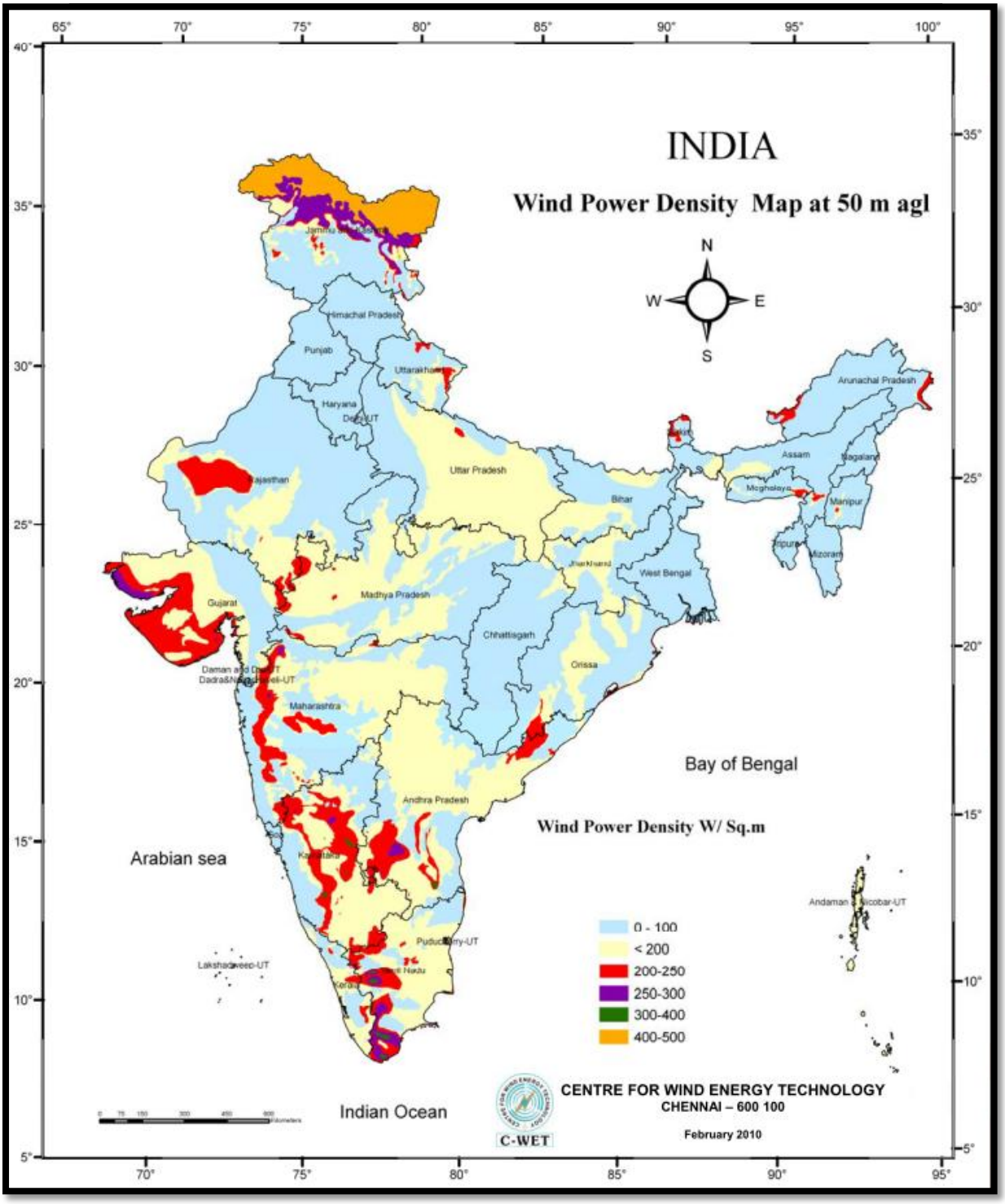
The total assessed wind power potential in the country is about 48,000 MW. The state of Maharashtra has a wind power potential of about 5,439 MW[11]. The Centre for Wind Energy Technology (C-WET) published the Indian Wind Atlas in 2010, showing large areas with annual average wind power densities of more than 200 Watts/m^2 at 50 meter above ground level. The potential sites have been classified according to annual mean wind power density ranging from 200 W/m^2 to 500 W/m^2. Sites with Annual Mean Wind Density above 200 W/m^2 are considered suitable for wind power projects. In all 213 such sites have been identified in the country, out of which 40 sites are located in Maharashtra. The **Figure 5.1** presents the potential area of wind power generation in country.

The total installed wind power capacity in the state of Maharashtra is about 2733.30 MW as on 31st January, 2012. The proposed project is an opportunity to utilize the potential for wind power generation. A ~~"N~~o Project Scenario" will not address the issue of power shortage. An alternative without the project is undesirable, as it would worsen the power supply-demand scenario, which would be a constraint on economic growth.

The proposed project using wind to generate electricity reduces CO_2 and SO_2 emissions. It does not deplete the natural resources and most importantly only a small part of land will be permanently utilised by the turbines, equipment and access roads. Therefore, existing land use of the site i.e., animal grazing land, can continue unaffected.

[11] Source : Maharashtra Energy Development Agency

Figure 6.1: Wind Power Density Map of India



Source: http://www.cwet.tn.nic.in

6.2 Alternate Location for the Proposed Project SIte

The site selection is guided by the wind velocity and wind power density observed in the area. The area falls in the region with wind speed between 200-250 W/m^2. The choice of site is limited, as 2078 MW of power generation is already underway in Maharashtra within the

identified areas of potential wind speed requirements. Other locations in the vicinity were also considered however the site selection was finalised based on the following considerations:

- The proposed site is a plateau with an elevation difference of 100 m between the villages (besides horizontal distance) and the locations for turbines.
- There is no habitation within the project site location and it is devoid of any agricultural practices in the recent years, which would imply minimum visual intrusion or inconvenience in terms of noise and shadow flicker.
- The proposed site has limited use for grazing activities; however that aspect will not be disturbed as the area around the wind farm will not be fenced.
- The site does not include any forest land
- Access road for the project site can be planned through the a portion of revenue land with diverting any private land
- Willingness of people to sell their land for the project.

Considering the location and site settings the identified site is a suitable option for the project.

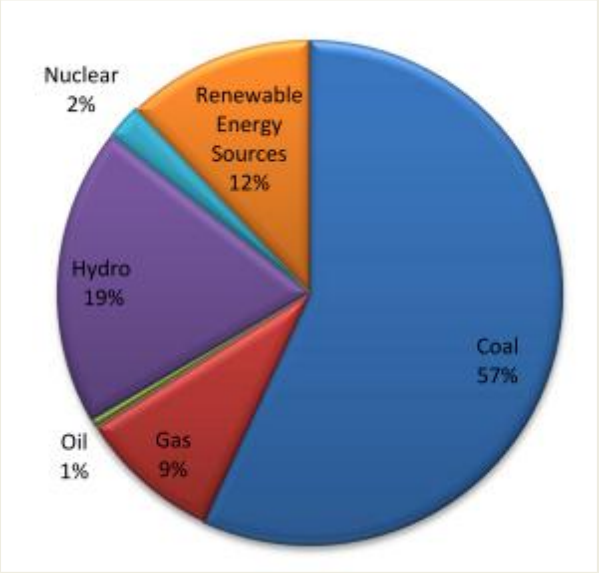
6.3 Alternate Methods for Power Generation

6.3.1 Electricity Generation Options

The electricity sector in India has the world's fifth largest installed capacity of 207.34 Gigawatt (GW) as on August, 2012. Captive power plants generate an additional 31.5 GW. Thermal power plants constitute 66% of the installed capacity, hydroelectric about 19% and rest being a combination of wind, small hydro, biomass, waste-to-electricity, and nuclear.

In terms of fuel, coal-fired plants account for 57% of India's installed electricity capacity followed by hydropower which accounts for 19%, renewable energy for 12% and natural gas for about 9%. The source wise installed capacity in India is presented in Figure 6.2.

Figure 6.2: Source Wise Installed Capacity



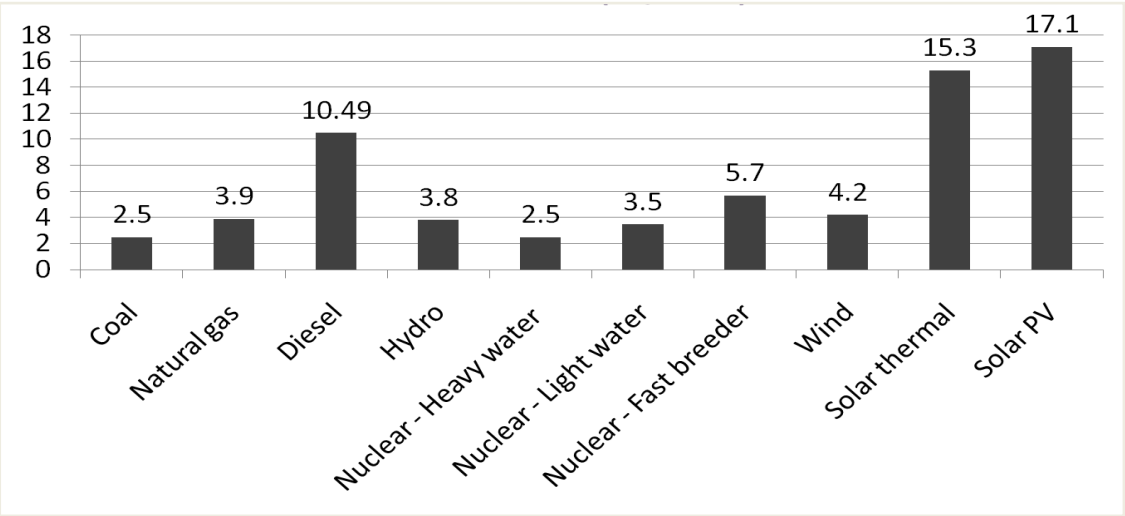
Source: Ministry of Power, 2012

Majority of the coal reserves of India are characterised by low calorific value and high ash content. The iron content is low in India's coal, and toxic trace element concentrations are negligible. The natural fuel value of Indian coal is poor. On average, the Indian power plants using India's coal supply consume about 0.7 kg of coal to generate a kWh, whereas United States thermal power plants consume about 0.45 kg of coal per kWh. According to Oil and Gas Journal, India had approximately 38 trillion cubic feet (Tcf) of proven natural gas reserves as of January 2011. Natural gas is expected to be an increasingly important component of energy consumption as the country pursues energy resource diversification and overall energy security.

6.3.2 Cost of Electricity Generation

There are several alternatives for energy generation available. To assess the economics of power generation, levelised cost of power generation which includes the initial investment costs, operations and maintenance, cost of fuel and cost of capital, has been considered (Refer Figure 6.3)

Figure 6.3: Levelised Cost of Power Generation (Rs/KWh)



Source: LBNL, CERC , CSTEP & NPCIL

It can be seen that the cost of power generation from conventional sources (coal and natural gas) is lower than the renewable energy source such as wind and solar.

6.3.3 Reliability of Power Generation

For assessing the reliability of power generation, the plant load factor can be used as an indicator, The load factor of an energy technology is the ratio (expressed as a percentage) of the net amount of electricity generated by a power plant to the net amount which it could have generated if it were operating at its net output capacity. The plant load factors for different power generation sources are presented in Table 5.3.

Table 6.3: Plant Load Factors

Technology	Plant Load Factor
Combined Cycle Gas Turbine (CCGT)	70-85%
Waste to Energy	60-90%
Coal	65-85%
Nuclear Power	65-85%
Hydro	30-50%
Wind Energy	25-40%
Wave Power	25%

Source: RenewableUK

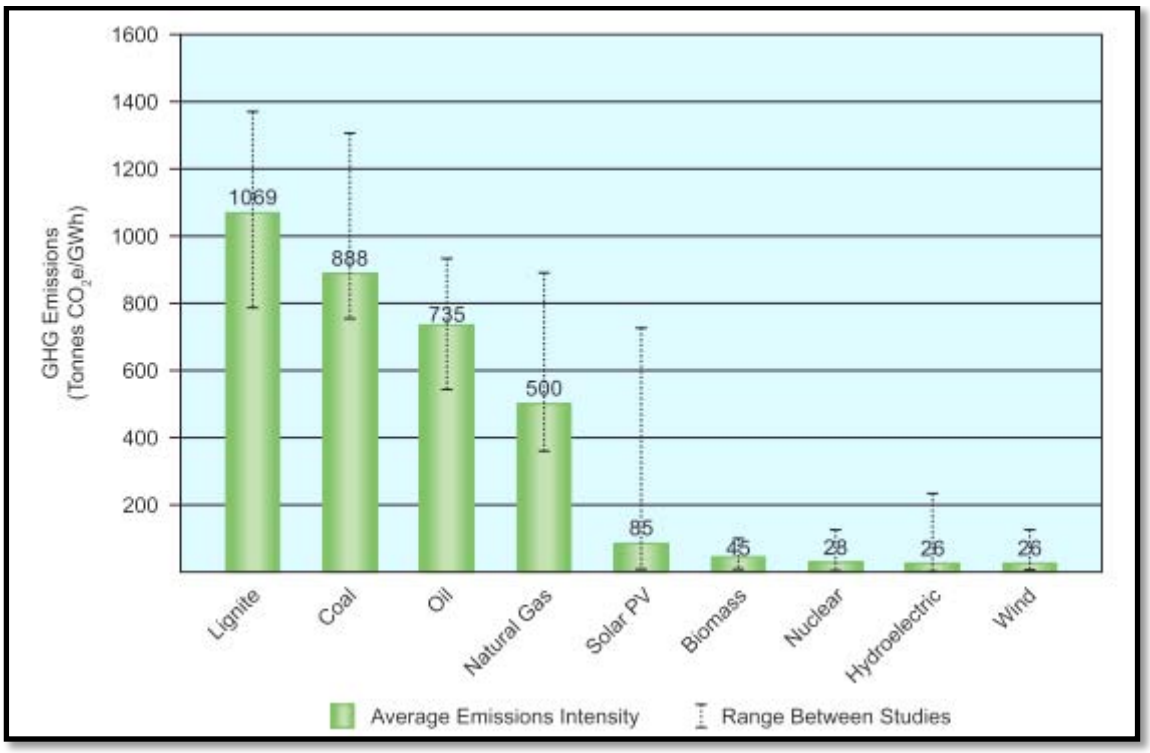
The conventional power generation sources have a higher load factor of 60% - 80% as compared to the renewable energy options with load factors of 25%-50%.

6.3.4 Greenhouse Gas Emissions

Coal fired power plants have the highest GHG emission intensities on a lifecycle basis. Although natural gas, and to some degree oil, have noticeably lower GHG emissions, biomass, nuclear, hydroelectric, wind, and solar photovoltaic all have lifecycle GHG emission intensities that are significantly lower than fossil fuel based generation.

World Nuclear Association (WNA)'s report places wind energy's 26 tonnes CO_2e/GWh emission intensity at 7% of the emission intensity of natural gas, and only 3% of the emission intensity of coal fired power plants. In addition, the lifecycle GHG emission intensity of wind power generation is consistent with renewable energy sources including biomass, hydroelectric and nuclear. Among other non conventional sources, only, nuclear power is better than wind power with respect to emissions. However, nuclear power is not a viable option in the identified site and require longer gestation period.

Figure 6.4 : Lifecycle GHG Emissions Intensity of Electricity Generation Methods



Source: World Nuclear Association Report

6.3.5 Statutory and Policy Requirements

India is a signatory to the United Nations Framework Convention on Climate Change (UNFCCC) and has as part of its obligations released a National Action plan on Climate Change 9 (released in June 2008) which lays out the government's vision for a sustainable and green future for India's economy. The government has therefore promoted investments in renewable energy sector including wind, hydro, solar and biomass projects. The National Electricity policy, 2005 stipulates several conditions to promote and harness renewable energy sources. The Electricity Act 2003 provides that co-generation and generation of electricity from non-conventional sources would be promoted by the State Electricity Regulatory Commissions by providing suitable measures for connectivity with grid and sale of electricity to any person and also by specifying, for purchase of electricity from such

sources, a percentage of the total consumption of electricity in the area of a distribution licensee.

Maharashtra Electricity Regulatory Commission (MERC) has also formulated a policy for power generation from non-conventional sources in 2008 which provides for benefits of renewable energy projects. The following fiscal and tax incentives have been offered by the Central and State government for promotion of wind power projects:

- 80% accelerated depreciation for investors if the project is commissioned before 30 September of the same financial year; or 40% if the project is commissioned before 31 March of the same financial year;
- Generation Based Incentive (GBI) scheme for grid interactive wind power projects -a GBI of Rs 0.50 per kWh as introduced in 2009;
- Concession on import duty on specified wind turbine components;
- 10 year income tax holiday for wind power generation projects;
- 100% exemption from excise duty on certain wind turbine components;
- Wheeling, banking and third party sales, buy–back facility by states;
- Guaranteed market through a specified renewable portfolio standard in some states, as decided by the state electricity regulator;
- Reduced wheeling charges as compared to conventional energy;
- 100% FDI investment allowed in renewable energy generation projects;
- Special incentives provided for promotion of exports from India for various renewable energy technologies under renewable sector specific Special Economic Zones (SEZ);
- Wind potential states have announced preferential tariffs, ranging from Rs 3.39–5.32 per kWh.

6.3.6 Method of Power Generation for the proposed project

The power generation options using conventional sources offer advantages such as lower levelised costs of power generation and higher plant load factors. Therefore, considering various factors such as favorable environmental and social settings; lowest GHG emissions in the project life cycle; availability of appropriate lands, and local community‘s acceptance of wind energy projects in the region wind energy based power generation is the most appropriate alternative in the region of Sangli and Satara districts.

Wind power generation is one of the cleanest and environment friendly methods of power generation. The operation and maintenance of wind farms does not typically involve air emissions or effluent discharges.There is no fuel requirements or large quantities of water for operation of the plant. The conventional sources of power (thermal power plants) have a very high environmental cost compared to non conventional sources. The air emissions, raw material requirement (coal, gas, etc), water requirement etc. impart negative irreversible impact on the environment. The gestation time required for thermal power plants are much longer than that of wind power plant which requires short lead time to design, install, and start up.

There are no green house gas emissions and other environmental pollution (stack emissions, ash management, etc). There are socio-economic advantages of wind energy projects as grazing land and vegetation is retained for the benefit of community.

There are no emissions associated with operation of wind energy, however manufacturing of wind turbines and related upstream and downstream construction activities are associated with emissions due consumption of fossil fuels which contributes to Green House Gases (GHGs).

6.4 Alternate Route for Transmission Line

The 33/220 KV Pooling Substation will be located at Hiwarwadi village to the west of the site. Power will be transmitted through a 5 to 12 km long single/ double circuit 33 kV transmission lines. NRPPL has also proposed to construct three 33kV feeders at site, each with capacity of 25MW in order to transmit power from the wind turbines to the Hiwarwadi pooling substation. The Hiwarwadi Pooling Substation will be common facility for other customers of ReGen in the vicinity.

The approach for identification of route for transmission line has been based on the following factors:

- Transmission line route has been planned to avoid any habitations along the route
- No house or community structures are located under the transmission line
- Areas of dense vegetation, or places requiring extensive clearing of vegetation are avoided
- No wetlands, archaeologically significant sites, areas with threatened or endangered species/species of special concern, areas of significant cultural significance fall within the route
- Right of way/access roads will be shared with the common user of the substation wherever possible

The route finalized for the transmission lines is the shortest possible route selected after considering the above factors. The use of common substation and consideration of all the above factors reduces the environmental and social footprint of the transmission line.

6.5 Conclusion

As discussed in the previous sections, there is a significant difference in demand and supply of power in the state of Maharashtra. Considering the ecological sensitivity of the location because of the Western Ghats, conventional sources of power generation are not suitable for the proposed site as they will lead to green house gas emissions and destruction to the natural habitats. It is proposed to develop a wind power project at the site because of wind resource availability, incentives being offered by the government and low pollution levels associated with wind power generation.

7 Information Disclosure, Consultation and Participation

The ADB Safeguard Policy requires the project proponent to undertake consultation with affected land losers and other concerned stakeholders and facilitate their informed participation in the project. The primary objective of the consultation process shall be to ensure that the views and concerns of the stakeholders are considered by the project proponent at an early stage of the project. All issues and concerns raised by the stakeholders shall be addressed in a timely and appropriate manner by the project proponent. Based on the consultation process, a grievance redress mechanism for the community shall be established to receive and facilitate the community concerns and grievances regarding the project.

The land required for the project involves both revenue and private land. The revenue land is purchased from the government Revenue Department while private land acquisition has been undertaken by the land aggregator Atlanta Power Private Limited (APPL). The stakeholder consultation has been undertaken on two occasions:

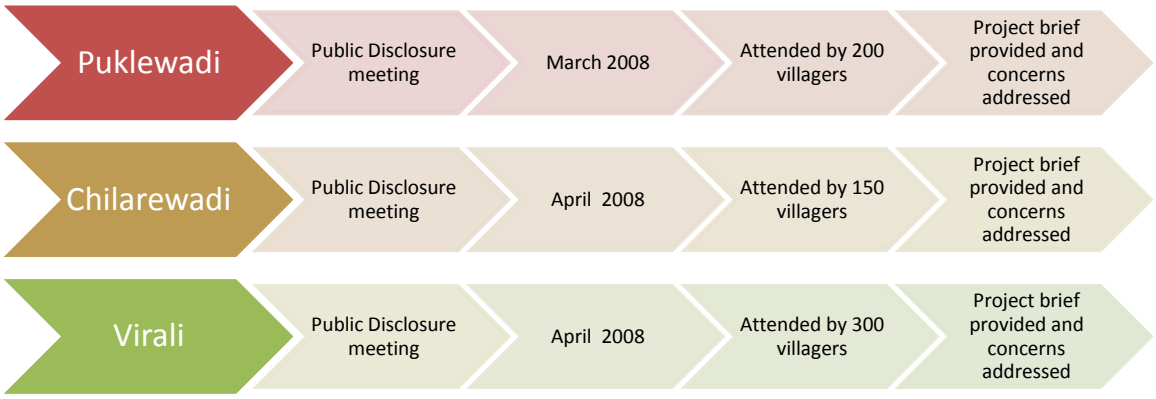
- Stakeholder Engagement Process by NRPPL/APPL
- Social survey and consultation by AECOM

7.1 Stakeholder Engagement Process Undertaken by NRPPL/APPL (2008)

Informal consultations and discussions were undertaken at the village level by the land aggregator Atlanta Power Private Limited (APPL) in 2008. The village Panchayat and village elders were briefed about the project and the proposed compensation. They were also informed about myths and benefits of wind farm.

APPL undertook public disclosure and stakeholder consultation at all the three villages from where private land will be procured for the project i.e. at Puklewadi, Chilarewadi, and Virali.

Figure 7.1: Stakeholder Engagement Process



The discussion involved village Panchayat members, local community and land owners. Brief summary of the meetings from each of the village are as presented below:

7.1.1 Puklewadi

The meeting was undertaken in the month March of in the year 2008 at the village temple.

All the elected members of the Gram Panchayat along with sarpanch attended the meeting. The meeting was attended by around 200 villagers of Puklewadi and adjoining area. The discussion of the meeting included:

- The present scenario of electricity and it is demand;
- Details about tentative location of wind farm and general details about wind farm;
- Need for land and general compensation terms and
- Generation of employment was discussed with villagers

The meeting concluded with agreement of the villagers, with demand for appropriate compensation and job for affected families.

7.1.2 Chilarewadi

The meeting was undertaken in the month of April in the year 2008 at the village temple.

All the elected members of the Village Panchayat along with the Sarpanch attended the meeting. The meeting was attended by around 150 villagers of Chilarewadi and adjoining area.

The discussion of the meeting included:

- The present scenario of electricity and it is demand;
- Details about tentative location of wind farm and general details about wind farm;
- Need for land and general terms compensation
- Generation of employment was discussed with villagers and
- Need for access roads and movement of traffic

The meeting concluded with agreement of the villagers, with demand for appropriate compensation and job for affected families. The need for access to the temple was also discussed

7.1.3 Virali

The meeting was undertaken in the month of April in the year 2008 at the village temple.

All the elected members of the Village Panchayat along with the Sarpanch attended the meeting. The meeting was attended by around 300 villagers of Viral and adjoining area. The meeting was undertaken at the village temple.

The discussion of the meeting included:

- The present scenario of electricity and it is demand;
- Details about tentative location of wind farm and general details about wind farm;
- Need for land and general terms compensation and
- Drought and general condition of herdsmen was also discussed
- Generation of employment was discussed with villagers

The meeting concluded with agreement of the villagers, with demand for appropriate compensation and job for affected families.

All the villages have provided No Objection Certificates for the wind farm projects which are provided in **Annex E.**

7.2 Social Survey and Consultation by AECOM (2011)

Discussions with members of Panchayat and local community members were undertaken at all the three villages i.e. Puklewadi, Chilarewadi and Virali. The findings are based mainly on the participatory methods of focus group discussions, key informant interviews, natural interviews. These methods are well established and have been widely used in environmental and sustainability research. The method goes beyond the superficial and gives depth and intensity to the discussion and incorporates the local point of view within a short period.

The process of stakeholder consultation included,

- Identification of the relevant stakeholders including all those individuals, groups and organizations potentially affected by or interested in the project;
- Imparting information about the project and its potential impacts on their lives in local and simple language;
- During the consultation process the project plan was clearly explained
- Recording of their concerns and aspirations through survey and discussions
- Responding to their queries in a neutral manner

In the primary research a list of open-ended questions are used in both the focus group discussions and the individual interviews. A two-person survey team carried out the discussions and the interviews. The list of persons involved in the public consultation is limited to those who were willing to allow their name to be added in the document.

Focus group discussions were held with the randomly selected villagers and land owners. These groups encompass a wide age range, as well as both genders, and people from the entire communal spectrum. The FGD included people who had given their land for the later phase of project also.

