Environmental and Social Impact Assessment Report

120 MW Wind Power Project, Anantapur, Andhra Pradesh

Hero Future Energies Pvt. Ltd.

November 2017

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		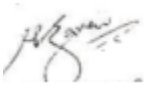
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1. Executive Summary

1.1 Introduction

M/s Vayu Urja Bharat Pvt. Ltd. (hereinafter referred as “VUBPL”), a special purpose vehicle (SPV) of Hero Future Energies Pvt. Ltd. (hereinafter referred as “HFE”) is developing a 120 MW Wind Energy Project (hereinafter referred as “project”) spread across three mandals namely, Kalyandurg, Kambadur, and Kundurpi mandals in Anantapur district, Andhra Pradesh, India. The proposed project will install 60 Wind Turbine Generators (WTGs).

1.2 Project Overview

The project comprises of 60 WTGs, each with a power rating of 2.0 MW (with total capacity of 120 MW) to be evacuated at proposed 132 kV / 220 kV Pooling Substation in Borampalli village, Anantapur. **Table 1-1** provides a key details pertaining to the project:

The project site is spread across three different mandals Kalyandurg, Kambadur, and Kundurpi mandals in Anantapur district, Andhra Pradesh, India. The project location is approximately 220 km to the North of Bengaluru city and can be accessed through NH 44 and NH3.

The site is connected to Anantapur town, approximately 80 km Northeast the project location through NH 82. The project has no set area demarcated as the WTG locations are dependent on the land availability in the area. During the site survey, primary data for 30 locations were collected. Post the site survey nine (9) additional WTG locations have been confirmed (as on date of issue of this report).

Table 1-1: Brief project information

Project Component	Description	Current status
Wind farm project with 60 WTGs	Wind project spread over three mandals (Kalyandurg, Kambadur, Kundurpi) in Anantapur district, Andhra Pradesh.	Micro-siting has been completed for the wind project. A total of 37 WTG locations have been identified. As on date of issue of this report, a total of 19 WTGs have been installed. The land procurement for 166 acres has been completed (a total of 247 acres are expected to be procured for the project). This is being managed by Win Power Engineering Pvt. Ltd. and SVS Infra Pvt. Ltd.
Access roads	The project will provide access roads that connect WTG locations. Approximate area of 10 to 20 acres of land will be required.	The land (100 % private land) procurement process for the same was in progress as on date of site survey. The land procurement for access roads is being initiated through two land aggregators (Win Power Engineering Pvt. Ltd. and SVS Infra Pvt. Ltd.)
Office and substation	The project will include Office area at the pooling substation in Thimmapuram. Approximately 16 acres of land has been procured for the PSS.	The land procurement process for the substation is complete and construction was underway during site survey. Please refer to Section 3.6 for more details.
Transmission line	The project will consist of approximately 24 km (total length) of external transmission line. ROW for internal transmission line (of approximately 65 km connecting WTG locations to the pooling substation) will be required for the project.	Private land (ROW) for the external transmission line was near completion as on date of site survey, whereas ROW for internal transmission line was yet to commence. This is presently being managed by M/s Maruthi Constructions.

The micro-siting for the project has been completed for the project and a Wind Resource Assessment report has been prepared. As on date of issue of this report a total of 37 WTG locations have been identified, out of which

19 WTGs have been installed and the rest of the identified locations are undergoing either civil or mechanical works.

The foundation work at the pooling substation in Thimmapuram village was partially completed at the time of site survey conducted in October 2016. 166.76 acres out of the 247 required for the project has been procured while the land for ROW for external transmission lines (24 km length) connecting to pooling substation is complete.

Land area of 10 to 20 acres is required for internal access roads. The same is presently being acquired through two land aggregators (Win Power Engineering Pvt. Ltd. and SVS Infra Pvt. Ltd.).

1.3 Land requirement

VUBPL is in the process of procuring private land on willing seller/ and willing buyer basis for the proposed project. Total land requirement for installation of WTGs will be around 247 acres (of which 166.76 acres have been acquired). Pooling substation at Thimmapuram village is under construction on private land. The entire project area comprises of private agricultural land. The component wise break-up of the land required for the project is provided in the following table:

Table 1-2: Component breakup of land area required for the Project

Project Facilities	Land Area (in acres)	Land Use Classification			Mode of Procurement
		Forest	Government	Private	
Wind Turbine	247	-	-	✓	Willing Buyer/ Willing Seller
Access Roads	10 to 20	-	-	✓	Willing Buyer/ Willing Seller
Substation/Switchyard/ Administration Building	16.22	-	-	✓	Willing Buyer/ Willing Seller
Internal Transmission Lines up to Pooling Substation (approx. 65km length)	ROW requirement yet to be estimated by VUBPL	-	-	✓	Willing Buyer/ Willing Seller
External Transmission Lines up to Grid Substation from PSS (approx. 24km length)	ROW requirement yet to be estimated by VUBPL	-	-	✓	Willing Buyer/ Willing Seller

1.4 Environmental Baseline

1.4.1 Physiography

Anantapur district can be divided into four major zones, namely granite-gneiss landscape, schist landscape, sandstone landscape and limestone land cape. These broad zones cover hill ranges and isolated hills, undulating and rolling hill- ide slopes, undulating to gently sloping pediments and narrow valley floors. The elevation of the district ranges from 450 to 1200 m above mean sea level (MSL).

1.4.2 Geology

The geological formations in Anantapur District can broadly be divided into two distinct and well-marked groups, the older group of Archaean Crystalline rocks and the younger group of Precambrian sedimentary rocks. The former group of rocks includes granites, granitic gneisses, phyllites and schists. These rocks have suffered considerable degree of disturbances as a result of which the rocks have been metamorphosed and re-crystallized. The later belongs to Cuddapah and Kurnool group of rocks.

1.4.3 Drainage

Anantapur is drained by five major rivers viz., Pennar, Chitravathi, Swarnamukhi, Hagari and Papagni. Radial drainage pattern is seen near Kalyandurg, Rayadurg and Urvakonda villages. All the streams in the district are ephemeral in nature.

1.4.4 Landuse

Land use relates to the human activity or economic function associated with a specific piece of land (Lillesand et al., 2004). Land cover relates to the composition and characteristics of land surface elements (Cihlar, 2000). The term land cover originally referred to the kind and state of vegetation, but it has broadened in subsequent usage to include human structures such as buildings or pavement and other aspects of the natural environment.

The land use pattern of Anantapur district can be broadly classified into Built-up area, Industries, Fallow Land, Agriculture Land, Forest Land, Waste Lands and Water Bodies. As per remote sensing data gathered for the project area the Landuse for the study area (5km radius from WTG locations) has been presented below:

Table 1-3: Landuse specific to the project area

S.no	Landuse Type	Area in Sq km	% of total area
1	Settlements	5.2727	1.34
2	River	1.4634	0.37
3	Waterbody	9.8801	2.52
4	Reserved Forest	23.1958	5.91
5	Rocky Land	4.9169	1.25
6	Barren Land	71.9184	18.33
7	Fallow Land	203.3295	51.82
8	Agriculture Land	72.4006	18.45
Total Area in Sq km		**392.3773**	**100.00**

1.4.5 Soil classification

The soils of Anantapur district can mainly be classified as red and black clayey soils. It is estimated that 82% of the area is red soil and 18% black clayey soils. These are underlain by older groups of Archaean crystalline and younger groups of Pre- Cambrian sedimentary rocks. The soils of Anantapur district are broadly classified into six types:

- Yellowish Brown to Grey Brown Alluvial and Colluvial Sand;
- Reddish Brown To Brown Fine Loamy, Clayey Soils;
- Reddish Brown To Brown Coarse To Fine Sands;
- Very Dark To Grey Fine Clayey Soils With Calcareous Crust;
- Lateritic Soils With Lateritic Gravels; and
- Gritty Or Skeletal Soils

The Project Mandals are found to exhibit Reddish brown to brown fine loamy soils and Reddish brown to Brown Coarse to fine sandy shallow soils. These are moderately permeable and moderately drained. The sub-soil is weak to moderately alkaline. They are composed of low to moderate organic matter with low potash and moderate potassium content. Soils in the Project districts can be classified as very poor to moderate fertile soils.

1.4.6 Hydrogeology

The Project Mandals shows Granite Lithology with discontinuous, un-confined to semi-confined weathered and fractured aquifers. Based on the stage of the ground water development and long term trend of pre and post monsoon ground water levels in the district, it can be inferred that the Project Mandals shows very high ground water usage viz., over all stage of ground water development to be >70%. Project Mandals Kalyandurg and Kambadur are categorised as semi-critical and Kundurpi is over-exploited category requiring intensive monitoring and evaluation and future ground water development through water conservation measures.

1.4.7 Climate and meteorology

The Project district, Anantapur experiences semi-arid climate. Being far from the east coast, the district is deprived of both the monsoons (north east and south west) and subjected to droughts. The normal annual rainfall of the district is 553.0 mm. The normal rainfall for the South-West monsoon period (June-September) is 338 mm, which is 61.2 per cent of the total rainfall for the year. The rainfall for North-East monsoon period (October-

December) is 156 mm only, which is 28.3 per cent of total annual rainfall (Government of Andhra Pradesh, 2009). The Annual Potential Evapotranspiration (PET) of the district is 1858mm and monthly PET ranges from 115 mm in December to 199 mm in May.

The minimum and maximum temperatures range between 17°C to 39°C. April and May are warm months when the normal daily maximum temperature ranges between 29°C to 39°C. November, December and January are cooler months when the temperature falls to about 17.3°C.

The annual mean wind speed in the project area during 1981 to 2010 was measured to be 9.7 Kmph (2.69 m/s). The most prominent wind direction is East during the months of October to March whereas the predominant wind direction is West from April to September.

1.4.8 Noise quality

It is observed that the noise levels at the monitoring locations ranged from 66.0 to 71.4 dB (A) during the daytime and 61.0 to 66.0 dB (A) during night time. The baseline noise levels at all the sampling locations were found to be exceeding the prescribed noise standards for Residential Area. These high baseline levels of ambient noise can be attributed to wind induced noise in the vacant land around the Project area with no or limited vegetation/other natural noise absorbers.

1.4.9 Ambient air quality

Ambient air quality monitoring conducted for another wind project in Anantapur district has been referred to establish ambient air quality baseline. The sampling locations chosen were similar to the environmental setup of this project area viz., rural habitations in Anantapur district near Vajrakarur which is approximately 40 to 50 km from the proposed project area. As per secondary data presented above, it was observed that concentration of all the monitoring parameters (PM_{10}, $PM_{2.5}$, SO_2 and NOx) were substantially below the National Ambient Air Quality Standards (NAAQS) prescribed by Central Pollution Control Board.

1.4.10 Water quality

Two water samples were collected to assess the water quality of the project area. Samples of groundwater were examined for physic-chemical, heavy metals and biological parameters as per standard testing procedures. Two ground water samples were collected from Obuganapalli village and Cheriapalli village. The pH value of the samples was observed to be within the prescribed range indicating neutral balance. TDS content in both of samples were observed to be exceeding the Acceptable Limit. Total Alkalinity content in GWQ1 is within the Acceptable Limit and in GWQ2, Alkalinity content is within the Permissible Limit. Hardness content in both the samples shows exceedance of Permissible limits. It must be noted that both the water samples show presence of bacterial parameters such as total Coliform and Escherichia coli (E.Coli). The presence of Coliform bacteria indicates that the water has been contaminated with the faecal matter.

1.5 Ecology baseline

1.5.1 Forest types and floristic species of the study area

The natural vegetation of the study area is open, scattered and stunted and forming thickets . This type of forest is resulted from degradation of Southern Tropical Thorn Forests. These forests are mainly composed of scattered shrubs intermixed with grasses and few other herbaceous species.

The forests are mixed, composed of comparatively few species and usually do not form marked plant communities.

Trees such as *Azadirachta indica, Balanites aegyptiaca, Euphorbia tirucalli, Phoenix sylvestris, Borassus flabellifer, Prosopis cineraria, Prosopis juliflora etc.;*

Shrubs such as *Lantana camara, Senna auriculata, Calotropis gigantea, Opuntia elatior, Wrightia tinctoria, Ziziphus* spp. etc.

Grasses such as *Aristida* spp., and *Heteropogon contortus,* which make up the ground cover.

1.5.2 Fauna

Amongst the raptors associated with a given windfarm area, the resident species are known to be relatively more vulnerable to windfarm-related collision risk.

Migratory waterfowl tend to carry out migratory flights by night when they are unlikely to spot and avoid wind-turbines and, thus, are vulnerable to collision-risk with operating wind-turbines.

Bats species including *Pteropus giganteus, Cynopterus sphinx, Taphozous longimanus, Rhinolophus Lepidus* are found in the project area.

Mammal species recorded in the project area include Vulnerable species such as Sambar (*Rusa unicolor),* Four-Horned Antelope (*Tetracerus quadricornis*), Blakc Buck (*Antilope cervicapra*), Common Leopard (*Panthera pardus*), Smooth-coated Otter (*Lutrogale perspicillata*), and Indian Pangolin (*Manis crassicaudata*).

Note: *Please refer to* ***Section 5.2*** *for specific details on ecological baseline of the project are.*

1.5.3 Critical habitats

The Rollapadu Wildlife Sanctuary, spreading over 6.14 sq. km area, is the nearest legally protected area. It is situated about 180 km east of the study area. However, the study area within 5 km from the WTG locations does not include any protected area.

1.6 Socio-Economic baseline

1.6.1 Demographic profile

Decadal growth between 2001 and 2011 of Anantapur was observed at 12.10 %. There has been a 13 % growth rate in female population which is higher than that of the male population which is 11%. Kalyandurg Mandal has population of 89,879, whereas Kambadur has the population of 50799. Female population in all mandals reflect above 40% representation with the highest female population in Kalyandurg (49.5%). Kalyandurg Mandal depicts the highest decadal growth from 81086 (2001) to 89879 (2011) with a decadal growth percent at 10.84%. Yenumaladoddi village has the highest decadal growth in population between the period of 2001 and 2011 at 18.6% followed by S.Mallapuram at 17.5%. It is to be noted here that there has been a negative growth rate in Thimmapuram village at -6.9%.

1.6.2 Social stratification

Amongst the three mandals, Kambadur has the highest number of Scheduled Caste population amounting to over 20% of the total population, Kalyandurg has shown the highest decadal population growth rate of Scheduled Castes (SC) at 13.7% and Scheduled Tribe (ST) at 17.6%.The percentage of Scheduled Tribe(ST) Population in relation to the total population is negligible in all three mandals.

A sizeable population of Scheduled Castes (SC) in all villages has been observed, however, Scheduled Tribe (ST) population is marginal in relation to the total population. The Scheduled Tribe population is significant in S. Mallapuram village which comprises over 40% of the village population. The substantial decadal growth in Scheduled Tribe Population in Yenumaladoddi and Kariganipalle may be attributed to two new additions to the Scheduled Tribe list.

1.6.3 Landuse pattern

Considerable variations are found in the general land use pattern because of landform diversities and rainfall in the study region. There is a need to shift from the generalities and study the particularities in order to help in better future planning of the study area. Anantapur district with geographical area of 1,91,30,00 hectares has 19, 69, 78 hectares of area covered with forests.15,01,40 hectares is land that is used for non-agricultural purposes and 5848 hectares is used for pastures and grazing lands. The rest of the land comprises of 16, 64, 25 hectares of barren and uncultivable land and 4, 85, 33 of culturable waste land.

1.6.4 Existing village amenities

Educational Facilities: Thimmapuram village has schools catering upto the secondary level with three (03) primary schools, two(02) middle schools and two(02) secondary schools in the village. Mulakanuru village has schools up to the middle school level with four (04) primary schools and one (01) middle school. The nearest secondary school is over ten kilometres. Pallur village has eight (08) primary schools and the nearest middle school and above is over three (03) kilometres away. S. Mallapuram has one (01) primary school in the village after which they have to travel over five kilometres to the nearest middle school. Kariganipalle has two (02) primary schools and one (01) middle school in the area .Yenumaladoddi has four (04) primary schools and one (01) each of middle and secondary school in the village. Duradakanta has one (01) school each upto the secondary level. Palavoy village has six(06)primary schools, one(01)middle school and one (01) secondary school. Duradakantaand Palavoy have one(01) adult literary centre each. Students wishing to pursue higher education from all the project area villages need to travel for over ten (10) kilometres.

Healthcare Facilities: There are nineteen (19) general hospitals and two (2) allied hospitals in Anantapur district. There is however no specialised treatment centres such as for tuberculosis, women and child care centre etc. in the district. All villages in the study area have a Primary Health-Sub Centre (PHSC) with the exception of S. Mallapuram village with the nearest Primary Health Centre(PHC) situated at over a distance of ten (10) kilometres.

Road and Transport facilities: All the villages in the study area have bus service facilities connecting the villages in the project area. The population have to travel for more than ten (10) kilometres to reach the nearest railway station at Anantapur which is approximately 90 km from the project area.

Communication and Banking Facilities: According to the MSME (2011) Brief Industrial Profile of the district there are 67,167 telephone connections and 943 post offices in the district. Post Offices are situated in all villages in the study area with the exception of S. Mallapuram village in Kundurpi Mandal. The nearest post office to S. Mallapuram is located at a distance of over five (5) kilometres.

Drinking Water and Electricity Supply Facilities: According to the Village Data 2001, all villages in the study area have access to water supply which is provided through pipelines and hand pumps supplied by the Panchayat. Electricity supply is present in all the study area villages.

1.7 Traffic baseline

Road traffic survey was carried out for the project site at two locations (to and fro) for 24 hours during the monitoring period so as to assess existing traffic characteristics with respect to type, category and number of vehicles plying on the road connecting the project site. The total hourly traffic volume indicates that the peak hour traffic is between 08:00 am to 11:00 am in the morning with slight increase around 03:00 pm to 05:00 pm and in the evening at around 08:00 pm to 11:00 pm. This trend is visible at both the sampling locations in both ways. Relatively high traffic with large number of vehicles is observed at TM2 i.e., Kalyandurgam towards Anantapur route. The composition of vehicles at this stretch indicates that out of the total number of vehicles observed, 79.2% of vehicles are Heavy Commercial Vehicles and about 18.9% are Three Wheelers.

1.8 Impact assessment

1.8.1 Soil Environment

During construction phase, following are the prevalent negative impacts on land/soil:

- Considerable disturbance to soil and nearby superficial geology due to activities such as excavations for foundations, construction of access roads and drainage, etc;
- Removal of existing vegetation for construction will decrease the rigidity of soil and make it loose and open to erosion. Since the region is windy, scouring of exposed soil might happen due to high velocity of wind;
- Top soils and sub soils will be extracted during excavation which will lead to loose soil generation and its subsequent dispersal by wind. Excavation can disturb the original topography of the area and consequently lead to soil erosion;
- Direct and indirect impact on the landscape of the region such as modification of initial appearance of the site, abandoning of certain parts of the site by its users due to installation of wind turbines;

- Construction debris, excavated soils or solid waste generated when workers are on site, if dumped in nearby fields will affect the quality of soil;
- Random disposal of excavated soil and construction debris in nearby fields and private land; and
- Soil contamination due to oil leaks/spillage from machinery and vehicles.

The overall impact (adverse) during construction phase on soil environment has been assessed to be ***Negligible.***

During the operation phase, 60 turbines of 2.0 MW each will be functioning at the same time. Hazardous waste such as waste/used oil and waste cotton/rug (used for cleaning of turbine parts) containing oil will be generated especially during maintenance works due to the presence of mechanical parts in wind turbine generators and usage of diesel generators. Improper storage, handling and disposal of these hazardous wastes can lead to contamination of soil at storage yard or at the project site office. The overall impact (adverse) during operation phase has been assessed to be ***Minor***, however, post implementation of mitigation measures as prescribed in **Section 7.4.1.3** the significance of the impact (adverse) will result in ***Negligible*** impact.

1.8.2 Noise Quality

Noise and vibration will be caused ***during site preparation***, operation of earth moving and excavation equipment, concrete mixers, cranes and the transportation of equipment, materials and people. There is potential for disturbance to habitations in proximity of WTG locations. Use of diesel generator sets may also lead to incremental noise however, that will be limited to a very short duration of 10 -15 days. Movement of traffic during night hours can also disturb the local community. Approximately 90-92 dB (A) of noise is expected to be generated from construction activity. The exact methodology and the timing of construction cannot be predicted at this time; however the construction activities will be temporary in nature and will not last for more than 15-20 days for a particular turbine site. The overall impact (adverse) during construction phase has been assessed to be ***Minor***, however, post implementation of mitigation measures as prescribed in **Section 7.4.2.2** the significance of the impact (adverse) will result in ***Negligible*** impact.

During Operation phase the results from the modelling exercise indicate that the incremental noise due to operation of WTGs at is in the range of 37.3-56.7 dB (A). The additional exposure to noise will be in the range of 0.0 - 0.2 dB (A) during night time and no exposure during the day time due to the operation of the wind turbines.

The estimated resultant noise levels exceeds the prescribed noise limits for the day and night time i.e. 55 dB (A) and 45 dB (A) at all the identified noise receptors. The ability to hear wind turbine noise depends on the existing ambient noise levels.

It is to be noted that the baseline noise recorded already exceeds the CPCB prescribed standard at all the receptor locations. The incremental noise from the wind turbines do not contribute significantly to the estimated resultant noise of the area if the background/baseline noise is higher than wind turbine noise.

The additional exposure to noise meets the noise guideline specified in IFC's Environmental, Health and Safety Guidelines of Wind Energy viz., maximum increase in background levels of 3 dB (A) at the receptor location.

The overall impact (adverse) during operation phase has been assessed to be ***Moderate***, however, post implementation of mitigation measures as prescribed in **Section 7.4.2.4** the significance of the impact (adverse) will result in ***Minor*** impact.

1.8.3 Shadow Flicker

Shadow flicker modelling was performed using EMD's WindPRO Software version 2.7, a wind modelling software program. WindPRO is used to calculate detailed shadow flicker map across an area of interest with site-specific locations using shadow receptors. IFC guidelines on Wind Energy (August, 2015) have suggested 30 hours of shadow flicker per year and 30 minutes of shadow flicker per day as the threshold of significant impact. As per the modelling results, none of the thirteen (13) identified sensitive receptor locations exceed the permissible limits. Overall impact (adverse) during construction phase has been assessed to be ***Minor***, however, post implementation of mitigation measures as prescribed in **Section 7.4.3.2** the significance of the impact (adverse) will result in ***Negligible*** impact.

1.8.4 Air Quality

During the construction phase of project, there will be direct and indirect activities which will negatively impact the environment and deteriorate the quality of air. Following are some such activities:

- Earthwork which generates dust to the highest degree
- Emissions from road traffic – While transporting filling materials and the like to the project site there are chances of dust formation, considering the small size of cement particles, sand etc., and windy nature of the region. Primary pollutant like particulate matter is also generated from re-suspended dust from roads.
- Exhaust fumes from Heavy Good Vehicles (HGV) containing primary pollutants like Sulphur dioxide and from machineries used for lifting and erection of turbine parts, diesel generators etc. Incomplete combustion of fossil fuels or oil spillage from poorly maintained vehicles, will also release pollutants

The overall impact (adverse) during pre-construction and construction phase has been assessed as ***Negligible.***

During operation phase the baseline air quality will not vary to a considerable extend as the operation of wind turbines doesn't involve any significant air polluting activities. Except for the minor emissions such as carbon monoxide and nitrogen oxides released from Diesel Generators during preventive maintenance period which are not likely to exceed air quality standards, there are no direct emissions from the wind turbines. Hence the overall impact (adverse) on air quality during operation phase is expected to be ***Negligible***.

1.8.5 Water Quality

During construction phase of the project, negligible quantity of wastewater is expected to be generated due to the following activities:

- Highly alkaline cement when mixed with concrete, any accidental spill during transfer may lead to changes in pH of underground water in the area;
- Spillage of fuels, waste oil or lubricants from vehicles and machinery or runoff from disturbed soils may cause sediment load in underground water during the construction of drainage channels, or excavation for foundation;
- Water from temporary toilets constructed for construction workers, if not properly channelized or stagnated can lead to contamination of underground water;
- Baseline water quality results of the ground water from project villages suggest that ground water in the project area is contaminated with faecal coliform bacteria which can be a potential health risk for individuals exposed to this water. It is therefore recommended for project related staff to not use the ground water in the project area for drinking purpose.

Overall impact (adverse) during construction phase has been assessed to be ***Negligible***.

1.8.6 Ecological Impacts

1.8.6.1 Loss/ degradation/fragmentation of habitats

During construction phase the natural vegetation in and around the proposed turbine sites and road alignments will be removed for site preparation. The removal of vegetation cover will result in direct loss or fragmentation of hitherto contiguous habitats. The resources associated with natural vegetation which provide food and shelter to faunal species, are likely to get degraded or lost permanently. The wildlife corridors connecting the various faunal populations in the region would be degraded due to habitat fragmentation. The clearing activities, in themselves, may result in death or injury to the ground organisms occupying the affected land areas. Overall impact (adverse) during construction phase has been assessed to be ***Negligible***.

1.8.6.2 Avian mortality / injury to birds or bats

During Operation phase the principal direct risk posed by windfarms to birds is the potential for individuals to be injured or killed as a result of collision with moving rotors. Raptors, which are relatively large-sized birds adapted for soaring and relatively less capable of manoeuvring in flight, and migratory waterfowl, which tend to carry out migratory flights by night when they are unlikely to spot and avoid wind-turbines, are the two groups of birds which are especially vulnerable to collision-risk with operating wind-turbines. During cloudy weather, night-flying

migratory birds tend to get attracted towards lights around their flight-height, such as those installed around ridge-top windfarms, leading to collisions with the turbines or other windfarm infrastructure.

Bats, besides being vulnerable to injury or death from direct collision with wind turbines, are also vulnerable to Barotrauma, that is, internal haemorrhaging induced by flying through the low-pressure zone around an operational turbine, leading to disruption of natural life-processes and eventual death. A correlation has been observed between low wind-speed nights and increased bat-fatalities around wind farms. Some evidence also suggests that bats may be attracted to turbines and that migratory and tree-roosting bats may have a higher risk of mortality. Other risks posed by windfarms to both, birds and bats, in general, include potential of entanglement with guy-wires or over ground transmission lines and electrocution by contact with uninsulated wiring. The overall impact (adverse) during Operation phase has been assessed to be ***Moderate***, however, post implementation of mitigation measures as prescribed in **Section 7.5.3.2** the significance of the impact (adverse) will result in ***Minor*** impact.

1.8.7 Impact on community and nearby settlements owing to land procurement

The land identified for the WTGs and its associated facilities comprises of private agricultural land. Based on the consultation undertaken with the land owners, all of them have sold a portion of their land holdings and still have a sizeable amount of land with them. It was mentioned that due to lesser rainfall over the years, rising cost of cultivation activities and lesser profits, these land owners decided to sell their land parcels. As the land parcels purchased till date are on private land, no impact on surrounding land areas is envisaged. None of the access roads to the turbines are obstructing access to settlements and sites of cultural heritage within the project area.

The overall socio-economic impact (adverse) during pre-construction stage with respect to land procurement has been assessed to be ***Negligible***.

1.8.8 Labour rights and welfare

It is anticipated that during the construction phase, the labour requirement will range from 130 to 150 workers during construction activities. The workforce as reported will be engaged both from surrounding areas and from other states. It was reported that the migrant workers would be provided accommodation within the villages in the vicinity of the project area on rented arrangement basis. The standards pertaining to labour accommodation will be applicable and hence, accordingly implemented by the EPC Contractor and Sub-Contractors. The EPC Contractor will require to provide the minimum wages due to the labourers including overtime wage as per the Building and Others Construction Workers Act. In addition, benefits in terms of Employee State Insurance should be provided to each worker engaged on site. The workers should be aware of their rights and benefits due to them so that no issues emerge. Toilet facilities and drinking water should be provided to all workers on site as well. Grievance Redressal Mechanism for workers should be developed and communicated to the workers so that the workers can approach the management if any concerns or issues are faced by them without any fear of retribution or intimidation. The overall impact (adverse) during construction stage has been assessed to be ***Negligible***.

1.8.9 Impact on Economy and Livelihoods

As reported during consultations with land owners, the project will create employment opportunities for the local population in terms of direct and indirect work. This will benefit the population in terms of developing a new skill set as well as diversifying the local economy. Subsidiary employments in terms of shops, eateries, garages, etc. would also see an increase with the development of the project in the area. Job creation in relation to petty vendors and contractors would also see an increase with the various project activities envisaged to be initiated. The overall impact (beneficial) during construction stage has been assessed to be ***Minor***

1.8.10 Community health and safety

The impacts assessed with respect to community health and safety include the following:

- Increase in traffic movement on the road network linked to the project leading to traffic congestion and delays;
- Short term closure of existing transport routes during proposed construction/widening of access roads thereby causing disruption and delays in traffic;
- Increase in traffic related noise and emissions;

- Damage to existing roads and related structures due to heavy vehicular/ equipment movement;
- Increase of probability of road accidents to livestock and people; and
- Parking of vehicles in open fields and other non-project locations.
- As the existing panchayat roads (internal access roads) will be used, therefore the impact on community health and safety is assessed to be moderate

The overall impact (adverse) during pre-construction / construction phase has been assessed to be ***Moderate***, however, post implementation of mitigation measures as prescribed in **Section 7.6.4.1** the significance of the impact (adverse) will result in ***Minor*** impact.

1.9 Analysis of Alternatives

United Nation's Intergovernmental Panel on Climate Change (IPCC) has projected that renewable energy can provide approximately 77% of global primary energy supply by 2050. The state level incentives provided by the new government of Andhra Pradesh are attractive enough to influence the wind power companies.

The project has many advantages like elevating the standard of rural economies, increasing the power supply of the energy deficit state of Andhra Pradesh in an environmentally friendly manner. The project with existing options for site, mode of power generation, route of transmission line etc., is the appropriate alternative and is beneficial for the region.

1.10 Conclusions and Recommendations

Based on the ESIA study conducted and as per IFCs categorisation of projects the proposed project can be categorized as **Category B**, which specifies that the project can cause potential and limited adverse social or environmental impacts which are generally site-specific, largely reversible and readily addressed through mitigation measures.

The rationale for categorisation being:

- Overall the project being a wind power project is a green project and does not have significant adverse impacts associated with the construction or operation activities;
- The land required for the project is taken on "willing seller-willing buyer" basis and individual negotiation with the land owners and the project does not involve any physical or displacement;
- Based on the consultations conducted with the landowners, it was noted that there are two (02) landowners belonged to the Scheduled Tribe (ST) category (Sugalis Tribe). They are legal titleholders of the land parcels owned by them and are engaged as in agriculture, similar to the occupational pattern of the mainstream general society. As the project area does not fall under the scheduled area, the landowners belonging to the ST category are legal titleholders of their land. The ST category landowners provided their consent voluntarily to sell their land for the proposed project without any force and have received payments in full in lieu of the land sold. Therefore, project does not involve any direct social issues associated with land procurement.
- The results from the noise modelling exercise indicate that the incremental noise due to operation of WTGs at is in the range of 37.3-56.7 dB (A). The additional exposure to noise will be in the range of 0.0-0.2 dB (A) during night time and no exposure during the day time due to the operation of the wind turbines.
- None of the project turbines are located within the vicinity of the reserve forest and does not involve any protected forest land. Therefore, ensuring minimal impact on ecology during the construction and operation phase of the project.

2. Introduction

2.1 Preface

M/s Vayu Urja Bharat Pvt. Ltd. (hereinafter referred as “VUBPL”), a special purpose vehicle (SPV) of Hero Future Energies Pvt. Ltd. (hereinafter referred as “HFE”) is developing a 120 MW Wind Energy Project (hereinafter referred as “project”) spread across three mandals namely, Kalyandurg, Kambadur, and Kundurpi mandals in Anantapur district, Andhra Pradesh, India. The proposed project will install 60 Wind Turbine Generators (WTGs).

As per the Power Purchase Agreement (PPA) singed between VUBPL and Southern Power Distribution Company of AP Limited (hereinafter referred as “DISCOM”) dated 18th July 2016, the switchyard with capacity 33kV will be constructed by HFE at Thimmapuram village, in Anantapur district, Andhra Pradesh and will be connected to proposed pooling substation at Borampalli village to step up the 132 kV to 220 kV.

2.2 Background and Rationale of the study

AECOM India Pvt. Ltd. (hereinafter referred as “AECOM”) understands that HFE intends to invest in the wind farm project with financial assistance from international lenders / multilaterals. In this context, the project requires evaluation of Environmental and Social risks associated with its operations. Evaluating such risks will help determining mitigation measures to avoid adverse impacts identified as part of the study.

As HFE is seeking project finance from international lenders, it is required to comply with the applicable International Finance Corporation (IFC) guidelines relating to Environment, Social issues and Occupational Health and Safety matters, in addition to regional and national laws and regulations.

HFE has commissioned AECOM to undertake an Environment and Social Impact Assessment (ESIA) in order to meet requirements of the following reference framework:

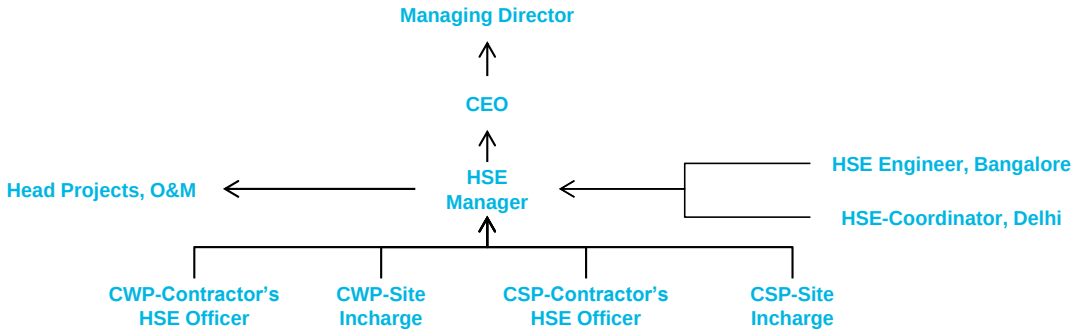
- Applicable national, state and local regulatory requirements;
- IFC Performance Standards (2012);
- IFC/World Bank EHS Guidelines for Wind Energy Projects (2015) and IFC/World Bank EHS Guidelines for Electric Power Transmission and Distribution (2007).

2.3 Project Proponent

HFE, established in 2012, is an Independent Power Producer, and is a fully owned subsidiary of the Hero Group. HFE has established projects in ten states of India with a power generation capacity totalling 360 MW across wind, solar PV (grid connected) and rooftop projects. The company has a pipeline of ~1100 MW of wind projects till 2018-19 and is estimated to secure over 500 MW of solar projects through state and central bidding process.

HFE has established several renewable energy initiatives through grid connected solar, Rooftop Solar and Wind Power projects. The list of wind projects initiated by HFE has been presented in **Table 2-1**.

The organization structure for Environmental and Social Management includes HSE Manager and HSE Engineer at the corporate level and Site specific HSE Officers representing HFE and EPC contractor. The EPC contractor reports project proceedings and Environment / Social aspects to HFE site incharge who in turn is responsible for forwarding the same to corporate office HFE. For this project, one EHS Officer from both EPC and HFE has been deployed onsite, who report to HSE Manager – Corporate. The organizational structure for the project has been presented in **Figure 2-1**.



Source: HFE Corporate Office

Figure 2-1: Organization structure for Project Management – VUBPL

The following are the wind farm projects undertaken by HFE as of December 2016:

Table 2-1: List of HFE Wind Projects across India

Sno.	Project Location	Capacity
1	Ratlam, Madhya Pradesh	100 MW (50 x 2 MW)
2	Bableshwar, Karnataka	50 MW (25 x 2 MW)
3	Anantapur, Andhra Pradesh	120 MW (60 x 2 MW)
4	Zaheerabad, Telangana	Upto 100 MW; Phase I : 31.5 MW (15 x 2.1 MW)
5	Manvi, Karnataka	50 MW (25 x 2 MW)
6	Gunga, Rajasthan	40 MW (20 x 2 MW)
7	Dangri, Rajasthan	40 MW (20 x 2 MW)
8	Satara, Maharashtra	32 MW (16 x 2 MW)
9	Pratapgarh, Rajasthan	37.5 MW (25 x 1.5 MW)

Source: HFE Corporate Office, December 2016

Gamesa Renewable Pvt. Ltd. (hereinafter referred as "Gamesa" or "EPC") has been engaged as the Engineering Procurement Construction (EPC) contractor for the project. The Operations and Maintenance services of the project will also be extended to Gamesa. Gamesa is part of Gamesa Corp., which is an ISO 9001: 2008 certified company with headquarters in Zamudio, Spain. Gamesa is engaged in wind turbine manufacturing and provides wind energy solutions and services and has established one Blade manufacturing plant in Gujarat and one nacelle assembly plant in Kanchipuram, Tamil Nadu. The WTGs will be transported from both its manufacturing and assembly units.

2.4 Project Overview

The project comprises of 60 WTGs, each with a power rating of 2.0 MW (with total capacity of 120 MW) to be evacuated at proposed 132 kV / 220 kV Pooling Substation in Borampalli village, Anantapur. **Table 2-2** provides a key details pertaining to the project:

Table 2-2: Key Components of the project

Project Component	Description	Current status
Wind farm project with 60 WTGs	Wind project spread over three mandals (Kalyandurg, Kambadur, Kundurpi) in Anantapur district, Andhra Pradesh.	Micro-siting has been completed for the wind project. A total of 37 WTG locations have been identified. As on date of issue of this report, a total of 19 WTGs have been installed. The land procurement for 166 acres has been completed (a total of 247 acres are expected to be procured for the project). This is being managed by Win Power Engineering Pvt. Ltd. and SVS Infra Pvt. Ltd.

Project Component	Description	Current status
Access roads	The project will provide access roads that connect WTG locations. Approximate area of 10 to 20 acres of land will be required.	The land (100 % private land) procurement process for the same was in progress as on date of site survey. The land procurement for access roads is being initiated through two land aggregators (Win Power Engineering Pvt. Ltd. and SVS Infra Pvt. Ltd.)
Office and substation	The project will include Office area at the pooling substation in Thimmapuram. Approximately 16 acres of land has been procured for the PSS.	The land procurement process for the substation is complete and construction was underway during site survey. Please refer to Section 3.6 for more details.
Transmission line	The project will consist of approximately 24 km (total length) of external transmission line. ROW for internal transmission line (of approximately 65 km connecting WTG locations to the pooling substation) will be required for the project.	Private land (ROW) for the external transmission line was near completion as on date of site survey, whereas ROW for internal transmission line was yet to commence. This is presently being managed by M/s Maruthi Constructions.

Source: HFE Corporate Office, December 2016

2.5 Objective and Scope of work

The scope of work for the ESIA broadly includes the following:

2.5.1 Defining the Project/Project Description

The project information includes providing project description with focus on understanding the environmental and social setting and sensitivities for the wind power project. This also includes any related facilities that may be required (e.g., access roads, transmission lines, water supply arrangements, housing, raw material etc). Also description of the larger setting in which the project is located.

2.5.2 Outlining Policy, legal, and administrative framework

Discussing the policy, legal, and administrative framework within which the assessment is carried out, including host country regulations, obligations under relevant international social and environmental treaties, agreements, and conventions, IFC Performance Standards and subsequently Reviewing the Social and Environmental compliance requirements against afore mentioned requirements.

2.5.3 Generating Baseline Data

Collecting and generating relevant baseline social environmental data (primary & secondary) relevant to decisions about project location, design, operation, or mitigation measures. The baseline data generation is specifically focused on issues around a) noise including cumulative impact assessment on noise quality due to operation of existing and proposed wind turbines, b) traffic, c) water- its quality, availability and adequacy vis-à-vis the requirements during different phases of the project life cycle, d) land and land use e) ecology/ biodiversity including baseline conditions and impact on birds and bats) f) physical or cultural heritage (if any), g) other environmental sensitivities like wetlands, forests etc. Review of the land take/lease process to assess any legacy or current/existing issues (like informal settlers, livelihood dependence, other usage etc) on the purchased/leased land is also assessed.

2.5.4 Consultation

Consultation with local community, stakeholders, household surveys is carried out to review land procurement and compensation process and assess compliance to IFC PS 5 standards.

2.5.5 Assessing Social and Environmental Impacts and Mitigation Measures

Evaluating potential Environment and Social impacts of the Project and its components (including associated facilities like, transmission line, access roads etc. as per the details available) and developing mitigation measures and plans to maximize project benefits in consultation with affected communities including, potential assessment of Cumulative impacts (linked to development or other wind projects), if relevant and as appropriate. The impact assessment will identify mitigation measures for any residual negative impacts that may not be mitigated and also evaluate impacts and risks from associated facilities and other third party activities. Sensitive receptors information includes collecting information on the positioning of households/settlements with respect to the proposed WTGs for shadow flicker assessment and subsequently assessing impact of shadow flicker on the community using appropriate software.

2.5.6 Analysing Alternatives

Comparing reasonable alternatives against proposed project site, technology, design, and operation in terms of their potential social environmental impacts is to be undertaken. The feasibility of mitigating these impacts, capital and recurrent costs, suitability under local conditions, and institutional, training, and monitoring requirements also has been considered. The resultant alternative will state the basis for selecting a particular site and project design by justifying recommended approaches to pollution prevention and abatement

2.5.7 Providing Management Program

The final step includes formulating management plan for mitigation of impacts as identified during assessment. This also entails developing Environmental and Social Management Plan (ESMP) based on the ESIA and procedures development for mitigation and monitoring of environment and social impacts on an ongoing basis and to identify any impacts/mitigation requirements that may occur subsequent to the completion of the ESIA. Where the client identifies measures and actions necessary for the project to comply with applicable laws and regulations and to meet the Performance Standards, the management program will include an Action Plan, which is subject to disclosure to the affected communities and ongoing reporting and updating.

2.6 Limitations

The Environment and Social Impact Assessment study of the project is limited to project information made available by the client, discussion with Gamesa and other contractor staff, primary monitoring, secondary data collected, consultation with local community and observations made during site survey. Professional judgement and interpretation of facts has been applied for presenting inference from the collected information.

Note: *A total of 60 WTGs (2.0 MW each) are proposed to be installed for the 120 MW project, out of which 37 locations have been identified based on the micro-siting study. VUBPL is in the process of confirming the pending locations. Impacts assessed in this report with respect to Noise, Shadow flicker, and social impacts amongst others (as presented in Section 7) are limited to the identified locations.*

2.7 Report structure

The report structure is outlined in the following manner:

- **Chapter 3** – outlines project description
- **Chapter 4** – outlines Environmental and Social regulatory framework
- **Chapter 5** – outlines Environmental and Social baseline
- **Chapter 6** – outlines stakeholder engagement and public consultation conducted for the study
- **Chapter 7** – describes impacts associated with the project
- **Chapter 8** – outlines alternatives that may be considered for the project
- **Chapter 9** – outlines community engagement and grievance redressal mechanism
- **Chapter 10** – presents the Environmental Management Plan
- **Chapter 11** - describes final recommendations and concluding remarks

3. Project Description

3.1 Overview

This section provides an overview of project and describes the project in terms of location, associated infrastructure, equipment required and activities to be performed during the construction, operation and decommissioning stages of the project.

The project once complete will have 60 WTGs with total capacity of 120 MW. The details about this development have been summarised in subsequent sections:

3.1.1 Project status

The micro-siting for the project has been completed for the project and a Wind Resource Assessment report has been prepared. As on date of issue of this report a total of 37 WTG locations have been identified, out of which 19 WTGs have been installed and the rest of the identified locations are undergoing either civil or mechanical works. Information pertaining to the project WTGs has been presented in **Table 3-1**.

The foundation work at the pooling substation in Thimmapuram village was partially completed at the time of site survey conducted in October 2016. As presented in **Table 2-2**, 166 acres out of the 247 required for the project has been procured while the ROW for external transmission lines (24 km length) connecting to pooling substation is complete.

Land area of 10 to 20 acres is required for internal access roads. The same is presently being acquired through two land aggregators (Win Power Engineering Pvt. Ltd. and SVS Infra Pvt. Ltd.).

Table 3-1: Status for number of WTGs confirmed and pending

WTGs status	Number of WTGs
Total number of WTG locations to be installed for the project	60
Total identified locations as on date of issue of this report	37
Number of identified WTG locations for which primary data was collated during site survey	27 (KA01 through KA25, KA28, KA 37 and one additional unconfirmed locations)
Number of land parcels identified for which WTG coordinates were yet to be confirmed as on date of site survey and for which primary date was collated	1 (SF 12)
Number of WTG locations identified post site survey	9 (KA 26, KA27, KA29 through KA35)
Number of installed WTGs as on date of issue of this report	19

Source: HFE Corporate Office, December 2016

3.1.2 EPC Contractor and Subcontractors

As per the agreement between HFE and Gamesa, the latter has been extended the responsibility for overall implementation and supervision of wind turbine supply, transportation of wind turbines, civil infrastructure related work, and electrical infrastructure related work, foundation work, and installation of WTGs through use of cranes, and site commissioning and testing. To meet the requirements, Gamesa has appointed subcontractors (as presented in **Table 3-2**) for various civil, mechanical and other labour related works.

Table 3-2: EPC Contractor and Subcontractor Responsibilities

S.No.	Contractor	Nature of Work
1	Sanghvi	Crane work
2	Sarens	Crane work
3	Speed Team	WTG Erections

S.No.	Contractor	Nature of Work
4	3S	Lift Installation
5	Maruthi Constructions	Civil Work

Source: HFE Corporate Office, December 2016

The workers engaged under the EPC and Sub-Contractors are sourced from Maharashtra, Tamil Nadu, West Bengal and Uttar Pradesh. Approximately, 40 workers engaged in civil construction work are sourced from surrounding areas of the project.

3.1.3 Operations and Maintenance (O&M)

The responsibility of Operations and Maintenance for the project has been extended to Gamesa.

3.2 Project Setting

3.2.1 Site setting

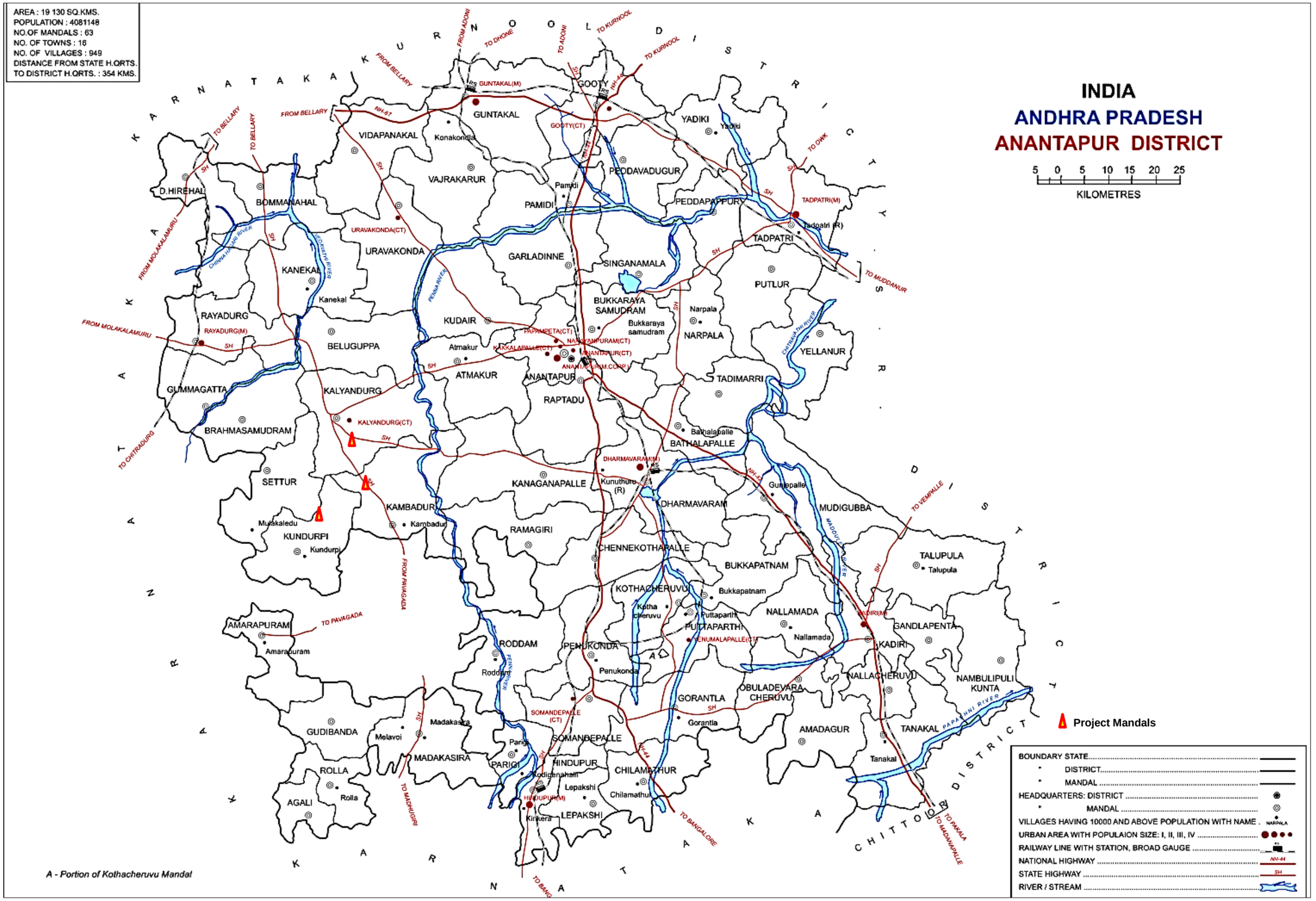
The project site is spread across three different mandals Kalyandurg, Kambadur, and Kundurpi mandals in Anantapur district, Andhra Pradesh, India. The project location is approximately 220 km to the North of Bengaluru city and can be accessed through NH 44 and NH3.

The site is connected to Anantapur town, approximately 80 km Northeast the project location through NH 82. The project has no set area demarcated as the WTG locations are dependent on the land availability in the area. The project location map has been presented in **Figure 3-1**. During the site survey, primary data for 30 locations were collected. Post the site survey nine (9) additional WTG locations have been confirmed (as on date of issue of this report).

Table 3-3 presents the site surroundings of each WTG location for which primary data was collected during site survey. Photo log on site setting / surroundings of each WTG location (N, S, E, W directions) has been attached in **Appendix A.**

The wind speed in the project area as per data collated from private wind monitoring station installed by VUBPL in Guravapalli, Anantapur, is 6.07 m/s (at 50 metres AGL)[1].

[1] Data extrapolated at 50 metres AGL from private monitoring station installed by VUBPL Guravapalli, approximately 11 km from store yard site. Source: http://niwe.res.in/assets/Docu/List_of_Private_WMS_30.11.2016.pdf



Source: Administrative map, Andhra Pradesh, Census 2011

Figure 3-1: Project location of WTGs

Table 3-3: WTG Specific surrounding features

WTG no.	Name of Village, Mandal	Coordinates (UTM) (43P)		Surrounding Landuse				Topographic profile			
		Easting	Northing	North	South	East	West	North	South	East	West
KA01	Thimmapuram, Kambadur	0736706	1588047	Partly Agricultural (Rain fed)	Partly Agricultural (Rain fed)	Partly Agricultural (Rain fed)	Partly Agricultural (Rain fed)	Undulated	Undulated	Undulated	Undulated
KA02	Thimmapuram, Kambadur	0737023	1588342	Slight vegetation	Slight vegetation	Slight vegetation	Partly Agricultural (Rain fed)	Undulated	Undulated	Undulated	Undulated
KA03	Thimmapuram, Kambadur	0736274	1587125	Partly Agricultural (Rain fed)	Partly Agricultural (Rain fed)	Partly Agricultural (Rain fed)	Partly Agricultural (Rain fed)	Undulated	Undulated	Undulated	Undulated
KA04	Thimmapuram, Kambadur	0736274	1587125	Slight vegetation	Slight vegetation	Slight vegetation	Slight vegetation	Undulated	Undulated	Undulated	Undulated
KA05	Thimmapuram, Kambadur	0737044	1589136	Slight vegetation	Slight vegetation	Slight vegetation	Slight vegetation	Undulated	Undulated	Undulated	Undulated
KA06	S. Mallapuram, Kundurpi	0730794	1587586	Partly Agricultural (Rain fed)	Partly Agricultural (Rain fed)	Partly Agricultural (Rain fed)	Partly Agricultural (Rain fed)	Undulated	Undulated	Undulated	Undulated
KA07	S. Mallapuram, Kundurpi	0730337	1588068	Partly Agricultural (Rain fed)	Partly Agricultural (Rain fed)	Partly Agricultural (Rain fed)	Partly Agricultural (Rain fed)	Undulated	Undulated	Undulated	Undulated
KA08	S. Mallapuram, Kundurpi	0730984	1588565	Slight vegetation	Partly Agricultural (Rain fed)	Slight vegetation	Partly Agricultural (Rain fed)	Undulated	Undulated	Undulated	Undulated
KA09	Thimmapuram, Kambadur	0731845	1588067	Slight vegetation	Slight vegetation	Slight vegetation	Slight vegetation	Flat	Flat	Flat	Flat
KA10	Thimmapuram, Kambadur	0732276	1587010	Slight vegetation	Slight vegetation	Slight vegetation	Partly Agricultural (Rain fed)	Undulated	Undulated	Undulated	Undulated
KA11	S. Mallapuram, Kundurpi	0730820	1589668	Partly Agricultural (Rain fed)	Slight vegetation	Partly Agricultural (Rain fed)	Partly Agricultural (Rain fed)	Flat	Flat	Flat	Flat
KA12	Thimmapuram, Kambadur	0733448	1590030	Partly Agricultural (Rain fed)	Partly Agricultural (Rain fed)	Slight vegetation	Slight vegetation	Flat	Flat	Flat	Flat
KA13	Yenumulapalli, Kundurpi	0725507	1593519	Partly Agricultural	Partly Agricultural	Partly Agricultural	Partly Agricultural	Undulated	Undulated	Flat	Undulated

WTG no.	Name of Village, Mandal	Coordinates (UTM) (43P)		Surrounding Landuse				Topographic profile			
		Easting	Northing	North	South	East	West	North	South	East	West
				(Rain fed)	(Rain fed)	(Rain fed)	(Rain fed)				
KA14	Enumuladoddi, Kundurpi	0728959	1594073	Partly Agricultural (Rain fed)	Partly Agricultural (Rain fed)	Partly Agricultural (Rain fed)	Partly Agricultural (Rain fed)	Flat	Flat	Flat	Flat
KA15	Mulakanur, Kambadur	0735372	1599175	Slight vegetation	Partly Agricultural (Rain fed)	Slight vegetation	Partly Agricultural (Rain fed)	Undulated	Undulated	Undulated	Undulated
KA16	Mulakanur, Kambadur	0735486	1597666	Rocky	Slight vegetation	Slight vegetation	Slight vegetation	Sloping up	Undulated	Undulated	Undulated
KA17	Mulakanur, Kambadur	0734306	1598512	Rocky	Partly Agricultural (Rain fed)	Rocky	Partly Agricultural (Rain fed)	Sloping up	Undulated	Sloping up	Undulated
KA18	Pallur, Kambadur	0738282	1596825	Slight vegetation	Slight vegetation	Slight vegetation	Slight vegetation	Flat	Flat	Flat	Flat
KA19	Pallur, Kambadur	0738282	1596825	Slight vegetation	Slight vegetation	Partly Agricultural (Rain fed)	Partly Agricultural (Rain fed)	Undulated	Undulated	Undulated	Flat
KA20	Pallur, Kambadur	0741081	1598072	Partly Agricultural (Rain fed)	Partly Agricultural (Rain fed)	Partly Agricultural (Rain fed)	Partly Agricultural (Rain fed)	Flat	Flat	Flat	Flat
KA21	Pallur, Kambadur	0739587	1599185	Slight vegetation	Slight vegetation	Slight vegetation	Slight vegetation	Flat	Flat	Flat	Flat
KA22	Pallur, Kambadur	0738317	1599708	Partly Agricultural (Rain fed)	Partly Agricultural (Rain fed)	Partly Agricultural (Rain fed)	Partly Agricultural (Rain fed)	Undulated	Undulated	Undulated	Undulated
KA23	Pallur, Kambadur	0739307	1597183	Partly Agricultural (Rain fed)	Slight vegetation	Partly Agricultural (Rain fed)	Slight vegetation	Flat	Undulated	Undulated	Undulated
KA24	Pallur, Kambadur	0739380	1598433	Slight vegetation	Slight vegetation	Partly Agricultural (Rain fed)	Slight vegetation	Undulated	Undulated	Undulated	Undulated
KA25	Thimmapuram, Kambadur	0737369	1590138	Partly Agricultural (Rain fed)	Slight vegetation	Slight vegetation	Slight vegetation	Flat	Flat	Flat	Flat
KA37	Pallur, Kambadur	740973	1597568	Partly Agricultural (Rain fed)	Slight vegetation	Slight vegetation	Partly Agricultural (Rain fed)	Flat	Flat	Flat	Flat

WTG no.	Name of Village, Mandal	Coordinates (UTM) (43P)		Surrounding Landuse				Topographic profile			
		Easting	Northing	North	South	East	West	North	South	East	West
KA28	S. Mallapuram, Kundurpi	0729948	1588789	Slight vegetation	Partly Agricultural (Rain fed)	Residential	Partly Agricultural (Rain fed)	Flat	Flat	Flat	Flat
SF 12 (coordinates not confirmed)	Pallur, Kambadur	-	-	Partly Agricultural (Rain fed)	Partly Agricultural (Rain fed)	Partly Agricultural (Rain fed)	Partly Agricultural (Rain fed)	Undulated	Undulated	Undulated	Undulated

Source: Primary data collated by AECOM, October 2016

Additional locations confirmed post site survey has been presented below:

Table 3-4: WTG Locations confirmed post site survey

WTG no.	Name of Village, Mandal	Coordinates (UTM) (43P)	
		Easting	Northing
KA26	Bydrahalli, Kalyandurg	0734056	1601103
KA27	Pallur, Kambadur	0734056	1601103
KA29	Pallur, Kambadur	0737629	1598111
KA30	Duradakunta, Kalyandurg	0734211	1600257
KA31	Duradakunta, Kalyandurg	0735093	1601890
KA32	Palluru, Kambadur	0740928	1597591
KA33	Guddella, Kambadur	0733987	1594858
KA34	Kariganipalli, Kundurpi	0728489	1588067
KA35	S. Mallapuram, Kundurpi	0731062	1590044

Source: HFE Corporate Office, December 2016

3.3 Project Components

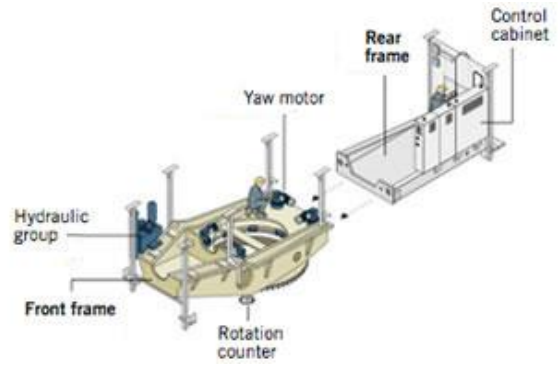
3.3.1 Wind Turbines

The project will comprise of 60 WTGs of the Gamesa 114 model, each of 2.0 MW aggregating to 120 MW. Each WTG will have a hub height of 106 metres with a rotor diameter of 114 metres and a tubular steel tower structure. The rotor speed will vary in between 7.8 to 14.8 rpm. A brief technical specification of Gamesa 114 wind turbine has been presented in **Table 3-5** and **Figure 3-2**.

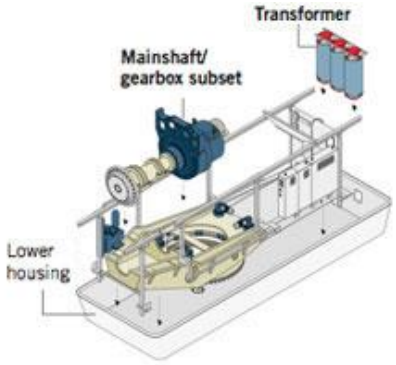
Table 3-5: Technical Specifications of Gamesa 114 model

Components	Specifications
Rotor	
Diameter	114 metres
Swept area	10,207 m^2
Rotational Speed	7.8 - 14.8 rpm
Speed control	Blade pitches in such a way that RPM is maintained
Over speed control	Blade pitches in such a way that RPM is maintained
Blades	
Number of blades	Three (3)
Length	56 metres
Airfoils	Gamesa
Material	Fiberglass reinforced with epoxy or polyester resin
Total weight of the blade	Approx. 11.5 Tonnes
Tower	
Type	Conical barrel tube
Height	106 metres
Gear box	
Type	1 planetary stage / 2 parallel stages
Ratio	1:128.5 (50 Hz), 1:102.5 (60 Hz)
Generator	
Type	Doubly-fed machine
Rated power	2.0 MW
Voltage	690 V AC
Frequency	50 Hz / 60 Hz
Protection class	IP 54
Cooling system	Passive air cooling
Power factor	0.95 CAP-0.95 IND throughout the power range

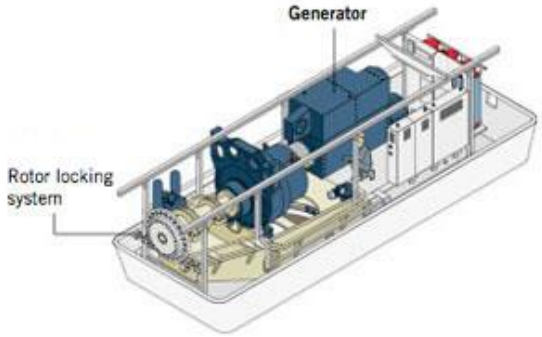
Source: Gamesa Platform Catalogue, August 2016



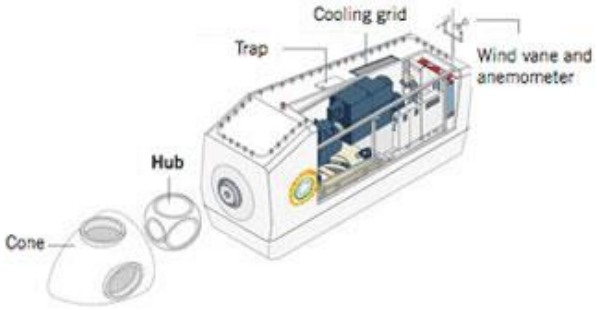
Frame diagram



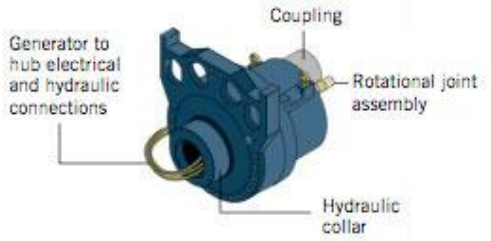
Gearbox assembly and lower housing



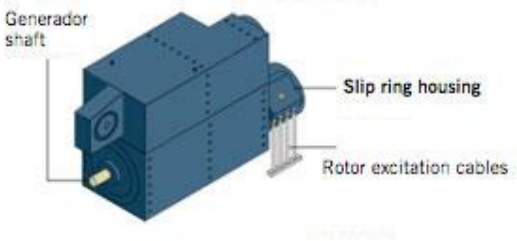
Generator



Upper housing



Gearbox diagram



Generator diagram

Source: *http://www.gamesacorp.com/en/*

Figure 3-2: Typical diagram of Gamesa Turbine

3.3.2 Access roads

The project location is approximately 220 km to the North of Bengaluru city and can be accessed through NH 44 and NH3. The site is also connected to Anantapur town, approximately 80 km Northeast the project location through NH 82. Access to the site is possible via the existing Bellari link road (tar road) connecting to both Anantapur in the north and Bengaluru in the south. The store yard, approximately 2 km from Bellari road and is linked via a tar road which connects to Thimmapuram village. The project related traffic is not expected to flow through the Thimmapuram village, but will utilize the existing road and bypass the village to reach WTG locations in and around Thimmapuram village. Land area of 10 to 20 acres is being procured for building internal access roads so as to connect WTG locations. This work is presently subcontracted to Win Power Engineering Pvt. Ltd. and SVS Infra Pvt. Ltd.

Presently the internal-access roads connecting WTG locations are being developed wherein dirt tracks are being levelled and widened. Dirt tracks will include considerable up-gradation and widening to 8 metres so as to enable smooth movement of heavy machinery during construction phase. Information on total length of the road for internal access routes for the project has not been finalized.

Equipment, supplies and personnel will move in and out from the site store yard which is connected through link road connecting Thimmapuram village and Bellari road. Heavy vehicles carrying wind turbines and necessary equipment will operate from store yard and utilize the existing link road and divert to dirt roads connecting WTG locations.

3.3.3 Substation and transmission line

As per technical specifications reported by the site management, substation works for building the 33 kV / 220 kV pooling substation has been contracted out to M/s PVR Constructions. An area of 6.5 ha has been procured for this purpose and the foundation works for the same have partially been completed.

Power generated from the project will be evacuated through 33 kV internal transmission lines (approximately 65 km in length) connecting the proposed pooling substation at Thimmapuram and WTG locations. Six feeders (two transformers) will be installed at the pooling substation at Thimmapuram to step up power 33 kV to 220 kV. 220 kV external transmission lines of length 24 km will be installed from pooling substation to proposed Borampalli substation. Thimmapuram substation was under construction during site survey and is expected to be completed prior to commissioning. Furthermore, ROW (as on date of site survey) for external transmission line was near completion whereas the ROW for internal lines was yet to be initiated. Land for ROW has been subcontracted to M/s Maruthi Constructions.

3.4 Project schedule and activities

The project life-cycle of a wind farm development can be divided into four phases as follows:

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

These phases are outlined in the sections below. The Project is currently in the construction phase.

3.4.1 Planning and Preconstruction Phase

The planning and pre-construction phase involves the conceptualization of the project and has following five components:

Site selection and wind resource assessment;

- Land purchase process;
- Site surveys as topographic, geo-technical investigations, micro-siting
- studies, power evacuation arrangements, zero-point marking etc.;
- Approvals/clearances/ permits; and
- Design and finalization of contractors (discussions have started)
- Mobilisation of contractors

The micro-siting has been completed for the project and a Wind Resource Assessment report has been prepared.

3.4.2 Construction Phase

The Construction activities for the wind farm development include:

- Construction of external connecting road and internal access roads;
- Site preparation activities such as clearance, excavation, filling, levelling etc.;
- Construction of site office, equipment and supplies storage areas, fuel storage areas and waste pits;
- Construction of turbine foundations at each WTG location;

- Transportation of equipment including towers, blades, turbines, supply materials and fuels;
- Completing internal electrical connections at each WTG location;
- Erection of internal overhead electrical lines;
- Establishment of pooling sub-station; and
- Commissioning of the WTGs

It must be noted that no labour camp will be established for the project as it was reported by the project proponent that the Contractors would make arrangements in villages within the vicinity of the project area on a rented basis and all migrant workers would be provided accommodation facilities within these rented arrangements

3.4.3 Operations and Maintenance Phase

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

- Required regulatory permits from the government authorities as prescribed under Chapter 4 of this report.
- Continuous remote monitoring of the WTG operations;
- Maintenance activities such as periodical greasing and cleaning;
- Annual shut down for maintenance which will mostly include cleaning and greasing, change of parts etc.; and
- Internal road repairs as and when required.

The design life of the project is expected to be twenty (20) years from the date of commissioning. Project's date of commissioning is expected to be April 2017. Regular maintenance is expected to ensure all WTGs perform at optimal efficiency. Day to day facility operations will involve remote monitoring through use of SCADA systems whereas limited maintenance and repair activities are expected.

3.4.4 Decommissioning Phase

The wind farm site, after having remained in operation for the lifecycle estimated at 20 years. The project, if it reaches a stage where no upgradation / expansion are expected, then the WTGs will be decommissioned and dismantled. Activities during this stage would primarily include, disembarking / dismantling and transport of WTGs and decommissioning of PSS.

3.5 Required Resources

3.5.1 Manpower

3.5.1.1 Construction phase

The labour requirement varies during the construction phase from the initial phase to the commissioning phase. As reported by VUBPL site management, approximately 130 to 150 workers (both skilled and unskilled included) will be employed depending on requirement. Labourers will be employed at the local level from the surrounding villages, as well as from other states. However, no labour camp is expected to be constructed as arrangements have been made in the nearby villages of the project area for rented accommodations for migrant workers. Total manpower required for various works has been presented in the following table:

Table 3-6: Manpower required during construction phase

Type of work	Manpower employed
Casting, reinforcement works and civil works	80 divided into two teams
Mechanical works (crane and erection works)	45 to 60
Electrical works	10
Civil works (all male migrant workers)	25 labourers from West Bengal

Source: VUBPL, December 2016

3.5.1.2 Operation Phase

The project is expected to engage a total of 15 to 20 employees which include both VUBPL and Gamesa staff.

3.5.2 Water requirements

3.5.2.1 Construction Phase

During construction phase, water will be required for domestic purposes as well as for construction activities. The water requirements will be primarily met through supply of water from tankers and additional water if required will be sourced from existing bore well located at the store yard. The water requirements during the construction phase have been presented in **Table 3-7**. Total water requirement for the project during construction phase is estimated to be approximately 8040 KL.

Table 3-7: Estimated water requirement during construction phase

Type of work	Water required
For erection works	2000 ltrs / location
For WTG specific civil works and casting	42000 ltrs / location
For curing works	90000 ltrs / location
Total water requirement during construction phase	**134000 ltrs / location**

Source: VUBPL, December 2016

3.5.2.2 Operation phase

VUBPL site management reported that approximately 3 to 5 m^3 / month of potable water and utility water is expected to be used during Operations and Management phase. Local contractors are expected to provide water through tankers.

3.5.3 Key material supplies and transportation routes

3.5.3.1 Construction Phase

The construction material along with wind turbines includes cement, aggregates, steel, paints, solvents etc. Besides these, other supplies required for the project are fuels and oils, drilling requirements, spare parts for construction machinery and food and supplies for construction workforce. Most supplies are expected to be procured locally. Details of material and supplies along with contractor details have been presented in **Table 3-8**.

Table 3-8: Details of materials required, source, and transportation routes

Material	Source and transport routes
Towers	Gamesa will supply towers for the wind turbines from Trichy
Nacelle and Hub	Gamesa will supply nacelle and hubs from its Chennai manufacturing unit to Anantapur. The same will be transported from Anantapur to store yard.
Blades	Blades for the WTG will be transported from Gamesa's manufacturing unit in Halol, Gujarat. The cargo will be transported from Halol to Gooty to Anantapur which will then be transported to store yard later. The blades are also expected from Gamesa's store at Nellore which will be transported to the project store yard through Anantapur
Soil and aggregates	Soil and aggregates will be provided by Maruti constructions and will be sourced locally
Cement	Cement will be supplied from Penna Cement and will be sourced locally. It was reported that batching plant will not be setup during construction phase.
Re-bar steel, and structural streel	SRJ Suppliers will be providing the required steel for the project during construction phase. The same will be sourced locally

Source: VUBPL. December 2016

3.5.3.2 Operation Phase

Supplies such as WTG spare parts and other operational requirements will be transported from Gamesa manufacturing unit in Chennai. Additional supplies such as fuel requirements and supplies for the site staff will be sourced locally.

3.5.4 Fuel supplies and storage

3.5.4.1 Construction Phase

Fuel quantity during construction phase will depend on need basis requirement. Separate storage for fuel is therefore not expected. Required fuel will be sourced from local vendor.

3.5.4.2 Operation Phase

The project is expected to allocate area for above ground storage facility for storage of lubricating oil. The oils will be unloaded in designated areas and stored in drums in dedicated stores. Details of the same have not yet been confirmed.

3.5.5 Power requirement

3.5.5.1 Construction Phase

As reported by VUBPL site management, the power requirement during construction phase will be met through two DG units of 30 kVA capacity and three DG units of 40 kVA.

3.5.5.2 Operation Phase

The power requirement at site office and WTG monitoring office will be met through electricity connection from State electricity board. Additionally, the DG units utilized during construction phase will also be used as backup in the operation phase.

3.6 Land requirement

3.6.1 Overview

VUBPL is in the process of procuring private land on willing seller/ and willing buyer basis for the proposed project. Total land requirement for installation of WTGs will be around 247 acres (of which 166.76 acres have been acquired). Pooling substation at Thimmapuram village is under construction on private land. The entire project area comprises of private agricultural land. The component wise break-up of the land required for the project is provided in the following table:

Table 3-9: Component breakup of land area required for the Project

Project Facilities	Land Area (in acres)	Land Use Classification			Mode of Procurement
		Forest	Government	Private	
Wind Turbine	247	-	-	✓	Willing Buyer/ Willing Seller
Access Roads	10 to 20	-	-	✓	Willing Buyer/ Willing Seller
Substation/Switchyard/ Administration Building	16.22	-	-	✓	Willing Buyer/ Willing Seller
Internal Transmission Lines up to Pooling Substation (approx. 65km length)	ROW requirement yet to be estimated by VUBPL	-	-	✓	Willing Buyer/ Willing Seller
External Transmission Lines up to Grid Substation from PSS (approx. 24km length)	ROW requirement yet to be estimated by VUBPL	-	-	✓	Willing Buyer/ Willing Seller

Source: VUBPL, December 2016

Land procurement for the project is being undertaken by two (02) land aggregators, Win Power Engineering Private Limited and SVS Infra Private Limited associated with VUBPL.

3.6.2 Land procurement / rental process

Out of the 247 acres of land required, VUBPL has procured 166.76 acres from eight (08) villages falling under Ananthapur district of Andhra Pradesh on willing seller/ and willing buyer basis.

Procurement of private land involves the following steps:

- Identification of land
- Negotiation with land owners
- Acquisition of land – execution of sale deed with land owners by the land aggregators

Details pertaining to land procurement process have been elaborated in Section 6.3.3 (please refer to **Table 6-5**)

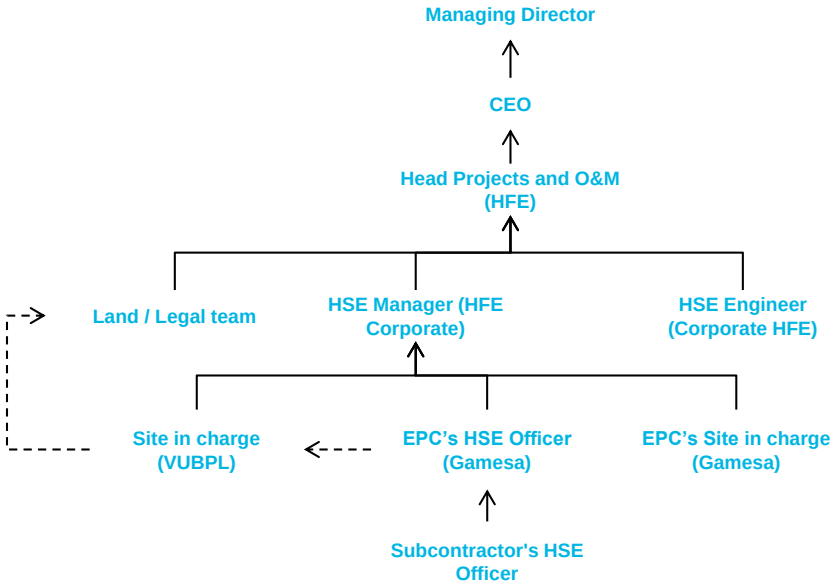
3.6.3 Details of land procured for the project

The Project Proponent has procured land measuring 166.76 acres for the project and its associated facilities from 35 private land owners. All the land procured for the project is private agricultural land directly negotiated by the Land Aggregators engaged by VUBPL with the individual buyers. By procuring the land on 'willing buyer/willing seller' basis, the Land Aggregator ensured that the negotiation took place with the seller's informed consent, the land markets or other opportunities for the productive investment of the sales income exist and the seller was provided with fair compensation based on prevailing market values. Details of the excerpts of consultations held with the land owners covering these aspects have been elaborated in Section 6.3.1 of the report.

The details of the land procured for the project along with landowners' names have been presented in **Table 3-10**.

3.7 Project organizational Structure

HFE has established a project specific organizational structure. **Figure 3-3** presents VUBPL's organizational structure. As reported by VUBPL site management, the EPC and subcontractors have deployed dedicated HSE officers who will be responsible for overseeing ongoing construction related activities. VUBPL has engaged one site incharge and several other technical staff (not shown in **Figure 3-3**) to monitor EPC's and its subcontractors' activities. The HSE officer and Site incharge of EPC directly report to the VUBPL Site incharge who reports to the HSE Manager at the corporate level.



Source: VUBPL, December 2016

Figure 3-3: Project Organization structure – VUBPL

Table 3-10: Details of Land Procured for the Project

Location No.	Serial No. (Survey No.)	Land Procured (acre & gunta)	Land Owner's Name	Village, Mandal	Sale Deed No. & Date	Mutation	Land Conversion
Sub Station	22/1A, 22/1B, 22/1C, 22/1A1	16.20	G. Narasanna Gowd & Gowni Manjunath & G. Ravichandra Gowd & Gowni Nagabhushana & G. Veeramallappa & Rachamalla Chandrakala & G. Santhamma & Nataraj & G. Radha Krishna	Thimmapuram, Kambadur	CS No. 2832/2016 & Doct No. 2720/2016; dated 26.08.2016	Completed	Completed
KA-01	157/2B	3.27	Golla Erakka	Thimmapuram, Kambadur	CS No. 1999/2016 & Doct No. 1899/2016; dated 30.06.2016	Completed	Completed
KA-02	155	3.2	Golla Sannagangappa @ Golla Sanna Nagappa & Pedda Doddanna gari Chikkanna & Seeganna & Eranna	Thimmapuram, Kambadur	CS No. 2036/2016 & Doct No. 1946/2016; dated 01.07.2016	Completed	Completed
KA-03	167/2B	3.5	Duradakunta Balamma @ Golla Balamma & Yarramma	Thimmapuram, Kambadur	CS No. 2012/2016 & Doct No. 1912/2016; dated 30.06.2016 & CS No. 2004/2016 & Doct No. 1904/2016; dated 30.06.2016	Completed	Completed
KA-04	167/1D	3.5	Vadde Anil Kumar & Vadde Eeranna & Vadde Kanakanna	Thimmapuram, Kambadur	CS No. 1068/2016 & Doct No. 995/2016; dated 16.04.2016	Completed	Completed
KA-05	142-2/2	3.5	Golla Naganna, Golla Eranna & Golla Ramesh & Golla Manjunatha	Thimmapuram, Kambadur	CS No. 1066/2016 & Doct No. 994/2016; dated 16.04.2016	Competed	Completed
KA-06	70/2	3.5	Sugali Thavrenayak	S. Mallapuram, Kundurpi	CS No. 1070/2016 & Doct No. 997/2016; dated 16.04.2016	Completed	Completed
KA-07	37/2	3.5	Rammurthy	S. Mallapuram, Kundurpi	CS No. 1071/2016 & Doct No. 998/2016; dated 16.04.2016	Completed	Completed
KA-08	56&57	3.3	Sugali Chinna Lokenaik & Vaddi Gangappa	S. Mallapuram, Kundurpi	CS No. 2010/2016 & Doct No. 1910/2016; dated 30.06.2016	Completed	Completed
KA-09	241	3.5	Gowni Mallana	Thimmapuram, Kambadur	CS No. 2006/2016 & Doct No. 1906/2016; dated 30.06.2016	Completed	Completed
KA-10	257/2	3.24	Chakali Pathappa @ Pathanna & C. Chiranjeevi & C. Vinod & Chakali Marappa @ Marenna & Chakali Basavaraju & Chakali Suddappa & Yannappa & Nagendra & Chakala Nagamani & C. Prakesh & Maranna & Chakali Hanumanthappa	Thimmapuram, Kambadur	CS No. 2038/2016 & Doct No. 1948/2016; dated 01.07.2016	Completed	Completed
KA-11	17	3.5	Swugali Narayana Nayak & Sugali Bojyya Nayak	S. Mallapuram, Kundurpi	CS No. 2005/2016 & Doct No. 1905/2016; dated 30.06.2016	Completed	Completed
KA-12	45/11B	3.6	Gowni Shankar Guru	Thimmapuram, Kambadur	CS No. 2011/2016 & Doct No. 1911/2016; dated 30.06.2016	Completed	Completed
KA-13	26	3.5	Badapalleppa @ Boya Badapalleppa & Chinna Badapalleppa @ Sanna Badapalleppa & Sriramulu @	Enumuladoddi, Kundurpi	CS No. 2634/2016 & Doct No. 2522/2016; dated 10.08.2016	Completed	Completed

Location No.	Serial No. (Survey No.)	Land Procured (acre & gunta)	Land Owner's Name	Village, Mandal	Sale Deed No. & Date	Mutation	Land Conversion
			Boya Sriramula & Boya Konda Bommanna				
KA-14	119	3.7	B.Mahalingappa & Marekka & Bommakka	Enumuladoddi, Kundurpi	CS No. 2635/2016 & Doct No. 2523/2016; dated 11.08.2016	Completed	Completed
KA-15	580	4	Avula Earanna & Avula Thimma	Mulaknur, Kambadur	CS No. 1069/2016 & Doct No. 996/2016; dated 16.04.2016	Completed	Completed
KA-16	591/2	3.5	Danda Narayanappa & Danda Govindappa & Danda Easwarappa & Danda Venkatesulu & Sakamma & Danda Syamalamma & D. Laxmi Devi & Danda Laksmi Devi	Mulaknur, Kambadur	CS No. 2633/2016 & Doct No. 2521/2016; dated 11.08.2016	Completed	Completed
KA-17	560/4	3.65	Talla Venkatesulu & Talla Naganna & Talla Narayanappa & Talla Yellappa & Talla Sanna Thimmanna & T. Ramadevi	Mulaknur, Kambadur	CS No. 2636/2016 & Doct No. 2524/2016; dated 10.08.2016	Completed	Completed
KA-18	218/1	3.91	Garikapati Anjineyulu @ K.Anjineyulu & Garikapati Parvathamma & D. Hanumantharayudu & Garikapati Thimmarayudu & Kamma Aswarthanarayana & Garikapti Bapooji	Palluru, Kambadur	CS No. 2630/2016 & Doct No. 2520/2016; dated 11.08.2016	Completed	Completed
KA-19	239/1	3.7	Kamasani Yerriswamy	Palluru, Kambadur	CS No. 2039/2016 & Doct No. 1949/2016; dated 01.07.2016	Completed	Completed
KA-20	290	3.7	V.Govindappa @ Govindarajulu & Vadde Mallela Nagaraju @ M. Nagaraju & M.Sundarayya @ Vadde Sundarayya & M.Srinivasulu @ Vadde Srinivasulu	Palluru, Kambadur	CS No. 2035/2016 & Doct No. 1945/2016; dated 01.07.2016	Completed	Completed
KA-21	145/2B	4	V.Govindappa	Palluru, Kambadur	CS No. 2001/2016 & Doct No. 1901/2016; dated 30.06.2016	Completed	Completed
KA-22	33	3.5	P.venkatamma & Yellareddy & T.Prakash Reddy & T.Lakshmi Reddy & T.Yella Reddy & T. Narayana Reddy & T.Lokananad Reddy	Palluru, Kambadur	CS No. 2037/2016 & Doct No. 1947/2016; dated 01.07.2016	Completed	Completed
KA-23	247/A	3.5	Venkatesulu	Palluru, Kambadur	CS No. 2000/2016 & Doct No. 1900/2016; dated 30.06.2016	Completed	Completed
KA-24	179/2B	3.75	Ramakrishna & N.Lingamaiah Chowdary & Venkatesulu @ Nadendla Venkatesulu	Palluru, Kambadur	CS No. 2003/2016 & Doct No. 1903/2016; dated 30.06.2016	Completed	Completed
KA-25	165/1	4	Paidipati Sreekantha Chowdary	Thimmapuram, Kambadur	CS No. 734/2017 & Doc No. 720/2017; dated: 23.03.2017	Completed	Completed
KA-26	273	3.5	Suddabavi Bojjanna & Suddabavi Ravi & Suddabavi Uday	Palavai, Kalyandurg	CS No. 3474/2016 & Doct No. 3351/2016; dated 07.10.2016	Completed	Completed
KA-27	32	4	P.Visalakshi & Kapu Prabhar @ Prabhakarreddy & P.Kasireddg& T.Ramulamma & Bommaareddygari Padmavathi & V.Nageswari	Palluru, Kambadur	CS No. 2041/2016 & Doct No. 1951/2016; dated 01.07.2016	Completed	Completed

Location No.	Serial No. (Survey No.)	Land Procured (acre & gunta)	Land Owner's Name	Village, Mandal	Sale Deed No. & Date	Mutation	Land Conversion
KA-28	29 & 45	3.38	V.Naganna & Vadde Ramanjineyulu @ Ramanjinappa	S. Mallapuram, Kundurpi	CS No. 2009/2016 & Doct No. 1909/2016; dated 30.06.2016 & CS No. 2008/2016 & Doct No. 1908/2016; dated 30.06.2016	Completed	Completed
KA-29	187/2	3.55	N. Sujatha	Palluru, Kambadur	CS No. 2040/2016 & Doct No. 1940/2016; dated 01.07.2016	Completed	Completed
KA-30	293/2B	3.5	Kuruba Obulesu & Kuruba Obulesu & Kamalamma & Y. Laxmi	Duradakunta, Kalyandurg	CS No. 3796/2016 & Doc No. 3651/2016; dated: 25.10.2016	Completed	Completed
KA-31	282/1A	3.5	Kuruba Kamalamma & Kuruba Obulesu & Kuruba Obulesu & Y. Laxmi	Duradakunta, Kalyandurg	CS No. 3797/2016 & Doc No. 3652/2016; dated 25.10.2016	Completed	Completed
KA-32	255/1	3.50	V.Govindappa	Palluru, Kambadur	CS No. 2007/2016 & Doct No. 1907/2016; dated 30.06.2016	Completed	Completed
KA-33	492	4	Vemula Bhargava & Vemala Ganganna	Mulakunur, Kambadur	CS No. 263/2017 * Doc No. 262/2017; dated 04.02.2017	Completed	Completed
KA-34	138	3.95	Mala Kishore Kumar & Maala Thippeswamy & Rama Lakshmi & Bhakthula Prasanth Kumar	Kariganipalli, Kundurpi	CS No. 826/2017 & Doc No. 812/2017; dated: 07.04.2017	Completed	Completed
KA-35	15	2.96	Madiga Marekka & Marenna & Jayasree	S. Mallapuram, Kundurpi	CS No. 733/2017 & Doc No. 721/2017; dated: 23.03.2017	Completed	Completed
KA-36	255/2	4.15	Ramalakshmi, Raghavendra, Thimmarajamma & Gangadhara	Palluru	CS No. 579/2017 & Doc No. 565/2017; dated 08.03.2017	Completed	Completed

Source: VUBPL, November 2017

The HSE Manager at the corporate level is responsible for overseeing EHS aspects associated with project. The land team undertakes land related proceedings through land aggregators.

3.8 Project schedule

The project schedule as shared by HFE has been presented in table below:

Table 3-11: Project schedule of VUBPL

Sno.	Activity	2016							2017				Total
		Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	
1	Land Availability		10	10	10	10	10	10					60
2	Access Road for Foundation		10	10	10	10	10	10					60
3	Foundation Casting			8	9	8	10	10	10	5			60
4	WTG Supply (at Site)			5	10	10	10	10	10	5			60
5	Erection			2	8	9	8	9	9	9	6		60
6	Pre Commissioning				5	11	8	9	10	9	8		60

Number of WTG under VUBPL Scope

Number of WTG under Gamesa scope

Source: HFE Corporate Office, December 2016

4. Environmental and Social Regulatory Framework

4.1 Introduction

This section highlights the environmental and social regulations applicable to the proposed Wind Power project. The section broadly focuses on the institutional framework, applicable environment, health and safety and social legislative requirements and IFC Performance Standards relevant to the proposed Project.

4.2 National and Regional authorities

All the permissions and approvals have to be taken from the concerned ministries, line departments and the local civic bodies for any upcoming project in India. The environmental and social governance approach in the country consists of –

- Regulatory and implementing entities;
- Legal framework including policies, acts and laws; and
- Permitting system

In India, Ministry of New and Renewable Energy (MNRE) is the nodal agency to manage wind power projects and the environmental aspects are governed by Ministry of Environment, Forests and Climate Change (MoEFCC), Central Pollution Control Board (CPCB,) Central Electricity Authority (CEA) Central Electricity Regulatory Commission (CERC) and National Institute of Wind Energy (NIWE). The social governance aspects at the micro level are addressed by institutions like panchayats and municipal bodies.

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

4.2.1 Ministry of Environment, Forests and Climate Change (MoEFC&C)

The Ministry of Environment, Forests and Climate Change (MoEF&CC) is the nodal agency in the administrative structure of the Central Government for the planning, promotion, co-ordination and overseeing the implementation of India's environmental and forestry policies and programmes.

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

The specific functions of MoEF&CC are as follows:

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

4.2.2 Central Pollution Control Board (CPCB)

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

- Prevent pollution of streams and wells;

- Advise the Central Government on matters concerning prevention, control and abatement of water and air pollution;
- Co-ordinate the activities of SPCB's and provide them with technical and research assistance;
- Establish and keep under review quality standards for surface and groundwater and for air quality;
- Planning and execution of national programme for the prevention, control and abatement of pollution through the Water and Air Acts; and
- The CPCB is responsible for the overall implementation and monitoring of air and water pollution control under the Water Act, 1974, and the Air Act, 1981.

4.2.3 Andhra Pradesh Pollution Control Board (APPCB)

Andhra Pradesh Pollution Control Board (APPCB) is a statutory authority entrusted to implement environmental laws and rules within the jurisdiction of the State of Andhra Pradesh, India. The Board ensures proper implementation of the statutes, judicial and legislative pronouncements related to environmental protection within the State. The APPCB was constituted in the year 1976 after the enactment of the first major environmental legislation of the country, the Water (Prevention and Control of Water Pollution) Act, 1974.

The Board functions through its Head Office at Hyderabad, five Zonal Offices headed by five Joint Chief Environmental Engineers and nineteen Regional Offices headed by nineteen Environmental Engineers. The important functions of board comprises of planning and execution of annual action plans to implement the provisions of various rules and Acts; consent management; environmental awareness; ensure legal actions defaulters; waste management and deals with public grievances.

Intimation to APPCB is required before the start of the project

4.2.4 Department of Environment, Andhra Pradesh

The Environment, Forests, Science and Technology Department is headed by the Principal Secretary, and is divided into nine sections. The Department primarily deals with:

- Proposals relating to forest lands, mining leases, encroachments on forest lands, forest Conservation Act 1980;
- Use of forest land for non-forest purposes, soil conservation Issues relating to Podu cultivation, forest settlement, forest survey and mapping Protection of forests and related notifications;
- Issues relating to destruction of forests;
- Budget planning and Non-Plan schemes;
- Research and development/monitoring and evaluation;
- Social forestry programmes; and
- Development of waste land.

Environment Protection Training and Research Institute (EPTRI) were set up as an independent registered society in 1992 by the department. The main objective of EPTRI is to provide training, consultancy, applied research services and advocacy in the area of environment protection to industry, regulatory bodies, Government, NGOs etc. It also focuses on waste minimization by way of resource / water conservation, segregation etc., through in-plant studies.

4.2.5 Petroleum and Explosives Safety Organization (PESO)

- The PESO is under the Department of Industrial Policy & Promotion, Ministry of Commerce and Industry, Government of India. The Chief Controller of Explosives is responsible to deal with provisions of
- The Petroleum Act 1934 and the Rules 2002,
- The Static and Mobile pressure vessels {Unfired} Rules, 1981 and amendment 2000, 2004;
- Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 and amendment 2000.

4.2.6 Director Industrial Safety and Health

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

4.2.7 Ministry of New & Renewable Energy (MNRE)

The MNRE is the nodal ministry of Government of India for all matters related to new and renewable energy. The broad aim is to develop and deploy new and renewable energy for supplementing the energy requirements of the country as stated on its website. The role of MNRE has been assuming importance in recent times with growing concerns of energy security. Energy self-sufficiency was identified as the major driver for new and renewable energy in the wake of the two oil shocks of 1970.

4.2.8 New & Renewable Energy Development Corporation of Andhra Pradesh (NREDCAP)

- The genesis of Non-conventional Energy Development Corporation of Andhra Pradesh Limited [NEDCAP] took place in the year 1986 with the help of Government of Andhra Pradesh. The sole objectives of NEDCAP are to:
- Generate electricity through renewable sources like wind and solar on decentralized manner
- Conserve energy in rural areas;
- Import and adopt viable technology and machinery in the areas of Non-conventional energy sources and ensures post installation service; and
- Impart training and to promote research and development in the field of Non-conventional energy sources

VUBPL should obtain an approval for project implementation and Certificate of Commissioning from NREDCAP after commissioning of the project. Project should also be registered under the State Nodal Agency.

4.2.9 National Institute of Wind Energy (NIWE)

National Institute of Wind Energy (NIWE) has been established in Chennai in the year 1998, as an autonomous R&D institution by the Ministry of New and Renewable Energy (MNRE), Government of India. It functions with the following structure.

- **Research & Development unit:** Its main focus towards novelty in developments of components as well as in sub-systems of wind turbines.
- **Wind Resource Assessment Unit:** The unit identifies resource rich regions in the country by conducting wind resource micro survey and offers its services to the wind farm developers.
- **Standards and Certification Unit:** The unit carries out Provisional Type Certification of Wind Turbines as per the Indian Certification Scheme for Wind Turbines viz. Type Approval - Provisional Scheme - TAPS – 2000 (amended). Standards on Wind Energy are being developed by the unit.

Information, Training & Commercial Service Unit: To establish and update the data bank and serve as finest information centre in wind energy by collecting, collating and analysing the related information.

Gamesa G-114 2.0 MW WTGs proposed to be utilized in the project is NIWE certified as per NIWE notification dated 10.06.2016 with Ref No. NIWE/S&C/RLMM/2016-17/27 on "Revised List of Models and Manufacturers of Wind Turbines – Consolidated "ADDENDUM –II List" to "Main List dated 28.09.2015"

4.2.10 Central Electricity Authority (CEA)

Central Electricity Authority (CEA) is a Statutory Body constituted under the erstwhile Electricity (Supply) Act, 1948, hereinafter replaced by the Electricity Act 2003, where similar provisions exists, the office of the CEA is an "Attached Office" of the Ministry of Power. The CEA is responsible for the technical coordination and supervision of programmes and is also entrusted with a number of statutory functions.

4.2.11 Central Electricity Regulatory Commission

The Commission intends to promote competition, efficiency and economy in bulk power markets, improve the quality of supply, promote investments and advise government on the removal of institutional barriers to bridge the demand supply gap and thus foster the interests of consumers. In pursuit of these objectives the Commission aims to –

- Improve the operations and management of the regional transmission systems through Indian Electricity Grid Code (IEGC), Availability Based Tariff (ABT), etc.;
- Formulate an efficient tariff setting mechanism, which ensures speedy and time bound disposal of tariff petitions, promotes competition, economy and efficiency in the pricing of bulk power and transmission services and ensures least cost investments; facilitate open access in inter-state transmission;
- Facilitate inter-state trading;
- Promote development of power market; and
- Improve access to information for all stakeholders;

4.2.12 Gram Panchayat

Gram Sabha or the Panchayats are the local bodies which have been bodies defined by the 73rd Constitutional Amendment Act, 1992. Panchayats have to be consulted before making the acquisition of land in the Scheduled Areas for development projects and before re-settling or rehabilitating persons affected by such projects in the Scheduled Areas. The responsibilities that have been entrusted upon Panchayats comprises of the preparation of plans for economic development and social justice and the implementation of such schemes for economic development and social justice, as may be assigned to them.

A Non- Objection Certificate (NOC) has to be obtained for the project from the Gram Panchayat of all the project villages for installation of the WTGs. VUBPL is yet to obtain the same.

4.2.13 Transmission Corporation of Andhra Pradesh Limited (APTRANSCO)

APTRANSCO came into existence on 1st February, 1999. APTRANSCO remained as Single buyer From Feb 1999 to June 2005 in the state-Purchasing power from various Generators and selling it to DISCOMs in accordance with the terms and conditions of the individual PPAs at Bulk Supply Tariff (BST) rates. Subsequently, in accordance with the Third Transfer Scheme notified by Government of Andhra Pradesh, APTRANSCO ceased to do power trading and has retained powers of controlling system operations of Power Transmission.

A Power Purchase Agreement for power evacuation has been signed (dated 16th July 2016) between Southern Power Distribution Company of AP limited (DISCOM), and M/s Vayu Urja Pvt. Ltd..

4.3 Applicable legislations

The relevant Acts and Rules pertaining to the project have been summarised in the following Table 4-1. Some of the policies (including sector specific) have been discussed briefly in the subsequent sections.

4.3.1 National Environmental Policy 2006

The dominant theme of this policy is that while conservation of environmental resources is necessary to secure livelihoods and well-being of all, the most secure basis for conservation is to ensure that people dependent on particular resources obtain better livelihoods from the fact of conservation, than from degradation of the resource.

VUBPL shall ensure compliance to the requirements of this policy.

4.3.2 National Electricity Policy 2005

The National Electricity Policy 2005 states that Environmental concerns would be suitably addressed through appropriate advance action by way of comprehensive Environmental Impact Assessment and implementation of Environment Action Plan (EAP). As per the policy, adequate safeguards for environmental protection with suitable mechanism for monitoring of implementation of Environmental Action Plan and R&R Schemes should be put in place. Open access in transmission has been introduced to promote competition amongst the generating

companies who can now sell to different distribution licensees across the country. This should lead to availability of cheaper power.

4.3.3 Andhra Pradesh Wind Energy Policy, 2015

The Wind Energy Policy has been formulated 13th February, 2015 by Energy, Infrastructure & Investment Department, and Andhra Pradesh with the following objectives:

- To encourage, develop and promote wind power generation in the State with a view to meet the growing demand for power in an environmentally and economically sustainable manner;
- To attract private investment to the State for the establishment of large wind power projects; and
- To promote investments for setting up manufacturing facilities in the State to generate local employment.

VUBPL intends to install WTGs of Gamesa Model, G-114 (rotor diameter of 114 m and hub height of 106 m with tubular tower) of 2 MW rated capacity, which is in line with clause no '7- Repowering' of the above said policy. Also, Gamesa holds the responsibility for development of power evacuation facilities along with interconnection scheme and bay equipment along with protection equipment from the proposed project till the grid sub-station of APTRANSCO.

4.4 International Standards

4.4.1 IFC Performance Standards

The IFC Performance Standards stipulates that any proposed project shall meet the following requirements throughout the life of an investment by IFC or other relevant financial institution:

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

These performance standards and guidelines provide ways and means to identify impacts and affected stakeholders and lay down processes for management and mitigation of adverse impacts.

4.4.1.1 Performance Standard 1

PS 1 establishes the importance of:

- Integrated assessment to identify the environmental and social impacts, risks, and opportunities of projects;
- Effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and
- The project proponent's management of environmental and social performance throughout the life of the project.

Applicability

The PS 1 is applicable to projects with environment and/or social risks and/or impacts. The proposed project will have environmental and social impacts such as generation of noise and small quantities of hazardous wastes (operation of DG sets etc.). PS 1 is therefore applicable for the project and thus requires an Environmental and Social Impact Assessment (ESIA) study to be conducted before commencement of the project. VUBPL also needs to develop and implement a project specific Environmental and Social Management System to monitor and manage the risks associated with project's operations.

Table 4-1: Applicable Environmental and Social Laws, Regulations and Policies

Sno.	Issues	Relevance	Applicable Legislation	Agency Responsible	Applicable Permits and Requirements
1.	Environmental Protection	Construction activities will generate air and noise emissions. Scattering of debris and construction material can contaminate the soil and surroundings	The Environment (Protection) Act 1986, as amended in April 2003; EPA Rules 1986, as amended in 2002.	APPCB MoEFCC CPCB	Compliance under the rules to maintain stipulated standards and environmental management through various supporting rules promulgated under the Act.
2.	Prevention and Control of Water Pollution	Waste water generation from construction and operation of the project	The Water (Prevention and Control of Pollution) Act, 1974, amended in 1988	APPCB	An Intimation As per the revised classification of industrial sectors under red, orange, green and white categories (February 29, 2016); Wind Power projects are categorised into White Category and are not required to obtain a Consent from the Pollution Control Board. Intimation to Andhra Pradesh Pollution Control Board with the following information prior to the construction phase of the project shall suffice. • List of raw materials consumed (with quantity) and products (with quantity) per day. • Process flow chart and details. • Amount of water and different type of fuels used per day. • Quantity of liquid wastes generated per day and its characteristics. • Expected quantity and characteristics of gaseous emissions (fuel burning and process) • Expected quantity of solid wastes generated including hazardous solid waste. • Proposal for controlling/ treatment of liquid, solid and gaseous emissions.
3.	License under Factories Act, 1948	Factory license is required as 'factory' means '*any premises having ten or more workers involved in a manufacturing process*'.	Chapter I of The Factories Act, 1948	Factories Inspectorate, Andhra Pradesh	VUBPL to obtain Factory License from the State Government or Chief Inspectorate of Factories, Andhra Pradesh
4.	Water Cess Collection (a tax on water use and water pollution caused)	Water use and waste water generation	The Water (Prevention and Control of Pollution) Cess Rules 1978, as amended through 16th July 1992and Water (Prevention and Control of Pollution) Cess Act 1977, as amended through 6th May 2003	APPCB	Filing of monthly returns as per prescribed format (Form I under the Act) Compliance under the Act. Gamesa to ensure Compliance
5.	Noise Emissions	Noise generated from operation of construction machinery	The Noise (Regulation & Control) Rules, 2000 as amended in October 2002.	APPCB	There will be generation of noise during construction activities and during operation of WTGs.

Sno.	Issues	Relevance	Applicable Legislation	Agency Responsible	Applicable Permits and Requirements
			As per the Environment (Protection) Act (EPA) 1986 the ambient noise levels are to be maintained as stipulated by CPCB for different categories of areas like, commercial, residential and silence zones etc.		The Rules require activity/processes generating noise to ensure that the ambient noise standards are within the prescribed Standards. The proposed project will result in generation of noise during construction and operation activities. The project is required to maintain the noise limits prescribed for residential area i.e., 55 dB (A) for daytime and 45 dB (A) for night-time. Gamesa shall ensure compliance under the rules to maintain stipulated standards.
6.	Hazardous Wastes Management	The proposed project will generate waste oil from diesel generator and transformer oil from switchyard. Solvents and chemicals used or cleaning etc.	Hazardous Wastes (Management Handling and Trans boundary Movement) Rules, 2008 as amended up to 2009 under Environment (Protection) Act, 1986	APPCB	Authorization for collection, reception, storage, transportation and disposal of hazardous wastes Filing of annual return under the rules Other compliance under the rules such as authorization by Central Pollution Control Boards to vendors accepting waste/used oil The occupier(VUBPL), transporter and operator (Gamesa) of the project shall be liable for damages caused to the environment resulting due to improper handling and disposal of hazardous waste listed in schedules to the Rules;
7.	Electricity Distribution License	Private sector projects to obtain distribution Licenses from the State Electricity Regulation Committee and to have open access to the transmission lines	The Electricity Act 2003 including rules 1956 and 2005	State Electricity Regulation Committee	Gamesa shall obtain license under the electricity act and ensure that the Health and Safety requirements specified under the rules are compiled to.
8.	Storage of Petroleum products	There will be storage of Diesel at site for operation of generators during construction phase.	The Petroleum Act 1934, as amended in August 1976 The Petroleum Rules 1976, as amended in March 2002.	PESO (Chief Controller of Explosives)	The site will store a small quantity of fuel at site. However, in case fuel storage exceeds the limit as stipulated in the Act, VUBPL/ Gamesa is required to obtain a license from PESO.
9.	Surface Transportation	Movement of construction vehicles and other vehicles for transportation of workers	The Motor Vehicles Act 1988, as amended by Motor Vehicles (Amendment) Act 2000, dated 14th August 2000 The Central Motor Vehicles Rules 1989, as amended through 20th October 2004 by the Central Motor Vehicles (Fourth Amendment) Rules 2004.	State Transport Authority	Gamesa to ensure Compliance of stipulated standards under rule 115
10.	Welfare and Work Environment	Engagement of workers for construction and operation of the plant	The Factories Act, 1948 and Andhra Pradesh Factories Rules, 1950	Deputy Chief Inspector of Factories.	VUBPL/ Gamesa shall comply with all requirements of factories rules and participate in periodic inspection. VUBPL/ Gamesa will ensure that no child labour is engaged.
11.	Labour	Engagement of Child Labour at site	The Child Labour (Prohibition and Regulation) Act, 1986	Department of Inspectorate of	The Act prohibits employment of children in certain occupation and processes. The Act also specifies conditions

Sno.	Issues	Relevance	Applicable Legislation	Agency Responsible	Applicable Permits and Requirements
				Factories, Andhra Pradesh	of work for children, if permitted to work. VUBPL/ Gamesa will ensure compliance
12.	Labour	Engagement of bonded Labour at site	Bonded Labour (Abolition) Act 1976	Department of Inspectorate of Factories, Andhra Pradesh	All forms of bonded labour is abolished VUBPL/ Gamesa will ensure compliance
13.	Labour	Provision of wages to labour engaged at the site	Minimum Wages Act, 1948	Department of Inspectorate of Factories, Andhra Pradesh	Requires the Government to fix minimum rates of wages and reviews this at an interval of not more than 5 years. Every employer shall be responsible for the payment to persons employed by him of all wages required to be paid under this Act. VUBPL/ Gamesa will ensure compliance
14.	Labour	Equal wages to male and female workers at site	Equal Remuneration Act 1976	Department of Inspectorate of Factories, Andhra Pradesh	It is the duty of an employer to pay equal remuneration to men and women workers for same work or work of a similar nature. VUBPL/ Gamesa will ensure compliance
15.	Labour	Engagement of Labour at site	Workmen's Compensation Act, 1923	Department of Inspectorate of Factories, Andhra Pradesh	Requires if personal injury is caused to a workman by accident arising out of and in the course of his employment, his employer shall be liable to pay compensation in accordance with the provisions of this Act. VUBPL/ Gamesa will ensure compliance
16.	Labour	Engagement of Female Labour at site	Maternity Benefit Act, 1961	Department of Inspectorate of Factories, Andhra Pradesh	No employer shall knowingly employ a woman in any establishment during the six weeks immediately following the day of her delivery or her miscarriage. No pregnant woman shall, on a request being made by her in this behalf, be required by her employer to do during the period any work which is of an arduous nature or which involves long hours of standing, or which in any way is likely to interfere with her pregnancy or the normal development of the foetus, or is likely to cause her miscarriage or otherwise to adversely affect her health. VUBPL/ Gamesa will ensure compliance
17.	Public Consultation and Local Grievances	The project is set in rural area surrounded by villages	Andhra Pradesh Panchayats Act 1994	Panchayat Union	Provides for application of consent from the respective panchayat body/village administrative officer etc., during the project life cycle. VUBPL/ Gamesa will ensure that all grievances raised by locals related to the project are addressed.
18.	Acquisition of Private land for the project.	Private land has been procured from private land owners on willing buyer / willing seller basis. Please refer to **Section 3.6** for more details on land procurement	The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013	Chief Commissioner of Land Administration	The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act is applicable only when land acquisition involving rehabilitation and resettlement and compensation is carried out by

Sno.	Issues	Relevance	Applicable Legislation	Agency Responsible	Applicable Permits and Requirements
		process			appropriate Government for its own use, hold and control including for Public Sector Undertakings for public purpose and for public private partnership projects. The land procured for the project is private agricultural land. The land has been procured on a 'willing buyer/willing seller' basis wherein the individually negotiated directly with the land seller with the help of a land aggregator and land prices have been determined above the prevailing market value. Since no Government authorities are involved in the land procurement process and the project does not come under the purview of public private partnership, the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act is not applicable.
19.	Possession of valid license by the engaged contractor.	Contractors or third parties to be involved in the construction works for the proposed project, if required, will also be engaged only subject to availability of valid registration.	Building and Other Construction Workers (Regulation Of Employment And Conditions Of Service) Act, 1996 and Contract Labour (Regulation and Abolition) Act, 1970.	Registration Officer	VUBPL/ Gamesa should ensure that contractor/ third party have a valid registration under the Building and Other Construction Works Act and Contract Labour (Regulation and Abolition) Act, 1970.
20.	Labour working at the site	Working conditions of contracted Labour working at the site	Andhra Pradesh Contract Labour (Regulations and Abolition) Rules, 1971	The Commissioner of Labour, Andhra Pradesh	VUBPL/ Gamesa should ensure that all the contracted workers are provided with condition of services, rate of wages, holidays, hours of work as stipulated in the rules.
21.	Conditions of Motor Vehicles associated with the proposed project	Every motor vehicle other than motor cycles of engine capacity not exceeding 70 cc, manufactured prior to the first day of March 1990, shall be maintained in such condition and shall be so driven so as to comply with the standards prescribed in these rules.	The Motor Vehicles Act 1988, as amended by Motor Vehicles (Amendment) Act 2000, dated 14th August 2000 The Central Motor Vehicles Rules 1989, as amended through 29th June, 2012	Andhra Pradesh Transport Department	VUBPL/ Gamesa shall ensure Compliance of stipulated emission standards under Rule 115.

4.4.1.2 Performance Standard 2

PS 2 recognizes that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental rights of workers. The objectives of the PS 2 are:

- To promote the fair treatment, non-discrimination, and equal opportunity of workers;
- To establish, maintain, and improve the worker-management relationship;
- To promote compliance with national employment and labour laws;
- To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain;
- To promote safe and healthy working conditions, and the health of workers; and
- To avoid the use of forced labour.

Applicability

The applicability of PS 2 will be more important during the construction phase as operation phase will only have limited number of staff. It not only covers the main plant employees, but all employees/workers, even those working through contractors. Migrant workers will not be engaged for the project therefore standards pertaining to campsites will not be applicable. VUBPL shall provide adequate provisions such as access to clean water, sanitary facilities and other necessary facilities at the construction sites.

VUBPL / Gamesa shall take measures to prevent child labour, forced labour and discrimination at site. Freedom of association and collective bargaining shall be provided. Wages, work hours and other benefits shall be as per the national labour and employment laws. VUBPL / Games will provide a grievance mechanism for workers (and their organizations, where they exist) to raise workplace concerns. In providing a grievance mechanism through which workers may raise workplace concerns, VUBPL should ensure that matters are brought to management's attention and addressed expeditiously. VUBPL / Gamesa shall document all grievances and follow up on any corrective actions.

VUBPL / Gamesa will extend a safe and healthy work environment to contracted workers and to any other workers who provide project-related work and services and should ensure that training is provided to all workers on relevant aspects of OHS associated with their daily work, including emergency arrangements and OHS briefing for visitors and other third parties accessing the premises. All occupational injuries, illnesses and fatalities are to be documented.

VUBPL should develop and implement procedures to manage and monitor performance of third parties. These procedures should be integrated in the day-to-day operations of the company and requirements should be clearly communicated to third parties, and if possible to workers engaged by these third parties.

4.4.1.3 Performance Standard 3

The PS 3 outlines approach to pollution prevention and abatement in line with internationally disseminated technologies and practices with the following objectives:

- Avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from activities; and
- Promote the reduction of emissions that contribute to climate change.

Applicability

The proposed project is a clean energy project and does not have major pollution sources associated with it. The construction works for the development of project will entail generation of wastes like wastewater, waste oil and construction debris .The operation phase will result in generation of minor quantities of waste such as used or spent oil and wastes or residues containing oil. Storage and disposal of hazardous wastes generated to be done as prescribed in Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016. VUBPL should monitor emissions to ensure that the requirements of PS 3 are being met.

4.4.1.4 Performance Standard 4

PS 4 recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. Its main stress is to ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the affected Communities.

Applicability

The applicability of this PS shall be established during the ESIA process, resulting in preparation of an Action Plan to be disclosed to the community. The Applicability will be limited to construction period with movement of heavy machinery / vehicles. Noise levels and shadow flicker impacts at adjoining villages to be kept within the acceptable norms and IFC guidelines. Labour and security staff to be engaged from local community.

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

4.4.1.5 Performance Standard 5

PS 5 recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. Its main aim is to anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by providing compensation for loss of assets at replacement cost and ensuring that resettlement activities are implemented with appropriate disclosure of Information, consultation, and the informed participation of affected persons and community.

Applicability

The PS 5 is applicable when there is physical and/or economic displacement because of the project.

The land for the proposed project comprises of agricultural land which has been purchased through 'willing buyer/willing seller' basis. The conditions of the 'willing buyer/willing seller' has been followed by the project proponent and associated land aggregators in terms of directly negotiating with the land sellers, providing compensation based on the prevailing market value and providing opportunities to the land sellers for productive investment of sales income.

As no physical and /or economic displacement has taken place due to the land transaction process for the project, PS 5 is therefore NOT applicable for the project.

4.4.1.6 Performance Standard 6

PS 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development. This standard is aimed to promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.

Applicability

The proposed project does not involve any diversion of forest land. The project activities are not likely to have any impact on the ecology. However, the proposed project will involve additional traffic movement which may impact the higher fauna.

For the protection and conservation of biodiversity, the mitigation hierarchy includes biodiversity offsets, which may be considered only after appropriate avoidance, minimization, and restoration measures. Baseline studies for ecological aspects have been described in ***Section 5. 4*** *of the report. The study has been gathered through site survey, literature review and initial desktop analysis. The extent of the literature review will depend on the sensitivity of the biodiversity attributes associated with the project's area of influence and the ecosystem services that may be impacted.*

With respect to impacts on priority ecosystem services of relevance to Affected Communities and where the client has direct management control or significant influence over such ecosystem services, adverse impacts should be avoided.

4.4.1.7 Performance Standard 7

PS 7 recognizes that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population. In many cases, their economic, social, and legal status limits their capacity to defend their rights to, and interests in, lands and natural and cultural resources, and may restrict their ability to participate in and benefit from development.

Applicability

The project area or its surroundings is not native to any indigenous people. No material degradation or adverse impact is expected on land resources on which people are dependent. Hence, PS7 is not applicable for this project.

4.4.1.8 Performance Standard 8

PS 8 recognizes the importance of cultural heritage for current and future generations. Consistent with the Convention concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to ensure that clients protect cultural heritage in the course of their project activities. In addition, the requirements of this Performance Standard on a project's use of cultural heritage are based in part on standards set by the Convention on Biological Diversity.

Applicability

This PS is applicable when tangible forms of cultural heritage, unique natural features or tangible objects that embody cultural values and certain instances of intangible forms of culture are impacted or are proposed to be used for commercial purposes. Religious structures were observed to be located at a distance of 1 km, 50 m and 1.5 km from WTG location no. KA15, KA16 and KA 17 respectively. However, the access to these structures will not get restricted as a result of the project activities. Hence, PS8 is not applicable for this project.

4.4.2 IFC Categorization of Projects

As part of its review of a project's expected social and environmental impacts, IFC uses a system of social and environmental categorization. This categorization is used to reflect the size of impacts understood as a result of the client's social and environmental assessment and to specify IFC's institutional requirements. The following categories are used by the IFC:

- ***Category A Projects***: Projects with potential significant adverse social or environmental impacts that are diverse, irreversible or unprecedented;
- ***Category B Projects***: Projects with potential limited adverse social or environmental impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures;
- ***Category C Projects***: Projects with minimal or no adverse social or environmental impacts, including certain financial intermediary (FI) projects with minimal or no adverse risks;
- ***Category FI Projects***: All FI projects excluding those that are Category C projects.

IFC therefore categorizes projects primarily according to the significance and nature of impacts. IFC defines the project's area of influence as the primary project site(s) and related facilities that the client (including its contractors) develops or controls; associated facilities that are not funded as part of the project (funding may be provided separately by a client or a third party including the government), and whose viability and existence depend exclusively on the project and whose goods or services are essential for the successful operation of the project; areas potentially impacted by cumulative impacts from further planned development of the project; and areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location. The area of influence does not include potential impacts that would occur without the project or independently of the project.

4.5 World Bank EHS Guidelines

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

- Environmental, Health, and Safety General Guidelines
- Environmental, Health, and Safety Guidelines for Wind Energy issued on 7th August, 2015.

The key requirements stated in the EHS guidelines have been discussed in **Table 4-2**.

Table 4-2: Key Requirements as per EHS Guidelines of IFC

Sno.	Relevant Requirements as stated in EHS and Wind Energy Guidelines
1.	*Landscape and visual impacts*
	Consideration should be given to turbine layout, size, and scale in relation to the surrounding landscape and seascape character and surrounding visual receptors
	Consideration should also be given to the proximity of turbines to settlements, residential areas, and other visual receptors to minimize visual impacts and impacts on residential amenity, where possible.
	Maintain a uniform size and design of turbines (e.g., type of turbine and tower, as well as height).
	Minimize presence of ancillary structures on the site by minimizing site infrastructure
	Erosion measures should be implemented and cleared land should be promptly re-vegetated with local seed stock of native species.
2.	*Noise*
	All modelling should take account of the cumulative noise from all wind energy facilities in the vicinity having the potential to increase noise levels.
3.	*Bio-Diversity*
	Baseline biodiversity surveys, where required, should occur as early as possible
	Consider adjustments of cut-in wind speeds to reduce potential bat collisions.
	Eliminate “free-wheeling” (free spinning of rotors under low wind conditions when turbines are not generating power).
	Install bird flight diverters on transmission lines and guy wires from meteorological masts to reduce bird collisions
4.	*Shadow Flicker*
	Modelling should be carried out in order to identify the distance to which potential shadow flicker effects may extend
	Wind turbines can be programmed to shut down at times when shadow flicker limits are exceeded.
	Site wind turbines appropriately to avoid shadow flicker being experienced or to meet limits placed on the duration of shadow flicker occurrence.
5.	*Wastewater Discharges*
	Water use efficiency to reduce the amount of wastewater generation.
	Compliance with national or local standards for sanitary wastewater discharges.
6.	*Occupational Health and Safety*
a.	*Over-exertion*
	Training of workers in lifting and materials handling techniques including the placement of weight limits.
	Planning work site layout to minimize the need for manual transfer of heavy loads.
	Implementing administrative controls into work processes, such as job rotations and rest or stretch breaks.
	Slips and Falls
	Implementing good house-keeping practices, such as the sorting and placing loose construction materials or demolition debris in established areas away from foot paths.
	Cleaning up excessive waste debris and liquid spills regularly.
b.	*Work in Heights*
	Training and use of temporary fall prevention devices
	Training and use of personal fall arrest systems
c.	*Stuck by Objects*
	Maintaining clear traffic ways to avoid driving of heavy equipment over loose scrap.
	Wearing appropriate PPE, such as safety glasses with side shields, face shields, hard hats, and safety shoes.

Sno.	Relevant Requirements as stated in EHS and Wind Energy Guidelines
d.	*Moving Machinery*
	Planning and segregating the location of vehicle traffic, machine operation, and walking areas, and controlling vehicle traffic through the use of one-way traffic routes, establishment of speed limits, and on-site trained flag-people wearing high-visibility vests or outer clothing covering to direct traffic.
	Using inspected and well-maintained lifting devices that are appropriate for the load, such as cranes, and securing loads when lifting them to higher job-site elevations.
e.	*Dust*
	Implementation of Dust suppression techniques such as applying water
	Community Health and Safety
f.	*Disease Prevention*
	Providing surveillance and active screening and treatment of workers.
g.	*Traffic Safety*
	Adoption of safety measures those are protective of project workers and of road users, including those who are most vulnerable to road traffic accidents.
	Regular maintenance of vehicles and use of manufacturer approved parts.
h.	*Community Health & Safety*
	Turbines must be sited at an acceptable distance ("setback") between wind turbines and adjacent sensitive receptors to maintain public safety in the event of blade failure.
	Minimize the probability of a blade failure by selecting wind turbines that have been subject to independent design verification/certification (e.g., IEC 61400-1), and surveillance of manufacturing quality.
	Ensure that lightning protection systems are properly installed and maintained
	Equip wind turbines with vibration sensors that can react to any imbalance in the rotor blades and shut down the turbine if necessary.
i.	*Public Access*
	Provide fencing of an appropriate standard around the substation with anti-climb paint and warning signs.
	Prevent access to turbine tower ladders.
	Post information boards about public safety hazards and emergency contact information.
8.	*Occupational Health and Safety Monitoring*
	Recording all incidents that occur over the course of project implementation.
	Recording near-miss (also known as near-hit) data during a project in order to identify trends and implement improvements.
	Carrying out workplace and worker auditing to assess the effectiveness of risk management systems and workplace safety culture.
	Conducting worker consultation and feedback via questionnaires or periodic safety meetings.

4.6 Applicable standards

4.6.1 Ambient Air Quality

As per the IFC EHS guidelines (December 2008), “the ambient air quality standards are ambient air quality levels established and published through national legislative and regulatory processes and ambient quality guidelines refer to ambient quality levels primarily developed through clinical, toxicological, and epidemiological evidence (such as those published by the World Health Organization)”. National Ambient Air Quality (NAAQ), as notified under Environment (Protection) Rules 1986 and revised through Environment (Protection) Seventh Amendment Rules, 2009 are given **Table 4-3**:

Table 4-3: National Ambient Air Quality Standards

Pollutant	Time Weighted Average	Concentration in Ambient Air	
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (notified by Central Government)
Sulphur Dioxide (SO_2), µg/m^3	Annual*	50	20
	24 Hours**	80	80
Nitrogen Dioxide (NO_2), µg/m^3	Annual*	40	30

Pollutant	Time Weighted Average	Concentration in Ambient Air	
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (notified by Central Government)
	24 Hours**	80	80
Particulate Matter (size less than 10 µm) or PM_{10}, µg/m^3	Annual*	60	60
	24 Hours**	100	100
Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$, µg/m^3	Annual*	40	40
	24 Hours**	60	60
Ozone (O_3), µg/m^3	8 Hours**	100	100
	1 Hour**	180	180
Lead (Pb), µg/m^3	Annual*	0.5	0.5
	24 Hours**	1	1
Carbon Monoxide (CO) , mg/m^3	8 Hours	2	2
	1 Hour**	4	4
Ammonia (NH_3), µg/m^3	Annual*	100	100
	24 Hours**	400	400
Benzene (C_6H_6), µg/m^3	Annual*	5	5
Benzo (O) Pyrene (BaP), particulate phase only, ng/m^3	Annual*	1	1
Arsenic (As), ng/m^3	Annual*	6	6
Nickel (Ni), ng/m^3	Annual*	20	20

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

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

4.6.2 Ambient Noise Standards

As per the EHS guidelines of IFC, for residential, institutional and educational area, the one hourly equivalent noise level (L_{eq} hourly) for day time is **55 dB (A)** while the L_{eq} hourly for night time is prescribed as **45 dB (A).** Noise standards notified by the MoEF vide gazette notification dated 14 February 2000 based on the *A- weighted* equivalent noise level (L_{eq}) are as presented in **Table 4-4.**

Table 4-4: Ambient Noise Standards

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

*Note: * Day time is from 6 am to 10 pm, Night time is 10 pm to 6.00 am;*

*** Silence zone is defined as area up to 100 m around premises of hospitals, educational institutions and courts. Use of vehicle horns, loud speakers and bursting of crackers are banned in these zones.*

4.6.3 Noise Standards for Occupational Exposure

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

Table 4-5: Standards for Occupational Noise Exposure

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

No exposure in excess of 115 dB (A) is to be permitted.

For any period of exposure falling in between any figure and the next higher or lower figure as indicated in column (1), the permissible level is to be determined by extrapolation on a proportionate scale.

4.6.4 Water Quality Standards

The designated best use classification as prescribed by CPCB for surface water is as given in **Table 4-6**

Table 4-6: Primary Water Quality Criteria for Designated Best Use Classes

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

Source: Central Pollution Control Board

As per the IFC EHS guidelines, the treated sewage discharge is required to meet the following guidelines.

Table 4-7: Treated sewage discharge guidelines IFC

Sno.	Parameter	Guideline Value
1	pH	6-9
2	BOD	30mg/l,
3	COD	125mg/l,
4	Total Nitrogen	125 mg/l,
5	Oil and Grease	10 mg/l,

Sno.	Parameter	Guideline Value
6	Total Suspended Solids	50 mg/l and
7	Total coliform bacteria	400 MPN/100 ml

4.7 Applicable International Conventions

Environmental problems which migrate beyond the jurisdiction (Trans-boundary) require power to control such issues through international co-operation by either becoming a Contracting Party (CP) i.e. ratifying treaties or as a Signatory by officially signing the treaties and agreeing to carry out provisions of various treaties on environment and social safeguards. The relevant international conventions are as provided in the **Table 4-8** below:

Table 4-8: Relevant International Conventions applicable to the project

Sno.	International Conventions	Salient Features
1	Montreal Protocol on Substances That Deplete the Ozone Layer (and subsequent Amendments)	India signed the Montreal Protocol along with its London Amendment on 17-9-1992 and also ratified the Copenhagen, Montreal and Beijing Amendments on 3rd March, 2003.
2	UN (Rio) Convention on Biological Diversity	India is a party since: 1994-02-18 by: Ratification; Protocol - Party since: 2003-09-11
3	Conventions on the Conservation of Migratory species of wild animals and migratory species	India is contracting party to the convention on conservation of migratory species of wild animals and migratory species.
4	Kyoto Protocol	The Kyoto protocol was signed by India in August 2002 and ratified in February 2005. The convention pertains to the United Nations framework on Climate Change. The 3rd Conference of the Parties to the Framework Convention on Climate Change (FCCC) in Kyoto in December 1997 introduced the Clean Development Mechanism (CDM) as a new concept for voluntary greenhouse-gas emission reduction agreements between industrialized and developing countries on the project level.
5	The Rotterdam Convention on the Prior Informed Consent (PIC) Procedure	The Rotterdam Convention on the Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals & Pesticides in international Trade was adopted by India at the Conference of Plenipotentiaries at Rotterdam in 1998
6	International Labour Organization conventions	India has also ratified many of the International Labour Organization conventions that are relevant to the Project including: C1 Hours of Work (Industry) Convention, 1919 (14:07:1921, ratified); C5 Minimum Age (Industry) Convention, 1919 (09:09:1955, ratified): C11 Right of Association (Agriculture) Convention, 1921 (11:05:1923, ratified): C14 Weekly Rest (Industry) Convention, 1921 (11:05:1923, ratified); C29 Forced Labour Convention, 1930 (30:11:1954, ratified) & C105 Abolition of Forced Labour Convention, 1957 (18:05:2000, ratified); C100 Equal Remuneration Convention, 1951 (25:09:1958, ratified); C107 Indigenous and Tribal Populations Convention, 1957 C111 discrimination (Employment and Occupation) Convention, 1958 (03:06:1960, ratified)

5. Environmental and Socio-Economic Baseline

5.1 Environmental Baseline

This section of the Environment and Social Impact Assessment (ESIA) presents information on the baseline condition of the physical, chemical, biological and social environment within the proposed project area.

The Environmental and Social baseline study helps determine existing environmental conditions. Local knowledge and scientific field work provided most of the site-specific information used in this report. Existing information from the scientific literature (both published and unpublished), engineering studies and test work results, technical reports, and community socioeconomic studies were used wherever available. These studies were used to validate the baseline information.

The proposed Project is located in Kambadur, Kalyandurg and Kundurpi mandals of Anantapur district in Andhra Pradesh. A study area of 5 km from the proposed project area was considered for the evaluation of environmental and social existing status and potential impacts. Activities that facilitated establishment of the baseline data include: site survey, ecological surveys, social surveys and interviews, processing of satellite imagery and secondary data review from established sources such as Indian Meteorological Department and Census of India amongst others.

This section covers the following topics:

- Physiography
- Geology
- Drainage
- Land Use
- Soil
- Hydrogeology
- Climate and Meteorology
- Natural Hazards
- Primary Monitoring
- Traffic Monitoring
- Ecology
- Social Setting

5.1.1 Physiography

Anantapur district can be divided into four major zones, namely granite-gneiss landscape, schist landscape, sandstone landscape and limestone land cape. These broad zones cover hill ranges and isolated hills, undulating and rolling hill- ide slopes, undulating to gently sloping pediments and narrow valley floors. The elevation of the district ranges from 450 to 1200 m above mean sea level (MSL). **Figure 5-1** shows the WTG locations whereas **Figure 5-2** presents the Physiographical map of Andhra Pradesh with project location indicated on the Map.

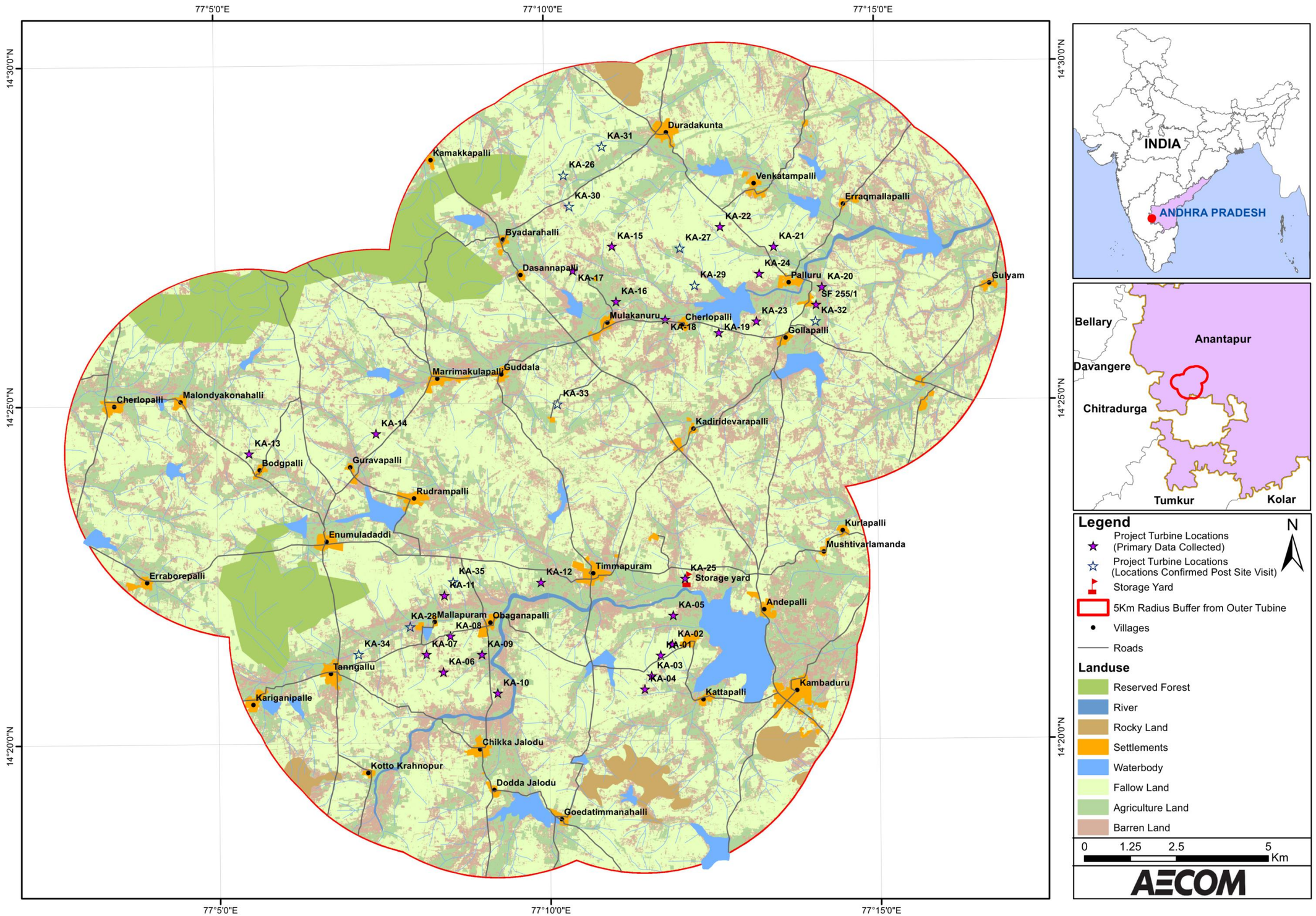
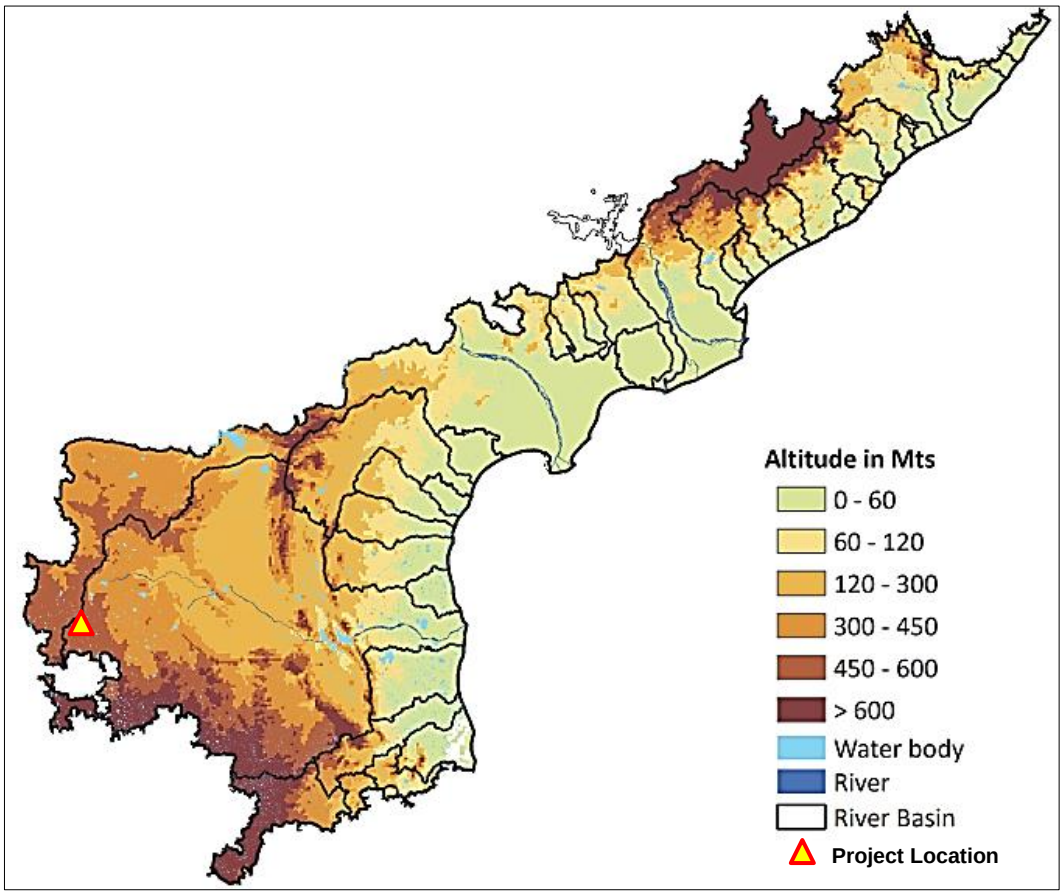


Figure 5-1: Map showing the study area with WTG Locations



Source: Andhra Pradesh State Remote Sensing Application Centre (APSRAC)

Figure 5-2: Physiography Map of Andhra Pradesh indicating the project location

5.1.2 Geology

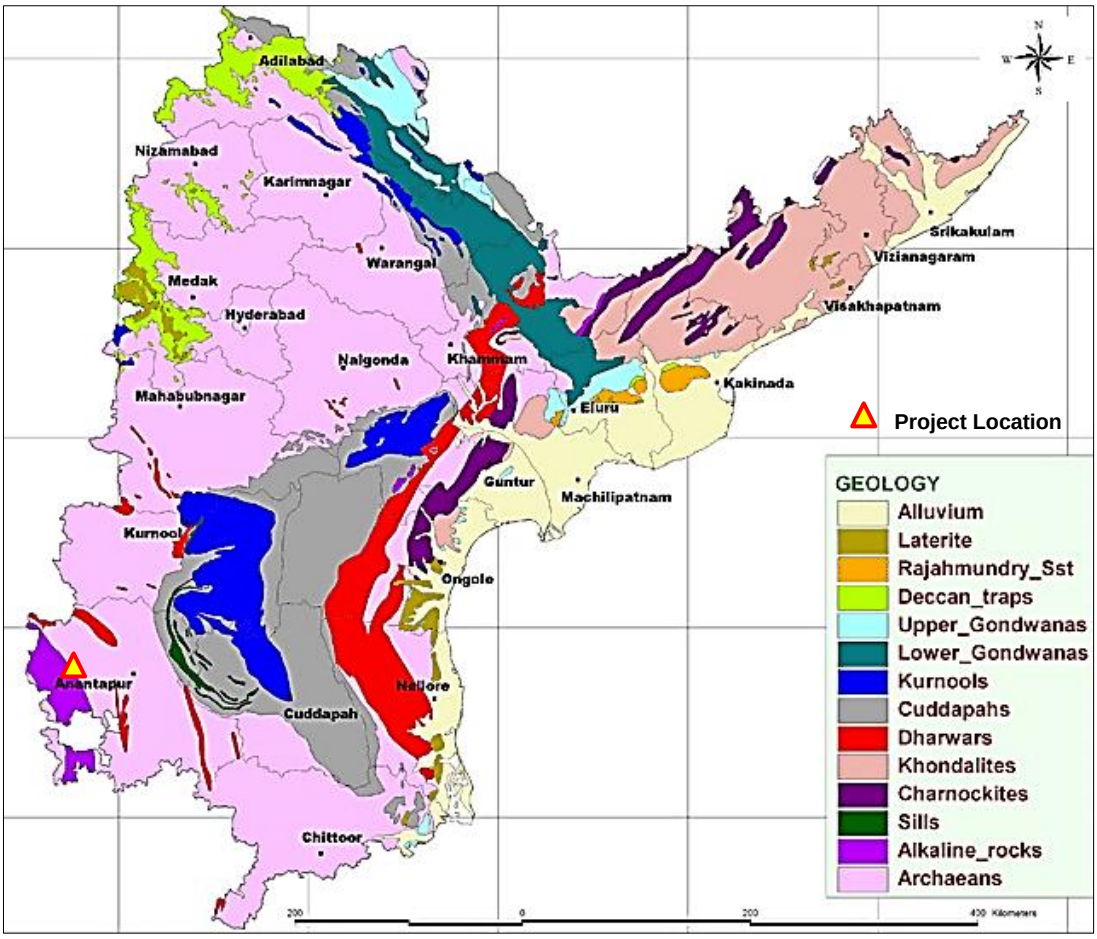
The geological formations in Anantapur District can broadly be divided into two distinct and well-marked groups, the older group of Archaean Crystalline rocks and the younger group of Precambrian sedimentary rocks. The former group of rocks includes granites, granitic gneisses, phyllites and schists. These rocks have suffered considerable degree of disturbances as a result of which the rocks have been metamorphosed and re-crystallized. The later belongs to Cuddapah and Kurnool group of rocks. **Table 5-1** below describes the Geological formations of Anantapur.

Table 5-1: Geological formations of Project district - Anantapur

Geological Formations	Lateral extent (Sq. km)	Lateral extent of group (Sq. km)	Percentage of total geographical area	Percentage to the total geographical area
Alluvium	1354	1354	7.08	7.08
Kurnool Group of rocks		76		0.40
Panyam quartzites				
Narji Limestones	2		0.01	
Banaganapalli quartzites	51		0.27	
	23		0.12	
Cuddapah super group of rocks		1535		8.02
Basic sills	167			
Tadipatri shales	922		0.87	
Pulivendula quartzites.	44		4.82	
Vempalli dolomitic limestones and shales	368		0.23	
Gulcheruvu quartzites	34		1.92	
			0.81	
Archaean group of rocks				84.50
Dharwar Schists		16165		

Geological Formations	Lateral extent (Sq. km)	Lateral extent of group (Sq. km)	Percentage of total geographical area	Percentage to the total geographical area
Grnaites	624		3.26	
Gneisses and migmatite	1725		9.00	
	13816		72.24	

Source: AP Ground Water Department



Source: AP Ground Water Department

Figure 5-3: Geological Map of Andhra Pradesh indicating the project location

5.1.3 Drainage

The District is drained by five major rivers viz., Pennar, Chitravathi, Swarnamukhi, Hagari and Papagni. The catchment of the rivers and drainage density, run-off particulars of the river basins are shown in the **Table 5-2** and **Table 5-3.** Radial drainage pattern is seen near Kalyandurg, Rayadurg and Urvakonda villages. All the streams in the district are ephemeral in nature.

Key water bodies inside the study area include Kambadaru Lake, approximately, 2 km from KA02 location, Peruru river tributary, and several manmade water bodies. **Figure 5-4** illustrates the Drainage Map of Andhra Pradesh indicating the Project location.

Table 5-2: Catchment areas of the Rivers in the Project district – Anantapur

Sno.	Major River	Area in Sq. Km	Percentage to the total geographical area of the District	Drainage density in Km/Sq. Km.
1	Pennar	8869	46.4	0.45
2	Chitravathi	6031	31.5	0.35
3	Swarnamukhi	689	3.6	0.47
4	Hagari	2354	12.3	0.71

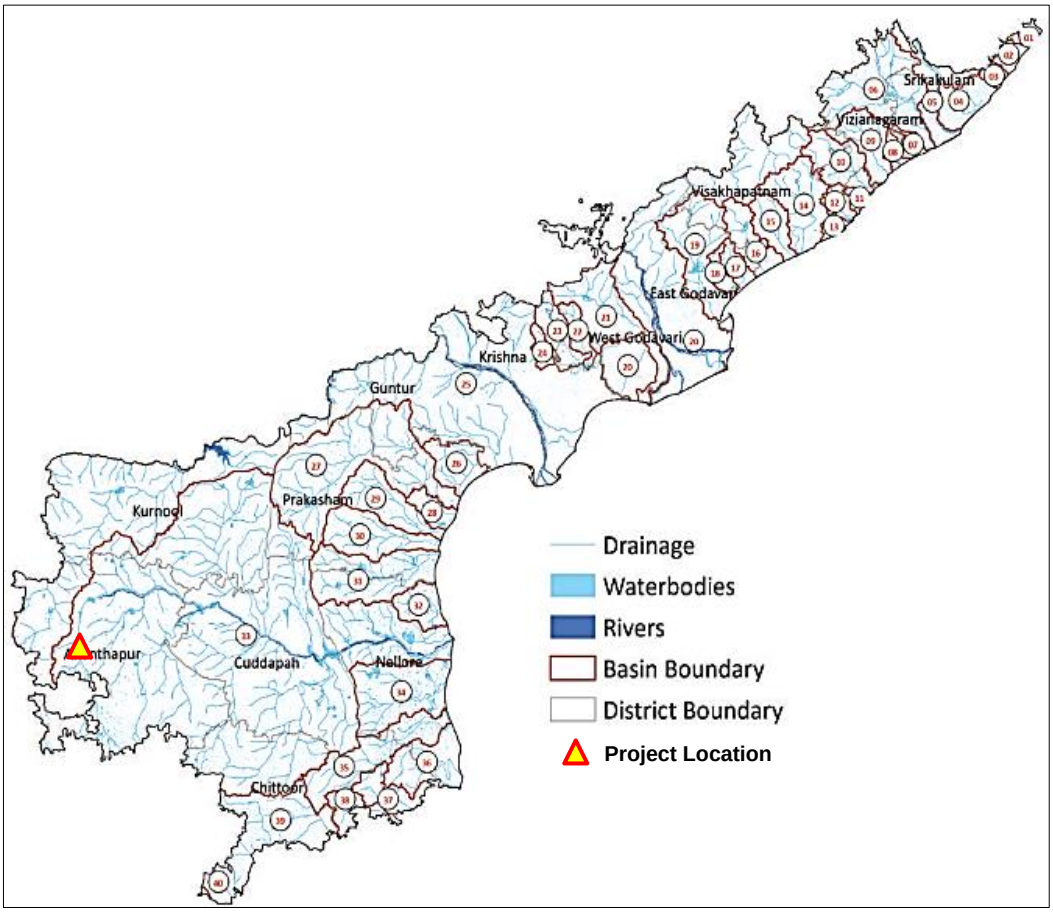
Sno.	Major River	Area in Sq. Km	Percentage to the total geographical area of the District	Drainage density in Km/Sq. Km.
5	Papagni	1187	6.2	0.32

Source: Dynamic Ground Water Resources of Anantapur District, AP (2008-2009), AP Ground Water Department, 2011

Table 5-3: Run-Off details of the project – Anantapur

Sno.	Name of the Basin	Year	Run-off in ha.m	Percentage of run-off
1	Chitravathi	1996-97	5282	3.62
2	Chitravathi	1998-99	2827	2.26
3	Penna	1996-97	7266	1.17
4	Penna	1998-99	10895	2.06
5	Papagni	1996-97	2138	3.22
6	Papagni	1998-99	610	0.58
7	Hagari	1996-97	1850	0.24
8	Hagari	1998-99	2864	0.42

Source: Dynamic Ground Water Resources of Anantapur District, AP (2008-2009), AP Ground Water Department, 2011



Source: Andhra Pradesh State Remote Sensing Application Centre (APSRAC)

Figure 5-4: Drainage Map of Andhra Pradesh indicating the Project Location

The drainage pattern specific to the project site has been presented in **Figure 5-5**.

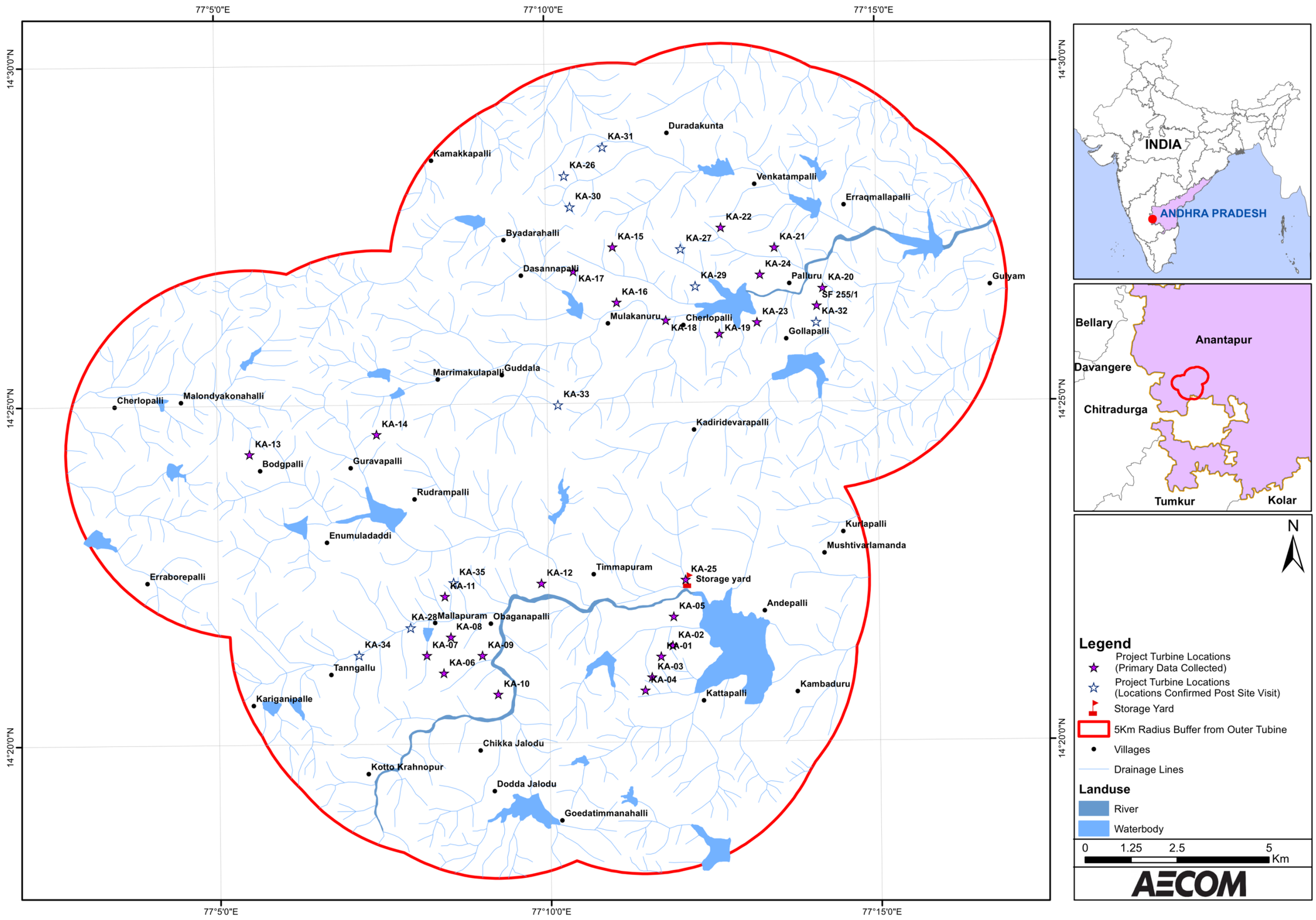
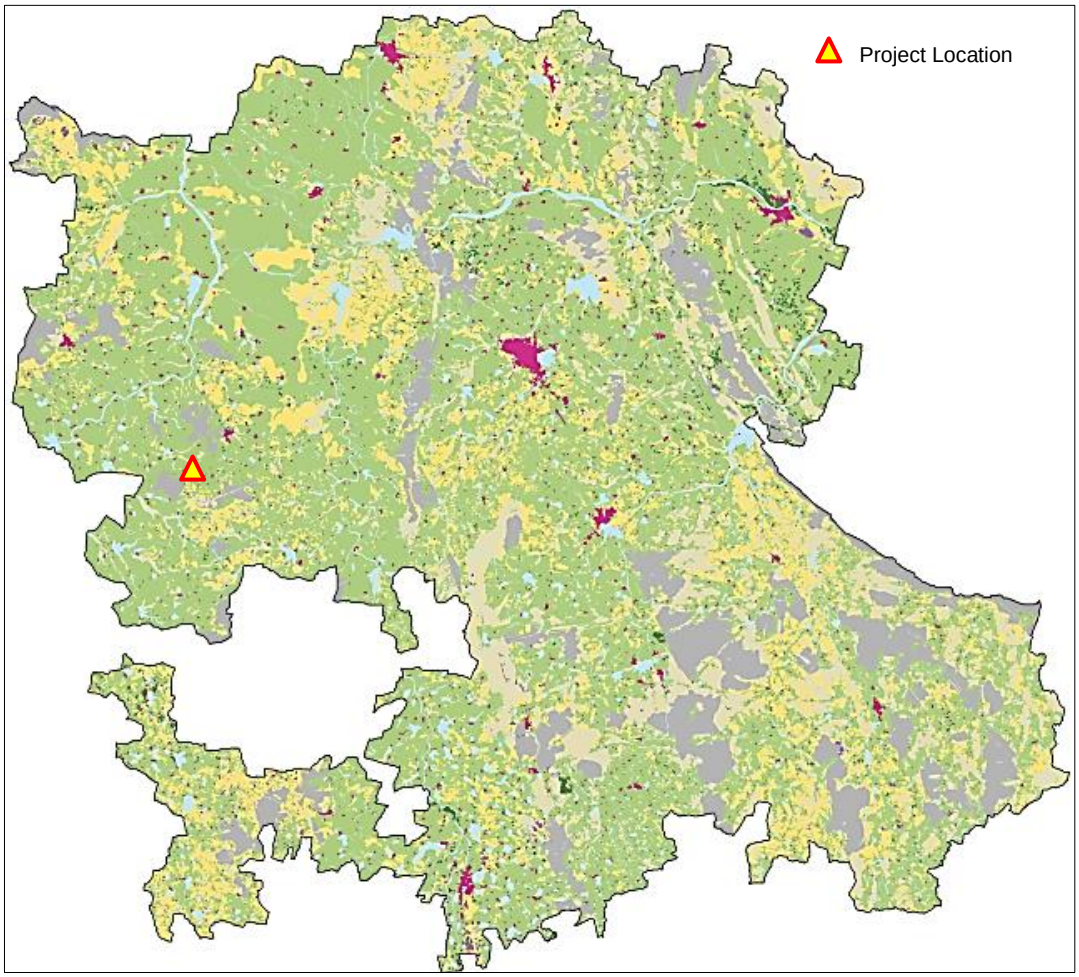


Figure 5-5: Drainage map of the project area

5.1.4 Landuse

Land use relates to the human activity or economic function associated with a specific piece of land (Lillesand et al., 2004). Land cover relates to the composition and characteristics of land surface elements (Cihlar, 2000). The term land cover originally referred to the kind and state of vegetation, but it has broadened in subsequent usage to include human structures such as buildings or pavement and other aspects of the natural environment.

The land use pattern of Anantapur district can be broadly classified into Built-up area, Industries, Fallow Land, Agriculture Land, Forest Land, Waste Lands and Water Bodies. Remote sensing and recent technological advancements is supportive in capturing the changes in the district by satellite imagery (**Table 5-4**) and **(Figure 5-6)** below illustrates the Land Use/land Cover of Anantapur district for the year 2011-12.



Source: Andhra Pradesh State Remote Sensing Application Centre (APSRAC)

Figure 5-6: Land Use/Land Cover Map of Anantapur district indicating the Project Location

Table 5-4: Land Use/Land Cover of the Project district – Anantapur

Legend	Main Category / Sub-Category	Area in Sq. Km	Percentage (%)
	Built-up area	321.1	1.68
	Urban	96.0	0.5
	Rural	225.1	1.18
	Industries	49.8	0.26
	Industrial	13.3	0.07
	Mining	36.5	0.19

Legend	Main Category Sub-Category	Area in Sq. Km	Percentage (%)
	Fallow	2954.6	15.44
	Agriculture	10510.2	54.94
	Crop Land	10355.0	54.13
	Plantation	155.2	0.81
	Forest	1816.1	9.49
	Deciduous Forest	678.6	3.55
	Forest Plantation	0.4	0.0
	Scrub Forest	1126.8	5.89
	Tree Clad Area	10.3	0.05
	Waste Lands	2461.9	12.87
	Barren/Rocky	533.7	2.79
	Gullied Land	0.3	0.0
	Salt Affected Land	294.4	1.54
	Sandy Area	6.0	0.03
	Scrub Land	1627.6	8.51
	Water Bodies	1017.0	5.32
	Canal/Drain	75.7	0.4
	Reservoir/Tanks	579.4	3.03
	River/Stream	362.0	1.89
	Total	**19130.6**	**100**

Source: Andhra Pradesh State Remote Sensing Application Centre (APSRAC)

Project specific Landuse has been presented in the following table:

Table 5-5: Landuse specific to project area

S.no	Landuse Type	Area in Sq km	% of total area
1	Settlements	5.2727	1.34
2	River	1.4634	0.37
3	Waterbody	9.8801	2.52
4	Reserved Forest	23.1958	5.91
5	Rocky Land	4.9169	1.25
6	Barren Land	71.9184	18.33
7	Fallow Land	203.3295	51.82
8	Agriculture Land	72.4006	18.45
Total Area in Sq km		**392.3773**	**100.00**

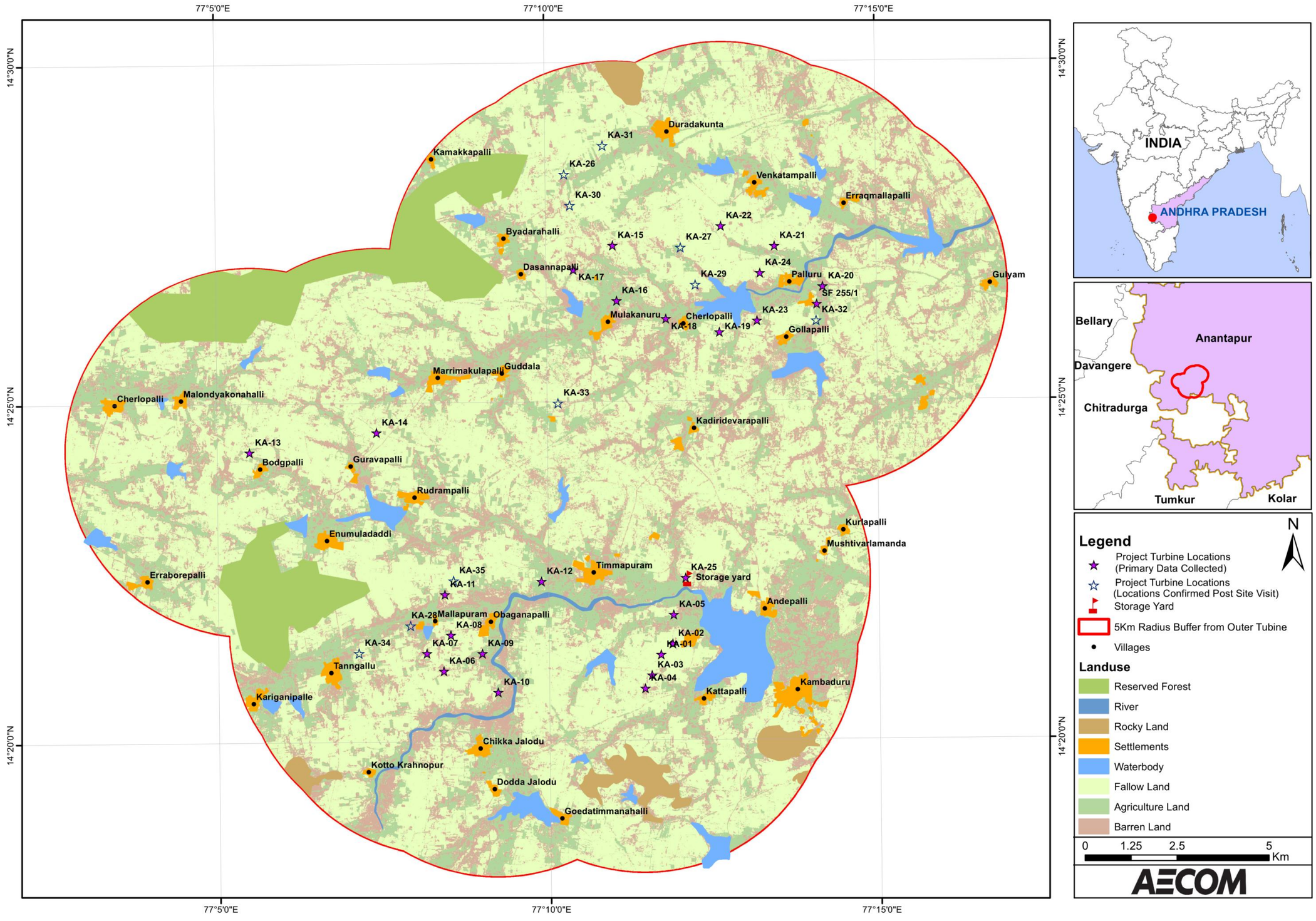
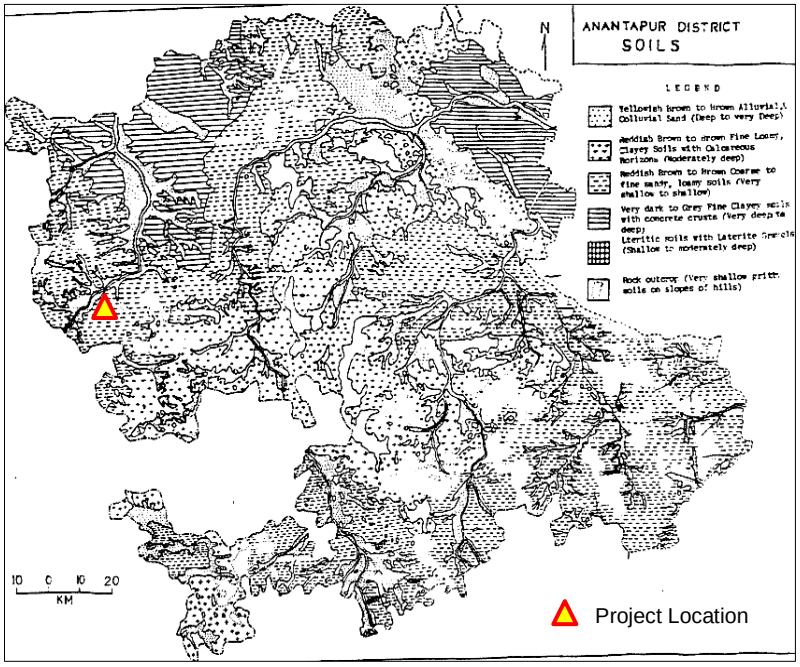


Figure 5-7: Landuse Map pf Project area showing the WTG locations

5.1.5 Soil Classification

The soils of Anantapur district can mainly be classified as red and black clayey soils. It is estimated that 82% of the area is red soil and 18% black clayey soils. These are underlain by older groups of Archaean crystalline and younger groups of Pre- Cambrian sedimentary rocks. The soils of Anantapur district are broadly classified into six types:

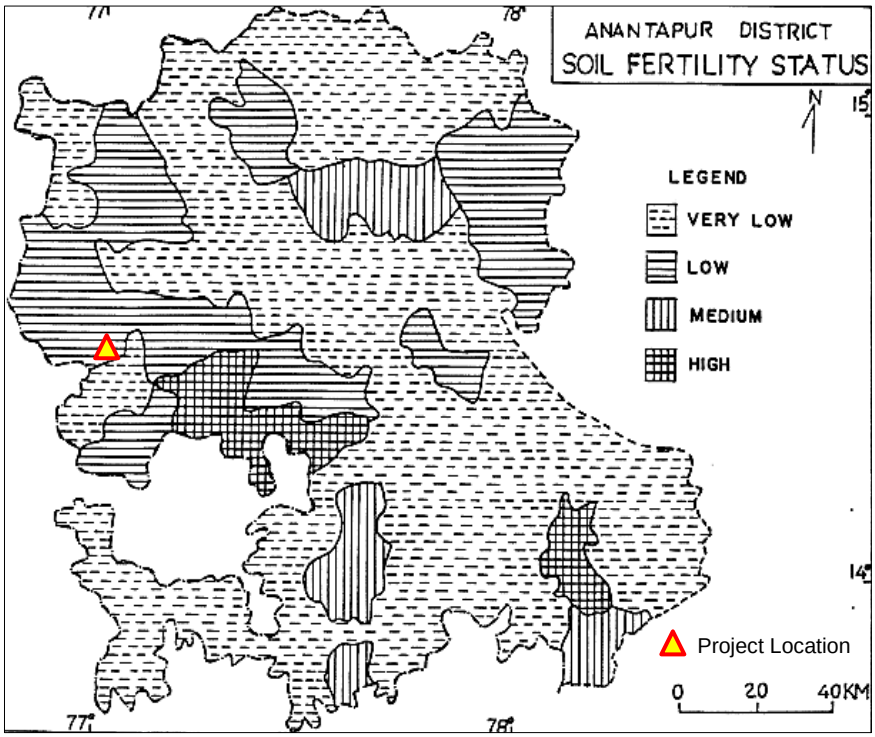
- Yellowish Brown to Grey Brown Alluvial and Colluvial Sand;
- Reddish Brown To Brown Fine Loamy, Clayey Soils;
- Reddish Brown To Brown Coarse To Fine Sands;
- Very Dark To Grey Fine Clayey Soils With Calcareous Crust;
- Lateritic Soils With Lateritic Gravels; and
- Gritty Or Skeletal Soils



Source: Shodhganga: a reservoir of Indian Theses (http://shodhganga.inflibnet.ac.in/)

Figure 5-8: Soil Map of Anantapur district indicating the project location

The Project Mandals are found to exhibit Reddish brown to brown fine loamy soils and Reddish brown to Brown Coarse to fine sandy shallow soils. These are moderately permeable and moderately drained. The sub-soil is weak to moderately alkaline. They are composed of low to moderate organic matter with low potash and moderate potassium content. Soils in the Project districts can be classified as very poor to moderate fertile soils. **Figure 5-8 a**nd **Figure 5-9** illustrate the Soils of Anantapur district indicating the Project location.



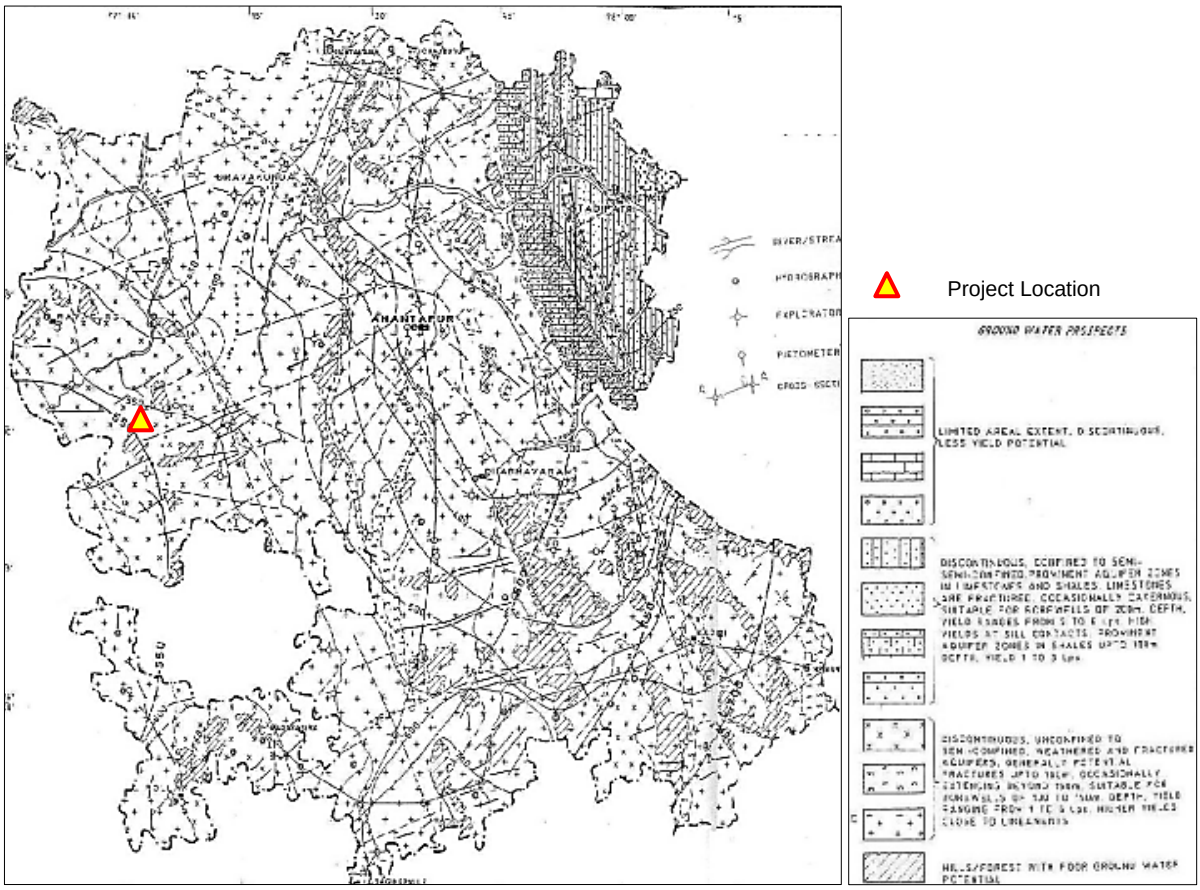
Source: Shodhganga: a reservoir of Indian Theses (http://shodhganga.inflibnet.ac.in/)

Figure 5-9: Soil Fertility Status of Anantapur district indicating the Project Location

5.1.6 Hydrogeology

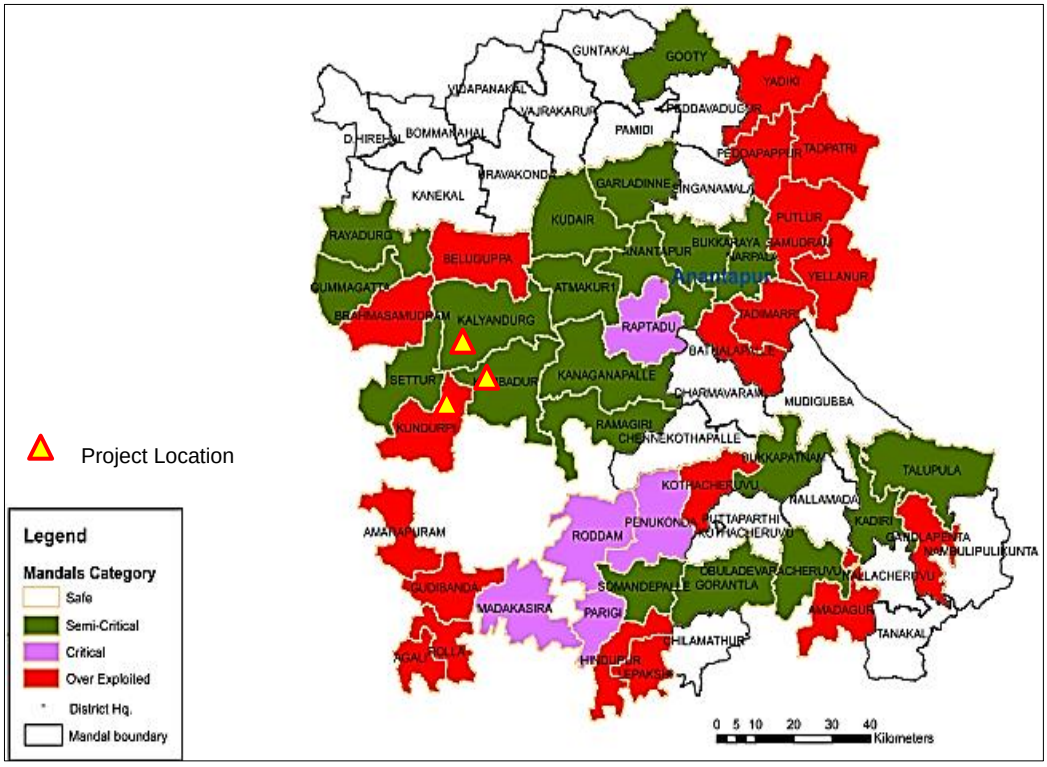
The occurrence, movement and recharge of ground water are governed by water bearing properties of the different litho units' occurring in the area. The district is underlain by granite gneisses and schists of Archaean age and formation of Cuddapah Super Group belonging to upper Precambrian to lower Paleozoic Age. River alluvium occurs along the major river courses and to some extent along minor stream courses. The hydro-geological map of the district is presented in **Figure 5-10** below.

The Project Mandals shows Granite Lithology with discontinuous, un-confined to semi-confined weathered and fractured aquifers. Based on the stage of the ground water development and long term trend of pre and post monsoon ground water levels in the district, it can be inferred that the Project Mandals shows very high ground water usage viz., over all stage of ground water development to be >70%. The **Figure 5-11** below illustrates that Project Mandals Kalyandurg and Kambadur are categorised as *semi-critical* and Kundurpi is *over-exploited* category requiring intensive monitoring and evaluation and future ground water development through water conservation measures.



Source: Ground Water Brochure, Anantapur District, Andhra Pradesh, 2012-13

Figure 5-10: Hydro-geology of Anantapur district indicating the Project Location



Source: Dynamic Ground Water Resources of Anantapur District, Andhra Pradesh, 2011

Figure 5-11: Stage of ground water development of Anantapur district indicating the Project Mandals

5.1.7 Climate and Meteorology

The Project district, Anantapur experiences semi-arid climate. Being far from the east coast, the district is deprived of both the monsoons (north east and south west) and subjected to droughts. The normal annual rainfall of the district is 553.0 mm. The normal rainfall for the South-West monsoon period (June-September) is 338 mm, which is 61.2 per cent of the total rainfall for the year. The rainfall for North-East monsoon period (October-December) is 156 mm only, which is 28.3 per cent of total annual rainfall (Government of Andhra Pradesh, 2009). The Annual Potential Evapotranspiration (PET) of the district is 1858mm and monthly PET ranges from 115 mm in December to 199 mm in May.

The minimum and maximum temperatures range between 17°C to 39°C. April and May are warm months when the normal daily maximum temperature ranges between 29°C to 39°C. November, December and January are cooler months when the temperature falls to about 17.3°C.

Climate data published by Indian Meteorological Department (IMD), for Anantapur for the period of 1981 to 2010 is given below in **Table 5-6**.

Table 5-6: Meteorological Data based on observation from 1981 to 2010 for Anantapur

Month	Mean Temperature		Relative Humidity (%)	Rainfall (mm)	Mean Wind Speed (km/hr)
	Daily Max (°C)	Daily Min (°C)			
January I[2]	31.0	17.5	71	1.3	7.2
II[3]			37		
February I	34.3	19.4	59	0.4	7.0
II			28		
March I	37.6	22.7	55	9.4	7.3
II			26		
April I	39.4	25.8	55	18.9	7.9
II			25		
May I	39.2	26.2	61	53.0	11.2
II			31		
June I	35.7	25.0	68	59.9	15.1
II			46		
July I	33.8	24.3	71	66.0	15.9
II			51		
August I	33.0	23.9	73	91.3	15.0
II			54		
September I	33.1	23.4	75	133.6	10.1
II			55		
October I	31.9	22.5	75	95.5	6.3
II			57		
November I	30.3	20.1	75	38.7	6.4
II			54		
December I	29.6	17.7	76	9.1	7.0
II			48		
Total Annual Mean I	34.1	22.4	68	551.3	9.7
			43		
Mean II			30		
No. of Years	30	30	30	30	30

Source: Climatological Tables of Observations in India (1981-2010), IMD report published 2015

Recent data for last five (5) years shows large variation in rainfall as shown in **Table 5-7**.

[2] Average (Mean) value of the parameter at 0300 UTC for the month
[3] Average value of the parameter at 1200 UTC for the month

Table 5-7: Average Annual Rainfall for Anantapur District

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total Annual
2010	26.9	0.0	0.0	47.1	106.2	75.1	109.0	172.6	75.0	76.4	162.2	3.3	853.8
2011	0.0	1.1	0.0	46.6	64.4	55.8	80.4	124.9	25.3	79.1	25.9	5.3	508.8
2012	0.6	1.0	5.1	74.0	28.3	16.0	82.4	113.4	80.2	72.6	59.4	3.0	536
2013	0.0	7.4	0.6	18.4	33.0	49.5	36.3	38.4	226.8	85.6	5.5	0.2	501.7
2014	0.0	0.0	15.1	15.2	69.6	60.0	36.3	71.2	46.0	107.5	13.6	3.3	437.8
Monthly average	5.5	1.9	4.16	40.26	60.3	51.28	68.88	104.1	90.66	84.24	53.32	3.02	

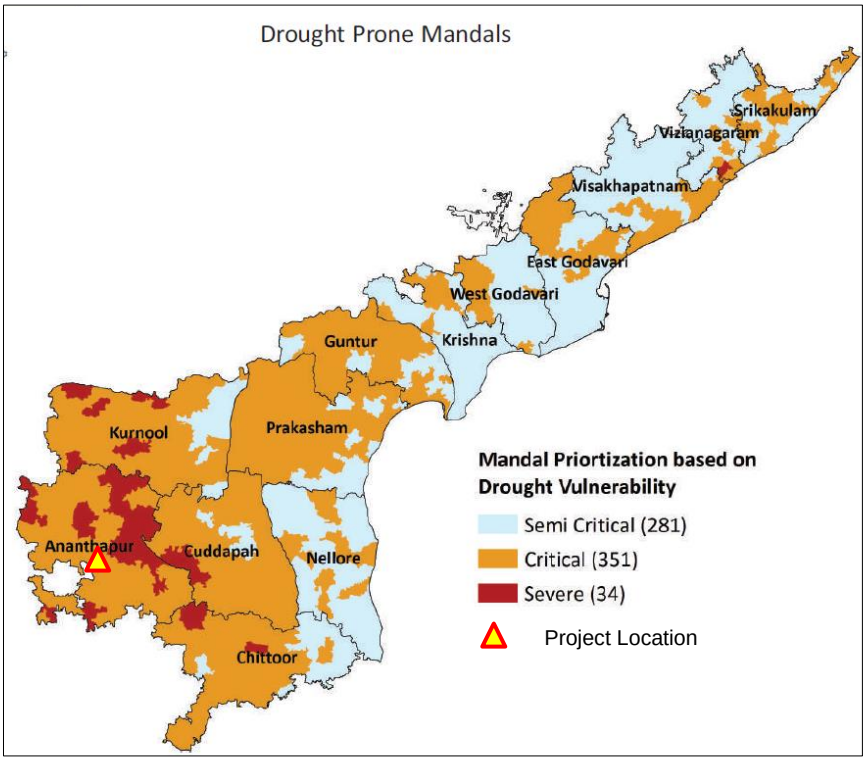
Source: IMD

The annual mean wind speed in the project area during 1981 to 2010 was measured to be 9.7 Kmph (2.69 m/s), as shown in **Table 5-6**. The most prominent wind direction is East during the months of October to March whereas the predominant wind direction is West from April to September.

5.1.8 Natural Hazards

5.1.8.1 Drought

Drought is an insidious hazard of nature. It originates from a scarcity of precipitation that persists long enough to produce a serious hydrologic imbalance. Drought should be considered relative to some long-term average condition of balance between precipitation and evapotranspiration (i.e., evaporation and transpiration) in a particular area. Drought differs in three essential characteristics: intensity, duration and spatial coverage. As per the drought vulnerability map of Andhra Pradesh illustrated in **Figure 5-12** the Project Mandals falls under Critical Category with respect to drought vulnerability.

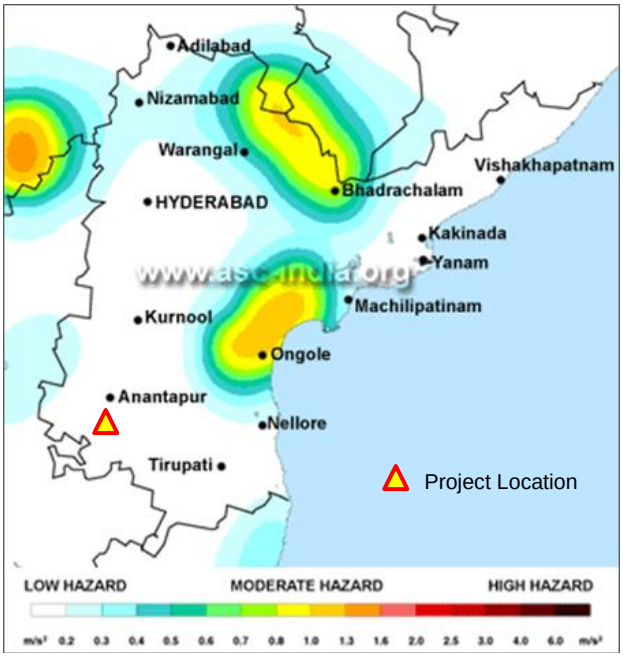


Source: Andhra Pradesh State Development Planning Society (APSDPS)

Figure 5-12: Drought vulnerability map of Andhra Pradesh state with project location

5.1.8.2 Seismicity

According to Global Seismic Hazard Assessment Program (GSHAP) data, the state of Andhra Pradesh falls in a region with low to moderate seismic hazard. As per the 2002 Bureau of Indian Standards (BIS) map, this state also falls in Zones II & III. Historically, parts of this state have experienced seismic activity in the M5.0-6.0 range. As shown in **Figure 5-13**, project site for the proposed project is located in low risk zone of seismic activity.



Source: Amateur Seismic Centre

Figure 5-13: Seismic activity of Andhra Pradesh as per data from Global Seismic Hazard Assessment Program (GSHAP)

5.1.9 Noise monitoring data

Sound pressure levels (SPL) measurements were recorded at Six (6) locations around the project area at the identified receptor locations. The readings were recorded; continuously for 24 hours for every hour. The day noise levels have been monitored during 6 am to 10 pm and night noise levels during 10 pm to 6 am at all the selected sampling locations. The sampling locations can be categorised as residential area. Therefore, the results of the ambient noise level monitoring presented in **Table 5-8** are compared with National Ambient Air Quality Standards (NAAQS) in respect of noise limits for day time and night time for residential area. Noise monitoring locations have been presented in **Figure 5-14**.

The details of noise monitoring locations are provided in **Table 5-9**.

Table 5-8: Details of noise quality monitoring locations

Sample Code	Geo-graphical Coordinates	Sampling Location
NQ-1	740821.00 m E, 1597652.00 m N	5 families residing near KA 37 at Pallur Village
NQ-2	739973.00 m E, 1598300.00 m N	Settlements of Pallur Village (50+ families)
NQ-3	737203.00 m E, 1597086.00 m N	Settlements of Cherlapalli Village (30+ families)
NQ-4	725306.00 m E, 1593385.00 m N	Unit 1- family near WTG No KA 13 of Bodupalli Village
NQ-5	730223.00 m E, 1588750.00 m N	Settlements of S. Mallapuram Village (50+ families)
NQ-6	731984.00 m E, 1588582.00 m N	Settlements of Obuganapalli Village (30+ families)

Source: AECOM Survey

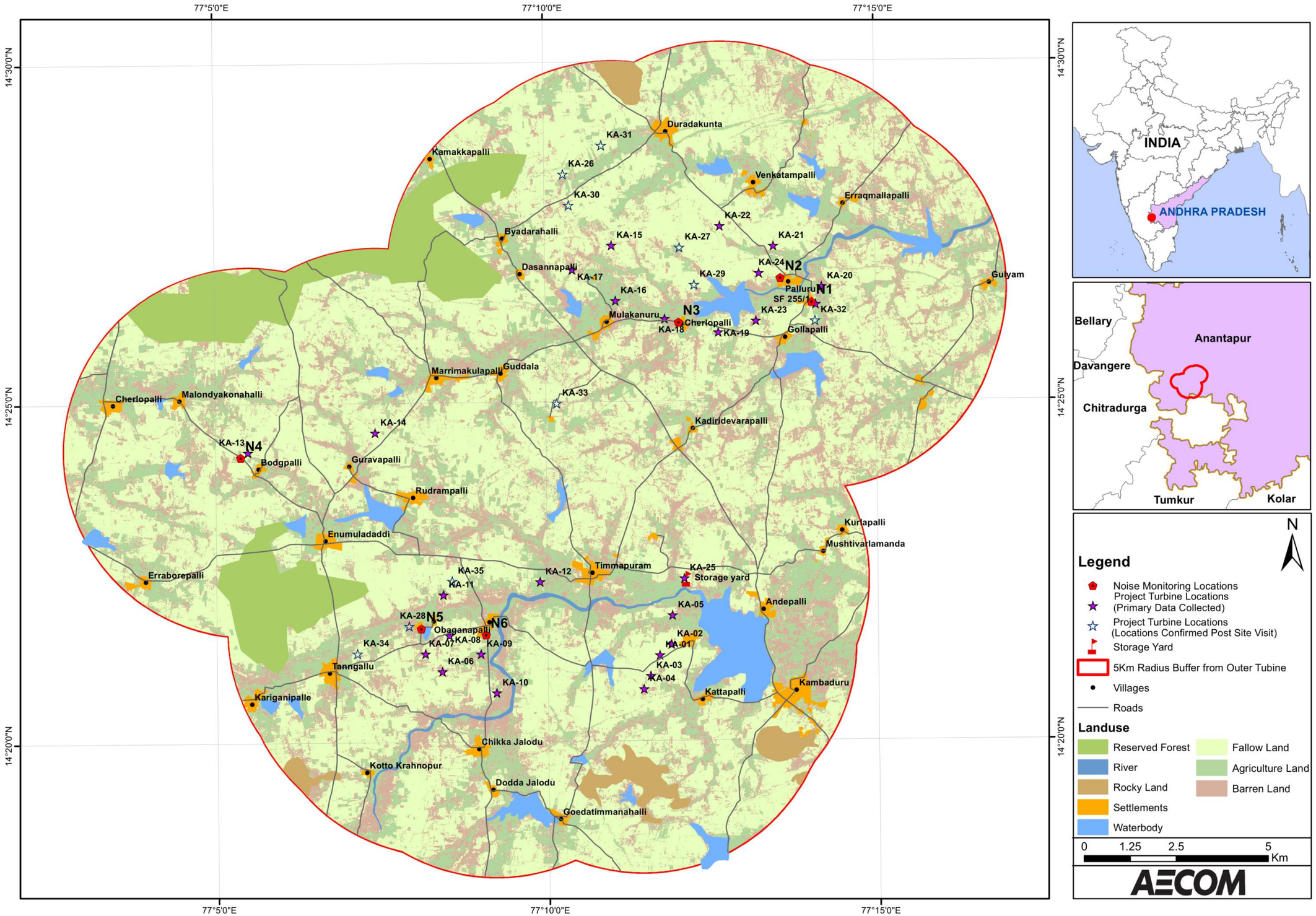


Figure 5-14: Map showing Noise Monitoring locations with WTG Locations

Table 5-9: Results of Noise level monitoring

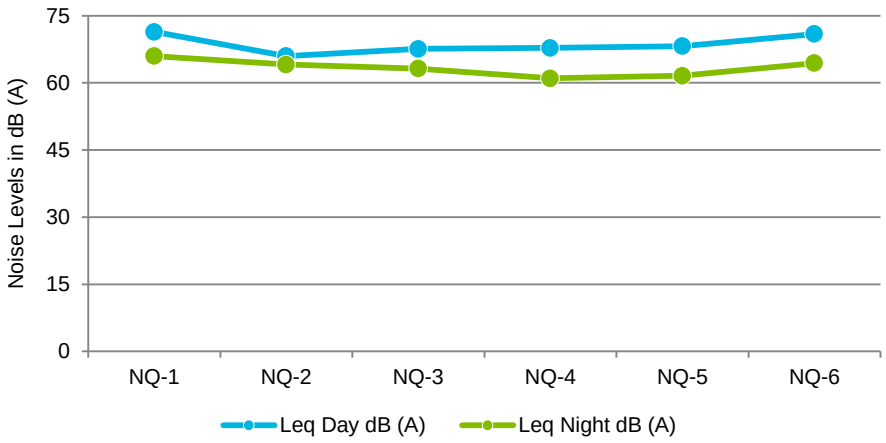
Location Code	Noise Standard (Residential Area)	NQ-1	NQ-2	NQ-3	NQ-4	NQ-5	NQ-6
L_{eq} Day dB (A)	55	71.4	66.0	67.6	67.8	68.2	70.9
L_{eq} Night dB (A)	45	66.0	64.1	63.2	61.0	61.6	64.4

Source: Netel Survey Results, December, 2016

Inference

It is observed that the noise levels at the monitoring locations ranged from 66.0 to 71.4 dB (A) during the daytime and 61.0 to 66.0 dB (A) during night time. The baseline noise levels at all the sampling locations were found to be exceeding the prescribed noise standards for Residential Area. These high baseline levels of ambient noise can be attributed to wind induced noise in the vacant land around the Project area with no or limited vegetation/other natural noise absorbers.

The day and night time noise levels are graphically presented in figure below:



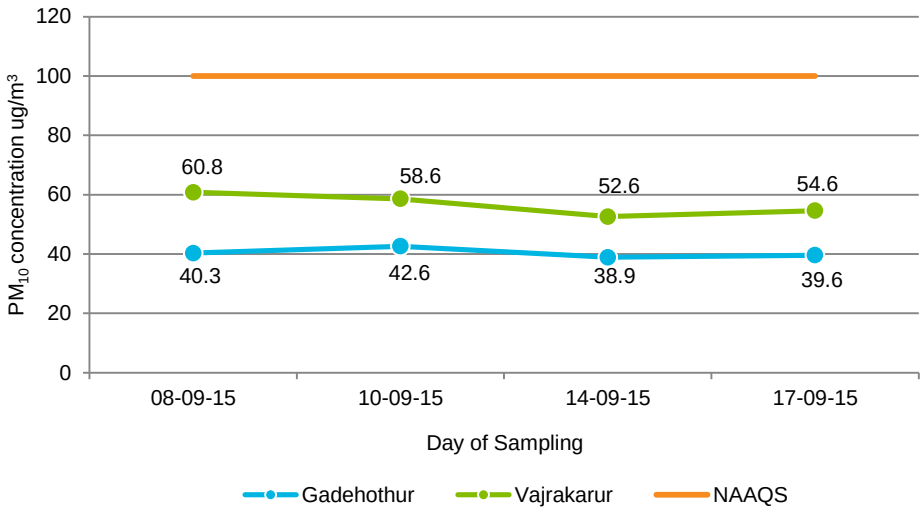
Source: Netel Survey

Figure 5-15: Noise Levels monitored in the study area

5.1.10 Ambient Air Quality

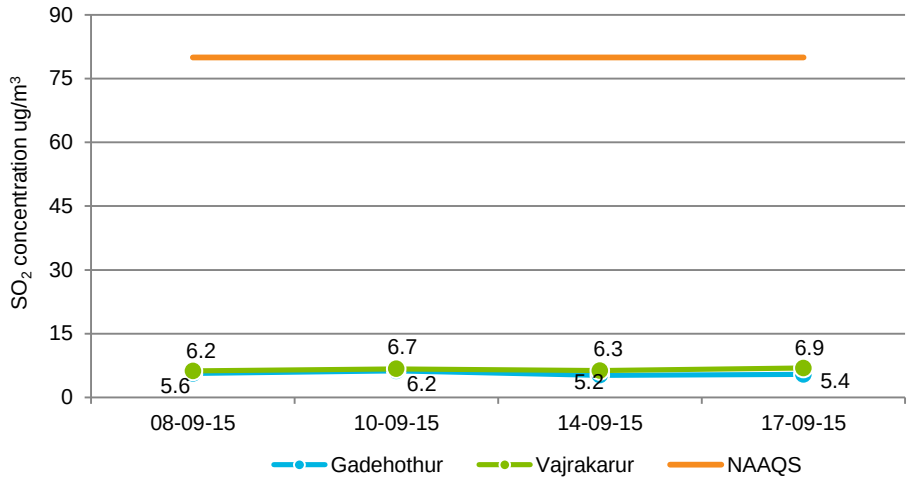
Wind power projects in particular do not cause any emissions during its operation phase and fugitive dust emissions are witnessed during construction phase of the project. Therefore, carrying out ambient air quality of the project area was not included in the scope of ESIA study.

Ambient air quality monitoring conducted for another wind project in Anantapur district has been referred to establish ambient air quality baseline. The sampling locations chosen were similar to the environmental setup of this project area viz., rural habitations in Anantapur district near Vajrakarur which is approximately 40 to 50 km from the proposed project area. Details of the air quality monitoring conducted during September 2015 have been presented in **Figure 5-16**, **Figure 5-17**, **Figure 5-18**, and **Figure 5-19.**



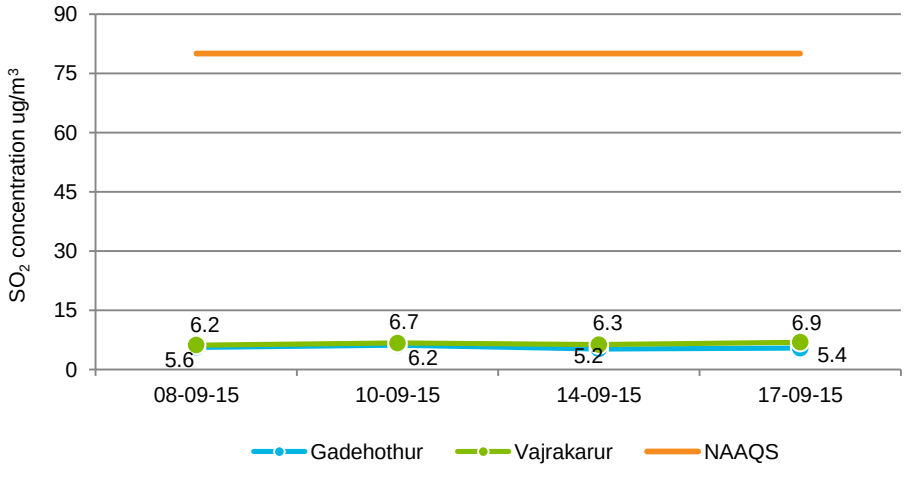
Source: ESIA Report for 100 MW in Vajrakarur, November 2015

Figure 5-16: PM_{10} levels near project site at Vajrakarur and Gadehothur



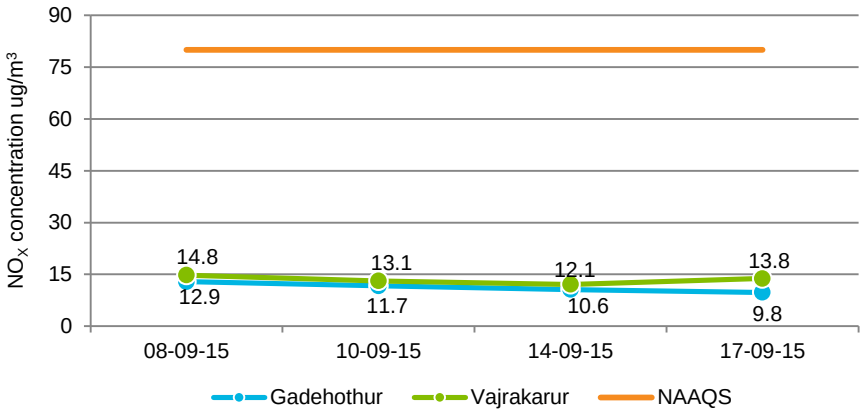
Source: ESIA Report for 100 MW in Vajrakarur, 2015

Figure 5-17: $PM_{2.5}$ levels near project site at Vajrakarur and Gadehothur



Source: ESIA Report for 100 MW in Vajrakarur, 2015

Figure 5-18: SO_2 levels near project site at Vajrakarur and Gadehothur



Source: ESIA Report for 100 MW in Vajrakarur, 2015

Figure 5-19: NO_X levels near project site at Vajrakarur and Gadehothur

As per secondary data presented above, it was observed that concentration of all the monitoring parameters (PM_{10}, $PM_{2.5}$, SO_2 and NOx) were substantially below the National Ambient Air Quality Standards (NAAQS) prescribed by Central Pollution Control Board.

5.1.11 Water quality

Two water samples were collected to assess the water quality of the project area. Samples of groundwater were examined for physic-chemical, heavy metals and biological parameters as per standard testing procedures. Two ground water samples were collected from Obuganapalli village and Cheriapalli village. Location details of the sampling locations are presented in **Table 5-10** and **Figure 5-21**.

Table 5-10: Details of Water Quality Monitoring Locations

S.No.	Sampling Locations	Location Code	Geographical Coordinates
1.	Obuganapalli village	GW1	14.362738°, 77.151544°
2.	Cheriapalli village	GW2	14.436032°, 77.200247°

Table 5-11 presents the results of analysis of the ground water samples which are compared with acceptable and permissible limits as specified in the drinking water standards IS10500:2012.

Table 5-11: Results of Ground Water Quality Analysis

S.No.	Parameters	Unit	GWQ1	GWQ2	AL(PL)
1.	Colour	Hazen	<5.0	<5.0	5 (15)
2.	Turbidity	NTU	0.5	<0.1	1(5)
3.	pH	—	7.48	7.60	6.5-8.5 (NR)
4.	Total Dissolved Solids	mg/l	1031	1591	500 (2000)
5.	Total Alkalinity	mg/l	192.0	532.8	200 (600)
6.	Total Hardness	mg/l	501.6	617.5	200 (600)
7.	Chloride	mg/l	173.56	390.5	250 (1000)
8.	Sulphate	mg/l	46.4	153.05	200 (600)
9.	Fluoride	mg/l	<0.2	<0.2	200 (600)
10.	Nitrate	mg/l	64.93	31.46	250 (1000)
11.	Phenolic Compound	mg/l	<0.001	<0.001	0.001 (0.002)
12.	Sulphide	mg/l	<0.1	<0.1	0.05 (NR)
13.	Calcium	mg/l	145.16	163.4	75 (200)
14.	Magnesium	mg/l	33.28	50.16	30 (100)

S.No.	Parameters	Unit	GWQ1	GWQ2	AL(PL)
15.	Iron	mg/l	0.13	<0.01	0.3 (NR)
16.	Mercury	mg/l	<0.001	<0.001	0.001 (NR)
17.	Cadmium	mg/l	<0.003	<0.003	0.003 (NR)
18.	Total Arsenic	mg/l	<0.01	<0.01	0.01 (0.05)
19.	Lead	mg/l	<0.01	<0.01	0.01 (NR)
20.	Manganese	mg/l	0.15	0.11	0.1 (0.3)
21.	Zinc	mg/l	0.11	0.10	5 (15)
22.	Total Chromium	mg/l	<0.01	<0.01	0.05 (NR)
23.	Copper	mg/l	<0.04	<0.04	0.05 (1.5)
24.	Boron	mg/l	<0.4	<0.4	0.5 (1.0)
25.	Nickel	mg/l	<0.01	<0.01	0.02 (NR)
26.	Selenium	mg/l	<0.01	<0.01	0.01 (NR)
27.	Cyanide	mg/l	<0.01	<0.01	0.01 (NR)
28.	Molybdenum	mg/l	<0.05	<0.05	0.07 (NR)
29.	Polychlorinated bipheyls (PCB)	mg/l	<0.0001	<0.0001	0.005 (NR)
30.	Polynuclear aromatic hydrocarbons (PAH)	mg/l	<0.0001	<0.0001	0.0001 (NR)
31.	Total Coliform	MPN/100 ml	14	>1600	Shall not be detectable in any 100 ml sample
32.	E.Coli	---	Present	Present	Shall not be detectable in any 100 ml sample

Source: Netel Lab Results, December 2016

Note: AL- Acceptable Limit; PL – Permissible Limit; NR – No Relaxation as per IS10500:2012

5.1.12 Inference

The summary of inferences of the analysis of the ground water samples results are presented in the following table:

Figure 5-20: Summary of Analysis for water quality monitoring

Observations
• Two ground water samples were collected from Obuganapalli and Cheriapalli villages and analysed for drinking water parameters; • The pH value of the samples were observed to be within the prescribed range indicating neutral balance; • Total Dissolved Solids content in both of samples were observed to be exceeding the Acceptable Limit, however, are within the Permissible Limit; elevated levels of TDS can be attributed to presence of inorganic salts and organic matter dissolved in water samples; • Total Alkalinity content in GWQ1 is within the Acceptable Limit and in GWQ2, Alkalinity content is within the Permissible Limit; Alkalinity refers to the capability of water to neutralise acid. It can be related to the hardness of the water. • Hardness content in both the samples shows exceedance of Permissible limits; • Chloride content in GWQ1 was observed to be within Acceptable limit, however GWQ2 was found to exceed the Acceptable Limit; Chlorides are not usually harmful to people; however, the sodium part of table salt has been linked to heart and kidney disease. Sodium chloride may impart a salty taste at 250 mg/l; • Nutrient parameters such as Sulphate, Fluoride and Nitrate content in both of the samples were observed to be within the Acceptable limit; • Metals and Mineral Parameters such as Calcium, Magnesium, Iron, Manganese and Zinc content in both the water samples were found to be exceeding the Accepted Limits but however is within the Permissible Limits; • Both the water samples show presence of Bacterial parameters such as Total Coliform and Escherichia coli (E.Coli); The presence of Coliform bacteria indicates that the water has been contaminated with the faecal matter. The presence of bacterial contamination is an indicator that a potential health risk exists for individuals consuming this water. Coliform bacteria may occur in water samples as a result of the overflow of domestic sewage or nonpoint sources of human and animal waste. • All other parameters were observed to be within the Acceptable limits as specified in the drinking water standard of IS10500:2012

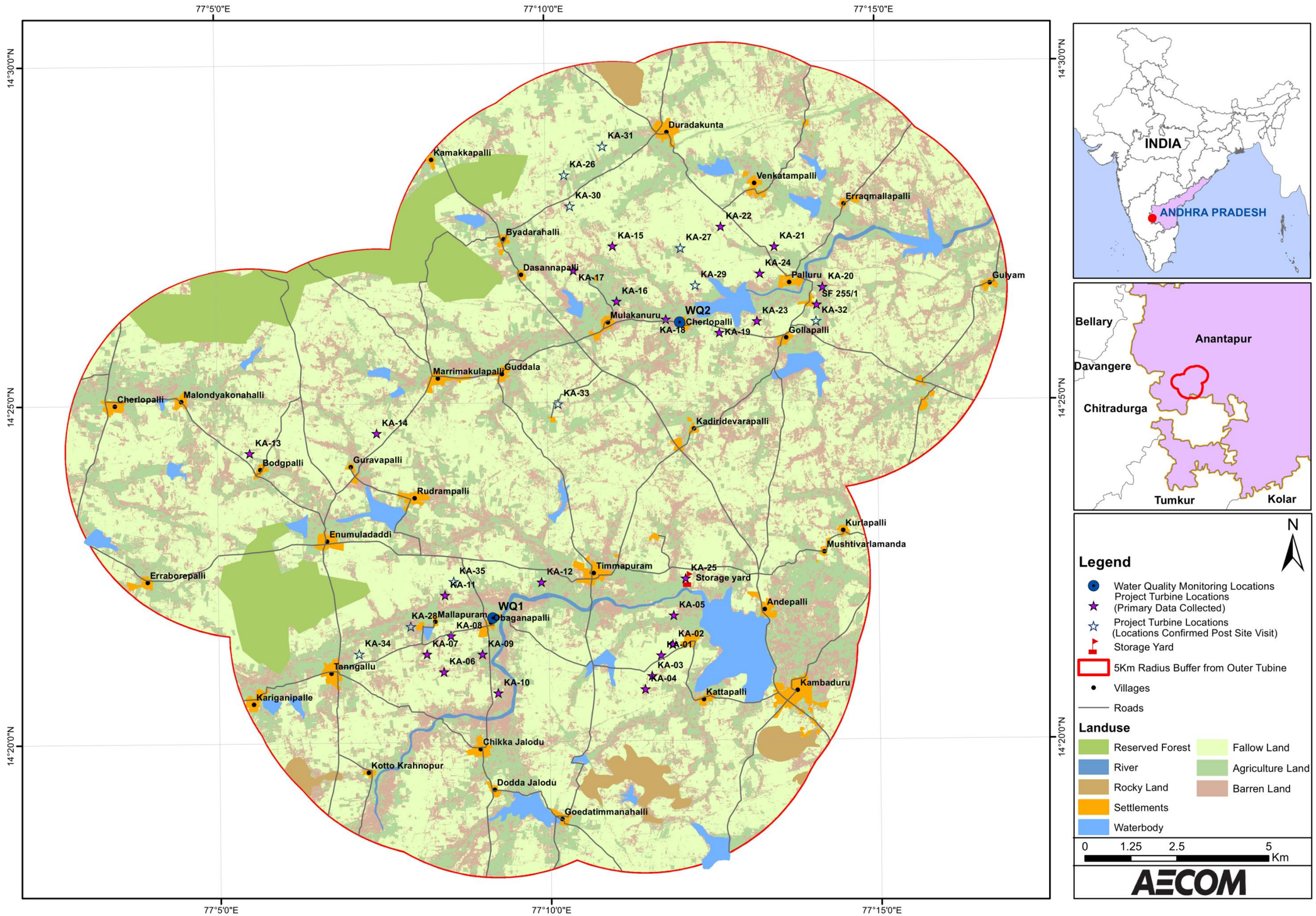


Figure 5-21: Map showing water quality monitoring locations

5.2 Ecology

5.2.1 Introduction

The proposed project site spreads over the Kambadur, Kundurpi and Kalyandurg mandals of Anantapur District of Rayalaseema region in Andhra Pradesh. Geographically, the project site is a part of the Deccan Plateau of Andhra Pradesh.

For the purposes of ecological assessment, an area encompassed within an imaginary line joining the outermost wind-turbine locations, along with an area extending outwards from this line up to a distance of 5 km, was considered as the 'Study Area' and is hereinafter referred to as such.

5.2.2 Ecological description of the study area

The study area is mainly represented by modified habitats such as agricultural lands, roads and habitations interspersed with small patches of natural vegetation. The topography of the study area is characterized by plains, hills and gently sloping lands. The terrain is generally flat to gently undulating. Most of the plain areas are utilized for agriculture purposes whereas uncultivated patches are covered mainly by open thorny scrub. The overall natural vegetation cover of study area is scanty and bushy. The major water sources in the study area include the seasonal and natural water-flows, lakes, a few farm ponds and artificial tanks.

5.2.3 Methodology

The ecological profile of the study area is described on the basis of primary data recorded through photo-documentation and secondary data sourced from available published literature such as books, research journals and websites of governmental departments, educational or research institutions. The information sources are quoted at the pertinent places in the report.

5.2.4 Findings on Flora

5.2.4.1 Forest types

According to the Champion and Seth Classification of Indian Forests, the natural vegetation of the study area appears to represent the following forest-type:

Type 6A/C1 Southern Thorn Forests [Sub-type C1- Southern Thorn Forests of Sub-group 6A – Southern Tropical Scrub Forests]

The natural vegetation of the study area is open, scattered and stunted and forming thickets . This type of forest is resulted from degradation of Southern Tropical Thorn Forests. These forests are mainly composed of scattered shrubs intermixed with grasses and few other herbaceous species.

The forests are mixed, composed of comparatively few species and usually do not form marked plant communities.

Trees such as *Azadirachta indica, Balanites aegyptiaca, Euphorbia tirucalli, Phoenix sylvestris, Borassus flabellifer, Prosopis cineraria, Prosopis juliflora etc.;*

Shrubs such as *Lantana camara, Senna auriculata, Calotropis gigantea, Opuntia elatior, Wrightia tinctoria, Ziziphus* spp. etc.

Grasses such as *Aristida* spp., and *Heteropogon contortus,* which make up the ground cover.

Source: H.G. Champion & S. K. Seth (2005). *A Revised Survey of the Forest Types of India.* Natraj Publishers, Dehradun.

5.2.4.2 Floristic species of the study area

Table 5-12 gives the details of the floristic species recorded in the study area. The plant family to which the species is assigned, as also, the habit, or morphological form, typically exhibited by the species, are also mentioned against the name of each species.

Table 5-12: Floristic Species of the Study Area

Sno.	Scientific Name	Family	Habit
1	*Acacia leucophloea*	Leguminosae	Tree
2	*Acacia nilotica*	Leguminosae	Tree
3	*Agave americana*	Agavaceae	Shrub
4	*Argemone mexicana*	Papaveraceae	Herb
5	*Azadiracta indica*	Meliaceae	Tree
6	*Borassus flabellifer*	Arecaceae	Tree
7	*Calotropis gigantea*	Apocynaceae	Shrub
8	*Calotropis procera*	Apocynaceae	Shrub
9	*Celosia argentea*	Amaranthaceae	Herb
10	*Cocos nucifera*	Arecaceae	Tree
11	*Eucalyptus* sp.	Myrtaceae	Tree
12	*Lantana camara*	Verbenaceae	Shrub
13	*Mangifera indica*	Anacardiaceae	Tree
14	*Phoenix sylvestris*	Arecaceae	Tree
15	*Pithecellobium dulce*	Leguminosae	Tree
16	*Prosopis cineraria*	Leguminosae	Tree
17	*Prosopis juliflora*	Leguminosae	Tree
18	*Senna auriculata*	Leguminosae	Shrub
19	*Tamarindus indica*	Leguminosae	Tree
20	*Ziziphus* sp.	Rhamnaceae	Shrub

Source: AECOM Primary Survey Photo-database

5.2.5 Findings on Fauna

This section of the report presents the details of the higher faunal species, namely, birds, mammals, reptiles amphibians and fishes, having recorded ranges that include the study area.

Wind-farms are known to pose potential risks to fauna in terms of direct and indirect habitat-loss through occupation of habitat areas by wind-farm structures and through avoidance of wind-farm areas by fauna associated to the area, respectively. The death of aerially moving fauna either through collision with turbines, or as an effect of conditions created by operational turbines is another major potential risk of wind-farms.

Amongst the fauna, only three groups of species are identified as vulnerable to the risk of death or injury from interaction with wind turbines. These comprise two bird groups, namely raptors and migratory waterfowl, and one mammalian group, namely bats. Thus, the faunal species of the study area are divisible into windfarm-vulnerable species and other species, that is, those that are not vulnerable to windfarm-related risks of death or injury.

Details of the faunal species having recorded ranges that include the study area are accordingly presented under two separate sub-sections. The faunal tables that follow also give the conservation status of each species, as per the IUCN Red Data List, and the Schedule under which the species is protected by the Wildlife (Protection) Act (WPA), 1972, of India.

5.2.5.1 Raptors

Raptors are relatively large-sized birds, varyingly adapted for soaring and relatively less capable of manoeuvring in flight and, thus, are known to be particularly vulnerable to collision-risk with operating wind-turbines.

Amongst the raptors associated with a given windfarm area, the resident species are known to be relatively more vulnerable to windfarm-related collision risk.

Table 5-13 lists the resident, as well as, migratory raptor species with recorded ranges that include the study area.

Table 5-13: Raptors of the Study Area

Sno.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**
Resident Species				
1	*Falco chicquera*	Red-necked Falcon	NT	I
2	*Falco jugger*	Laggar Falcon	NT	I
3	*Elanus caeruleus*	Black-winged Kite	LC	IV
4	*Milvus migrans*	Black Kite	LC	IV
5	*Haliastur indus*	Brahminy Kite	LC	IV
6	*Pernis ptilorhynchus*	Oriental Honey Buzzard	LC	IV
7	*Neophron percnopterus*	Egyptian Vulture	EN	IV
8	*Gyps bengalensis*	White-rumped Vulture	CR	I
9	*Gyps indicus*	Indian Vulture	CR	I
10	*Sarcogyps calvus*	Red-headed Vulture	CR	I
11	*Circaetus gallicus*	Short-toed Snake Eagle	LC	IV
12	*Spilornis cheela*	Crested Serpent Eagle	LC	IV
13	*Accipiter badius*	Shikra	LC	I
14	*Butastur teesa*	White-eyed Buzzard	LC	IV
15	*Clanga hastata*	Indian Spotted Eagle	VU	IV
16	*Aquila rapax*	Tawny Eagle	LC	IV
17	*Aquila fasciata*	Bonelli's Eagle	LC	IV
18	*Nisaetus cirrhatus*	Crested Hawk Eagle	LC	IV

Sno.	Scientific Name	Common Name	Season of Migration	IUCN Status*	WPA Schedule**
Migratory species					
19	*Falco tinnunculus*	Common Kestrel	Winter	LC	IV
20	*Falco peregrinus*	Peregrine Falcon	Winter	LC	IV
21	*Pandion haliaetus*	Osprey	Winter	LC	I
22	*Circus aeruginosus*	Eurasian Marsh Harrier	Winter	LC	IV
23	*Circus melanoleucos*	Pied Harrier	Winter	LC	IV
24	*Circus pygargus*	Montagu's Harrier	Winter	LC	IV
25	*Circus macrourus*	Pallid Harrier	Winter	NT	IV
26	*Hieraaetus pennatus*	Booted Eagle	Winter	LC	IV

*****Status assigned by the International Union for Conservation of Nature and Natural Resources, where – CR – Critically Endangered; EN – Endangered; NT – Near Threatened; VU – Vulnerable and LC – Least Concern.*

*** Schedules I to VI: Indian Wildlife (Protection) Act, 1972.*

Sources: R. Grimmett, C. Inskipp & T. Inskipp (2011). Birds of the Indian Subcontinent. Oxford University Press, pp 1-528; Salim Ali (2012) reprinted. The Book of Indian Birds. Oxford University Press, pp 1-326; IUCN (2016). The IUCN Red List of Threatened Species. Version 2016-3; Schedules I to VI: Indian Wildlife (Protection) Act, 1972.

5.2.5.2 Migratory Waterfowl

Migratory waterfowl tend to carry out migratory flights by night when they are unlikely to spot and avoid wind-turbines and, thus, are vulnerable to collision-risk with operating wind-turbines.

Table 5-14 lists the migratory waterfowl species with recorded ranges that include the study area.

Table 5-14: Migratory Waterfowl of the Study Area

Sno.	Scientific Name	Common Name	Season of Migration	IUCN Status*	WPA Schedule**
1	*Anser indicus*	Bar-headed Goose	Winter	LC	IV

Sno.	Scientific Name	Common Name	Season of Migration	IUCN Status*	WPA Schedule**
2	*Tadorna ferruginea*	Ruddy Shelduck	Winter	LC	IV
3	*Anas strepera*	Gadwall	Winter	LC	IV
4	*Anas clypeata*	Northern Shoveler	Winter	LC	IV
5	*Anas acuta*	Northern Pintail	Winter	LC	IV
6	*Anas querquedula*	Garganey	Winter	LC	IV
7	*Anas crecca*	Common Teal	Winter	LC	IV
8	*Aythya ferina*	Common Pochard	Winter	VU	IV
9	*Plegadis falcinellus*	Glossy Ibis	Winter	LC	IV
10	*Ardea cinerea*	Grey Heron	Winter	LC	IV
11	*Anhinga melanogaster*	Darter	Winter	NT	IV
12	*Phalacrocorax fuscicollis*	Indian Cormorant	Winter	LC	IV
13	*Phalacrocorax carbo*	Great Cormorant	Passage Migrant	LC	IV
14	*Turnix tanki*	Yellow-legged Buttonquail	Winter	LC	-
15	*Himantopus himantopus*	Black-winged Stilt	Winter	LC	IV
16	*Philomachus pugnax*	Ruff	Winter	LC	IV
17	*Gallinago stenura*	Pin-tailed Snipe	Winter	LC	IV
18	*Gallinago gallinago*	Common Snipe	Winter	LC	IV
19	*Limosa limosa*	Black-tailed Godwit	Winter	NT	IV
20	*Numenius arquata*	Eurasian Curlew	Winter	NT	IV
21	*Tringa erythropus*	Spotted Redshank	Winter	LC	IV
22	*Tringa totanus*	Common Redshank	Winter	LC	IV
23	*Tringa stagnatilis*	Marsh Sandpiper	Winter	LC	IV
24	*Tringa nebularia*	Common Greenshank	Winter	LC	IV
25	*Tringa ochropus*	Green Sandpiper	Winter	LC	IV
26	*Tringa glareola*	Wood Sandpiper	Winter	LC	IV
27	*Actitis hypoleucos*	Common Sandpiper	Winter	LC	IV
28	*Calidris minuta*	Little Stint	Winter	LC	IV
29	*Calidris temminckii*	Temminck's Stint	Winter	LC	IV
30	*Chlidonias hybrida*	Whiskered Tern	Winter	LC	-

***Status assigned by the International Union for Conservation of Nature and Natural Resources, where – NT – Near Threatened; VU – Vulnerable and LC – Least Concern.*

***Schedules I to VI: Indian Wildlife (Protection) Act, 1972.*

Sources: R. Grimmett, C. Inskipp & T. Inskipp (2011). Birds of the Indian Subcontinent. Oxford University Press, pp 1-528; Salim Ali (2012) reprinted. The Book of Indian Birds. Oxford University Press, pp 1-326; IUCN (2016). The IUCN Red List of Threatened Species. Version 2016-3; Schedules I to VI: Indian Wildlife (Protection) Act, 1972.

5.2.5.3 Bats

Bats are vulnerable to risk of death or injury, from not only collision with wind-turbines, but also from barotrauma (internal organ damage from rapid pressure-change), as an effect of flying through altered pressure-zones generated by wind-turbines in operation.

A correlation has been observed between low wind-speed nights and increased bat-fatalities around wind farms. Some evidence also suggests that bats may be attracted to turbines and that migratory and tree-roosting bats may have a higher risk of mortality.

Table 5-15 lists the bat species having recorded ranges that include the study area.

Table 5-15: Bats of the Study Area

Sno.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**
1	*Pteropus giganteus*	Indian Flying Fox	LC	V
2	*Cynopterus sphinx*	Greater Short-nosed Fruit Bat	LC	V
3	*Taphozous longimanus*	Long-winged Tomb Bat	LC	-
4	*Rhinolophus lepidus*	Blyth's Horseshoe Bat	LC	-
5	*Hipposideros speoris*	Schneider's Leaf-nosed Bat	LC	-
6	*Hipposideros fulvus*	Fulvous Leaf-nosed Bat	LC	-
7	*Megaderma lyra*	Greater False Vampire	LC	-
8	*Scotophilus heathii*	Greater Asiatic Yellow Bat	LC	-
9	*Pipistrellus tenuis*	Indian Pygmy Bat	LC	-
10	*Pipistrellus ceylonicus*	Kelaart's Pipistrelle	LC	-
11	*Scotozous dormeri*	Dormer's Bat	LC	-

*****Status assigned by the International Union for Conservation of Nature and Natural Resources, where - LC – Least Concern*

***Schedules I to VI: Indian Wildlife (Protection) Act, 1972.*

Sources: Vivek Menon (2014), Indian Mammals: A Field Guide. Hachette Book Publishing India Pvt. Ltd., Gurgaon, India, pp 1-522; IUCN (2016). The IUCN Red List of Threatened Species. Version 2016-3; Schedules I to VI: Indian Wildlife (Protection) Act, 1972.

5.2.6 Other Fauna in the study area

The following higher fauna, other than windfarm-vulnerable groups, is having recorded ranged that include the study area. Though these faunal species are also likely to be directly or indirectly affected by the project, they are not perceived to be particularly vulnerable to known wind farm impacts.

5.2.6.1 Resident birds

Table 5-16 lists the resident birds of the study area other than the windfarm-vulnerable species. The details of the migratory birds other than windfarm-vulnerable species appear in **Table 5-13**.

Table 5-16: Resident birds of the study area

Sno.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**
1	*Francolinus pictus*	Painted Francolin	LC	IV
2	*Francolinus pondicerianus*	Grey Francolin	LC	IV
3	*Coturnix chinensis*	King Quail	LC	IV
4	*Perdicula argoondah*	Rock Bush Quail	LC	IV
5	*Galloperdix spadicea*	Red Spurfowl	LC	IV
6	*Galloperdix lunulata*	Painted Spurfowl	LC	IV
7	*Gallus sonneratii*	Grey Junglefowl	LC	II
8	*Pavo cristatus*	Indian Peafowl	LC	I
9	*Dendrocygna javanica*	Lesser Whistling Duck	LC	IV
10	*Nettapus coromandelianus*	Cotton Pygmy-goose	LC	IV
11	*Anas poecilorhyncha*	Indian Spot-Billed Duck	LC	IV
12	*Tachybaptus ruficollis*	Little Grebe	LC	IV
13	*Mycteria leucocephala*	Painted Stork	NT	IV
14	*Anastomus oscitans*	Asian Openbill	LC	IV

Sno.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**
15	*Ciconia episcopus*	Woolly-necked Stork	VU	IV
16	*Threskiornis melanocephalus*	Black-headed Ibis	NT	IV
17	*Pseudibis papillosa*	Red-naped Ibis	LC	IV
18	*Platalea leucorodia*	Eurasian Spoonbill	LC	I
19	*Butorides striata*	Striated Heron	LC	IV
20	*Nycticorax nycticorax*	Black-crowned Night Heron	LC	IV
21	*Ardeola grayii*	Indian Pond Heron	LC	IV
22	*Ardea cinerea*	Grey Heron	LC	IV
23	*Ardea purpurea*	Purple Heron	LC	IV
24	*Bubulcus ibis*	Cattle Egret	LC	IV
25	*Casmerodius albus*	Great Egret	LC	IV
26	*Egretta intermedia*	Intermediate Egret	LC	IV
27	*Egretta garzetta*	Little Egret	LC	IV
28	*Microcarbo niger*	Little Cormorant	LC	IV
29	*Sypheotides indicus*	Lesser Florican	EN	I
30	*Amaurornis phoenicurus*	White-breasted Waterhen	LC	IV
31	*Amaurornis akool*	Brown Crake	LC	IV
32	*Turnix sylvaticus*	Small Buttonquail	LC	IV
33	*Turnix suscitator*	Barred Buttonquail	LC	IV
34	*Porphyrio porphyrio*	Purple Swamphen	LC	IV
35	*Gallinula chloropus*	Common Moorhen	LC	IV
36	*Fulica atra*	Eurasian Coot	LC	IV
37	*Burhinus (oedicnemus) indicus*	Indian Thick-knee	LC	-
38	*Esacus recurvirostris*	Great Thick-knee	NT	-
39	*Hydrophasianus chirurgus*	Pheasant-tailed Jacana	LC	IV
40	*Metopidius indicus*	Bronze-winged Jacana	LC	IV
41	*Vanellus malabaricus*	Yellow-wattled Lapwing	LC	IV
42	*Vanellus indicus*	Red-wattled Lapwing	LC	IV
43	*Charadris dubius*	Little Ringed Plover	LC	IV
44	*Rostratula bengalensis*	Greater Painted-snipe	NA	IV
45	*Cursorius coromandelicus*	Indian Courser	LC	-
46	*Rhinoptilus bitorquatus*	Jerdon's Courser	CR	I
47	*Glareola lactea*	Small Pratincole	LC	-
48	*Sterna aurantia*	River Tern	NT	-
49	*Pterocles exustus*	Chestnut-bellied Sandgrouse	LC	IV
50	*Pterocles indicus*	Painted Sandgrouse	LC	IV
51	*Columba livia*	Common Pigeon	LC	-
52	*Streptopelia orientalis*	Oriental Turtle Dove	LC	IV
53	*Streptopelia decaocto*	Eurasian Collared Dove	LC	IV
54	*Streptopelia tranquebarica*	Red Collared Dove	LC	IV
55	*Stigmatopelia chinensis*	Spotted Dove	LC	IV
56	*Stigmatopelia senegalensis*	Laughing Dove	LC	IV

Sno.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**
57	*Treron phoenicopterus*	Yellow-footed Green Pigeon	LC	IV
58	*Psittacula krameri*	Rose-ringed Parakeet	LC	IV
59	*Psittacula cyanocephala*	Plum-headed Parakeet	LC	IV
60	*Clamator jacobinus*	Jacobin Cuckoo	LC	IV
61	*Hierococcyx varius*	Common Hawk Cuckoo	LC	IV
62	*Cacomantis sonneratii*	Banded Bay Cuckoo	LC	IV
63	*Cacomantis passerinus*	Grey-bellied Cuckoo	LC	IV
64	*Eudynamis scolopaceus*	Asian Koel	LC	IV
65	*Taccocua leschenaultii*	Sirkeer Malkoha	LC	IV
66	*Centropus (sinensis) parroti*	Southern Coucal	LC	IV
67	*Tyto alba*	Barn Owl	LC	IV
68	*Otus bakkamoena*	Indian Scops Owl	LC	IV
69	*Glaucidium radiatum*	Jungle Owlet	LC	IV
70	*Athene brama*	Spotted Owlet	LC	IV
71	*Bubo bubo*	Eurasian Eagle Owl	LC	IV
72	*Ketupa zeylonensis*	Brown Fish Owl	LC	IV
73	*Strix ocellata*	Mottled Wood Owl	LC	IV
74	*Caprimulgus atripennis*	Jerdon's Nightjar	LC	IV
75	*Caprimulgus asiaticus*	Indian Nightjar	LC	IV
76	*Caprimulgus affinis*	Savanna Nightjar	LC	IV
77	*Cypsiurus balasiensis*	Asian Palm Swift	LC	-
78	*Hemiprocne coronata*	Crested Tree Swift	LC	-
79	*Apus affinis*	Little Swift	LC	-
80	*Upupa epops*	Common Hoopoe	LC	IV
81	*Coracias benghalensis*	Indian Roller	LC	IV
82	*Halcyon smyrnensis*	White-throated Kingfisher	LC	IV
83	*Alcedo atthis*	Common Kingfisher	LC	IV
84	*Ceryle rudis*	Pied Kingfisher	LC	IV
85	*Merops orientalis*	Green Bee-eater	LC	-
86	*Ocyceros birostris*	Indian Grey Hornbill	LC	-
87	*Megalaima zeylanica*	Brown-headed Barbet	LC	IV
88	*Megalaima haemacaphala*	Coppersmith Barbet	LC	IV
89	*Dendrocopos nanus*	Brown-capped Pygmy Woodpecker	LC	IV
90	*Dendrocopos mahrattensis*	Yellow-crowned Woodpecker	LC	IV
91	*Picus xanthopygaeus*	Streak-throated Woodpecker	LC	IV
92	*Dinopium benghalense*	Lesser Goldenback	LC	IV
93	*Chrysocolaptes festivus*	White-naped Woodpecker	LC	IV
94	*Tephrodornis pondicerianus*	Common Woodshrike	LC	IV
95	*Artamus fuscus*	Ashy Woodswallow	LC	-
96	*Coracina macei*	Large Cuckooshrike	LC	IV
97	*Aegithina tiphia*	Common Iora	LC	IV

Sno.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**
98	*Pericrocotus cinnamomeus*	Small Minivet	LC	IV
99	*Lanius vittatus*	Bay-backed Shrike	LC	-
100	*Lanius meridionalis*	Southern Grey Shrike	NA	-
101	*Dicrurus paradiseus*	Greater Rocket-tailed Drongo	LC	IV
102	*Dicrurus macrocercus*	Black Drongo	LC	IV
103	*Dicrurus caerulescens*	White-bellied Drongo	LC	IV
104	*Oriolus xanthornus*	Black-hooded Oriole	LC	IV
105	*Rhipidura (albicollis) albogularis*	White-spotted Fantail	LC	-
106	*Rhipidura aureola*	White-browed Fantail	LC	-
107	*Dendrocitta vagabunda*	Rufous Treepie	LC	IV
108	*Corvus (macrorhynchos) culminatus*	Indian Jungle Crow	LC	IV
109	*Corvus splendens*	House Crow	LC	V
110	*Parus major*	Great Tit	LC	IV
111	*Ptyonoprogne concolor*	Dusky Crag Martin	LC	-
112	*Petrochelidon fluvicola*	Streak-throated Swallow	LC	-
113	*Hirundo smithii*	Wire-tailed Swallow	LC	-
114	*Mirafra cantillans*	Singing Bushlark	LC	IV
115	*Mirafra affinis*	Jerdon's Bushlark	LC	IV
116	*Ammomanes phoenicura*	Rufous-tailed Lark	LC	IV
117	*Eremopteryx griseus*	Ashy-crowned Sparrow Lark	LC	IV
118	*Alauda gulgula*	Oriental Skylark	LC	IV
119	*Pycnonotus jacosus*	Red-whiskered Bulbul	NA	IV
120	*Pycnonotus cafer*	Red-vented Bulbul	LC	IV
121	*Pycnonotus luteolus*	White-browed Bulbul	LC	IV
122	*Pycnonotus xantholaemus*	Yellow-throated Bulbul	VU	IV
123	*Prinia hodgsonii*	Grey-breasted Prinia	LC	-
124	*Prinia sylvatica*	Jungle Prinia	LC	-
125	*Prinia socialis*	Ashy Prinia	LC	-
126	*Prinia inornata*	Plain Prinia	LC	-
127	*Cisticola juncidis*	Zitting Cisticola	LC	-
128	*Orthotomus sutorius*	Common Tailorbird	LC	-
129	*Dumetia hyperythra*	Tawny-bellied Babbler	LC	IV
130	*Pomatorhinus horsfieldii*	Indian Scimitar Babbler	LC	IV
131	*Turdoides caudata*	Common Babbler	LC	IV
132	*Turdoides malcolmi*	Large Grey Babbler	LC	IV
133	*Turdoides striata*	Jungle Babbler	LC	IV
134	*Turdoides affinis*	Yellow-billed Babbler	LC	IV
135	*Chrysomma sinense*	Yellow-eyed Babbler	LC	IV
136	*Zosterops palpebrosus*	Oriental White-eye	LC	IV
137	*Acridotheres tristis*	Common Myna	LC	IV
138	*Sturnia pagodarum*	Brahminy Starling	LC	IV
139	*Zoothera citrina*	Orange-headed Thrush	LC	IV

Sno.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**
140	*Copsychus saularis*	Oriental Magpie Robin	LC	IV
141	*Saxicoloides fulicatus*	Indian Robin	LC	IV
142	*Saxicola caprata*	Pied Bushchat	LC	IV
143	*Cyornis tickelliae*	Tickell's Blue Flycatcher	LC	IV
144	*Chloropsis jerdoni*	Jerdon's Leafbird	LC	IV
145	*Dicaeum agile*	Thick-billed Flowerpecker	LC	IV
146	*Dicaeum erythrorhynchos*	Pale-billed Flowerpecker	LC	IV
147	*Leptocoma zeylonica*	Purple-rumped Sunbird	NA	IV
148	*Cinnyris asiaticus*	Purple Sunbird	LC	IV
149	*Passer domesticus*	House Sparrow	LC	-
150	*Gymnoris xanthicollis*	Chestnut-shouldered Petronia	LC	-
151	*Ploceus philippinus*	Baya Weaver	LC	IV
152	*Euodice malabarica*	Indian Silverbill	LC	IV
153	*Amandava amandava*	Red Avadavat	LC	IV
154	*Lonchura striata*	White-rumped Munia	LC	IV
155	*Lonchura punctulata*	Scaly-breasted Munia	LC	IV
156	*Lonchura malacca*	Black-headed Munia	LC	IV
157	*Motacilla maderaspatensis*	White-browed Wagtail	LC	-
158	*Anthus rufulus*	Paddyfield Pipit	LC	IV

***** *Status assigned by the International Union for Conservation of Nature and Natural Resources, where - EN – Endangered; NT – Near Threatened; LC – Least Concern; NA – Not Assessed.*

***Schedules I to VI: Indian Wildlife (Protection) Act, 1972.*

Sources: R. Grimmett, C. Inskipp & T. Inskipp (2011). Birds of the Indian Subcontinent. Oxford University Press, pp 1-528; IUCN (2016). The IUCN Red List of Threatened Species. Version 2016-3; Schedules I to VI: Indian Wildlife (Protection) Act, 1972.

5.2.6.2 Mammals (other than bats)

Table 5-17 lists the mammal species (other than bats) having recorded ranges that include the study area.

Table 5-17: Mammals (other than bats) of the Study Area

Sno.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**
1	*Macaca radiata*	Bonnet Macaque	LC	II
2	*Semnopithecus entellus*	Northern Plains Langur	LC	II
3	*Moschiola indica*	Indian Chevrotain	LC	I
4	*Muntiacus muntjak*	Indian or Red Muntjac	LC	III
5	*Rusa unicolor*	Sambar	VU	III
6	*Axis axis*	Spotted Deer	LC	III
7	*Boselaphus tragocamelus*	Nilgai	LC	III
8	*Tetracerus quadricornis*	Four-Horned Antelope	VU	I
9	*Antilope cervicapra*	Blackbuck	NT	I
10	*Sus scrofa*	Indian Wild Pig	LC	III
11	*Panthera pardus*	Common Leopard	NT	I
12	*Felis chaus*	Jungle Cat	LC	II
13	*Prionailurus viverrinus*	Fishing Cat	LC	I

Sno.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**
14	*Paradoxurus hemaphroditus*	Common Palm Civet	LC	II
15	*Viverricula indica*	Small Indian Civet	LC	II
16	*Herpetes edwardsii*	Grey Mongoose	LC	II
17	*Hyaena hyaena*	Striped Hyeana	NT	III
18	*Canis lupus*	Grey Wolf	LC	I
19	*Canis aureus*	Golden Jackal	LC	II
20	*Vulpes bengalensis*	Indian Fox	LC	II
21	*Mellivora capensis*	Honey Badger	LC	I
22	*Lutrogale perspicillata*	Smooth-coated Otter	VU	I
23	*Lepus nigricollis*	Indian Hare	LC	IV
24	*Manis crassicaudata*	Indian Pangolin	NT	I
25	*Anathana ellioto*	Southern Tree Shrew	LC	II
26	*Suncus murinus*	House Shrew	LC	II
27	*Hystrix indica*	Indian Crested Porcupine	LC	IV
28	*Funambulus palmarum*	Tree-striped Palm Squirrel	LC	-
29	*Tatera indica*	Indian Gerbil	LC	-
30	*Vandeleuria oleracea*	Indian Long-tailed Tree Mouse	LC	V
31	*Mus musculus*	House Mouse	LC	V
32	*Mus booduga*	Little Indian Field Mouse	LC	V
33	*Millardia meltada*	Soft-furred Field Rat	LC	V
34	*Madromys blanfordi*	White-tailed Wood Rat	LC	V
35	*Bandicota indica*	Large Bandicoot Rat	LC	V
36	*Bandicota bengalensis*	Indian Mole Rat	LC	V
37	*Rattus rattus*	House Rat	LC	V

***Status assigned by the International Union for Conservation of Nature and Natural Resources, where – NT –Near Threatened; VU- Vulnerable and LC – Least Concern.*

***Schedules I to VI: Indian Wildlife (Protection) Act, 1972.*

Sources: Vivek Menon (2014), Indian Mammals: A Field Guide. Hachette Book Publishing India Pvt. Ltd., Gurgaon, India, pp 1-522; IUCN (2016). The IUCN Red List of Threatened Species. Version 2016-3.

5.2.6.3 Reptiles

Table 5-18 lists the reptile species having recorded ranges that include the study area.

Table 5-18: Reptiles of the Study Area

Sno.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**
1	*Indotyphlops braminus*	Bootlace Snake, Brahminy Blindsnake	NA	IV
2	*Grypotyphlops acutus*	Beaked Worm Snake	NA	IV
3	*Python molurus molurus*	Indian Python	NA	I
4	*Gongylophis conicus*	Common Sand Boa	NA	IV
5	*Eryx johnii*	Red Sand Boa	NA	IV
6	*Coelognathus helena helena*	Common Trinket Snake	NA	IV
7	*Ptyas mucosa*	Indian Rat Snake	NA	II
8	*Argyrogena fasciolata*	Banded Racer	NA	IV
9	*Oligodon taeniolatus*	Russel Kukri Snake	LC	IV

Sno.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**
10	*Oligodon arnensis*	Common Kukri Snake	NA	IV
11	*Dendrelaphis tristis*	Common Bronzeback Tree Snake	NA	IV
12	*Lycodon striatus*	Barred Wolf Snake	NA	IV
13	*Lycodon aulicus*	Common Wolf Snake	LC	IV
14	*Dryocalamus nympha*	Vellore Bridal Snake	NA	IV
15	*Sibynophis subpunctatus*	Dumeril's Black-headed Snake	NA	-
16	*Xenochrophis piscator*	Checkered Keelback	NA	II
17	*Amphiesma stolatum*	Striped Keelback	NA	IV
18	*Macropisthodon plumbicolor*	Green Keelback	NA	IV
19	*Boiga trigonata*	Common Cat Snake	LC	IV
20	*Ahaetulla nasuta*	Common Vine Snake	NA	IV
21	*Bungarus caeruleus*	Common Krait	NA	IV
22	*Calliophis melanurus*	Indian Coral Snake	NA	IV
23	*Naja naja*	Spectacled Cobra	NA	II
24	*Daboia russelii*	Russell's Viper	LC	II
25	*Echis carinatus*	Saw-scaled Viper	NA	IV
26	*Varanus bengalensis*	Indian Monitor Lizard	LC	I
27	*Chamaeleo zeylanicus*	Asian Chameleon	LC	-
28	*Sitana ponticeriana*	Fan-throated Lizard	LC	-
29	*Hemidactylus leschenaultii*	Bark Gecko	NA	-
30	*Hemidactylus flaviviridis*	Yellow-Green House Gecko	NA	-
31	*Psammophilus dorsalis*	South Indian Rock Agama	LC	-
32	*Hemidactylus frenatus*	Asian House Gecko	LC	-

***Status assigned by the International Union for Conservation of Nature and Natural Resources, where – LC – Least Concern; NA – Not Assessed.*

***Schedules I to VI: Indian Wildlife (Protection) Act, 1972.*

Sources: Indraneil Das (2002). Snakes & other Reptiles of India. New Holland Publishers (UK) Ltd pp. 1-144; Romulus Whitaker & Ashok Captain (2006). Snakes of India; Dreko Books, Chennai, pp 1-146; IUCN (2016). The IUCN Red List of Threatened Species. Version 2016-3; Schedules I to VI: Indian Wildlife (Protection) Act, 1972.

5.2.6.4 Amphibians

Table 5-19 lists the amphibian species having recorded ranges that include the study area.

Table 5-19: Amphibians of the Study Area

Sno.	Scientific Name	Common Name	IUCN Status *	WPA Schedule**
1	*Bufo melanostictus*	Common Indian Toad	LC	-
2	*Bufo scaber*	Ferguson's Toad	LC	-
3	*Bufo stomaticus*	Marbled Toad	LC	-
4	*Kaloula taprobanica*	Indian Painted Frog	LC	-
5	*Ramanella variegata*	Marbled Narrow Mouth Frog	LC	-
6	*Uperodon globulosus*	Balloon Frog	LC	-
7	*Uperodon systoma*	Marbled Balloon Frog	LC	-
8	*Polypedates maculatus*	Common Tree Frog	LC	-

Sno.	Scientific Name	Common Name	IUCN Status *	WPA Schedule**
9	*Euphlyctis cyanophlyctis*	Skipper Frog	LC	-
10	*Haplobatrachus tigerinus*	Indian Bull Frog	NA	IV
12	*Haplobatrachus crassus*	Jerdon's Bullfrog	LC	IV
13	*Rana malabarica*	Fungoid Frog	LC	IV

***Status assigned by the International Union for Conservation of Nature and Natural Resources, where – LC – Least Concern, NA – Not assessed.*

***Schedules I to VI: Indian Wildlife (Protection) Act, 1972.*

Sources: R. J. Ranjit Daniels, (2005). Amphibians of Peninsular India.Indian Academy of Sciences, University Press, pp 1-258; IUCN (2016). The IUCN Red List of Threatened Species. Version 2016-3; Schedules I to VI: Indian Wildlife (Protection) Act, 1972.

5.2.6.5 Fishes

Table 5-20 lists the fish species having recorded ranges that include the study area or waterbodies in the catchments of which the study area is situated.

Table 5-20: Fishes of the Study Area

Sno.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**
1	*Anguilla bengalensis*	Indian Long-fin Eel	NA	-
2	*Cirrhinus reba*	Reba Carp	LC	-
3	*Labeo calbasu*	Kalbasu	LC	-
4	*Labeo rohita*	Rohu	LC	-
5	*Hypselobarbus kolus*	Kolus	VU	-
6	*Puntius conchonius*	Rosy Barb	LC	-
7	*Puntius dorsalis*	Long-snouted Barb	LC	-
8	*Puntius sarana subnasutus*	Peninsular Olive Barb	NA	-
9	*Puntius sophore*	Spotfin Barb	LC	-
10	*Puntius ticto*	Ticto Barb	LC	-
11	*Puntius vittatus*	Kooli Barb	LC	-
12	*Tor khudree*	Yellow Mahseer	EN	-
13	*Barilius bendelisis*	Hamilton's Baril	NA	-
14	Brachydanio rerio	Zebra Fish	NA	-
15	*Esomus danrica*	Flying Barb	LC	-
16	*Parluciosoma daniconius*	Blackline Rasbora	LC	-
17	*Nemacheilus denisoni*	Day's Loach	LC	-
18	*Lepidocephalus thermalis*	Malabar Loach	LC	-
19	*Aorichthys seenghala*	Giant River Catfish	NA	-
20	*Rita rita*	Rita	LC	-
21	*Ompok bimaculatus*	Indian Butter-Catfish	NT	-
22	*Wallago attu*	Shark Catfish	NT	-
23	*Pangasius pangasius*	Pungas	LC	-
24	*Aplocheilus lineatus*	Striped Panchax	LC	-
25	*Gambusia affinis*	Mosquito Fish	LC	-
26	*Pseudambassis ranga*	Glassfish	LC	-
27	*Nandus nandus*	Mottled Nandus	LC	-
28	*Oreochromis mossambica*	Egyptian Mouth Breeder	NA	-

Sno.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**
29	*Glossogobius giurus*	Goby	NA	-
30	*Anabas testudineus*	Climbing Perch	DD	-
31	*Pseudosphromenus cupanus*	Indian Paradise Fish	LC	-
32	*Channa marulius*	Giant Snakehead	LC	-
33	*Channa punctatus*	Spotted Snakehead	NA	-
34	*Channa striatus*	Striped Snakehead	NA	-
35	*Mastacembelus armatus*	Tyre-track Spiny Eel	LC	-

*****Status assigned by the International Union for Conservation of Nature and Natural Resources, where – EN – Endangered; NT – Near Threatened; LC – Least Concern; DD – Data Deficient and NA – Not Assessed.*

***Schedules I to VI: Indian Wildlife (Protection) Act, 1972.*

Sources: R. J. Ranjit Daniels, (2002). Freshwater Fishes of Peninsular India, Indian Academy of Sciences, University Press, pp 1-282; IUCN (2016). The IUCN Red List of Threatened Species. Version 2016-3; Schedules I to VI: Indian Wildlife (Protection) Act, 1972.

5.2.7 Habitat Profile of the Study Area

5.2.7.1 Natural Habitats

The natural habitats in the study-area comprise small patches of dry deciduous scrub forest, seasonal streams and a few knolls and hills. Though these natural habitats are patchy and not in a pristine state, they are likely to be providing habitat needs to some specialist species, including windfarm vulnerable species.

5.2.7.2 Modified Habitats

The modified habitats in the study-area comprise farmlands, pasturelands, habitations, bunds, ponds, lakes, tanks, roads and wind energy installations.

5.2.7.3 Critical habitats

Habitats critical to the survival of IUCN-designated Critically Endangered or Endangered species, migratory species, congregatory species and endemic or restricted range species are considered to be critical habitats.

Critically Endangered Species

Table 5-21 lists the species designated by the IUCN as Critically Endangered or Endangered having recorded ranges that include the study area.

Table 5-21: Critically Endangered/Endangered Species of the Study Area

Sno.	Scientific Name	Common Name	IUCN Status*
Birds			
1	*Neophron percnopterus*	Egyptian Vulture	EN
2	*Gyps bengalensis*	White-rumped Vulture	CR
3	*Gyps indicus*	Indian Vulture	CR
4	*Sarcogyps calvus*	Red-headed Vulture	CR
5	*Rhinoptilus bitorquatus*	Jerdon's Courser	CR
6	*Sypheotides indicus*	Lesser Florican	EN
Fishes			
7	*Tor khudree*	Yellow Mahseer	EN

***** *Status assigned by the International Union for Conservation of Nature and Natural Resources, where CR – Critically Endangered and EN– Endangered*

Sources: R. Grimmett, C. Inskipp & T. Inskipp (2011). Birds of the Indian Subcontinent. Oxford University Press, pp 1-528; IUCN (2016). The IUCN Red List of Threatened Species. Version 2016-3.

Endemic / Restricted Range Species

Table 5-22 lists the species which are reported as being endemic to, or have restricted ranges that include, the region in which the study area is situated. None of these was observed during the field survey.

Table 5-22: Endemic / Restricted Range Species of the Study Area

Sno.	Scientific Name	Common Name	Range
Birds			
1	*Galloperdix lunulata*	Painted Spurfowl	Peninsular India
2	*Galloperdix spadicea*	Red Spurfowl	Peninsular India
3	*Perdicula argoondah*	Rock Bush Quail	Western & Central India
4	*Gallus sonneratii*	Grey Junglefowl	Southern Peninsula
5	*Pycnonotus xantholaemus*	Yellow-throated Bulbul	South Indian hills
6	*Rhinoptilus bitorquatus*	Jerdon's Courser	Andhra Pradesh
7	*Strix ocellata*	Mottled Wood Owl	Peninsular India
8	*Rhipidura (albicollis) albogularis*	White-spotted Fantail	Peninsular India
9	*Pomatorhinus horsfieldii*	Indian Scimitar Babbler	Southern Peninsula
Mammals			
10	*Anathana ellioto*	Southern Tree Shrew	Peninsular India
11	*Macaca radiata*	Bonnet Macaque	Peninsular India
Reptiles			
12	*Psammophilus dorsalis*	South Indian Rock Agama	India

Sources: Jathar, G.A. & Rahmani, A.R. (2006). Endemic Birds of India. Buceros: ENVIS Newsletter: Avian Ecology & Inland Wetlands. Vol. 11, No.2 & 3; IUCN (2016). The IUCN Red List of Threatened Species. Version 2016-3, downloaded on 13 December 2016; http://Intreasures.com/reptiles

Migratory Species

The entire Indian subcontinent, including the study area, falls within the limits of the Central Asian Flyway (CAF), one of the eight globally identified flyways. The CAF connects a large swathe of the Palaearctic region with the Indian subcontinent and contains several well-established routes along which a number of bird-species migrate annually. This flyway covers a large part of the continental area of Eurasia and includes the whole of the Indian sub-continent. Thus, the study-area is very likely to be situated in the flight-path of the various winter, summer and passage visitor-birds migrating either to or through the region in which it is situated.

Migratory species of the windfarm-vulnerable avifaunal groups namely raptors and migratory waterfowl are listed under the heading 'Findings on the Windfarm Vulnerable Species of the Study Area' in **Table 5-14**.

Table 5-23 lists the migratory avifaunal species having recorded ranges that include the study area or waterbodies in the catchments of which the study area is situated.

Table 5-23: Migratory Species of the Study Area

Sno.	Scientific Name	Common Name	Season of migration	IUCN Status*	WPA Schedule**
1	*Coturnix coturnix*	Common Quail	Winter	LC	IV
2	*Coturnix coromandelica*	Rain Quail	Winter	LC	IV
3	*Asio flammeus*	Short-eared Owl	Winter	LC	IV
4	*Merops philippinus*	Blue-tailed Bee-eater	Winter	LC	-
5	*Jynx torquilla*	Eurasian Wryneck	Winter	LC	IV
6	*Pitta brachyuran*	Indian Pitta	Winter	LC	IV

Sno.	Scientific Name	Common Name	Season of migration	IUCN Status*	WPA Schedule**
7	*Coracina melanoptera*	Black-headed Cuckooshrike	Passage Migrant	LC	IV
8	*Lanius cristatus*	Brown Shrike	Winter	LC	-
9	*Lanius schach*	Long-tailed Shrike	Winter	LC	-
10	*Dicrurus leucophaeus*	Ashy Drongo	Winter	LC	IV
11	*Oriolus (oriolus) kundoo*	Indian Golden Oriole	Winter	LC	IV
12	*Terpsiphone paradisi*	Asian Paradise-flycatcher	Winter	LC	IV
13	*Hirundo rustica*	Barn Swallow	Winter	LC	IV
14	*Cecropis daurica*	Red-rumped Swallow	Winter	NA	IV
15	*Acrocephalus dumetorum*	Blyth's Reed Warbler	Winter	LC	-
16	*Hippolais caligata*	Booted Warbler	Winter	LC	-
17	*Iduna rama*	Sykes's Warbler	Winter	LC	
18	*Phylloscopus humei*	Hume's Leaf Warbler	Winter	LC	
19	*Phylloscopus trochiloides*	Greenish Warbler	Passage Migrant	LC	-
20	*Sylvia curruca*	Lesser Whitethroat	Winter	LC	-
21	*Sylvia althaea*	Hume's Whitethroat	Passage	LC	-
22	*Sylvia hortensis*	Orphean Warbler	Winter	LC	-
23	*Sturnia malabarica*	Chestnut-tailed Starling	Winter	NA	IV
24	*Pastor roseus*	Rosy Starling	Winter	NA	IV
25	*Luscinia svecica*	Bluethroat	Winter	LC	IV
26	*Phoenicurus ochruros*	Black Redstart	Winter	LC	IV
27	*Saxicola torquatus*	Common Stonechat	Winter	LC	IV
28	*Monticola solitarius*	Blue Rock Thrush	Winter	LC	IV
29	*Monticola cinclorhynchus*	Blue-capped Rock Thrush	Winter	LC	IV
30	*Muscicapa dauurica*	Asian Brown Flycatcher	Winter	LC	IV
31	*Ficedula superciliaris*	Ultramarine Flycatcher	Winter	LC	IV
32	*Eumyias thalassinus*	Verditer Flycatcher	Winter	LC	IV
33	*Motacilla flava*	Yellow Wagtail	Winter	LC	IV
34	*Motacilla cinerea*	Grey Wagtail	Winter	LC	IV
35	*Motacilla alba*	White Wagtail	Winter	LC	IV
36	*Anthus godlewskii*	Blyth's Pipit	Winter	LC	IV
37	*Anthus trivialis*	Tree Pipit	Winter	LC	IV
38	*Anthus hodgsoni*	Olive-backed Pipit	Winter	LC	IV
39	*Carpodacus erythrinus*	Common Rosefinch	Winter	LC	IV

***Status assigned by the International Union for Conservation of Nature and Natural Resources, where –LC – Least Concern and NA- Not assessed.*

***Schedules I to VI: Indian Wildlife (Protection) Act, 1972.*

Sources: R. Grimmett, C. Inskipp & T. Inskipp (2011). Birds of the Indian Subcontinent. Oxford University Press, pp 1-528; Salim Ali (2012) reprinted. The Book of Indian Birds. Oxford University Press, pp 1-326; IUCN (2016). The IUCN Red List of Threatened Species. Version 2016-3; Schedules I to VI: Indian Wildlife (Protection) Act, 1972.

Congregatory Species

Congregatory species includes the species that gather in globally significant numbers at a particular site and at a particular time in their life cycle for feeding, breeding or resting (during migration).

Table 5-24 lists the congregatory species having recorded ranges that include the study area.

Table 5-24: Congregatory Species of the Study Area

Sno.	Scientific Name	Common Name	IUCN Status*	WPA Schedule**
1	*Phalacrocorax niger*	Little Cormorant	LC	IV
2	*Phalacrocorax fuscicollis*	Indian Cormorant	LC	IV
3	*Phalacrocorax carbo*	Great Cormorant	LC	IV
4	*Mycteria leucocephala*	Painted Stork	NT	IV

***** *Status assigned by the International Union for Conservation of Nature and Natural Resources, where CR – Critically Endangered; EN – Endangered; NT – Near Threatened and VU – Vulnerable.*

Sources: R. Grimmett, C. Inskipp & T. Inskipp (2011). Birds of the Indian Subcontinent. Oxford University Press, pp 1-528; Salim Ali (2012) reprinted. The Book of Indian Birds. Oxford University Press, pp 1-326.

5.2.8 Species of conservation concern

Amongst the three groups of species considered to be especially vulnerable to risk of death or injury from interaction with wind turbines, namely, raptors, migratory waterfowl and bats, it is only the globally threatened or near-threatened species which, because of their already low or fast-decreasing numbers, face a risk from the proposed project at a species level, and thus represent a conservation concern.

Table 5-25 lists the species of raptors and migratory waterfowl that are designated as globally threatened or near-threatened by the IUCN and have reported ranges that include the study area. None of these was observed during the field survey.

None of the bat species associated with the study area is designated by the IUCN as globally threatened or near-threatened.

Table 5-25: Species of Conservation Concern

Sno.	Scientific Name	Common Name	IUCN Status*
1	*Falco chicquera*	Red-necked Falcon	NT
2	*Falco jugger*	Laggar Falcon	NT
3	*Neophron percnopterus*	Egyptian Vulture	EN
4	*Gyps bengalensis*	White-rumped Vulture	CR
5	*Gyps indicus*	Indian Vulture	CR
6	*Sarcogyps calvus*	Red-headed Vulture	CR
7	*Clanga hastata*	Indian Spotted Eagle	VU
8	*Circus macrourus*	Pallid Harrier	NT
9	*Anhinga melanogaster*	Darter	NT
10	*Limosa limosa*	Black-tailed Godwit	NT
11	*Numenius arquata*	Eurasian Curlew	NT
12	*Aythya ferina*	Common Pochard	VU

***** *Status assigned by the International Union for Conservation of Nature and Natural Resources, where CR – Critically Endangered; EN – Endangered; NT – Near Threatened and VU – Vulnerable.*

Sources: R. Grimmett, C. Inskipp & T. Inskipp (2011). Birds of the Indian Subcontinent. Oxford University Press, pp 1-528; Salim Ali (2012) reprinted. The Book of Indian Birds. Oxford University Press, pp 1-326.

5.2.9 Designated areas

Designated areas include nationally or internationally designated ecologically sensitive areas such as legally protected areas, namely, Protected Forests, Reserve Forests, Wildlife Sanctuaries, National Park, as also, Important Bird Areas and Ramsar Sites.

5.2.9.1 Legally Protected Areas

The Rollapadu Wildlife Sanctuary, spreading over 6.14 sq. km area, is the nearest legally protected area. It is situated about 180 km east of the study area.

5.2.9.2 Important Bird Areas (IBA)

The Horsely Hills is the nearest Important Bird Area. It is situated approximately 146 km southeast of the study area.

5.2.9.3 Ramsar Sites

The only Ramsar Site in Andhra Pradesh state is Kolleru Lake. It is situated about 500 km northeast of the study area.

5.2.10 Ecosystem services

5.2.10.1 Provisioning services

The study area provides provisioning ecosystem services through the soil in which agricultural crops are cultivated by the local communities, as also, wild plants that serve the food, fodder, fuel-wood and timber needs of the local communities.

Crops

Table 5-26 lists major crops cultivated in the study-area.

Table 5-26: Major Crops of the Study Area

Sno.	Species	Common Name	Type of Crop
1	*Arachis hypogea*	Groundnut	Nut
2	*Cajanus cajan*	Pigeon Pea	Pulse
3	*Cicer arietinum*	Cicer, Gram, Bengal Gram	Pulse
4	*Gossypium spp.*	Cotton	Fibre
5	*Helianthus annus*	Sunflower	Seed
6	*Mangifera indica*	Mango	Fruit
7	*Oryza sativa*	Rice	Grain
8	*Sorghum bicolor*	Great Millet	Grain
9	*Vigna radiata*	Green Gram	Pulse
10	*Vigna unguiculata*	Cowpea	Pulse
11	*Zea mays*	Maize	Grain

Source: http://www.ap.gov.in/about-ap/districts/anantapur; R. Rukmani & Manjula, M. Designing Rural Technology Delivery systems Mitigating Agricultural Distress: A Study of Anantpur District.

Fodder

The natural vegetation of the study area, including the plant cover of fallow lands, provides fodder to the livestock of the area.

Fuelwood and Timber

The trees and shrubs growing naturally in the study area provide fuel-wood and timber to the local communities.

5.2.10.2 Regulating services

The natural functioning of the ecosystems in the study area leads to the following processes that provide both, direct and indirect benefits to the local communities.

Ground Water Recharge

The natural and seasonal water-flows in the study-area, comprising the tributary water-channels of Pennar river. These water-flows contribute to the recharge of wells, ponds and lakes of the area, which provide the freshwater needs of the local communities. The vegetation cover of the area also helps to slow down the surface run-off, which in turn increases the percolation of water into sub-surface layers, thereby promoting the recharge of groundwater.

Surface Water Purification

The plants and soil organisms of the study area absorb and process a number of chemical compounds dissolved in local water-flows, effectively recycling wastes and purifying the water. The vegetation cover of the study area, especially its collective root systems, also acts as a physical filtration system, filtering out particulate matter as the water flows towards the area's ponds, lakes, streams and rivers. Thus, the study area contributes to the regulation of the water-quality of the area by purifying surface water.

Soil Erosion Control

The vegetation cover of the study area anchors soil-particles and binds them together, lowering the rate of soil erosion by water and wind. Thus, the study area contributes to control of soil erosion in the area.

Pollination and Pest Control

The vegetation cover of the study area provides habitats to a range of faunal species that include pollinator species, such as, pollen or nectar feeding insects and birds, as well as, insectivorous species, including frogs, lizards, birds and bats. By harbouring such species, the study-area provides pollinator-services and pest-control services to natural, as well as, agricultural plants in the area.

5.2.10.3 Supporting services

The natural functioning of the ecosystems of the study area lead to the following processes that create or maintain basic natural resources, such as soil-nutrients and photosynthetic production, that support human life-sustaining activities, such as farming, food-gathering, cooking and grazing of livestock.

Nutrient Capture and Recycling

The food-chains constituted by the organisms of the study area are continuously involved in the capture and transfer of the macro and micro nutrients in the soil, water and air, effectively recycling nutrients and making them available in the nutrient-sinks of the local ecosystems. The biomass generated by the study-area, and transferred physically by water and wind, helps recharge the soil-fertility in the surrounding area. Thus, the natural vegetation and topography of the study-area contribute to the natural productivity of the area.

Primary Production

The photosynthetic organisms of the study-area act as primary producers, creating food-reserves that directly or indirectly support the consumers of the area, including the local communities. This primary production includes, besides a number of resources utilized directly by local communities (and covered under Provisioning Services), the grass blades and leaves consumed by grazing and browsing animals like grasshoppers, bugs, beetles, snails, goats and sheep, the flowers, pollen and flower-nectar consumed by butterflies, moths, bees and sunbirds, the seeds consumed by seed and grain-eaters like ants, sparrows, larks, pipits and mice, and the fruits consumed by birds and bats.

5.2.10.4 Cultural services

A number of temples situated in the study area are active places of worship providing cultural services to the local communities in the area.

5.3 Socio-economic Environment

This section of the report primarily summarises the socio economic characteristics of the project influenced areas from the macro district level to the micro village level. The data collected through desk-based review have been studied and analysed to present a comprehensive analysis of the socio economic characteristics of the project

influence area. Report on the data collected through stake holder consultations have also been analysed and presented below.

5.3.1 Approach and Methodology

The scope of work as detailed earlier in the proposal has been the guiding criteria for the undertaking the Social Impact Assessment (SIA) Study. The turbine location and the associated facilities fall primarily in the Anantapur District of the state of Andhra Pradesh. In order to undertake the primary survey and identification and consultation of the stakeholders, the location of the turbine and its associated facilities was considered for the study.

A structured questionnaire was prepared to undertake the focus group discussions and evaluate the socio-economic status of the project affected families. In addition, discussions were also held with representatives of the influenced villages to provide an understanding of the socio-economic status of the people residing in the area.

5.3.2 Review of Secondary Data

A detailed review and assessment of the secondary data available on the project location was done wherein the turbines and associated facilities are to operate. Detailed reviews of available documents on the socio- economic characteristics of the project-influenced areas were undertaken. The documents referred to for the desk-based research are,

- Primary Census Abstract (PCA), 2001
- Primary Census Abstract (PCA), 2011
- Village Directory Data (VDA), 2001
- Statistical Abstract Andhra Pradesh, 2015
- District Handbook of Anantapur District, 2011
- Handbook of Statistics Anantapur District, 2011
- Brief Industrial Profile of Anantapur District (MSME), 2011

5.3.3 Collation of Primary data

Primary data was collected on the socio- economic status of the villages wherein the turbines were to be located through identification of stakeholders and thereafter focus group discussions and consultations with them. The data collected have been collated and analysed to understand the impact of the project on the area. Additionally, traffic data was conducted by Netel during 15th and 16th of December as part of primary data collection.

5.3.4 Project location – A description

Andhra Pradesh has huge wind power potential that is yet to be harnessed. The state is capable of generating around 14,497 MW of wind energy at 80 m level. Several districts have been identified to generate maximum wind energy and Anantapur district is one of them. Anantapur district is the largest district of Andhra Pradesh spread over 1,913,000 hectares and lies between 13.40° to 15.15° northern latitude and 76.50° and 78.30° eastern longitude. It lies at the extreme south-west of the Andhra Pradesh and is bounded by Bellary and Kurnool district on the north and Cuddapah and Kolar districts of Karnataka on the South East and North respectively.

Although a drought prone district and being infamously known for the highest number of farmer suicides in the country its major industry is agro-based with primary focus on non-food crops .Rice and Maize are the major cereals produced in the district along with Bengal gram pulses and groundnut. The Central and State Government in order to diversify livelihood options in the district has introduced the Drought Prone Areas Programme in the District. Under this programme there are a number of livestock development programmes that have been initiated.

According to the Statistical Abstract of Andhra Pradesh 2015, Anantapur district has 475 factories employing around 17,312 individuals. There are 266 units manufacturing food products followed by eighty-eight (88) units of wood and wood products manufacturing apart from furniture and the rest comprise of other miscellaneous smaller units. To boost industrial investment in the district, the industrial centre is target driven and with its

abundance of mineral deposits in the area, cement industries are also prevalent there .There is a substantial renewable energy sector presence as well as of the eighty four (84) large and medium scale units present in Anantapur, twenty four (24) units are windmills generating wind power.

5.3.5 Administrative setup

The district population according to the census 2011 data is 4,081,148.The rural population of 2,93,5437 is spread over 949 villages. These villages fall under sixty three (63) mandals and are grouped into five (05) revenue divisions for administrative purposes. In addition to the existing Anantapur, Dharamvaram and Penukonda revenue divisions Kadiri, Kalyandurg Revenue Divisions were formed in the year 2013 as the Government of Andhra Pradesh aims to add ten revenue divisions across the state to facilitate faster and more concerted public services. There are sixteen (16) towns and one (01) urban agglomeration classified in the district. Kambadur, Kundurpi and Kalyandurg Mandals fall in the study area. Kambadur and Kundurpi fall under the Dharamvaram Revenue Division and Kalyandurg under Kalyandurg Revenue Division.

5.3.6 Project area villages

The project area is spread across eight (08) villages under three (03) Mandals in Anantapur District. The section below provides information regarding the important statistics which enables to understand the present scenario in these villages. The villages are:

Table 5-27: List of Villages and Mandals falling under the project area

Sno.	Mandals	Villages
1.	Kambadur mandal	Thimmapuram
2.		Mulakanur
3.		Pallur
4.	Kundurpi mandal	S.Mallapuram
5.		Kariganipalle
6.		Yenumaladoddi
7.	Kalyandurg mandal	Duradakunta
8.		Palavoy

Source: VUBPL, December 2016

Kambadur Mandal has twelve (12) villages under its jurisdiction. Kambadur has basic educational and health facilities present, with primary schools in all villages and one (01) senior secondary school in the Mandal. One (01) Primary Health Centre (PHC) and thirteen (13) Primary Health Sub Centres (PHSC) to address the health issues in the mandal. Access to Public Distribution System and other nutritional benefits programmes is prevalent.

Kundurpi Mandal has ten (10) villages under its jurisdiction. Educational Facilities up to the Senior Secondary level is present in the Mandal. There are primary and middle schools in all villages. There is one (01) Primary Health Centre (PHC) and eight (08) Primary Health Sub-Centres (PHSC) in the area. Access to Public Distribution System and other nutrition benefits programmes of the central and state governments.

Kalyandurg Mandal has fifteen (15) villages under its jurisdiction. Kalyandurg has basic educational and health facilities present in it. There are three (03) senior secondary schools, one (01) Primary Health Centre and twelve(12) Primary Health Sub-Centres present in the Mandal. Good road, mobile network connectivity and power supply is present in all of its villages. Prevalence of government schemes for nutritional benefits and access to public distribution system is also available in the villages.

5.3.6.1 Demographic Profile of Project Area

The villages in the study area fall within three (03) mandals namely Kambadur, Kundurpi and Kalyandurg. The details regarding the socio economic and demographic profile will include one (01) district, three (03) mandals and eight (08)) villages have been illustrated and elaborated below:

Table 5-28: District level population

District	Population 2001			Population 2011			Decadal Growth Rate %
	Total Population	Male Population	Female Population	Total Population	Male Population	Female Population	
Anantapur	3,640,478	1,859,588	1,780,890	4,081,148	2,064,495	2,016,753	12.10

Source: 2001 and 2011 Census Data

It can be observed in the above table that the decadal growth between 2001 and 2011 of the district is 12.10 %. There has been a 13 % growth rate in female population which is higher than that of the male population which is 11%.

Table 5-29: Mandal level population

District	Mandal	Population 2001			Population 2011			Decadel Growth Rate in %
		Total Population	Male Population	Female Population	Total Population	Male Population	Female Population	
Anantapur	Kambadur	46,740	23,950 (51%)	22,790 (48.7%)	50,799	25,972(51.1%)	24,827 (48.8%)	8.68
	Kundurpi	48,205	24,699 (51%)	23,506 (48.7%)	53,180	27,145 (51%)	26,035 (48.9%)	10.32
	Kalyandurg	81,086	41,292 (50.9%)	39,794 (49%)	89,879	45,307 (50.4%)	44,572 (49.5%)	10.84

Source: 2001 and 2011 Census Data

The data represented above indicates that Kalyandurg Mandal has the highest population at 89,879 and Kambadur has the lowest population of 50799 amongst the three mandals. Female population in all mandals reflect above 40% representation with the highest female population in Kalyandurg (49.5%). Kalyandurg Mandal depicts the highest decadal growth from 81086 (2001) to 89879 (2011) with a decadal growth percent at 10.84%.

Table 5-30: Project area – village level population

Mandal	Villages	Population 2001			Population 2011			Decadel Growth Rate in %
		Total Population	Male Population	Female Population	Total Population	Male Population	Female Population	
Kambadur	Thimmapuram	6269	3278 (52%)	2991 (47.8%)	5833	2891 (49.5%)	2942 (50%)	-6.9
	Mulakanur	4874	2424 (49.7%)	2450 (50%)	5622	2843 (50.5%)	2779 (49%)	15.34
	Pallur	5418	2816 (51.9%)	2602 (48%)	5877	3012 (51%)	2865 (48.7%)	8.47
Kundurpi	S.Mallapuram	548	268 (48.9%)	280 (51%)	644	332 (51.5%)	312 (48%)	17.5
	Kariganipalle	4350	2214 (50.8%)	2136 (49.1%)	4749	2453 (51.6%)	2296 (48.3%)	9.1
	Yenumaladoddi	5219	2681 (51.3%)	2538 (48.6%)	6190	3131 (50.5%)	3059 (49%)	18.6
Kalyandurg	Duradakunta	2278	1152 (50.5%)	1126 (49%)	2345	1170 (49.8%)	1175 (50%)	2.9
	Palavoy	5139	2637 (51%)	2502 (48.6%)	5517	2812 (50.9%)	2705 (49%)	7.3

Source: 2001 and 2011 Census Data

As observed from the table above, Yenumaladoddi village has the highest decadal growth in population between the period of 2001 and 2011 at 18.6% followed by S.Mallapuram at 17.5%. It is to be noted here that there has been a negative growth rate in Thimmapuram village at -6.9%.

5.3.6.2 Sex Ratio

Sex ratio is an important demographic indicator reflecting the socio-economic structure of any society. Gender equality is a core development objective and has been incorporated in the broader development strategies of the Indian Government. The state of Andhra Pradesh ranks fourth (4th) with a ratio of 993 females per 1000 males in the country. The data for District, Mandal and Villages have been provided below:

District

Ananthapur does not fare well in ranking amongst the districts in Andhra Pradesh. It ranks thirteenth (13th) out of thirteen (13) districts in the state. However, the sex ratio has improved from 958 in the year 2001 to 977 females per 1000 males in the year 2011.

Mandals

The sex ratios for the three (03) mandals are Kambadur at 955, Kalyandurg stands at 983 and Kundurpi at 959 to every 1000 males.

Villages

The table below represents the prevalent sex ratios in the project villages. They are presented below:

Table 5-31: Sex Ratio of Villages in the Project Area

Mandals	Villages	Sex Ratio
Kambadur	Thimmapuram	1017
	Mulakanur	977
	Pallur	951
Kundurpi	S.Mallapuram	939
	Kariganipalle	935
	Yenumaladoddi	977
Kalyandurg	Duradakunta	1004
	Palavoy	961

Source: 2011 Census Data

The data represented above depicts the highest sex ratio is in Thimmapuram village of Kambadur Mandal wherein there are 1017 females per 1000 males. Analysis of the sex ratio in the project villages shows a healthy trend with above 900 females per 1000 males in all the villages.

5.3.6.3 Social Stratification

Social Stratification is the stratification of society into hierarchies and it is classified on the basis of access to resources and amenities. The accessibility or its absence thereof can be attributed to the level of integration and responsiveness to mediums which enhance and improve livelihoods. Marginalization from the resources can be a result of social exclusion thereafter hindering all round development and improvement of livelihood of groups. Categories such as scheduled tribes, scheduled castes primitive tribal group, legally released bonded labour and manual scavengers and other backward classes are recognised as socially excluded categories. With the aim of integrating these categories into the mainstream development trajectory many schemes and projects are targeted at these groups.

Andhra Pradesh has fifty nine (59) notified Scheduled Castes (SC) and thirty four (34) notified Scheduled Tribes (ST) with two (02) additions after 2001 in the census 2011 data. The number of primitive tribal group in Andhra Pradesh stands at 46,791 and legally released bonded labour at 512 and number of manual scavengers at 388. For the purpose of the study the data on Scheduled Caste (SC) and Scheduled Tribe (ST) population has been analysed. The tables below depict the representation of Scheduled Castes and Scheduled tribes in the District, Mandal and Village levels.

Table 5-32: Scheduled Caste and Scheduled Tribe Population in the District

District	Total Population		SC Population		Decadal Growth (%)	ST Population		Decadal Growth (%)
	2001	2011	2001	2011		2001	2011	
Anantapur	3,640,478	4,081,148	514,896 (14%)	583,135 (14%)	13.2	127,161 (3%)	154,127 (3.7%)	21.2

Source: 2001 / 2011 Census Data

The Scheduled caste and Scheduled Tribes comprise 18 % of the total population of the district. The increase in the number of scheduled tribe population can be attributed to two additions to the notified scheduled tribes in the state. The decadal growth rate between 2001 and 2011 shows the population of Scheduled Caste (SC) has increased at 13.2% and Scheduled Tribe(ST) at 21.2%.

Table 5-33: Scheduled Caste and Scheduled Tribe Population in Mandals

District	Mandals	Total Population		SC Population		Decadal Growth (%)	ST Population		Decadal Growth (%)
		2001	2011	2001	2011		2001	2011	
Anantapur	Kambadur	46740	50799	11147 (23.8%)	12286 (24%)	10.2	2992 (6%)	3232 (6%)	8
	Kundurpi	48205	53180	8287 (17%)	9242 (19%)	11.5	383 (0.79%)	433 (0.81%)	13
	Kalyandurg	81086	89879	11715 (14%)	13322 (14.8%)	13.7	3268 (4%)	3844 (4%)	17.6

Source: 2001 / 2011 Census Data

Amongst the Mandals, Kambadur has the highest number of Scheduled Caste population amounting to over 20% of the total population, Kalyandurg has shown the highest decadal population growth rate of Scheduled Castes (SC) at 13.7% and Scheduled Tribe (ST) at 17.6%.The percentage of Scheduled Tribe(ST) Population in relation to the total population is negligible in all three mandals.

Table 5-34: Scheduled Tribe and Scheduled Caste Population in Project Area Villages

Mandals	Villages	Total Population		SC Population		Decadal Growth (%)	ST Population		Decadal Growth (%)
		2001	2011	2001	2011		2001	2011	
Kambaduru	Thimmapuram	6269	5833	2128 (33.9%)	1858 (31.8%)	-12.6%	346 (5.5%)	332 (5.6%)	4.04
	Mulakanuru	4874	5622	1316 (27%)	1475 (26.2%)	12%	106 (2%)	110 (1.9%)	3.7
	Pallur	5418	5877	1293 (23.8%)	1441 (24.5%)	11.%	794 (14.6%)	847 (14%)	6.6
Kundurpi	S. Mallapuram	548	644	81 (14.7%)	97 (15%)	19.7%	271 (49%)	297 (46%)	9.5
	Kariganipalle	4350	4749	942 (21.6%)	1011 (21.2%)	7%	26 (0.59%)	43 (0.90%)	65
	Yenumaladoddi	5219	6190	942 (18%)	980 (14.1%)	4%	10 (0.19%)	30 (0.48%)	200
Kalyandurg	Duradakunta	2278	2345	440 (19%)	429 (18.8%)	-2.5%	15 (0.65)	0	-
	Palavoy	5139	5517	951 (18.5%)	1007 (18%)	(5.8%)	228 (4%)	182 (3%)	-20

Source: 2001 / 2011 Census Data

The data represented above shows that there is a sizeable population of Scheduled Castes (SC) in all villages however the Scheduled Tribe (ST) population is marginal in relation to the total population. The Scheduled Tribe population is significant in S. Mallapuram village which comprises over 40% of the village population. The

substantial decadal growth in Scheduled Tribe Population in Yenumaladoddi and Kariganipalle may be attributed to two new additions to the Scheduled Tribe list.

5.3.6.4 Religious demography

The religious demography of the district has been detailed below:

Table 5-35: Religious Demography of Anantapur District

District	Major Religion	Hindu	Muslim	Christian	Sikh	Buddhist	Jain	Other religions	Not Stated
Anantapur	Hinduism	88.20%	10.87 %	0.50%	0.02%	0.01%	0.03%	0.01 %	0.36%

Source: http://www.census2011.co.in/data/religion/state/28-andhra-pradesh.html

The data above reflects that Anantapur district predominantly practices Hinduism with almost 88.2% of the population following this religion. Anantapur district is famous for the presence of the second largest ISKCON temple in the country and also is renowned all over the world for being the home of the famous spiritual guru Sri Sathya Sai Baba in Puttaparthi sub-district. Therefore Anantapur district is a popular religious destination.

5.3.6.5 Social economic status

The state economy, as measured by growth in the real Gross State Domestic Product (GSDP) has been witnessing a strong growth phase since 2004-05. Between 2005-06 and 2007-08, while the country's economy grew at an impressive rate of 8.02%, the performance of the state economy was even more impressive with the average growth of 8.37%. The advance estimates represent a growth rate of 5.29% during 2012-13. The Per Capita Income (PCI) at constant (2004-05) prices, has also gone up from INR 42,186 in 2012-13 to INR 44,481 in 2013-14, a growth rate of 5.4%[4] . In order to assess the income level of the state Below Poverty Line (BPL) is used by the Government of India as an economic benchmark and a poverty threshold to indicate economic disadvantage and to identify individual and households that are in need of government assistance which is provided through especially designed poverty alleviation schemes. The state has also shown a significant reduction in the percentage of people living below poverty line from 29.9% in 2004-05 to 9.2 %in 2011-12[5].

However, it also reflects a paradox as Anantapur district it is one of the poorest districts in the country. As it falls in the rain-shadow region of Andhra Pradesh receiving 522 mm rainfall annually, recurring droughts are a common phenomenon in this district. As a result of which it has been recorded to have the highest number of farmer suicides in the country. It has been identified by the Government of India for implementation of Drought Prone Alleviation Programme and Desert Prone Programme in order to mitigate the crisis. These programmes are aimed at developing the drought prone area with an objective of drought proofing by taking up of soil land moisture conservation, water harvesting structures, afforestation and horticulture programmes on a comprehensive micro watershed basis.

5.3.6.6 Literacy level

For the purpose of measurement of literacy level in census, any person aged seven years or above, who can both read and write any Indian language with understanding, is considered to be a literate person. The literacy level of a country and states therein reflects and indicates the socio economic growth of the country. Higher literacy levels indicate higher productivity levels and greater contribution of its citizens.

The literacy level of Anantapur District is reflected in **Figure 5-22**:

[4] Socio-Economic Survey 2013-14, Planning Department, Govt. of Andhra Pradesh (http://www.aponline.gov.in/apportal/Downloads/Socio_Economic_Survey_Book_let.pdf)
[5] Review of Expert Group to Review the Methodology for Estimation of Poverty (2009) Planning Commission, Government of India; Press Note on Poverty Estimates, 2011 – 12 (2013) Planning Commission, Government of India; PRS.

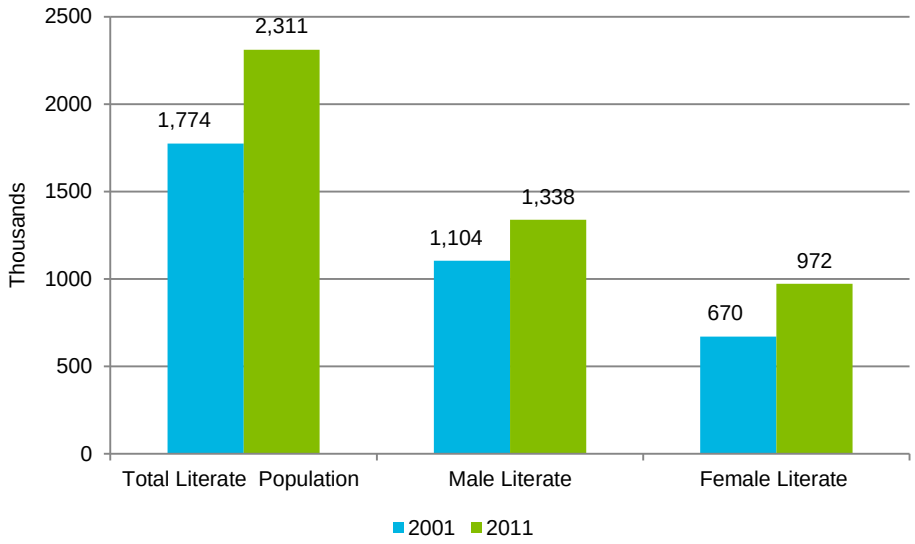


Figure 5-22: Literacy level in the District

The chart above depicts that the literacy level has shown an increasing trend with 30% increase in the total literate population from 2001 to 2011. It also shows a remarkable 45 % increase in female literacy.

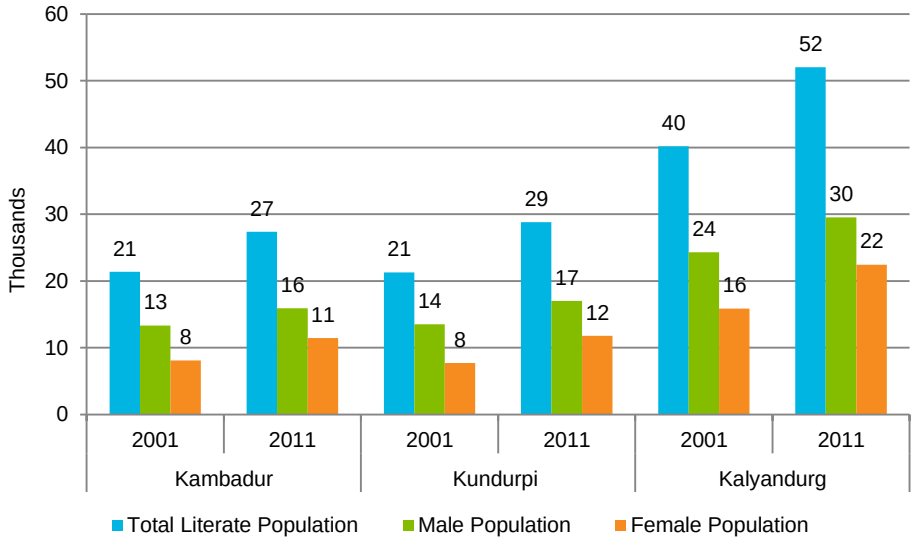


Figure 5-23: Literacy Levels in Mandals

The chart above demonstrates that Kalyandurg Mandal at 57 % has the highest literate population amongst the project villages. All mandals reflect an above 40% literate female population with Kalyandurg at 43.17 % followed by Kambadur at 41.82% and Kundurpi at 40.89%

The literacy level of the eight (08) project villages has been demonstrated below:

Table 5-36: Literacy Level in Project Area Villages

Mandal	Village	Literate Population 2001			Literate Population 2011			Decadel Growth in %
		Total Literate Population	Male Literate Population	Female Literate Population	Total Literate Population	Male Literate Population	Female Literate Population	
Kambadur	Thimmapuram	3423	2131 (62%)	1292 (37.7%)	3393	1890 (55.7%)	1503 (44%)	-0.87
	Mulakanur	1801	1158 (64%)	643 35.7%	2781	1634 (58.7%)	1147 (41.2%)	54
	Pallur	2349	1473	876 (37%)	3041	1766	1275	29

Mandal	Village	Literate Population 2001			Literate Population 2011			Decadel Growth in %
		Total Literate Population	Male Literate Population	Female Literate Population	Total Literate Population	Male Literate Population	Female Literate Population	
			(62.7%)			(58%)	(41.9%)	
Kundurpi	S. Mallapuram	289	151 (52%)	138 (47.7%)	340	192 (56%)	148 (43.5%)	18
	Kariganipalle	1992	1271 (63.8%)	721 (36%))	2718	1632 (60%)	1086 (39.9%)	36
	Yenumaladoddi	2235	1417 (63%)	818 (36.5%)	2840	1702 (59.9%)	1138 (40%)	27
Kalyandurg	Duradakunta	1073	657 (61%)	416 (38.7%))	1398	775 (55%)	623 (44.5%)	30
	Palavoy	2382	1502 (63%)	880 (36.9%)	2952	1767 (59.8%)	1185 (40%)	27

Source: 2001 and 2011 Census Data

From the above table, it can inferred that there has been a higher decadal growth in the literacy level at Mulakanur village from 1801 to 2781 at 54% growth. The table reflects that the highest literate female population amongst the villages is in Duradakunta village at 44.5%. Thimmapuram village however, has shown a negative decadal growth rate of literacy level at -0.87%.

5.3.6.7 Landuse pattern

Considerable variations are found in the general land use pattern because of landform diversities and rainfall in the study region. There is a need to shift from the generalities and study the particularities in order to help in better future planning of the study area. Anantapur district with geographical area of 1,91,30,00 hectares has 19, 69, 78 hectares of area covered with forests.15,01,40 hectares is land that is used for non-agricultural purposes and 5848 hectares is used for pastures and grazing lands. The rest of the land comprises of 16, 64, 25 hectares of barren and uncultivable land and 4, 85, 33 of culturable waste land[6].

The details of the land use pattern of the villages have been provided below:

Table 5-37: Land Use Pattern of the Project Area Villages

Village name	Mandal	Total Land Area (in ha)	Forest Land (in ha)	Total Irrigated Land(in ha)	Total unirrigated Land (in ha)	Culturable Waste land (in ha)	Area not available for cultivation (in ha)
Thimmapuram	Kambadur	3999	0.00	80.00	2099.00	271.89	524.93
Mulakanur		4377	510.12	80.96	2580.00	180.10	1025.82
Pallur		6339	0.00	190.27	4552.71	161.57	1434.45
S.Mallapuram	Kundurpi	401	0.00	32.80	285.00	31.80	51.40
Kariganipalle		2461	330.40	76.00	1724.10	15.00	315.50
Yenumaladoddi		3615	369.60	88.60	2865.00	54.28	237.52
Duradakanta	Kalyandurg	305	0.00	27.13	250.07	0.00	27.80
Palavoy		3243	98.64	99.19	2644.36	0.00	400.81

The table above shows that in all the villages, most of the land holdings used for agriculture is basically dependent upon rainfall. The irrigated land areas are minimal as compared to areas dependent upon rain fed cultivation.

[6] Statistical Abstract of Andhra Pradesh 2015

5.3.6.8 Workplace participation

The workforce participation rate is defined as the percentage of total workers (marginal and main) as compared to the total population.

According to the Census 2011 Data, Anantapur District has 203, 61, 66 productive individuals. The workforce comprises of 120, 85, 44 males and 82, 76, 22 females. There has been a 1.7 % decadal growth of female participation in the workforce from 70, 20, and 80 in the year 2001 to 82, 76, 22 in the year 2011.

The details of the workforce participation at the Mandal levels are given below:

Table 5-38: Workforce Participation at Mandal Level

	Working Population 2001			Working Population 2011		
Mandals	Total Working Population	Male Working Population	Female Working Population	Total Working Population	Male Working Population	Female Working Population
Kambadur	24583	13411	11172 (45.4%)	26729	14984	11745 (43.9%)
Kundurpi	25928	14008	11920 (47%)	30096	16154	13942 (46.3%)
Kalyandurg	37795	23050	14745 (39.01%)	45742	26684	19058 (41.6%)

Source: 2001 and 2011 Census Data

It can be noted in the above table that all mandals have seen considerable growth in the number of total working population. Kalyandurg has the highest increase in the number of total working population from 37795 in the year 2001 to 45742 in the year 2011 indicating a 21 % increase. The trend in all the mandals depicts that there is above forty 40 % involvement of women in the workforce.

The workforce can further be segregated into Main and Marginal workers. Main Workers are those workers who have been engaged in an economically productive activities for more than one hundred eighty three (183) days and Marginal workers are those workers who have been engaged in any economically productive activity for less than one hundred eighty three days (183) days .The table below represents the number of Main and Marginal workers in the districts:

Table 5-39: Main and Marginal Workforce Participation in Mandals

Mandals	Total Working Population	Main Workers Population	Marginal Workers Population
Kambadur	24583	19766 (80%)	6963
Kundurpi	25928	25540 (98%)	4556
Kalyandurg	37795	34747 (91%)	10995

Source: 2011 Census Data

The data represented above indicates that the majority of the working population falls under the main working population. The main workers population is the highest in Kundurpi Mandal at 98% followed by Kalyandurg at 91 % and Kambadur at 80%.

5.3.6.9 Existing village amenities

The presence and accessibility to certain basic infrastructure facilities and amenities is a critical index of a country's economic and social growth. The absence of basic amenities such as educational and health facilities as well as reliable transportation and communication facilities acts as a major obstacle to growth and economic vitality. The section below elaborates on the presence or absence of important amenities in the villages.

Educational Facilities

Thimmapuram village has schools catering upto the secondary level with three (03) primary schools, two(02) middle schools and two(02) secondary schools in the village. Mulakanuru village has schools up to the middle school level with four (04) primary schools and one (01) middle school. The nearest secondary school is over ten

kilometres. Pallur village has eight (08) primary schools and the nearest middle school and above is over three (03) kilometres away. S. Mallapuram has one (01) primary school in the village after which they have to travel over five kilometres to the nearest middle school. Kariganipalle has two (02) primary schools and one (01) middle school in the area .Yenumaladoddi has four (04) primary schools and one (01) each of middle and secondary school in the village. Duradakanta has one (01) school each upto the secondary level. Palavoy village has six(06)primary schools, one(01)middle school and one (01) secondary school. Duradakantaand Palavoy have one(01) adult literary centre each. Students wishing to pursue higher education from all the project area villages need to travel for over ten (10) kilometres.

Healthcare Facilities

There are nineteen (19) general hospitals and two (2) allied hospitals in Anantapur district. There is however no specialised treatment centres such as for tuberculosis, women and child care centre etc. in the district. All villages in the study area have a Primary Health-Sub Centre (PHSC) with the exception of S. Mallapuram village with the nearest Primary Health Centre(PHC) situated at over a distance of ten (10) kilometres.

Road and Transport facilities

All the villages in the study area have bus service facilities connecting the villages in the project area. The population have to travel for more than ten (10) kilometres to reach the nearest railway station at Anantapur which is approximately 90 km from the project area.

Communication and Banking Facilities

According to the MSME (2011) Brief Industrial Profile of the district there are 67,167 telephone connections and 943 post offices in the district. Post Offices are situated in all villages in the study area with the exception of S. Mallapuram village in Kundurpi Mandal. The nearest post office to S. Mallapuram is located at a distance of over five (5) kilometres.

Thimmapuram and Duradakanta villages are the only villages in the project area that have commercial banking facilities. According to the village data 2001, there is no presence of cooperative banks or credit societies in the study area villages. To avail of banking facilities the villagers have to travel a distance of over three (3) kilometres.

Drinking Water and Electricity Supply Facilities

According to the Village Data 2001, all villages in the study area have access to water supply which is provided through pipelines and hand pumps supplied by the Panchayat. Electricity supply is present in all the study area villages.

5.3.6.10 Development Schemes and NGOs

The Government of Andhra Pradesh has initiated a number of social welfare schemes for the backward sections of the society. The schemes initiated refer to Pavala Vaddi (interest subsidy to self-help groups), National Old Age Pension Scheme, Swarnajayanti Grama Swarojgar Yojana (SGSY) (poverty eradication through self-help groups), schemes for tribal welfare etc. to name a few.

Rural Development Trust, a Non-Governmental Organisation (NGO) working towards the development of marginalized and underprivileged sections of SC, ST, Backward Caste and persons with disability has been implementing programmes in the project area. Their service relates to providing assistance in terms of accessing government resources/services, welfare and development initiatives, health program, housing program, livelihood development program for women, education program and cultural program.

5.3.7 Traffic data

Road traffic survey was carried out for the project site at two locations (to and fro) for 24 hours during the monitoring period so as to assess existing traffic characteristics with respect to type, category and number of vehicles plying on the road connecting the project site. The details of the traffic monitoring location have been provided in the **Table 5-40**.

Table 5-40: Traffic Monitoring Locations

S.No	Traffic Monitoring Location	Location ID	Geographical Coordinates	Date of Monitoring
1.	Anantapuram to Kalyandurgam	TM1	14.374164°, 77.219588°	16/12/2016
2.	Kalyandurgam to Anantapuram	TM2		16/12/2016
3.	Kalyandurgam to Khamadur	TM3	14.535775°, 77.115232°	17/12/2016
4.	Khamadur to Kalyandurgam	TM4		17/12/2016

Traffic count has been subdivided into five categories/classes viz.:

- Two Wheelers;
- Three Wheelers;
- Light Commercial Vehicles (LCV);
- Heavy Commercial Vehicles (HCV);
- Non-Motor Vehicle

Since the vehicles are of different types, a factor needs to be accounted for each of them in order to express them at par in single unit terms. The factors, commonly known as Passenger Car Unit (PCU), are shown in table below:

Table 5-41: Passenger Car Unit (PCU) factors

Vehicle Type	PCU Factor
Two Wheelers	0.75
Three Wheelers	1.2
Light Commercial Vehicles (LCV)	1.0
Heavy Commercial Vehicles (HCV)	3.7
Non-Motor Vehicle	0.5

Source: The Indian Roads Congress Code – IRC 109-1990

The traffic volume counts have been tabulated in the following table:

Time	TM1					TM2				
	Two Wheelers	Three Wheelers	LCVs	HCVs	Non Motor Vehicle	Two Wheelers	Three Wheelers	LCVs	HCVs	Non Motor Vehicle
06:00-07:00	3.75	3.6	4	48.1	0.5	3	1.2	3	37	0
07:00 - 08:00	9	2.4	10	55.5	0	6.75	1.2	8	29.6	0
08:00 - 09:00	24	4.8	16	70.3	0	10.5	1.2	13	59.2	0
09:00 - 10:00	20.25	2.4	12	77.7	0	9	2.4	14	62.9	0.5
10:00 - 11:00	15.75	1.2	13	66.6	0	12	0	18	51.8	0
11:00 - 12:00	11.25	0	11	48.1	0	9	0	16	40.7	0.5
12:00 - 13:00	13.5	1.2	10	37	0	8.25	1.2	12	33.3	0
13:00 - 14:00	12.75	1.2	14	62.9	0.5	9.75	2.4	11	44.4	0
14:00 - 15:00	9	1.2	10	70.3	0	12	1.2	13	48.1	0
15:00 - 16:00	16.5	1.2	12	66.6	0.5	18	0	16	51.8	0.5
16:00 - 17:00	21	2.4	18	70.3	0.5	12.75	1.2	22	59.2	0
17:00 - 18:00	14.25	2.4	15	51.8	1	15.75	0	13	74	0.5

Time	TM1					TM2				
	Two Wheelers	Three Wheelers	LCVs	HCVs	Non Motor Vehicle	Two Wheelers	Three Wheelers	LCVs	HCVs	Non Motor Vehicle
18:00 - 19:00	10.5	1.2	12	44.4	0	9	2.4	9	66.6	0
19:00 - 20:00	7.5	1.2	8	37	0	5.25	1.2	11	44.4	0
20:00 - 21:00	9	2.4	7	66.6	0	4.5	2.4	9	37	0
21:00 - 22:00	5.25	0	9	55.5	0	3	0	6	40.7	0
22:00 - 23:00	2.25	0	6	44.4	0	1.5	0	4	51.8	0
23:00 - 00:00	1.5	0	3	48.1	0	0	0	0	25.9	0
00:00 - 01:00	0.75	0	2	40.7	0	0	0	1	29.6	0
01:00 - 02:00	0	0	0	37	0	0	0	1	22.2	0
02:00 - 03:00	0	0	0	25.9	0	0	0	0	11.1	0
03:00 - 04:00	0	0	0	33.3	0	0	0	0	7.4	0
04:00 - 05:00	0	2.4	0	18.5	0	0	0	1	14.8	0
05:00 - 06:00	0.75	1.2	1	37	0	2.25	1.2	2	25.9	0

Source: Netel Lab Results, December 2016

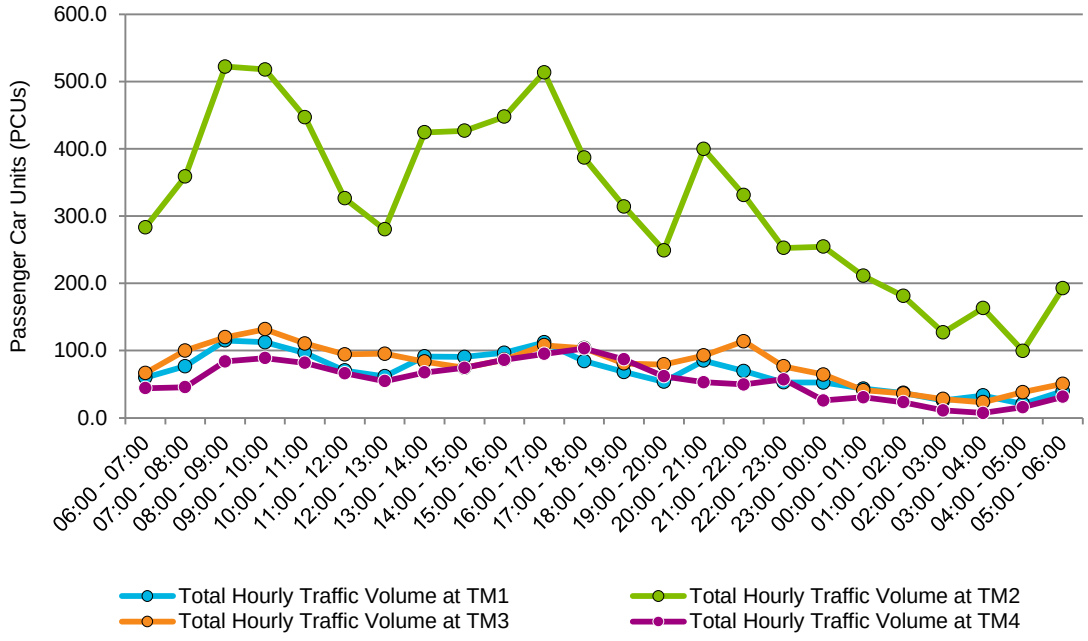


Figure 5-24: Total Hourly Traffic Volume

5.3.7.1 Inference

The total hourly traffic volume indicates that the peak hour traffic is between 08:00 am to 11:00 am in the morning with slight increase around 03:00 pm to 05:00 pm and in the evening at around 08:00 pm to 11:00 pm. This trend is visible at both the sampling locations in both ways. Relatively high traffic with large number of vehicles is observed at TM2 i.e., Kalyandurgam towards Anantapur route. The composition of vehicles at this stretch indicates that out of the total number of vehicles observed, 79.2% of vehicles are Heavy Commercial Vehicles and about 18.9% are Three Wheelers.

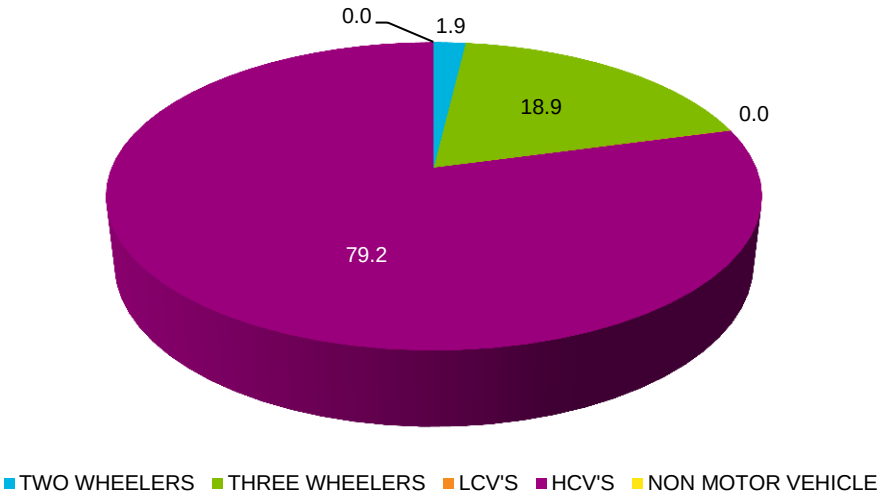


Figure 5-25: Vehicle Composition at TM2

6. Stakeholder engagement and public consultation

This section of the report presents detail on stakeholder identification and consultation undertaken for the project.

6.1 Introduction

Stakeholder consultations are an important process through which a two way dialogue is created between the project proponent and the stakeholders. Stakeholders are persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project and/ or the ability to influence its outcome, either positively or negatively.

A reconnaissance survey and site survey was undertaken to the study area from 14th and 15th October 2016. The following schedule was adhered to while undertaking the survey and interviews.

Table 6-1: Schedule for the Socio-Economic Survey and Stakeholder Consultation

Sno.	Place Visited	Tasks	Date
1	Kambaduru	Interview with VUBPL's Site Representative and Hero Future Energies (HFE) Representatives	14th October 2016
2	Kambaduru	Interview with Land Sellers for the Project	14th October 2016
3	Thimmapuram	Interview with Mandal Parishad Territorial Constituency Representative	14th October 2016
4	S. Mallapuram	Interview with Land Sellers for the Project	15th October 2016
5	Thimmapuram	Interview with Land Sellers for the Project	15th October 2016

Source: AECOM, Site Survey

6.2 Stakeholder consultation objectives and scope

The stakeholders for the project were prioritized by identifying their direct and indirect influence and interest level with the project. The key stakeholders that were consulted as part of the study included the following,

- Land Owners who sold their land for the project and its associated facilities
- Representative of Mandal Parishad Territorial Constituency
- Site Representatives of VUBPL and HFE Representatives

6.2.1 Methodology adopted

The stakeholder consultation comprised primarily of a socio-economic survey and consultation initiated by AECOM professionals. The consultations revolved around getting information relating to the socio-economic status of the resident population within the study area, the concerns/issues of the local population and benefits/ expectations from the project. The findings of the consultations are based mainly on the use of participatory methods like key informant interviews and natural interviews. These methods give an in depth and intensity to the discussion and incorporates the local population point of view within a short duration of time.

The process of stakeholder consultation included:

- identification of the relevant stakeholders including all those individuals, groups and organizations potentially influenced by or interested in the project;
- imparting information about the project and its potential impacts on their lives in local and simple language;
- verifying if the area proposed for the project does not infringe the formal or informal rights of the local population;
- recording of their concerns and aspirations through discussions; and
- responding to their queries in a neutral manner.

A questionnaire with a list of open-ended questions was used to initiate the discussion process. A total of 10 land owners from the villages within the study area were interviewed along with the Kambaduru Mandal Representative Security Personnel. In addition, the site representative from VUBPL and HFE representatives

were also contacted to enhance the overall understanding of the project and its implications on the surrounding areas.

A sample of the questionnaire used for the consultation purposes has been attached as **Appendix B**.

6.3 Consultation undertaken with various stakeholders

The section below details excerpts of the consultations undertaken with various stakeholders during the site survey.

6.3.1 Views expressed by Land Owners

A sample size of 10 land owners were consulted to assess the land procurement procedure adopted by the Project Proponent and verify whether the conditions of 'willing buyer/willing seller' were adhered to during the land purchase process. The consultations undertaken with the land owners have been presented in two separate sections in the following, one on general information of the landowners and second on the perception of the land owners on the Project.

General Information about the Landowners

Details of the general information gathered from the landowners during the site survey have been presented in **Table 6-2**.

Perception about the Project

Information on the perception of the Project gathered during the consultation process with the landowners has been broadly provided in **Table 6-3**.

Indigenous Population

Based on the consultations conducted with the ten (10) landowners, it was noted that there are two (02) of the landowners belonged to the Scheduled Tribe (ST) category (Sugalis Tribe). As reported during consultations held, the members of these households do not follow any distinct cultural traits or beliefs and have mainstreamed themselves into the general society. They are legal titleholders of the land parcels owned by them and are engaged as in agriculture, similar to the occupational pattern of the mainstream general society.

As the project area does not fall under the scheduled area, the landowners belonging to the ST category are legal titleholders of their land. As reported during the consultation process, the ST category landowners provided their consent voluntarily to sell their land for the proposed project without any force and have received payments in full in lieu of the land sold.

Cultural Heritage

It was observed during the site survey, that a small temple dedicated to Goddess Durga located in the south west direction of KA 16 turbine location, at an approximate distance of 40 to 50 m in Mulukunoor village was present. In addition, a grave yard area was present towards the south east direction of KA 11 turbine location in S. Mallapuram village. Both these sites are outside the boundary of the turbine and access roads and have not been affected by the development of the turbine and associated facilities. Moreover, the access to the sites by the community has not been obstructed by the project activities currently being undertaken.

From the table above it can be inferred that all the landowners consulted are dependent upon rainfed agriculture for their livelihood. The main crops cultivated are groundnut, tomato, green chillies and toor dal. Most of the landowners consulted own land parcels between 5 to 10 acres and more. On an average most of landowners have sold land with an area of 3.5 acres for the project.

During consultations it was reported that the minimum income of landowner ranged between INR 1, 00, 000 to INR 5, 00, 000 per annum if there was a productive harvest. It was informed that rainfall over the years has shown a decreasing trend which has in turn affected the agriculture activities in the area to a large extent. Due to this reason, the landowners were interested in selling their land parcels for the project.

Table 6-2: Details of General Information provided by Land Owners

Name of the Interviewee	WTG Location No.	Land Owner Name	Relationship of Landowner with Interviewee	Village	Total Land owned by Land Owners (in acres & gunta)	Total Area Sold for the Project (in acres & gunta)	Land Status prior to sale of land	Occupation of Landowner
Chidananda Nayak	KA-06	Sugali Thavrenayak	Son	S.Mallapuram	8	3.5	Agriculture	Cultivator of Groundnut, Tomato and Toor Dal
Ram Murthy	KA-07	Ram Murthy	Self	S.Mallapuram	7	3.5	Agriculture	Cultivator of Groundnut, