Environment and Social Due Diligence Report (Appendix 4B)

August 2017

IND: Clean Energy Finance Investment Program –Orange Anantapur Wind Power Pvt. Ltd.

Prepared by

Indian Renewable Energy Development Agency for the Asian Development Bank

7.3.7 Water Environment

The industrial development of any region is contingent on the availability of sufficient water resources, as most of the process industries would require water for process or cooling purposes. The potential for exploitation of ground water resources increases as development of new projects increases in industrial and agricultural areas. With the increasing industrialization and urbanization the possibilities of contamination of surface water and ground water sources are rapidly increasing. The water resources in the area broadly fall into following categories:

- Surface Water resources: Streams and ponds, etc.
- Ground Water resources: Accumulation in deeper strata of ground.

To assess the quality of the surface and ground water samples were collected at site during 24th Aug and 25th Aug of 2015.

Surface Water Resources

As there are no rivers, streams in the region, representative water samples were collected from HLC canal, Tungabhadra canal, Renumakulapalle and DL canal and analyzed according to the drinking water standards; IS: 10500 - 1991. The representative surface water sampling locations are shown in Figure below and analysis results are tabulated. The analysis results show that the water from the area is predominantly clean and meets the prescribed standards.

Ground Water Resources

Ground water is the accumulation of water below the ground surface, caused by rainfall and its subsequent percolation through pores and crevices. Percolated water accumulates till it reaches impervious strata consisting of confined clay or confined rocks. Occurrence of ground water is controlled by landform, structure and lithology.

Ground water abstraction is by means of dug wells, dug cum driven wells, and bore wells. Ground water resources are ample in the study area. Every village has a number of traditional wells large and small. The state authorities have also provided tube wells fitted with hand pump for the drinking water requirement of villages in the study area. Presently the drinking water needs are mostly met from the ground water resources.

Quality of Ground Water

The quality of ground water occurring in the geological formations in the study area is generally good in most of the areas. The representative samples are collected from various dug wells and bore wells in the study area. The analytical results of water samples drawn from various locations in the study area are presented in Table 3.3. The map showing the locations of ground water sample collection is Figure. 3.3.

An analysis result of industry site sample indicates the water quality within the prescribed standards of IS: 10500-1991. The ground water results reflect the nature of the area. All the samples including

the samples drawn from the site are found to be within the prescribed limits. Total dissolved solids, hardness and chlorides are found to be above the limits in the sample collected from site.

Table 7-11: Water Analysis Data (Surface water)

Surface Water parameter	Unit	Method of Analysis	IS 10500:2012 Std	SW-10	SW-11	SW-12	SW-13	SW-15	SW-14
Location				Tungabhadra Canal Upstream	Tungabhadra Canal Downstream	HLC Canal Upstream	HLC Canal Downstream	Renumakulapalle	DL Canal
Temperature	˚C	IS:3025 part 09:2002	NS	30	31	29	27	30	30
Color	Hazen	IS:3025 part 04:2012	5	1	1	1	1	1	1
Turbidity	NTU	IS:3025 part 10:2006	5	0.1	0.1	0.1	10	0.1	0.1
pH Value		IS:3025 part 11:2006	6.5-8.5	8.13	8.15	8	7.84	7.43	8.35
Total Solids	mg/l	IS:3025 part 15:2003	NS	99	97	93	73	683	211
Total Dissolved Solids	mg/l	IS:3025 part 16:2006	1500	89	86	82	63	669	198
Total Suspended Solids	mg/l	IS:3025 part 17:2006	NS	10	11	11	10	14	13
Total Hardness (as $CaCO_3$)	mg/l	IS:3025 part 21:2009	NS	56	56	51	31	260	112
Calcium (as Ca)	mg/l	IS:3025 part 40:2009	NS	12	12	10	8	59	24
Magnesium	mg/l	IS:3025 part 46:2009	NS	6.2	6.2	6.2	2.5	27	12
Sodium	mg/l	IS:3025 part 45:2003	NS	12	11	11	11	100	37
Sodium Absorption Ratio (SAR)			NS	5.7	6.6	7.5	8.4	10.2	9.3
Potassium	mg/l	IS:3025 part	NS	1.9	1.9	1.8	1.8	79	1.1

		45:2003							
Carbonate	mg/l	IS:3025 part 51:2006	NS	Nil	Nil	Nil	Nil	Nil	20
Bicorbonate	mg/l	IS:3025 part 51:2006	NS	45	45	35	25	205	70
Total Alkalinity (as $CaCO_3$)	mg/l	IS:3025 part 23:2003	NS	45	45	35	25	205	90
Chlorides (as Cl)	mg/l	IS:3025 part 32:2007	600	18	18	21	14	179	18
Sulphate	mg/l	IS:3025 part 24:2009	400	8	6	6	7	94	58
Nitrate Nitrogen (as NO3)	mg/l	IS:3025 part 34:2009	50	Nil	Nil	Nil	Nil	0.41	0.23
Silica (as SiO2)	mg/l	IS:3025 part 35:2003	NS	3.7	3.4	3.4	2.4	7.6	4.2
Floride	mg/l	IS:3025 part 60:2008	1.5	0.5	0.55	0.54	0.53	0.47	0.83
Residual Free Chlorine	mg/l	IS:3025 part 26:2009	NS	Nil	Nil	Nil	Nil	Nil	Nil
Cyanide	mg/l	IS:3025 part 27:2003	0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Aluminium (as Al)	mg/l	APHA-3500-Al	NS	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic	mg/l	IS:3025 part 37:2003	0.2	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Boron	mg/l	IS:3025 part 57:2010	NS	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cadmium	mg/l	IS:3025 part 41:2003	0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Total Chromium	mg/l	IS:3025 part 52:2003	0.05	0.02	0.04	0.02	0.03	0.02	0.04
Hexavalent Chromium	mg/l	IS:3025 part 52:2003	0.05	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03

Copper	mg/l	IS:3025 part 42:2009	1.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	mg/l	IS:3025 part 53:2009	50	<0.33	<0.39	<0.14	<0.43	<0.86	<0.78
Lead	mg/l	IS:3025 part 47:2009	0.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Manganese	mg/l	APHA-3500-Mn	NS	<0.01	<0.01	<0.11	<0.19	0.07	0.13
Mercury	mg/l	IS:3025 part 48:2003	NS	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	mg/l	IS:3025 part 54:2003	NS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Selenium	mg/l	IS:3025 part 56:2003	0.05	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/l	IS:3025 part 49:2009	1.5	0.3	0.4	0.05	0.12	0.05	0.05
Oil & Grease	mg/l	IS:3025 part 38:2003	0.1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Disolved Oxygen	mg/l	IS:3025 part 38:2003	4	4.6	4.6	4	4.2	4	4.1
Chemical Oxygen Demand	mg/l	IS:3025 part 58:2006	NS	89	283	65	154	145	81
BOD	mg/l	IS:3025 part 44:2003	3	25	90	20	45	45	25

Table 7-12: Water Analysis Data (Ground water)

Ground water Parameter	Unit	Method of Analysis	IS 10500:2012 Standard	W-147 Amidyala	W-148 Mopidi	W-149 Pedda Musturu	W-151 Uravakonda
Temperature	˚C	IS:3025 part 09:2002		30	31	30	30
Color	Hazen	IS:3025 part 04:2012	5	1	1	1	1
Turbidity	NTU	IS:3025 part	1	0.05	0.1	0.05	0.05

		10:2006					
pH Value		IS:3025 part 11:2006	6.5-8.5	7.06	7.11	7.12	7.02
Total Solids	mg/l	IS:3025 part 15:2003	NS	1652	805	535	451
Total Dissolved Solids	mg/l	IS:3025 part 16:2006	500	1636	794	524	440
Total Suspended Solids	mg/l	IS:3025 part 17:2006	100	16	11	11	11
Total Hardness (as $CaCO_3$)	mg/l	IS:3025 part 21:2009	200	964	515	464	310
Calcium (as Ca)	mg/l	IS:3025 part 40:2009	75	286	114	120	80
Magnesium	mg/l	IS:3025 part 46:2009	30	61	56	40	27
Sodium	mg/l	IS:3025 part 45:2003	NS	124	75	23	34
Sodium Absorption Ratio (SAR)			100	1.9	1.6	0.5	0.9
Potassium	mg/l	IS:3025 part 45:2003	NS	168	41	2	3.4
Carbonate	mg/l	IS:3025 part 51:2006	NS	Nil	Nil	Nil	Nil
Bicorbonate	mg/l	IS:3025 part 51:2006	NS	605	270	260	220
Total Alkalinity (as $CaCO_3$)	mg/l	IS:3025 part 23:2003	200	605	270	260	220
Chlorides (as Cl)	mg/l	IS:3025 part 32:2007	250	421	158	84	64
Sulphate	mg/l	IS:3025 part 24:2009	20	180	149	57	67
Nitrate Nitrogen (as NO3)	mg/l	IS:3025 part 34:2009	45	16	23	24	16

Silica (as SiO2)	mg/l	IS:3025 part 35:2003	NS	17	15	17	13
Floride	mg/l	IS:3025 part 60:2008	1.0	0.83	0.59	0.55	0.62
Residual Free Chlorine	mg/l	IS:3025 part 26:2009	0.20	Nil	Nil	Nil	Nil
Mineral Oil	mg/l	IS:3025 part 39:2013	0.50	Nil	Nil	Nil	Nil
Cyanide	mg/l	IS:3025 part 27:2003	0.05	<0.02	<0.02	<0.02	<0.02
Aluminium (as Al)	mg/l	APHA-3500-Al	0.03	<0.01	<0.01	<0.01	<0.01
Arsenic	mg/l	IS:3025 part 37:2003	0.01	<0.001	<0.001	<0.001	<0.001
Boron	mg/l	IS:3025 part 57:2010	0.50	<0.2	<0.2	<0.2	<0.2
Cadmium	mg/l	IS:3025 part 41:2003	0.003	<0.002	<0.002	<0.002	<0.002
Total Chromium	mg/l	IS:3025 part 52:2003	0.05	0.03	0.02	0.03	0.04
Hexavalent Chromium	mg/l	IS:3025 part 52:2003	0.05	<0.03	<0.03	<0.03	<0.03
Copper	mg/l	IS:3025 part 42:2009	0.05	<0.01	<0.01	<0.01	<0.01
Iron	mg/l	IS:3025 part 53:2009	0.30	<0.54	<0.29	<0.54	0.3
Lead	mg/l	IS:3025 part 47:2009	0.01	<0.01	<0.01	<0.01	<0.01
Manganese	mg/l	APHA-3500-Mn	0.10	0.03	0.19	0.01	0.01
Mercury	mg/l	IS:3025 part 48:2003	0.001	<0.001	<0.001	<0.001	<0.001
Nickel	mg/l	IS:3025 part	0.02	<0.02	<0.02	<0.02	<0.02

		54:2003					
Selenium	mg/l	IS:3025 part 56:2003	0.01	<0.001	<0.001	<0.001	<0.001
Zinc	mg/l	IS:3025 part 49:2009	5.0	0.2	0.1	0.89	0.94

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 beyond the desirable limits of 500 mg/l at all locations monitored. Total hardness of the all the water samples were also beyond 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 all locations.

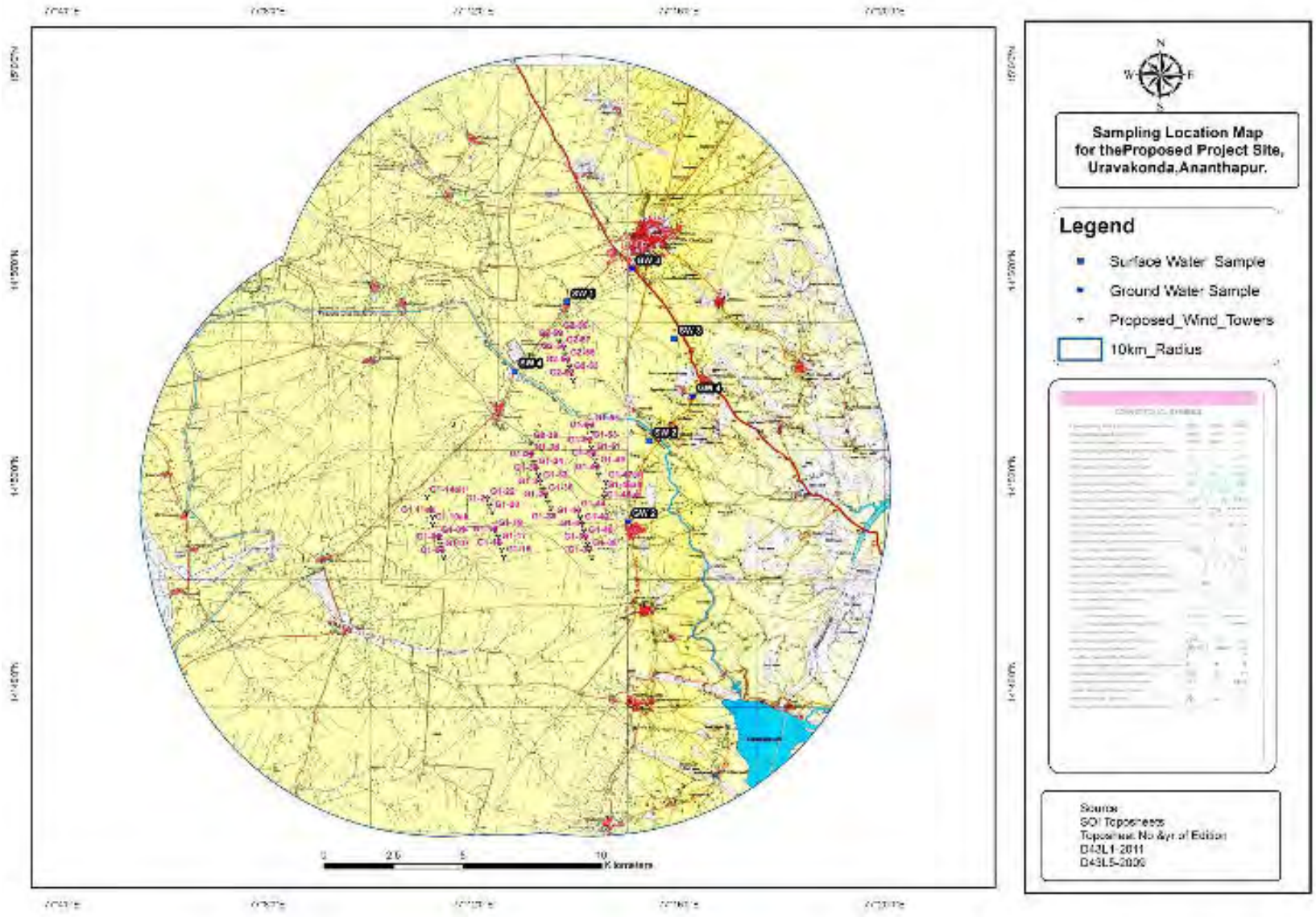
Photograph 7-2: Sampling Team Collecting Ground Water Sample

Source: Site Survey

Photograph 7-3: Sampling Team Collecting Ground Water Sample

Source: Site Survey

Figure 7-21: Water sampling Location



7.3.8 Noise Environment

Noise is an unwanted sound without musical quality. Artificial noise and its impact on environment, grown space with advancing human civilization. Noise pollution is equally hazardous to environment as air, water and other forms of pollution. Various noise measurement units have been introduced to describe, in a single number, the response of an average human to a complex sound made up of various frequencies at different loudness levels. The most common scale is, weighted decibel dB (A), measured as the relative intensity level of one sound with respect to reference sound.

The impact of noise depends on its characteristics (instantaneous, intermittent or continuous in nature), time of day (day or night) and location of noise source. The environmental impact of noise can have several effects varying from noise induced hearing loss to annoying depending on noise levels.

The assessment of noise pollution on neighborhood environment due to the proposed industry was carried out between "24th Aug to 30th Aug 2015" keeping in view, all the considerations mentioned above. The existing status of noise levels is measured at 6 locations at various villages including the site within the study area. The measured noise values are shown in Table 3.12. Noise levels are high at the urban traffic junctions compared to the industrial and village areas.

Table 7-13: *Equivalent Noise levels in the Study Area*

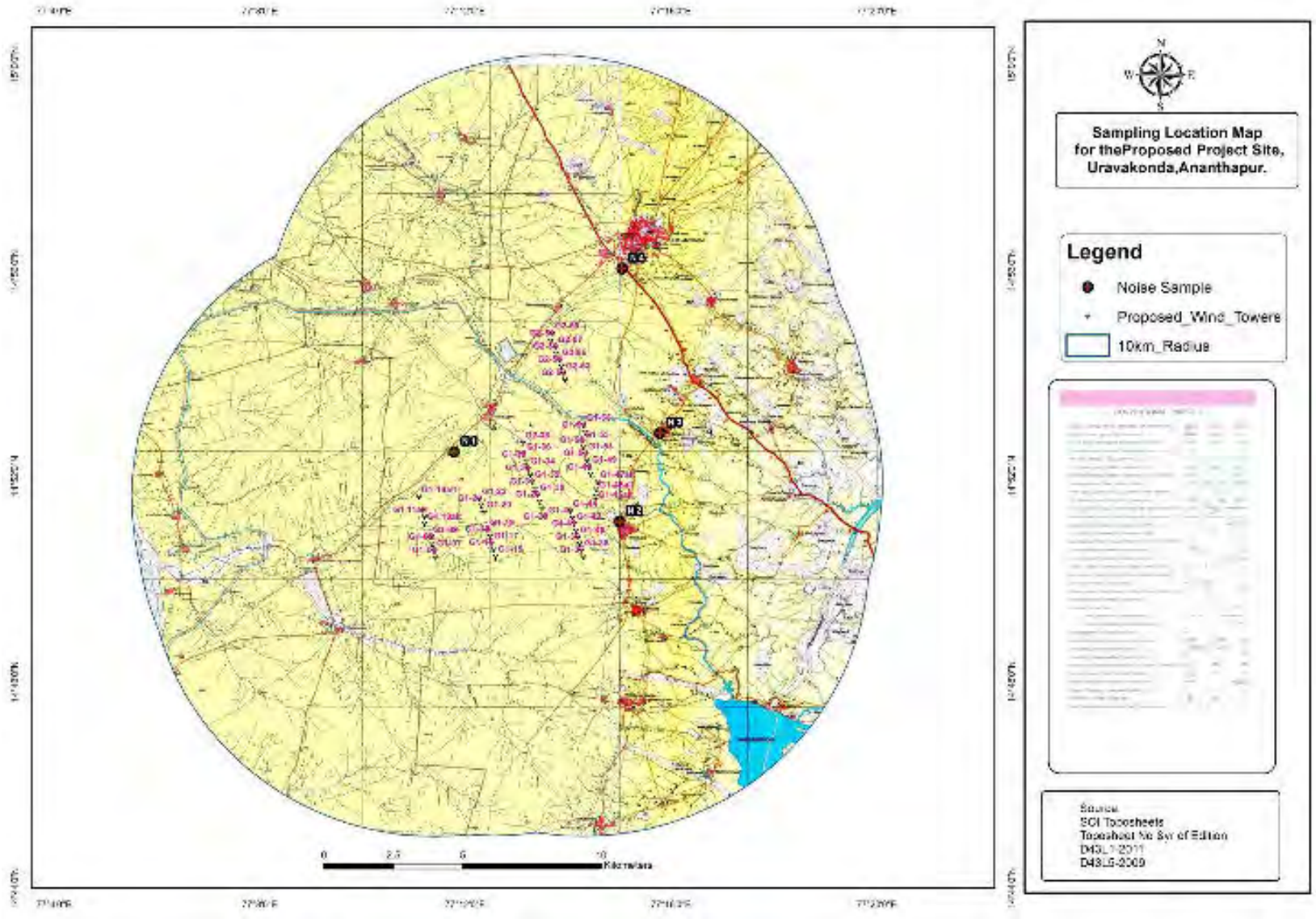
Site Code	Location	Equivalent Noise Level dB(A)			
		Day Maximum	Day Minimum	Night Maximum	Night Minimum
Std CPCB norm/IFC Guideline		55.00		45.00	
FN-105	Project Site	50.00	43.00	44.00	41.00
FN -106	Nimbagallu	51.00	46.00	42.00	41.00
FN -107	Mopidi	49.00	45.00	44.00	42.00
FN -108	Uravakonda	54.00	41.00	44.00	42.00
FN -109	Amydyala	50.00	46.00	41.00	40.20

Note: Day time is reckoned in between 6.00 a.m to 10.00 p.m./ Night time is reckoned between 10.00 p.m. to 6.00 a.m.

Photograph 7-4: Sampling Team Setting Noise Location

Source: Site Survey

Figure 7-22: Noise sampling Location



7.3.9 Soil Quality

The Soil characteristics include both physical and chemical parameters. Soil survey and sampling was carried out between "24th Aug to 26th Aug 2015" to assess the soil characteristics of the study area. Representative soil sampling was done at several important locations and these locations are shown in Figure 3.2. Analytical data of soil samples is presented in Table 3.1.

Table 7-14: *Soil Analysis data*

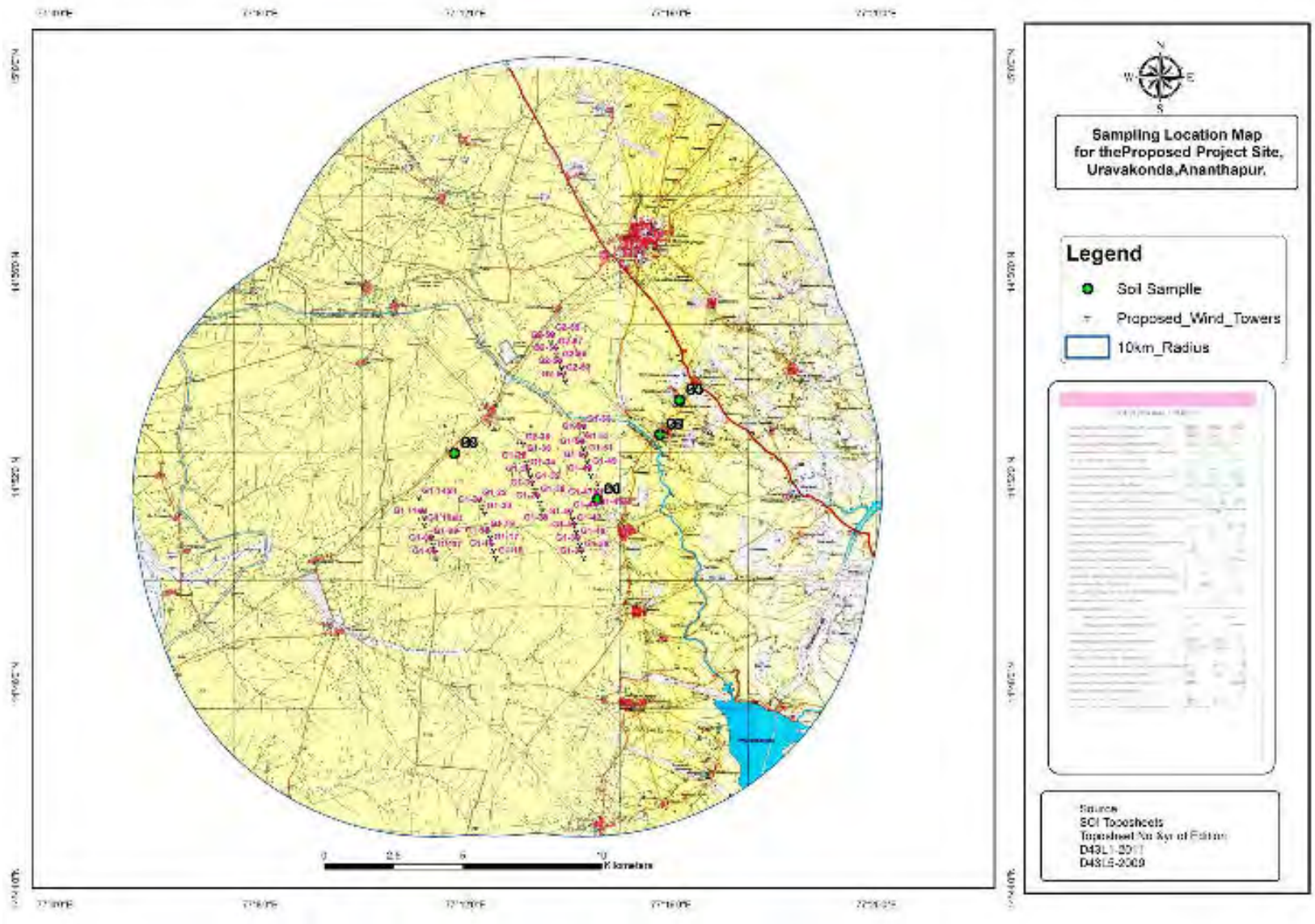
Soil parameter	S-058	S-059	S-060	S-061
Sampling Location	Pedda Musturu	Mopidi	Nimbagallu	Amidyala
pH Value	7.19	6.94	7.99	7.93
Electrical Conductivity	0.163	0.048	0.188	0.134
Bulk Density	1.33	1.43	1.11	1.11
Cation Exchange Capacity	1.7	0.9	1.8	2.2
Infiltration Rate	21	24	13	16
Porosity	50	46	58	58
Water Holding Capacity	0.78	1.69	2.8	3.8
Moisture	0.78	1.72	2.85	4
Organic Matter	0.44	0.2	1.3	0.74
Sand	58	56	45	42
Silt	34	38	44	46
Clay	8	6	11	12
Organic Carbon	0.25	0.12	0.78	0.43
Nitrogen	0.113	0.009	0.069	0.019
Phosphorus	0.568	0.49	0.284	0.49
Potassium	187	63	281	338
Sodium	207	115	162	240
Calcium	32	24	56	40
Magnecium	15	15	10	4.9
Soodium Absorption Ratio	3.1	3.5	0.88	3.98
Chlorides (as Cl)	28	28	57	28
Sulphate	34	39	39	69
Aluminium (as Al)	<0.01	<0.01	<0.01	<0.01
Arsenic	<0.001	<0.001	<0.001	<0.001
Boron	<0.2	<0.2	<0.2	<0.2
Cadmium	<0.002	<0.002	<0.002	<0.002
Chromium	2.4	1.6	1.2	1.3
Copper	0.04	<0.01	<0.10	<0.01
Iron	17	16	16	24
Lead	<0.01	<0.01	<0.01	<0.01
Manganese	6	4.1	12	13
Mercury	<0.001	<0.001	<0.001	<0.001
Nickel	0.14	0.08	0.08	0.26
Selenium	<0.001	<0.001	<0.001	<0.001
Silver	<0.01	<0.01	<0.01	<0.01

Zinc	0.85	0.44	0.56	0.51
Texture	Sandy Loam	Sandy Loam	Loam	Loam

Photograph 7-5: Sampling Team Collecting Soil Samples

Source: Site Survey

Figure 7-23: Soil sampling Location



7.4 Biological Environment

7.4.1 Introduction:

A detailed biological study for the study area [core zone and buffer zone (10 km radius of the periphery of the project site)] was carried out during the ecological site survey between 24th Aug 2015 to 27th Aug 2015 and repeated on 7th Sep 2015. Details of flora and fauna, duly authenticated, separately for core and buffer zone are furnished based on field survey clearly indicating the Schedule of the fauna present. It is necessary to furnish a conservation plan in case of any scheduled-I fauna existence in the study area. Necessary allocation of funds for implementing the same should be made as part of the project cost".

Both primary and secondary survey of fauna of the proposed area (core area) and its buffer zone extending up to a radius of 10 Km was carried during the monsoon season of 2015 by a team of experienced ecologists, Botanists and Zoologists. Appropriate data / information available with the State Forest and Wildlife Department, Biodiversity Board and Botanical Survey of India as well as the Zoological Survey of India have also been referred and used during the survey. In addition, relevant publications on flora and fauna of the area have been consulted.

The basic objectives of the study is to evaluate the status of the flora and fauna of the core zone and the buffer areas with specific reference to the rare or endangered or endemic or threatened (REET) species in accordance with the EAC approved T.o.R. The study is also designed to evaluate the adverse impacts of the proposed wind mills and to suggest remedial / mitigation measures in accordance with the objectives as desired by the IAIA and the Ministry of Environment and Forests (M.o.E & F), Government of India (GoI). With these objectives in mind, the following work was undertaken by a team of experienced professional:

- Documentation and evaluation of the status of the terrestrial flora of the core area and surrounding areas (buffer area).
- Inventorization of the terrestrial flora of the core area and buffer area.
- Assessment of the frequency, density, dominance, Importance Value Indices (IVI) and Shannon – Wiener Indices of diversity of structural species in the dominant plant communities.
- Prediction of the impacts of the proposed activity on the REET species.
- Development of a management / mitigation plan to minimize the impacts the proposed activity on the biotic environment so that there is no net loss of biodiversity.
- 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.

7.4.2 Vegetation in the Study Area:

The natural vegetation of the study area 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. The natural vegetation of the study area is mostly in the form of an open, and along

the road side 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.

The project site is a non-forest agricultural land sparsely colonized mainly by a shrub species *Balanites aegyptiaca* followed with *Sarcostemma viminale, Cassia auriculata, Randia dumetorum, Jatropha gossypifolia, Azadiracta indica, Calotropis procera, Peltoforum pterocarpum, Prosopis juliflora*. Within the site a few isolated individuals of both palatable and non palatable common weeds represented by *Hyptis suaveolens, Parthenium hysterophorus, Celosia argentia, Sida acuta, Cassia occidentalis, Cassia tora, Cleome viscosa, Heliotropium indicum, Croton bonplandianum, Amaranthus spinosus and Cassia occidentalis*. *Cymbopogon coloratus, Heteropogon contortus, Erempogon foeveolatus, Dicanthium annulatus, Digera arvensis, Cressa critica, Chloris barbata, Dactyloctenium aegyptium, Iseilema laxum, Andrographis echinoids etc*.

The total plant cover of the proposed project site was very limited (less than 10%). There are no large trees except few common species such as Neem and *Acacia nilotica*. In the core area as well as in the wastelands around the proposed project site, *Ziziphus,* Mesquite (*Prosopis juliflora*), *Prosopis spicigera, Balanites aegyptiaca, Phoenix sylvestris*, *Calotropis procera,* and *Cassia auriculata* were most widespread, abundant and dominant. In addition to the shrubs mentioned above, there are a few perennial climbers such as *Pergularia daemia, Sarcostemma secamone* present in the core area. The proposed project site is widely covered with dry perennial grasses of *Cymbopon coloratus*. But it turned green wherever it was burnt.

7.4.3 Methodology of Assessment

The prediction of impacts industries on flora and fauna depends on understanding of the proposed activities, its magnitude/extent, scale and ecological conditions in the surrounding area. Collection of comprehensive baseline information on flora and fauna is therefore a prerequisite for assessment of impacts of 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 and analysis for the present study.

7.4.3.1 Desktop work:

Before field trip, details of project and possible impacts on the native flora and fauna are collected through the maps related to road, rail network, drainage pattern, Contour, forest type, forest cover, Land use and Land cover details. The total area analysed with GIS tools and marked around 20 sampling points by covering the various ecosystems of core and buffer zones in all the directions.

7.4.3.2 Field survey:

After reaching the study site, contacted local villagers to take the support during the field survey. A vehicle is hired to make the trip. The entire tour is planned to cover all the points in shortest duration. During the survey, a random observation has been made for village side, road side and near the agriculture. General Interviews are made with the local people about the native animals and traditional medicinal plants used frequently. A thorough review has been made about each sampling point and spent about 30 minutes at each sampling point and documented the flora and fauna in the prescribed proformas. GPS mode Photographs are taken at each point and vegetation structure.

Survey Types used:

- ✓ Reconnaissance survey (Near Agricultural, Human habitations and Road side)
- ✓ Quadrate and Line transact method for trees, shrubs and herbs
- ✓ Belt transect method (For butterflies and flora near road side)
- ✓ Point count method for birds and bats.

Equipment / Instruments deployed

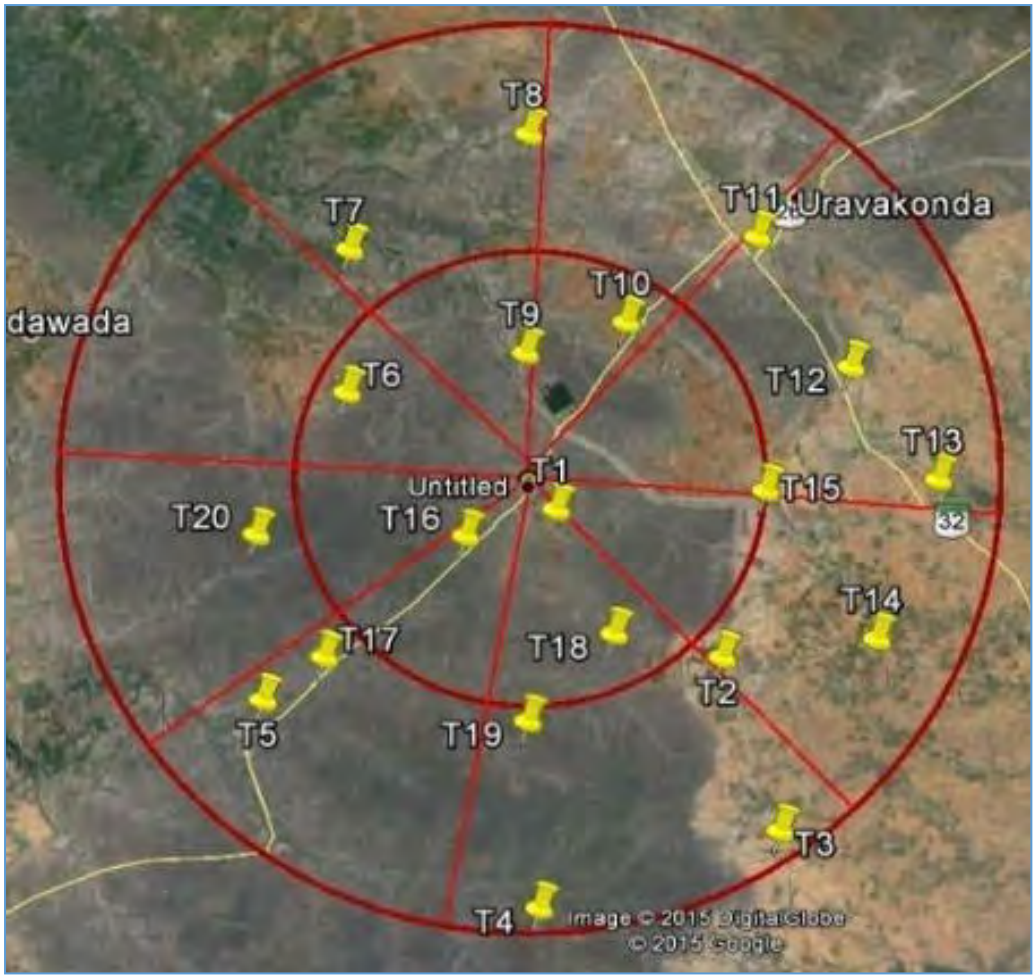
- ✓ Digital Camera (NIKON 42 X zoom)
- ✓ GPS
- ✓ Measuring tape (Small)
- ✓ Binoculars
- ✓ Field observation book

Study Team: Rapid resurvey of terrestrial flora and fauna of the core area and its environs extending up to a radius of 10 km was carried out during the monsoon season of 2015 by team of experts in that field.

A detailed survey has been carried out by using the following methodology.

- ✓ Survey has been carried out in for core and buffer zones, habitat wise, forest block wise and species-wise with special emphasis on endemic, endangered and threatened species.
- ✓ Secondary data has been collected from the forest department and local villagers.
- ✓ Prepared species-level exhaustive check list of flora and fauna.
- ✓ Digital Photo documentation has been carried for identification of unknown species.
- ✓ Discussing the impact related issues with local villagers and EIA functional area experts on air, water, noise and other pollutants.
- ✓ Impacts quantification through vegetation analysis and site specific parameters.
- ✓ Preparation of the mitigation measures.
- ✓ Prepared conservation based action plan for onsite implementations and for proper management of the species and habitat.

Figure 7-24: Map showing all the sample collection points in and around the study area



7.4.4 Floral Study:

Quadrate method has been used for carryout the study of trees, shrubs, herbs and grasses. 10 m X 10 m Quadrates for tree species, 5 m X 5 m quadrates for shrubs and 1 m X 1 m quadrates for herbs. During belt transects, an area of 10 m X 10m width is estimated for statistical analysis, List of floral species observed at each quadrant is documented and photographed. Species are compared with standard floras and identifying the plants need for conservation.

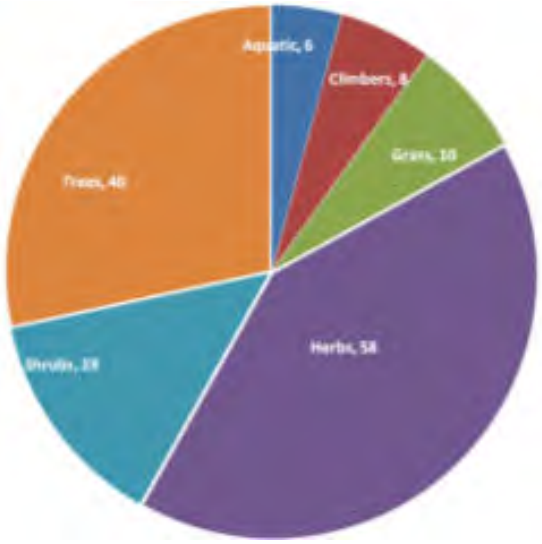
7.4.4.1 Observed Floristic Diversity:

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). The Importance Value Indices (IVI) of structural species was calculated as the sum of relative frequency, relative density and relative dominance. Dominance was based on canopy cover. Density was calculated as the number of individuals per hectare in case of shrubs and tree like plants. As the herbaceous species have completed life cycle and died (dried), they are not considered for quantitative analysis. Importance value indices (IVI) of different species were calculated as the sum of relative frequency, relative density and relative dominance (relative dominance was based on the percent cover). Relative values were calculated by dividing the value attained by a species by the total parametric value and multiplying with 100. Based on the IVI values, Shannon–Wiener Indices of Diversity, Simpson Index of dominance and Jaccard index of Evenness were calculated.

7.4.4.2 Vegetation and flora of the buffer area (Primary data result):

In the buffer zone only few villages located at a distance of 5 to 10 km. This area is enriched with scrub species. Vegetation is very sparse except in inaccessible regions. The forests belong to the Southern Tropical dry deciduous type of Champion and Seth. *Bauhinia racemosa, Prosopis spicigera, Carissa spinarum, Euporbia antiuorum, Holoptelia integrifolia* are quite abundant widely scattered in the forest areas. But the entire ground was covered by dry *Cymbopon coloratus* which acts as a fuse to spread the fire and fuel to support the fire. Hence burning during dry is a common practice. Common herb species found on ground level are *Croton banplantianum* and weed species such as *Parthenium histerophorus* etc. As most part of the buffer zone is represented by current fallows without any plant growth and as the natural vegetation is limited to a few wastelands or grazing lands and roadsides, quadrate methods of sampling were not undertaken in the buffer zone. Further, the proposed project activity is unlikely to have any impacts on the flora of the buffer zone. Most of the non-cultivable wastelands ware colonized mainly by *Prosopis juliflora, Caltropis procera, Cassia auriculata, Ziziphus horrida*, *Datura metel, Leucas aspera, Cymbopogon coloratus etc.* Neem is the most common and dominant natural as well as cultivated tree. Almost all tropical native or naturalized exotic species of trees such as Subabul, Ficus and *Eucalyptus* are grown as avenue trees. A list of plant species found in the buffer zone of the proposed wind mills project site are given in tables below. There are no rare or endangered or endemic or threatened (REET) plant species within the buffer zone of 10 Km except Black buck. Similarly, there are no thick rain forests or biosphere reserves or national parks or wildlife sanctuaries or other ecologically sensitive areas within a radius of 10 Km from the proposed project site. Most of the trees, herbs and shrubs found in the project site as well as in the buffer zone were common to many inland areas of Andhra Pradesh. In addition to the above, several



herbaceous weeds were also found in association with crops and orchards. As the vegetation is sparse and as there is lot of human activity and biotic disturbances, no wildlife except the common wild and domesticated animal species were found. There are a few common resident birds and no exotic migratory bird habitats occur in the study area.

7.4.4.3 Listing of existing species:

During the survey documented the various types of species found at each sampling point along with their number. GBH is also taken for trees to estimate the forest cover. The status of the each species is represented by common, sporadic and rare. This is mainly depends upon the population density and occurrence of each species in the quadrate. The list is compared with the red data book to check REET species.

Dominance D	**0.07224**
Shannon H	2.778
Simpson 1-D	0.9278
Evenness e^H/S	0.8039
Menhinick	1.153
Margalef	3.329
Equitability J	0.9272
Fisher alpha	4.819
Berger-Parker	0.1329

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

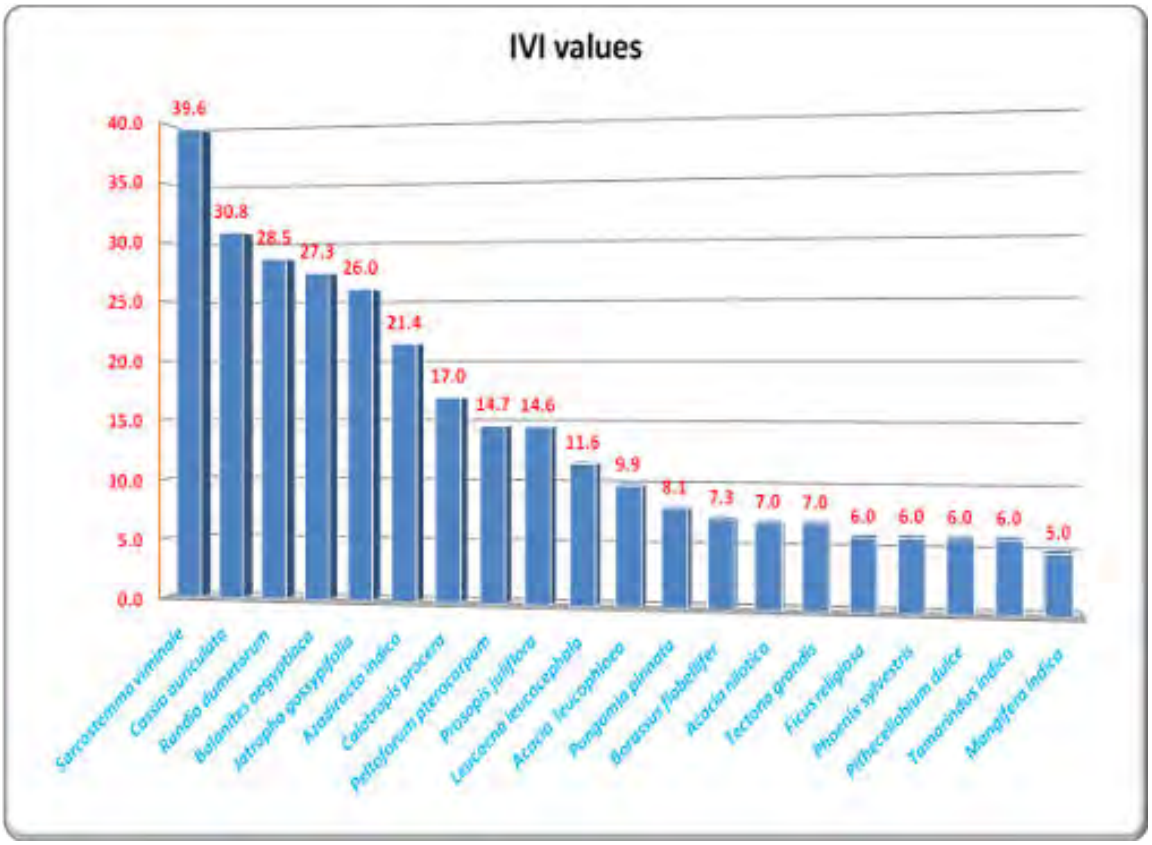
7.4.5 Faunal Study:

A detailed study in has been carried out to cross check the list taken from secondary source and local villagers. In case of vertebrate species, no sampling could be done. Depending on as and when sighted, the species are recorded if found within the delimited project and buffer areas, the animal species are listed on secondary data and circumstances evidence besides direct observations. These techniques are accepted in EIA studies as per the EIA Notification of 2006. Observations are made on direct and indirect evidences for mammalian, avifauna and reptilian fauna within the study area. As an entomologist, the effort was also made to indentify invertebrate species. The species were photographed and identified with standard pictorial guides. Scheduling of species according to Indian Wildlife Protection act (1972) and IUCN is done for each species and checked the REET species. No quantitative data is calculated as some species are listed through secondary source. As the animals are migratory, habitats used by protected, important or sensitive species for breeding, nesting, foraging, resting, over wintering, migration are ascertained.

Table 7-15: Frequency, density and abundance of dominant vegetation in the study area

Botanical name	Frequency	Density	Abundance	IVI
Acacia leucophloea	33.3	0.5	1.4	9.9
Acacia nilotica	26.7	0.3	1.0	7.0
Calotropis procera	66.7	1.1	1.6	17.0
Azadiracta indica	73.3	1.5	2.1	21.4
Borassus flabellifer	20.0	0.3	1.3	7.3
Cassia auriculata	93.3	2.6	2.8	30.8
Balanites aegyptiaca	80.0	2.2	2.8	27.3
Ficus religiosa	20.0	0.2	1.0	6.0
Leucaena leucocephala	46.7	0.6	1.3	11.6
Mangifera indica	13.3	0.1	1.0	5.0
Peltoforum pterocarpum	53.3	0.9	1.6	14.7
Phoenix sylvestris	20.0	0.2	1.0	6.0
Pithecellobium dulce	20.0	0.2	1.0	6.0
Pongamia pinnata	33.3	0.3	1.0	8.1
Prosopis juliflora	46.7	0.9	1.9	14.6
Sarcostemma viminale	86.7	3.7	4.2	39.6
Tamarindus indica	20.0	0.2	1.0	6.0
Tectona grandis	26.7	0.3	1.0	7.0
Jatropha gossypifolia	93.3	2.0	2.1	26.0
Randia dumetorum	73.3	2.3	3.2	28.5

Figure 7-25: IVI Values



The interpretations based on the above analysis and the floristic composition reveals that, the vegetation encountered in the study area is termed as the original characteristic of Thorn forests / Scrub forests, Southern tropical dry deciduous forests, Southern mixed dry deciduous forests, and tropical dry ever green forests. The study area comprises of agricultural and fallow lands. The type of vegetation found in the study area is Open scrub along with the representative elements of the deciduous forest types. Physiognomically it occurs in the shape of scrub woodland or thicket, the latter may be dense or discontinuous. Floristically it is distinguished by some characteristic and preferential species (Braun-Blanquet, 1932), exclusively or mostly confined to this vegetation type, in relation to the types described by champion (1936) and champion and Seth (1968).

7.4.6 Status of the Plants:

There is no endangered, threatened, or rare species of plants recorded in the study area.

Rare or endangered or endemic or threatened (REET) flora and fauna of the study area: The list of plants found in the core and buffer areas are compared with the list of CITES plants in India (www.bsenvis.nic.in/citesplant.htm). None of the plants listed are included in Appendix III of CITES or in the REET category of the Botanical Survey of India. Similarly, few species such as blackbuck and wild boar of the vertebrates reported from the study area belong to REET category. The presence of Blackbuck is very common in these crop fields which is globally near Threatened and Schedule –I species animal.

7.4.6.1 Terrestrial Fauna of the study area:

As the core area is not isolated from its surroundings by any barrier, there are no chances for any kind of isolation or restriction of any wild animal to the core area or the buffer area. As they are capable of moving from place to place either for food or shelter or mate, it is not proper to list them separately for different areas. Hence, common lists are prepared based on available secondary data and on the basis of direct observation, indirect or circumstantial evidence such as foot prints, feathers, skin, hair, hooves etc. The area of survey and study extends up to a radius of 10 km in case of terrestrial fauna. As there are no dense forests or wildlife reserves or other protected areas around the proposed project site and as the area is surrounded by croplands and villages the chances of occurrence of any rare or endangered wildlife is remote. However during the field survey we found certain threatened animals such as blackbuck.

The core area is suitable for terrestrial reptiles such as snakes and lizards. Among the mammals, monkeys were commonly sighted in the buffer zone. The presence of near Threatened and Schedule –I species animal, Blackbuck is very common with a population of more than 700 within buffer area and occasionally occur in core region. A list of vertebrate species other than birds either spotted or reported from the study area is given in the tables section below in the chapter. Many terrestrial birds such as Indian Ring dove, Crows, Sparrows, Parrots, Mynas, Swifts, Doves, Pigeons, Egrets and Weavers etc were common. A list of birds either spotted or reported from the study area is given in the tables section below in the chapter. There are no foreign visitors or winter migrants from across the globe.

7.4.6.2 Conservation of Blackbuck:


Black Buck

Physical appearance: Adult male Black Buck have black and white fur. Upper part of the body is black, while the under part and a ring around the eyes is white in colour. Even the fawns have these markings. The males are born lighter in colour, but turns darker at maturity. The females are usually hornless. Males have 24 inches long horns, which are twisted in tight spiral. They are about five feet long and weigh about 85 pounds. Males are dark brown in colour, while the young ones and females are light brown in colour. Black Bucks have the capacity to run 50 miles per hour. It is one of the fastest animal in the world.

Habitat: Black Buck live in open plains, grass lands, dry thorn and scrub lands. They live in herds of 20- 30 individuals.

Diet: Black Buck are herbivorous. They prefer eating Grasses, fruits, pods, flowers, shrubs and herbs.

Reproduction: Male Black Buck attain sexual maturity in 3 years and the female black buck in approximately 2 years. Females attain sexual maturity much faster than the males. Males hold their nose up and place their horns parallel to their back, to attract the females during the mating season. Gestation period rests for ten months. Mating season of the Black Buck rests from August to October and March to April. Females can give birth twice in the 14 months to one or two young ones at a time. Young ones remain with their mother up to the age of one year. Males remain in sexual excitement throughout the year.

Conservation status: Black Buck is a highly endangered species. Wildlife parks and zoos are breeding this beautiful species to increase its population. Black buck is one of 26 species of mammals, which have been declared endangered. Poaching and habitat destruction has seriously affected the population of the Black Bucks. It is usually haunted for its skin, flesh and also for sports. It is also haunted for meat. Black Buck also holds the cultural importance in Hinduism and Buddhism. In the 19 th and 20 th century Black Buck was the most haunted animal all over India.

Lifespan: Few Black Bucks live more than 12 years. Lifespan of the Black Buck is about 16 years.

For Black buck monitoring:

- ✓ Number of existing water holes are to be maintained.
- ✓ No WTGs to be placed near any of the water holes/water bodies.
- ✓ Environmental education should be given to the staff and villagers.
- ✓ Sign boards and models are to be developed.
- ✓ Lure crop for Black buck should be maintained away in all seasons by project authority.
- ✓ An ecologist should conduct survey once in every season to get more strategies.

Table 7-16: IVI values of the Fauna

Botanical name	IVI
Sarcostemma viminale	39.6
Cassia auriculata	30.8
Randia dumetorum	28.5
Balanites aegyptiaca	27.3
Jatropha gossypifolia	26.0
Azadiracta indica	21.4
Calotropis procera	17.0
Peltoforum pterocarpum	14.7
Prosopis juliflora	14.6
Leucaena leucocephala	11.6
Acacia leucophloea	9.9
Pongamia pinnata	8.1
Borassus flabellifer	7.3
Acacia nilotica	7.0
Tectona grandis	7.0

Ficus religiosa	6.0
Phoenix sylvestris	6.0
Pithecellobium dulce	6.0
Tamarindus indica	6.0
Mangifera indica	5.0

7.4.7 Wind Energy Projects and Concerns of Bird & Bats Mortalities

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).

7.4.8 Legal Framework & India's International Obligation 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.

7.4.9 Ecological importance sites:

As per the detailed study there are no important or ecologically sensitive sites for protecting the flora and fauna.

TABLES: The below tables lists species of Flora & Fauna found in the study area.

Table 7-17: Study area trees, shrubs, perennial climbers and grasses

: List of trees, shrubs, perennial climbers and grasses found in the Core area during the study period.		
Scientific name	**Local /Common name**	**Family**
Acacia leucophloea	Tella thumma	Mimosaceae
Acacia nilotica	Nalla thumma	Mimosaceae
Aganosma cymosa	Nalla teega	Apocynaceae
Agave americana	Kalabanda	Agavaceae
Azadirachta indica	Vepa	Meliaceae
Calotropis procera	Jilledu	Asclepiadaceae
Cassia auriculata	Tangedu	Caesalpiniaceae
Cymbopogon coloratus	Bodha gaddi	Poaceae
Cynodon dactylon	Garika gaddi	Poaceae
Euphorbia antiquorum	Bontha jamudu	Euphorbiaceae
Euphorbia tortillis	Naaga jamudu	Euphorbiaceae
Pergularia daemia	Dori	Asclepiadaceae
Prosopis juliflora	Mesquite	Mimosaeceae
Waltheria indica	Nalla benda	Ssterculiaceae
Ziziphus horrrida	Tella regu	Rhamnaceae
Ziziphus nummularia	Regu	Rhamnaceae
Cassia occidentalis	Kasintha	Leguminosae
Balanites aegyptiaca		Balanitaceae
Phoenix sylvestris	Eetha	Arecaceae
Croton bonplandianus	Vana mokka	Euphorbiaceae
Borassus flabellifer	Thadi chettu	Arecaceae
Prosopis spicigera	Jammi	Mimosaeceae

Table 7-18: Buffer zone, trees shrubs, perennial climbers and tall grasses

Table: List of trees, shrubs, perennial climbers and tall grasses found in the Buffer zone				
S.No.	**Botanical Name**	**Common name**	**Family**	**Habit**
1	*Eichornia crassipes*		Pontederiaceae	Aquatic
2	*Hydrilla verticillata*		Hydrocharitaceae	Aquatic
3	*Ipomoea aquatica*	Thooti Koora	Convolvulaceae	Aquatic
4	*Lemna minor*		Araceae	Aquatic
5	*Nymphaea pubescens*		Nymphaeaceae	Aquatic
6	*Typha ungustata*	Jammu	Typhaceae	Aquatic
7	*Abrus precatorius*	Gurivinda	Leguminosae	Climber
8	*Cardiospermum halicacabum*	Budda kakara	Sapindaceae	Climber
9	*Cassytha filiformis*		Lauraceae	Climber
10	*Cissus quadrangularis*	Nalleru	Vitaceae	Climber
11	*Daemia extensa*		Asclepidaceae	Climber
12	*Hemidesmus indicus*		Asclepiadaceae	Climber
13	*Ipomoea macrantha*		Convolvulaceae	Climber
14	*Ipomoea nil*		Convolvulaceae	Climber

15	*Chloris barbata*		Poaceae	Grass
16	*Cynodon dactylon*	Garika	Poaceae	Grass
17	*Cyperus castaneus*		Poaceae	Grass
18	*Cyperus rotundus*	Tunga	Cyperaceae	Grass
19	*Dactyloctenium aegyptium*		Poaceae	Grass
20	*Digitaria ciliaris*		Poaceae	Grass
21	*Eragrostis tenella*		Poaceae	Grass
22	*Fimbristylis cymosa*	Pulupu gaddi	Cyperaceae	Grass
23	*Phragmites karka*		Poaceae	Grass
24	*Saccharum spontaneum*	Kaki Cheraku	Poaceae	Grass
25	*Abutilon indicum*		Malvaceae	Herb
26	*Achyranthes aspera*	Uttareni	Amaranthaceae	Herb
27	*Aerva lanata*	Konda pindi	Amaranthaceae	Herb
28	*Aloe vera*		Asphodelaceae	Herb
29	*Alternanthera sessilis*	Ponaganti kura	Amaranthaceae	Herb
30	*Amaranthus spinosus*		Amaranthaceae	Herb
31	*Argemone mexicana*	Bhrama dandi	Papaveraceae	Herb
32	*Asparagus racemosus*	Pilliteegalu	Asperagaceae	Herb
33	*Barleria cristata*	Neeli Gorinta	Acanthaceae	Herb
34	*Barleria prinotis*		Acanthaceae	Herb
35	*Biophytum nervifolium*	Junuku	Malpighiaceae	Herb
36	*Blumea mollis*	Kukka pogaku	Asteraceae	Herb
37	*Blumea virens*	Adavi pogaku	Asteraceae	Herb
38	*Boerhaevia diffusa*	Atukamaamidi	Nyctaginaceae	Herb
39	*Boerhaevia diffusa*	Atukamaamidi	Nyctaginaceae	Herb
40	*Borreria hispida*	Madanaaku	Rubiaceae	Herb
41	*Cassia auriculata*	Adavi Chennangi	Caesalpiniaceae	Herb
42	*Cassia tora*	Tagarisa	Caesalpiniaceae	Herb
43	*Cassia uniflora*	Tagarisa	Caesalpiniaceae	Herb
44	*Catharanthus roseus*		Apocynaceae	Herb
45	*Celosia viridis*		Amaranthaceae	Herb
46	*Cleome viscosa*	Yerri Vaminta	Cleomaceae	Herb
47	*Cocculus hirsutus*	Dusaari	Menispermaceae	Herb
48	*Commelina longifolia*		Commelinaceae	Herb
49	*Crotan bonplantianum*	Bhu thulasi	Euphorbiacea	Herb
50	*Crotan bonplantianum*	Bhu thulasi	Euphorbiacea	Herb
51	*Datura stramonium*		Solanaceae	Herb
52	*Dendrocalamus strictus*	Sanna vedru	Poaceae	Herb
53	*Eclipta alba*	Gunta galijru	Asteraceae	Herb
54	*Eupatorium odoratum*	Galivana	Asteraceae	Herb
55	*Euphorbia antiquorum*	Bontha Jemudu	Euphorbiaceae	Herb
56	*Euphorbia hirta*	Bontha Jemudu	Euphorbiaceae	Herb
57	*Euphorbia nivulia*	Aaku jemudu	Euphorbiaceae	Herb
58	*Evolvulus alsinoides*	Visnu krantha	Convolvulaceae	Herb
59	*Gymnema sylvestre*	Podapatri	Asclepiadaceae	Herb
60	*Hyptis suaveolens*	Maha beera	Lamiaceae	Herb
61	*Leucas aspera*		Lamiaceae	Herb
62	*Merremia tridentata*		Convolvulaceae	Herb
63	*Ocimum basilicum*		Lamiaceae	Herb
64	*Ocimum canum*	Kukka Tulasi	Lamiaceae	Herb

65	*Oldenlandia umbellata*		Rubiaceae	Herb
66	*Parthenium hysterophorus*	Congress Grass	Asteraceae	Herb
67	*Pavonia zeylanica*		Malvaceae	Herb
68	*Phyllanthus amanus*	Nela Usiri	Euphorbiaceae	Herb
69	*Pupalia lappacea*	Gundu Uttareni	Amaranthaceae	Herb
70	*Sida acuta*	Bala	Malvaceae	Herb
71	*Sida cordata*	Bala	Malvaceae	Herb
72	*Solanum surattense*	Vakudu	Solanaceae	Herb
73	*Sphaeranthus indicus*	Bodataram	Asteraceae	Herb
74	*Tephrosia purpurea*		Fabaceae	Herb
75	*Tragia involucrata*	Durada gondi	Euphorbiaceae	Herb
76	*Tribulus terrstris*	Palleru	Zygophyllaceae	Herb
77	*Tridax procumbens*		Asteraceae	Herb
78	*Triumfetta rhomboidea*	Marla Benda	Taccaceae	Herb
79	*Urena lobata*	Nalla Benda	Malvaceae	Herb
80	*Vanda tessellata*	Kodikalla chettu	Orchidaceae	Herb
81	*Vernonia cinerea*	Sahadevi	Asteraceae	Herb
82	*Ziziphus numularia*	Nela Regu	Rhamnaceae	Herb
83	*Agave americana*		Asparagaceae	Shrub
84	*Balanites aegyptiaca*	Gara, ingalukke	Balanitaceae	Shrub
85	*Calotropis gigantea*	Tella Jilledu	Asclepiadaceae	Shrub
86	*Calotropis procera*	Jilledu	Asclepiadaceae	Shrub
87	*Cassia occidentalis*	Adavi Chennangi	Caesalpiniaceae	Shrub
88	*Clerodendron inerme*	Pisingi	Verbenaceae	Shrub
89	*Dodonaea viscosa*	hopbush	Sapindaceae	Shrub
90	*Grewia hirsuta*	Jaani Chettu	Tiliaceae	Shrub
91	*Grewia obtusa*	Jaana	Tiliaceae	Shrub
92	*Indigofera cassiodes*	Karu kandi	Papilionaceae	Shrub
93	*Ipomoea carnea*	Rubber mokka	Convolvulaceae	Shrub
94	*Jatropha curcas*	Adavi amudamu	Euphorbiaceae	Shrub
95	*Jatropha gossypifolia*	adaviamudamu	Euphorbiaceae	Shrub
96	*Lantana camara*	Lantana	Verbenaceae	Shrub
97	*Opuntia dillenii*	Nagajamudu	Cactaceae	Shrub
98	*Plumeria alba*	Devaganneru	Apocynaceae	Shrub
99	*Randia dumetorum*	Manga	Rubiaceae	Shrub
100	*Sarcostemma viminale*		Apocyanaceae	Shrub
101	*Solanum torvum*		Solanaceae	Shrub
102	*Acacia leucophloea*	Tella tumma	Mimosaceae	Tree
103	*Acacia nilotica*	Nalla tumma	Mimosaceae	Tree
104	*Annona squamosa*	Custard apple	Annonaceae	Tree
105	*Azadirachta indica*	Vepa	Meliaceae	Tree
106	*Bambusa arundinacea*	Veduru	Poaceae	Tree
107	*Bauhinia purpurea*	Deva kanchanum	Fabaceae	Tree
108	*Bauhinia racemosa*	Are	Caesalpiniaceae	Tree
109	*Borassus flabellifer*	Taati / Taadi	Araceae	Tree
110	*Cassia fistula*	Rela	Leguminosae	Tree
111	*Catunaregam spinosa*	Manga	Rubiaceae	Tree
112	*Chloroxylon sweitenia*	Billudu	Flindarsiaceae	Tree
113	*Cocos nucifera*	Coconut	Arecaceae	Tree
114	*Dalbergia latifolia*	Jitregi	Papilionaceae	Tree

115	*Dalbergia paniculata*	Porla patcharu	Papilionaceae	Tree
116	*Dalbergia sissoo*	Sisu	Leguminosae	Tree
117	*Delonix regia*	Sunkesula	Fabaceae	Tree
118	*Eucalyptus teretocronis*	Eucalyptus	Myrtaceae	Tree
119	*Euphorbia tirucalli*	Milk Bush	Euphorbiaceae	Tree
120	*Ficus benghalensis*	Marri	Moraceae	Tree
121	*Ficus hispida*	Bommedu	Moraceae	Tree
122	*Ficus religiosa*	Raavi	Moraceae	Tree
123	*Ficus religiosa*	Raavi	Moraceae	Tree
124	*Grewia flavescens*	Pedda Jana	Tiliaceae	Tree
125	*Leucaena leucocephala*	Subabul	Mimosaceae	Tree
126	*Mangifera indica*	mamidi	Anacardiaceae	Tree
127	*Melia azedarach*	Turaka vepa	Meliaceae	Tree
128	*Peltophorum pterocarpum*	Konda chinta	Leguminosae	Tree
129	*Phoenix sylvestris*	Eetha	Araceae	Tree
130	*Pithecellobium dulce*	Seema chinta	Mimosaceae	Tree
131	*Polyalthia longifolia*	Naramamidi	Annonaceae	Tree
132	*Pongamia pinnata*	Ganuga	Fabaceae	Tree
133	*Prosopis juliflora*	English tumma	Mimosaceae	Tree
134	*Tamarindus indica*	Chinta	Caesalpiniaceae	Tree
135	*Tecoma stans*	Patcha turai	Bignoniaceae	Tree
136	*Tectona grandis*	Teak	Verbenaceae	Tree
137	*Terminalia catappa*	Badham	Combretaceae	Tree
138	*Thespesia populnea*	Ganga Raavi	Malvaceae	Tree
139	*Vitex negundo*	Vaavili	Verbenaceae	Tree
140	*Ziziphus marutiana*	Regu Chettu	Rhamnaceae	Tree
141	*Zizyphus jujuba*	Regu	Rhamnoceae	Tree

Table 7-19: Vertebrates other than Birds in study area and buffer

Table: List of Vertebrates other than Birds either observed or reported from the project area and its surroundings up to a radius of 10 Km. Note: LC means Least Concern and WPA indicates Schedule of the Wildlife Protection Act. (Vide:www.iucnredlist.org/apps/redlist/details/13143)		
Amphibians		
Latin name	Common name	IUCN / WPA
Bufo melonostrictus	Common Indian Toad	LC/IV
Hyla arborea	Tree Frog	LC/IV
Rana hexadactyla	Green Pond Frog	LC/IV
Reptiles		
Bungarus caeruleus	Common Krait	LC/IV
Calotes versicolor	Garden lizard	LC/IV
Chamaeleon zeylanicus	Indian Chameleon	LC/IV
Dryophis nasutus	Whip Snake	LC/IV
Dryophis pulverulentus	Tree Snake	LC/IV
Hemidactylus brookii	Brook's House Gecko	LC/IV
Hemidactylus prashadi	Wall lizard	LC/IV
Ptyas mucosus	Rat snake	LC/IV
Typholops braminus	Blind Snake	LC/IV

Varanus bengalensis	Monitor lizard	LC/IV
Mammals		
Bandicota bangalensis	Field Rat	LC / V
Funambulus palmarum	Three Striped Squirrel	LC/IV
Golunda ellioti	Indian bush Rat	LC/IV
Herpestes javanicus	Small Indian Mongoose	LC/IV
Herpestes edwardsi	Common Mongoose	LC/IV
Lepus nigricollis	Common Hare	LC/IV
Macaca mulatta	Rhesus monkey	LC/ II
Rattus rattus	House Rat	LC / IV
Rousettus leschenaulti	Fruit bat	LC / V
Suncus murinus	Musk shrew	LC / V
Sus scrofa	Wild Boar	LC / III
Antilope cervicapra	Black buck	VU / I

Table 7-20: Birds either spotted or reported from the areas

Table: List of birds either spotted or reported from the areas around the proposed project Area up to a radius of 10 Km. The species found in the study area are indicated by *		
Common Name	**Scientific Name**	**WPA Schedule**
Common kingfisher*	*Acedo atthis*	IV
Common myna*	*Acridotheres tristis*	IV
Small blue kingfisher*	*Alcedo atthis*	IV
Red munia	*Amandava amandava*	IV
Oriental tree pipit	*Anthus hodgosoni*	IV
Paddy field Pipit	*Anthus novaeseelandiae*	IV
Cattle egret*	*Bubulcus ibis*	IV
Crow pheasant*	*Centropus sinensis*	IV
Lesser Pied Kingfisher	Ceryle rudis	IV
Bristled grass bird	*Chaetornis striatus*	IV
Kentish plover	*Charadrius 181lexandrines*	IV
Little ringed plover	*Charadrius dubius*	IV
Yellow eyed babbler	*Chrysomma sinense*	IV
Green Bulbul	*Chloropsis aurifrons*	IV
Pied crested cuckoo	*Clamator jacobinus*	IV
Blue rock pigeon*	*Columba livia*	IV
Oriental magpie robin*	*Copsychus saularis*	IV
Blue Jay*	*Coracias benghalensis*	IV
Large cuckoo shrike	*Coracina macei*	IV
Jungle crow	*Corvus macrorhyncos*	IV
House crow*	*Corvus splendens*	V
Large egret	*Cosmerodius albus*	IV
Indian treepie	*Dendrocitta vagabunda*	IV
Yellow fronted pied woodpecker	*Dendrocopos mahrattensis*	IV
Brown capped pigmy woodpecker	*Dendrocopos nanus*	IV
Tickell's Flower pecker	*Dicaeum erythrorhynchos*	IV
Black drongo*	*Dicrurus asimilis*	IV
Rocket tailed drongo	*Dicrurus remifer*	

Golden backed woodpecker	*Dinopium benghalense*	IV
Little egret*	*Egretta garzeta*	IV
Intermediate egret	*Egretta intermedia*	IV
Asian koel	*Eudynamys scolopacea*	IV
White breasted kingfisher*	*Halcyon smyrnensis*	IV
Crested tree swift	*Hemiprocne coronata*	IV
Black winged stilt	*Himantopus himantopus*	IV
Booted warbler*	*Hippolais caligata*	IV
Pheasant tailed jacana*	*Hydrophasianus chirurgus*	IV
Black tailed godwit	*Limosa limosa*	IV
White rumped munia	*Lochura striata*	IV
Silver billed munia	*Lonchura malabarica*	IV
Spotted munia	*Lonchura puctulata*	IV
Chestnut headed bee eater	*Merops etanus*	IV
Small green bee-eater*	*Merops orientalis*	IV
Blue cheeked bee eater	*Merops persicus*	IV
Blue tailed bee eater	*Merops philippinus*	IV
Median egret	*Mesophoyx intermedia*	IV
Bronze winged jacana*	*Metopidious indicus*	IV
Rufous Woodpecker	*Microternus brachyurus*	IV
Black kite*	*Milvus migrans*	IV
Grey wagtail	*Motacilla cinerea tunstall*	IV
Yellow wagtail*	*Motacilla flava linnaeus*	IV
White browed wagtail	*Motacilla maderaspatensis*	IV
Purple sunbird	*Nectarinia asiatica*	IV
Loten's sunbird	*Nectarinia lotenia*	IV
Purple rumped sunbird	*Nectarinia zeylonica*	IV
Golden oriole	*Oriolus oriolus*	IV
Common tailorbird	*Orthotomus sutorius*	IV
Great tit	*Parus major*	IV
House sparrow*	*Passer domesticus*	IV
Spot billed kingfisher	*Pelargopsis capensis*	IV
Small minivet	*Pericrocotus cinnamomeus*	IV
White bellied minivet	*Pericrocotus erythropygius*	IV
Yellow throated sparrow	*Petronia xanthocollis*	IV
Large cormorant	*Phalacorax carbo*	IV
Indian cormorant*	*Phalacrocorax fusicollis*	IV
Little cormorant*	*Phalacrocorax niger*	IV
Indian pitta	*Pitta bracyura*	IV
Baya weaver*	*Ploceus philippinus*	IV
Ashy prinia*	*Prinia socialis*	IV
Rose ringed parakeet*	*Psittacula krameri*	IV
Red vented bulbul	*Pycnonotus cafer*	IV
White browed fantail fly catcher	*Rhipidura aureola lesson*	IV
Red crested pochard	*Rhodonesa rufina*	IV
Greater painted snipe	*Rostratula benghalensis*	IV
Pied bush chat	*Saxicola caprata*	IV
Common stonechat	*Saxicola torquata*	IV
Indian robin*	*Saxicoloides fulicata*	IV
Black bellied tern	*Sterna acuticauda*	IV

Spotted dove*	*Streptopelia chinensis*	IV
Indian Ring dove *	Streptopelia decaocto	IV
Asian pied myna	*Sturnus contra*	IV
Brahminy starling	*Sturnus pagodarum*	IV
Lesser white throat	*Sylvia curruca*	IV
Little grebe	*Tachybaptus ruficollis*	IV
Common wood shrike	*Tephrodornis pondicerianus*	IV
Wood sandpiper	*Tringa glareola*	IV
Common greenshank	*Tringa nebularia*	IV
Green sandpiper	*Tringa ochropus*	IV
Marsh sandpiper	*Tringa stagnatilis*	IV
Common babbler	*Turdoides caudatus*	IV
Large grey babbler	*Turdoides malcolmi*	IV
Jungle babbler*	*Turdoides striatus*	IV
Common buttonquail	*Turnix suscitator*	IV
Hoopoe	*Upupa epops*	IV
Red wattled lapwing	*Vanellus indicus*	IV
Yellow wattled lapwing	*Vanellus malabaricus*	IV
Note: The conservation status of the birds have been verified with the Birdlife International's 2010 update of the IUCN Red List for birds from web sites *www.birdlife.org&www.iucnredlist.org*and found that there are no REET category birds in and the around the proposed project site area up to a radius of 10 Km.		

Photograph 7-6: Field photos during the study

Photograph 7-7: Flora and Faunal Survey photos:

7.5 Socio Economic Environment

7.5.1 Introduction:

Industrial development reflects in social development i.e., growth in infrastructure facilities, growth in employment rates, increased demands for housing, and other amenities etc., which will have a bearing on the socio economic status. The Study area is rural in nature. The study area is dependent mostly on dry crop agriculture. The area is irrigated by ground water sources and few tanks. In this context it is necessary to study the present socioeconomic status with respect to the proposed development in the coming future.

Socio-economic survey was conducted between 04th Sep 2015 to 08th Sep 2015 to ascertain the existing socio-economic status to compare the same with the developments due to the proposed project. Baseline data of demographic characteristics- occupational status, literacy, health status and the access to infrastructure facilities for social development in the project area has been collected from the secondary data and validated through field observations.

7.5.2 District Profile:

Anantapur District is a district in the Rayalaseema region of Andhra Pradesh, India. The district headquarters is located at Anantapur city. Anantapur district is bounded by Kurnool District in the north; Cuddapah District in the north-east; Chitoor District in the south-east; and Karnataka State on the West. The district has a total geographical area of 19.13 lakh hectare. For administrative purposes, the district is divided into three revenue divisions, namely, Anantapur, Dharmavaram, and Penukonda; there are sixty-three revenue *mandals.* As per 2011 census, the district has 10 towns and 964 revenue villages.

As of 2011 Census, the district had a population of 4,083,315, of which 28.09% is urban and a literacy rate of 64.28%. It is the largest district in terms of area in Andhra Pradesh and 7th largest district in India respectively. Almost 75 percent of the population in the district lives in rural areas. Anantapur city is 354 km from Hyderabad, 200 km from the neighboring state capital of Bangalore. Anantapur connects Hyderabad and Bangalore through National Highway-7. Bangalore International Airport is nearest international airport to Anantapur. The economy is principally agrarian with a developing industrial sector.

Anantapur District is in the arid agro-ecological zone and is marked by hot arid bioclimatic condition with dry summers and mild winters. The district is characterised by hills, ridges, and undulating and gently sloping lands. Of the total geographical area of the district, hills and ridges cover 14 percent; undulating lands, 27 percent; gently sloping lands and very gently sloping plains extend over 54 percent; and valleys cover 5 percent. Anantapur receives very less rainfall due to its location in the rain shadow area of Indian Peninsula.

Agriculture remains the predominant activity in the villages, with 80 percent of total workers engaged in agriculture, either as cultivators or agricultural labourers. *Kharif* is the major crop season in Anantapur District. Prominent crops include groundnut, sunflower, rice, cotton, maize, chillies, sesame, and sugarcane. Silk trade, limestone quarrying, iron and diamond mining. Anantapur town is known as Groundnut City in reference to the neighboring Bangalore being called as Garden City. The

soils of Anantapur originated from both the granite and granite-gneiss land forms, as wells as the Dharwar landforms. Both these land forms are characterised by hills and ridges and undulating and gently-sloping lands. There are about thirty-four soil families in the district of Anantapur, and among these, the Anantapur and Penukonda soil families are the most predominant.

In urban areas, about 11 percent of the workforce is engaged in agriculture. Mining is also an important activity in Anantapur District as it is endowed with rich deposits of iron ore and lime stone, as well as other minerals. There are more than fifty small-scale industrial units in the district, of which nearly one-half are to do with granite. There are also couple of cement industries and steel industries in the district.

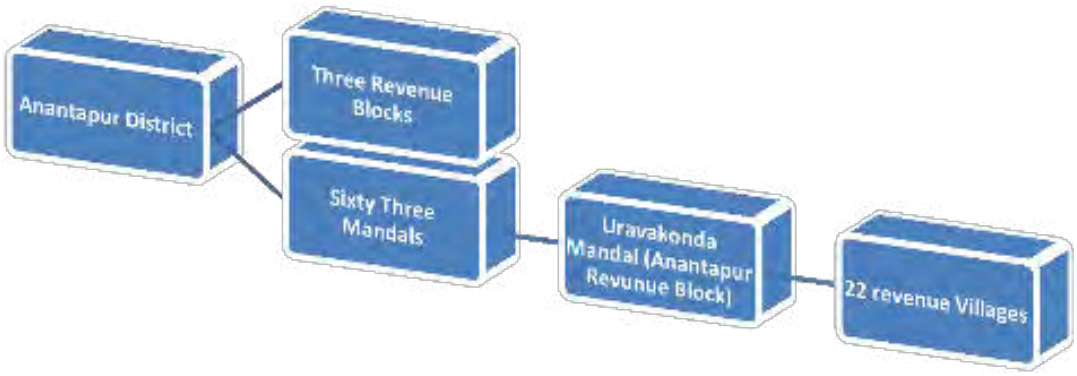
7.5.3 Adminstrative Setup of the Study Area

The project activity is ocated in the largest district in the state of Andhra Pradesh. The district of Anantapur consists of more that 63 Mandals and has over 1000 villages under its administration.

The district of Anantapur consists of three revenue blocks, of which each block has a number of Mandals under its administration. The Mandal of Uravakonda directly falls under the revenue block of Anantapur and has 22 revenue villages.

The administrative structure at the rural level follows the Panchayati Raj System of India (The Panchayati Raj Act, 73rd Amendment and the Panchayati Raj Extended to Scheduled Areas Act (PESA), 1996. The PESA (Panchayati Raj (extension to Scheduled Areas) Act) 1996 was passed to enable tribal self-rule in the fifth schedule areas in nine states (including Madhya Pradesh) by the provisioning of Panchayats in these areas as well.

Figure 7-26: Administrative Setup of the Study Area



Source: Handbook of Statistics, Anantapur District

7.5.4 Methodology:

Primary data is generated by adapting a simple random sampling method. Among all the villages, 7 villages are selected in all four directions i.e. east, west, north and south from core area in the radius of 2k.m, 5k.m, 7k.m and 10k.m. From these 7 villages, about 6% of households was selected (covering all social categories, especially the SC and ST communities) randomly and attained the sample size of 200 households. This chapter contains the socioeconomic analysis of 7 villages based on census data and the analysis of 200 sample households based on primary data generated through field survey.

Secondary data was collected from the Govt. departments/agencies, Census 2001 in respect of the proposed project. In this baseline study, the respondents residing near the project exploration area served as the unit of observation and relevant information was obtained from these respondents that is necessary for the socio-economic analysis.

The study included both primary and secondary data collection. The primary data was generated using the structural questionnaire through formal interaction by undertaking door to door transact walk to all the 200 households which falls under 7 villages in the study.

Keeping in view the objectives of the baseline study, the information pertaining to the following parameters were obtained from the respondents residing within 10km radius of the proposed new mine exploration area.

- Basic household profile: age, sex, marital status, religion, caste, occupation, sources of income, family size, and educational status.
- Homestead land information on agricultural situation (land holding size, cropping pattern, productivity, net return etc.)
- Occupation
- Annual income from various sources
- Information on family budget
- Savings
- Family assets
- Existing social infrastructure facilities
- Quality of life
- Health status
- Cultural and aesthetic attributes
- Project awareness

The baseline information has been presented by aggregating the findings of all the respondents from the project area in the form of tables, graphs and pie diagrams.

7.5.4.1 Socio-economic analysis based on the Secondary data

The socioeconomic environment of all the villages within the 10km radius of the project area based on the census data is presented as under.

7.5.4.2 Socio-economic aspects

To assess the anticipated impacts of the proposed activities on the socio economic aspects of people, it is necessary to study the existing socio-economic status of the local population, which will be helpful for making efforts to further improve the quality of life in the area. The sociological aspects of this study include human settlements, demography and social strata and literacy levels including infrastructure facilities available in the area. The economic aspect includes occupational structure of the people. The baseline demographic and socio-economic characteristics with regards to demography, literacy and occupational status have been described.

7.5.5 Project Area Profile:

Demographic characteristics of the study area falling within 10 km radius of the proposed project site have been compiled to assess the pre-project socio-economic status. Secondary data has been collected from various government agencies i.e., chief planning officer, Anantapur district and other government departments of forestry, irrigation etc., and Mandal Development Offices of the relevant government departments.

7.5.5.1 Demography

The study area falls under Uravakonda mandal in Anantapur district. The study area contains 7 Revenue villages.

7.5.5.2 Population Distribution

The population distribution of the study area is presented in table below. The population density in the study area is less reflecting the rural nature and lack of irrigation facilities. The total population of the area is 18002 consisting of 9011 males and 8991 females. The population of the scheduled castes is 3263 consisting of 1625 males and 1638 females, while the scheduled tribe population is 94 consisting of 47 males and 47 females.

Table 7-21: Population Distribution-Study Area

Name	No of Households	Total Population Person	Total Population Male	Total Population Female
Renimakulapalle	350	1666	852	814
Chinna Musturu	481	1942	964	978
Pedda Musturu	324	1409	675	734
Mopidi	611	2462	1222	1240
Indravathi	191	736	368	368
Nimbagal	657	2849	1405	1444
Amidala	1543	6938	3525	3413
Total	4157	18002	9011	8991

Table 7-22: Population of SC & ST Distribution-Study Area

Name	Scheduled Castes population Person	Scheduled Castes population Male	Scheduled Castes population Female	Scheduled Tribes population Person	Scheduled Tribes population Male	Scheduled Tribes population Female
Renimakulapalle	333	174	159	0	0	0
Chinna Musturu	402	204	198		0	0
Pedda Musturu	682	313	369	40	22	18
Mopidi	129	56	73	0	0	0
Indravathi	125	70	55	0	0	0
Nimbagal	471	236	235	0	0	0
Amidala	1121	572	549	54	25	29
Total	3263	1625	1638	94	47	47

7.5.5.3 Literacy

Census operations consider a literate as a person who is above six years old and who can write and read as per the census. The table presents the literacy levels in the study area.

Table 7-23: Literacy - Study Area

Name	Literates Population Person	Literates Population Male	Literates Population Female	Illiterate Persons	Illiterate Male	Illiterate Female
Renimakulapalle	823	492	331	843	360	483
Chinna Musturu	911	537	374	1031	427	604
Pedda Musturu	637	379	258	772	296	476
Mopidi	1266	737	529	1196	485	711
Indravathi	378	237	141	358	131	227
Nimbagal	1505	869	636	1344	536	808
Amidala	3155	1914	1241	3783	1611	2172
Total	8675	5165	3510	9327	3846	5481

The percentage of literacy level in the study area among males is 59.54 and 40.46 among females. It may be observed that the literacy level among females is comparatively less than males.

7.5.5.4 Employment/Occupation

Work is defined as participation in any economically productive activity -Physical/mental. The work force is classified into three categories: a) main workers, b) cultivators and c) agricultural labor. Main workers are those who work for a substantial part of the year for a living such as salaried employees, etc. Marginal workers are those who worked the previous year but has not worked for a substantial part of this year. Non-workers constitute students, house wives, dependents, pensioners etc. Table below presents the population distribution for employment.

It may be observed that a majority of the study area population falls in the non-worker category among 43.4% of the total population. The male female difference is also significant in all the categories. There are few females among the workers and more females among non workers.

Table 7-24: Employment – Study Area

Name	Total Population Person	Total Worker Population Person	Main Working Population Person	Main Cultivator Population Person	Main Agricultural Labourers Population Person	Main Household Industries Population Person	Main Other Workers Population Person	Marginal Worker Population Person
Renimakulapalle	1666	1063	1009	176	805	11	17	54
Chinna Musturu	1942	1101	981	98	608	16	259	120
Pedda Musturu	1409	819	776	132	565	24	55	43
Mopidi	2462	1469	993	333	537	6	117	476
Indravathi	736	391	342	82	155	0	105	49
Nimbagal	2849	1554	1221	542	539	10	130	333
Amidala	6938	3792	3441	793	2168	38	442	351
Total	18002	10189	8763	2156	5377	105	1125	1426

The main workers are further classified into; Total cultivators: those who engage a single worker or his family member to cultivate land for payment in money, kind or share; Agricultural labor: those who work in other's lands for wages; Household workers: Workers involved in manufacturing and processing industries in the house hold industries; and other services: construction workers, workers in trade and commerce, workers involved in transport, storage and communication government employees, teachers, priests, artists etc. Table 3.15 presents the main workers distribution among the study area population.

It may be observed that over 12% of the study area population is involved in cultivation, followed by agriculture labor to the tune of 29.86% which can be attributed to the semi-arid nature and non-arable lands of the area.

7.5.6 Living Standards and Infrastructure

Sustainable development of any area is dependent not only the population but also on the availability of infrastructure which leads to better living standards. The infrastructure facilities are essential in providing education, awareness, health, communication, potable water, transport etc. The standards of living are the sum of the availability of the infrastructure to the subject community, wide variations in terms of income, economic conditions and patterns of spending.

The infrastructure facilities available in the impact zone are reflecting the rural nature of the entire study area.

Photograph 7-8: Picture Facilities in the Villages of Study Area



Source: Site Survey

7.5.6.1 Educational Facilities

The educational facilities available in the rural areas are limited to secondary schooling. There are 09 primary schools and 06 high schools in the study area. There are no colleges in the area which is available in the nearby town of Uravakonda. The higher educational need of the population is also met by Anantapur and Guntakal. Particularly, the University in Anantapur is famous which draws aspirants from the surrounding villages to pursue higher education.

Photograph 7-9: Schools in the Study Area


Source: Site Survey

7.5.6.2 Health facilities

The medical and health facilities available in the impact zone are inadequate; there are 2 PHC, 7 PHS and no child welfare center. The nearest hospital with acceptable emergency response is in the town of Uravakonda. The health needs of the population in this area are met by quacks and other semi qualified persons.

Figure 7-27: *Community Centre dubbed as Medical care Centre (as per interviews)*

Source: Site Survey

7.5.6.3 Availability of Potable Water

The entire population in this area is dependent on government water supply schemes and ground water for drinking purposes. The water supply was only possible after the construction of canals though the vicinity of project site. The village if Indravathi had to provide majority of its farm land to government for this construction. The canal and subsequent construction of water tank in Nimbagallu village has helped supply of water to the about all the villages in the study area. However, it is to be noted that the population at large are many a times still dependent on the tube wells and hand pumps.

Photograph 7-10: Water Supply by Government & Hand pumps

Source: Site Survey

7.5.6.4 Transport and Communication

Transport is essentially provided by the A.P. State Road Transport Corporation (APSRTC). Most of the study area has excellent road network in all the villages. APSRTC bus facility is available for the all the villages. However it is observed that a number of private transport vehicles are observed in the area connecting them to Uravakonda and Guntakal.

7.5.6.5 Sources of Energy and Availability

The primary source of energy in the study area is electricity, and the entire study area has electricity for agriculture and domestic purpose. The urban areas have LPG facility for their cooking purpose. A significant number of people in the urban area are also dependent on Kerosene for cooking purposes, which is contingent on the vagaries of public distribution system. A majority of the rural area is mostly dependent on Kerosene, dried cow dung cakes, wood from roadside trees for their domestic energy needs.

7.5.6.6 Post and Telegraph facilities

There are two Post sub-branch office and one post branch offices in the area and no Telegraph exchanges in the study area. Phone facilities however are extended to all the villages through Mobile towers present in the study area.

7.5.6.7 Housing

Census defines the house hold as a group of persons living together and sharing their meals from a common kitchen. The numbers of households in the study region are 4157. The density of the households is approximately five. The traditional houses made up of cement walls and tin sheets or concrete. There are a number of kachha houses as well made of mud walls and dry grass roofs. The government has been augmenting the housing standards by constructing housing colonies for various weaker sections of the society.

Photograph 7-11: Representation Pakka & Kachha houses in Village

Source: Site Survey

7.5.7 Summary of Socio-Economic Assessment

The socio- economic impact assessment of the respondents with respect to the Uravakonda is as under Social division. Social division is playing a crucial role in influencing the respondent's quality of life. This is evident from the fact that even though the percentage of the forward caste respondents in the study area is low as compared to the other marginalized social divisions and minority communities yet, these forward caste respondents are superior in terms of quality of life. Hence Social division is found to have a major influence on the quality of life of the respondents. Even though the percentage of forward caste respondents is less the individual land holdings of these respondents is more and hence the annual income is more among the forward caste people than marginalized communities like SC and ST.

Even though the literacy rate is poor in study area the literacy rate among forward categories is better than marginalized communities. The prevailing social condition reflects that the marginalized communities are very poor in all aspects than forward categories and they are more socially privileged than the other castes in the study area. Literacy and Occupational assessment Illiteracy being widespread in the study area, majority of the respondents is unskilled. Irrespective of the literacy level, caste and age group, agricultural labour work has been opted as the principal occupation followed by farming in large numbers. Further education is not found to have any significant influence on their choice of occupation thus the need for being educated has not gained any significance amongst the respondents. Because of the illiteracy and lack of skills they don't fit into the existing job market. Therefore they are into agricultural labour work as their principal occupation.

7.5.7.1 Annual income

Agricultural labour work and agriculture is commonly preferred by majority of the respondents which is serving as a major source of livelihood. As the infrastructural facilities are very poor in the study area the fields which are near to water source are getting more yield other fields just away from the existing stream or pond are getting less yield and whatever the agricultural produce is there, that is sufficient only for the family consumption. So their annual income is very less with the existing employment opportunities.

7.5.7.2 Annual expenditure

The expenditure pattern reflects the first preference for food followed by medicines and final Environmental Impact Assessment / Environment Management Plan for study area. This bears testimony to the fact that their earnings through agriculture and labour work are meagre and just meets the basic needs. This is also observed that little importance is also given to the traditional and cultural practices in everyday life of the respondents in the specified year. However education has taken a backseat among the respondents in terms of the basic necessities. The fact that education and social occasions are given the least priority over basic needs reflects the impoverishment.

7.5.7.3 Health assessment

Number of studies has revealed that there is an association between socio-economic disadvantage and health. The mechanisms by which socio-economic status influences the health status are complex and varied. Also the association between socio-economic status and health is not always straightforward; it is confounded by many factors. It is often hypothesized that a number of inter-related factors including education, place of residence, health beliefs and behaviour, occupation, income, access to health services and the environment in which people live determine the socio-economic disadvantage and health. But here in the study area lack of access to the health facilities is the main reason for high infant and maternal mortality rates.

Dissatisfaction among the respondents in the study area with the existing medical facilities is proved from the fact that large proportion of the people in the study area are dying due to diseases like T.B, Malaria, Dysentery and Typhoid, Where as in other parts of the nation these diseases are considered as common diseases and has advanced treatments and death rate from these diseases is almost negligible except T.B. This is also an indication of the fact that the existing medical facilities in the study area are not satisfactory owing to the various reasons like lack of minimum medical facilities, shortage of trained medical staff in the nearby hospitals, unavailability of the necessary medicines in the nearby hospitals as well as chemist shops.

The above factors give a picture of the poor condition of the medical facilities which can be attributed to the absence of proper roads, lack of communication facilities also.

7.5.8 Conclusion

The respondents from the villages in and around the core region are very much aware of the project and they are enthusiastically waiting for the project irrespective of their annual income, literacy level and social divisions. But the respondents from far away villages i.e. from 7 to 10k.m radius are totally unaware about the project. So they are not sure about the positive and negative impacts of the project on them and on their villages. But the literate respondents expressed the hope that present proposed project activity will increases the employment sources and as well as their land rates.

8 ANTICIPATED IMPACTS AND MITIGATION MEASURES

8.1 Introduction:

This section assesses the extent and nature of environmental and social impacts based on review of information provided by ANPWPL on planning, scheduling and installation activities and interviews conducted with local communities and project affected people.

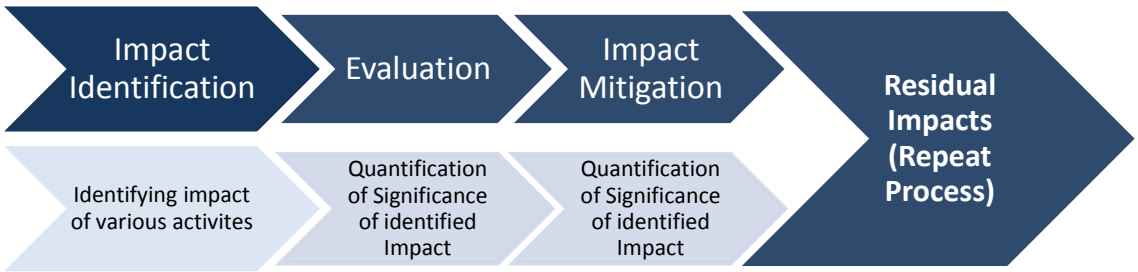
This chapter describes various positive and negative environmental and social impacts identified and assessed for the construction and operation phases of the wind power project. These impacts have been identified through review of available project information; discussions with the local community;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

8.2 Impact Assessment Methodology:

The generalized scheme of impact assessment beings with scoping and is continued through the complete process of ESIA study. The objective is to define what environmental changes may result from the proposed activities and assess the severity of such changes. The principal impact assessment steps are as shown in the figure below:

Figure 8-1: Impact assessment methodology flow presentation



Impact Identification/Prediction: This step typically is the determination of potential effects/consequences of the activities on resources/receptors in the project study area;

Impact evaluation: This step involves the quantification of any consequence of the project activity. It considers factors like the sensitivity, importance of the affected receptor, magnitude and likelihood of its occurrence;

Impact Mitigation: This is identification of appropriate measures which should help in enhancing project benefits and mitigate any negative impacts;

Residual impact evaluation: The reminder of consequences/impact after mitigation measures are implemented is called the **residual impact.** Initially a qualitative review of the potential impact severity is analysed and detailed. Then taking into account impact mitigation measures to be implemented the residual impact has been assessed to evaluate the significance of impacts assuming effective implementation of mitigation and enhancement measures.

8.3 Impact Appraisal Criteria

The severity of anthropogenic disturbances of the environment and social components is assessed based on the following parameters:

- Spatial Scale: It refers to the area of direct influence from the impact of a particular project activity.
- Duration: It is the time for which an activity has continuing impact on an environment/social component. It can also be defined as the time taken by a component to recover back to normalcy from the state of impact.
- Intensity: It reflects the magnitude of an Impact
- Consequence: This is categorizing an impacts based on its nature to be whether beneficial or adverse.

In most assessments of environmental and social impact it is difficult to determine the quantitative value of the environmental change. The methodology proposed is a semi-quantitative assessment based on scores (1-4 in ascending order of severity). The above criterions used for the appraisal of impacts are detailed below:

Table 8-1: Criteria of Impact

	Sub-Classification	Insignificant / Site	Limited/Medium Spread	Area/High spread	Regional/Significant
Spatial Scale	Impact Score	1	2	3	4
	Defining Limit	Impact is effecting or is restricted within the foot prints of the Project boundary For transmission line it will be within the right of way	Impact is spread from up to 2 km from the boundary of the WTGs	Effects components within 2-10 kms from the WTGs and upto 500m on either side of transmission line	Effects components within beyond 10 kms of the individual WTGs and may spread for over other regions beyond project area.
	Remarks	With exceptions of loss of vegetation at the WTG site and within the base of pylon and under the conductors (Ecology)	With exceptions of loss of vegetation and trees at the WTG site with limited disturbance to adjoining flora &	With exceptions of loss of vegetation and trees at the WTG site with limited disturbance to adjoining flora &	With exceptions of loss of vegetation and trees at the WTG site with limited disturbance to adjoining flora &

			fauna)	fauna)	fauna)
Duration	**Sub-Classification**	**Insignificant / Short Duration**	**Medium Duration**	**Long Duration**	**Permanent/Multiyear**
	Impact Score	1	2	3	4
	Defining Limit	When impact is likely to be restricted for duration less than 1 year	when impact extends up to 3 years	when impact extends beyond 3 years;	when impact extends beyond 5 years;
	Remarks	the anticipated recovery of the effected environmental component within 2 years	with an anticipated recovery of the effected environmental component within 6 years	with anticipated recovery of prevailing condition to happen within 6 years or beyond or upon completion of the project life	Except for ecology (which is defined as loss of vegetation at site and/or damage to adjoining flora and fauna)
Intensity	**Sub-Classification**	**Insignificant intensity**	**Low intensity**	**Moderate intensity**	**High intensity**
	Impact Score	1	2	3	4
	Defining Limit	when resulting in changes in the environmental baseline conditions is minimal	when resulting changes in the baseline conditions is experienced in the immediate surroundings	when resulting changes in the baseline conditions or alters the baseline conditions in the surrounding area	when changes resulting in the baseline conditions are significantly modified
	Remarks	However, it shall be reconsidered where the baseline values are already high.	For ecology it refers to minimal changes in the existing ecology in terms of their reproductive capacity, survival or habitat change	For ecology, it refers to changes that are expected to be recoverable	While for ecology, high changes that result in serious destruction to species, productivity or their habitat

Apart from the criteria mentioned above some other parameters considered which are more qualitative in nature, these being Consequence of Impact and Likelihood (Unplanned situations).

A significance assessment matrix was developed to assess the impacts based on the appraisal criteria developed above, which is as given in the table below:

Table 8-2: Impact Significance Criteria

Impact Parameters			**Integrated Score**	**Category of Severity/Significance**	
Spatial Scale	**Duration**	**Impact Intensity**		**Scores**	**Severity**

Insignificant / Site (1)	Insignificant/ Short Duration (1)	Insignificant intensity (1)	1	1	Almost Unnoticeable like (Insignificant Impact)
Limited/ Medium (2)	Medium Duration (2)	Low intensity (2)	8	2-8	Impact of Low/Negligible Severity (Minor Impact)
Area/High (3)	Long Duration(3)	Moderate intensity (3)	27	28-64	Impact of Moderate Severity (Moderate Impact)
Regional/Significant (4)	Permanent/Multiyear (4)	High intensity (4)	64	28-64	Impact of High Severity (Major Impact)

Integrated Score Calculation:
It is the sum of the three scores. (Spatial Scale x Duration x Impact Intensity)

8.4 Impact Identification

The available information such as project description, proposed activities, and social and environmental baseline data was processed to assess the project impacts. The assessment not only includes the data available through secondary sources but also involves direct environmental baseline data and data procured through social survey and consultations.

The below table shows the impact of various activities during the project lifecycle on the environmental & social components.

Table 8-3: Impact Matrix

Social and Environmental Aspects / /Project Phase and Activities	Land use	Ecology	Cultural heritage	Ambient Air Quality	Surface water	Soil and ground water	Ambient Noise levels	Socio-Economic	Health and Safety	Visual
Planning Phase										
Mast Installations										
Micrositing of WTG locations										
Power evacuation planning process										
Road capacity assessment leading to WTG sites										
Land acquisition process										
Construction phase										
Access road and pathways construction										
Site clearance activity										
Transport & Storage of Construction Equipment										
Transport & Storage of Construction Material										
Erection of Batching Plant										
Foundation excavation and construction										
Transit Storage for WTG parts and other equipment										
WTG parts transport to site										
Erection and commissioning equipment transport										
Transformer yard construction and erection										
Transmission line – Pole laying and line erection										
Commissioning of WTGs										
Operation and maintenance phase										
Routine maintenance										
Major Maintenance Activities at individual WTGs										
Operation and maintenance of ancillary facilities										
Maintenance of transmission lines										
Maintenance of Projects' road network										

Decommissioning										
Uninstallation of WTGs and ancillary facilities										
Clearing transmission lines										
Return intra-site access roads										

The potential impacts on the environment from the proposed expansion activity are identified based on the nature of the various activities associated with the operation and also on the current status of the environmental quality at the project area and its surroundings. Both beneficial (positive) and adverse (negative) impacts are considered.

The Impact assessment has been developed based on the individual activities during the various phases of the project activity. The phases being:

i) Pre-Construction Phase (Planning Phase)

ii) Construction Phase

iii) Operation Phase and

iv) Decommissioning Phase

8.4.1 Pre - Construction Phase Impact Assessment

The pre-construction phase is the stage includes all the activities as listed in the ***chapter 3*** of the report.

Below, in this section, the assessments of the likely impacts anticipated during this phase are detailed:

- Siting of the Project & associated facilities
- Land procurement process
- Site clearance

8.4.1.1 Siting of Project and associated facilities

This particular stage includes activities like; Wind resource assessment/siting of WTGs, access roads and transmission lines. This phase also includes resource planning by the contractor. The project is under construction and the micro siting has been carried out few months back and all the locations have been finalized.

The locations and layout of the project was finalized taking into consideration the wind resource assessment, resource availability, environmental and social factors. The environmental and social factors were key in choosing the individual sites in a way as to keep safe distance from settlements and strategically distanced from the existing roads so as to avoid additional road construction and avoid any disturbance to the local community.

Impacts

Visual Aesthetics

The project WTGs are scattered, this will impact the visual Aesthetics of the site. There will be a significant change to visual quality of the area resulting from development or change in land use that will alter the landscape. Changes in the visual landscape will range from construction phase to commissioning of the turbines and further during operations.

Land Use

All the WTGs are planned on private land and most of which is agricultural land. So, the project will result in change of land use. However, the region has record low level of production per acre of land and some patches of land are not cultivated for the same reason. As the vegetation in the project region is relatively very low, grazing activity for cattle and other livestock is severely limited.

Social/Livelihood Pattern

Land purchase from farmers will impact the livelihood of the farmers. In particular, the marginalized farmers will have severe impact. Also if any basic amenities or infrastructure which the community or farmer is using, will no more be available their use the after the land purchase.

Mitigation Measures

The impacts due to siting activity are anticipated to be minor as the project developer has incorporated adequate efforts during the planning phase itself. The following additional mitigation measures are suggested:

- Visual impact shall be considered while finalizing the layout for access roads/transmission lines by avoiding proximity to households, habitation, dense vegetation etc.
- Only required land parcels shall be acquired and no more than technical requirement shall be purchased to avoid any further impact on the Land use.
- Special care has been taken by the land aggregator to not approach any marginalized farmer. Purchase of land is restricted to large farmers who will have little impact due to erection of WTGs.

Impact Value

The impact due to siting of project and its associated facilities on different environmental and social components has been presented in the table below:

Impact Value – Siting of Project

Aspect	Scenario	Spread	Duration	Intensity	Overall
Siting of project	***Visual Impact***				
	Without Mitigation	Local	Short	Moderate	Minor
	With Mitigation	Local	Short	Low	Minor
	Land Use				
	Without Mitigation	Local	Moderate	Low	Minor
	With Mitigation	Local	Short	Low	Minor

	Social /Livelihood				
	Without Mitigation	Local	Short	Moderate	Minor
	With Mitigation	Local	Short	Low	Minor

8.4.1.2 Procurement of Land

The proposed project activity needs land for WTGs, transmission lines, access roads and storage yard. The proposed project comprises of 50 WTGs and an area of about 2.5 acres - 3.0 acre is required for each wind turbine. The total land area procured for the project is about ~160 acres for WTGs alone. In addition to this 10 acres for access road, 10 acres for transmission lines is required. Gamesa has leased another 5-10 acres for storage yard and purchased 10 acres for pooling substation both of which being common facility for other upcoming wind farms in the region. Majority of land identified for the project comprises of agricultural land which is all private land only. The private land is procured on willing seller – willing buyer basis and the price is determined based on negotiations. It is ensured that the price paid to the farmers is higher than the market price of land in the region.

The Pooling substation is located in Nimbagalu villages where a total of 10 acres of land is purchased for erection of PSS. The transmission lines are spread over a length of 11 kms till the PSS, however, the land requirement for transmission line is significantly less as it is limited to the area required for the foundation of pylons.

Impacts

Social/Livelihood Pattern

Though the overall land requirement of the project is significant; however it is scattered across several individual landowners, hence rendering the impact relatively small on each landholder. The land involved in the project is mostly agricultural land which is currently used for rain-fed agriculture and it will be kept unutilised except the monsoon time. So, the proejct will have limited adverse impact on the project. However, the impacts are limited as it does not involve any physical displacement associated with the land for WTGs. Also, many of the land patches are not cultivated continuously due to the very low yield in the region. Further, the grazing for cattle and livestock is very limited due the sparse vegetation in the region; this reduces the possibility of possible impact of construction on any grazing activity.

Mitigation Measure

- Land is purchased from medium level landholders and not small/marginal landholders.

- Counselling of the land owners for better utilization of compensation amount and make rewarding investments.
- Preference in employment in the project to families who sold land subject to their suitability for the job
- Procuring resources from the local sources that would induce more employment in supply chain
- Only the central area comprising of the wind turbine generator and transformer will be fenced. All the remaining area shall be left open for grazing activities;
- Details of transmission lines and access roads to the WTGs shall be discussed with the affected families and the community;
- All private land procurements for associated facilities should consider the increase in land rate and compensate proportionate to the increase in price.
- ANPWPL to implement the community grievance redressal mechanism for ensuring that people residing in the nearby areas have the provision of reporting any project related issue to site staff during construction and operation phases. The action should be undertaken in a time bound manner.
- Timely redress of grievances through an effective and transparent grievance mechanism pertaining to compensation provided and negotiations undertaken is vital to completion of the project on schedule

Impact Value

As evident above, the impact on social components from land procurement will have a localized impact with medium duration and a low intensity after mitigation measures are employed.

Impact Value – Land Procurement

Aspect	Scenario	Spread	Duration	Intensity	Overall
Procurement of land	***Social/livelihood pattern***				
	Without Mitigation	Medium	Short	Moderate	Moderate
	With Mitigation	Local	Medium	Low	Minor

8.4.1.3 Site Clearance

Site clearance is the activity to clear any obstacles at the site for erection of the WTGs and ancillary facilities. The project sites are free from vegetation and large trees and hence there will not be any clearance of existing vegetation at site. The site clearance will be limited to leveling of the project site area where ever necessary. The site clearance will be required for access roads to site, pooling substation, to enable movement of machinery and storage of construction material.

Impacts

Ecology

The land clearance activities for the construction activities lead to removal of vegetation, habitat disturbance for resident birds and mammals.

However, there will be near to no considerable effect on the vegetation at site as the site region is predominantly tress less and sparse on vegetation. Site clearance is also not supposed to have any indirect impact on the habitat for small mammals and birds. It was observed that the site does not support any dense ground vegetation. The locations identified for the wind turbine generators does not comprise of any trees in the immediate vicinity. Hence the impact on ecological environment is assessed to be minor for this project.

Soil Quality

The impact of the site clearance activities will involve site leveling and grading. The details are as provided below:

- The removal of vegetation may result in loose soil at site. However, as observed the site is very low on vegetation. The area being a high wind zone will result in loss of soil and generation of dust;
- The activities of site clearance may result in increased loss of surface soil and lead to run offs/nutrient loss;
- Movement of heavy vehicles may enhance the compaction of soil and disturb the original stability along the slope. This can further add to soil erosion;

Mitigation Measures:

- The clearance of vegetation shall be carried out along a radius of 20 m around each turbine location while the entire area procured for each wind turbine may not be cleared. The site clearance for access road and ancillary facilities shall be restricted to the necessary footprint area only;
- Vegetation shall not be removed from the 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;
- Areas shall be re-vegetated at the earliest.
- Artificial continuous light source should be avoided near the WTG area as they attract the prey (insects). If light source are to be used blinking or pulsing lights are recommended.
- Flash lamps on the WTGs will prevent bird collision at nights.
- Regular checking of the vacuums or holes in the towers to avoid nesting facility of any of the birds; and

- Bird mortality count in the immediate vicinity is proposed to establish a strong link between the wind turbines and birds mortality for two years starting from the commissioning of the wind farm;
- The transmission poles should be raised with suspended insulators in order to reduce the electrocution of bird species; and
- Bird-safe strain poles[5] require insulating chains at least 60 cm in length should be adopted.
- The site clearance activity to be completed in non-windy season so as to avoid impact of dense wind and monsoons.
- The existing roads shall be utilized as far as possible;
- Localized water sprinkling shall be done at areas where vegetation is removed for the entire construction period;
- Any shallow soft rock encountered during excavation for the foundation, shall not be mixed with the topsoil;
- The potential for soil admixing shall be mitigated through the stripping of topsoil from any area which requires grading and the storage of the topsoil separately from the subsoil for reuse during rehabilitation of the site;
- The construction activities shall be scheduled to minimize the time period between topsoil storage and reclamation;
- The roads shall be provided with adequate drainage facilities;
- Depending on the orientation of the towers, staging area shall be planned to enable erection of more than one tower from one staging area.
- Movement of vehicles shall be restricted to planned roads to avoid unwanted disturbance to soil;

Impact Value

After implementation of adequate mitigation measure the activities will have a localized impact with medium duration and a low intensity after mitigation measures are employed.

Impact Value – Site Clearance

Aspect	Scenario	Spread	Duration	Intensity	Overall
Site Clearance	***Ecology***				
	Without Mitigation	Medium	Short	Moderate	Minor
	With Mitigation	Medium	Short	Low	Insignificant
	Soil Quality				
	Without Mitigation	Medium	Short	Moderate	Moderate
	With Mitigation	Medium	Short	Low	Minor

5 https://wcd.coe.int/ViewDoc.jsp?p=&id=1493445&Site=&BackColorInternet=B9BDEE&BackColorIntranet=FFCD4F&BackColorLogged=FFC679&direct=true

8.4.2 Impact Assessment – Construction Phase

8.4.2.1 Construction of Roads and Transportation

In construction of a wind power project one of the early steps is to create accessibility to the project site. Since the project's individual WTG location is away from the existing roads, construction of roads will be the foremost activity so as to allow transportation of turbine components and to facilitate carrying out of operation and maintenance activities once the project is commissioned. The un-paved access roads will be required to access each turbine location and the substation from existing public roads during the construction, operation and decommissioning phases of the project. Where possible, existing road alignments will be upgraded and used to minimise the requirement for new road footprints to be created. The construction of roads shall involve the following activities:

- Route determination
- Operation and Movement of heavy vehicles along the planned transmission line
- Transportation and Unloading of construction material
- Requirement of material & utilities such as water, power, sanitation facilities
- Handling and Disposal of construction wastes;
- Parking of vehicles in open fields and other non-project locations;

Impacts

Transportation and Traffic

Construction requires large cranes and the delivery of turbines by highway, this could cause traffic delays, aggravation and damage to roads. There will be additional traffic on the existing roads till the point where internal roads start as the construction activity will require movement of material and equipment to the site frequently. Such movement of vehicles will have the following impacts:

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

The traffic in internal areas after Uravakonda is very sparse. The road connecting Anantapur-Uravakonda-Guntakal is broad enough to accommodate large loads without congestion. The

additional truck movement for transportation of materials will be spread over a period of about couple of months of construction phase. The proposed project will thus not have any significant impact due to construction of roads on the traffic and transportation of the region.

Health & Safety

The road construction activity will involve excavation and levelling of site. The following health and safety problems are identified in road construction and transportation:

- Changes in environmental quality due to construction activities
- The principle physical hazards associated with the activity is operating machinery and moving vehicles.
- Risk of accidents
- The chemical hazards can be associated with exposures to dust during construction and paving activities; exhaust emissions from heavy equipment and motor vehicles.
- Increased prevalence of disease arising from the influx of workers

The project region is predominantly plain agricultural land and does not involve elevated or sloppy areas. Due to this, it is assumed that there is negligible risk from rolling objects and heavy bolder movement.

Community & Social

During the construction of roads, common property resources will be used which will have direct impact on the local Community health and safety. The key issues will include dust, vehicular emissions, noise and vibration from construction vehicle transit. Other identified impacts have been listed below:

- Risk to livestock due to increased vehicular movement.
- Use of open fields (non-project land) for parking vehicles
- Increased traffic and resultant congestion in internal roads.
- Disturbance from traffic movement during night time;

The construction of roads will be a short duration activity spread over couple of months, the contractors will be required to follow a strict health and safety plan and therefore the impact on community health and safety is assessed to be minor.

The construction of roads will be a short duration activity spread over couple of months, the contractors will be required to follow a strict health and safety plan and therefore the impact on community health and safety is assessed to be minor.

Soil & Water

Construction of roads may have the following impacts:

- Accidental spills or leakage of oil/petroleum products could end up into the drainage channels and finally into other water surface bodies
- Movement of heavy vehicles can enhance compaction of soil as well as disturb the original stability along the terrain, this can further add to soil erosion;
- Oil spills from construction machinery and vehicles during re-fuelling at construction site can contaminate the storm water and soil;
- Disturbance of ground surface can also result in increased loss of soil with surface run offs leading to nutrient loss and degradation of water quality in nearby water bodies;
- Dispersal of construction material due to wind, leading to contamination of soil in the areas in proximity to wind farm and along the road;
- Random disposal of excavated soil and construction debris in nearby fields and private land.
- Significant quantities of rock and soil materials may be generated from earth moving during construction activities;

Air Environment

Dust released during the excavation and levelling operations is the key source of suspended particles during road construction. There are no significant emissions from this activity except for exhaust from vehicles which is the sole source of direct emissions.

Noise

Due to movement and operation of vehicles, the construction activities will result in noise generation. Considering the scale and duration of the project activities, the incremental noise from construction of roads is not expected to be significant. This disturbance is expected to have only a minor impact on the noise environment as most of the access roads and WTG locations are away from settlements.

Ecology

The construction of roads is carried out in restricted area which will not involve any major site clearance activities or modification of slopes or destruction of habitats during the construction phase of the project. The impact on ecology due to construction of roads is restricted to destruction of terrestrial habitats along the proposed route. Due to the limited area of activity, it will not have any significant impact on the ecology of the region.

Mitigation Measures

Transportation & Traffic

- The existing roads should be used to the extent possible and construction of new roads shall be limited to situation unavoidable.
- Further, the routes for transport of construction material for road development shall be done based on a survey of the existing road conditions.

- Routes shall be planned along wider and less-restrictive roads.
- 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.
- All vehicles engaged for transportation will be verified for fitness.
- The transportation shall be undertaken on appropriate time considering the traffic of the road in any location.
- Any incidence of breakdown will be attended immediately to ensure smooth flow of vehicle along the road.
- Movement of vehicle will be restricted to the identified routes and only trained drivers shall be employed.
- Advance public notice should be made to local residents and the business community.
- Repairs to public roads be carried out if any need arises

Health & Safety

The following measures shall be adopted to ensure safety of workers involved in road construction:

- Keep a low maximum speed limit in work zones;
- Maintenance of work vehicles and machinery to minimize air emissions;
- Proper training of workers in safety issues related to their activities, such as hazards of working on foot around equipment and vehicles;
- Readiness drill for identifying & responding to potential hazardous conditions
- Measures to reduce the prevalence of diseases will include screening of workers, undertaking health awareness among communities, implementation of vector control programs and avoiding presence of unsanitary conditions.

Community & Social

The following measures shall be adopted:

- Construction activities to be completely avoided during night-times;
- Avoiding or minimizing project transportation through community areas;
- Alternative routes are to be provided in cases where a main road is being modified.
- All road related works to be planned and swiftly completed to avoid inconvenience to road users
- Maintenance of the road to prevent mechanical failure of vehicles due to road conditions;
- Development of new roads and widening of existing roads (corners) will be discussed with the community and undertaken only after all concerns and compensations (if applicable) are addressed;
- Any concerns regarding damage to roads and associated structures (if any) will be addressed prior to use of village road;
- Consultation with local people to finalize the alignment especially to decide location for culverts, drainage structures and other community resources;

Soil & Water

The following measures shall be adopted:

- Any soil piles should be maintained at least 50m away from natural drains and 100m away from water bodies.
- The drainage pattern of the area shall not be disturbed during construction to the extent possible;
- Excavation activities shall not be carried out during months of heavy rainfall;
- Drainage around the road to be designed in a way as to avoid direct impact of run-off water.
- Run off control measures such temporary bunding around storage of construction material, silt traps etc. shall be employed;
- During site levelling operations, it shall be ensured that the length and steepness of slopes is minimized;
- The area around the WTG locations shall be re-vegetated as early as possible;
- All construction material stored at site shall be covered and or kept wet on surface to avoid dispersal with wind;
- All vehicles carrying construction material shall be covered;
- Construction debris and excavated material shall be used for filling up of low lying areas.
- All vehicles carrying construction material shall be covered;
- Water conveyances shall be provided for all permanent and temporary roads to be constructed for the project;

Air Environment

To supress dust and suspended particles, localized sprinkling of water at areas where vegetation is removed shall be undertaken for the entire duration of construction

Noise

The landscape of the region is not hilly and blasting activities might not be required. In case of need blasting shall be limited and controlled so as to prevent noise and vibrations. Adequate precautions and information shall be provided prior to execution of any blasting activity. Portions of site shall be fenced temporarily during construction to avoid movement of grazing animals and local people.

Ecology

The project region is very low on vegetation and is predominantly treeless at most of the sites. The road construction will not involve any significant vegetation clearance. If vegetation is required to be cleared it will be restricted to the area where construction will happen and not any area surrounding it.

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Impact Value

The impact due to the construction of roads on various environmental and social components has been presented below.

Impact Value – Construction of Roads

	Scenario	Spread	Duration	Intensity	Overall
Construction of Roads	***Transportation and Traffic***				
	Without Mitigation	Medium	Short	Moderate	Moderate
	With Mitigation	Medium	Short	Low	Minor
	Health and Safety				
	Without Mitigation	Local	Medium	Moderate	Moderate
	With Mitigation	Local	Medium	Low	Minor
	Community and Social				
	Without Mitigation	Medium	Short	Moderate	Moderate
	With Mitigation	Medium	Short	Low	Minor
	Soil and Water				
	Without Mitigation	Medium	Short	Moderate	Moderate
	With Mitigation	Medium	Short	Low	Minor
	Air Environment				
	Without Mitigation	Medium	Short	Moderate	Moderate
	With Mitigation	Medium	Short	Low	Minor
	Ecology				
	Without Mitigation	Medium	Short	Moderate	Moderate
	With Mitigation	Medium	Short	Low	Minor

8.4.2.2 Erection of WTG's

The erection of WTGs will be carried out as per the project schedule mentioned in the ***chapter 3*** of this report. It is evident that the erection and commissioning time for each WTG is short and will have impacts for a very short period of time. The Erection and commissioning of the WTG's shall involve construction activities like establishment of foundation for the tower support, construction of transformer pad, welding of tower components, installing the turbine components and erection of towers. Wind turbines comprise of large components. Few activities and impacts associated with construction of WTGs will be similar to the impacts associated with construction of roads and hence have not been discussed again. Impacts which are not covered in the construction of road and are exclusively associated with erection of WTGs are discussed in the following section.

Impacts

Traffic & Transportation

The impact of traffic will be similar to that of the impacts already discussed under construction of roads. However, with exception that during erection, extra-large components are transported to the site and proper planning is required to avoid acute congestions in case of failure to estimate and properly plan route.

These vehicles can cause damage to the road infrastructure, culverts, bridges, drainage structure, poles, signboards etc. The movement of oversize structures will be slow and can lead to blockade of traffic and congestions at crossing and turns. The breakdown of vehicles and unplanned halt along the road can lead to traffic blockade and discomfort to community. Protrusions and edges of components being transported can lead to damage of road side structures and can lead to accidents.

Ambient Air Quality

The air quality is impacted due to the emissions from transport vehicles and other equipment at the site which will release emissions. Apart from emissions, the activity of construction, will result in generation if dust and fine particles. Due to wind the dust may get carried away and any settlements near to the construction activity and the workers may be impacted.

Ambient Noise Quality

The key source of noise during erection activity will be from operation of cranes, Diesel Generators for power generation and fabrication processes. The above mentioned activities shall generate noise and vibration; although in small- scale it may scare away the grazing animals around the site. Noise will also be generated from operation of construction and mixing machineries. Blasting activities for foundation of towers may also be involved which is carried out will have impact beyond few hundred meters of the site location.

Soil & Water Quality

Installation and erection of WTGs will have moderate impact on the soil and surface water. During the erection, there is there is a possibility of contamination of the surface waters due to runoff from the site or domestic water runoff from the portable toilets. Improper disposal of construction debris and excavated soils can cause soil and water contamination at the project vicinity along with the potential sediment to flow into water bodies. Improper disposal of package material, boxes, plastics, ropes etc. can lead to littering in the area.Oil spillage from the storage of fuel at project site can cause contamination of soil and water resources. Fuel will be stored at site for maintenance and smooth operation of machineries. Soil contamination can also result from leaks and drips from machinery and vehicles at site.

Occupation, Health & Safety

The construction of wind power project will involve a range of activities that could potentially be unsafe to workers and the local community without mitigation measures. This would involve working at heights, excavation for wind turbine foundations, use of pneumatic drills for cutting

through hard rock, working at heights, trenching, etc. Other occupational risks associated with erection of WTGs may include physical injury during handling of wind turbines, trip and fall hazards due to improper storage, loading and unloading of turbine components etc. Such activities require the use and operation of heavy-duty earth moving equipment, machinery and vehicles.

Mitigation Measures

Traffic & Transportation

Wind turbine components are defined as abnormal loads that will be transported to the project site from various locations. Gamesa has carried out a detailed analysis for movement of these components. Appropriate vehicles will be used to transport the components; as, it would reduce the chances of toppling and jams. These load carrying vehicles will move carefully and slowly to ensure that the wind turbine components are not damaged during transportation. The pace of movement may cause temporary jams in internal roads and the public will be kept aware about the movement to avoid inconvenience. Any incidence of breakdown shall be attended immediately to ensure smooth flow of vehicle along the road.

The general conditions of the road, width, intersections, height restrictions, load restrictions of existing bridges etc will be considered well before starting the transport. Where road widths are insufficient, either temporary widening of the road with gravel or full depth widening of the pavement structure shall be undertaken. Every vehicle shall have adequate number of helpers to ensure that the components reach safely and jams are avoided at every possible point.

The transport process will be undertaken in accordance with the Traffic Act and other relevant road laws in India. Subsequently it is anticipated that most impacts will occur during the construction phase of the project.

Ambient Air Quality

Soil from excavation actives shall be kept covered at all times. All excavation actives shall be carried out in controlled manner in order to avoid unnecessary excavation. To prevent dust generation, frequent sprinkling of water at all the location with construction shall be carried out

Ambient Noise Quality

- Work together with the local community in the project area and provide prior warning when a noisy activity is to take place; this will reduce the probability of the impact.
- Noise prone activities will be restricted to the extent possible during night time 2200 to 0600 hours to reduce the noise impact
- Wherever possible all construction plant and equipment shall be fitted with silencers.
- Noise emission characteristics of equipment shall be considered when selecting equipment for the project and, select the least noisy machine available to perform the specific work
- Provision of make shift noise barriers near high noise generating equipment to minimize horizontal propagation of noise
- Construction vehicles to be well maintained and minimize idling time for vehicles when not in use;
- Noise protective gear should be provided to the personnel working around equipment.
- Ensure that the 750m buffer zone is maintained between a wind turbine and the nearest household
- Decrease traffic speeds and use well maintained vehicles

Soil & Water Quality

- The construction plant and equipment is to be maintained in a good state of repair with minimal leaks.
- Additionally storage of chemicals and hydrocarbon products shall be in bunded areas of sufficient capacity.
- The waste generated in course of time shall be sold to an approved vendor at an interval of three months.
- Measures shall be incorporated to minimise the waste generation. All packaging material shall be collected at the storing area and sold to vendors.
- Construction debris and excavated material shall be used for filling up of low lying areas and for foundation works of the associated facilities.
- Refuelling of project machinery & equipment shall only be done by trained personnel at designated, bunded areas of hard-standing that are situated a minimum of 50m from surface water bodies.
- A spill tray and an emergency response spill kit will be brought onto the site with the mobile fuel bowser during refuelling operations
- Personnel operating machinery or vehicles on the site will be trained in the use of these emergency spill kits.

Occupational Health & Safety

It shall be ensured that Occupational Health and Safety (OHS) requirements are observed at all times during the construction and erection of the project WTGs. The key aspects of OHS to be taken care of during the erection of WTG are:

- Trained Professional: All project equipment shall be operated only by well trained professional. Any activity of loading and unloading and erection shall be under supervision of experienced and trained professionals.

- Medical Fitness: All personnel working at the site shall periodically undertake health test to ensure that that they are fit to work under the demanding conditions of site.
- Protective Gear: The access to site shall not be allowed without protective gear. The personnel working shall be relevant gear as per their job profile viz, gloves, helmets, ear muffs, safety belts etc. Personal safety gear shall include fall arrest systems for those working on heights.

- Machinery & Equipment: The equipment used shall be is best of conditions and operating directions, load capacities shall be clearly mentioned on all machinery.

- Storage of Turbine Components: All components shall be clearly labelled and stored in the safe guarded areas. The storage plan shall ensure that ingress and egress of these large components is carried out with ease.

- Fire Control: The staff shall be trained to deal with event of fire and accidents. Arrangement for fire control measures shall be made available at site.

- Emergency Contacts: Display of emergency phone numbers of the city/local fire services, ambulances, police etc. shall be clearly displayed at number of places at site.

Impact Value

The impact on environment and social components from erection of WTG's will have a localised impact for a short duration and a low intensity after mitigation measures are employed.

Impact Value – Erection of WTG's

	Scenario	Spread	Duration	Intensity	Overall
Erection of WTG's	***Ambient Air Quality***				
	Without Mitigation	High	Short	Moderate	Moderate
	With Mitigation	Medium	Short	Low	Minor
	Traffic and transport				
	Without Mitigation	Medium	Short	Moderate	Moderate
	With Mitigation	Local	Short	Low	Insignificant
	Ambient Noise Quality				
	Without Mitigation	High	Short	Moderate	Moderate

	With Mitigation	Medium	Short	Low	Minor
	Soil and Water Quality				
	Without Mitigation	Medium	Short	Moderate	Moderate
	With Mitigation	Medium	Short	Low	Minor
	Occupational, Health and Safety				
	Without Mitigation	Local	Short	High	Moderate
	With Mitigation	Local	Short	Moderate	Minor

8.4.2.3 Labour Engagement

The construction phase of the project activity will require maximum number of labourers. During the peak of construction phase the requirement can be in the range of 150-200 workers. The construction activities for the project will be undertaken by Gamesa and will be distributed to sub-contractors. As the construction activity involves skilled work as well, there will be a number of skilled migrant labours working at the site.

Impacts

Expectations for Local Recruitment

The project inevitably will have expectation to raise temporarily recruitments. Large numbers of immigrant labourers can cause dissatisfaction among the local communities. Local communities make an important part in the projects stakeholders and any tiff with them can lead to delays.

Migrant Labour

Most of the migrant will fall under skilled labourer category. They will be accommodated at labour camps at site or in rented houses in villages. Their involvement can have the following impacts:

- Dispute with local labourers over right to opportunity and employment.
- Spread of diseases under poor hygiene and personal health care.
- Presence of large numbers the migrant labourers may also lead to increased use of community facilities such as health centres, temples, transport facility etc., leading to discomfort among local community.
- Conflict among workers based on cultural, religious or behavioural practices;

Mitigation Measures

Expectation of Local Recruitment

- Local labourers shall be engaged wherever possible without adversely impacting the skill level of construction team.
- Most of the requirement of labourers shall be fulfilled locally to ensure inclusion of locals in the project activity and avoid cultural conflicts.
- The project proponent shall ensure engagement of local labour in the construction activity, through contractual obligations. Community expectations for employment and other local benefits need to be addressed and managed. Adequate representation for local labour shall be decided by the GAMESA management and conveyed to the community. Regular updates on opportunities and skill requirements shall be provided to the community;
- Wherever, private land is procured from farmers whose livelihood is dependent on income from farming, it shall be responsibility of Gamesa/ANPWPL to employ a member of such family. In other cases, they can also be trained with Gamesa and be placed in an appropriate profession.

Migrant Labour

- Migrant laboueres shall me engaged in skilled profile only which cannot be fulfilled by local labours.
- The migrant labours shall me given a heads-up on the local community relations, grievances mechanisms etc.
- The contracts and sub-contracts shall ensure that the migant labourers are fully aware about their rights. This shall be done by introducing them to theie right and introducing them to labour laws and international guidelines on labour treatment.
- GAMESA to ensure that adequate sanitation and waste disposal facility shall be provided at project site
- The contractor shall undertake medical test of the workers engaged for the project to identify any communicable disease prior to engagement;
- The water usage shall be monitored and controlled to minimise generation of wastewater;
- Through clear contractual terms contracts and subcontractors shall ensure that there is absolute zero tolerance towards engagement of bounded or child.
- Locl businesses may be at gain due to inceased expenditure by the migrant labourers.

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.

Impact Value – Labour Engagement

	Scenario	Spread	Duration	Intensity	Overall
Labour Engagement	***Social Impacts***				
	Without Mitigation	Medium	Short	Moderate	Moderate
	With Mitigation	Medium	Short	Low	Minor

8.4.2.4 Construction Demobilization

Post completion of construction activity, demobilization will require removal of all temporary structures, used machinery, temporary workers.

Impacts

The key issue associated with demobilisation are:

- All the temporary jobs created during the construction will be lost.
- Disposal of useable material and waste may create environmental hazard.
- The temporarily increased income of the local business will drop to normal.

Mitigation measures

The mitigation measures for demobilisation shall include:

- Every worker shall be well aware about the period of their contract. This will help them plan their next opportunity well in advance.
- A systematic reduction in workforce shall prevent sudden rush of large numbers of workers looking for opportunity.
- There shall be no residue from the project activity left at the site. All material should be sent for recycling or disposed as per norm at the nearest disposal site.

Impact Value – Construction Demobilization

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

8.4.3 Impact Assessment – Operation Phase

Operational phase has considerably lessimpact on environment and local community when compared to construction phase. However, the fact that operational phase lasts for over 25 years makes it the most important phase of the project cycle. The impacts from operation of a wind power plant are far less of concern when put along with a conventional power plant. Below in this section, we have discussed thhe various onissues of concern:

Impacts on Ecology

The potential impacts of wind projects include the following:

- Habitat loss for small mammals and birds due to setting up of turbines and associated

- Facilities
- Barrage effect for migrating birds, causing a change of flight route;
- Collision of birds with rotating blades or static elements;
- Increased risk of fires at the site due to failure of machinery or transmission line

The nearest breeding locations of migratory birds are considerably far from the study area. The project site does not also fall in any of the identified migratory pathways of the Indian sub-continent. There are a few seasonal water bodies which may spring up during monsoon and may attract limited number of birds. However, there are no large water bodies which have been oberverved to attract scheduled birds or migratory bords in the region. Further, the study area does has very poor vegetation density or forest cover to provide roosting /nesting areas.

Dispatches by Collision

The only way birds are directly impacted by a wind tubine is through collision with moving rotors. The collision rates are higer in the region where water birds are observed or in habitats of birds with large wing span. The most important foctors deciding a bird hit are the size of the bird, the breadth and pitch of the turbine blades, the rotation speed of the turbine and the flight speed of the bird.

A number of studies have established the fact that though bird strikes are oberseved even at windfarms with low bird habitats, however, the number of such incidences is low and other obstacles like buildings, coounication towers and power lines pose a greater threat.

There is no habitat with significant bird population or protected species in the region. There are no migratory bird routes via the project location.

The study are has few seasonal water bodies and a water tank in the village of Amidayala. During the ecological survey it was observed that the tank does not attract any considerable number of birds in the region. Further the tank is over 1000m away from the nearest turbine. Few small water bodies were observed to be present in the project area. The seasonal water bodies are not likely to serve as bird staging or nesting area.

The distribution of wind turbines in a large area make puts the risk of a real collision at low. A linear layout of turbines leads to formation of walls and restricts bird movement. The barrage effect of wind parks can prevent migrating birds from following their airways and can restrict the movement of local birds as well. After construction, local birds can become accustomed to the turbines.

It was also observed that during community consultations, locals did not report presence or sightings of any large or special birds in the area.

Mitigation Measures

The following measures shall be adopted:

- The turbines shall me distributed in a way as to not restrict the movement of birds which would also prevent he risk of hit;
    - Due to their size, the smaller birds do not pose a significant threat from the turbine however; birds such as raptors and water birds are more prone to collision risk. Hence, it shall be resured that there is no water logging near to WTGs and further there are no food sources which attract these birds.
- Underground wriing shall be adopted wherever possible such as between the WTGs this will prevent any eletrcution and also help in free movement of birds.
- Insulated above ground wiring will be provided; Daytime visual markers shall be provided on any guy wires used to support towers to enhance visibility of towers for bird;
- Operation of any lights which may attract insects shall be avoided near the turbines as it may attract birds. In case the use of lights is unavoidable pulsing lights or blinking lights are to be
- Flash lamps on the WTGs will prevent the collision at nights.
- Any dead animals/carcass shall be removed in time from the site so that it does not attract movement of vultures;
- Regular checking of the vacuums or holes in the towers to avoid nesting facility of any of the birds
- The transmission poles should be raised with suspended insulators in order to reduce the electrocution of bird species
- Bird kill monitoring shall be conducted at regular intervals by GAMESA. The project will keep record of any bird hit observed during its operation.

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.

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

- Avoid crowind around and handle the bird quietly and calmly to avoid adding to its stress.
- 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.

Impacts by Noise

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 proposed project using the WindPro software latest version available for the design and planning of wind farms. WindPro 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.

The proposed wind farm will comprise of 50 number of Gamesa G97 IIIA Model with 2 MW rated capacity. The ISO 9613-2 General noise calculation model was used which considers frequency dependant attenuation due to geometric divergence, atmospheric absorption, and ground effect. The model is valid for downwind propagation under a well-developed moderate ground based temperature inversion, which are conditions favourable to noise propagation from source to receiver. The modelling exercise has been undertaken considering the average wind speed at the project site which is 6, 8 & 10 m/s. Nearest **WTGs G1-45** at Amidyala Village.

Table 8-4: Resultant Noise Levels

Receptor Name	Distance from nearest WTG	Baseline dB(A)		Incremental due to Project dB(A)	Additional Exposure dB(A)	
	km	Day	Night		Day	Night
Amidyala 1	820m from WTG G1-45	Ref baseline	Ref baseline	None	None	None

CPCB Day time Standards: 55 dB(A); CPCB Night time Standards: 45 dB(A)

The results indicate that there will be no incremental noise at the receptor locations. The nearest of settlements will also not have any increase in noise levels during both day and nights.
The noise levels during both day and night time are well within the prescribed CPCB standards at all the locations. Further, the results from the modelling exercise indicate that there will near to none

impact on the baseline noise levels as the nearest WTGs to settlement (*Amidyala*) is **G1-45** which is at a distance of more than 820m. Hence, none of the WTGs location needs any shift in position.

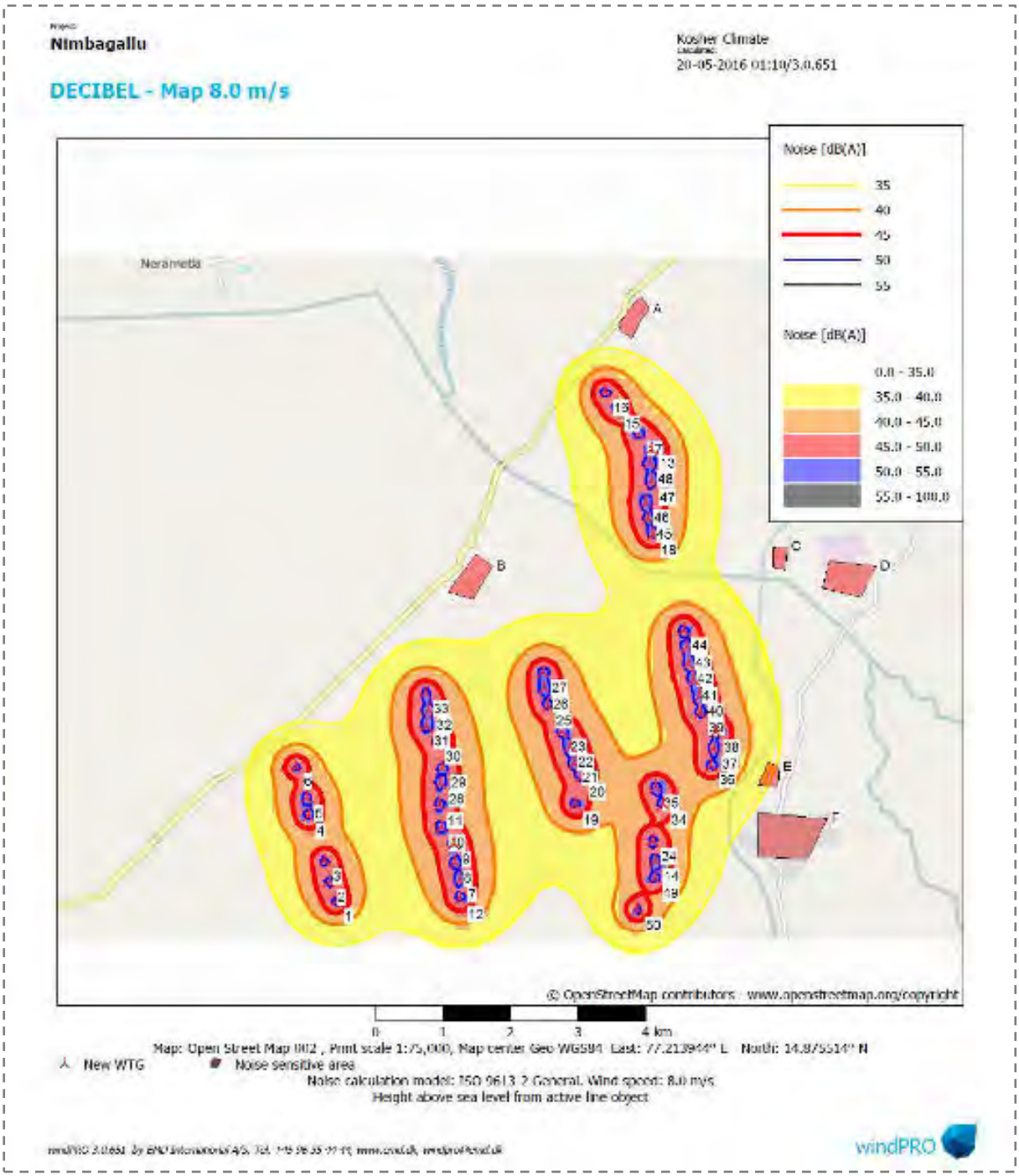
Figure 8-2: The Noise Levels at various receptors

Sound Level

Noise sensitive area				Sound Level
No. Name	Longitude	Latitude	Z [m]	Max From WTGs [dB(A)]
A Noise sensitive area: (Renumakulapalli)	77.231371° E	14.917653° N	460.3	33.0
B Noise sensitive area: (Nimbagallu)	77.209343° E	14.882418° N	467.6	32.0
C Noise sensitive area: (Indravathi)	77.250740° E	14.886739° N	473.9	31.2
D Noise sensitive area: (Mopidi)	77.257607° E	14.883914° N	462.9	28.9
E Noise sensitive area: (Amidyala)	77.249413° E	14.859013° N	470.0	36.4
F Noise sensitive area: (Amidyala 2)	77.248638° E	14.853499° N	471.2	34.3

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 8-3: Cumulative Noise Modelling



Transmission lines Noise

The phenomenon of 'Corona Discharge' (a limited electrical breakdown of the air) is well known to creat a continuous low hissisng sound. This is caused due to a limited electrical breakdown of the sir which comes in contact with energised overhead lines. 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. 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. Furthermore, noise due to Corona Discharge is negligible for transmission lines up to 220 kV grade.

Mitigation Measures

It is evident from the analysis abouve that there is no impact predicted due to noise, the following mitigation measures shall be considered to further limit any concerns of habitations in the vicinity.

- Limit the cutting/clearing of vegetation surrounding the proposed substation.
- Wind turbines shall be designed in accordance with the international acoustic design standards;
- Keep turbines in good running order throughout the operational life of the project
- through routine maintenance;
- Operation and Maintenance staff to be provided with personal protective equipment (PPEs) such as ear plugs and ear muffs when working close to turbine in operation;
- Undertake ambient noise level monitoring on an annual basis in order to understand the increase in noise levels due to the project operation; and
- The greviance registered shall be accessible to the households surrounding any WTGs. This shall ensure record & resolution of complaints regarding operational noise;

Visual Impact

Visual resources refer to all objects and features 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.

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 locations and among various segments of the population.

Visual contrast with the existing landscape is often unavoidable because of the size and typical location of wind farms. Nevertheless, there are some measures when incorporated during desing can greatly minimize the effect adverse visual impact.

Mitigation measures

- Plantations near settlements which can buffer or screen the view to a certain extent
- The baldes can be painted with an antireflective paint coating to mitigate the possible impact of light reflection/ blade glint.
- The current layout of the project WTGs is scattered and in distanced from one another. This is a minimalistic approach.
- All the wind turbines will have uniform visual characteristics such as colour, size, and design of turbine. A visual assessment for the proposed project was also carried out.
- An average elevation difference of 100m further diminishes the potential for viewing the towers against the existing landscape. Elevation difference between WTG location and settlement will reduce the visual intrusions of the wind turbines against the existing landscape.
- Signage related to the Wind Farm must be discrete and confined to entrance gates. No other corporate or advertising signage, particularly billboards to be displayed on site;
- The footprint of the operations and maintenance facilities, as well as parking and vehicular circulation, should be clearly defined, and not be allowed to spill over into other areas of the site;

Impact on Water Quality

During operational phase, the water requirement will be very small. The drainage and sewerage system will be provided for the collection and disposal of waste water at SCADA building and substation areas. No wastewater discharge on open land will be practised

The soil and ground water contamination could occur during operation phase at storage area and substation areas. Whereas at WTG location, chances of contamination are restricted to regular maintenance activity period. The storage area will be provided with secondary containments for storing oil and used oil/chemicals. Spill control plan will be followed to prevent soil and ground water contamination. The quality of water bodies will be affected only due to polluted storm water run-offs from project foot print area, if any, and will be only during rains.

Mitigation measures

- Optimising water usage in the SCADA building and substation area by application of water conservation measures such as sensor based taps, low flush urinals etc.
- Maintaining good housekeeping in the storage yard to avoid any spillages

Conservation of water through rain water harvesting at SCADA building.

Impact on Occupational Health and Safety

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

Working at height: Being a wind power plant there will be activities involving working at heights such as turbine service and repair etc. There can be the risk of free fall, slip, phobia with the personnel working at site.

Electrical/Fire Hazards: There are very few recorded incidents of fire at a wind farm, however, it is a real and possible risk. The workers involved in electrical work are susceptible to risks viz., electrical shocks, electrical burns, and fire and/or explosion hazards. The risk involve:

i) Electrical skock
ii) Electrical burns
iii) Fire hazard and;
iv) Eye conditions such as “photo keratitis”

Other Hazards: *The opration involves various activities and some of it may be dealing with heavey machinery (crane operation, loading/unloading, etc). In such activities, th*e workers involved are always susceptible to risks of physical injuries.

Mitigation measures

Working at Heights: The O&M team will need to adherence to precautions and safety measures as setup by the HSE team. Some of the measures are as mentioned below:

- There shall be clear instructions and procedures to all the workers involved in service repair of wind turbines
- Scheduled of maintemance will be altered considering wind speeds and other external conditions
- All work at height to be undertaken during daytime with sufficient sunlight;
- Only workers trained in climbing techniques and use of fall protection measures shall be engaged for work at height
- Ensure use of safety belt and need for safety net as required;
- Fixtures shall be installed on tower components to facilitate the use of fall protection systems;
- Work permit system shall be implemented for working at height (typically when working over 2 m above) and for hot jobs;

Electrical/Fire Hazards: Though extremely rare every possible measure must be taken to prevent any incidents leading to fire:

- The electrical staff shall be well trained and participate infrequently.
- Access to areas containing exposed electrical equipment shall be enclosed and posted with warning signs
- Workers involved in electric operations shall be provided with Protective Equipment
- such as rubber gloves etc
- Fire fighting equipments such as fire extinguishers and sand buckets shall be
- provided at appropriate locations;
- Wind turbines shall be equipped with an earthing system;

Impact of 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. 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.

The distance between a wind turbine and a potential shadow flicker receptor affects the intensity of the shadows cast by the blades, and therefore the intensity of flickering. Shadows cast close to a turbine will be more intense, distinct and focused. The flickering effect is important only for receptors located along East-West axis of the wind turbine.

For the assessment of shadow flicker due to the proposed Project, a modelling exercise was carried out taking into account the WTG's dimensions and the movement of the sun throughout the year. This modelling was carried out using EMD's WindPro v 3.0 software.

Data which are input to the WindPro software are as follows:

- ❖ The geographic locations and characteristics of the proposed WTGs;
- ❖ The locations of identified receptors; and
- ❖ Topography was assumed to be flat as a worst case scenario.

The WindPro software calculates the position of the sun throughout the day in accordance to the curvature of the earth, the time of year and the project site's position. The software calculates the occurrences of shadow flicker at each of the identified receptor. Analysis was conducted to represent a worst case scenario, with the following conditions:

- The sun is shining all the day, from sunrise to sunset
- The rotor plane is always perpendicular to the line from the WTG to the sun
- The WTG is always operating

The analysis was carried out at area of 2000m from WTGs and a total of 09 receptors were identified. All of which were more than 1000 m except for ones in Amidayala village. The receptors at Amidayala village were to the east to the project and hence the impact of shadow flicker was noticeable to be very mild. As a result of the scenario described above, the shadow flicker calculations represent a worst case scenario. The identified receptors are listed in table below with the corresponding results.

Table 8-5: Impacts of "Worst Case" Shadow Flicker Effects

Receptor Name	Location	Nearest WTG	Dist/Dir of WTG	Shadow hr/year	Shadow days/year	Max shadow hours per day	Shadow Expected Values (Hours /year)
Shadow Receptor 6	Amidayala	**G1-43, G1-44**	1500m/W	4:50	37	0:11	**2:39**
Shadow Receptor 7	Amidayala	**G1-33**	1300m/W	9:16	74	0:10	**5:39**
Shadow Receptor 8	Amidayala	**G1-33**	1300m/W	9:16	51	0:14	**5:25**
Shadow Receptor 9	Amidayala	**G1-23**	1300m/W	16:11	92	0:15	**9:24**

The shadow flicker assessment indicates that receptors are present in the villages of Renumakulapalli, Indravathi, Nimbagallu and Amidayala. However, all the receptors are more than 1000m from the nearest WTGs and are not placed on east of west of the both the receptors with exception of receptor in Amidayala. **However, the nearest WTG to any receptor in Amidayala village is more than 1300m and hence the effect of shadow flicker is minimal**. As shown in Table above, the highest possible shadow hours per year for any receptor will be below 10 hours. From the description above it can be said that the impact of shadow flicker is near to

insignificant in the current project.

Figure 8-4: The Worst Case scenario result of shadow Flicker at all the Receptor

Calculation Results

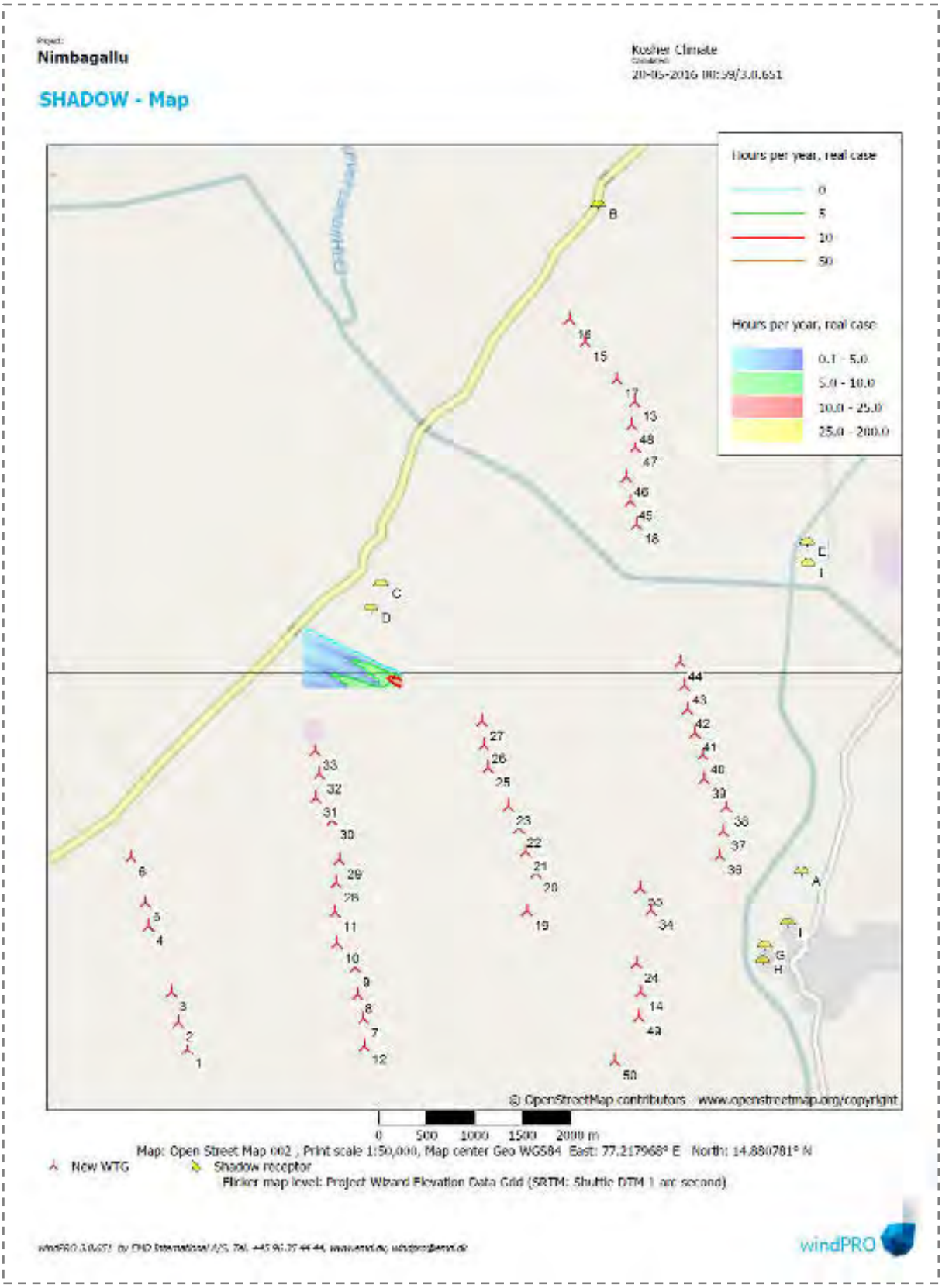
Shadow receptor

No.	Name	Shadow, worst case: Shadow hours per year [h/year]	Shadow, worst case: Shadow days per year [days/year]	Shadow, worst case: Max shadow hours per day [h/day]	Shadow, expected values: Shadow hours per year [h/year]
A	Shadow Receptor 6 (Amidyala)	4:50	37	0:11	2:39
B	Shadow Receptor 1 (Renumakulapalli)	0:00	0	0:00	0:00
C	Shadow Receptor 4 (Nimbagallu)	0:00	0	0:00	0:00
D	Shadow Receptor 5 (Nimbagallu)	0:00	0	0:00	0:00
E	Shadow Receptor 2 (Indravathi)	0:00	0	0:00	0:00
F	Shadow Receptor 7 (Amidyala)	9:16	74	0:10	5:39
G	Shadow Receptor 8 (Amidyala)	9:16	51	0:14	5:25
H	Shadow Receptor 9 (Amidyala)	16:11	92	0:15	9:24
I	Shadow Receptor 3 (Indravathi)	0:00	0	0:00	0:00

Figure 8-5: Below if the table representing real and worst case scenario for individual WTGs

No.	Name	Worst case [h/year]	Expected [h/year]	No.	Name	Worst case [h/year]	Expected [h/year]
1	WTG G1-07	0:00	0:00	26	WTg G1-35	0:00	0:00
2	WTG G1-08	0:00	0:00	27	WTG G1-36	0:00	0:00
3	WTG G1-09	0:00	0:00	28	WTG G1-37	0:00	0:00
4	WTG G1-11	0:00	0:00	29	WTG G1-38	0:00	0:00
5	WTG G1-12	0:00	0:00	30	WTG G1-39	0:00	0:00
6	WTG G1-14	0:00	0:00	31	WTG G1-40	0:00	0:00
7	WTG G1-15	0:00	0:00	32	WTG G1-41	0:00	0:00
8	WTG G1-16	0:00	0:00	33	WTG G1-42	0:00	0:00
9	WTG G1-17	0:00	0:00	34	WTG G1-43	2:50	1:37
10	WTG G1-18	0:00	0:00	35	WTG G1-44	2:00	1:01
11	WTG G1-19	0:00	0:00	36	WTG G1-45	0:00	0:00
12	WTG G1-20	0:00	0:00	37	WTG G1-46	0:00	0:00
13	WTG G1-21	0:00	0:00	38	WTG G1-47	0:00	0:00
14	WTG G1-23	16:56	10:19	39	WTG G1-48	0:00	0:00
15	WTG G1-24	0:00	0:00	40	WTG G1-49	0:00	0:00
16	WTG G1-25	0:00	0:00	41	WTG G1-50	0:00	0:00
17	WTG G1-26	0:00	0:00	42	WTG G1-51	0:00	0:00
18	WTG G1-27	0:00	0:00	43	WTG G1-52	0:00	0:00
19	WTG G1-28	0:00	0:00	44	WTG G1-53	0:00	0:00
20	WTG G1-29	0:00	0:00	45	WTG G1-54	0:00	0:00
21	WTG G1-30	0:00	0:00	46	WTG G1-55	0:00	0:00
22	WTG G1-31	0:00	0:00	47	WTG G1-56	0:00	0:00
23	WTG G1-32	0:00	0:00	48	WTG G1-57	0:00	0:00
24	WTG G1-33	9:05	4:45	49	WTG G1-58	8:42	5:24
25	WTG G1-34	0:00	0:00	50	WTG G1-59	0:00	0:00

Figure 8-6: Cumulative Map of Shadow Flicker Impact



Mitigation measures

Although no impacts are expected due to shadow flicker from turbine blades during operation, it is recommended that GAMESA should formulate a complaint resolution procedure for the local community so that any issues or concerns associated with shadow flicker are reported to the site staff. GAMESA will ensure that appropriate and timely action is taken in case of receipt of such complaints. The measure to mitigate impact can be providing vegetation around the receptor, supply of shade around the house and in worst cases switching operation of the particular WTG for such specific time.

Impact on Community/social issues

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

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

Impacts

Electromagnetic Fields

Electromagnetic Fields (EMF) emanate from any wire carrying electricity. 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.

Grazing Activities and Community Functions

The proposed site does not make grazing land. However, there may be taches of grazing land acquired with any changes in any of the locations, and it may result in loss of grazing land.

Mitigation Measures

Electromagnetic Fields

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 tables below:

Table 8-6: 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 8-7: 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. Hence the ICNIRP standards and guidelines have been considered. 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 220KV unit will be lesser than the suggested value.

Grazing Activities and Community Functions

GAMESA shall ensure that the entire wind farm area is not fenced/barb wired and shall provide access to the movement of livestock in the area for grazing purposes. GAMESA shall ensure that all the individual turbines with transformers are fenced and locked and cables are insulated to avoid any electrical hazards. Access to turbine tower ladders shall be restricted.

Impact on Communication Facilities

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.

These effects on off air television apply to analog 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.

Mitigation measures

The impact of WTGs is expected to be near to none in the project region's communication as the WTGs are located far away from habitations. No specific mitigation is required for prevention of disturbance to communication.

Impact Value

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

Impact Value

	Scenario	Spread	Duration	Intensity	Overall
Operation Phase	***Ecology***				
	Without Mitigation	Local	Short	High	Moderate
	With Mitigation	Local	Short	Moderate	Minor
	Noise generation due to operation of WTGs				
	Without Mitigation	Local	Long	Moderate	Moderate
	With Mitigation	Local	Long	Low	Minor
	Visual Impacts				
	Without Mitigation	Local	Short	Moderate	Minor
	With Mitigation	Local	Short	Low	Insignificant
	Water Quality				

	Without Mitigation	Local	Short	Low	Minor
	With Mitigation	Local	Short	Low	Insignificant
	Occupational Health & Safety				
	Without Mitigation	Local	Short	Moderate	Minor
	With Mitigation	Local	Short	Low	Insignificant
	Shadow Flicker				
	Without Mitigation	Local	Short	Moderate	Insignificant
	With Mitigation	Local	Short	Low	Insignificant
	Community/Social issues				
	Without Mitigation	Local	Long	Moderate	Moderate
	With Mitigation	Local	Long	Low	Minor
	Impact on communication facility				
	Without Mitigation	Local	Short	Moderate	Insignificant
	With Mitigation	Local	Short	Low	Insignificant

8.4.4 Cumulative Impacts

A cumulative impact is the result of combined impacts of various effects from the Project or effects from other existing and future projects as well.

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

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

The project activity has other existing wind power projects at adistance of 15 kms (approx.) and there are over 200 MW (100 WTGs) more proposed to be added in the vicinity of the project area. This makes the possibility of cumulative impacts even more certain.

Cumulative impacts are important because impacts of individual projects may be minor when considered in isolation but quite significant when the projects are viewed collectively. The cumulative impact of the project along with proposed new projects (established close the project) will lead to impacts in the project area, far beyond what has been predicted for this project.

If this happens, the cumulative impacts are likely to be positive due to the additional wind park facilities including further improvement in transportation, provision of employment and social benefits and enhancement of economic growth. However, this may also have negative impacts like including loss of habitats and biodiversity, increased pressure on natural resources, increased insecurity and unplanned settlements, visual intrusion and increased pollution among other negative impacts.

The potential cumulative impacts from the advent future wind projects identified are provided below.

Impact on Socio Economic Status

The project region is arid with very low yielding cropland. During the extensive social survey it was identified that a number of farmers were looking forward for sale of their land as the demad for land in this region is very low. New projects will provide opportunity for land owner to get a decent reneuaration from their drought hit land. More projects will also help in improving local employment and continuous engagement within the area. There is high possibility that the infrastructure such as roads will be developed. Hence, the additional wind farms will support the local economy.
The possible CSR activity from all of these projects will also help in development of medical facilities, clean water and other infrastructure assistance in the project influenced villages. On the whole, the cumulative impact will result in positive on the socio-economic status of the local people.

Impact on Land use

The land in the region is arid and drought hit. As expalined earlier in the report, the region has

mostly agricultural lands which are being used for rain-fed agriculture. Mostly leguminous plants with low water requirement are grown. Predominant lands do not have any irrigation facilities and there by totally dependent on rainfall and post-monsoon the land remains dry. Advent of the new wind projects in the region will open the opportunities for utilization of barren / dry waste land which is left unused otherwise.

The yield is one of the lowest in the country and hence, many farmers are willing to sell their lands for decent renumration. Even after the sale farmers will be allowed to use their land beyond safety limits. Also no restrictions will be placed on the movement of grazing animals in the area and farmers will be allowed to farm. Hence, overall the change in landuse will cumulatively have a positive impact.

Migrant Workers

Although the proposed project will not engage any unskilled 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 may potentially lead to cultural conflicts. Most of the civil works being small in nature will be handled by the local contractors from Anantapur or nearby regions. This would ensure that the workers are largely from within Andhra Pradesh. 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 Water Availablity

The project region falls in the district of Annatapur which is a known for low rainfall and arid climatic conditions. Though wind power projects do not use considerable water during operation, the construction phase must be monitorined to ensure that the local population does not suffer. The subcontractors must use water from authorized supplier and ensure that no illegal underground water is drawn. Special provision will be made in the CSR plan to help solve the water problem in the region. With adequate monitoring of water sources during construction, the cumulative impact of the future developments can be assessed to be neutral.

Impact on Visual Intrusion

As detailed in the earlier section, the visual instrusion is a matter of perception and varies widely. With the numbers of WTGs increasing in a small area, it has the potential to distract observers from the normal scenery. However, there is also a possibility that the wind projects will attract visitors to the area. Hence, the projects will implement the mitigation measures as suggested in the previous section for reducing the effects of visual impact.

Impact on Air, water & Soil Quality

During operation of the project no fuel of any kind will be burnt. Therefore no emission will result from the project activities. However, there can be the problem of duest from construction activities.

The measures suggest earlier such as sprinkling of water covering excavated soil and limited excavation should be followed religiously. 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.

Impact on Traffic

The project and future project will lead to continuous dust generation by the road side and the house just beside transport routs will be effected. A possible breakdown of large vechile can cause prolonged traffic jams and blockade. The houses by the transport routs shall be provided with curtains and such regions with settlements shall be sprinkled with water before any major movement of vehicles. The local community shall be kept informed about transportation of large equipment to avoid inconvenience.

9 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

9.1 Introduction of ESMP

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. The purpose of the ESMP is to ensure that social and environmental impacts, risks and liabilities identified during the ESIA process are effectively managed during the construction, operation and closure of the proposed project. The ESMP specifies the mitigation and management measures to which the Proponent is committed and shows how the Project will mobilize organizational capacity and resources to implement these measures. The ESMP also shows how mitigation and management measures will be scheduled. Best practice principles require that every reasonable effort is made to reduce and preferably to prevent negative impacts while enhancing the benefits. These principles have guided the ESIA process. In many cases, potential negative impacts have been avoided through careful design and location of facilities. The ESIA involved concurrent and on-going data collection and public consultation activities to date.

The objectives of the present ESMP are:

- ✓ To ensure that mitigation measures are properly implemented.
- ✓ To establish a scheme and procedures for this purpose.
- ✓ To monitor how effective are the mitigation measures.
- ✓ To ensure that proposed mitigation measures comply with environmental laws and regulations.
- ✓ An adequate action when unexpected impacts occur.

The EMP also address the formation of a monitoring committee, with the objective of finding out whether different pollution related issues and social development commitments related to health, education, infrastructure, employment, etc., are adhering to the time schedule or not. In case of delays, the reasons for the delays need to be identified and suggestions to be made for rectifying them.

The wind speed throughout the year is the main criterion for site selection and to ensure reliability and economic sustainability of a wind farm project. Apart from wind speed, many environmental and social impacts can be averted or resolved at the project planning stage by adequate site selection.

ANPWPL, Gamesa and its sub contracts are 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.

9.2 Organization Roles & Responsibilities

ANPWPL and its contractors as an organization shall ensure structuring of a dedicated team and responsibilities to implement ESMP during the lifesyscle of the project. The roles of organizations being:

- ❖ The contractor/sub-contractors are duly informed of the ESMP, associated responsibilities and implications
- ❖ Both ANPWPL and contractors to appoint an HSE officer to monitor the implementation of this ESMP who inturn shall be a qualified HSE professional with relevant HSE expertise;
- ❖ Ensuring that the construction contract makes provision for mitigation measure to the satisfaction of the impacted communities or as per the provisions of this ESMP.

The organization structure of the HSE has been provided under ***chapter 3*** of this report. The same team shall be responsible for the management of ESMP.

The overall management and coordination of the project will be managed through Chief Executive Officer (ANPWPL) who will be supported by the Site Head (Project). The Site Head will overview, monitor and control the activities of Site Manger and team. The EHS supervisor at the site reports directly to the EHS-Head located at corporate office. 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.

Resposibilities of HSE Manger & 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 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.

The HSE Officer (ANPWPL)

The HSE officer shall be a qualified HSE professional. The HSE officer shall be responsible for checking compliance of the contractor/sub-contractors with the requirements of this ESMP and any other relevant environmental legislation for all activities associated with the contract.
The general duties of the HSE officer are as follows:

- ✓ Being familiar with the environmental management requirements contained in this EMP
- ✓ Regular auditing of the contractor/sub-contractors with the view of ensuring that all activities on the site are undertaken in accordance with the ESMP;
- ✓ Issuing regular audit reports to the HSE Head and contractor regarding compliance with this

ESMP;

- ✓ Providing ad-hoc environmental advice including environmental legal requirements to the Project Manager, Proponent and the contractor/sub-contractors regarding issues that may arise during the contract.

9.3 Contractors Management

Prior to assigning any contract, Gamesa will pre-qualify each contractor according to commercial, technical, quality assurance and its past performance on EHS standards so as to satisfy GAMESA's requirements.

The contractor(s) must ensure that all aspects of the contract comply with both this EMP and other relevant environmental legislation. The contractor(s) shall be responsible for:

- ✓ Appointing an HSE officer (on-site) who irrespective of other duties will also be responsible for overseeing all activities associated with the contract;
- ✓ Ensuring that the HSE officer has the means to carry out his/her tasks;
- ✓ Be responsible for rehabilitation of, or the cost of rehabilitation of any environmental damage that may arise out of non-compliance with this EMP and/or environmental legislation. Such rehabilitation shall be to the satisfaction of the relevant authorities and/or the Project Manager.

Contractor's HSE Officer (Gamesa)

The contractor's HSE officer shall be responsible for implementation of this ESMP and any other environmental requirements that may be identified by the Project Manager during the course of the contract. The contractor(s) HSE officer shall have received basic HSE training either as part of the contract or previously. In addition to any other responsibilities, the general duties of the contractor(s) HSE officer shall be:

- ❖ Ensuring that all personnel (including sub-contractors) are duly informed of the requirements contained in this ESMP, and the associated responsibilities and implications of this ESMP;
- ❖ Ensuring that all records needed to demonstrate compliance with the ESMP requirements are obtained, filed and readily available for inspection by the Project Manager or the Proponent;
- ❖ Consulting with the Client's HSE Officer regarding interpretation of the ESMP and any other aspects of the contract that may impact significantly on the environment;
- ❖ Ensuring that all personnel demonstrate respect and care for the environment in which they are operating;
- ❖ Acting as a point of contact for local residents and community members.

9.4 Implementation of ESMP (Inspection Monitoring & Compliance Audit)

- ❖ The client's HSE officer and the contractor(s) HSE officer shall conduct a pre-construction site inspection to identify sensitive environments, no-go areas, location of site camps, etc.;
- ❖ The client's HSE officer will prepare a pre-construction audit report which will include

photographs of the general condition of the key features of the site. The photographs shall be used for comparison purposes on completion of the contract i.e. after rehabilitation of the construction areas;

- The client's HSE officer will conduct monthly site audits of all construction related activities;
- On completion of the construction activities, the client's HSE officer together with the contractor's HSE officer will conduct a site inspection. Any items requiring attention shall be included in a post-construction audit report;
- On completion of the defects liability period, the client's HSE officer shall accompany the Project Manager and the contractor with the view of determining whether outstanding matters from the post-construction audit have been adequately addressed.

9.5 Reporting & Review of HSE Incidents

- The contractor's HSE officer shall maintain a register of all HSE related incidents occurring as a result of the activities associated with the contract. HSE related incidents that shall be recorded include (but not limited to):
  - Fires;
  - Accidents;
  - Spills of hazardous materials that contaminate soil or water resources;
  - Improvement orders/notices issued by the NEMA or DOSHS or other relevant lead agencies; and
  - Non-compliance with this EMP.
- Each HSE related incident will be investigated by the client's HSE officer and an incident report forwarded to the contractor and project manager. An incident report will be presented within five working days;
- HSE incident reports will include as a minimum, a description of the incident, actions taken to contain any damage to the environment, personnel or the public, and the corrective actions to repair/remediate any damage; and
- Prescribe additional measures that may be required to remediate damage resulting from the incident and/or to prevent similar incidents occurring in the future.

9.6 Emergency Readiness Training for the HSE Teams

The contractor is responsible for ensuring that their workers are provided HSE training as stipulated in the OSHA 2007 and its subsidiary legislation. In addition to formal training, the contractor should undertake tool-box talks. A training register should be kept on site for all training conducted as proof for auditing purposes. The HSE training should include among other topics:
The importance of conforming to all HSE policies;

- The HSE impacts of the proposed activities;
- HSE benefits of improved personal performance;
- Worker roles and responsibilities in achieving conformance with the client's HSE policy, procedures and this ESMP including associated procedures and emergency preparedness and response requirements;

- ❖ Potential consequences of departure from specified operating procedures; and
- ❖ Mitigation measures required to be implemented when carrying out their work activities.

9.7 Structure of the ESMP

The ESMP stipulates the environmental standards to be adhered to by the parties involved in the various phases of the project life cycle. As such the ESMP comprises of a section for each of the following project life cycle phases:

- ✓ Planning and design;
- ✓ Pre-construction and construction activities;
- ✓ Operation; and
- ✓ Decommissioning

Representation of ESMP Actions Phase wise:

Impact Identified	Suggested Mitigation	Monitoring / Training	Management Responsibility
PRE-CONSTRUCTION PHASE			
Siting of Project and associated facilities			
• Land use changes; • Impact on livelihood pattern • Visual Intrusions	• The land aggregator shall refrain from purchase of any additional apart from the apt requirement of the project plan. • The project layout planning shall consider minimal land requirement for the WTGs, transmission and access roads. • The existing water canal (Tungabhadra high canal) shall be considered while purchase any land. As fields with adequate water supply shall be avoided. • Visual impact shall be considered while finalizing the layout for access roads/transmission lines. A good way is to keep away from settlements, scattered layout of WTGs a good 100m elevation difference.	None	• OAWPPL
Procurement of Land			
• Loss of land • Livelihood Impact	• Procurement of land from marginal farmers shall be avoided at all costs. If unavoidable, one family member of such family should be permanently employed with Contractor. • Leaving a safety area, the remaining of land procured around WTGs shall be left accessible for cattle and other livestock for grazing. • Sale of farming land will have considerable impact on land sellers and Gamesa shall ensure to provide them with financial counselling on beneficial investment and apt utilization of compensation amount resulting in creation of assets or source of income.	None	• OAWPPL & Gamesa

Impact Identified	Suggested Mitigation	Monitoring / Training	Management Responsibility
Site Clearance			
• Removal of Vegetation at site; • Contamination	• Any areas with removal of vegetation shall re-vegetated immediately after commencement of project operation • Removal of vegetation may result in soil erosion and dust formation. To prevent this localized sprinkling of water at such areas shall be taken up; • Loose soil shall be covered to prevent from wind and runoff; • Use of existing track for transport of man and material to the extent possible;	• The region has sparse vegetation and hence, protecting/re-vegetation is vital. • A Re-vegetation Plan for disturbed areas to be prepared • Handling of soil shall be included in the HSE plan by OAWPPL. • It is lot easier to maintain dedicated tracks and hence, while at site, the drivers shall be instructed to use only designated tracks.	• HSE Managers. • HSE Managers shall update it in their HSE registers and give feedback to contractors.
CONSTRUCTION PHASE			
Construction of Roads			
<u>Transportation and Traffic</u> • Dust Generation; • Vehicular Emissions; • Traffic disruption	• Reinforcement of roads used for transportation is undertaken. It will prevent excessive dust and ware of existing roads. • The site area must be guarded and all vehicles must have helps to prevent accidents. • Regular maintenance of vehicles to be taken up; • Widening of roads will be undertaken wherever necessary to prevent traffic disruption. • Transportation routes shall be planned to minimize any impact to local community. • All construction and modification activities to be undertaken after prior approval / permission from local administration; • A speed cap of 30kmph shall be established as standard for all project vehicles while driving through any areas with settlements.	• Gamesa has undertaken transportation feasibility for ease of construction activities. • A traffic management plan to be developed and implement to ensure hassle free construction. • Drivers shall ne well trained for safe handling of construction vehicles for speed restrictions. • They shall also be fully aware of traffic regulations • Incidents shall be recorded and reported to in the HSE report.	• HSE Managers

Impact Identified	Suggested Mitigation	Monitoring / Training	Management Responsibility
<u>Health and Safety</u> • Slippage of boulders during excavation works; • Physical and chemical hazards	• Adequate training of workers in safety issues related to their activities, such as the hazards of working on foot around equipment and vehicles. • Reduction of engine idling time in construction sites. • Maintenance of work vehicles and machinery to minimize air emissions;	• The availability of use of Proper Personal Protection Equipment (PPE) shall be monitored frequently and recorded. Used of Personal Protection Equipment (PPE) to be enforced through sub-contractors. • All workers to be well trained used of PPE and their right to safe working conditions.	• HSE Managers
<u>Community and Social</u> • Traffic congestion; • Damage to village roads; • Potential of accidents	• New routes to be finalized in consultation with local community • Maintenance of the road existing roads; • Construction activities to be restricted during day light only.	• None of the community The site personnel will ensure that during the construction phase there is no misuse of community facilities	• HSE Managers
<u>Soil and Water</u> • Fugitive dust emissions; • Oil leaks; • Disturbance of soil; • Waste Disposal	• 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; • Excavation activities shall not be carried out during months of heavy rainfall; • Optimal utilization of water to be ensured throughout the construction phase; • Curing chemicals to be used to reduce water requirement;	• Storm water arrangements to be monitored for clogging on weekly basis. • Workers to be instructed about optimal use of water; • Daily consumption of water to be recorded and assessed on weekly basis for wastage;	• HSE Managers

Impact Identified	Suggested Mitigation	Monitoring / Training	Management Responsibility
	• Leaks and losses to be checked frequently to enhance utilisation; • 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; • Hazardous waste will be store at a secure location and disposed through authorized vendors only;		
<u>Ambient Air quality</u> • Fugitive Dust Emissions; Vehicular emissions;	• As detailed earlier, sprinkling of water is key during construction to prevent dust formation. The areas of vehicle movement, areas cleared of vegetation, soil heaps must be sprinkled with water frequently. • Raw material like, sand, cement, gravel etc should be covered during rains and high winds. • Vehicles carrying soil, loose raw material shall be covered by tarpaulin; • All the vehicles entering the site to have updated PUC (Pollution under control) certificates; • Frequent check and preventive maintenance of construction equipment shall be practiced. • Idling of all machinery shall be avoided ; • Generator to be optimally used with proper orientation and adequate stack height. • Sprinkling of water on unpaved roads at the construction site; • Use of designated tracks inside the site shall be practiced by all drivers to prevent dust formation. • Restricted speed for all vehicles in the site will minimize generation of dust.	• Inspection of surrounding areas for signs of excessive dust deposition shall be undertaken to assess the effectiveness of preventive measure.	• HSE Managers

Impact Identified	Suggested Mitigation	Monitoring / Training	Management Responsibility
• Noise • Noise generation due to blasting operations • Noise from operation of equipment	• Blasting area to have protective boundary; • All plans of blasting shall be communicated to local authorities and community. • All the project machinery shall be maintained in good working conditions and practice preventive maintenance. • Silencers or machinery with least noise levels shall be chosen for construction activities.	• Use of protective boundary shall be monitor individually before each blast. • Monitoring of Noise levels shall be monitored at the nearest settlements on frequent basis and recorded.	• HSE Managers
• Ecology • Loss of vegetation; • Impact on livestock	• Cutting of trees to be limited to unavoidable circumstances. • During this construction period, grazing in the project site to be avoided and area to be fenced. • Re-vegetation at all the location possible particularly those which were cleared off vegetation for siting. • Workforce to be instructed to avoid any other activity likely to affect the local flora & fauna; • Movement of vehicles shall be restricted to designated tracks only;	• The workers of all the sub-contractors shall be instructed prevent any activities from happening that may adversely affect the ecology;	• HSE Manager
Erection of WTGs			
• Traffic and Transport • Damage to Roads; • Blockade of roads; • Damage of roadside structures;	• Particularly large and heavy vehicles can damage internal roads and hence strengthening of roads prior to planned transportation shall be carried out. • Vehicle movement and parking within the project premises shall be manned properly to avoid accidents; • Local community shall be informed about the movement of heave vehicles to prevent inconvenience. • Trucks carrying WTGs components must have helpers and can be provided with pilot vehicles to manage traffic and assist free movement. This will prevent accidents and damage to any structures in the narrow	• Gamesa has undertaken a transport plan for the movement of WTG components • A detailed traffic feasibility plan has also been undertaken by the Gamesa team. Implementation of recommendations under this report shall be monitored.	• HSE Managers

Impact Identified	Suggested Mitigation	Monitoring / Training	Management Responsibility
	internal roads.		
• Ambient Air Quality • Vehicular Emissions; • Fugitive emissions	• Similar measures as undertaken during construction of roads to be undertaken.		
• Noise • Noise from blasting operations for foundation of towers;	• Similar measures as undertaken during construction of roads to be undertaken • Choice of quiet plant and equipment as far as reasonably practicable; • Regular maintenance of equipment to ensure noise emissions are maintained at design levels; • Equipment with noise shielding to be used where possible. • Arrangements of silencers, acoustic louvres and enclosures shall be made where ever possible to reduce the impact of fixed noise sources. • Provision of rubber paddings/noise isolators at equipment/machinery used for construction; • Use of noise barriers near high noise generating equipment to minimise horizontal propagation of noise; • Noise prone activities will be restricted to the extent possible during night time 2200 to 0600 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. • Local community members to be kept informed about the blasting activities well in advance;	• Similar measures as undertaken during construction of roads to be undertaken.	

Impact Identified	Suggested Mitigation	Monitoring / Training	Management Responsibility
• Soil and Water Quality • Oil leaks	• Refuelling of machinery shall be carried out at designated areas. • The site area shall be kept clean of dirt and debris by deputing sweepers on daily basis. • Water for construction and for consumption of construction workers to be arranged by the construction contractors through authorised tanker water suppliers; • Special care to be taken with painting activity and the left over paints and empty containers. These are to be disposed through vendors.	• 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.	
• Health and Safety • Working at height; • Operation of heavy machinery; • Accidents leading to injuries fatalities; • Occupational health hazards	• Ensure personal protective equipment for all personnel present at site are made available; • 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.; • 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; • ∑ All operations of lifting/dropping/lowering of construction material shall only be carried out under strict supervision only.	• All workers must be trained 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.	
Waste Disposal			

Impact Identified	Suggested Mitigation	Monitoring / Training	Management Responsibility
• Accumulation of construction waste; • Runoff into rain water channels; • Unhygienic condition for labours; • Hazardous waste from machinery, generators etc	• Construction waste to be properly stored and disposed off to local municipal waste disposal site; • 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; • Access road shall be planned to cause minimal disturbance to the terrain topography; • Existing surface drainage pattern to be retained to the extent possible; • Portable toilets with septic tank-soak pit arrangement to be provided for workers; • Adequate number of toilets for male and female workers to be provided; • 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 the sites on daily basis. • Hazardous waste will be stored at a secure location and sold to authorised vendors;	• Contractors shall be briefed about the need for proper storage and disposal of construction waste; • Contractors shall obtain authorisation for handling, storage and management of hazardous waste from pollution board authorities and comply with the requirements of authorisation.	• HSE Manager • To be incorporated in the contract with the construction contractor • HSE manager to make observations and convey it to the contractors • Monthly report of EHS team (OAWPPL) to include compliance and observations on waste management
Water Resource and Quality			

Impact Identified	Suggested Mitigation	Monitoring / Training	Management Responsibility
• Runoff into rain water channels • Loss of soil • Change in micro level drainage pattern • Wastage of water	• Excavation activities shall not be carried out during months of heavy rainfall; • Water for construction and consumption to be arranged by construction contractor through authorised tanker water supplier. • Adequate arrangement for storm water management 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; • Curing chemicals to be used to reduce water requirement; • Leaks and losses to be checked frequently to enhance utilisation. • Σ Optimal utilization of water to be ensured throughout the construction phase;	• Workers to be instructed about optimal use of water; • Daily consumption of water to be recorded and assessed on weekly basis for wastage; • Storm water arrangements to be monitored for clogging on weekly basis. • Σ Water quality monitoring of nearby water bodies shall be conducted at least twice during construction period.	• EHS Manager • EHS teams to keep record of water consumption • Weekly report of EHS teams to be send to EHS heads.
Cultural			
• Existing religious structure near site; • Cultural differences amongst workers	• Access to no religious structures will be blocked during erection of the WTGs • The immigrant workers to be instructed about interaction with the local community or other local workers; • To the extent possible local labour to be employed for construction purpose.	• All personnel working on the project shall respect the sanctity of religious structures. • Immigrant workers to be briefed about need for cooperation and harmony with the community;	• Construction Contractor (Gamesa)
Social			
• Access to Common Property Resources; • Access to grazing	• Common resources in the region will be subjected to usage by workers of the project as well. They shall be instructed on optimal usages and interactions.	• The site personnel will ensure that during the construction phase there is no misuse of	• On-site personnel and contractors

Impact Identified	Suggested Mitigation	Monitoring / Training	Management Responsibility
lands; • Village approach road to the site.	• Any of the affected families will find opportunity with the project developer; • Grazing of livestock in and around the wind farms will not be completely restricted; • Local community be will engaged for development and repair of new and existing roads • 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;	community facilities	• HSE team shall recommend CSR activities based on their records and observations.
• Job Expectations; • Expectations for other local benefits	• The project shall engage local labourers at all the possible jobs. • The projects will ensure that there is a transparent process of giving jobs/contracts and other benefits.	• OAWPPL will engage in discussions with the local regulatory authorities in relation to employment and inform them about the opportunity of employment. • All concerns must be addressed through a formal grievance redressal process.	• Construction Contractors • OAWPPL
• Influx of Migrant Workers • Social Impacts; • Health Impact; • Economic Impacts.	• For all the unskilled jobs Local labour shall be hired and for skilled jobs local labour to the extent possible will be preferred. • Health and safety training of the labour, raising awareness about STDs, and HIV, and maintaining behaviour standards while moving in the community shall be done; • Community should be consulted at regular intervals. Any complaints or concerns with respect to labour shall be addressed without delay; • Local contractors, suppliers shall be engaged for	• Contractors shall ensure that the onsite contract workers complies with the terms and conditions of contract • In addition, personnel shall be aware of the applicable regulatory requirements for ensuring compliance to good working and labour law compliance.	• Gamesa & OAWPPL

Impact Identified	Suggested Mitigation	Monitoring / Training	Management Responsibility
	procurement of goods and services required for project activities. • Local administration and police shall be appraised about the details of outside labourers as also a list should be provided to the Gram Panchayat office.		
• Local Employment	• The Panchayat office is appraised of the requirement of labours in various stages of project construction. • Priority for employment opportunity is given to local people,	• Educated youth from the local community to be engaged I the existing skill development programmes of Gamesa. • Capacity building activities is carried on for youth and women for better employment opportunities.	• Gamesa & OAWPPL
• Demands for materials, services and inputs	• For all material required a local contractor shall be engaged. • Avoid using any community infrastructure facilities like water bodies, electricity etc. • The project shall refrain from use of common resources unless it is unavoidable.	None	• Gamesa & Sub-contractors
OPERATION PHASE			
Ecology			
• Bird Mortality; • Avian collision	• The turbine layout to provide adequate spaces between each turbine for movement of birds which would reduce the potential for accidental collision; • Visibility enhancement objects such as marker balls, bird deterrents, or diverters shall also be installed along the transmission line to avoid avian collision. • Wiring between the WTGs shall be kept underground to the extent possible.	• The project will maintain a record of any incidences of bird hit. • Based on the incidences physical monitoring will also be carried out to understand the key reasons if any. • This identified reason shall be	• Gamesa & OAWPPL

Impact Identified	Suggested Mitigation	Monitoring / Training	Management Responsibility
	• Water logging around the WTGs shall be prevented.	communicated to the HSE head.	
Visual Impacts			
• Visual intrusion	• Non reflective paints to be used for the turbines • Towers to be painted uniformly so as not to create any differing contrast to the landscape;	--	• Gamesa
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 Manager • Site In-charge (OAWPPL)
Occupational Health and Safety			
• Working at Height; • Use of Cranes; • Electrical hazards; • Accidents leading to injury/fatality.	• There shall be clear instructions and procedures to all the workers involved in service repair of wind turbines • Scheduled of maintenance will be altered considering wind speeds and other external conditions • All work at height to be undertaken during daytime with sufficient sunlight; • Only workers trained in climbing techniques and use of fall protection measures shall be engaged for work at height • Ensure use of safety belt and need for safety net as required; • Fixtures shall be installed on tower components to facilitate the use of fall protection systems;	• Adequate training of the workers regarding health and safety procedures and their right to safety; • Workers to be trained for use of Personal Protection Equipment and its importance.	• SHSE Manager • Site In-charge • Contractor (Gamesa)

Impact Identified	Suggested Mitigation	Monitoring / Training	Management Responsibility
	• Work permit system shall be implemented for working at height (typically when working over 2 m above) and for hot jobs;		
Community/Social Issues			
Impacts on Local Economy	All project material and services shall be procured locally where ever possible.	-	Procurement team (Gamesa)
• Shadow Flicker	• The WTGs shall be placed at least 500m away from any settlements. • The mitigation measures are key as the nearest of WTGs with any settlements is over 820m away and no Shadow flicker is not anticipated	• Fall of shadow from all turbines to be observed and vegetative shield to be opted, if required.	• OAWPPL
• Upgrade of local infrastructure • Grazing land	• Reinforcement of existing roads • Participation in existing local government programmes and assist in development programs to elevate the social economic conditions; • Allow farmers to use the used area around WTGs	• The CSR plan will be developed based on the baseline survey and will be the key for implementation of all community development activity	• CSR team and HSE team of OAWPPL

Impact Identified	Suggested Mitigation	Monitoring / Training	Management Responsibility
	beyond safety limits. • Allow grazing area to be retained with fencing limited to transformer are	• Monitoring of all the activities conduced and results will be carried out annually.	
Waste Disposal			
• Used oil; • Transformer oil	• Storage of used oil is at designated area. The designated period for such storage shall not be more than 30 day and beyond which it shall be handed over to authorized vendors for disposal only; • The supplier of transformer shall be responsible for return of transformer oil as well.	• The HSE team shall conduct weekly monitoring on safe storage of used oils • O&M staff shall be well trained and instructed on proper storage and disposal waste oil	• EHS Managers • Transformer Suppliers • Site In-charge (OAWPPL)

10 GRIEVANCE REDRESSAL MECHANISM

10.1 Introduction:

A grievance can be defined as an actual or perceived problem giving ground for complaint. According to IFC requirements, a Grievance mechanism:
"Addresses concerns promptly, using an understandable and transparent process that is culturally appropriate and readily accessible to all segments of the affected communities, and at no cost and without retribution."

The current Grievance Redressal Mechanism (GRM) is proposed in order to manage any local concerns and understand community expectations better. The proposed GMR provides a mechanism to receive and respond timely to any complaints made about the Project and helps in making basis for development of appropriate mitigation strategies.

10.2 Applicability of the Mechanism:

The Grievance Mechanism will be available for those living or working in the areas of influence (study area) around the Project.

Any personnel directly or indirectly employed by ANPWPL will fall within the framework of the GRM, which shall identify processes for receiving applicable grievances in person, in writing and by phone. Gamesa shall be held responsible for their fair and appropriate handling of its employee grievances.

Any person with the right to participate in the Grievance Mechanism will have easy access to it and will be encouraged to use this confidential complaint system.

Supplier complaints related to commercial issues will not covered under the GRM, however, any complaints even from the Local suppliers of non-commercial nature can be managed within the proposed is GRM (with a precondition that it should fit in the interest of people/community .

10.3 Teams for Management of GRM:

ANPWPL to ensure that a team has been designated the management with defined roles and responsibilities.

The **IFC Performance Standard 2** requires the client to ensure that contracted workers have access to GRM in order to raise workplace concerns. Effective and timely response to complaints is essential for maintaining good working relations with the labours that can be addressed only through an efficient grievance redressal. Hence, ideally the mechanism should engage a local team (at site) and a review team at the head office. The proposed structure is as below:

10.3.1 Local GRM Team (Site Team)

This should consist of representative of ANPWPL and Gamesa. The team members should be capable of decision making and preferably in-charge of the site. It is ideal to compose the team of senior most personnel who may not need to report to another manager at the site itself. This team shall be responsible to address any issue locally and more importantly address any issue before hand in order to prevent adverse impacts.

10.3.2 Corporate GRM Team (Head Office)

ANPWPL being a part of large coporate can dedicate a team to handle the issues of EHS/CSR/GRM. The personnel heading the Corporate GRM Team shall consist of top management (like Director, Managing Director, Projects Heads, HSE Head, HR Head). The purpose of this team would be to address grievances of stakeholders who have direct contact with project affected communities and review the performance of Site GRM team.

10.4 Reception of Complaints:

Complaints will be received verbally as well as in writing. Both written and verbal complaints, channelled through the GRM teams, will be recorded in a standard format (see Annexure). The details flowchart is also provided in this section below. Some importance aspects related to the registration and recording of grievances are:

- Secured Grievance boxes shall be placed at specific public place within the community and the site offices.
- If the stakeholder wishes to remain anonymous, he/she can write down the grievances and drop it in the available complaint boxes;
- The Grievance Mechanism is publicised using culturally relevant and inclusive medium;
- The system should be assessable to illiterates as well and hence, in case of verbal complaints of labour or any other stakeholder the site GRM team should record the grievance in the grievance register.
- Every stakeholder should be aware of whom to approach for reporting a grievance and the support and sources of advice that are available to them.
- Any worker with concerns pertaining to onsite work such as accommodation facilities, sanitation, terms of employment, wages paid etc may register their complaint in writing to the nominated persons at site;
- The immediate task of the GRM teams shall be to record the complaint in designated log.
- In case any complaint is not addressed satisfactorily within the promised time, it shall be escalated to the head office to “Corporate GRM team”.

10.5 Various Means of Registering a Complaint:

The mechanism of recording a complaint should be easy to understand and access: Any direct or indirect stakeholder **can lodge the grievance through various means** as:

- Registering through a designated phone number and email (eg: +91 7827681368, info@orangerenewable.net).
- By using the GRM form which should be available and accessible at ANPWPL site office, head office and Gamesa site office.
- Provision in the website of Orange to write a complaint.

Apart from the above it should be ensured that the GRM forms are available in local languages. The contracts shall inform sub-contracts and workers about details of this mechanism and keep it available at the notice board of site offices.

10.6 The GRM Form:

The grievance/complaint register records the following:

- Complainant's name and address;
- Date time place where the complaint was received;
- Description of the complaint
- Information on proposed corrective action;
- Promised date of greivence closure;
- The date when the complaint was closed.

In some exception cases it is acceptable to not record the name and particulars of Complainant.

Gamesa is following a current GRM mechanism with the form being:

Figure 10-1: Grievance Form of Gamesa

10.7 Grievance Investigation and Closeout

It will be priority of GRM teams to intervene and prevent any situation which may lead to adverse impacts or complain from any stakeholder.

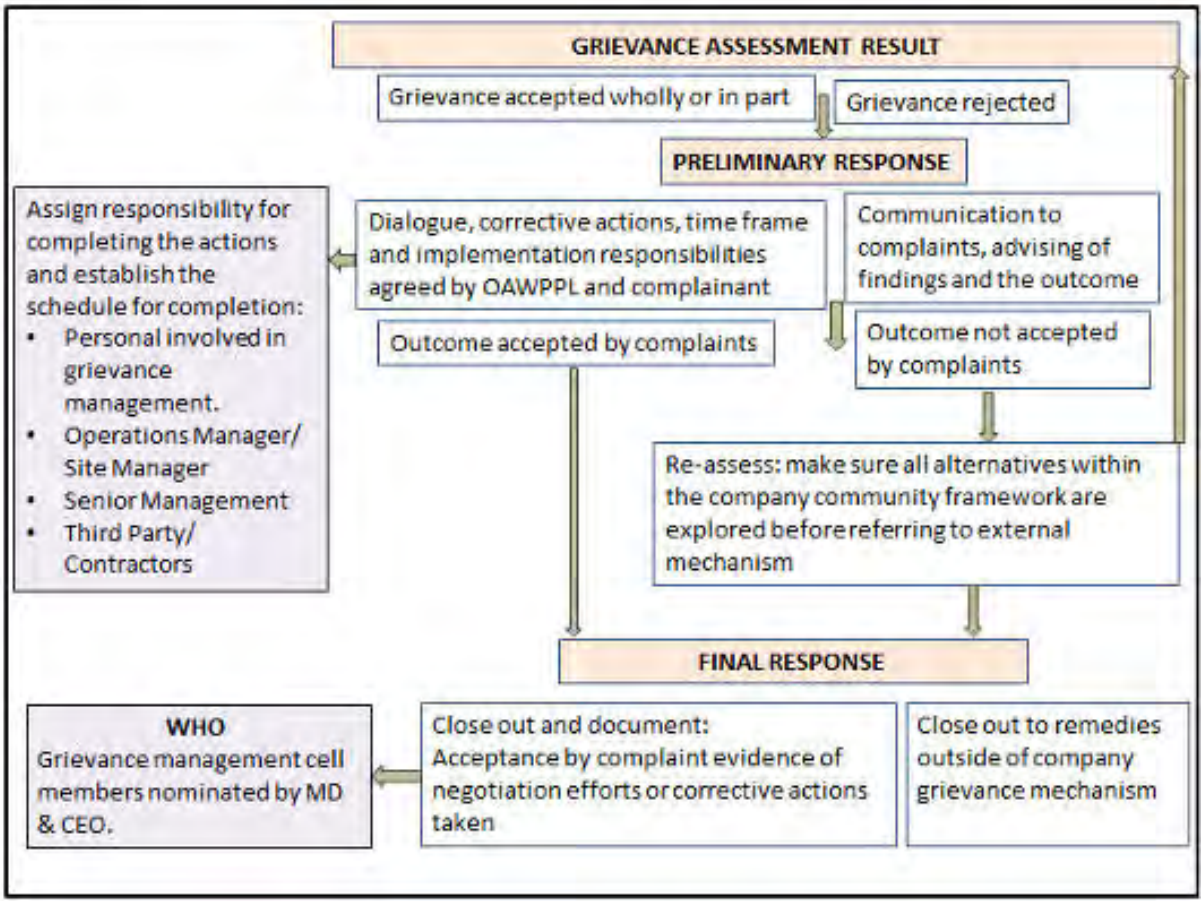
Once the grievance is received, it is registered in the prescribed form or through a online register. The complaints should be available in a form which can be tracked (like, company tracking system, a spread sheet, a log record)

The following steps will be followed for analysis and closure of Complaints:

- If a complaint can be resolved with discussion and proper explanation, or delivery of information, it will be provided immediately. The event will be recorded.
- During the assessment of complaints, the team will gather information about the key issues and concerns and helps determine whether and how the complaint might be resolved.
- The screening and assessment of complaint will be completed by the GMR teams within 2 working days.
- Depending on the type of complaint, it will be brought to the notice of departmental heads.
- Assistance from these departmental heads be taken to address or taken action to close the complaint.
- Assistance of community representatives of panchayat will be considered in case all the internal resources have been tried in vain. Further reassessment will be undertaken to explore all alternatives within the complainant before setting escalating it to corporate level.
- If even after all the efforts any complaint is not solved satisfactorily within 7 working days, it will be escalated to the Corporate GRM team.
- The Corporate GRM team consists of top level management and head of departments. They will have more reach and wider decision making capabilities and try to use available resources to close the complaint.
- The solution for the grievance will be devised within next 7 working days with final decision to be taken by the MD and CEO of the company.
- In the final stage grievance will be closed and the proof will be documented. Evidence of negotiation efforts as accepted by complainant will also be recorded.

As shown in the flowchart all grievances shall be treated as confidential and without prejudice. They shall be acknowledged within five-six days and responded to within two weeks or more quickly in cases where there is specific urgency. The grievance investigation and closeout procedure has been illustrated in flowchart below.

Figure 10-2: Grievance investigation, Management and closeout system



11 CORPORATE SOCIAL RESPONSIBILITY (CSR) PLAN

11.1 Introduction:

The CSR plan is based on the stakeholder consultations conducted by Kosher Climate as detailed under the chapter Stakeholder Mapping. The project activity falls in five villages viz. and there are 2 other villages as described under baseline chapter. However, the impact on these villages is near to none as the road is away from these villages' centres and the movement of project vehicles will have limited to no impact. The current CSR plan is proposed for the five villages where the project's WTG are located.

The land for the project is being procured through a land aggregator engaged by Gamesa on willing seller-buyer basis. There is specific caution taken to avoid land purchase from marginal farmers. The land is low yield and single crop type which will not have any livelihood dependence and hence, it is expected that there will be no significant impact from the procurement of land.

In order to improve the socio-economic status of the local population, as part of the Corporate Social Responsibility initiatives of ANPWPL proposes to set up an interventions programme; this will identify and improve socio-economic condition of the villages.

The proposed plan describes the approach that the project is taking with respect to community commitments and borrows inputs from the stakeholders collected during the consultation process.

11.2 Community Needs and Development Priorities

The development priorities have been designed based on the baseline survey provided under ***chapter 7*** and community expectations provided under ***chapter 6*** of this chapter. The study are has five villages among which Amidalya is the largest villages and Indravathi is smallest of all. The villages are predominantly farming based except for Indravathi which has only 20% farmers and rest being labourers. The basic medical and educational facilities are present in all the villages with limited support and infrastructure. It can be said that some of the villagers are on support from the Government for their livelihood being dependent of ration and employment schemes (Upadhi Padakam). The table below covers the essential needs and current status of the villages. Recommendations are made in the same which recommends action which can be taken to improve condition of livelihood in the villages:

Parameter	Status	Recommendation
Health	Most of the villagers are dependent on RMP (Doctors) who are many times not experienced enough to treat new/less popular/distributed illnesses. Medical facilities are available in all the villages with minimal availability of medicines and medics. However, the village of Indravathi	The villages should be supported with availability of more medicines at the village medical centres and medical compass can be conducted to focus on reaching to those who are due to come reason not able to reach these medical centres or are not benefitting

	has no medical facility of doctor of its own, It is completely dependent on the nearby village Amidyala for medical needs. Recently in the village two deaths took place due to Dengue Fever.	from the facilities.
Education	All the villages have primary and secondary schools setup in the villages itself, with the exception of Indravthi which has only primary school and is dependent on nearly Amidyala for secondary schooling requirements. Bicycles are provided by the Andhra Pradesh Government to secondary school going children for access to the nearest school. The nearest graduation college is in the town of Uravakonda which is within 10 kms of all the villages. The nearest University being at Anantapur, which is at a distance of 60kms.	The reach to education is acceptable in the study area, however, capacity building for the school teachers can be carried out to help them deal with children more sensibly and be able to bring motivation and curiosity in children. For the children in higher secondary classes, there should be carried guidance arranged which can help them understand possible carrier paths and required qualifications
Infrastructure	Apart from water, road, the infrastructure of villages will include availability of electricity, street lighting, shared facilities in villagers, panchyat bhavan, medical facility building, villager welfare association, banks etc	The detail of facilities in the villages is provided under ***chapter 7*** of this report. It is evident that there is lot more scope of improvement in the region. The improvements in infrastructure will in-turn improve the livelihood in the region. ANPWPL may plan to
Sanitation	The study area is low on sanitation. Most of the houses have bathing facility but very few have any toilets. It may just that less than 10% of the houses hold a toilet in there house. Open defecation is a general practice for both men and women. The government if India has initiated an massive programme to eradicate this practice but it seems to have reached the villages yet. There have been many such initiatives in the past as well which just brought some marginal changes.	The ANPWPL team can team up with the local administration in successful implementation of the Government programme. The government provides reimbursement for building up toilet facility. It is limited, but helps willing villagers to take action. ANPWPL can help spread awareness and make material contribution for building up toilets.
Livelihood	The villages are predominantly dependent on farming with the exception of Indravathi villages which has just few farmers which other being labourers. There is a need to decentralize the source of incomes from the families in the village by engaging them in	The district of Anantapur has numerous NGOs who are working in the area of low water farming and are improving productivity with wise usage of water. ANPWPL can bring the representative of NOGs and conduct

	training activities and giving carrier counselling to the youth of the village.	awareness programme on wise use of water in irrigation and alternative methods and crops to grow in such climatic conditions.
Water (Domestic)	There is a water storage tank created in the village of Nimabagallu for supply of water to the surrounding villages. The condition of water is acceptable with difficulty at times during summer season. Currently the water is supplied through hand pumps, and supply through RWS & Sri Sathya Sai Water supply.	The condition of deomestic water supply is stable with reare shortages during summers. ANPWPL, to engage villager in education on conservation of water and ensure that none of activities under project harm the water condition in the region.
Water (Irrigation)	The lively hood in the region is heavily dependent on rainfall which determines the production of crop in any particular year. The yields from the past seven years in the region are very low (3-6bags/acre) due to bad monsoons and very low rainfall. Hence, it can be said that the livelihood in the region is directly linked to water availability for irrigation. There are in past effort to improve the water condition in the villages such as construction of HNSS canal and check dams. The key programmes like Integrated Watershed Management Programme (IWMP) by Government of India have also been focusing in the drought prone areas of Anantapur.	The district of Anantapur has numerous NGOs who are working in the area of low water farming and are improving productivity with wise usage of water. ANPWPL can bring the representative of NOGs and conduct awareness programme on wise use of water in irrigation and alternative methods and crops to grow in such climatic conditions. Rain water harvesting structures like contour bunding, check dams, percolation tanks, farm ponds etc., are present and may need more additions/repairs. The construction of artificial recharge structures should be taken up on watershed basis after ascertaining the quantum of runoff potential.
Road Connectivity	All the villages are well connected to the main road. Most of the houses have cements roads till their entrances and some houses just doing with gravel roads. The connectivity to the town centre and nearest district as well is good enough. The only village with kaccha road to the nearest town centres (Uravakonda) in Indravathi. Due to this reason many villages avoid the 6kms kachha road and take the 11kms pakka road to Uravkonda.	The connectivity to Indravathi can be improved by connecting it to the Uravakonda, which will involve construction of road for a distance of ~6 kms. ANPWPL must repair any damage to the road during construction period is before usage strengthen any roads which will be extensively used.
Skilled Labourer	The study region is mixed of various group of people with varied backgrounds. Most of the villagers make there living through farming	The project activity will employ local workers to the extent possible. It is recommended that post construction,

	however, some work as labourers as well. The village of Indravathi is predominantly a village of labourers who range from unskilled to skilled labours. This makes the project region a good source of manpower.	ANPWPL conduct training for unskilled labourers to help them improve their livelihood. The prime focus should be the village of Indravathi for labour training.
Condition of Women	Though there are women welfare association in the villages it is to be noted that most of the women are restricted to household activity and do no hold decision making in key factors. As in the case of the village Amidayala the Sarpanch is a women, it was understood that she had very less independence in terms of actually heading the panchayat. The men of the house were looking after the activity on her behalf. Financial literacy is key to elevation of women's status and livelihood.	ANPWPL, must engage in strengthening the existing women welfare group by: 1) Conducting training for women on various skills. 2) Train them in financial management to make them financially literate 3) Help them connect to groups promoting sale of products made by women. The education and training of women will also help in decentralizing economic dependence of farming.
NGO's reach	Anantapur district is a hub for a number of Non-government Organization (NGOs) working for empowerment of poor and irrigation techniques. However, in the project region particularly, the participation of NGOs for development/awareness activity is found to be very low.	ANPWPL, can help engage the NGOs working in the project region to improve their presence in project region and in-turn can get assistance in implementation of various CSR activities by them un the region.
Cattle Health	Being dependent of farming the village has significant numbers of cattle. Cattle are one of the key assets of a farmer and hence, health of cattle is crucial to economic benefits to the farmers. It was understood that some nominal facility is available in the town of Uravakonda which is limited in the extent to which it can treat an animal. The nearest veterinary assistance is available in Anantapur district centre which is quite far. Being a sparsely vegetated area, the project region even has a fodder problem as for simple act of grazing has to be carried at around the basin of canals. During the summer season the availability of fodder is even more difficult and hence a reliable plan is required for maintenance for cattle by any	ANPWPL, may conduct awareness about cattle health and hygiene to the farmers. A visiting veterinary doctor can solve the problem of cattle health and hygiene. As, fodder availability is identified as a serious problems specifically during the summer months, the farmers must be made aware about the Agriculture Contingency Plan of Government in Anantapur and how can the farmers be benefitted. The right choice and growth of fodder can help the issue and farmers must be educated about all possible best practices.

	Farmer.	

11.3 Suggested Development Activities

In ***chapter 7*** and ***chapter 6***, the social conditions of the region and concerns and expectations of the stakeholders' have been explained. Now, the table above, details of possible actions by ANPWPL has also been shared. Having experience from existing projects, ANPWPL has taken necessary actions to prevent any complaints from the stakeholders. Similarly, Gamesa being a versatile player in the wind market has taken cautions to engage local community in the implementation of the project activity.

Based on the above development priorities and expectations an indicative list of activities are suggested to be taken up in project villages along with timelines and estimated budgetary considerations is presented in the table below:

Parameter	Suggested Activities	Frequency	Suggested Budget
Health	➢ Helping is setting up a medical facility in Indravathi.	Once	3,00,000 (one time)
	➢ Special Health check-up camps with specialist like eye check up, cardio, etc. ➢ Awareness programmes about health and nutrition. ➢ Awareness programme about necessary sanitation to prevent diseases and prevent fatalities (like that of Indravathi)	Every six months	1,00,000/camp
Education	➢ Upgrading Infrastructure in schools like, provision of Library and Computer rooms, furniture and fans in schools.	Once	1,50,000/school (a total of 14 schools)
	➢ Training programme for teachers to sensitise them towards motivating and encouraging students. ➢ Carrier Guidance to senior secondary students ➢ Identifying meritorious/interested students and providing special training	Quarterly	20,000/programme
Sanitation	➢ Contribution of Manpower for construction of toilets	--	900/Toilet (In addition to central govt contribution)
	➢ Educate the harmful effects of defecating in open ➢ Conduct worshops on hygienic practices at home and village.	Every six months	20,000/programme
	➢ Join hands with local government body in	--	None

	implementation of Swachh Bharat Mission and construction of toilets.		
Livelihood	➢ Educating villagers about best practices in farming. ➢ Help marginalized farmers to decentralize the source of income from farming to other sources by means of providing infrastructure support.	Every six months	50,000/programme
Water (Domestic)	➢ Plan, assist and implement water conservation activities in the villages ➢ Support for repair /strengthening of existing water resources.	Once every two years	5,00,000/village
	➢ Educate villages about methods to replenish underground water.	Every six months	50,000/programme
Water (Irrigation)	➢ Plan and assist in water conservation activities in the fields. ➢ Assist farmers in implementation of low farming method to their farms. ➢ Educate them about the best practices is arid regions and best crops to grow.	Every six months	2,00,000/programme
Road Connectivity	➢ Strengthening of existing roads in the villages during construction period and post construction period. ➢ Construction of pukka road from Indravathi to Uravakonda town (6kms)	Once	Budget to be estimated by ANPWPL
Skilled Labourer	➢ Conducting skill based training in the villages with specific focus on Indravathi village.	Every six months	50,000/programme
	➢ Engagement of the local skilled labourers from the project region to the extent possible.	Once	--
Condition of Women	➢ Support and infrastructure assistance to Women welfare groups.	Once every year	1,00,000/village
	➢ Special skill based training for women ➢ Training of finance management	Every six months	50,000/programme
NGO's reach	➢ Engage reputed NGOs in the region to work in the project area. ➢ Provide required infrastructure and monetary assistance to these NGOs in the areas identified already under CSR objects.	--	Covered in earlier objectives
Cattle Health	➢ Educate the farmers about best practices for cattle management ➢ Educate about the Agriculture contingency plan by government and suggested mitigation measure to prevent loss of cattle.	Every six months	50,000/programme

	➢ Conduct veterinary camps for livestock in the project villages.		

Implementation & Monitoring of the CSR Plan:

ANPWPL must form a dedicated team to handle, plan, assist, execute and monitor the CSR plan. The team must be composed of site team as well as corporate team who can monitor all the activities.

Orange Renewable has expericen in implementation of CSR plan and the company has been implementing CSR plan at its other project sites. The company has another 100.5MW wind power project implemented in the state of Madhya Pradesh and has carried quite a few activities from disctribution of furniture, books to schools to development of drinking water facility and toilets at schools & temples.

Table 11-1: Summary of CSR activities initiated by Orange around 100.5 MW wind power project at Mamatkheda, dist. – Mandsaur & Ratlam (MP).

S. No	Site Nomenclature	Areas covered around the site	CSR activities	Approx. Budget (in lacs)
1	MMK North Cluster	Behpur, Garoda, Karju, Dehri, Bhandariya, Sagwali	Furniture distribution in Schools	4.15
2	MMK North Cluster	Behpur, Garoda, Karju, Dehri, Bhandariya, Sagwali	Stationary (Books and Note books distribution in Schools	2.62
3	MMK	Mandsaur city	Development of drinking water facilities at district Ayurveda hospital	2.2
4	MMK north and south cluster	Behpur, Garoda, Karju, Dehri, Bhandariya, Sagwali, Mawta, Riyawan, Nandwel, Ranipur, Thikriya	Furniture distribution in Schools	15.5
5	MMK North Cluster	Karju	Toilets at Temple and school	2.05
6	Total			26.52

Below are presented particular details of activies and quatification of support expented:

Table 11-2: Furniture Distribution in Mandsaur & Ratlam district in MP

S. No.	Furniture	Quantity (in nos.)	School	Village
1	Mini stool	221	Primary school	Groda, Karju, Dehri, Bhandariya, Sagwali
2	Single seating bench with Desk	210	Inter college	Behpur
3	Triple seating bench with desk	75	Jr. High school, inter college	Groda, Karju, Dehri, Bhandariya
4	Office table	01	Primary school	Karju

Photograph 11-1: Furniture Distribution

Table 11-3: Stationary Distribution in Mandsaur & Ratlam district in MP:

S.no	Village	School/college	Long copy	Rough Copy	Practical Copy	Maths Kit	Science Kit	Ball pen	No of student
1	Behpur	Inter college	592		222			100	
2		primary school	254					100	
3		Jr high school	498			1	1	100	
4	Dhandhoda	Jr. high school	438			1	1	100	
5		Primary school	132					100	
6		high school	116		58			100	

7	Garoda	Jr. High school	238			1	1	100	
8		Primary school	100					100	28
9	Karju	intermediate college	270					100	
10		Primary school	377					100	122
11		Jr high cshool	326	65		1	1	100	
12	Dehri	Primary school	250					100	
13		Jr. high school	294			1	1	100	
14	Bhandariya	Jr. high school	663			1		100	
15		primary School	300					100	50
16	Sagwaali	Sagwali	502					100	40
17	**TOTAL Quantity**		**5350**	**65**	**280**	**6**	**5**	**1600**	**240**

Photograph 11-2: Stationary Distribution

Photograph 11-3: Three Toiles contructed at the village Karju;

Drinking Water: Drinking water supply system in zila ayurvedic hospital, Mandsaur (MP)

Drinking water facility at zila ayurvedic hospital was very poor. Hospital staff and patient were depends on one hand pump in hospital premises for drinking water. On request of CMO, Mandsaur, drinking water facility developed by the Orange Renewable at hospital premises. Orange renewable installed a bore well, 1 RO, 1 water cooler, 1 water storage tanks and water supply pipe fittings o distribute the water in hospital premises. Now drinking water facility is available at hospital premises.

Photograph 11-4: Drinking Water systems setup by Orange

As a first step towards Corporate Social Responsibility, Orange Renewable identified infrastructure development in education and healthcare as a primary activity.

Being a socially responsible organization, Orange Renewable is planning to add on to its CSR activities in all operational states as MP, Rajasthan, Maharashtra and Andhra Pradesh in near future. The areas of intervention and possible scope of the activities could focus on:

- Education (Infrastructure development, skill devepolement, scholarships etc.)
- Health (Medical camps, infrastructure development, awareness programs etc.)
- Sanitary (infrastructure development and awareness programs)
- Environment (Afforestation, Rain water harvesting, awareness camps)
- Employment (Skill development training program)
- Women empowerment (Awareness camps, nutrition camps, skill development etc.)

12 CONCLUSION AND RECOMMENDATIONS

The project activity under this study pertaining to its location benefits has avoided interfering with local environment and society. Based on the assessment of environmental and social factors it can be firmly said that the project "100 MW Wind Power Project by ANPWPL" has limited adverse environmental and social impacts that are generally site specific and can be readily addressed through the proposed mitigation measures. Hence the project can be categorised as a **Category B** project, as per IFC's institutional requirement.

Having said that, it is imperative to follow the recommendations of this report for minimal residual impacts.

The technology of wind power generation itself 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 very well addressed by standard construction techniques as described in the ESMP. The residual impact after proper mitigation measure will be negligible.

The most active period in the life cycle of the project is construction phase, after which during operation, the impacts will be mostly positive form the project as it provide renewable energy and does not generate any gaseous, solid and liquid wastes. The location of project has a key advantage as it restricts the impact of Noise and shadow flicker from the project activity. The relatively isolated location is a favourable aspect in its assessment. The aspect and possibility of Bird kill remains an issue for most of the wind farms, however, it can be managed by following methods described in this report.
The region has also been spotted with presence of Blackbuck which is an endangered animal and protected under law. The client must take necessary measures to conserve Blackbuck and not cause any disturbance in their natural environment.

The social condition of the villages is poor is the most conservative aspect, the client should take inputs from the outcome of social consultation and CSR plan to help the local communities improve their livelihood.

Overall, after appropriate implementation of mitigation measures, the project will have a positive impact in the environment and local communities as a whole. It is recommended that ANPWPL proceeds with the wind power project at Nimbagallu and implements measure suggested in the Environmental Social Impact Assessment Study.

13 ANNEXURES

Annexure I: List of Documents Reviewed and collected from ANPWPL

i) Satellite imagery and Topographical maps of Survey of India

ii) Wind Resources Assessment Study Report by 3 Tier

iii) Detailed technical specification of the Wind turbine generators

iv) Project layout and various drawings including SLD of sub-station

v) Various HSE documents and HSE Policy of ANPWPL, Gamesa

vi) ISO 9001, ISO14001 and OHSAS 18001 Certification of Gamesa

vii) Insurance Policies of the Labourers working under sub-contractors

viii) Contract Labour License of Gamesa

ix) Land Acquisition protocol copy by Gam from Gamesa

x) Various land related documents

xi) Allotment/Approval of Wind power project by NREDCAP

xii) Soil test/investigation report for construction

xiii) Approved tower Schedule by APTRANSCO

Annexure II: Project Allotment from NREDCAP (New & Renewable Energy Corporation of Andhra Pradesh Ltd)

ఆంధ్రప్రదేశ్ నూతన మరియు పునరుద్ధరణీయ ఇంధన వనరుల అభివృద్ధి సంస్థ లి.

New & Renewable Energy Development Corporation of Andhra Pradesh Ltd.

(A State Government Company)

(Formerly Non-Conventional Energy Development Corporation of Andhra Pradesh Ltd)

Regd. Office : 5-8-207/2, Pisgah Complex, Nampally, Hyderabad - 500 001. India.

Tel : Off : 040-23202391, 23202262, 23203376 Fax : 040 23201666.

E-mail : info@nedcap.gov.in, nedcap@ap.nic.in Website : www.nedcap.gov.in

Ref: NREDCAP/WE/GWTPL/10508/2013 Dt. 03.07.2014

To

M/s. Gamesa Wind Turbines Pvt Ltd,
The Futura IT Park, Block-B,
8th floor, No.334, Rajiv Gandhi Salai,
Sholinganallur, Chennai- 600 119

Sir,

Sub: - Establishment of Wind Power Projects in Honnura- Palturu, Ananthapur District - Demarcation of areas - Reg.

Ref: - 1. Agreements entered on 20.07.2012 & 30.10.2013
2. Your Lr.No.Gamesa/WP/Paltur, Nimbagallu &Molagavalli/2013dt.25.11.13.
3. Our letter No.NREDCAP/WE/GWTPL/10508/2013 Dt. 29 -11-2013
4. Our letter No.NREDCAP/WE/GWTPL/10508/2013 Dt. 07-04-2014

****

In the reference 4th cited, it was informed that, the letter No. NREDCAP/WE/ GWTPL / 10508/2013 Dt. 29 -11-2013 stating the boundary co.ordinates for wind power project issued by this Office was kept abeyance till the issue is settled.

After examination of the MoU and proposals, it was decided finally that the area originally applied at the time of MoU entered for Palturu, Uravakonda Tq, Ananthapur district was allotted to M/s Gamesa Wind Turbines Pvt Ltd for the implementation of 300 MW capacity wind power project sanctioned. (copy of the map furnished by M/s Gamesa is enclosed).The Boundary co-ordinates are furnished hereunder.

S.No.	Location	Capacity in MW	Boundary Co-ordinates in Topo sheet no: 57 F/ 1	
01	Honnura- Palturu Ananthapur District	300	1. N 15° 00"00'	E 77° 08"00'
			2. N 15° 00"00'	E 77° 15" 00'
			3. N 14° 53"56'	E 77° 08"00'
			4. N 14° 53"56'	E 77° 15" 00'

Hence, M/s. Gamesa Wind Turbines Pvt Ltd is advised to take immediate necessary action for implementation of above projects as per the agreement entered.

Thanking you,

Yours faithfully,

VC & Managing Director

Annexure III: Evacuation Approval by Transmission Corporation of Andhra Pradesh Ltd

TRANSMISSION CORPORATION OF ANDRA PRADHESH LTD

Office of the
Superintending Engineer
OMC Circle::Anantapuramu.

Memo.No.SE/OMC/ATP/DE.Tr/AE.T1/F.222 /D.NO. 4044 /2015, Dt: 10- 07-2015

Sub : - APTRANSCO-OMC-Circle-ATP-Erection of 220kv moose DC line from proposed 220 /33KV pooling station at Nimbagallu to the 400/220KV SS Uravakonda(Under construction) for evacuation of 300MW Power from wind power project to be set by M/S Gamesa wind turbines pvt ltd at Palthuru (v),Urvakonda(m) in Anantapur District -Profile and Tower schedule –Approved – Regarding.

Ref :- 1) Lr.no.HRD&Plg/DE-comml/ADE-C/F.Gamesa/D.No.66/14,Dt:11-08-2014
2) Lr.no.CPT 130/SE/PM/Gamesa Wind power /300MW/D.No.801/2015,Dt:23-6-2015
3) Lr.No.AEE/TLC-II/ATP/F.232/D.No.102/15,Dt:09-07-2015
4) Lr no.EE/Construction division/ATP/F.No: / D.No.1410/2015,Dt:09-07-2015.

& & & &

With reference to the above, 2 Nos. Profile and Tower schedule pertaining to Erection of 220kv DC line from proposed 220/33KV pooling station at Nimbagallu to 400/220KV SS Uravakonda(Under construction) for evacuation of 300MW Power from wind power project to be set by M/S Gamesa wind turbines pvt ltd at Palthuru (v),Urvakonda(m) in Anantapuramu District submitted by the Executive Engineer/Consiruction/Anantapuramu vide reference (4) cited, is here with Approved.

The EE/construction/Anantapuramu and EE/TLC/CIVIL/LIS/KURNOOL are requested to take further necessary action accordingly.

The EE/Construction /Anantapuramu is requested to hand over a copy of the approved profile to the contractor and original may be retained at the Division office for verification.

Encl: 1)Profile -2 No's
2)Tower Schedule-6Nos

Superintending Engineer
OMC Circle::Anantapuramu

To
The Executive Engineer/Construction/Anantapuramu.

Copy submitted to :
The chief engineer/Kadapa zone/Kadapa
The Chief engineer/Construction/APTRANSCO/V.S/Hyderabad.

Copy to:
The Executive engineer/Civil/TLC-LIS/Division/Kurnool
The Assistant Executive Engineer/TLC/SD-II/Anantapur
The Assistant Executive Engineer/Civil/TLC/SD/Anantapur.

Annexure IV: List of Land Owners (Finalized till December 2015)

List of some of the Land Sellers and Extent of Land Offered			
WTG Location Number	**Name of the Land owner**	**Total Extent in Acres**	**Village**
G1-45 & G1-46 & G1-47	Boya Sarojamma W/o Kristappa	3.06	Amidyala
	Boya Prashad S/o Kristappa	3	
	Boya Nagaraju S/o Kristappa	3	
	T.Chinna Subbaraidu	12.91	
	T.Venkatasubbaiah		
G1-48	Madamanchi Subbalakshmamma	8.34	Mopidi
	D.Shidappa S/o D.Ramappa	9.61	
G1-49	Karanam Venkobarao	8.6	
	Madamanchi Venkataramana	9.15	
	M.rajesh S/o Srinevasulu		
G1-55	Kummara Ramachandrappa	7.4	Indhravathi
	Kummara Yerriswamy		
	Kummara Laxmidevamma		
	Kuruba Mallikarjuna		
G1-27	Jatti Rajesh Kumar S/o Prabrakar	3.6	Indhravathi
	Jatti Lakshmanna S/o Anjineya	3.6	
	Koka Jayalaxmamma	6.25	

Annexure V: Stakeholders' Grievance Record

Stakeholder Section	
Name of Complainant	
Address	Postal Address: _____ _____ Telephone: Email:
Suited Method of Contact	Post/Telephone/Email
Date of Grievance/Incident	
Recurrence of Grievance	One Time: Multiple Times: Continuous:
Description: (What happened? Where did it happen? Who did it happen to? What is the result of the problem? Source and duration of the problem?)	
Project Management Section	
Record Ref No	ANPWPL/Grievance/2016-17/**0001**
Information on Corrective Action	
Planned Date of Resolution	
Any Revision in CSR	
If Yes Description	

Grievance Satisfactorily Resolved	Yes / No
Stakeholders' Signature	
Signature of Project Management	
Remarks (if any)	

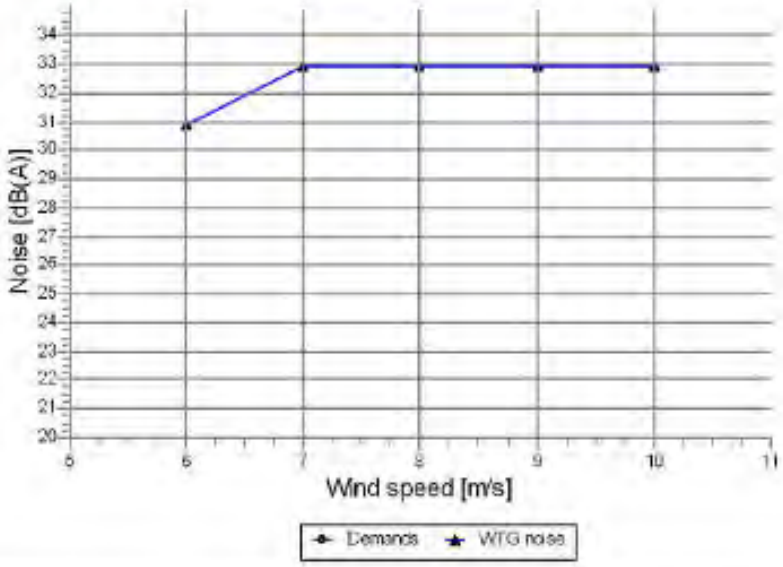
Project:
Nimbagallu

Kosher Climate
Calculated
20-05-2016 00:59/3.0.651

DECIBEL - Detailed results

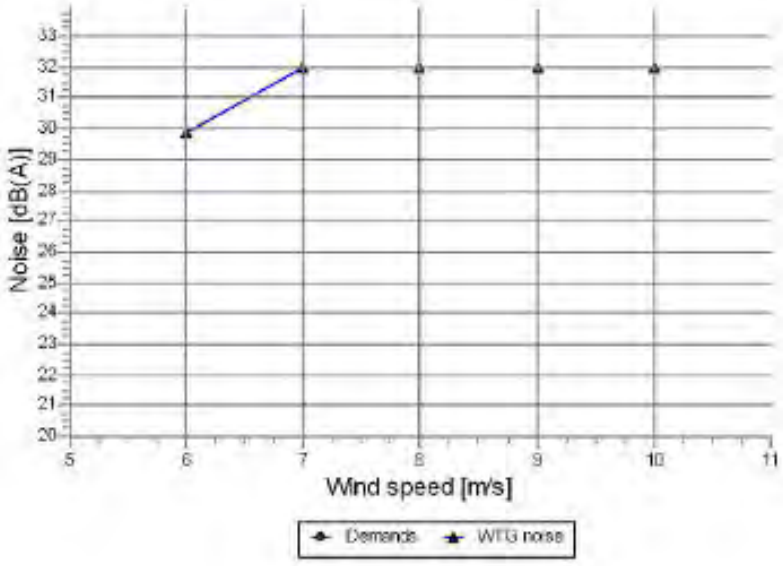
Noise calculation model: ISO 9613-2 General

Noise sensitive area: (Renumakulapalli) (A)



Wind speed [m/s]	Sound Level WTG noise [dB(A)]
6.0	**30.9**
7.0	**33.0**
8.0	**33.0**
9.0	**33.0**
10.0	**33.0**

Noise sensitive area: (Nimbagallu) (B)



Wind speed [m/s]	Sound Level WTG noise [dB(A)]
6.0	**29.9**
7.0	**32.0**
8.0	**32.0**
9.0	**32.0**
10.0	**32.0**

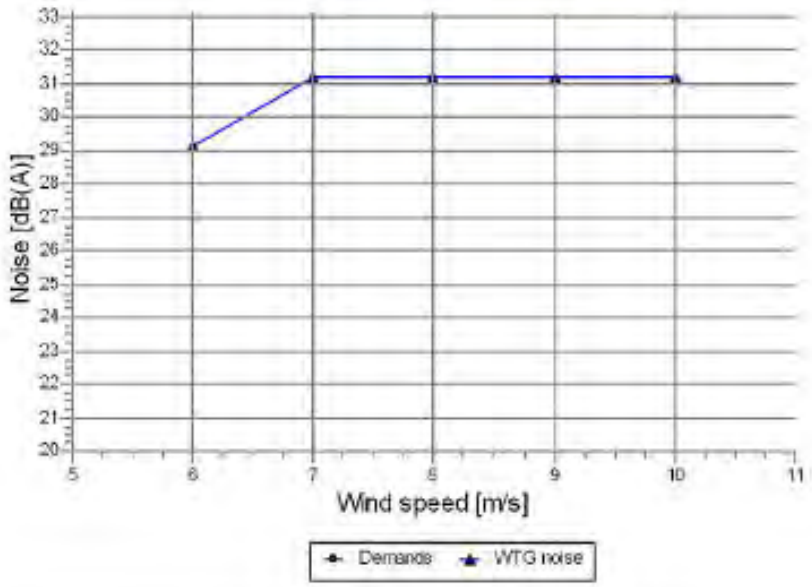
Project:
Nimbagallu

Kosher Climate
Calculated:
20-05-2016 00:59/3.0.651

DECIBEL - Detailed results

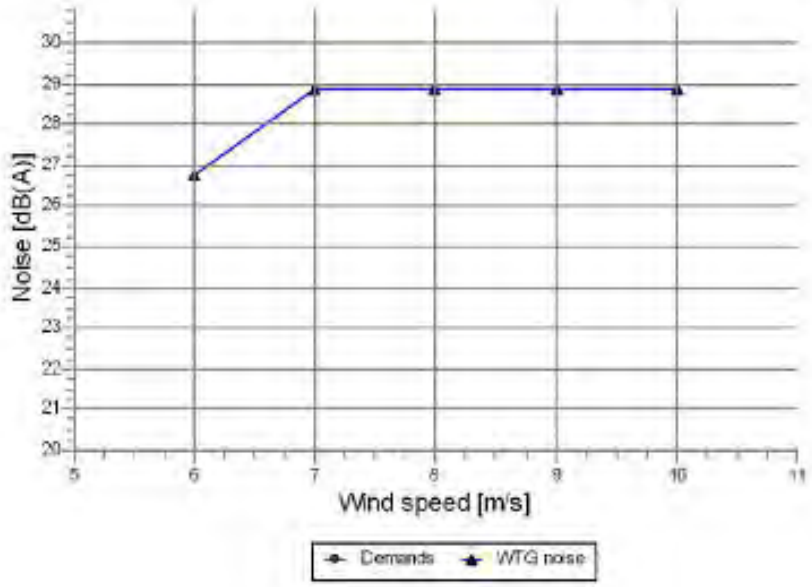
Noise calculation model: ISO 9613-2 General

Noise sensitive area: (Indravathi) (C)



Wind speed [m/s]	Sound Level WTG noise [dB(A)]
6.0	**29.1**
7.0	**31.2**
8.0	**31.2**
9.0	**31.2**
10.0	**31.2**

Noise sensitive area: (Mopidi) (D)



Wind speed [m/s]	Sound Level WTG noise [dB(A)]
6.0	**26.8**
7.0	**28.9**
8.0	**28.9**
9.0	**28.9**
10.0	**28.9**

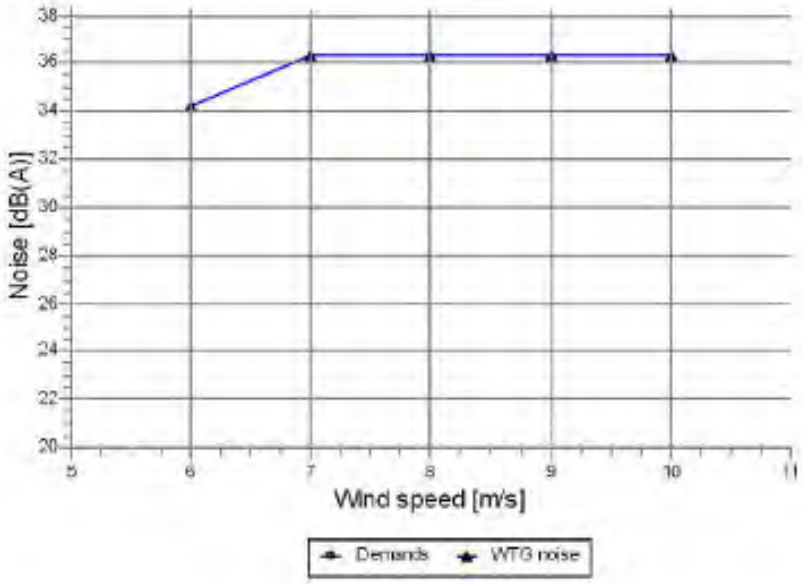
Project:
Nimbagallu

Kosher Climate
Calculated:
20-05-2016 00:59/3.0.651

DECIBEL - Detailed results

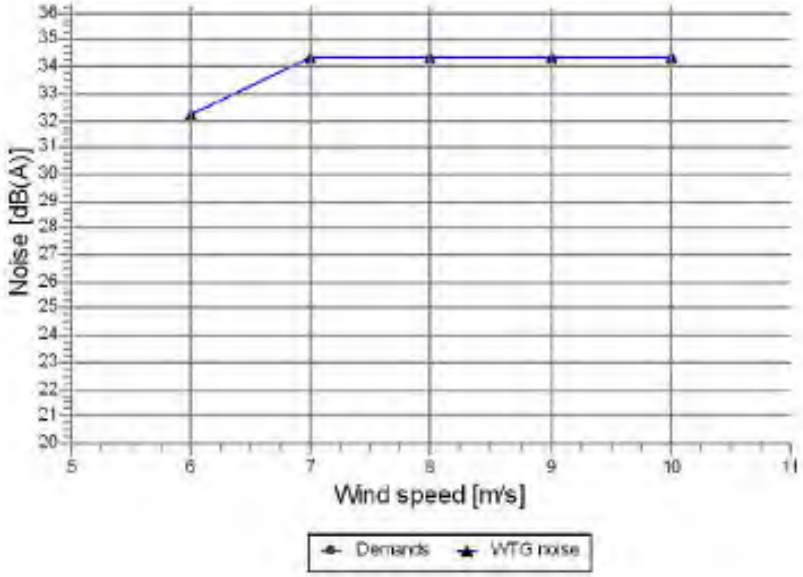
Noise calculation model: ISO 9613-2 General

Noise sensitive area: (Amidyala) (E)



Wind speed [m/s]	Sound Level WTG noise [dB(A)]
6.0	**34.3**
7.0	**36.4**
8.0	**36.4**
9.0	**36.4**
10.0	**36.4**

Noise sensitive area: (Amidyala 2) (F)



Wind speed [m/s]	Sound Level WTG noise [dB(A)]
6.0	**32.2**
7.0	**34.3**
8.0	**34.3**
9.0	**34.3**
10.0	**34.3**

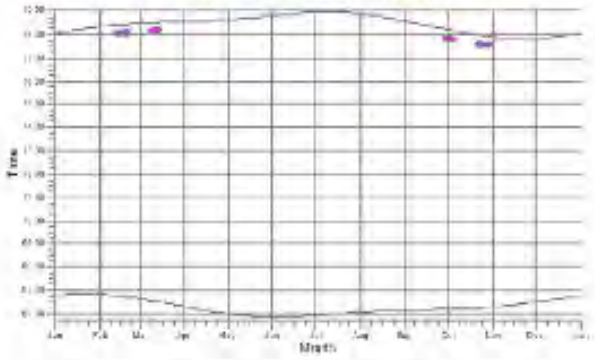
Annexure VII: Shadow Flicker Analysis for Individual Shdaow Receptor

Project:
Nimbagallu

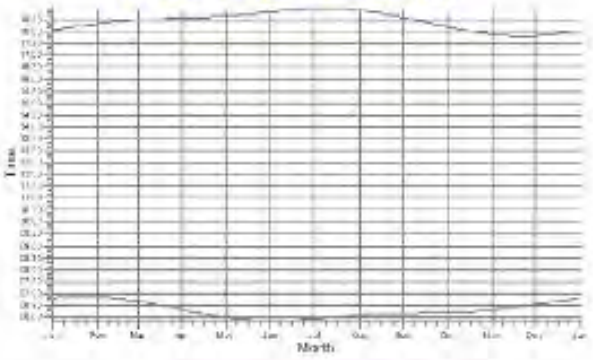
Koshler Climate
Calculated:
20.05.2016 00:59/3.0.651

SHADOW - Calendar, graphical

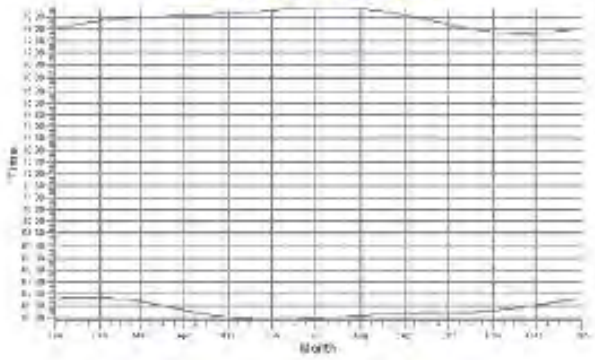
A. Shadow Receptor 8 (Amidyala)



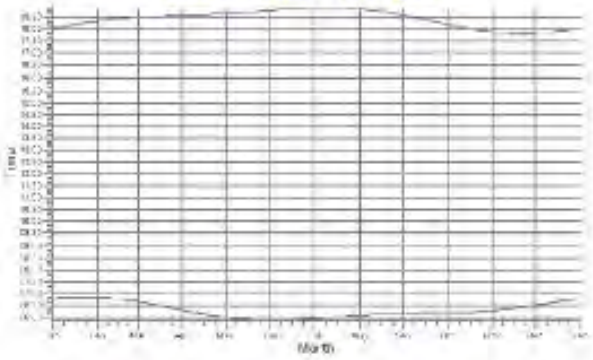
B. Shadow Receptor 1 (Rerumakulapalli)



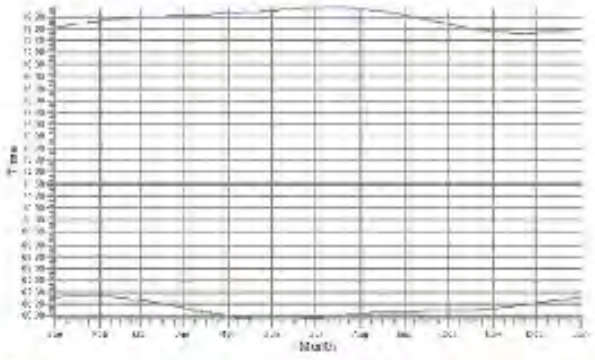
C. Shadow Receptor 4 (Nimbagallu)



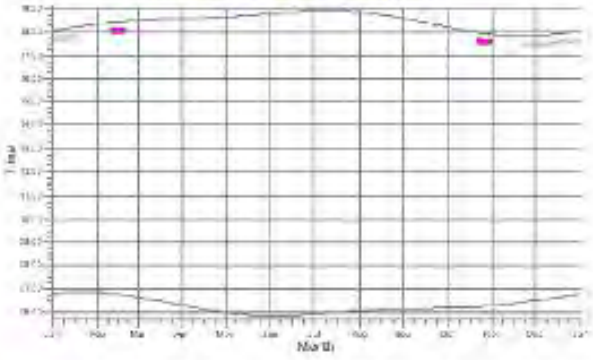
D. Shadow Receptor 5 (Nimbagallu)



E. Shadow Receptor 2 (Indravathi)



F. Shadow Receptor 7 (Amidyala)



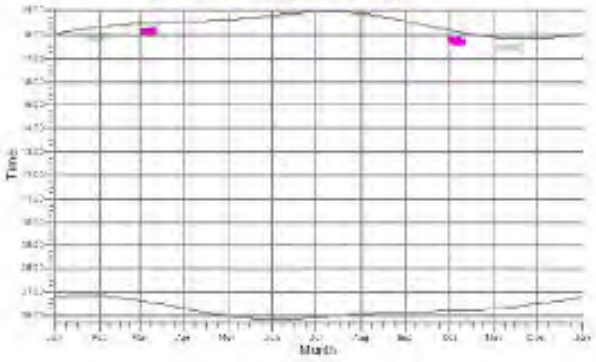
WTGs

Nimbagallu

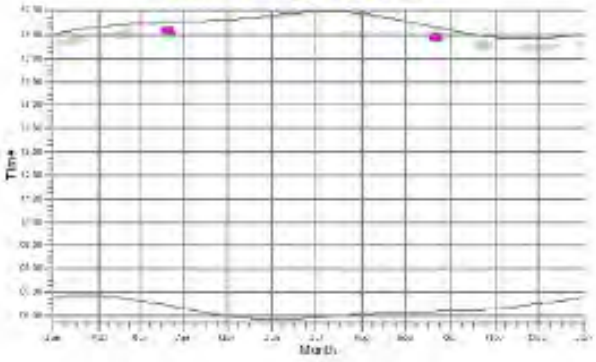
Koshen Climate
20-05-2016 00:59/3.0.651

SHADOW - Calendar, graphical

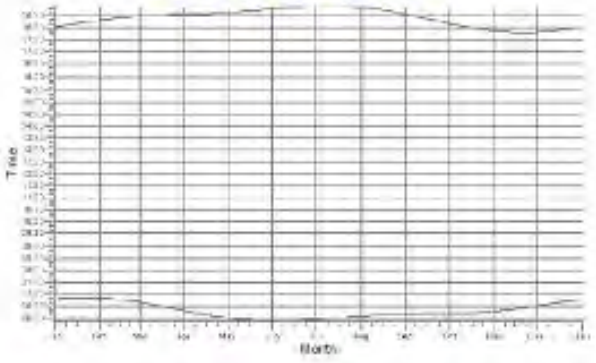
G: Shadow Receptor 8 (Amidyala)



H: Shadow Receptor 9 (Amidyala)



I: Shadow Receptor 3 (Indravathi)



Annexure VIII: Sample Format Used for Social Consultation- Local Community

Cell:- 9573402643

SOCIAL IMPACT ASSESSMENT

A. General Identification

Household no: ......HSC-17.......... Village/quarter: ... Indravathi

Name of the respondent: ..Manjula Mallikarjuna........ Age (in completed years): 50

Education of the respondent : Instruction: TICK ONLY ONE

1. Illiterate 2. Literate but no formal education 3. School up to 5 years (Class1-5) 4. School up to 6-9 years (Class 6-9) 5. SSC/HSC 6. Under Graduate 7. Graduate /Post Graduate (General) 8. Professional (Doctor, Engg, LLB,MBA) 9.Technical (Diploma/IT) 10 Others (Specify) ____

Occupation of the respondent Instruction: TICK ONLY ONE

1. Farmer 2. Wage labourer 3. Skilled worker 4. Petty Trader(shop keeper) 5. Self employed 6. Service – Government 7. Service Private 8. Homemaker 9. Student 10. Retired 11. Unemployed 12. Others

B. Property Identification

1. Address of the property identified: ....
2. Use of property: 1. Residential 2. Commercial 3. Res-Comm 4. Govt. Office 5. Agri 6. Other ....
3. Status of the user of the property: 1. Owner 2. Tenant, 3. Encroacher 4. Squatter
4. Name of owner of the property:..V. Laxmidevi.. Occupation: ....
5. Name of the user of the property:...
6. Name of the respondent: ......Wife............ Relationship with the User...............

B-1. The property is: 1. Woman headed 2. Disabled person headed 3. BPL 4.None of these

B-2. Household Information

7. If physical/social disability in the household, define (e.g., physical disability - dumb and deaf, blind, lame, etc., social disability - old, infirm, orphan, destitute, etc.):
8. Living in this structure for how many years? ...60 Years
9. Does the household have a ration card? 1. Yes 2. No If yes, since when? (year) ....
   Type of card- APL / BPL

B-3. Enlistment:

10. Is the head of the property user listed in the voters' list? 1. Yes 2. No. If not, why? ...

Page 1 of 4

C. Household Member Information/Commercial Employees Information

1. Number of family members (entitled persons): ...3.......
2. Household member details/Commercial employees details:

Sr #	Name	Age	M/F	Marital status	Rel. to Head	Education	Occupation Main	Occupation Subs	Total Income (monthly)
1	M. Malli Karjuna	50	M			Dobyee			2000/-
2	V. Laxmidevi	42	F						
3									
4									
5									
6									
7									
8									24000/- per y

C-1: Social Group Particulars:

3. HH Religion: 1. Hindu 2. Muslim 3. Christian 4. Other (please specify): ....
4. Scheduled Caste/ Scheduled Tribe/ Other Backward Caste: 1. SC 2. ST 3. OBC 4. None

D. Land Use: (please convert local unit for area into m^2)

Description	Area
Total area of immovable property owned by the HH	5
Area used for family dwelling	5
Area used for business, rental, etc. if any	—
Area used for agricultural production, if any	—
Area unused for being fallow land, if any	—

E. Structure and Homestead Land:

Area of structure (sq. m.)	
Type of structure	1. Pucca 2. Kutcha
Wall construction material	1. Laterite 2. Bricks 3. Mud bricks 4. Others
Roofing material	1. Tiles 2. Terraced 3. Both 4. Thatched 5. Other
Flooring material	1. Concrete 2. Red/black oxide 3. Mud 4. Other

F. Owner's and Tenant's Response with regard to Structure: Owner?/ Tenant ?

1. How old is the structure (in years)? ....13..
2. If you are a tenant in that structure, since how long you are living there? ....
3. Do you have electricity connection in the structure? ...... 1. Yes 2. No
4. Do you have tap water connection in the structure? ....1. Yes 2. No
5. How are the solid wastes disposed?

1) collected regularly 2) Disposed to a predefined landfill

3) Disposed to a wild disposal area 4) Disposed irregularly 5) Disposed to the river/lake

6) Burning 7) Other ..... 8) I do not know

6. Which fuel do you mainly use for heating? (Tick one)

1) fuel wood / Firewood 2) LPG/Gas c) Gobar gas/bio fuels 3) Kerosene 4) other

G. Total Household Income:

Income item	Income amount
1. Income from regular job	
2. Income from business	
3. Income from seasonal jobs	2000/=
4. Income from cultivation and/or on *own* land	
5. Income from any other source	
TOTAL	24000/= per year

H. Land Tenure: (refers only to agricultural/plantation land)

1. Do You Own Agricultural / Plantation Land a) Yes b) No (Go to **Q**)
2. Area of land holding (Acre):
3. Type of land ownership:
   1)I own and cultivate this land 2). I own but don't cultivate this land 3). I rent this land from someone else 4). I rent out this land 5). Other (please specify).....
4. Do you have legal documents for your type of ownership? ..... 1). Yes 2). No
5. If not owned by head of HH, name and location of owner:
6. What do you cultivate on this land?
7. How do you use the products?
   1). For subsistence 2). Selling at internal markets 3). Selling at external markets 4). Other

I. Are you aware of the proposed projects/industries in/near your village?

1). Yes (please explain how you came to know about it) 2). No

2). Was there any consultation giving details of the project?

J. Will this land be acquired for the project?

1). Yes 2). No (if the answer is no, go to **Q**)

K. Have the negotiations started/completed?

1). Not started 2). In progress 3). Completed 4). I do not know

L. Do/did you prefer in kind or cash compensation for your land?

1). In kind (land to land) 2). Cash 3). I do not know

M. With the compensation you get, are you able to buy a parcel of similar/better size and quality?

1). Yes, i can buy a land which is better quality and/or bigger in size
2). Yes, i can buy a land of similar size and quality
3). No i can not buy a similar/better land
4). I do not know
5). Not applicable (the negotiations haven't completed)

N. Do you depend on the income from the land parcel to be acquisited?

1). Yes 2). Partially 3). No 4). I do not know

O. How do you plan to use your money?

P. Do you have any grievances about the land acquisition? Yes/ No

1. **If yes, have you communicated this to the company?**
2. **What is it?**
3. **How is this dealt with?**

Q. What do you think would be the benefits and demerits of the project?

Name and signature of the investigator:
Date:

Signature of the supervisor:
Date

Annexure IX: Sample of Format Used for Social Consultation- Village Head

Sarpanch Cell:-9848310380

Questionnaire For Village Head/ Local Officials

B. Obilesh S/O Yerrappa Village Preudent Indravathi

1. HISTORICAL PROFILE

1. When was the village founded? short history of the village.

Based on Indravathi Canal

2. DEMOGRAPHY/GENERAL PROFILE

2. How many people are there in the village? How many households are there?

1200/- people 250 Houses

3. How many different ethnic groups are there in this village? Can you tell me what the main ethnicities are? What are the cultural differences?

NIL

4. Which languages are spoken in your community?

Telugu

5. What is the main religion in your community? Are there any other religions?

Hindu only

6. Has there been migration into the area? Where have these people come from and why? What were the positive effects of migration? What were the negative effects of migration? Has there been any conflict between residents and migrants?

10%. only

3. ADMINISTRATION / LEADERSHIP

7. Are there any groups, organisations, associations or cooperatives in the village? What are these? (e.g. women's savings groups, hunters association, etc).

11 women Organizations -

8. What is the local development plan of the panchayat? How do you develop it? What are the priorities? Is sufficient funds available under various govt schemes>?

Not Sufficient grant

4. LOCAL ECONOMY/ LIVELIHOODS

9. What are the main jobs that people in the community do?

Agriculture

10. Are there any caste-wise classified jobs? What? How?

NIL

Questionnaire For Village Head/ Local Officials

5 FOREST RESOURCES/LAND OWNERSHIP

11. Is there a forest in the close vicinity of your village? Do people pick up firewood from the forest? Do people pick up non-wood forest products?

NIL

12. Can you give some information about agricultural production. Which agricultural products do you produce? Are farms small or large in general? – mainagri cultivation in the area? % of cultivators/farmers, agrilabourers?

Groundnut, Almond, Dal, Paddy

13. How many women titleholders in the area? Is there any practices that limit such freedom of ownership of land?

30% women title holders

6. SOCIAL COHESION AND INTEGRATION

14. Has there been any conflict / tension with the neighbouring villages? If yes, what was / were the reason(s) for the tension(s)/conflict(s)? Is it still continuing? If no, how do these disputes get resolved?

NIL

15. Has there been any conflict with the industrial facilities nearby? If yes, what was/were the reason(s) for the conflict? Is it still continuing? If no, how do these disputes get resolved?

NIL

7. SOCIO-ECONOMIC INFRASTRUCTURE

16. please list out the public / private social institutions / infrastructure facilities in the area?

Social institutions	Name of the institution	Distance in Kms	Is this service sufficient for the current Population?
Primary education school	1 one HP School	0	Yes
High school	one RBT school	---	
Hospital	---	---	
Health center (village clinic)	---	---	
Other health facilities	---	---	
Police station	---	---	

Questionnaire For Village Head/ Local Officials

Library	—	—	—
Shops (Market, butcher, bakery etc)	—	—	—
Financial (e.g. banks, ATM, exchange offices)	—	—	—
Post office	—	—	—
Other (please specify)	—	—	—
Which are the prominent religious institutions in the area?	—	—	—
ANY CULTURAL MONUMENTS?	—	—	—

17. How many households in the village are electrified? Are you satisfied with the electricity supplies in your village? Are there any management problemsin this sector?

100% Power Connection

18. What are the main sources of drinking water in the village? Is sufficient water available for various use? Any water related problems, especially water quality issues? Any incidence of water born diseases?

Satya Sai Baba water

19. Is there a sewage system in the village, where is it discharged to? If no, how do you deal with the waste waters? Are you experiencing any problems with wastewaters/sewage?

NIL

20. How is the solid waste handled? Do you experience any problems regarding solid waste disposal?

NIL

21. What are the educational facilities in the village? Are you satisfied with them?

80% Sufficient

22. What are the health facilities in your village? Are you satisfied with them?

NIL

23. Morbidity patteren of the village for last 5 years-prominent disease?

dengue, Typoid, Malaria, Fever

24. What is the public transport system in your village? Are you satisfied with it?

NIL

Questionnaire For Village Head/ Local Officials

25. Village roads are
1 paved-made of asphalt 2 stabilized 3 unpaved 4 other ..... cc Roads

26. Do you have any environmental problems in your village? If so, what are they?
No drainage System

27. Do you have any social problems in your village, if so what are they?
Social and Caste discrimination
SC and ST are not allowed to temple

28. Do you have any economic problems in your village, if so what are they?
High Economic problems

29. Do you have any agricultural problems in your village, if so what are they?
Yes Rain fall nil, Govt seeds Subsidy

8. IDENTIFICATION OF VULNERABLE GROUPS

30. How many BPL families in the village? Other vulnerable groups? What welfare measures are available to support them?
40% are BPL families 50 families are very poor

31. Do you know about any proposed projects /industries coming in the region? How were you informed? What in your view are the possible benefits and hazards of this project?
NIL

32. Are there any school-age children who don't go to school? If yes, please explain why they do not go to school? Are girls sent to school? If no, please explain why they are not sent to school?
10% Because financial problems

33. Are there any people whose lands will be acquisited in this village?
NIL

10. KEY SOCIAL PROBLEMS AND DEVELOPMENT ISSUES

34. Identify the developmental priorities of your village
Toilets, Hospital, cc Roads, post office public toilets.

Name of the investigator:
Name of the supervisor:Date:

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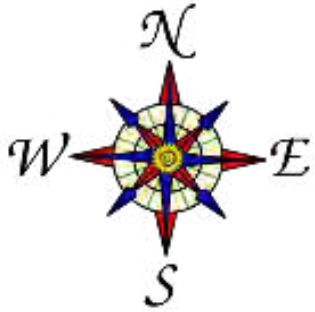

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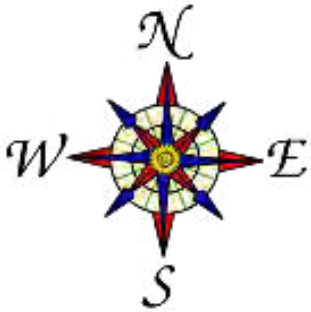

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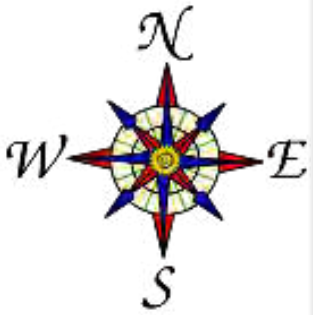

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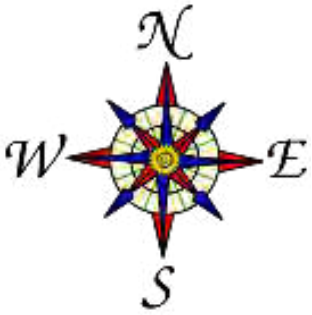
WTG Location: G1-55



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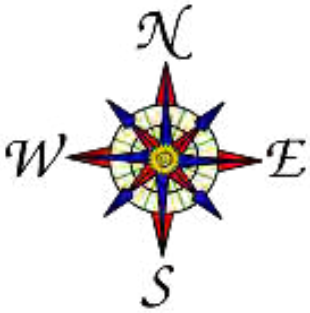

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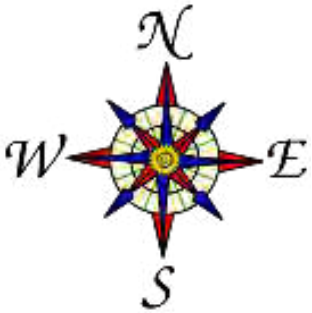

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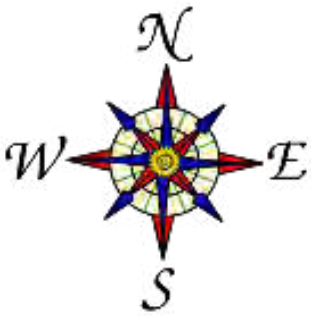

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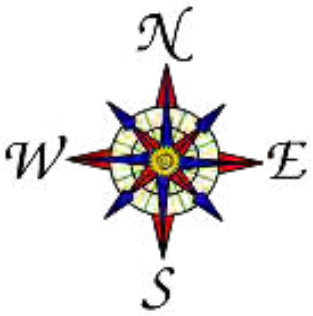

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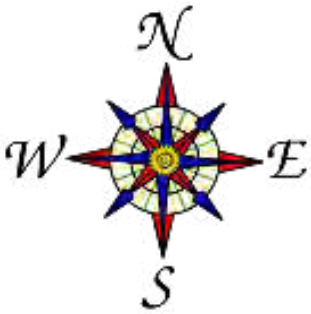

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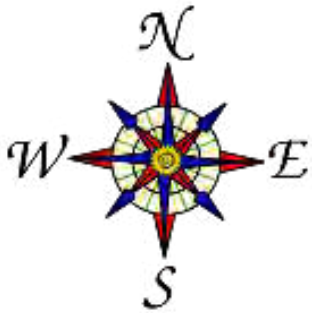

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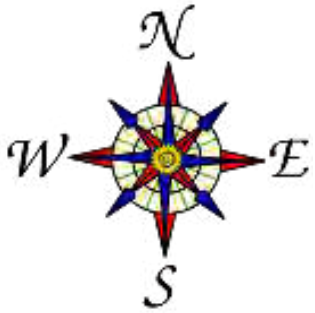
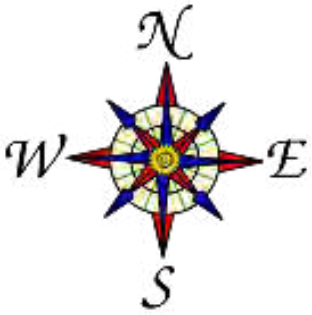


G2-59



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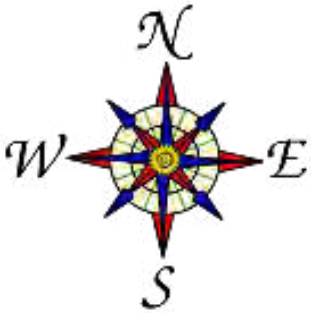

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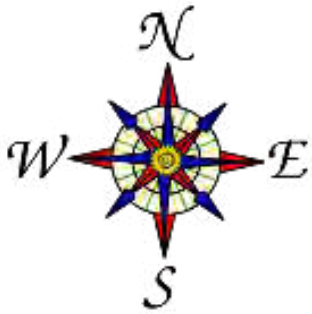

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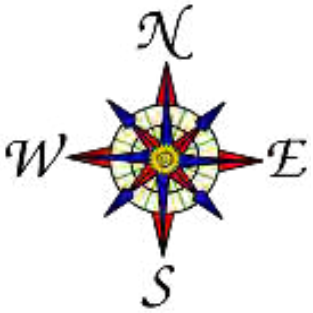

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