Natural group discussions were also conducted, where ever possible. Natural group discussions are interviews conducted with ‗naturally' occurring groups. The method has the advantage of being interviewed at a time and place of their convenience, and is suitable from the point of view of the interviewee. The result is honest and open discussion in a more relaxed and informal manner. The consultations were conducted in three villages, the number of individuals consulted were:

- Virali:16
- Chilarwadi:18
- Puklewadi :21

The aspects covered questions and broad responses obtained during the social survey, consultation, discussion and interviews are as provided below:

7.2.1 Awareness about the project

All the respondents were aware of the proposed project and were informed by the land aggregators about the proposed project. They were not clear about the access roads planned for the project to move up the plateau and expected it to be kept away from the habitations. The individuals interviewed informed about the consultations undertaken by the land aggregator in 2008 and confirmed that discussions were undertaken in all three villages.

Photo 4.1: Consultations with land sellers

Photo 4.2: Focussed group discussions being carried out at project villages

Photo 4.3: Consultations with villagers from Puklewadi village

Photo 4.4: Stakeholder consultation at Virali

The respondents were aware about the process of wind turbines to be erected. They were however not aware of the various phase of development and the schedule of construction. Their concerns and expectations are presented in Table 4.26.

7.2.2 Occupation and Livelihood

Agriculture and livestock rearing (Sheep/goat) is the key occupation however a significant population has moved on to cities for other jobs. Need for agricultural labourers is limited to harvest season, most of the agricultural work is undertaken by the landowners themselves.

The productivity of the area is poor because of lack of irrigation sources and major part of crop is being used up for household consumption. Livestock rearing is considered to be the main source of income and the farmers earned INR 1.0 to 1.5 lakhs from trade of 50 to 55 sheep and goats.

There are very few avenues for job and non-agricultural works are far and few, most of the men migrate to the nearby towns of Satara for better job opportunities.

7.2.3 Use of the land being procured

The community has reported that the terrain is difficult for agricultural purposes as there is no source of water and carrying water up the plateau is not worth the output of production. The land is not being used for irrigation from past five to ten years. The area on the top is not very suitable for grazing; however limited grazing in post monsoon season is undertaken in the area. The community is willing to sell the land and buy more land in other area which is more productive. There are no other use of the land and benefits from the area being considered for the project.

7.2.4 Rates offered for the project

The land owners agreed to the fact that rate being offered by the land aggregators is better than what they would have received if there was no project. However, there is a mixed response to the rate offered as a certain section of community believes that the land rates have increased after the signing of Agreement to Sale and needs to be revised.

There is no family rendered landless by procurement of land as all of the land owners have more land besides that on the plateau. The villagers intend to use the compensation for procurement of more livestock and land.

7.2.5 Cultural Issues

There are three small temples which fall in the project site area. Two of them are on plateau close to Katrevadi and one on the plateau above Chilarewadi. These temples are reported to host important rituals and functions at least three-four times a year (including Dusshera Magh Purnima, Gudiparva and Maha Shivratri). About 1000 to 1500 villagers from the surrounding villages are reported to collect at these temples during the festival season. The temples are free of visitors for most part of the years besides the festivals. The community expressed desire that temple at Chilarewadi and Katrewadi gets better access roads and that their rituals are not hindered by the project activities

7.2.6 Migrant Labour

The community would prefer engagement of local youth for the construction work and as security guards after the project is commissioned. They were however aware that some of the skilled workers will come from outside and were comfortable with migrant labourers coming and working in their project area.

7.3 Stakeholders Identified

A stakeholder is any group or individual who may affect or be affected by a specific project. They should be prioritized by identifying direct (those who have a direct interest or influence on the project) and indirect stakeholders whose interest is indirect. Stakeholders may also be internal within the Project or external to the Project. Stakeholder identification is useful to prioritize, analyze and assess stakeholder issues while creating management systems and strategies to address specific concerns. The stakeholders identified and summary of consultation with the stakeholders is provided in **Table 7.1.**

Table 7.1: Stakeholders

Stakeholders	Profile	Concerns and Expectations	Addressal of Issues/Concerns by NRPPL
Local Community	**Land owners** Affected persons whose land has entered into sales agreement with Atlanta Power or already acquired (purchased) for the project.	Concerns and expectation raised during consultations were: • The land owners expected adequate compensation for affected land; • They expressed desire to sell entire gut of land rather than patches required for wind farm • Expectation of employment opportunities from the project • They expressed desire to retain the access to existing temples on the plateau • Land required for transmission line and access roads to be disclosed • Access to grazing area on the plateau shall not be completely blocked	NRPPL/APPL has paid adequate compensation for the private land procured based on negotiations with land owners, reportedly at higher rates than the prevalent market price. APPL has procured the entire gut of land in cases where the land owners have expressed desire for the same. NRPPL will identify employment opportunities based on skill set requirement for people whose land plots have been impacted. At least one individual from each of the project affected family will be offered with employment during the construction work. The siting and location of wind turbine towers has taken into consideration the proximity and access to the temple. The turbine location as identified by NRPPL is at a significant distance from the temple and will not restrict access to the temple in any manner. The details of land required for transmission lines and access roads have already been disclosed to the community. NRPPL will not fence/barb wire the entire area and shall allow normal movement of goats and

Stakeholders	Profile	Concerns and Expectations	Addressal of Issues/Concerns by NRPPL
			sheep in most part of the site. Since the area has a shortage of fodder for livestock, especially in summers, NRPPL shall contribute fodder to cattle camps arranged by the local administration.
	Women Most of the men folk are out with livestock and grazing activities and women play an important role in household activities. The decision making on issues pertaining to land however remains with the men and other elders	Concerns and expectations raised by women during consultation were: • Women expressed concerns about water availability during non rainfall season, they were however aware of the fact that rainfall in the area is not affected by presence of wind farms. • They wanted engagement of more local people specially those who sold their land for the project as there are security issues with outsiders; • They expressed desire that temple at Chilarewadi and Katrewadi gets better access roads and that their rituals are not hindered by the project activities • The women expressed concerns over movement of heavy traffic, as they fear safety of children and livestock which roam around freely in the area	As part of its ongoing CSR process, NRPPL shall contribute to improving the water situation of the area by repairing irrigation tanks, setting up of water pumps/ tube wells etc. For construction activities, all labour will be hired locally, therefore no influx of migrant labour are envisaged. Only skilled workers for crane operation and electrical works will be brought in from outside. All workers will be adequately briefed about the code of conduct to be maintained and to respect local customs and women. As explained above, the siting of the project will not restrict the access to the existing temple at Chilarewadi and Katrewadi. All community functions associated with the temple will be allowed to function as existing. A transportation and traffic management plan has been proposed to enable more efficient management of construction traffic associated with the proposed project. NRPPL shall implement all components of the plan during construction phase of the project in order to address the concerns raised by the women of

Stakeholders	Profile	Concerns and Expectations	Addressal of Issues/Concerns by NRPPL
			the community.
Local institutions	**Gram Panchayat** The Gram Panchayat is the lowest level of the three tiers Panchayati Raj Institutions (PRI). In the project area, it can consist of more than one revenue village. The Gram Panchayat generally has control over the local resources and the Panchayat works on the general agenda of local area and community development. It understands the local needs/issues and can also act as a good ally for conflict resolution at the community level. The Panchayat also has the powers to decide on affairs relating to the village, address concerns and grievance and decide upon issues of land diversion and change in land use	• The Gram Panchayat was observed to be supportive of the project. They felt that the land being sought for the project was not serving any purpose because of the topography and lack of sufficient rainfall. • They wanted greater engagement of local community and employment opportunities to local people. • Gram Panchayat expect local benefits like enhancement the local infrastructure, targeted social investment programme through CSR initiatives. The Gram Panchayat hinted at the following activities: *Measures to improve the water availability of the area* *Improved access to temples on the plateau* *Need for skill development for youth and other workers* *Contribute towards developmental activities of the village*	NRPPL will identify employment opportunities based on skill set requirement for people. It is proposed that during construction phase all labour will be hired locally, except for skilled workers for crane operation and electrical works who will be brought in from outside. The CSR initiatives proposed by the Gram Panchayat and suggestions made during the need based assessment study have been included in the Community Development Plan formulated by NRPPL and will be implemented as part of the plan. **The Community Development Plan is presented in Annex I.**

Stakeholders	Profile	Concerns and Expectations	Addressal of Issues/Concerns by NRPPL
Govt. institutions	**Regulatory authorities** *State Labour department* is the agency for implementation of labour standards and the state labour policy. *Revenue department* will be interested in compliance of affected revenue land by project. Maharashtra State Electricity Transmission Company Limited will receive the power generated for further transmission to Grid	The main concerns of the State Labour Policy would be ensuring compliance to labour and working condition standards and implementation Revenue department will approve diversion of revenue land affected by project. The requisite application with respect to the same has been forwarded to the administration. Maharashtra State Electricity Transmission Company Limited to finalize the location of common substation so that the final alignment of the transmission line could be finalized	NRPPL will comply with all regulatory requirements and obtain all requisite consents.
Local NGOs and Civil Societies	**NGOs** In project area no NGO/civil society has been noticed in function for development programme in concerned communities.	Social organisations observed in the area were not directly associated with any of the project related functions.	--
Site Developer/Land aggregator	The site developer agency i.e. Atlanta Power Private Limited (APPL) has the role to initiate land acquisition through negotiation and mutual concern with affected community. Verify the ownership records i.e. form	The process of deciding the rate of land shall be transparent and well informed to the concerned community. A set of community engagement has been undertaken at the affected villages. The site developer should organize public consultations	The rate of land was based on negotiations with individual land owners for the turbines as well as associated facilities.

Stakeholders	Profile	Concerns and Expectations	Addressal of Issues/Concerns by NRPPL
	7/12 and transfer the land to customer through sale deed.	with affected land owners and Panchayats to redress their grievances regarding compensation prior to mutation of land. The site developer shall also engage with community for negotiation of land required for access roads and transmission lines after identification of alignment.	
Site Occupier and Project Developer	NRPPL will be responsible for all the project activities undertaken directly or through the sub contractors.	NRPPL shall engage with the community prior to mobilisation of construction workers and material. NRPPL shall engage with the Panchayats and explore potential for CSR initiatives	A need based assessment study was conducted by NRPPL at all the three villages wherein consultations were undertaken with the affected community, Panchayats and land owners.

8 Grievance Redressal Mechanism

ADB‘s Environmental Safeguards requires the project proponent to establish a mechanism in order to receive and facilitate resolution of affected people‘s concerns, complaints and grievances about the project‘s environmental performance. The mechanism shall use an understandable and transparent process that addresses the affected people‘s concerns and complaints promptly.

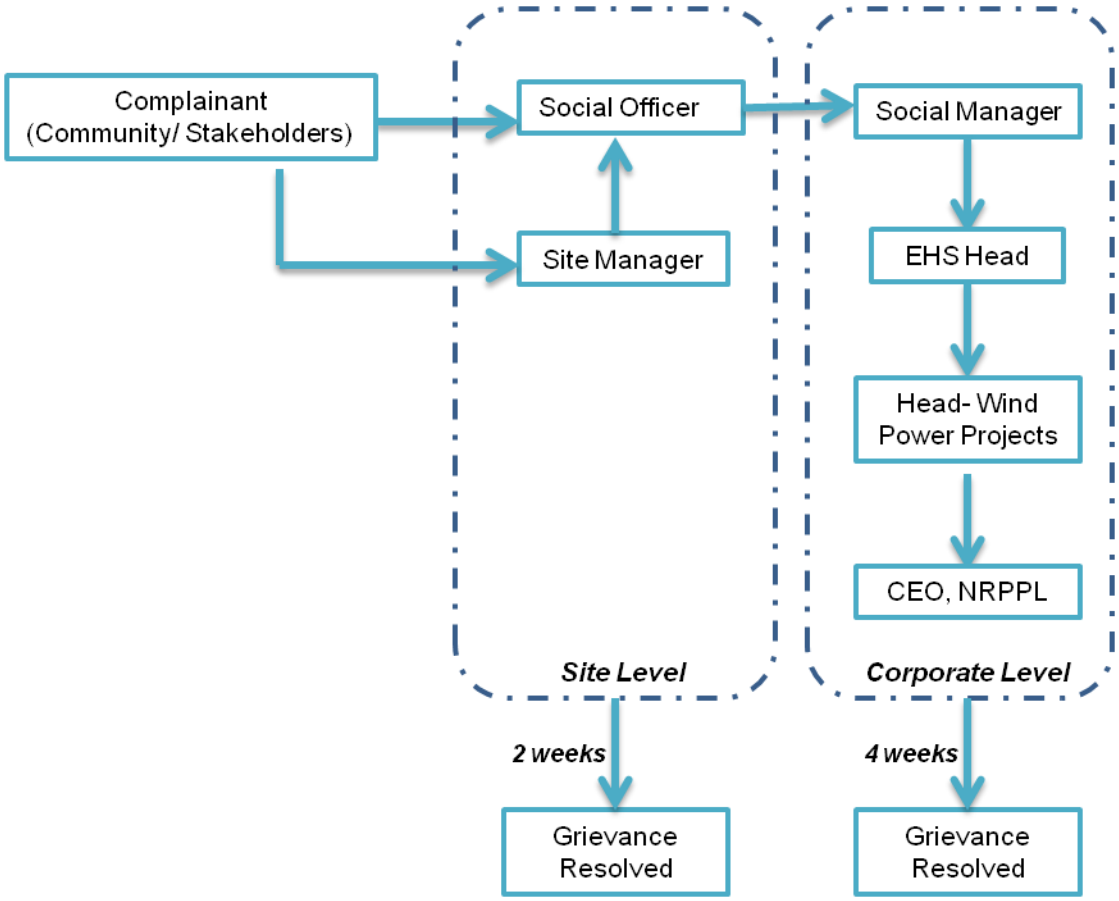
8.1 Grievance Redressal Mechanism

The grievance redressal mechanism at present is not structured and undertaken in an informal manner. In order to establish a documented and structured approach towards understanding community expectations and manage their concerns, NRPPL will constitute a Grievance Redressal Mechanism for the community. The Grievance Redressal Mechanism outlines the process and steps to be taken and the time limit within which the issue would need to be resolved to the satisfaction of the complainant. The project will endeavour to get all complaints recorded and addressed in a uniform and consistent manner.

The grievance redressal mechanism will be managed by the Social Management Cell through the social field officer with the site manager being the overall in-charge. This grievance mechanism will respond to the concerns and grievances of local communities, NGOs, Panchayats and any other aggrieved party or stakeholder. The purpose of the cell will be to record the grievances of the community and other stakeholders and find mutually acceptable solutions for problems like employment, disputes with project activities, damages to private property, community development needs, socio-economic development of villages etc. The project will share information about these mechanisms to the stakeholders through locally appropriate communication tools.

The cell will comprise of a Grievance Redressal Committee which will convene meetings on monthly basis and take steps to redress the grievance. The cell will have two levels of Redressal system functional at Site and Corporate office of NRPPL based on following structure:

Figure 8.1: Process Flow Diagram for Grievance Redressal Mechanism



8.1.1 Levels of Grievance Redressal

Level 1: Site Grievance Redressal

- The site level grievance cell shall comprise of the Site Manager and Community Officer of NRPPL. These persons will be available at the project office at site.
- A member from the respective Panchayats might also be included in the Cell.
- Any individual/ group with concerns related to onsite work such as pollution, transportation, traffic, occupational health, etc. may be directly register their concerns either verbally or in writing to the above nominated person at site.
- Concerns related to job opportunities, compensation, small contracts, etc. may also be directly received verbally or in writing.
- The issues registered at this level will be appropriated acted upon within two weeks of the date of receipt of complaint based on the assessment of cell.

Level 2: Corporate Grievance Redressal

- The Level 2 of grievance redressal will be the headed by the Head-Wind Power Projects, along with EHS Manager of NRPPL. A member from the respective Panchayats will be included in the cell.
- Issues unresolved from the previous levels or issue with greater reputational risks will be undertaken at this level. If the conclusion arrived at this level is not acceptable to the complainant then legal recourse can be opted for.

- The issues registered at this level will be resolved within 4 weeks from the date of registration.

8.1.2 Grievance Registration Method

Any person / group of persons having grievance with the project can register their concerns at Level 1 by suitable means of registering i.e. verbal or written. Drop boxes and registers will be provided at all Panchayat offices for the ease of stakeholders. In case the issue is not resolved at Level 1, a written complaint or verbal communication needs to be made to Level 2.

- Complainant can also lodge their grievances, directly in the permanent –Grievance Register" kept at the project office or through post or submit by hand.
- Any grievance communicated verbally, will be written in –Grievance Register" with allotment of a serial number, by the nominated person who has received the verbal grievance.
- The project authority will issue an acknowledgement of the complaint immediately (in case of hand delivery) or by post to the complainant through registered post within next two days.
- The complaint boxes will be cleared twice a week and gist of the complaints will be noted down along with date and name of the complainant with an allotment of serial number to the complaint in the –Grievance Register".

8.1.3 Processing of Complaint

Different problems will be addressed in different manners depending on the type of grievance; however the generic approach to resolution of all grievances will include the following steps:

- The complaint received will be reviewed and screened for the factual details and will be considered for resolution at local level. The grievance will be assessed to determine if the issues raised in the complaint fall within the mandate of the grievance mechanism and the complainants have standing.
- If the complainant requires intervention then it will be considered for resolution otherwise it will be rejected and the same will be communicated to the concerned complainant.
- The grievance will be evaluated to clarify the issues and concerns raised in the complaint, to gather information on how others see the situation, and to identify whether and how the issues might be resolved.
- All options for solving problems will be explored, with or without the assistance of independent, third parties:
  - Internal decision-making processes, whereby issues are handled by designated officials of NRPPL, using stated standards and criteria, to develop and propose a company response to the grievance and to allow for an appeals process.
  - Joint problem solving, in which NRPPL and the complainant engage in direct dialogue.
  - Third-party decision making to offer a solution when a voluntary agreement is not possible.
- Grievance tracking, monitoring, and reporting to the community will be undertaken as soon as a mutual consent is arrived at.

8.1.4 Communication of Mechanism to Stakeholders

Formal information of Grievance Redressal Committee constituted, as suggested above, will be communicated to the respective stakeholders and nominated members of the committee. This communication can be made through personal letters, letter to Gram Panchayat, pamphlets, posters, public announcement at strategic locations such as during respective Gram Sabha Meetings. The stakeholders will be encouraged to approach this committee with their concerns and suggestions.

8.1.5 Meeting of Grievance Redressal Committee

The site committee will meet at least once every fortnight in the first 6 months of implementation, and thereafter once, every month. At every Grievance Redressal Committee meeting the issues raised in the last meeting and report on action taken, will be summarized. Issues that cannot be resolved at the GRC would be referred / directed to next designated levels. The Corporate Committee will convene their meetings as and when required.

8.1.6 Closing of Grievance

The complaints lodged in the GRC Register will be resolved amicably by the above mechanism and closed by informing to the complainant directly with closing signatures on the GRC Register or by sending registered post to the complainant, in case he is not approachable. The resolution shall be informed to respective Gram Panchayat also in writing for display at a common place for information to interested parties.

9 Environmental Management Plans

The ADB Environmental Safeguards requires the project proponent to prepare an environmental management plan which addresses the identified potential impacts and risks. An effective environmental management system is a dynamic, continuous process initiated by management and involving communication between the project proponent, the workers, and the local communities directly affected by the project. The EMP includes proposed mitigation measures, environmental monitoring and reporting requirements, training measures, implementation schedule and cost estimates.

NRPPL is committed to execute all construction and operation related activities for the proposed wind power project as per the best established environmental, health and safety (EHS) standards. Mitigation measures are proposed for impacts which are identified and quantified. Some residual impact will however persist after the all mitigation measures are employed, the Environmental and Social Management Plan intends to delineate monitoring and management measures to minimize such impacts by allocating management responsibility and suggesting skill requirement for implementation of these measures during construction and operational phase.

9.1 Regulatory Agencies

The authorities/agencies to be coordinated for ESMP implementation include the following:

- District Administration of Satara District;
- Land Revenue Department;
- Maharashtra State Pollution Control Board;
- State Electricity Board;
- Central Electricity Authority;

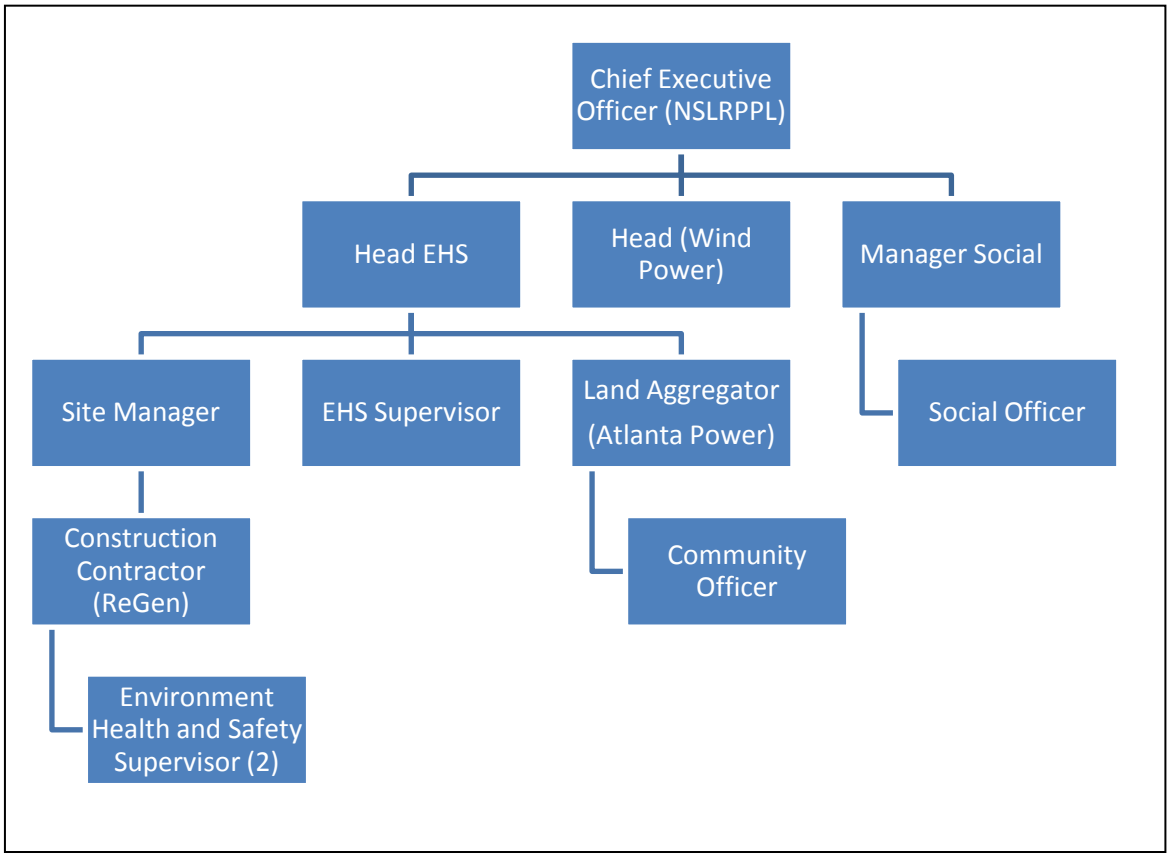
9.2 Social Environmental Health and Safety Management System (SEHSMS)

A Social Environment Health and Safety Management System (SEHSMS) shall be prepared to assist NSL Renewable Power Private Limited (NRPPL) in developing a comprehensive mechanism at the corporate level to lay down a rationalized procedure for assessing and managing social, environmental, health and safety issues at all stages of their activities. The corporate SEHSMS will guide the implementation at the project level compliance to the standards as committed by NRPPL as a corporate entity. The Environment and Social Management Plan (ESMP) provided in the subsequent sections will be operationalized within the framework of the management system.

9.2.1 Organisation, Roles and Responsibilities

The proposed organizational structure to implement the ESMP during the construction phase is as proposed:

Figure 9.1: Construction Phase Organizational Structure for ESMP Implementation



The overall management and coordination of the project will be managed through Chief Executive Officer (NRPPL) who will be supported by the Head (Wind Power) and Head (EHS). The Head - EHS along with the wind power) will overview, monitor and control the activities of Site Manger and the EHS supervisor at the site. The Environment and Social staff at site shall be hired prior to commencement of construction works. The contractors will be controlled by the site manager during construction phase. The land aggregators will be required to have community officer in the team to interact with local community. The construction contractor will be required to have two Environment, Health and Safety supervisors in their team.

The usual activities of the EHS manager and his team will be as following:

- Ensuring availability resources and appropriate institutional arrangements for implementation of ESMP;
- Compliance of legislative requirements and ADB safeguards;
- Carryout audits, and inspection of all the project activities;
- Preparation of necessary documents and record keeping system; and
- Review and updating of ESMP for effective its implementation.

9.2.2 Contractors Management

Prior to assigning any contract, NRPPL will pre-qualify each contractor according to commercial, technical, quality assurance and its past performance on EHS standards so as to satisfy NRPPL's requirements.

NRPPL will ensure that the job specific training and EHS Induction Training needs are identified based on the specific requirements of ESMP and existing capacity of site and project personnel (including the Contractors and Sub-contractors) to undertake the required actions and monitoring activities. Special emphasis will be placed on traffic management and operation of cranes.

General environmental awareness will be increased among the project's team to encourage the implementation of environmentally sound practices and compliance requirements of the project activities. This will help in minimising adverse environmental impacts, compliance with the applicable regulations and standards, and achieving performance beyond compliance. The same level of awareness and commitment will be imparted to the contractors and sub contractors prior to the commencement of the project.

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

- Purpose of action plan for the project activities;
- Requirements of the specific Action Plans;
- Understanding of the sensitive environmental and social features within and surrounding the project areas; and
- Aware of the potential risks from the project activities;

A basic occupational training program and specialty courses should be provided, as needed, to ensure that workers are oriented to the specific hazards of individual work assignments. Training should be provided to management, supervisors, workers, and occasional visitors to areas of risks and hazards. Workers with rescue and first-aid duties should receive dedicated training so as not to inadvertently aggravate exposures and health hazards to themselves or their coworkers.

Through appropriate contract specifications and monitoring, the employer should ensure that service providers, as well as contracted and subcontracted labor, are trained adequately before assignments begin.

As part of the ADB Social Protection Requirements and IFC Performance Standard -2 requirements, NRPPL has initiated the revision of its HR Policy. The updated HR policy is reported to include:

- NRPPLs position on child labour, forced labour, as well as commitment to favorable/safe working conditions;
- Applicability of the policy to indirect employees like contractors, contracted laborers or other stakeholders in the supply chain;

- Provide details of recruitment, induction, leave, termination, insurance, medical facility, training and incentives;
- Define leave policy;
- Provide measures against discrimination on basis of caste, religion or sex;
- Provide details of health benefits and insurance coverage;
- Provide for measures against sexual harassment;
- Provide for measures taken to ensure –Occupational Health and Safety" is ensured for all employees on site;
- Provide for employee forums as an alternative to collective bargaining or registration with a trade union.

Although all employee related matters would be documented and monitored at the corporate level, given the limited footprint and operations of the wind power plant, management of labour and employee relations can be one of the responsibilities of the plant manager who can be assisted by the on-site field supervisor in charge of implementing the social management systems on site. It is suggested that the revised human resource systems shall be applicable to the proposed project. However, the HR management systems framework would need to take the following into account:

- Awareness of the requirements under the ADB Social Protection Requirements and IFC Performance Standards 2 on Labour and Working Conditions, particularly with respect to training of contractors and occupational health and safety provisions;
- Providing all employees and labour with an access to an alternative collective bargaining or grievance redressal forum;
- Ensuring that all contractors and sub-contractors for whom NRPPL is the –principle employer" are compliant for all applicable provisions of the Indian Labour Laws, particularly with regards to child labour, working houses, minimum wages, overtime etc during the construction and operations phase;

9.2.3 ESMP Review and Amendments

The ESMP provided with this report is an environment management tool which needs to be reviewed periodically to address changes in the organisation, process or regulatory requirements.

9.2.4 Inspection, Monitoring & Audit

In order to implement the ESMP, the on-site team will develop a time-bund and action-oriented Environmental and Social Action Plan to implement the mitigation measures provided for each of the identified environmental and social impacts. This ESMP will have to be monitored on a regular basis, quarterly or half-yearly and all outcomes would need to be audited in accordance with existing EHS commitments.

The monitoring process will cover all stakeholders including contractors, labourers, suppliers and the local community impacted by the project activities and associated facilities. Inspection and monitoring of the environmental and social impacts of construction and operation phase activities will increase the effectiveness of suggested mitigations. Through the process of inspection, audit, and monitoring NRPPL will ensure that all the contractors comply with the requirements of conditions for all applicable permits including suggested action plans. The inspections and audits will be done by NRPPL's trained team and external

agencies/experts. The entire process of inspections and audits will be documented. The inspection and audit findings will be implemented by the contractors in their respective areas.

9.2.5 Reporting and Review

NRPPL will develop and implement a programme of reporting through all stages of the project - construction and commissioning, operation and decommissioning. Contractors will be required to fully comply with the reporting requirements in terms of timely report submission with acceptable level of details. Reporting will be done in form of environmental, health, safety and social check list, incident record register, environmental, health, safety and social performance reports (weekly, monthly, quarterly, half yearly, yearly etc).

External Reporting and Communication

All complaints and enquiries are to be appropriately dealt with and records be maintained in a Complaint/Enquiry Register by EHS Officers or other delegated staff.

NRPPL shall also submit annual monitoring reports to ADB on the progress of implementation of the ESMP. NRPPL shall undertake annual inspections in order to verify compliance with the ESMP and progress towards the expected outcomes. Necessary corrective actions shall be identified based on the verifications and a corrective action plan shall be formulated. NRPPL shall ensure effective implementation of these corrective actions and submit periodic monitoring reports to ADB. NRPPL shall also provide ADB with an annual report on its compliance with ADB‘s social protection requirements.

Internal Reporting and Communication

Inspection and audit observations along with their improvement program are to be regularly reported to the senior management for their consideration. The same are also to be communicated within the staff working on the project. To maintain open communication between the staff and management on EHS&S issues the following shall be used:

- Team Briefings,
- On-site work group meetings;
- Work Specific Instructions; and
- Meeting with stakeholders.

9.2.6 Documentation and Record Keeping

Documentation and record keeping system has to be established to ensure updating and recording of requirements specified in ESMP. Responsibilities have to be assigned to relevant personnel for ensuring that the ESMP documentation system is maintained and that document control is ensured through access by and distribution to identified personnel in form of the following:

- Documented Environment management system;
- Legal Register;
- Operation control procedures;
- Work instructions;
- Incident reports;
- Emergency preparedness and response procedures;

- Training records;
- Monitoring reports;
- Auditing reports; and
- Complaints register and issues attended/closed.

9.2.7 Proposed Environment and Social Management Plan

An Environment and Social Management Plan has been developed following the delineation of impacts and mitigation measures. These measures will be adopted by the project proponent and imposed as conditions of contract of the sub contractor employed for respective phases of the power project. The mitigation measures suggested during operation will be made part of the regular maintenance and monitoring schedule.

The ESMP includes the following:

- Mitigations suggested for adverse environmental and social impacts and associated risks;
- Institutional arrangement - management tools and techniques for the implementation of environmental impacts and risk mitigations;
- Monitoring and reporting of requirements and mechanisms for the effective implementation of the suggested mitigations;
- Monitoring arrangements for effective implementation of suggested mitigations for the proposed project; and
- Reporting requirement to the regulatory agencies and funding institutes

Table 9.1: Environment and Social Management Plan for Construction Phase

Impact Identified	Suggested Mitigation	Monitoring / Training	Management Responsibility	Cost Estimate and Timeline
Soil				
• Erosion and compaction • Contamination	• Disturbed area to be re-vegetated at the earliest • Localized sprinkling of water at areas where vegetation is removed shall be undertaken for the entire duration of construction. • Use of existing track for transport of man and material to the extent possible • Loose soil to be protected from wind and runoff by covering or watering • All construction material to be kept within the footprint of the area acquired. • Loose construction material to be covered to avoid being carried into adjoining areas by wind. • Painting of panels, switchyard structures to be undertaken after covering the land beneath with a sheet of impervious material. • Re-fuelling of machinery at site to be undertaken over paved surface. • In case of any accidental spill the soil to be cut and stored securely for disposal with hazardous	• NRPPL representative to make daily observations on storage and handling of soil and construction material. • Workers to be trained on handling and storage of fuel and hazardous waste • Workers handling painting activity to be briefed about the need to prevent contamination. • Drivers to be instructed about use of dedicated tracks within the site • A Re-vegetation Plan is provided as **Annex C**.	• To be mentioned in the contract with the construction contractor • Site supervisor to make observations and convey it to the contractors. • EHS supervisor of NRPPL will monitor the implementation of the same and report to NRPPL on weekly basis.	• Re-vegetation cost will have limited capital cost as saplings can be obtained free from forest department. *Before commissioning of project* • The maintenance of the green area shall cost INR 20,000-30,000 per month. *During*

Impact Identified	Suggested Mitigation	Monitoring / Training	Management Responsibility	Cost Estimate and Timeline
	waste.			*operation phase*
Waste Disposal				
• Accumulation of construction waste • Runoff into rain water channels • Unhygienic condition for labours • Hazardous waste from machinery , generators etc (lube oil, hydraulic oil, waste oil etc)	• Access road shall be planned to cause minimal disturbance to the terrain topography. • Existing surface drainage pattern to be retained to the extent possible. • Construction waste to be properly stored and disposed off to local municipal waste disposal site • Other wastes like wood packaging material, metal, jute, etc. will be sold to scrap dealers. • Random stocking of raw material, storage of debris, piling of loose soil etc to be strictly controlled. • Portable toilets with septic tank-soak pit arrangement to be provided for workers • Hazardous waste will be stored at a secure location and only be sold to MPCB authorised vendors. • Empty paint container will be stored at a secured area identified for scrap and sold to vendors. • Housekeeping of the area to be maintained by deputing sweepers to remove dirt/debris from	• Workers to be instructed to use dustbins and toilets at the site • Contractors will be briefed about the need for proper storage and disposal construction waste • Contractors shall obtain authorisation for handling, storage and management of hazardous waste from MPCB and comply with the requirements of authorisation.	• Site manager • To be mentioned in the contract with the construction contractor • Site supervisor to make observations and convey it to the contractors. • Weekly report of EHS supervisor to include the compliance and observations on waste management	• To be incorporated as part of project budget, no additional cost is envisaged. *During construction phase*

Impact Identified	Suggested Mitigation	Monitoring / Training	Management Responsibility	Cost Estimate and Timeline
	the sites on daily basis.			
Water Resource and Quality				
• Runoff into rain water channels • Loss of soil • Change in micro level drainage pattern • Wastage of water	• Water for construction and consumption to be arranged by the construction contractors through authorised tanker water suppliers. • Adequate arrangement for storm water management during construction period to be made to avoid sediment runoff from the site. • Storm water flow during monsoons to be directed to the existing channels with silt traps to avoid sedimentation of the channels or the receiving water body. • Optimal utilization of water to be ensured throughout the construction phase • Curing chemicals to be used to reduce water requirement. • Leaks and losses to be checked frequently to enhance utilisation. • Proper storage and supply facilities to be arranged before undertaking construction activities. • Portable toilet with septic tank soak pits will be provided at site to facilitate the sewage generated.	• Daily consumption of water to be recorded and assessed on weekly basis for wastage • Workers to be instructed about optimal use of water • Storm water arrangements to be monitored for clogging on weekly basis • Water quality monitoring of nearby water bodies shall be conducted at least twice during the construction period.	• Site manager • To be mentioned in the contract with the construction contractor • Site supervisor to make observations and convey it to the contractors • EHS supervisor to keep parallel record of water consumption. • Weekly report of EHS supervisor to be sent to EHS head	• Water quality monitoring cost – INR 20,000 per sample • Performance parameters – Suspended Solids (SS), Total dissolved solids (TDS), oil, grease, Biological oxygen demand (BOD), Total coliforms, Faecal coliforms *2 months after commencement of construction*

Impact Identified	Suggested Mitigation	Monitoring / Training	Management Responsibility	Cost Estimate and Timeline
Ecology				
• Clearing of vegetation • Cutting of trees • Disturbance to avifauna, small mammals	• Re-vegetation of disturbed areas to be undertaken at the earliest • Construction zone to be fenced to avoid grazing cattle from moving in • Tree cutting to be limited to those directly affecting the wind turbine • Workforce to be instructed to avoid any other activity likely to affect the local flora & fauna. • High noise generating activities to be restricted to daytime with proper mitigation measures • Transportation to be undertaken along identified paths. • Existing food plants for the Milkweed butterfly group shall not be removed during construction activities. In areas where clearance of such plants is unavoidable, the same plant species will be re-vegetated after completion of construction phase.	• Construction contractor to instruct and inform workers about need to refrain from activities that may adversely affect the ecology • A standard operating procedure for blasting activities which shall include measures to prevent injuries to grazing animals on the plateau	• Site supervisor • To be mentioned in the contract with the construction contractor • EHS supervisor will be present at site to observe vegetation clearance.	*Tree cutting is not envisaged during development of the project site since the area is devoid of vegetation.*
Traffic and Transport				
• Movement of heavy vehicles leading to congestion and accidents	• Vehicle movement and parking within the project premises shall be manned properly to avoid accidents • Routes for use by construction traffic to be planned to minimize impact on adjoining	• Contractor (ReGen Power Tech) shall undertake a detailed analysis of transportation feasibility will be undertaken prior to transportation of turbine and associated components	• Site supervisor • To be mentioned in the contract with the construction contractor	• Regular maintenance of vehicle and upkeep of roads shall be

Impact Identified	Suggested Mitigation	Monitoring / Training	Management Responsibility	Cost Estimate and Timeline
• Improper parking of vehicles used by workers and for movement of material can lead to discomfort to other users. • Damage to road and related structure from heavy vehicles • Risk to livestock and cattle	activities. • Dedicated path within the site for exclusive entry and exit of the construction vehicles to be provided. • Regular maintenance of vehicles to be taken up. • Where road widths are insufficient, either temporary widening of the road with gravel or full depth widening of the pavement structure to be undertaken. • All construction and modification activities to be undertaken after prior approval / permission from local administration. • Local administration and village Panchayat to be informed in advance about the movement of heavy and oversized components of turbines. • Pilot vehicles to be provided with trucks carrying large components to manage traffic and assist the movement without any damage or accident to structures along the road. • Speed of all project vehicles to be restricted to 30km/hr on village roads. • Appropriate traffic diversion schemes shall be implemented during bitumen paving is under progress and all works shall be planned and swiftly completed to avoid inconvenience to	• Necessary training to the driver of construction vehicles for speed restrictions and to crewmembers on do's and don'ts during construction vehicles movements. • Drivers to be assessed for their knowledge on traffic rules before engagement. • A Traffic Assessment and Management Plan is provided as **Annex B**. • During the construction phase, number of vehicles as well as any incidents and accidents need to be reported and their outcomes monitored.		included in O&M budget *One month prior to commencement of construction phase*

Impact Identified	Suggested Mitigation	Monitoring / Training	Management Responsibility	Cost Estimate and Timeline
	road users			
Atmospheric Emissions				
• Fugitive dust • Emissions from diesel engines	• Dust generating activities to be avoided. • During high wind speeds, covers to be provided for loose construction material at construction site. • Construction equipments to be properly maintained to minimise smoke in the exhaust emissions. • Machinery to be turned off when not in use. • Housekeeping of the area to be maintained • The impact of emissions from vehicles bringing construction material to be minimised by proper upkeep of maintenance of vehicles, sprinkling of water on unpaved roads at the construction site and planned movement of such vehicles. • Vehicle speed to be restricted to 15km/hour at site to minimize potential for dust generation in the surroundings • Trucks /dumpers to be covered by tarpaulin sheets during off site transportation of friable construction materials and spoil • All the vehicles entering the site to have updated PUC (Pollution under control) certificates.	• Dust fall monitoring at locations within the project area shall be conducted at least twice during the construction period. • Ambient air quality monitoring within the project area shall be undertaken at least once during the construction period.	• Site supervisor • To be incorporated in the contract with contractor	• Water tankers would cost INR 800-1200 per tanker (15,000-20,000 litres) • Ambient air quality monitoring – INR 5000 per location once in quarter. • Performance parameters – PM10 and PM2.5 *Throughout construction phase*

Impact Identified	Suggested Mitigation	Monitoring / Training	Management Responsibility	Cost Estimate and Timeline
	• Generator to be optimally used with proper orientation and adequate stack height			
Noise and Vibration				
• Disturbance to habitations • Disturbance to fauna • Occupational Hazard	• Use of inherently quiet plant and equipment as far as reasonably practicable and regular maintenance to ensure noise emissions are maintained at design levels. • Integral noise shielding to be used where practicable and fixed noise sources to be acoustically treated, for example with silencers, acoustic louvres and enclosures. • Provision of rubber paddings/noise isolators at equipment/machinery used for construction • Construction vehicles to be well maintained and minimise idling time for vehicles when not in use. • Provision of make shift noise barriers near high noise generating equipment to minimise horizontal propagation of noise • Loud, sudden noise emissions to be avoided wherever possible. • Information about blasting activities to be provided to villagers in advance • Noise prone activities will be restricted to the extent possible during night time 2200 to 0600	• Noise monitoring at site and surrounding villages to be undertaken once in two months time. • Arrangements/facilities for noise reduction to be monitored on weekly basis • Schedule of activities to be discussed and finalised between site manager and the contractor • 24 hourly continuous monitoring to be undertaken at every village in proximity. • Values of Leq Day, Leq Night to be determined	• Site manager • Construction Contractor • Third party monitoring agency to be engaged for Noise Monitoring • External training on use of PPE, Snake bite, Health and Safety and First aid to be arranged by NRPPL.	• Cost of Noise monitoring shall be INR 5000 per location once in quarter. • Performance parameter – Leq-day, Leq-night, Leq-average • Training on HSE and related issue will be INR 1,50,000-2,00,000 *Throughout construction phase*

Impact Identified	Suggested Mitigation	Monitoring / Training	Management Responsibility	Cost Estimate and Timeline
	hours to reduce the noise impact. • Site workers working near high noise equipment use personal protective devices to minimise their exposure to high noise levels.			
Cultural				
• Existing temples near site • Shadow Flicker • Cultural differences amongst workers	• Access to the existing temple to be retained as existing while working on turbines close to the temple. • Turbines to be located at least 700 m from temple if aligned along east west axis • The construction workers to be instructed about their behaviour and interaction with the local community or other workers. • To the extent possible sourcing of construction labour to be done from local region.	• Workers to be briefed about need for cooperation and harmony with the community • Workers to respect the sanctity of the temple.	• Construction Contractor	• Assistance to temples as per the request of community and consultations
Health and Safety				
• Working at height • Operation of heavy machinery • Accidents leading to injuries fatalities • Occupational health hazards	• All the required safety measures based on the individual‘s job profile to be provided (as per working guidelines, use of personal protective equipments like gloves, helmets, ear muffs, safety belts etc.) for construction workers through the contractors. • Ensure effective work permit system for hot work, electrical work, working at height, working in confined space etc.	• Proper training of the workers regarding health and safety procedures • Workers to be trained through sub contractors regarding use of Personal protection equipment and its importance. • Operation of Cranes to follow a Crane Safety Plan presented as	• Site Manager • Safety Officer • To form part of the contractor‘s contract.	• Training of workers will be mostly given by internal resources. *Throughout construction*

Impact Identified	Suggested Mitigation	Monitoring / Training	Management Responsibility	Cost Estimate and Timeline
	• Ensure personal protective equipment for all personnel present at site are made available. • Arrangement for fire control measures • Display of phone numbers of the city/local fire services, etc. at site. • Ensure good housekeeping at the construction site to avoid slips and falls. • Lifting /Dropping/lowering of construction material or tool to be restricted and undertaken only under strict supervision, if required.	**Annex D.**		*phase*
Social				
• Access to Common Property Resources • Access to grazing lands; • Village approach road to the site;	• The project will engage with the affected community (if any) to understand the stakeholders on the common property resources whose access would be impacted. • Grazing of livestock in and around the wind farms will not be completely restricted • The project will upgrade the existing roads before use and restore roads to better than before use. • These roads will be handed back to the community as an improved/better quality infrastructure. • Local community will engaged for development and repair of new and existing roads	• The site personnel will ensure that during the construction phase there is no misuse of community facilities	• NRPPL to ensure the workers are trained to ensure harmony with community • The social officer to undertake a need assessment for implementation of CSR functions. • On-site personnel and contractors to be aligned with the requirements of social	-

Impact Identified	Suggested Mitigation	Monitoring / Training	Management Responsibility	Cost Estimate and Timeline
	• Migrant labour to briefed on code of conduct to be maintained		responsibility	
• Job Expectations • Expectations for other local benefits	• The project will communicate and discuss with the community about employment/contract and other opportunities in a transparent manner on a regular basis and demonstrate the efforts being made to accommodate as many people as possible. • The projects will ensure that there is a transparent process of giving jobs/contracts and other benefits. • Consultation with women/women's groups will also be held during construction and operation phases to listen to their issues and concerns regarding labour, health and safety etc. as well as to solicit their ideas on various community initiatives.	• NRPPL shall hold regular consultations with the local Panchayat and regulatory authorities. • All concerns must be addressed through a formal grievance redressal process.	• NRPPL • APPL • ReGen PowerTech	-
• Local Employment	• Assess the exact number of workers to be required at each stage in the construction period and notify the community about number of labourers and skills required; • Ensure priority is given to local people for short term/long term employment opportunities.	• Explore possibilities of training and capacity building to enable the community to be able to secure the available jobs and contracts • NRPPL to explore possibility to engage women for office work and documentation related work.	• NRPPL to assess potential for engagement of local community and for women.	-
• Demands for materials, services	• Ensure local contracting and vendor opportunities as far as possible;		• NRPPL /Contractor	-

Impact Identified	Suggested Mitigation	Monitoring / Training	Management Responsibility	Cost Estimate and Timeline
and inputs	• Avoid using any community infrastructure facilities like water bodies, electricity etc.			

Table 9.2: Environment and Social Management Plan for Operation Phase

Issue	Suggested Mitigation	Monitoring / Training	Management Responsibility	Cost Estimate
Aesthetics and Visual Impact				
• Visual intrusion	• Towers to be placed on elevated plateau Towers to be painted white so as not to create any differing contrast to the landscape • Non-reflective paints will be used for the turbines		• Project Manger	*Prior to commencement of operation*
Waste Disposal				
• Used oil • Transformer oil	• Used oil to be securely stored and sold only to MPCB approved vendors. • Transformer oil to be replaced and returned by the supplier of transformers	• O&M staff to be briefed and trained about the need for proper storage and disposal waste oil	• Project Manager • EHS officer of O&M • Transformer Suppliers	-
Ecology				
• Bird Kill • Avian collision	• The turbine layout provides adequate spaces between each turbine for movement of birds which would reduce the potential for accidental collision. • Red paints on turbine blades shall be considered to enhance visibility. • Intra-farm wiring to be kept underground above	• It is suggested to have monitoring of bat colonies for initial three years of project operations since some bat colonies have been identified. • Train the security staff on handling injured birds/bat with basic first aid. Along with providing first aid, the	• NRPPL to engage an expert to periodically assess bat and bird status. The expert shall also train the staff at site and address incidents of bird	• Quarterly Monitoring cost through external expert (INR 200,000 -

	ground wiring, if any will be insulated to avoid any chance of electrocution. • Daytime visual markers will be provided on any guy wires used to support towers to enhance visibility of towers for birds. • Visibility enhancement objects such as marker balls, bird deterrents, or diverters shall also be installed along the transmission line to avoid avian collision. • In case any endangered bird or bat species are identified during operation phase of the project, NRPPL shall obtain a No Objection Certificate from the Chief Wildlife Warden, Maharashtra.	species of the injured/dead bird shall also be identified and recorded.	hit/injury.	300,000 per year)
Noise				
• Turbine noise • Corona Discharge	• Maintenance and repair of turbines will be undertaken on regular basis • Transmission line to have Conductors designed to minimise corona effects • Implement a complaint resolution procedure to assure that any complaints regarding operational noise are promptly and adequately investigated and resolved.	• Turbines certified by IEC to be engaged • Monitor noise at all nearby village once every six months	• Project Manager • EHS officer of O&M	• Monitoring cost 40,000per year • Performance parameters-Leq-day, Leq-night and Leq-average
Water Resource and Quality				
• Water requirement for cleaning	• Water through authorised tanker water suppliers to be used	• Water consumption to be recorded and assessed on weekly basis for wastage	• EHS officer O&M • Plant manager	-

Health and Safety				
• Working at Height • Use of Cranes • Electrical hazards • Accidents leading to injury/fatality	• Work permit system shall be implemented for working at height (typically when working over 2 m above) electric and for hot jobs. • Personal protective equipment to be provided for all personnel during maintenance work • Crane safety plan to be followed • Workers handling electricity and related components to be provided with shock resistant gloves, shoes and other protective gears. Adequate training regarding health and safety to be provided to the workers. • The switchyard building to be provided with fire extinguishers and sand buckets at all strategic locations to deal with any incident of fire.	• Proper training of the workers regarding health and safety procedures • Workers to be trained for use of Personal Protection Equipment and its importance.	• Site Manager • O&M	• Internal resources
Social				
• Impacts on Local Economy	• The project shall try and involve local enterprises for procurement of material wherever possible.	-	• Procurement team	-
• Shadow Flicker	• All turbines located along the edges close to habitation to have a minimum set off of 500 m to negate the spread of any distinct shadow at the village. • Shadow flicker is not anticipated	• Fall of shadow from all turbines to be observed and vegetative shield to be opted if required.		-
• Upgrades to Local Infrastructure • Grazing land	• Collaborate with local government for any community development programs to share the resources and cut cost; • Provide better access to the existing temples	• Any community development activity will be guided and implemented in accordance with group CSR Policy • A need assessment will be	Social officer with the CSR Team	

	and contribute towards its development • Grazing area to be retained with fencing limited to transformer areas	conducted every two years to understand the requirements of the community		

9.2.8 Feedback Mechanism

The key indicators from various monitoring will be helpful in refining the mitigation measures suggested and also for introduction of new measures as required. The key indicators on the status of project during the various stages of the project are:

Construction

- **Grievance redressal shall be the key indicator to assess community concerns, concerns of women and behavioural issues of workers.** The EHS supervisor will assess the basic behaviour of workers at site towards local community, women and other workers. The inputs from EHS supervisor will determine the need for extent and frequency of briefing and training on local customs, respect for women and code of conduct to be imparted to the workers. The liaison officer will continuously interact with the community and land aggregators to address the key concerns.

- **Incident reporting mechanism shall be a key indicator for the Health and Safety aspects of the site.** The safety Officer shall either directly or through EHS supervisor verify the capability of the contractors / sub contractors to implement the EHS requirement. The need for training and scope for improvement shall be charted internally and implemented. NRPPL shall focus on incident reduction and follow up measures.

- **Internal and External Audits of the site shall be carried out on periodic basis.** Internal Audit can be on monthly basis while external audit shall be undertaken after the construction work is fully initiated. The Audit reports and the corrective actions submitted shall be implemented on a time bound manner by NRPPL under the guidance of the corporate EHS head.

- **Debris removal and re-vegetation of site**: Restoration of site post construction is a key indicator for the lenders and NRPPL to assess the commitment to environment. Removal of debris and re-vegetation at each site shall be undertaken in a time bound manner for each turbine and the access roads.

Operation:

- **Grievance Redressal** will remain a key indicator for community concerns and to understand the effectiveness of CSR programs planned/implemented. It will also provide an assessment of behaviour of security staff with the local community, especially women.

- **Noise Monitoring:** The noise predicted from the turbines is within limit; however the cumulative noise may change with advent of more turbines or other activities in future. Also with ageing of turbines the noise levels may increase. The Noise monitoring proposed every six month through an independent agency will ensure a feedback on the same.

- **Bat Monitoring:** Presence of bat colony in the area has been observed noted, for which a monitoring plan is proposed. The documentation of information pertaining to bat will enable NRPPL to understand the extent of bat kill and respond accordingly.

- **Need Assessment Study:** The Social Officer along with the team will undertake a need assessment study for all the project villages and the output of th assessment will be utilised to plan and Implement the CSR Program. The Assessment shall be carried out every two years.

10 Conclusion and Recommendations

Based on the impact assessment study, it is inferred that the proposed 75 MW Chilarewadi wind power project has very few adverse environmental impacts that are generally site specific and can be readily addressed through the proposed mitigation measures. Hence the project can be categorised as an **Environment Category B** project.

Wind power projects usually have minimal or no adverse social or environmental risks or/and impacts. The major impacts are related to the dust generation, soil erosion, noise generation and traffic congestion of the route hauling, during transport, and storage of the construction materials limited to construction phase of the project. Those issues could be addressed by standard construction techniques as described in the environment management plan. The land for the proposed project also comprises of fallow land and no physical or economic displacement is involved with the project.

During operation the project impacts are mostly positive as it provides renewable energy and does not generate any gaseous, solid and liquid wastes. The operation of turbines will also have limited impact on the habitation in terms of noise and shadow flicker. However, bird kill is a residual impact of the project that could be minimized by the recommended mitigation measures but could not be completely eliminated. An environmental and social monitoring program has been developed with third party participation to guide in the implementation, modification or development of new mitigation measures.

It is thus recommended that NRPPL proceeds with the wind power project at Chilarewadi. An Environmental and Social Management Plan including the management responsibilities and cost estimates, has been prepared for the project and NRPPL shall effective and timely implementation of the management plan.

Annexure A

Photo documentation of Project and Surrounding Areas

Client Name: NRPPL	Site Location: Chilarwadi/Virali/Puklewadi village, Man taluka, Satara district, Maharashtra	Project No. DEL-D-12084

Photo No. 1	Date: March 2011

Description:

Proposed Wind Farm Site on table top land

Client Name: NRPPL	Site Location: Chilarwadi/Virali/Puklewadi village, Man taluka, Satara district, Maharashtra	Project No. DEL-D-12084

Photo No. 2	Date: March 2011

Description:

Proposed Wind Farm Site on table top land

Client Name: NRPPL	Site Location: Chilarwadi/Virali/Puklewadi village, Man taluka, Satara district, Maharashtra	Project No. DEL-D-12084

Photo No. 3	Date: March 2011

Description:

Temple near to project site

Client Name: NRPPL	Site Location: Chilarwadi/Virali/Puklewadi village, Man taluka, Satara district, Maharashtra	Project No. DEL-D-12084

Photo No. 4	Date: March 2011

Description:

Flat topped Plateau of Wind farm site

Client Name: NRPPL	Site Location: Chilarwadi/Virali/Puklewadi village, Man taluka, Satara district, Maharashtra	Project No. DEL-D-12084

Photo No. 5	Date: March 2011

Description:

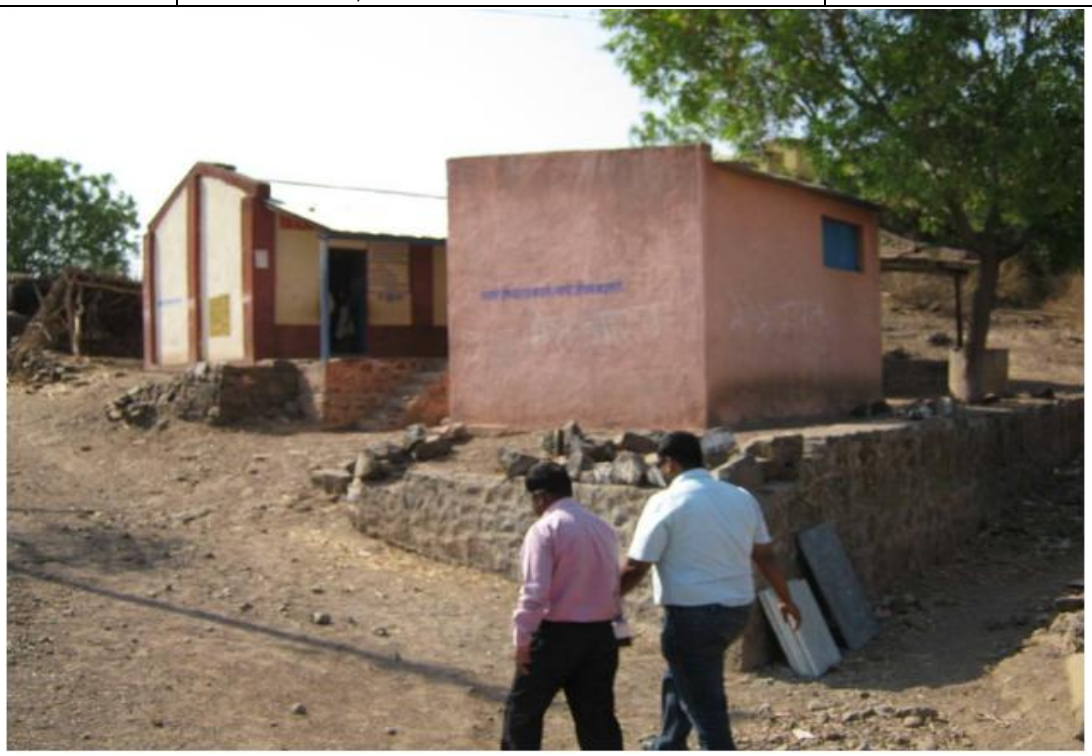
Existing Wind farm in the area

Client Name: NRPPL	Site Location: Chilarwadi/Virali/Puklewadi village, Man taluka, Satara district, Maharashtra	Project No. DEL-D-12084

Photo No. 6	Date: March 2011

Description:

Chilarewadi Village



Client Name: NRPPL	Site Location: Chilarwadi/Virali/Puklewadi village, Man taluka, Satara district, Maharashtra	Project No. DEL-D-12084

Photo No. 7	Date: March 2011

Description:

Public consultation at Virali village

Client Name: NRPPL	Site Location: Chilarwadi/Virali/Puklewadi village, Man taluka, Satara district, Maharashtra	Project No. DEL-D-12084

Photo No. 8	Date: March 2011

Description:

Visit and consultation at project village Chilarewadi

Client Name: NRPPL	Site Location: Chilarwadi/Virali/Puklewadi village, Man taluka, Satara district, Maharashtra	Project No. DEL-D-12084

Photo No. 9	Date: March 2011

Description:

Consultation with affected land owners at Kukudwad/ Puklewadi village

Client Name: NRPPL	Site Location: Chilarwadi/Virali/Puklewadi village, Man taluka, Satara district, Maharashtra	Project No. DEL-D-12084

Photo No. 10	Date: March 2011

Description:

Water sampling near project site

Client Name: NRPPL	Site Location: Chilarwadi/Virali/Puklewadi village, Man taluka, Satara district, Maharashtra	Project No. DEL-D-12084

Photo No. 11	Date: March 2011

Description:

Soil sampling near project site

Client Name: NRPPL	Site Location: Chilarwadi/Virali/Puklewadi village, Man taluka, Satara district, Maharashtra	Project No. DEL-D-12084

Photo No. 12	Date: March 2011

Description:

Air quality monitoring near project site

Annexure B

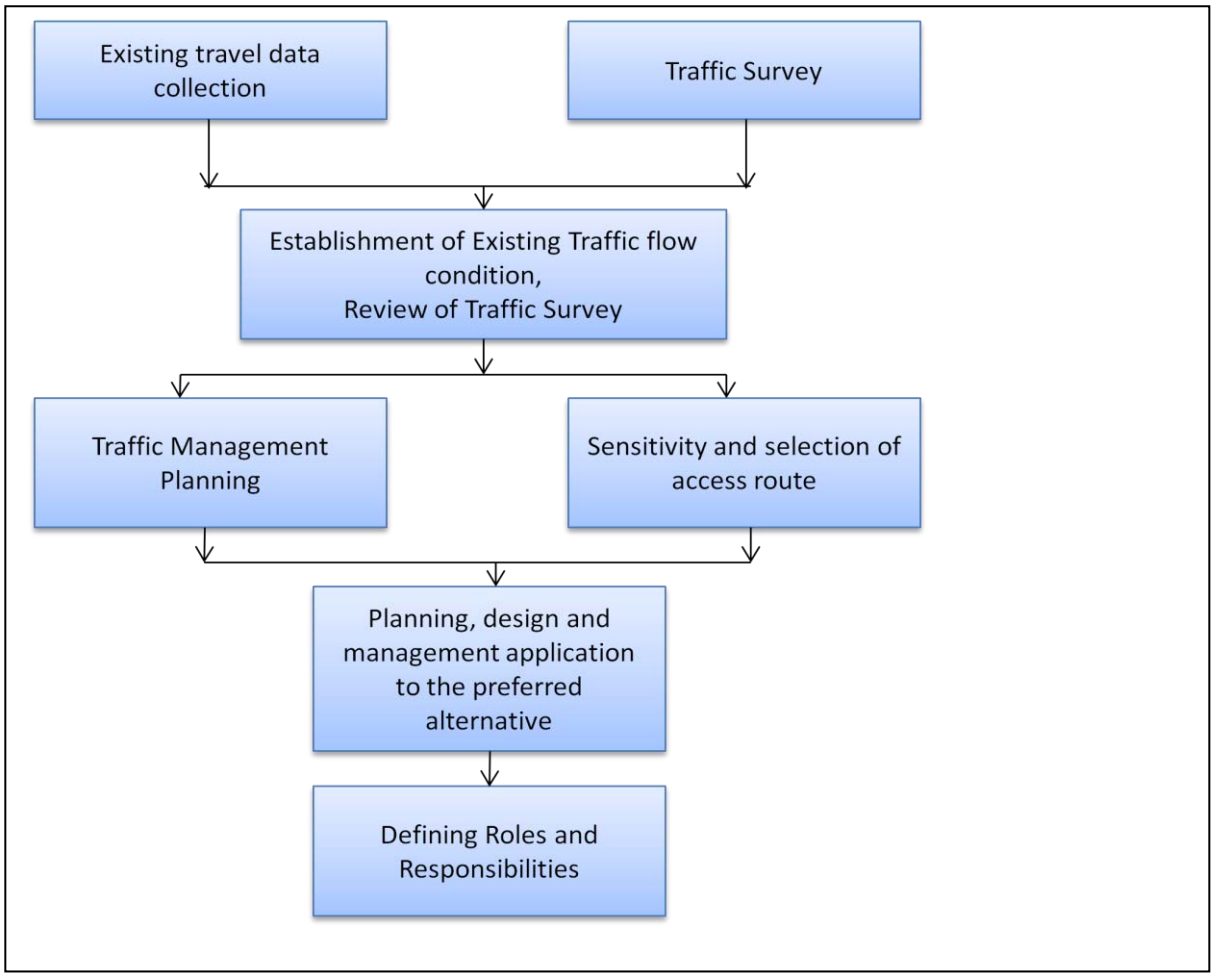
Transportation and Traffic Management Plan

Transportation and Traffic Management Plan

It is envisaged that the components of the proposed project will be conveyed from State Highway via district road to the site at Chillarwadi. Although at present the traffic on these roads is low, it is expected that traffic will marginally increase due to proposed project activity, mainly during construction work. This has the potential to disturb local people in the area and also increase chances of road accidents. A Transportation and Traffic Management Plan (TTMP) is proposed to minimise adverse impacts.

This Transportation and Traffic Management Plan (TTMP) has been prepared to enable the more efficient management of construction traffic associated with the proposed wind power project. In particular, the TMP aims to reduce the impacts of construction traffic movements in relation to disruption and delay to traffic and to reduce the risk of road traffic accidents in relation to the project activities.

Figure 1: Outline of the transport and Traffic management Plan



The key elements addressed by the Transportation and Traffic Management Plan include:

- Traffic Survey
- Review and Considerations on the basis of Traffic Survey
- Traffic management planning
- Access route selection and management
- Road –Related Accidents
- Parking facilities
- Driver training
- Vehicle management and maintenance
- Community liaison and safety
- Roles and Responsibilities

The essential features of each element are outlined below:

1.1 Traffic Survey

It is observed that the connectivity of the area is good and road infrastructure in the region. The roads in the area are already developed and upgraded by many of the existing wind farms; however a traffic survey shall still be carried out by the project proponent for the route of delivery of wind turbine components and other construction equipments to the proposed site entrance. The main objective of traffic survey will be to identify the following:

- Assess the adequacy of the existing road infrastructure (capacity level) along the route to accommodate the transportation of wind turbine components.
- Determine the extent of potential alignment constraints and bottlenecks.
- Generate traffic flow data for envisaged access roads.
- Identify potential effects of construction traffic generated on the local area and transport infrastructure.
- Identify the effect of operational and maintenance vehicles on existing traffic flows and the public road network.
- Identify any improvements that may be required along the route to enable the safe passage of abnormal load deliveries and to reduce the delay and disruption caused to network traffic flows during the construction of the wind turbines.
- Forecast traffic demand for construction
- Identification of alternative access route

The traffic survey will be carried out by a team of 3 members comprising of a 1 traffic engineer and 2 support staff. A full video and route condition survey shall be undertaken to identify any risks due to adverse curvature/ bend or poor road conditions that could give rise to a risk of the vehicles over-turning or difficulty in movement with large turbine components.

The methodology suggested for traffic survey is outlined below:

- Survey will be scheduled once during a weekday and weekend each in order to ensure representative traffic flow data is collected.
- Reconnaissance survey of site and abutting area within 0.5 km on both sides of the road will be done.

- Average daily traffic (traffic flow) data will be collected at 3-5 locations in terms of traffic composition:
    - Two Wheelers-Motor Cycles, Scooters
    - Three Wheelers – Auto Rickshaw
    - LCV's - Car, Jeep, Mini Cab, Matador
    - HCV's- Truck, Bus
    - Non-Motorized- Bicycle, Bullock-Cart
- Peak hour traffic and directional split at survey locations will be calculated.
- Width of road falling in the route will be measured.
- Curvature of bends will be calculated and presence of vertical curves if any will be identified.
- Existing Bridges, natural drains and culverts (if any) will be identified.
- Information will be collected on right-of-way available, carriageway width and surface type.
- Existing infrastructure in terms of street lighting, safety signage, road marking etc will be assessed and documented.
- A trial-run will be undertaken for abnormal loads simulate with appropriate projections from the vehicle, to ensure the access route suitability i.e. in relation to passing places, turning circles and any obstructions.

1.2 Review and Considerations on the basis of Traffic Survey

Based on the traffic survey undertaken the existing transport infrastructure available for the project will be reviewed and adequate measures will be taken.

- If the width of roads is found to be inadequate for the transport requirements of turbine blades and other large construction equipments, permission will be taken from the respective authorities for required widening.
- Signage will be erected to identify site access routes and to inform motorists that local roads are accommodating construction traffic. Signage warning of the site access junction locations and an advisory speed restriction of 30 kmph will be erected.
- Widening and strengthening of the carriageway will be undertaken where necessary, to accommodate the turbine delivery vehicle wheel tracks.
- When practicable, construction traffic movements (equipment and materials) will be scheduled to avoid the peak traffic periods at the beginning and end of each day and other sensitive periods, in order to minimise any potential disturbance to local traffic.
- Telegraph poles and overhead cables will be relocated where necessary.
- Appropriate speed limits for various motor vehicles and construction equipments will be determined as part of the traffic management based on type of roads available en-route the location to and fro of the project component where construction material is to be transported project.
- If any bottlenecks are identified in the traffic survey, appropriate measures will be taken to avoid congestion due to project.
- Alternative access routes for the transport of project construction vehicles and windmill parts to project site will be identified.
- Alternative transportation approaches including barge, rail will be considered.

1.3 Traffic management planning

Many of the impacts that are associated with the project related road traffic can be mitigated through efficient traffic planning and management. Wherever possible, the use of community road transport network and undue associated adverse environmental impacts will be minimised by the project proponent and the contractor by efficient traffic planning. The efficient management and planning of transport will require the implementation of following measures:

- Impose and enforce speed limits on all haulage vehicles operating on haul routes.
- Establishment of safe sight distances including within construction areas.
- The movement of heavy, wide or slow-moving loads will be planned at times when traffic volume on the roads concerned is least.
- Vehicles shall enter and exit project area in a forward direction, so far as is possible and reversing if required will not be done unattended.
- Prepare detailed plan for signage around the construction areas to facilitate traffic movement;
- Regular inspection of access roads conditions and whenever, necessary, repair of construction traffic related damages will be done.
- Appropriate supervision will be provided to control flow of traffic when machinery needs to cross roads.
- Information will be provided to local authorities relating to the construction period, including abnormal load traffic movement schedules.
- Wheel washing on site and road sweeping will be carried out to keep the local highway clear of mud and debris.
- Training and testing of heavy equipment operators and drivers, including vision tests, with records kept of all trainings.
- Create traffic awareness among the local people and inform parents to keep children from exposing themselves to the traffic in the construction area. Vehicle traffic will be minimized during the periods when children are travelling to and from schools falling on traffic routes.
- Maintaining records of all accidents involving project vehicles and implementing a traffic complaint and corrective action procedure.
- Liaison with the police and other authorities prior to the movement of any abnormal loads or any over dimensioned consignment.
- If road closures are required, diversions will be planned and communicated to the authorities and affected communities in advance. All diversion will be constructed to the specifications of the applicable road authority and will be maintained in good drivable conditions until the completion of the re-instatement work.
- Most construction equipment and vehicles would be brought to the wind farm site at the beginning of the construction process during construction mobilization and would remain on site throughout the duration of the construction activities for which they were needed.
- The project traffic or any project activity will not obstruct the access to neighboring properties.
- Ambulance and fire services will be consulted regarding road diversions. Road diversions will not increase the response time of these services to local communities.

Where there is the potential for cumulative impacts from congestion and related impacts from construction traffic to settlements near or en route to the project component locations, transport movement will be carefully considered in order to minimise disturbance impacts.

1.4 Access route selection and management

Access will only be allowed via specified access routes. Key routes will identified and described in the form of detailed transport and access maps, and will take account of environmentally sensitive areas, sensitivity of schools, natural reserves and major pedestrian crossings.

New access roads will be selected such that they:

- Balance project cost with biophysical and socio-economic issues and considerations.
- Preferentially utilize land already impacted by human activities.

All the new access roads will be designed and built in accordance with the project design specifications. Adequate slope and cross-fall drainage to channel storm water safely will be provided for the construction of new access roads, thereby preventing erosion or siltation.

The traffic management is to be monitored on daily basis to evenly spread traffic flow during a day so as to avoid congestion and minimise chances of road accidents. In addition, the contractor will comply with all statutory vehicle limits with respect to width, height, weight, loading, etc.

Throughout the project construction period, project proponent will be responsible for monitoring the condition of access roads used by project traffic and for ensuring that they are maintained in a condition that is at least as good as the condition they were in before the start of construction, to the satisfaction of the road maintenance authorities. The project proponent is expected to adopt appropriate measures to keep access roads free from mud, dust and debris, such as:

- The use of hard concrete surfaces on access roads;
- The provision of easily cleaned paved area within the project components;
- The provision of wheel washing facilities for vehicles leaving the marshy or slushy construction base/working width;
- Appointment of personnel/sweepers to clean hard standing area and to remove any mud/debris deposited on the access roads and public highways; and
- Sheeting of all project vehicles carrying potentially dusty material or likely to deposit loose materials on the access roads.

1.5 Road –Related Accidents

Hazards to personnel associated with vehicle transportation, both on road and off-road, will present one of the most significant risk exposures of the project. Accordingly, contractor will develop and implement management systems and procedures that will provide control over these hazards. This will cover arrangement for the following aspects:

- Source and number of qualified drivers needed,

- Drivers' training,
- Hours of driving and rest periods,
- Driver, vehicle and load security arrangements,
- Driver's communication with control point and vehicle equipment,
- Language/communication,
- Source and number of suitable vehicles required,
- Vehicle quality and specification,
- Vehicle preventative maintenance programme,
- Vehicle routes, route planning and alternative routes,
- Overall vehicle movements,
- Emergency recovery of vehicle;
- Strategic vehicle parking locations,
- Impact of vehicles on local community, villages, roads, and
- Inspection and audit of the project transport system.

1.6 Parking facilities

A detailed plan for signage around the construction areas to facilitate traffic movement, parking facilities, provide directions to various components of the works, provide safety advice and warnings will be prepared. All signs shall be posted in both English and Hindi language.

sThe parking of construction vehicles along footpaths, single lane roads shall be prohibited on community roads and public highways in the vicinity of the project site. Provision for dedicated parking area will be made near the project office other suitable location for the private vehicles of construction personnel.

Temporary concrete paved areas will be provided for parking of vehicles and overhaul provisions will be made for any accidental spill of oil or fuel during parking or whenever the vehicle is idling.

1.7 Driver training

The project EHS requirements and Indian regulatory requirements specify the requirements for driver training. The project proponent and contractor are required to ensure that all drivers and driver trainers are suitably trained in accordance with driver training requirements. All drivers will be trained and evaluated in defensive and off-road vehicle operation.

The following issues and documents are to be addressed during driver training in a language (Hindi language) mostly understood by drivers:

- Trip Management Plan;
- Daily pre-use vehicle inspection by the driver;
- Safety kit in vehicle and
- Health and Safety Standards and Practices;
- National and local legal requirements to drive a vehicle.

Unauthorised passengers in project related vehicles will be strictly prohibited. All the personnel who drive vehicles as a part of contract will have to be in possession of a driving license and will adhere to the Driver's Safety code and Passenger's Safety code as supplied in the Trip management plan.

1.8 Vehicle management and maintenance

In order to ensure that accident rates and the overall transport fuel consumption are minimised, it will be ensured that the vehicle fleet working on the project (whether directly for the contractor or for the contractor's subcontractors) is maintained according to the manufacturers' specifications. This shall include the compliance of all vehicles with all safety related specifications (such as the fitting of the correct tyres, with adequate reserves of tread, safe for movement in snow areas, inflated to manufacturer recommended levels), as well as mechanically maintaining vehicles to manufacturer specifications so as to minimise fuel consumption as well ensure safety on road.

The project proponent will ensure the following in respect of vehicle maintenance, noise and emission standards:

- All vehicles shall be maintained so that their noise and emissions do not cause nuisance to workers or local people.
- An up to date database of all vehicles and construction equipments deployed across various project component locations will be maintained. The database will contain details about the periodical maintenance, schedule of maintenance, vehicular emission and noise emission testing done as per Indian regulatory requirements, copy of PUC certificates etc.
- New vehicles/equipment purchased 'as new' after contract award shall comply with emission standards in force on the purchase date.
- Older vehicles/equipment not purchased 'as new' after contract award shall be maintained so that noise and emissions levels are no greater than when the vehicle/ equipment was new.
- Avoidance of passage through and near settled areas during night time hours.
- Oil and fuel leaks must be addressed within 24 hrs of observation or reporting on any vehicle or construction equipment.
- Vehicle maintenance and management parameters will form a critical component of key performance indictor for the contractor responsible to maintain their vehicles.
- All heavy vehicles like cranes, battery operated trolleys etc. will be provided with reversing siren.

1.9 Community Liaison and Safety

Traffic safety in local communities must be a high priority for project and their contractors. Project as well as the contractor must seek to minimise the amount of traffic through communities, the distance travelled by employees to undertake work and the distances over which equipment will be transported by precise and optimal planning.

It will be ensured that communities are advised in advance of project progress and near term activities where transport issues have the potential to impact local communities. The communications to the community will discuss the timing (start, duration and finish of project activities in their vicinity) of road closures, if any and diversions, and, if more than one viable alternative exists, the community's preferences for diversion routes.

Other aspects of project transportation that will be the subject of community liaison will include the upgrading of existing roads to facilitate their use for project purposes. These issues will be taken up with the communities through Project Social Supervisor who in turn will also seek support of local administration for management of heavy traffic and closure of community used roads.

Efforts will be made to brief women particularly on safety measures. As the primary caretakers, women are well positioned to pass on safety information to their children. The Social Supervisor will carry out traffic safety awareness programme as part of road safety awareness programme on behalf of project.

1.10 Roles and Responsibilities

Responsibilities specific to the traffic management are listed below and will be reflected in job descriptions as appropriate.

S.No.	Project Proponent Responsibilities	Contractor's Responsibilities
1.	Development of Transportation Traffic Management Plan (TTMP) to implement traffic management relevant commitments and contractual requirements.	Comply with the requirement as delineated in the TMP and all its components such as verification and monitoring aspects, reporting, maintaining records etc
2.	Communicating the contents and requirements of TTMP to all personnel and contractors managing transport operations and fleet.	Communicating to the workforce the contents and requirements of TTMP
3.	Coordinating the preparation of management plans at micro-level, if required and, reviewing and approving the Contractor plans before allowing the commencement of work	Identify appropriate personnel responsible for coordinating and managing traffic related issues across their respective location of the project component
4.	Securing a periodical updated listing of all transport vehicle fleet details and their corresponding environmental regulatory compliance details with regards emission and noise from the project contractors	Performance of all subcontractors with respect to the requirements of management plan and compliance with all relevant statuary requirements, permits and licence conditions
5.	Workforce training and ensuring that all personnel are aware of their responsibilities	Securing and updating the necessary permits for on-road and off-road vehicles from concerned regulatory authorities.
6.	Working internally, and with contractors, to minimise traffic generation	Workforce training and ensuring that all personnel are aware of their responsibilities
7.	Implementation of appropriate inspection and monitoring programme	Ensuring that all fleet vehicles comply with environmental regulations with regards emission and noise
8.	Determining corrective action for non-compliance, and identifying opportunities for continuous improvement	Record keeping and reporting

Annexure C

Re-vegetation Plan

Re-vegetation Plan

1.1 General Guidelines Regarding the Plantation-plan

The original topography and vegetation of the site must be retained, that newly-planted saplings may get the benefit of their natural micro-climate and may survive with relatively less inputs.

Soil from the site should be used for the plantation, as far as possible, and supplemented with external nutrients only where necessary.

Chemical fertilizers or pesticides must be avoided, as they reduce soil-quality and integrity, as also, the food/medicinal value of plants. Locally available leaf-litter, grass-cuttings, agricultural residue, compost or other organic material may be used as supplementary plant-nutrients.

Ground-vegetation should be allowed to shed seeds before cutting or mowing it for mulch. This would leave behind a seed-bank to flourish in the next growing-season, providing a natural source of mulch for the following year.

Burning of land must be avoided, as it reduces soil-quality, and harms the ground-vegetation, amphibians, reptiles and ground-nesting birds.

Dumping of waste on the soil must be avoided. Non-biodegradable waste must be carefully collected and safely disposed. Biodegradable waste should be collected and processed (composted), that it may be used to enrich the site-soil.

Water-saving practices, such as drip-irrigation and mulching, are recommended.

1.2 Suggestions Regarding the Plantation-process

Pits measuring approximately 2'x2'x2' may be dug where the soil is reasonably deep, and, pits measuring approximately 3'x3'x3' where the soil is shallow or gravelly. Expose the pits to direct sunlight for about 15 days.

Where the soil at the site is reasonably good, pits may be filled with 80% site-soil + 20% composted cow-dung. About 200g neem-cake and leaf-litter, grass or agricultural residue may be added.

Where the soil at the site is poor, pits may be filled with 35% site-soil + 35% fertile soil (from an external source) + 30% composted cow-dung. Neem-cake and other organic matter may be added as in the previous instance.

Saplings should ideally be planted after the annual rains begin. The saplings would need to be watered once the rains cease. Construction of temporary shelters of locally available materials such as bamboo and grass around the growing saplings is recommended in the summer, to help the plants withstand the hot sun.

1.3 Suggested Tree-species (Names in brackets are the most common vernacular names)

Acacia leucophloea (Hivar)

Acacia nilotica (Baabhul)

Aegle marmelos (Bael)

Ailanthus excelsa (Mahaaneem)

Alangium salvifolium (Ankol)

Albizzia lebbek (Shirish)

Albizzia procera (Kinai)

Azadirachta indica (Nimb)

Balanites aegyptica (Hinganbet)

Bauhinia purpurea (Kaanchan)

Bauhinia racemosa (Aapta)

Capparis divaricata (Pachunda)

Cassia fistula (Bahaava)

Cochlospermum religiosum (Ganer)

Cordia dichotoma (Bhokar)

Dalbergia sissoo (Shisoo)

Emblica officinalis (Aavla)

Erythrina stricta (Paangaara)

Ficus arnottiana (Pipran)

Ficus microcarpa (Naandruk)

Holoptelea integrifolia (Waaval)

Phoenix sylvestris (Shindi)

Pongamia pinnata (Karanj)

Tamarindus indica (Chinch)

Terminalia bellerica (Beheda)

Thespesia populnea (Bhend)

Vitex negundo (Nirgudi)

1.4 Suggested Shrub-species (Names in brackets are the most common vernacular names)

Bauhinia tomentosa (Pivla-kaanchan)

Capparis decidua (Nepti)

Cassia auriculata (Tarvad)

Clerodendrum inerme (Koynel)

Helicteres isora (Murud-sheng)

Holarrhena pubescens (Paandhra-kuda)

Maytenus senegalensis (Henkal)

Sarcostemma viminale (Somavalli)

Woodfordia fruticosa (Dhaayti)

Annexure D

Crane Safety Plan

Crane Safety Plan

Cranes are carefully designed, tested, and manufactured for safe operation. When used properly they can provide safe reliable service to lift or move loads. Because cranes have the ability to lift heavy loads to great heights, they also have an increased potential for catastrophic accidents if safe operating practices are not followed.

Crane operators and personnel working with cranes need to be knowledgeable of basic crane capacities, limitations, and specific job site restrictions, such as location of overhead electric power lines, unstable soil, or high wind conditions. Personnel working around crane operations also need to be aware of hoisting activities or any job restrictions imposed by crane operations, and ensure job site coordination of cranes. Crane inspectors therefore should become aware of these issues and, prior to starting an inspection, take time to observe the overall crane operations with respect to load capacity, site coordination, and any job site restrictions in effect. The inspection requirements and qualification requirement for crane operation are provided in the following subsections.

1.1 Inspection

a. All lifting appliances shall be thoroughly examined by a competent person (as per Building and Other Construction Central Rules), once at least in every twelve months after entering into site.
b. If a crane is removed from site and then returned it shall be re-inspected by both the above mentioned competent person prior to its use on site
c. Crane operators must inspect all controls and safety devices each day before beginning work. If any of the controls do not operate properly, they must be repaired before the crane is operated.
d. Before using any crane, the Operator must also visually inspect the work location for any unsafe conditions. Unsafe conditions must be reported to supervision and shall be corrected before the crane work is begun.
e. The Operator shall ensure all mechanical and control repairs made to a crane must be performed according to the manufacturers' recommendations and approvals.
f. When a mobile crane is relocated from one point to another within the site, the crane set-up in the new location will be inspected by the site before the crane is operated.

1.2 Qualification of Operator

a. The contractor shall ensure no person is engaged in driving or operating lifting appliances unless he is sufficiently competent and reliable, possess the knowledge of inherent risks involved in the operation and is medically examined periodically. Per Section 23 of the Factories Act, 1948, as amended, young persons (below 18 years of age) must not allowed to work at any dangerous machine (including cranes) unless they have been fully instructed about the dangers arising pertaining to the machine and the precautions to be observed, and

1) have received sufficient training in work at the machine, or
2) are under adequate supervision by a person who has a thorough knowledge and experience of the machine

1.3 Equipment requirements:

a. The contractor shall ensure every crane must be equipped with a legible, durable load chart that shows the manufacturer's recommended load configurations and maximum load weights. The chart must be securely attached to the cab and easily visible to operators when they are seated at the control station.
b. The contractor shall ensure every crane shall be equipped with an automatic safe load indicator.
c. The contractor shall ensure every crane shall be clearly marked for its safe working load.
d. The contractor shall ensure the cabin of crane operator shall be provided with suitable seat, foot rest and protection from vibration. It shall be adequately ventilated and provided with suitable fire extinguisher.

1.4 Operational requirements:

a. All Operators shall ensure no lifting appliances are operated without signal of an experienced rigger (rigger refers to a person who specializes in (and generally supervises) moving large/heavy objects at a site and specifically involved in rigging ropes for lifting or hoisting heavy materials).
b. Operator shall maintain continuous contact, either visual or vocal, with a qualified signalperson. (If for any reason that contact is lost, the crane operator must stop all operations until full contact is restored).
c. Store items such as tool, lubrication cans, and waste materials in a toolbox. (Do not leave any loose items in cab).
d. Operator shall be constantly alert to the effects of dynamic loading when swinging, hoisting, and lowering the load or when moving the crane.
e. Prior to moving a crane into an area, the Manager shall evaluate the surface conditions for ensuring crane’s stability during the lifting operations, as the stability of a crane can be jeopardized when outriggers of the crane sink into the surface/soft soil, which can result in the crane tipping over. The site shall also evaluate the possibility of damage to the underground facilities or injury to personnel before using a crane in a specific area.
f. The site shall ensure to barricade the swing radius of the counterweight.
g. Assure the crane hooks’ safety latches are in good working order and are used properly.
h. Operator shall follow the manufacturer's instructions for entering and exiting the cab. The only acceptable alternative is using a straight ladder that has been affixed to the crane.
i. Seat belts shall be worn by the Operator when seated at the controls.
j. The site shall assure that no one works or walks under a suspended crane load, and that no one rides the ball or load.

k. The site shall not allow anyone else on the crane when it is in use.
l. Operator shall follow the manufacturer's recommendations for maximum allowable loads and maximum loads and maximum boom lengths.

1.5 Operation of Winches:

a. The contractor shall ensure double gear winches are not used unless a positive means of locking the gear shift is provided.
b. The contractor shall ensure there is no load other than the fall and the hook assembly on the hook assembly on the winch while changing gears on a two gear winch.

1.6 Responsibility of the Primary Employer[1]

a. The employer shall comply with the manufacturer's specifications and limitations applicable to the operation of any and all cranes and derricks. Where manufacturer's specifications are not available, the limitations assigned to the equipment shall be based on the determinations of a qualified engineer competent in this field and such determinations will be appropriately documented and recorded. Attachments used with cranes shall not exceed the capacity, rating, or scope recommended by the manufacturer.
b. Rated load capacities, and recommended operating speeds, special hazard warnings, or instruction, shall be conspicuously posted on all equipment. Instructions or warnings shall be visible to the operator while he is at his control station.
c. The employer shall designate a competent person who shall inspect all machinery and equipment prior to each use, and during use, to make sure it is in safe operating condition. Any deficiencies shall be repaired, or defective parts replaced, before continued use.
d. A thorough, annual inspection of the hoisting machinery shall be made by a competent person, or recognized agency. The employer shall maintain a record of the dates and results of inspections for each hoisting machine and piece of equipment.
e. Except where electrical distribution and transmission lines have been de-energized and visibly grounded at point of work or where insulating barriers, not a part of or an attachment to the equipment or machinery, have been erected to prevent physical contact with the lines, equipment or machines shall be operated approximate to power lines only in accordance with the following:

    (i) For lines rated 50 kV or below, minimum clearance between the lines and any part of the crane or load shall be 10 feet;
    (ii) For lines rated over 50 kV, minimum clearance between the lines and any part of the crane or load shall be 10 feet plus 0.4 inch for each 1 kV over 50 kV, or twice the length of the line insulator, but never less than 10 feet;
    (iv) A person shall be designated to observe clearance of the equipment and give

[1] OSHAS Mobile Crane Inspection Guidelines for OSHA Compliance Officers

timely warning for all operations, where it is difficult for the operator to maintain the desired clearance by visual means;

(vi) Any overhead wire shall be considered to be an energized line unless and until the person owning such line or the electrical utility authorities indicate that it is not an energized line and it has been visibly grounded.

f. No modifications or additions which effect the capacity or safe operation of the equipment shall be made by the employer without the manufacturer's written approval. In no case shall the original safety factor of the equipment be reduced.

Annexure E

No Objection Certificates (NOC) from Panchayat

Summary of NOC Chilarewadi:

The village Panchayat has No Objection to the Wind Power Project being developed by NSL at Village Chilarewadi, Man Taluka, District Satara. The Panchayat has considered the national interest and the interest of the local community in terms of employment opportunities while issuing the no objection.

Summary of NOC Puklewadi:

The village Panchayat has No Objection to the Wind Power Project and transmission lines being developed by NSL at Village Puklewadi, Man Taluka, District Satara. The Panchayat expects the company to repair and develop the village roads. The Panchayat has considered the national interest and the interest of the local community in terms of employment opportunities while issuing the no objection.

Summary of NOC Virali:

The village Panchayat has No Objection to the Wind Power Project and transmission lines being developed by NSL at Village virali, Man Taluka, District Satara. The Panchayat expects the company to repair and develop the village roads. The Panchayat has considered the national interest and the interest of the local community in terms of employment opportunities while issuing the no objection.

"स्वच्छतेकडून समृध्दीकडे"

ग्रामपंचायत चिलारवाडी

ता. माण, जि. सातारा

✷ स्वच्छतेचे सहा संदेश

१) पिण्याचे पाणी उंचावर ठेवावे.
२) पिण्याचे पाणी झाकून ठेवावे.
३) पिण्याचे पाणी घेताना ओगराळ्याचा वापर करावा किंवा पिंपाला तोटी असावी.
४) शौचावरून आल्यानंतर हात साबणाने किंवा राखेने स्वच्छ धुवावेत.
५) बाळाची शी धुतल्यानंतर हात साबणाने किंवा राखेने स्वच्छ धुवावेत.
६) स्वयंपाकापूर्वी किंवा जेवणापूर्वी हात साबणाने किंवा राखेने स्वच्छ धुवावेत.

जा. नं. दिनांक २४/७/२०१०

ग्रामसभा ठरावाची
प्रत

ग्रामसभा दि० 20/7/2010 रोजीच्या ठ. क्र. 2 चा
उतारा

विषय क्र – २८ मे नुझीवीडु प्रा. लि. यांचा दि. १९/७/२०१० च्या
अर्जाचे अवलोकन करणे बाबत.

ठराव क्र – २८ मे. नुझीवीडु सिड्स प्रा. लि. कंपनीने सातारा जिल्हातील माण तालुक्या परिसरातील डोंगर पठारावरील जमिनीवर पवनऊर्जा प्रकल्प उभारणे तसेच ग्रामपंचायत हद्दीतील अस्तित्वात असणारे रस्ते दुरुस्त करणे व नवीन रस्ते तयार करून वापरण्याचे आहेत. सदर कामाच्या काही भाग ग्रामपंचायत चिलारवाडी ता० माण येथील जमिनीवर येत आहे तरी सदर प्रकल्प उभारणी करण्यापूर्वी ग्रामपंचायत परवानगी घेणे आवश्यक आहे तसेच पवनऊर्जा प्रकल्प उभारणी झाल्यानंतर नियमानुसार ग्रामपंचायत कर भरणे बंधनकारक राहील तरी सदर प्रकल्प हा देश हिताच्या असलेमुळे तसेच सदर प्रकल्पामुळे रोजगार उपलब्धी होणार आहे यामुळे या कामास आपल्या ग्रामपंचायतीची काही हरकत नाही पवन ऊर्जा प्रकल्प ज्या जागेवर उभा करावयाचा आहे त्या संबधीत मालकाची परवानगी घेणे बंधनकारक राहील. वरील प्रमाणे अटीस अधिन राहुन अर्जाचे वाचन करण्यात येवुन मंजूर करण्यात येत आहे.

सूचक :- बाबा नारायण खुडुकले
अनुमोदक :- रामहरी कृ. खुडुकले
ठराव सर्वानुमते पास

(सही)	J. N. G
ग्रामसेवक	सरपंच
ग्रामपंचायत चिलारवाडी	ग्रामपंचायत चिलारवाडी
ता. माण जि. सातारा	ता. माण जि. सातारा

"स्वच्छतेकडून समृध्दीकडे"

ग्रामपंचायत पुकळेवाडी

ता. माण, जि. सातारा

✸ **स्वच्छतेचे सहा संदेश**

१) पिण्याचे पाणी उंचावर ठेवावे.
२) पिण्याचे पाणी झाकून ठेवावे.
३) पिण्याचे पाणी घेताना ओगराळ्याचा वापर करावा किंवा पिंपाला तोटी असावी.
४) शौचावरून आल्यानंतर हात साबणाने किंवा राखेने स्वच्छ धुवावेत.
५) बाळाची शी धुतल्यानंतर हात साबणाने किंवा राखेने स्वच्छ धुवावेत.
६) स्वयंपाकापूर्वी किंवा जेवणापूर्वी हात साबणाने किंवा राखेने स्वच्छ धुवावेत.

जा. नं.

दिनांक ९ / २ /२०१०

ग्रामसभा ठरावाची नक्कल

मौजे पुकळेवाडी ग्रामपंचायतीची ग्रामसभा मा. सरपंच यांचे अध्यक्षतेखाली दि २६/१/२०१० रोजी सकाळी ११.०० वाजता ग्राम कार्यालयासमोर झाली त्या मधील ठराव नं.२ची नक्कल

विषय नं.२- मे नुसीवीडू सीड्स प्रा.लि. यांचा दि १८/१२/२००९ च्या अर्जाचे अवलोकन करणे

ठराव नं.२- मे नुसीवीडू सीडस प्रा.लि. कंपनीने सातारा जिल्हातील माण तालुका परिसरातील डोंगरपठारावरील जमीनीवर पवन उर्जा प्रकल्प उभारणे, तसेच विद्युतवाहिनी टाकणे तसेच ग्रामपंचायत हद्दीतील अस्तित्वात असणारे रस्ते व जुने पांदर रस्ते दुरूस्त करणे व नविन रस्ते तयार करून वापरण्याचे आहेत. सदर कामाचा काहि भाग ग्रामपंचायत मौजे पुकळेवाडी ता-माण जि-सातारा येथिल जमिनीवर येत आहे. सदरचा प्रकल्प हा देशहिताचा असलेमुळे तसेच सदर प्रकल्पामुळे रोजगार उपलब्धी होणार आहे. यामुळे या कामास आपल्या ग्रामपंचायतीची काहि हरकत नाहि. वरिल प्रमाणे अर्जाचे वाचन करण्यात येवून मंजूरी करण्यात येत आहे.

सुचक - आनंदा बापू पुकळे
अनुमोदक - रमेश सखाराम पुकळे

ठराव सर्वानुमते मंजूर

येणे प्रमाणे असे.

ग्रामसेवक
ग्रामपंचायत पुकळेवाडी
ता. माण, जि. सातारा

सरपंच
ग्रामपंचायत पुकळेवाडी
ता. माण, जि. सातारा

ग्रामपंचायत विरळी

ता. माण, जि. सातारा.

स्वच्छतेचे सहा संदेश

१) पिण्याचे पाणी उंचावर ठेवावे.
२) पिण्याचे पाणी झाकून ठेवावे.
३) पिण्याचे पाणी घेताना ओगराळ्याचा वापर करावा किंवा पिंपाला तोटी असावी.
४) शौचावरून आल्यानंतर हात साबणाने किंवा राखेने स्वच्छ धुवावेत.
५) बाळाची शी धुतल्यानंतर हात साबणाने किंवा राखेने स्वच्छ धुवावेत.
६) स्वयंपाकापूर्वी किंवा जेवणापूर्वी हात साबणाने किंवा राखेने स्वच्छ धुवावेत.

ग्रामपंचायत विरळी ता. माण, जि. सातारा

जा. नं.

दिनांक २३ / ७ /२०१०

ग्रामसभा ठरावाची प्रत

ग्रामसंसभा दि. 29/07/2010 रोजीचा ह. क्र. 2 चा. ठराव

विषय क्र. = मे नुझीवीडु प्रा. ली. यांचा दि 9/07/2010 चा अर्जाचे अवलोकन करणे बाबत

ठराव क्र. :- मे. नुझीवीडु सीडस प्रा. लि. कंपनीने सातारा जिल्हातील माण तालुका परिसरातील डोंगर पठारावरील जमिनीवर पवनऊर्जा प्रकल्प उभारणे तसेच ग्रामपंचायत हद्दीतील अस्तित्वात असणारे रस्ते व नुतन पानंद रस्ते दुरुस्त करणे व नवीन रस्ते तयार करुन वापरण्याचे आहेत सदर कामाच्या काही भाग ग्रामपंचायत मौजे विरळी ता. माण जि सातारा येथील जमिनीवर येत आहे तरी सदर प्रकल्प उभारणी करण्यापुर्वी ग्रामपंचायत परवानगी घेणे आवश्यक आहे तसेच पवनऊर्जा प्रकल्प उभारणी झाल्यानंतर नियमानुसार ग्रामपंचायत कर भरणे बंधनकारक राहील. तरी सदर प्रकल्प हा देशहिताचा असलेमुळे तसेच सदर प्रकल्पामुळे रोजगार उपलब्धी होणार आहे यामुळे या कामास आपल्या ग्रामपंचायतीची काही हरकत नाही पवन-ऊर्जा प्रकल्प ज्या जागेवर उभा करावयाचा आहे त्या संबधीत मालकाची परवानगी घेणे बंधनकारक राहील. वरील प्रमाणे अटीस आधीन राहुन अर्जाचे वाचन करण्यात येवून मंजूर करण्यात येत आहे

सुचक :- बापूराव सिताराम माळवे

अनुमोदक :- शिवराम सुदाम गोरड

ठराव सर्वानुमते पास

मंदिप पिंगळे
ग्रामपंचायत विरळी

Ramesh
ग्रामसेवक

Annexure F

Detailed Results of Noise Modelling

Project:
chillarwadi

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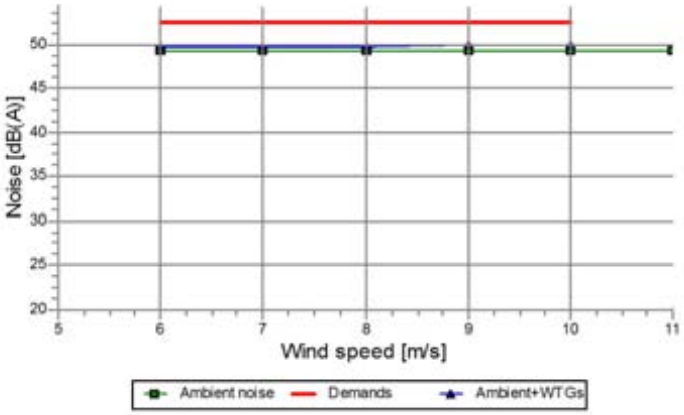
Aecom
5th Floor, Building 10 B, DLF Cybercity, DLF Phase 2,
IN-122002 Gurgaon
+91 1244830100
Ajay Pillai / ajay.pillai@aecom.com

Calculated:
12/24/2012 10:40 PM/2.7.486

DECIBEL - Detailed results

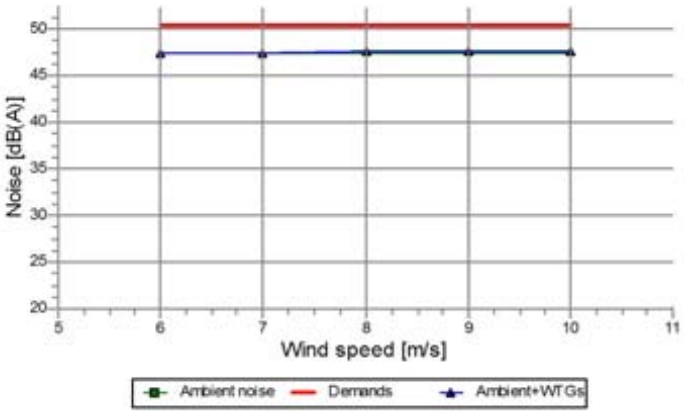
Noise calculation model: ISO 9613-2 General

Noise sensitive area: (2) (A)



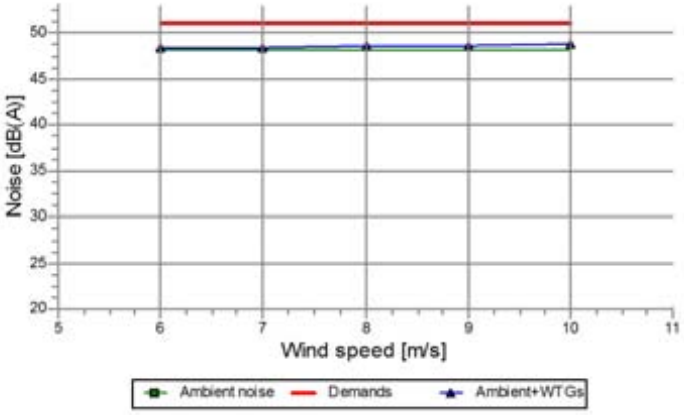
Wind speed	Ambient noise	Demands: Allowed addition exposure	Sound Level: WTG noise	Sound Level: Ambient+WTGs	Result: Additional exposure	Result: Demands fulfilled ?
[m/s]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	
6.0	49.4	3.0	37.2	49.7	0.3	Yes
7.0	49.4	3.0	38.3	49.7	0.3	Yes
8.0	49.4	3.0	39.3	49.8	0.4	Yes
9.0	49.4	3.0	40.3	49.9	0.5	Yes
10.0	49.4	3.0	41.2	50.0	0.6	Yes

Noise sensitive area: (3) (B)



Wind speed	Ambient noise	Demands: Allowed addition exposure	Sound Level: WTG noise	Sound Level: Ambient+WTGs	Result: Additional exposure	Result: Demands fulfilled ?
[m/s]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	
6.0	47.4	3.0	29.6	47.5	0.1	Yes
7.0	47.4	3.0	30.6	47.5	0.1	Yes
8.0	47.4	3.0	31.6	47.5	0.1	Yes
9.0	47.4	3.0	32.6	47.5	0.1	Yes
10.0	47.4	3.0	33.6	47.6	0.2	Yes

Noise sensitive area: (4) (C)



Wind speed	Ambient noise	Demands: Allowed addition exposure	Sound Level: WTG noise	Sound Level: Ambient+WTGs	Result: Additional exposure	Result: Demands fulfilled ?
[m/s]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	
6.0	48.1	3.0	36.1	48.4	0.3	Yes
7.0	48.1	3.0	37.1	48.4	0.3	Yes
8.0	48.1	3.0	38.1	48.5	0.4	Yes
9.0	48.1	3.0	39.1	48.6	0.5	Yes
10.0	48.1	3.0	40.1	48.7	0.6	Yes

Project:
chillarwadi

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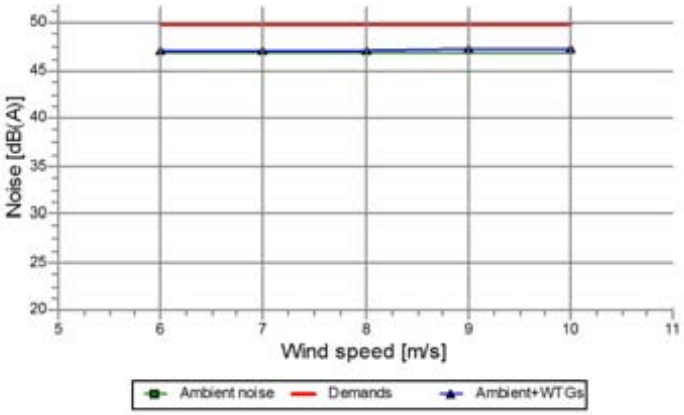
IN-122002 Gurgaon
+91 1244830100
Ajay Pillai / ajay.pillai@aecom.com

Calculated:
12/24/2012 10:40 PM/2.7.486

DECIBEL - Detailed results

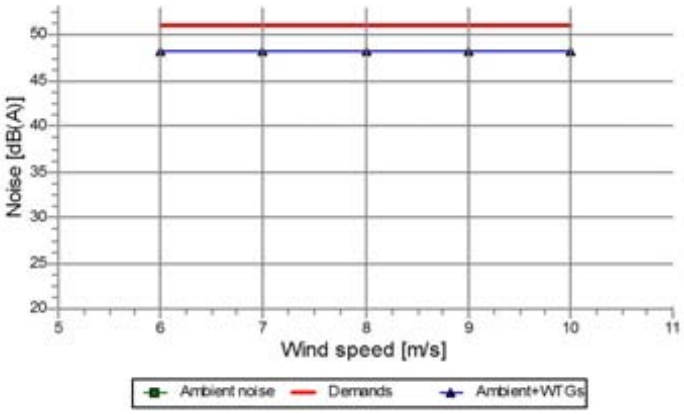
Noise calculation model: ISO 9613-2 General

Noise sensitive area: (5) (D)



		Demands	Sound Level		Result	
Wind speed	Ambient noise	Allowed addition exposure	WTG noise	Ambient+WTGs	Additional exposure	Demands fulfilled ?
[m/s]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	
6.0	46.8	3.0	33.9	47.0	0.2	Yes
7.0	46.8	3.0	34.9	47.1	0.3	Yes
8.0	46.8	3.0	35.9	47.1	0.3	Yes
9.0	46.8	3.0	36.9	47.2	0.4	Yes
10.0	46.8	3.0	37.9	47.3	0.5	Yes

Noise sensitive area: (6) (E)



		Demands	Sound Level		Result	
Wind speed	Ambient noise	Allowed addition exposure	WTG noise	Ambient+WTGs	Additional exposure	Demands fulfilled ?
[m/s]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	
6.0	48.1	3.0	26.9	48.1	0.0	Yes
7.0	48.1	3.0	27.9	48.1	0.0	Yes
8.0	48.1	3.0	28.9	48.2	0.1	Yes
9.0	48.1	3.0	29.9	48.2	0.1	Yes
10.0	48.1	3.0	30.9	48.2	0.1	Yes

Annexure G

List of Land Owners

S.N.	Gat No.	Village	Purchased Area in Ares[1] (100 Ares= 1ha)	Name of Land Owner(s)
1	565	Chilarwadi	140	Mr. Balaji Pratap Sinha Jadhdev
2	1585	Virali	99.75	Mr. Shivaji Anna Gorad Mr. Dadu Shivna Gorad Mr. Shingu Shivna Gorad Mr. Vaman Satyaba Gorad Mr. Jagannath Satyaba Gorad.
3	35	Pukalewadi	153	Mr. Ishwar dada Pukale Mr. Prakash Dada Pukale
4	20	Pukalewadi	107.00	Mr. Balaji Prataosinha jadhav
5	28	Pukalewadi	100	Mr. Jagu Krishna Pukale Mr. Rama Krishna Pukale
6	605	Chilarwadi	58	Mr. Dadaso Shrimant Ghutukade Mr. Bapu Shrimant Ghutukade Mr. Sadashiv Shrimant Ghutukade Mr. Bhimarao Shrimant Ghutukade Mrs. Tulasabai Shrimant Ghutukade
7	523	Chilarwadi	7.33	Mr. Shrimant Shidu Ghutukade Mr. Dada Daghu Ghutukade Mr. Popat Daghu Ghutukade Mr. Rajaram Daghu Ghutukade Mr. Satyawan Sopan Ghutukade Shobha Janarthan Ghutukade Ujwala Chandrakant Ghutukade Vaishali Sopan Ghutukade Janabai Sopan Ghutukade Natha Bayaji Ghutukade
8	536	Chilarwadi	8.50	
9	43	Pukalewadi	100	Mr. Baba Budhya Pukale
10	1539	Virali	70	Mr. Dada Shankar Ghutukade Mr. Dwarakabai Namdeo Gorad Mr. Anjabai Atmaram Virkar Mr. Sadashiv Ramchandra Gorad Mr. Suhas Brahmadeo Gorad Aniita Prakash Narbad Subhadra Brahmadeo Gorad Shardabai Bapu Virkar Mr. Dada Khashaba Gorad Mr. Dagdu Abba Gorad
11	1512	Virali	100	Mr. Dadu Shivna Gorad Mr. Shingu Shivna Gorad
12	1601	Virali	75.16	Mr. Pandurang Babu Gorad Mr. Shidha Kasu Gorad Mr. Nivrithi Namdeo Gorad Mr. Shivaji Namdeo Gorad Mr. Mahadeo Namdeo Gorad Mr. Akutai Khasaba Kolekar Mr. Chandabai Namdeo Gorad

[1] "Are" is a land measurement unit used in the state of Maharashtra. 100 Ares is equal to 1 hectare =2.47 acres.

S.N.	Gat No.	Village	Purchased Area in Ares[1] (100 Ares= 1ha)	Name of Land Owner(s)
13	1571	Virali	57.5	Mr. Kailas babu Kashid Mr. Adhinath Babu Kashid Mr. Dattatray Atmaram Kashid
14	1572	Virali	38	
15	515	Chilarwadi	100	Mr. Dada Dagdu Ghutukade Mr. Popat Dagdu Ghutukade Mr. Rajaram Daghu Ghutukade Shobha Janarthan Ghutukade Mr. Datywan Sopan Ghutukade Ujwala Chandrakant Ghutukade Vaishali Sopan Ghutukade Janabai Sopan Ghutukade
16	1819	Virali	16.87	Mr. Sampatrao Namdeo Gorade Mr. Kusum Chandrakant Ghutukade Mr. Popat Dagdhu Ghutukade
17	524	Virali	78.58	Mr. Shrimant Shidu Ghutukade Mr. Dada Daghu Ghutukade Mr. Popat Daghu Ghutukade Mr. Rajaram Daghu Ghutukade Mr. Satyawan Sopan Ghutukade Shobha Janarthan Ghutukade Ujwala Chandrakant Ghutukade Vaishali Sopan Ghutukade Janabai Sopan Ghutukade Natha Bayaji Ghutukade
18	1819	Virali	22.13	Mr. Rajesh Kakasaheb Ghadge Mr. Chandrakant Sakharam Ghutukade Mr. Satyawan Sopan Ghutukade Shobha Janarthan Ghutukade Ujwala Chandrakant Ghutukade Vaishali Sopan Ghutukade Janabai Sopan Ghutukade
19	604	Virali	21	Mr. Ramesh Vikram Sona Wane Mr. Kalabai Dada Ghutukade Mr. Dilip Shreepati Ghutukade Mr. Ashok Shreepati Ghutukade Mr. Nivas Shreepati Ghutukade Vidhya Vishnu Sargar Malan Shreepati Ghutukade Mr. Prakash Shankar Ghutukade Mr. Sharada ShankarGhutukade Mr. Ratan Nivrutti Gorade Mr. Sitabai Maruti Gorade Savitrabai Bhikan Gorade Tulsabai Shankar Ghutukade Mr. Popat Dagdu Ghutukade Mr. Satyawan Sopan Ghutukade Shobha Janarthan Ghutukade Ujwala Chandrakant Ghutukade Vaishali Sopan Ghutukade Jayabai Sopan Ghutukade Mr. Sandipan Devba Ghutukade
20	606	Virali	10	
21	603	Virali	23	

S.N.	Gat No.	Village	Purchased Area in Ares[1] (100 Ares= 1ha)	Name of Land Owner(s)
22	1822	Virali	106.25	Mr. Rajesh Kakasaheb Ghadge
23	1575	Virali	53.81	Mr. Dilip tatoba Nalavade
24	1575	Virali	44.98	Mr. Dilip Tatoba Nalavade Mr. Dadasaheb Muralidhar Nalavade Mr. Kusum Rajendra Katkar Usha Tanaji Bagal Mr. Ratan Murlidhar Nalavade Mr. Bajirang Vithoba Nalavade
25	1582	Virali	62	Mr. Changdev Vitthu Nalavade
26	511	Chilarwadi	449.5	Mr. Pandurang Babu Gorad Mr.Uttam Dyanu Chavan
27	511	Chilarwadi	108.5	Mr. Bajarang babu Gorad Mr. Bhagwan Babu Gorad Mr. Pandurang babu Gorad Mr. Uttam Dyanu Charan
28	1652	Virali	202.5	Mr. Daji Shivana Gorad Mr. Anna Shivana Gorad Mr. Raghu Shivana Gorad Mr. Dasharath Shivana Gorad Mr. Sanjay Baba Gorad Mr. Prakash Baba Gorad Mrs. Tarabai Baba Gorad Mr. Dagdhu Hariba Gorad Mr. Shida Hariba Gorad Mr. Bhagvan Hariba Gorad Mrs. Ashabai Rajaram Gorad Mrs. Sonabai Uttam Ghutukade Mrs. Gokula dhondiba Pukale
29	72	Pukalewadi	100	Mr. Hari Vithu Pukale
30	1821	Pukalewadi	11.95	Mr. Rajesh Kakasaheb Ghadge Mr. Chandrakant Sakharam Ghutukade Mr. Satyawan Sopan Ghutukade Shobha Janarthan Ghutukade Ujwala Chandrakant Ghutukade Vaishali Sopan Ghutukade Janabai Sopan Ghutukade
31	19	Pukalewadi	20.53	Mr. Balaji Prataosinha jadhav
32	12	Pukalewadi	105.00	Mr. PreshitKumar Ravindrakumar Kamble Mr. Surendrskumar Vishvanath Jadhav Mr. Janardhan Lalaso Ghadge Mr. Krushnath Narayan Shedge
33	50	Pukalewadi	105.83	
34	44	Pukalewadi	10.31	
35	30	Pukalewadi	70.00	
36	71	Pukalewadi	25.5	
37	583		12.00	Mr. Ramesh Vikram Sona Wane

S.N.	Gat No.	Village	Purchased Area in Ares[1] (100 Ares= 1ha)	Name of Land Owner(s)
38	36	Pukalewadi	108.66	Mr.Shamrao Bhairu Shelke Mr. Maruti Bhairu Shelke Mr. Tattyaba Bhairu Shelke Mr. Harishchandra Bajirao Shelke Mr. Dajiram Ramu Shelke Mr. Rajaram Ramu Shelke Mr. Mahadeo Ramu Shelke Mr. Popat Ramu Shelke Mr.Jyotiram Ramu Shelke Mr. Chaturabai Hariba Jankar Mr. Bai Balu Hubale Mr. Govind Pandarinath Pukale Mr. Chagan Pandarinath Pukale Raibai Bhima Bankar Rukmini Shivaji Dadas Mr. Gopal Babu Pukale Jagabai Babu Pukale Mr. Ramdas Walchand Pukale Chandrabhaga Walchand Pukale Mr. Rahul Sadashiv Pukale Kavita Sadashiv Pukale Meghnarani Sadashiv Pukale Madhuri Sadashiv Pukale Pusphalata Sadashiv Pukale Mr. Dhondiram Hari Shelke Mr. Mayappa Sadhu Shelke
39	37	Pukalewadi	33.00	
40	47	Pukalewadi	24.00	
41	41	Pukalewadi	10.58	
	Total		**3,050.72 Ares (~30.5 ha)** **Area for Wind Turbines : 25.85 ha** **Internal Access roads : 4.65 ha**	

Annexure H

Additional Biological Survey of the Site (undertaken by NSL)

RAPID BIOLOGICAL ASSESSMENTS OF CHILAREWADI WINDFARM SITE

JULY 2012

NSL POWER

GREEN SUPPORT SERVICES
GUJARAT
INDIA

RAPID BIOLOGICAL ASSESSMENTS OF CHILAREWADI WINDFARM SITE

JULY 2012

GREEN SUPPORT SERVICES

443/1, SECTOR-8B, GANDHINAGAR
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Content

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Summary

A rapid biological risk assessment for Chilarewadi Wind Farm site by NSL Power Limited was carried out in July-2012. The study was a rapid survey involving desk reviews and field visit between 12th to 15th July 2012. With detailed investigations, understanding of the biological issues (mainly birds, bats, other wildlife species, rare, endangered species and natural habitats) was developed and assessment was done in low, medium and high risk scale.

Our observation suggests that 'Chilarewadi Wind farm' is likely to be a low risk site in terms of bird and bat mortalities. This is because the site maintains safe distances from protected areas, Important Bird Areas, Endemic Bird Areas, World Heritage Sites/Biodiversity hotspots, large/medium wetlands etc. During our field visit we observed very low bird diversity and abundance. Details of issues, concerns, reasons, conclusions and suggestions are provided for each site separately.

NSL Power shall monitor the existence and number of bats in 2 identified bat roosts in the periphery of the project site. This would also help understand the cumulative impacts of Wind Farm on large bat species of the region.

1. Introduction

1.1. Wind energy projects and concerns of Bird & Bats mortalities

Wind farms are a relatively new method of obtaining 'clean' energy by avoiding air pollution and other forms of environmental degradation associated with fossil fuel technologies (Nelson and Curry 1995) and have received strong public support as an alternative energy source (Leddy *et al.* 1999). Moreover, wind farms have shown a spectacular growth because they have reduced the costs of energy production. This phenomenon has resulted in a proliferation of wind farms around the world (Germany, Holland, Spain, United States, etc.) (Osborn *et al.* 2000).

However, there are wide concerns over wind farm developments, that they are cause of bird and bats mortalities. Bird and bats are known to hit windmill blades and die. There are three special concerns that arise with respect to the development of wind farms. Several studies across the world have raised the concerns on the wind farm development.

They represent a source of noise, they have an aesthetic impact on landscapes and they might represent a supplemental negative impact on bird populations (Nelson and Curry 1995). Wind turbine farms in landscapes have given rise to much controversy relating to bird conservation issues in many European countries (Larsen and Madsen 2000). Wind turbines seem to add an obstacle for bird movements and research has shown that birds fly into the rotor blades (Morrison and Sinclair 1998).

Although some studies have recorded bird collisions with rotor blades (Orloff and Flannery 1992; Barrios 1995; Musters *et al.* 1996; Hunt 1999), other studies gave evidence that birds could detect the presence of wind turbines and generally avoid them (Nelson and Curry 1995; Osborn *et al.* 1998). Wind turbines kill far fewer birds in general each year than do many other causes linked to humans, including domestic cats and collisions with glass windows. But wind power has a disproportionate effect on certain species that are already struggling for survival (Subramanian 2012). The scarce information on the possible

interactions between birds and wind turbines has shown that: (1) waterfowl and raptors seem to be the groups with the highest risk of collision, not directly related to their abundance (Orloff and Flannery 1993; Osborn *et al.* 1998), (2) familiarity with turbines, leading to a decrease in awareness, may be an important factor contributing to increased mortality (Orloff and Flannery 1993), (3) dark nights increase mortality of waders (Dirksen *et al.* 1998), (4) passerine species appear to be at greatest risk of colliding during spring and autumn migrations (Higgins *et al.* 1996; Osborn *et al.* 1998), and (5) there is evidence that waterfowl, wading bird and raptor densities near turbines are lower (Leddy *et al.* 1999). Moreover, birds avoid flying in areas with wind turbines and their flight patterns are deferred when wind turbines are rotating or not rotating (Osborn *et al.* 1998). However, up to now population-level effects have not yet been demonstrated to reject the further development of wind power. The main purpose of our research were to determine (1) the possible impacts of wind turbines on both the local, breeding and migratory bird populations (2) the degree of flight behavioral change in birds resulting from the presence of a wind farm.

Research shows that wind farms can impact wildlife in 2 principal ways: 1) they can eat up or fragment habitat and/or 2) they can directly kill birds and bats. Habitat fragmentation occurs when wind farms and their associated roads, power lines, and other structures displace wildlife. The impacts of habitat fragmentation go far beyond the immediate “footprint” of the wind farm, because some wildlife particularly grassland species will avoid areas with high towers.

Bird and bat deaths occur in two ways. Birds die when they collide with turbines, power lines, and other structures. Although bat collisions can occur (sometimes bats turn off their echolocation and can run into structures), recent scientific studies indicate that barotrauma may be a significant cause of bat deaths at wind farms. Baratrauma occurs as bats chase the turbine blade (their echolocation detects a moving object). As the bat gets close to the blade, it is pulled into a low pressure area immediately behind the blade. This low pressure area causes the bat’s lungs to expand into its body cavity, exploding the blood capillaries in the bat’s lungs. This phenomenon was recently established as a significant killer of bats at an Alberta wind farm.

1.2. Wind Energy Sector Promotion by the Indian Government

In view of the need of substantial energy to match country's growth, and security, Indian government is promoting development of renewable energy projects in the country. The government of India has announced many benefits for such projects. Wind energy projects in India are given special incentives and benefits by the Government of India.

- Ministry of Environment & Forests, Government of India, has issued guidelines dtd 10.11.2003 and amendments thereafter for diversion of forest land for non-forest purpose under the forest (conservation) act, 1980 for promoting wind energy.

- Wind Power Project does not fall in the purview of getting "Environment Clearance" under Environment Protection Act 1980.

- Guidelines for declaration of Eco-Sensitive zones around National Parks and Wildlife Sanctuaries issued by Ministry of Environment and Forests, Government of India, dtd 9th February 2011 also suggest promotion of green technology and use of renewable energy in these zones.

- Dandi eco-sensitive zone notification by Ministry of Environment and Forests, Government of India, dated 13th October 2010 (F.No. 24011/11/2009-SICOM) also promotes setting up of non-conventional energy sources such as wind and solar.

1.3. Legal framework & India's international obligations for biodiversity conservation

Though, wind farm projects are considered clean energy projects and they are encouraged by the Governments, there are still wide concerns over their impacts on birds, bats, natural habitats and wildlife especially when they are close to protected areas. The impacts of wind farm projects are being studied and several studies have shown that it can prove detrimental if the projects are placed without considering the biodiversity conservation of the area. India being signatory to various international conventions and treaties, it is bound to preserve its biodiversity, conserve natural habitats, and protect migratory birds by various laws and acts. Some of the conventions, treaties, laws, rules and acts

are listed below. Any undue impacts of project on biodiversity, wildlife, killing or torturing of animals could be subjected to these laws.

1.3.1. Wildlife (Protection Act 1972)

The Government of India enacted Wild Life (Protection) Act 1972 with the objective of effectively protecting the wild life of this country and to control poaching, smuggling and illegal trade in wildlife and its derivatives. The Act was amended in January 2003 and punishment and penalty for offences under the Act have been made more stringent. The Ministry has proposed further amendments in the law by introducing more rigid measures to strengthen the Act. The objective is to provide protection to the listed endangered flora and fauna and ecologically important protected areas.

1.3.2. Environment Protection Act 1986

The Ministry of Environment and Forests (MoEF) is responsible for the implementation and enforcement of the Environment Protection Act, 1986, and Rules issued under the Act under sections 3 and 5 of the EP Act, 1986. The Ministry retains enormous powers to issue directions in the interests of environment protection. The specific functions of MoEF are as follows: Environmental policy planning; Effective implementation of legislation; Monitoring and control of pollution; Environmental Clearances for industrial and development projects covered under EIA notification; Promotion of environmental education, training and awareness; and Forest conservation, development, and wildlife protection.

1.3.3. The Biological Diversity Act 2002

This act was born out of India's attempt to realize the objectives enshrined in the United Nations Convention on Biological Diversity (CBD) 1992 which recognizes the sovereign rights of states to use their own Biological Resources. The Act aims at the conservation of biological resources and associated knowledge as well as facilitating access to them in a sustainable manner and through a just process. For purposes of implementing the objects of the Act it establishes the National Biodiversity Authority in Chennai.

1.3.4. The Prevention of Cruelty to Animals Act 1960

The Prevention of Cruelty to Animals Act was enacted in 1960 to prevent the infliction of unnecessary pain or suffering on animals and to amend the laws relating to the prevention of cruelty to animals. After the enactment of this Act, the Animal Board of India was formed for the promotion of animal welfare.

India is also signatory to following conventions which bind and guide the country to take initiatives for conservation of its biodiversity, wetlands and migratory species including migratory birds.

1.3.5. Convention on Biological Diversity 1992

The Convention on Biological Diversity (CBD), known informally as the Biodiversity Convention, is an international legally binding treaty. The Convention has three main goals: 1) conservation of biological diversity (or biodiversity); 2) sustainable use of its components; and 3) fair and equitable sharing of benefits arising from genetic resources. In other words, its objective is to develop national strategies for the conservation and sustainable use of biological diversity. It is often seen as the key document regarding sustainable development. The Convention was opened for signature at the Earth Summit in Rio de Janeiro on 5 June 1992 and entered into force on 29 December 1993. 2010 was the International Year of Biodiversity. The Secretariat of the Convention on Biological Diversity is the focal point for the International Year of Biodiversity. At the 2010 10th Conference of Parties (COP) to the Convention on Biological Diversity in October in Nagoya, Japan, the Nagoya Protocol was adopted. On 22 December 2010, the UN declared the period from 2011 to 2020 as the UN-Decade on Biodiversity. They, hence, followed a recommendation of the CBD signatories during COP10 at Nagoya in October 2010.

1.3.6. Ramsar Convention 1971

The Convention on Wetlands (Ramsar, Iran, 1971) -- called the "Ramsar Convention" -- is an intergovernmental treaty that embodies the commitments of its member countries to maintain the ecological character of their Wetlands of International Importance and to plan for the "wise use", or sustainable use, of all of the wetlands in their territories. Unlike the other global environmental conventions, Ramsar is not affiliated with the United Nations system of

Multilateral Environmental Agreements, but it works very closely with the other MEAs and is a full partner among the "biodiversity-related cluster" of treaties and agreements.

1.3.7. Convention on Migratory Species 1979

The Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or the Bonn Convention) aims to conserve terrestrial, marine and avian migratory species throughout their range. It is an intergovernmental treaty, concluded under the aegis of the United Nations Environment Programme, concerned with the conservation of wildlife and habitats on a global scale. The Convention was signed in 1979 in Bonn (hence the name) and entered into force in 1983.

Migratory species threatened with extinction are listed on Appendix I of the Convention. CMS Parties strive towards strictly protecting these animals, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them. Besides establishing obligations for each State joining the Convention, CMS promotes concerted action among the Range States of many of these species.

1.4. Scope of Work

The scope of work communicated by NSL Power Company is as follow.

- Review available baseline data and ESIA report, review other secondary data, undertake a site visit and interact with relevant stakeholder to provide on: a) whether significant risks of bird and bat hits/mortality exist due to the project and cumulative impacts from other projects in the vicinity and, b) Likelihood of significant mortality and impact on IUCN CR, EN specie, endemic species and/or on national or long range migratory species or other bird/bat species.
- Incase significant impact is likely, provide and opinion on whether population viability of any of the spices (particularly IUCN CR, EN, NT, endemic, national migratory, or long range migratory species) will be adversely impacted.
- Incase significant is likely, suggest if a detailed avian impact and collision risk assessment is necessary; outline the timing and approach/methodology of such a study.
- Outline the good international industry practice migration and/or monitoring measures that NSL may exist: a) but is not significant; b) but population viability

of any species is not expected to be adversely impacted; and c) and population viability of bird and bat species is adversely impacted.

1.5. Objectives of the study

In view of the scope of work extended by the company and above mention facts, country's laws/acts/obligations as well as company's requirement to meet with international environmental safety standards, we carried out the present study. The study was carried out with following objectives to assess the impacts of proposed wind farm on bird, bats and natural habitats.

- Evaluate the risk levels of project sites for birds, bats, important species and natural habitats through desk reviews and field visits.
- Provide understanding on the issues of concern with reasons.
- Provide suggestions and mitigations for wind farm development and operation.

2. Methods

2.1. Basic framework of data collection

As with other sources of renewable energy, wind energy is generally considered to result in few environmental impacts. Despite this, assessment of impacts of wind farm development on birds and bats and other biodiversity requires sufficient and systematic information on various aspects in and around the proposed site. The prediction of impacts of wind farm industries on birds and bats depends on understanding of the proposed activities and its extent, scale and ecological conditions in the surrounding area. Collection of baseline information on birds, bats and natural habitats is a prerequisite for assessment of impacts of wind farm development activities. It would also help in advance planning and mitigate the impacts and ultimately managing the natural habitats and resources. The approach to achieve the stated objectives within defined scope of work, include field surveys, interviews, and reviews of literature. Following was the basic fame work of the data collection.

2.2. Basic understanding of the project & surrounding areas

It is important to understand the project areas and its geography in order to collect data and predict impacts of the projects. Following activities were carried out to get basic understanding of the project areas.

2.2.1. Field visit

Field visit was conducted between 12th to 15th July 2012 to understand and assess the impacts of wind farm projects on birds, bats and natural habitats. We evaluated the distribution of birds, bats and important natural habitats in and around the project site.

2.2.2. Orientation and location

In order to know the orientation and location of the project sites with reference to the distances and boundaries of important bird and bats areas and natural habitats, we studied project site maps. We also used Global Positioning System (GPS) to find out distances from each of these. This was useful in assessing whether the proposed project sites falls within the boundaries of any important bird, bats and natural habitats such as protected areas or any other designated ecologically important areas.

2.2.3. Surrounding area and geography

In order to know the surrounding habitats, geography and land use pattern, we made field visits to the proposed project sites, studied maps of the areas and used freely available satellite imageries on internet (Google Earth). This was useful in assessing the overall suitability of land for wildlife and to see if these sites make any part of corridors/migration route for any important bird species or not.

2.3. Baseline status of birds and bats species

In order to acquire information on the distribution of birds species of the project areas, we interviewed several local people which include farmers, herders and villagers, tourist guides etc. They were asked several questions about the presence of various bird and wildlife species in the surroundings and their sightings, breeding habitats such as nests, their observation seasons and timings etc. The respondents were also shown relevant photographs from the standard books in order to improve the check list of birds and wildlife species of the project area. They were also asked specific questions, whether the windmills have any negative impacts on wildlife, agriculture and the people etc. In human dominated landscape, human response to wildlife presence can serve as an index to understand the intensity of wildlife use of the area. Field observations were therefore complemented by efforts to generate information from informal consultations with local people on use of area, corridor by any wildlife species.

The information received on the status of the birds and bats species were plotted in matrix of concern, issues and status of issues in relation to the project sites. The information gathered on distribution of birds, bats and natural habitats provided clear understanding of the species present in the project area. For example, migratory birds are found in the winter season and most of them are found in the wetlands. Now measuring the distances from wetlands would let us know if the migratory birds would be affected from the projects or not. In order to understand the importance of the other wildlife species of the project areas, they were classified in the threat categories defined by the IUCN and Birdlife International. The species list was classified into endangered, vulnerable, near threatened, least concerned categories. They were further classified in to migratory, resident and passage migrant's categories of bird species.

2.4. Important birds & bats habitats, hotspots and their distances

The distances from important bird habitats such as protected areas, wetlands, and grassland areas were measured using GPS. These important areas also include Important Bird Areas (IBAs), classified by Birdlife International. Boundaries of the protected areas were prepared using GPS and also plotted on Google Earth™ for better understanding or the surrounding areas. Some of these areas were personally visited in order to check the status of habitats i.e. grassland meadow and wetlands etc.

2.5. Desk Literature Review

Considering the time limitation to undertake statistically rigorous data collection, we relied mostly on existing secondary literature and knowledge on the ecology and biodiversity of the region. Importantly, there are quite a few studies undertaken in the past dealing with the impacts of wind turbines on birds and bats and other concerns of biodiversity conservation in many countries. Literature on wind farm and associated environmental issues, were downloaded and collated using internet. Books on birds, bats and wildlife were also studied in order to understand the biology of several relevant and important species.

2.6. Analysis to evaluate the potential impacts.

The information collected on status of birds & bats, their spatio temporal distributions, hotspots, and potential impacts of wind farm project development were logically analyzed and conclusions were drawn for making suggestions for developing ecologically sustainable project.

2.7. Limitations of the study

The study undertaken is structured around the project information as provided by the project proponent, any change in the proposed activities may result in variation of outcome. The biological assessment study is based on literature review, consultation with local community and field survey undertaken. Professional judgment and subjective interpretation of facts has been applied for this study. All information's and inferences presented herein are based on the specifics currently available within the limits of the scope of work, information provided by the client or its representative, existing secondary data, budget and schedule.

3. Potential issues & Analysis

3.1. General characteristics of the site

NRPPL intends to develop a 75MW Wind Power Project in Satara District of Maharashtra State, India. The project falls in the villages of Chilarewadi, Puklewadi and Virli, which is about 85km from Satara towards the south east direction and 135 km in south-East of Pune city (Map-3.1). The wind farm will be located on a table top plateau (890-905m AMSL) with a total area of approximately 62 ha.

Map-3.1: Location map of the proposed wind farm site.

The project site falls in what is locally known as “Sahyadri hills” in the Western Ghats. As part of the Deccan Plate, Sahyadri hill region has Gondwanaland origins. The Sahyadri sub-cluster includes the middle and upper elevation biomes of the northern Western Ghats, contain geologically and biologically unique formations. Sahyadri Hills are the northernmost part of the Western Ghats in the country and therefore play a vital role in the zoogeography of India. Presence of numerous barren, rocky, lateritic plateaus, locally known as ‘sadas’, is a unique feature of the Northern Western Ghats. It supports characteristic ephemeral flush vegetation harboring monotypic genera, many of which show restricted or narrow distribution (Kanade *et al*. 2008). The underlying rock is the

igneous trap – basalt and the superficial rock is laterite in general. The soil is gravelly, red or reddish-brown in colour. The area receives sparse rainfall rarely amounts to more than 600 mm a year

Plate-3.1: Chilarewadi Wind Farm project site.

3.2. Biological Assessment

3.2.1. Assessment of Birds

Western Ghats is one of the eight Endemic Bird Areas (EBA) of India recognized by Birdlife International. We assessed the bird

Bird activity/abundance: During our field visit in month of July -2012, we walked total 3 transects of 1.0 km length in order to assess the bird encounter rate and activity. Transects were walked in the morning hours in the proposed project area of Chilarewadi, Puklewadi and Virli villages.

During transects we encountered only bird 23 species in the study area with very low encounter rates (Annexure-I). The species with higher encounter rate were Ashy-crowned Sparrow-Lark (1.7/km), Green bee eater (1.3/km) and Indian robin (1.3/km). The overall bird activity was found to be very low in the project area.

Detailed analysis of the birds sighted shows that majority of the birds were passerines and did not belonged to threatened or endemic categories. All the birds reported, belonged to least concerned category by Birdlife International and IUCN. Moreover, all the birds seen during the field visit falls in Schedule-IV category of Indian Wildlife Protection Act 1972.

It is also the fact that the project site is located at 90.0 km distance from the Chandoli National Park and 10 km from Mayani Bird Sanctuary. Apparently, this protected area is not listed as an Important Bird Areas by Birdlife International (IBA book). However Koyna Wildlife Sanctuary located at 90 km from project site in Western direction is identified as an Important Bird Area of Maharashtra.

Since the project site maintains safe distance from all the above mentioned 2 protected area and 1 IBA, the endemic birds inhabiting in these forests are less likely to be affected by the project.

Migratory birds: Due to absence of wetlands in and around the project site, the migratory and local waterbirds with large flocks are not present in and around the project site. There are two major wetlands which are located at 17 km in East and 18 km in West of the project site. Migratory birds with large, heavy bodies and large flocks are more susceptible to collision with the wind turbines. Since there are no wetlands in and around the project site, it is safely stated that the project is less likely to have any issue with migratory waterbirds.

There are reports of small flocks of migratory waterbirds and flamingos visiting Mayani Bird Sanctuary in winter season. The literature review suggests that very small vagrant flocks of Greater Flamingos visited Mayani Bird Sanctuary in the past. However, while visiting the Sanctuary area, it was apparent that the sanctuary is infested with weeds and the bird activities were very low. Since small occasional and vagrant flocks of flamingos visiting Mayani Bird Sanctuary located at more than 10.km distance, chances of collision is less likely to be affected by wind farm activities.

Raptors: During our field visit, we observed only 1 species of raptors in the project area i.e. Shikra. This species of raptor is common and has wider distribution throughout the country. In view of lower raptors density and abundance, the chances of collisions of raptor species in the proposed wind farm area are likely to be low.

Carcass Search: During our field visit we checked for any carcasses of birds below 10 operational wind turbines in the same area during the early morning hours. We found no carcasses, feathers or any remains of birds beneath the wind turbines that would confirm the bird collision event.

3.2.2. Assessment of Bats

There are total 41 species of bats reported from Western Ghats. Some of the bat species i.e. Wroughton's freetailed bat and Salim ali's fruit bat are known to be endemic species to the western Ghats. The distribution of bats species in Sahyadri hills, particularly in and around the project site is unknown due to unavailability of published literature on this subject.

During our field visit, we searched bat colonies in 5.0 km periphery of the project site. We also interviewed local people about the bat, some of the respondents provided us information on the Indian Flying Fox or Indian Fruit bat (*Pteropus giganteus giganteus*) (Table-3.1 &Plate-3.2). As per their information, this species is very common in this landscape. There are two small roosts of around 50-100 individual are located in villages particularly in the foothills. However, no such roosts were reported from the project site during our field visit.

Table-3.1 Bat roosts reported within 5.0 km periphery of the project site.

No	Coordinates	Distance from Project site	Direction
1	17°33'27.86"N 74°39'40.99"E	1.75 Km	North
2	17°27'50.70"N 74°42'58.50"E	4.0 Km	South

Plate-3.2: Roost of Indian Fruit bat (*Pteropus giganteus giganteus*).

Though the observed roosts of Indian Flying Fox were located at safe distances from the project site, the impact of the proposed wind project on their population could not be ruled out. Moreover, there are operational wind turbines within 5.0 km periphery of these roosts which may cause cumulative impact on the species.

It is also the fact that this species is listed as Least Concerned by IUCN view of its wide distribution in the country and in the region. Moreover, it is listed as Schedule-V of Indian Wildlife Protection Act 1972 suggesting their higher population and wider distribution in India. It is suggested the above mentioned two roosts of Indian Flying Fox shall be monitored constantly for studying the cumulative impact of the wind farms in the region.

In absence of substantial information on other bats species, it is difficult to assess the impact of proposed wind project on the other bat species of the region. It is important to check the site and its peripheries for presence of any endemic bat roosts. It is also the fact that during our field visit we checked for any carcasses of bats below 10 wind turbines of the project site during the early morning hours. We found no carcasses of bats beneath the wind turbines.

3.2.3. Rare and endangered species

Our observations, literature survey, interview of local naturalists and local people do not suggest presence of any terrestrial mammalian endangered species from the project site. It is also the established fact that the mammals are less affected by the wind turbines. It is observed that project site is less likely to be a part of any important roosting, feeding or nesting sites of any endangered birds or bats species. It is also noticed that the project site does make part of any critical wildlife habitat for any rare, endangered and endemic species with high conservation significance (except reptiles and Amphibians which are not evaluated). Since we could not evaluate the presence of endemic species of reptiles and amphibian in the project site, it is suggested that project activities do not cause any further destruction of the ecology of the region. It is observed that the project activities such as maintenance of roads etc. involve excavation of soil from the project site. Such activities may cause destruction of micro habitats of the reptiles and small birds.

3.2.4. Ecologically sensitive areas

World Heritage Sites: The Western Ghats are internationally recognized as a region of immense global importance for the conservation of biological diversity, besides containing areas of high geological, cultural and aesthetic values. The UNESCO World Heritage Committee, meeting at St. Petersburg in Russia in July-2012, decided to inscribe 39 serial sites of the Western Ghats on the World Heritage List. There are total 4 areas identified as World Heritage Sites from Sahyadri hills of Maharashtra. These areas are 1) Kas Plateau, 2) Koyna Wildlife Sanctuary 3) Chandoli National Park and 4) Radhanagari Wildlife Sanctuary.

The proposed project site is located at substantial distance from above mentioned sites. The distances from each of the sites are given below (table3.2).

Table-3.2: Distances of World Heritage Sites from project area.

No	Site	Distance
1	Kas Plateau	90
2	Koyna Wildlife Sanctuary	87
3	Chandoli National Park and	100
4	Radhanagari Wildlife Sanctuary	150

Ecologically sensitive area: Government of India is also considering proposing Sahyadri hills as part of Western Ghat eco-sensitive zone and biosphere reserve (Kapoor et al 1999). A Western Ghats Ecology Expert Panel (WGEEP) panel was constituted to identify and map ecologically sensitive areas and to recommend for notification of such areas as ecologically sensitive zones under the Environment (Protection) Act, 1986 (website-2).

The hills in the project site vary in height from 890-905 AMSL. The vegetation in the project site and its surroundings is representative that of Sayadri hills of Western Ghats. The vegetation is more or less in the form of fragmented patches in contrast to continuous stretches of forests in surrounding Chandoli National Park. The topography of the site hilly; most of the hills are flat-topped with stony outcrops with steep to gentle slopes. Site is well connected with tar roads. Movement of people and vehicles is higher because of the presence of villages and irrigated agriculture in the foothills.

Table-3.3. Matrix of biological issues vs. status in relation to Chilarewadi Wind Farm project site.

No	Concerns	Issues	Risk Level	Reason/Status in relation to project site	Suggestions	Reference/method
A	**Birds**	Waterbirds	Low	No wetlands present in and around project site. Closest wetland is located at 3.0 km which is very small and seasonal in nature.	Nil	Google earth, literature review
		Grassland Birds	Low	No higher bird activities reported during peak breeding season. No species with high conservation significance was reported during field visit from the project site.	Do not excavate earth from project site for road maintenance	Field visit, literature review
		Raptors	Low	No hotspot/major breeding site for raptors in the project site or close vicinity	Nil	IBA book for Maharashtra, bird newsletters, field visits
		Threatened/endemic species	Low	Project site and its nearby area do not fall in IBA, or Endemic Bird Area or Important Bird Areas identified by BNHS & BLI.	Nil	Literature review, field visit, bird newsletter, bibliography of ornithology
		Migratory routes	Low	No major wetlands present in and around project site, therefore, no waterbirds concentration found in the vicinity of the project site	Nil	Google earth image, field visit
B	**Bats**	Species	Unk	No information available for the project site	Unk	No information available, Field visits
		Bat Roosts	Med	Two roosts of locally common bat species located at 1.7 and 4.0 Km distances form project site.	Monitor for 3 years after wind turbine installation and operation	Field visits, personal observations
		Endemic/Rare bats species	Unk	No information available for the project site	Unk	No information available, Field visits
C	**Other Species**	Rare/Endangered	Low	Not present in the project site	Nil	Interview of local people, papers on Sahyadri hills, standard reference books of birds, reptiles and mammals for the region.
		Endemic Species	Unk	No information on Reptiles and Amphibians in the project site	Nil	
D	**Important Natural Habitats**	Protected Areas	Low	Mayani Bird Sanctuary located at 10.0 Km, Koyna Wildlife Sanctuary located at 87.0 Km and Chandoli N.P at 100 Km distances	Nil	Google earth, IBA book (Birdlife International)
		Important Bird Area	Low	Koyna Wildlife Sanctuary-IBA located at 87.0 Km	Nil	IBA Book (Birdlife International)
		Endemic Bird Areas	Low	Koyna Wildlife Sanctuary-IBA located at 87.0 Km	Nil	IBA Book (Birdlife International)
		Ramsar site	Low	No Ramsar sites present in Maharashtra state in India	Nil	Ramsar website, Google Earth
		Wetlands of National Importance	Low	Not present in 40 km periphery	Nil	Wetlands directory of Government of India
		Wetlands of international Importance	Low	No wetlands of international importance present in 100 km periphery of the project site	Nil	Li *et al.* 2009 "Status of waterbirds in Asia". wetlands International publication,
		Wildlife Corridors	Low	Site does not form part of corridors of any wildlife species	Nil	Literature survey, Field visit, interview of local people
		Eco-sensitive zone identified by government	Low	Project site does not form part of eco-sensitive zone identified by Western Ghat Ecological Expert Panel (WGEEP) any protected area. Or identified eco-sensitive zone by government	Nil	Literature review and Consultation with Forest Department officials

3.3. Conclusion and suggestions:

Based on field visit, desk review of literature and understanding of issues and logical analysis, we present following conclusions:

- The Chilarewadi windfarm site is proposed to be developed on table top of Sahyadri hills in Satara district.
- The project site maintains safe distances from protected areas/World Heritage sites, such as Chandoli National Park (100.0km), Koyna Wildlife Sanctuary (87km), Kas Plateau (90Km), Radhanagari Wildlife Sanctuary (150 km) and Mayani Bird Sanctuary (10.0 km).
- There are no major wetlands with high bird activities present within and immediate periphery of the project boundary, therefore the issue of waterbird collision with wind turbines may not arise.
- Project site does not fall within or even close proximity to internationally known sites (i.e. Ramsar, Biosphere reserves) for birds, bats or any other biodiversity.
- Koyna Wildlife Sanctuary being IBA is located at 87.0 km distance in West direction from the project site.
- Project site falls in low bird activity (waterbirds and raptors in particular) and low intensity migration routes of large bodied large flocks of birds because of absence of large wetlands with shallow waterbeds in and around the project site.
- It is Suggested that routine project activities such as excavation of earth for road maintenance etc. shall be carried out carefully so that the micro habitats of some of the endemic reptiles, amphibians species (may be present) in the project site are not affected.
- Hence based on our field visit, review of literature, ESIA report, consultation with local people, we opine that the site does not fall near any bird or biodiversity hotspots area and therefore does not pose significant risk of bird mortality.
- Moreover, no roosting, feeding or breeding habitats of any threatened bird species are reported from the project site and its vicinity suggests lower risk to such species.

- The issue of endemic bat species presence is not understood properly in relation to the project, hence no concluding remarks on this is issued. However, 2 roost of common bat species i.e. Indian Flying Fox shall be monitored for their presence and population for coming 3 years after installation and operation of the wind farm. This would help understand cumulative impacts of wind farm on the species.

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Annexure-I: Details of birds encountered in the project site during transect walks.

No.	Common Name	Scientific Name	Conservation Status as per IWPA-19720(Schedule I to VI)	Conservation Status as per IUCN	Puklewadi Tr-1	Chilarewadi Tr-2	Virli Tr-3	Total	Encounter Rate /km
1	Black drongo	*Dicrurus macrocercus*	Schedule-IV	Least Concern	1	0	0	1	0.3
2	Cattle egret	*Bulbulcus ibis*	Schedule-IV	Least Concern	0	1	0	1	0.3
3	Common babbler	*Turdoides caudatus*	Schedule-IV	Least Concern	0	0	1	1	0.3
4	Common swallow	*Hirundo rustica*	Schedule-IV	Least Concern	0	0	1	1	0.3
5	Common tailor bird	*Orthotomus sutorius*	Schedule-IV	Least Concern	0	1	1	2	0.7
6	Creasted lark	*Galerida cristata*	Schedule-IV	Least Concern	1	0	1	2	0.7
7	Eurasian collared dove	*Streptopelia decaocto*	Schedule-IV	Least Concern	0	1		1	0.3
8	Green bee eater	*Merops orientalis*	Schedule-IV	Least Concern	2	1	1	4	1.3
9	House crow	*Corvus splendens*	Schedule-V	Least Concern	0	0	1	1	0.3
10	House sparrow	*Passer domesticus*	Schedule-IV	Least Concern	0	1	0	1	0.3
11	Indian robin	*Saxicoloides fulicata*	Schedule-IV	Least Concern	1	2	1	4	1.3
12	Indian silverbill	*Lonchura malabarica*	Schedule-IV	Least Concern	1	0	1	2	0.7
13	Jungle crow	*Corvus macrorhynchos*	Schedule-IV	Least Concern	0	0	1	1	0.3
14	Spotted Dove	*Spilopelia chinensis*	Schedule-IV	Least Concern	0	1	0	1	0.3
15	Oriental magpie robin	*Copsychus saularis*	Schedule-IV	Least Concern	1	1	0	2	0.7
16	Purple sunbird	*Nectarinia asiatica*	Schedule-IV	Least Concern	0	0	1	1	0.3
17	Red vented bulbul	*Pycnonotus cafer*	Schedule-IV	Least Concern	1	1	0	2	0.7
18	Rose ringed parakeet	*Psittacula krameri*	Schedule-IV	Least Concern	0	1	0	1	0.3
19	Rufus tailed lark	*Ammomanes phoenicurus*	Schedule-IV	Least Concern	0	0	1	1	0.3
20	Shikra	*Accipiter badius*	Schedule-IV	Least Concern	0	1		1	0.3
21	Southern grey shrike	*Lanius meridionalis*	Schedule-IV	Least Concern	1	0	0	1	0.3
22	Sykes Crested Lark	*Galerida deva*	Schedule-IV	Least Concern	0	1	1	2	0.7
23	Ashy-crowned Sparrow-Lark	*Eremopterix griseus*	Schedule-IV	Least Concern	2	1	2	5	1.7

Annexure- II: Curriculum Vitae of the Expert, Dr. Bharat Jethva (Ornithologist & Wildlife Biologist)

ACADEMIC QUALIFICATION:

1. **Ph.D**. in Ecological & Wildlife Sciences-FEB-23 from Wildlife Institute of India-FRI Deemed University-. Thesis title: Feeding Ecology and Habitat Needs of Wolves in the *Bhal* Area of Gujarat).
2. **M.Phil., Zoology,** 1995 Department of Zoology, School of Sciences, Gujarat University Ahmedabad. (Topic of M. Phil. Thesis: Short term Treatment of Fluoride and its Reversal on Kidney, Liver and Muscle of Male Mice).
3. **M.Sc., Zoology** 1994 (with special subject as Reproductive physiology and Endocrinology). Department of Zoology, School of Sciences, Gujarat University Ahmedabad. India
4. **B.Sc., Zoology**, 1992 from Bahauddin College-Junagadh, Saurashtra University Gujarat, India.

WORK EXPERIENCE:

1. More than 18 years of experience in the field of Wildlife Research and Conservation with special emphasis on Endangered species, Birds, Wetlands, Coastal and Marine Ecosystems, Grasslands and Desert Ecosystems and Environmental Impact Assessments.
2. Asian Waterbird Census Coordinator with Wetlands International South Asia, New Delhi, Setp-28-June 211.
3. Scientist at GEER Foundation, Gandhinagar, September 23-August 28.
4. Senior Research Fellow in the Conservation of the India Wolf Research Project at Wildlife Institute of India from January-2 to August 23.
5. Junior Research Fellow, in the Conservation of the India Wolf Research Project at Wildlife Institute of India. From December-1997 to December-1999.
6. Technical Assistant on Conservation of the Indian Wolf Research Project at Wildlife Institute of India. From November 1995 to December 1997.

MEMBERSHIPS:

1. Member of **IUCN**-**Flamingo** Specialist Group.
2. Member International Society for **Mangrove** Ecosystems (**ISME**)
3. Member Executive Committee, **Mangrove** Society of India (**MSI**)
4. Member **Sirenian** International, USA
5. Indian Bird Conservation Network (**IBCN**)
6. **Bird Conservation Society** of Gujarat

PEER REVIEWED PUBLICATIONS:

1. Munjpara Sandeep B., B. Jethva & C.N. Pandey. 2011. Distribution of the Indian Bustard Ardeotis nigriceps (Gruiformes: Otididae) in Gujarat State, India Journal of Threatened Taxa Short Communication 3(9): 2090–2094
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1. Status, distribution and habitat Survey of **Great Indian Bustard** *Ardeotis nigriceps* in Gujarat, 28. Project sponsored by Ministry of Environment and Forests, Government of India.
2. Status of ***Gyps* Vultures in Gujarat, 27**- A comprehensive state-wide survey of vulture nests and population. Project sponsored by Ministry of Environment and Forests, Government of India. Published by GEER Foundation.
3. **Biodiversity of Purna Wildlife Sanctuary** a comprehensive ecological and socio-economic study. Mammals and socio-economic studies 27.
4. **Biodiversity of Jessore Wildlife Sanctuary** a comprehensive ecological and socio-economic study. Contribution in studies on mammals 28.
5. Movement Pattern of **Wild Ass Across the Proposed Kachachh Branch Canal** (Sardar Sarovar Narmada Nigam Limited) on the Northern Fringe of Wild Ass Sanctuary in Gujarat, 26.
6. Status of ***Gyps* Vultures in Gujarat, 25-** A comprehensive state-wide survey of vulture nests and population. Published by GEER Foundation
7. **Proceedings** of the workshop on **"Cranes and Community in Gujarat**-a holistic conservation strategy for future" held on 23rd November-24 at GEER Foundation, Gandhinagar, Gujarat, India.

8. Ecological Impacts of **Lignite Mining in Kutch** with Special Emphasis on the Indian Grey Wolf and its Habitats, 1997. WII-EIA Technical Report No-19, Wildlife Institute of India.

TRAININGS OBTAINED:

1. One week Regional Training Programme on Wetland Management and Conservation held between 2-6th May 28 at GEER Foundation, Gandhinagar, Gujarat.
2. UNESCO Regional training program on Satellite Image Processing for Natural Resources Management (21-31 January 22), conducted by Center for Geo-Sciences and Engineering, Anna University, Chennai.
3. Animal Welfare Training Course 1995. Conducted by Animal Welfare Board of India, Ministry of Environment and Forests held at Sakkarbaug Zoo, Junagadh Gujarat.

SELECTED PRESENTATIONS/ABSTRACTS : (International conferences)

1. Conservation Potential of Green Sea Turtle (*Chelonia mydas*) in Gujarat. National **workshop on Marine biodiversity** and community held at GEER Foundation with the support of MoEF, Government of India at Ahmedabad.
2. Jethva B. 25, Vulture Conservation initiatives in Gujarat, Abstract and Oral Presentation in the conference of **Society for Conservation Biology Asia Chapter** held in Kathmandu, Nepal, November-25.
3. Jethva B. 25, Crane Conservation and community in Gujarat, Abstract and Oral Presentation in the conference of **Society for Conservation Biology Asia Chapter held in Kathmandu,** Nepal November-25.
4. Jethva B and Jhala Y.V 23, Foraging ecology, economics, and conservation of Indian wolves. Abstract for an oral presentation in **International Wolf congress to be held at Banff, Alberta Canada** on September-25–28, 23.
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6. Jethva B and Jhala Y.V 2, "Food habits, Consumption and predation by wolves in the Bhal, India, Abstract in an international symposium "Beyond 2: Realities of Global Wolf Restoration held at **Duluth, Minnesota, USA**, Feb-2.
7. Jethva B. and Jhala Y.V. 2. "Ecological Impact Assessment of Lignite Mining in Kutch India". Oral presentation given in an international symposium: **Carnivore-2, held in November-2 at Denver, Colorado. USA**.

Annexure I

Community Development Plan

Community Development Plan

75 MW Wind Power Project at Chilarewadi, District Satara, Maharashtra, India

March 2013

Implemented by:

NSL WIND POWER COMPANY (SATARA) PRIVATE LIMITED
4th Floor, NSL ICON,
D.No: 8-2-648/2/A, Road No. 12,
Banjara Hills, Hyderabad - 5000034

Contents

1.1 INTRODUCTION

NSL Renewable Power Private Limited (NRPPL) is a fully owned subsidiary of NSL Power Private Limited established for implementation of renewable power projects across the country. NRPPL intends to set up wind power project of 75 MW in Man Taluka (also known as Dahivadi Taluka) in Satara District of Maharashtra. The project area falls in three villages viz. Chilarewadi, Puklewadi and Virli of Man Taluka. In order to ensure close monitoring and execution of the project, a Special Purpose Vehicle (SPV) has been created which is known as NSL Wind Power Company (Satara) Private Limited.

The land for the project is being procured through a land aggregator M/s Atlanta Power Private Limited (APPL) on willing seller-buyer basis. There are no significant impact identified from the procurement of land as it is barren and at present there is no livelihood dependence on that land. The land is mainly used as grazing area for cattle and other livestock. As part of the Corporate Social Responsibility initiatives of NRPPL and in order to improve the socio-economic status of the local population, a set of interventions are proposed through a Community Development Plan (CDP).

The objective of the CDP is to describe the approach that the project is taking with respect to community commitments made by the project, and described in the ESIA. The plan serves as an important part of the social management process in translating the commitments into guidelines for implementation. This is an outcome of the needs assessment and the consultations with the project villages.

1.2 POLICY FRAMEWORK

NRRPL sees positive environmental and social performance as essential conditions for sustainable business. NRPPL's approach to effective social development program involves mitigating the potential negative impact and extending the positive impact wherever possible. In line with NSL Groups CSR vision NRPPL aims

"to contribute towards social, economic, health and cultural development of the community where the operations of the company take place for a better and sustainable development of all the stake-holders".

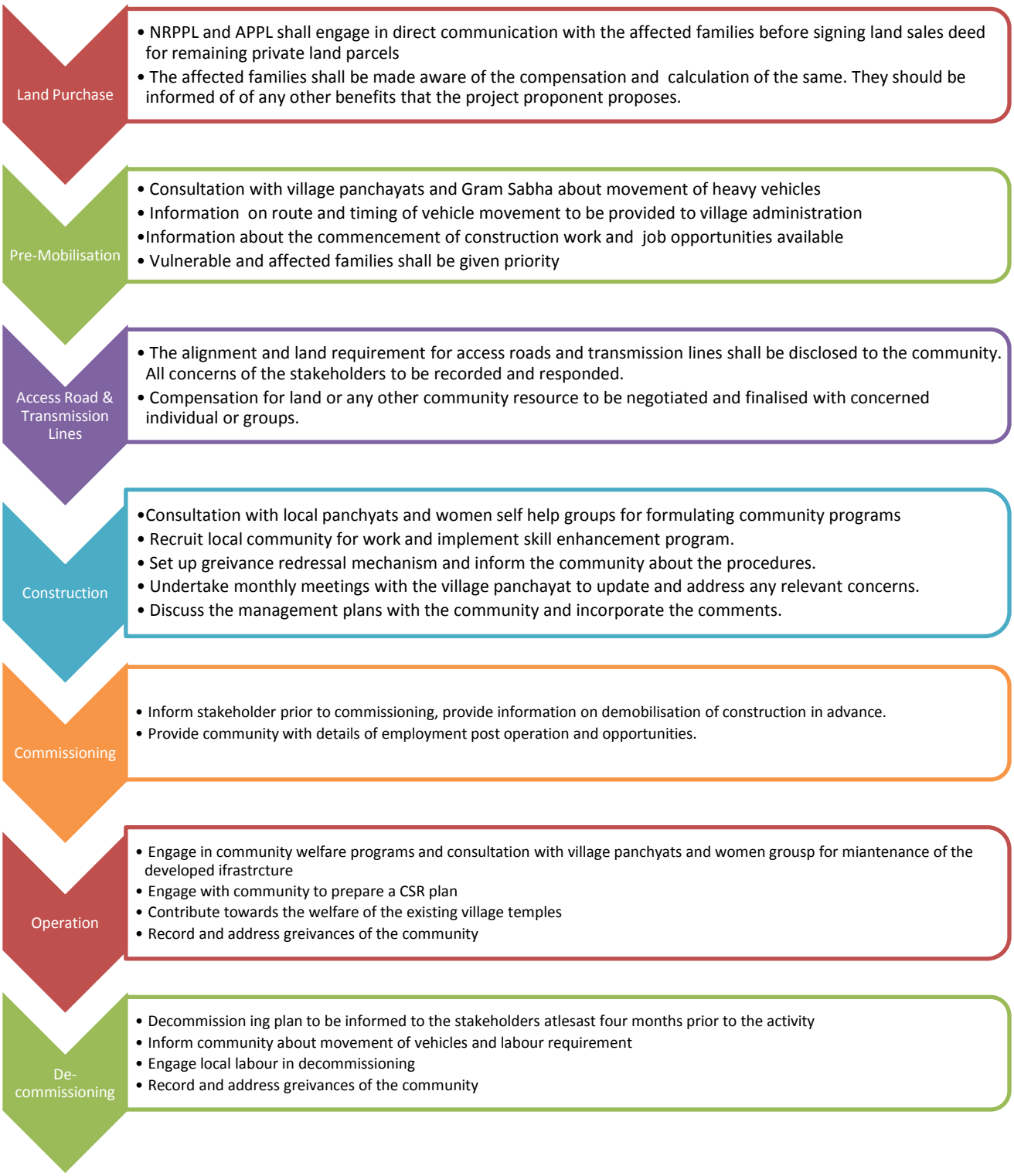
Most of the NRPPLs CSR investment is undertaken towards contribution to the community through revenue contribution, employment practices, ethical conduct, knowledge sharing, technology sharing etc. In addition NRPPL will be driven by IFC & ADB guidelines which will help establish effective community development programmes for communities located near or affected by operations[1]. The guidelines state that companies, communities, governments and NGOs all have a role to play in promoting development. The guidelines provide valuable information for those developing communities programmes, including listing a series of key principles as follows:

[1] Investing in People: Sustaining Communities through Improved Business Practice, IFC, 2000

- Engage in effective community consultation;
- Build Trust;
- Manage expectations by clearly defining roles and responsibilities;
- Develop appropriate capacity;
- Mobilise core competencies;
- Set measurable goals and report on progress;
- Forge strategic partnerships; and
- Plan for sustainability.

The proposed plan to engage with community throughout the project life is as provided in **Figure 1.1.**

Figure.1.1 : Proposed Community Engagement Process



1.3 COMMUNITY NEEDS AND DEVELOPMENT PRIORITIES

NRPPL undertook consultations local communities in an effort to identify community needs and priorities for designing and implementing community development initiatives. The participatory consultative processes involved village level open meetings, transect walks and visits to ascertain the status of infrastructure and other facilities that are available in each of the villages in the project area. The development priorities were also drawn from the issues and concerns raised by the communities during the ESIA process.

1.3.1 Community Needs - Village Virli

As part of the consultations for community development activity a village level meeting was conducted on 29th August 2012 at Panchayat Bhawan, Virli. The participants included the village public representatives, community leaders and local people. The some of the issues discussed and highlighted during the meetings and the priorities for development along with other observations made during the transect walks include the following.

- The village is linked to the main road via a kutcha and potholed approach road of less than a kilometer. All the habitations of the village are electrified. The street lighting facility is available only for Virli main habitation and not available for other habitation such as Kapuswadi and Jamalwadi.

- The village has a government run Middle School and a Primary School. Both the schools lack adequate infrastructure such as benches, chairs, proper toilet facility etc. The village also has a Private High School run by a local trust, while for college education local people go to Karad located 80 kms from the village. The village has a small library run by local community organization.

- Due to the perennial drought conditions in the region availability of water for drinking and other use is a major problem identified by the local people. The available overhead tank and tapped water supply system is defunct for the last 5 years. The open wells and tube wells in the village are dried up. To overcome the problem the local administration is providing water through tankers from a nearest tank namely Dhakni located 15 kms away from the village.

- The village has a primary health sub-centre and services provided through this centre include maternity and child care, emergency health care, free medicines, family planning services etc. The centre is operational and local people from other nearby villages also visit this centre.

- The total cultivable land available is un-irrigated. There are 4 check dams built under minor irrigation schemes of the local government but due to drought conditions none of them can be productively utilized. Given the drought conditions a new project under

Integrated Watershed Management Programme (IWMP) of Government of India is being sanctioned for this area.

- The availability of fodder for the livestock is also identified as a serious problems specifically during the summer months. To overcome the problem the local administration is arranging for cattle camps. The local people from nearby villages take their cattle at identified camps where in fodder and water is provided.

- The village has financial institutions including branch of District Level Commercial Bank, Co-operative credit society (3 nos) which lend money for agriculture and other livelihood purposes.

- The village has 3 Women Self Help Groups who run the Anganwadi/balwadi Centers. The other local community groups include Youth Association, Women Association, which actively organize the local religious festivals and national events.

- The participation of Non-government Organization for development/awareness activity in the local villages is found to be very low. Only one agency namely Yashoda based at Pune is reportedly undertaking water harvesting programme in the local villages.

- The religious infrastructure available in the village includes 3 Temples. In addition a new temple in name of Goddess Janubai along with community hall is being constructed recently. The local important festivals such as Dasara, Diwali, Ganesh, Ugadi etc are celebrated with gaiety and community leaders wanted the project to support these events.

Figure 1.2 : Photo Log – Village Virli

	
Approach road to Virli	**Govt Run Middle School**

	
Health Sub-Centre at Virli	**Overhead Water Tank at Virli (non Functional)**
	
New Janubai Temple under Construction at Virli	**Existing Hanuman Temple at Virli**
	
Consultation at Panchayat Bhawan Virli	**Library Centre at Virli**

1.3.2 Development Priorities in Virli

Some of the community activity suggested by locals for Virli and its habitations include the following:

- Strengthening the village approach roads
- Up-gradation of infrastructure in Middle school
- Conducting health check up camps with specialist doctors
- Conducting health awareness programmes
- Financial support to meritorious students for higher education
- Support for Sports events
- Support for Science laboratory facility in High School
- Support for Library facility
- Support in Construction of new Temple
- Support to village youth and women associations for their activity

1.3.3 Community Needs – Village Puklewadi

The village level meeting for community development activity in Puklewadi is conducted on 30th August 2012 at Panchayat Bhawan, Puklewadi. The participants include the community leaders and local people. The issues discussed and prioritized for development along with other observations made during the transect walks include the following.

- The village is relatively a small village of about 125 Households and is declared as a separate Panchayat in 1989. It is separated from its erstwhile Panchayat of Kukudwad which is also a block head quarter. The public transport of bus is available to the village. The approach road of 2 kms to the village from the main link road is kutcha and found to be in bad shape with all the metal protruding outside. The village internal roads are pucca and CC Roads.

- The village is totally electrified and street lighting facility is available only for Puklewadi village and not available for Shilka Awasthi a small habitation near to main road.

- A Govt Upper Primary School and an Anganwadi School are available in the main village and one primary school at Shilka Awasthi. For high school the village boys go to Kukudwad which is 2.5 kms away from the village. The village has a small gym run by the local community organization.

- Puklewadi is also facing the problem of availability of water for drinking and other domestic purposes such as bathing, cooking etc. The problem is found to be acute since October 2011. The village has open wells and pumping system for water supply. The water is pumped to the public stand post constructed at various locations which is not

functional. like other village water is provided water through tankers and local people store it plastic drums.

- The village does not have any health facility and nearest Primary health centre facility is available at Kukudwad. The Auxiliary Nursing Midwife from this facility visits the village.

- The village has one small irrigation tank namely *Pajar talau*, however due to non maintenance of the tank the little water that is collected is reportedly leaked from the bund. This village is also covered under Integrated Watershed Management Programme (IWMP) of Government of India and an amount of Rs 49 Lakhs is being sanctioned for watershed activity in this area. About 3 numbers of concrete check dams are being proposed for construction under this program.

- The village has a Kirtan Mandal, Youth Club and women Self Help Group which are mainly involved in organizing the local religious festivals and national events.

- Other than the Government agency a village community level organization namely *Shri Siddhanath Puklewadi Dangar Samaj Bahuudheshi Samstha* is undertaking some development activity in the village. They manage a small village library, organize sports, provide scholarships to meritorious students.

- The village has two main temples one located on hill top namely Siddhanatha Temple and other one in the village habitation. The temple located on hill top is near by to our project area and a large annual gathering for celebrating Dassera and Mahag festivals is seen. The villagers reiterated their request to support these occasions and also assist them for developing these facility.

Figure 1.3 : Photo Log – Village Puklewadi

	
Approach road to Puklewadi	**Internal CC Roads in Puklewadi**

	
Primary School at Puklewadi	**Public Stand Post for water supply**
	
Siddhanath Temple on Hill Top, Puklewadi	**Temple at Puklewadi Main village**
	
Consultation at Puklewadi Panchayat Bhawan	**A Check Dam in Puklewadi Village**

1.3.4 Development Priorities in Puklewadi

The development support activity suggested by locals for Puklewadi includes:

- Construction of compound walls for 2 schools
- Computers and LCD Projectors for Schools
- Conducting health awareness programmes
- Veterinary camps for livestock
- Financial support to meritorious students for higher education
- Support for Sports events
- Support for development of Sidhanatha Temple

1.3.5 Community Needs – Village Chilarewadi

The community consultation in Chilarewadi was conducted on 29th August 2012. The participants include the community leaders and local people. The issues discussed and prioritized for development include the following.

- The village is located 1.5 kms from Virli village. The village is located adjacent to BT link road from Virli. It is a small habitation (100 families) at the foot hills of the neighborhood plateau. The internal roads are kutcha gravel roads. Street lighting facility is available for the total village.

- The village is inhabited by a homogenous community namely *Dangar*. The community is categorized as nomadic tribes and comes under Other backward castes.

- The village has 1 primary school and one anganwadi centre in main village. One more primary school is under construction. For high school, the students come to Virli.

- For drinking water they are dependent on Tubewells. For other domestic use the water is supplied through the water tankers. For health needs they are dependent on health sub centre at Virli.

- The village is reportedly having 3 small irrigation tanks under its limits. However due to non-maintenance and inferior construction they are not useful. One new check dam is also sanctioned for this village and the construction is yet to begin.

- Community level association is limited to a youth club which actively participates and organizes all village level events. No NGO are found to undertake any development activity.

- The main Temple of the namely Siddhanath Temple is located at a distance of 1.5 kms on hill top. As it is a practice seen in other villages and in the region every year during the major festivals of Dassera and Mahag in month of January all the villagers including the neighborhood villagers gather around the Temple are celebrate the festivals. This temple also falls near to the proposed project WTG locations. The community requested for development of this Temple.

- As the village is very small and remotely located the level of interest for the development works with the local administration is reportedly found to be low.

Figure 1.4 : Photo Log – Village Chilarewadi

	
Internal roads in Chilarewadi	**Primary School at Chilarewadi**
	
Temple under construction at Chilarewadi	**Anganwadi centre at Chilarewadi**

	
Siddhanatha Temple of Chilarewadi on Hill Top	**A Hill Top view of Total Chilarewadi Village**

1.3.6 Development Priorities in Chilarewadi

The development support activities suggested by locals for Chilarewadi are as follows:

- Assistance to schools for improving infrastructure
- Conducting health awareness programmes
- Veterinary camps for livestock
- Repair and reconstruction of irrigation Tanks
- Support for Sports events
- Support for development of Sidhanatha Temple at Chilarewadi

The list of participants in above meetings is enclosed as **Appendix -1**.

1.4 CONCERNS AND EXPECTATIONS RAISED DURING SOCIAL ASSESSMENT

As per the ESIA study some of the concerns and expectations raised by local village Gram Panchayat and women groups include engaging local community for construction works and employment opportunities to local people, enhancement of the local infrastructure, measures to improve the water availability of the area, improved access to temples on the plateau, safety of children and livestock during movement of heavy traffic etc.

1.5 MEASURES TAKEN TO ADDRESS THE CONCERNS AND EXPECTATIONS

As far as engaging local labour during construction activities, all labour will be hired locally, therefore no influx of migrant labour are envisaged. Only skilled workers for crane operation and electrical works will be brought in from outside. All workers will be adequately briefed about the code of conduct to be maintained and to respect local customs and women.

The construction of the project will not restrict the access to the existing temple at Chilarewadi, Katrewadi and Puklewadi. All community functions associated with the temples will be continued without any interruptions and during such function the approach access to these facilities will be improved.

To address the concerns raised by local women towards any possible obstructions and accidents during the transportation of equipment and movement of vehicles a traffic management plan has been prepared and will be implemented during the construction activity. The management plan will enable more efficient management of construction traffic associated with the proposed project.

On expectations towards community development activity NRPPL along with the land aggregator M/s Atlanta Power Private Limited (APPL) so far has undertaken few initial measures as part of the ongoing CSR process. Due to the prevailing drought conditions since the last 3 to 4 years the drinking water problem in project area is acute and the local administration is struggling to overcome this problem. To provide immediate relief to the locals the project has provided support for digging tube well etc. In addition based on the local demand the project has provided financial support for the construction of the local tempels.

The list of some of the community engagement activity completed/in progress till end of January 2013 and the expenses incurred towards the same is presented in **Table 1**.

Table 1: Community Engagement Activities Completed/In Progress (January, 2013)

Sl. No	Activities Undertaken	Status	Expenses Incurred (Rs. million)
1	Engagement of local workers for construction activity	In progress	6.0
2	Engagement of security staff	In progress	0.5
3	Engagement of locally available tractors and vehicles for project activities	In progress	30.0
4	Assistance towards development of community hall at Puklewadi village	Completed	0.3
5	Contribution towards local festivals and village level events	Completed	0.2
6	Contribution towards construction of temple in Virali village	Completed	0.1
7	Construction of water supply system in Virali village	Completed	0.1
Total			**37.2**

1.6 DEVELOPMENT ACTIVITY PROPOSED AND BUDGET CONSIDERATIONS

Based on the above development priorities and expectations an indicative list of activities proposed to be taken up in project villages along with timelines and estimated budgetary considerations is presented in **Table 2**.

Table 2: Budget Estimates for Community Development Activities

S.No.	Development Activities	Timeline	Estimated Budget (Rs)
1	Assistance to the project villages for the following developmental activities: • Strengthening of village approach roads • Up-gradation of infrastructure in schools • Scholarships for meritorious students • Support for upkeep of existing temples • Support for events conducted by youth and women associations • Support for repair /strengthening of existing water resources	During construction period.	Needs to be finalized after discussion with concerned Panchayats. *The budget to be finalized within a month from acceptance of the ESIA report by ADB.*
2	Conduct health awareness programmes and organize health check up camps with specialist doctors at regular intervals in the project affected villages.	Every 6 months after start of operation of project at each of the three villages.	INR 80,000 per camp
3	Conduct veterinary camps for livestock in the project affected villages.	Every 6 months after start of operation of project at each of the three villages.	INR 100,000 per camp
4	During the operation stage conduct a need based assessment study for the community activity.	Every 2 years after start of operation of the project.	INR 400,000 per study

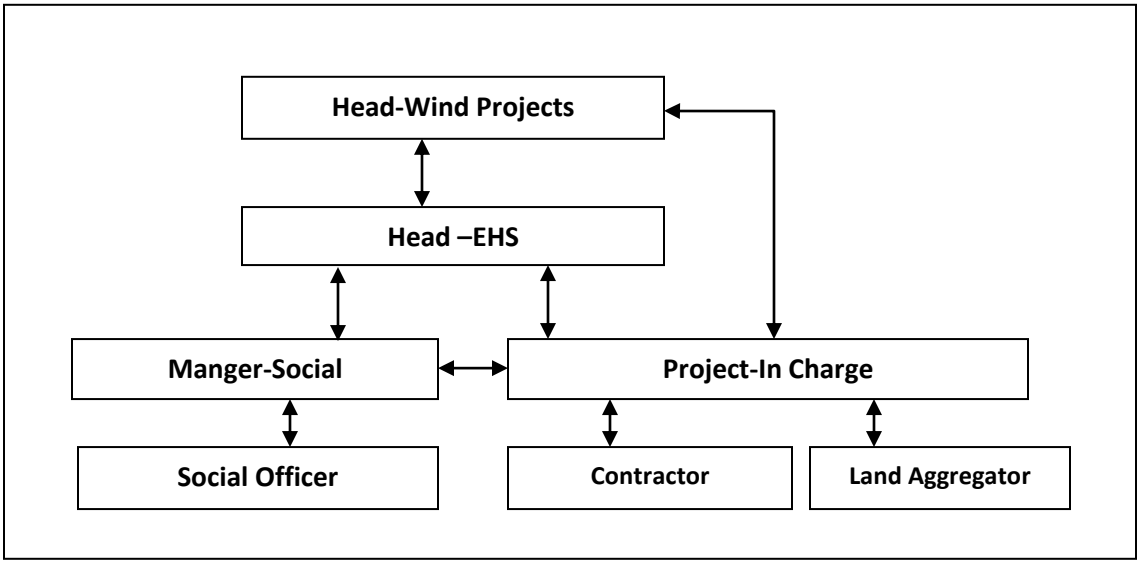
1.7 IMPLEMENTATION ARRANGEMENTS

For the effective implementation of the community development plan NSL Wind Power Company (Satara) Pvt. Limited will identify a Social Officer to manage the community engagement, community development, labour issues etc. The identification and mobilization of the officer will be undertaken within a month after approval of the ESIA report by ADB. Some of the responsibilities of the Social Officer include the following.

- Liaison with the government authorities and local institutions including the Gram Panchayats, women groups, youth association, community associations and others;
- Managing all grievances of the project and their outcomes;
- Undertaking community development initiatives in the affected villages.
- Implementing, monitoring and updating the CDP; and
- Support the training of contractors and other employees for social and community issues.

The organization arrangement is presented in **Figure 1.5**.

Figure 1.5 : Organization arrangement for implementation of Community Development Plan



In order to effectively address the above mentioned functions, as given in the above chart he will be co-coordinating and reporting with both Project-In Charge of the project and with Manager-Social at Environment and Social Group at NRPPL. The focus of the program will be to enhance the ongoing development programmes in the identified village rather than duplicate the efforts or initiate parallel institutions. As part of the implementation process he will receive specific and detail proposal from the village panchayat/women group/ agency through a formal request. These requests by the community should have an approval from the concerned Gram

Panchayat (GP). Upon receiving the requests will prepare a micro plan constituting the following details:

- Issues and problems identified by the community,
- Implementation details like role and responsibilities of the project proponents, community and the GP.
- Details of the intended beneficiaries
- Time frame for implementation
- Potential benefits, and methods of measuring them
- Safeguards to ensure transparency and participation
- Indicative budget
- Ways to link the proposed activity with on-going government programmes
- Internal and external monitoring mechanisms by the community members and the project proponents respectively.

The completed micro plans will be submitted to NRPPL for review and approval for implementation.

1.8 MONITORING AND EVALUATION

The monitoring and evaluation of CDP implementation will provide tangible evidence to demonstrate whether the programme is being effectively implemented and that its desired intent- that of improving the social benefits is being achieved. To assess the impacts of CDP implementation and to ensure that it is moving in the right direction, it is important that an effective monitoring and evaluation mechanism is put in place.

As the onus of CDP implementation would largely be on the GP/community, internal monitoring is essential to monitor that the activities are being implemented within the prescribed time frame and are likely to produce desirable results. An internal monthly monitoring by the community is recommended so that they are able to identify the gaps and make an effort to bring it back on the right track.

The Social Officer of the project would be required to undertake quarterly monitoring to identify the gaps and redress them. It would also help in assessment of the impacts made so far. The external annual audit and evaluation by an independent agency on Social and EHS parameters includes the monitoring of CDP activity as well. The assessment would provide an objective view of the project activities and process of consultations during the implementation. It will also suggest means to overcome the problems in implementation and ways to enhance the positive impacts of the project. It will also evaluate whether the process was transparent, the needs of the vulnerable groups were met and implementation was carried out in a participatory manner.

1.9 REPORTING AND RECORD KEEPING

The records pertaining to all correspondence on CDP such as the minutes for each meeting held and attended in relation to the CDP, the representations and requests received, the micro plans prepared, the details of implementation or asset purchased, the documentation of the events and others will be compiled and reported periodically. Records to be held of all programmes supported. The records also include copies of all correspondence pertaining to an activity, approval documentation and monitoring and evaluation reports. The progress reports will be submitted on quarterly basis.

APPENDIX I

NSL WIND POWER COMPANY (SATARA) PRIVATE LIMITED

List of Participants in Consultations for 75 MW Wind Power Project at Chillarwadi Village, Satara District, Maharashtra

NAME OF VILLAGE: VIRLI

LOCATION: PACHAYAT OFFICE

AGENDA OF MEETING: Community Development Programe

DATE: 29-08-2012

Sl No	Name	Occupation	Signature
1)	Shri Kantelwal Anna Aadgwolkar	Sarpanch	
2)	Shri Dilip Ghatukade	Social worker	[illegible] 9702000822
3)	[illegible]	शेती	[illegible]
4)	[illegible]	शेती	[illegible]
5)	राजू ईश्वर घुटुकडे	"	[illegible]
6)	[illegible]	"	[illegible]
7)	[illegible]	"	[illegible]
8)	[illegible]	"	[illegible]
9)	प्रकाश ईश्वर घुटुकडे	"	Ghutukade
10)	[illegible]	"	[illegible]
11)	Shri Shriram Sudam Gaude	Up-Sarpanch	[illegible]
12)	P. Venkatesh	Engineer	[illegible]
13)	Shaik Feroze	Site Engineer	[illegible]
14)	Sudheesh	Site Supervisor	[illegible] 29/08

NSL WIND POWER COMPANY (SATARA) PRIVATE LIMITED

List of Participants in Consultations for 75 MW Wind Power Project at Chillarwadi Village, Satara District, Maharashtra

NAME OF VILLAGE: Pusalawadi

LOCATION: Panchayat Bhawan

AGENDA OF MEETING: Community Development Programme

DATE: 30-08-2012

Sl No	Name	Occupation	Signature
1)	पुकले अमरदेव तुकाराम	शेती	Pukale
2)	पुकले महादेव ज्ञानोबा	शेती	
3)	पुकले विनायक ज्ञानदेव	शेती	
4)	ज्ञानोबा तुकाराम पुकले	शेती	Pukale
5)	बाबा कुशा पुकले	शेती	
6)	दादा धोंडी पुकले	शेती	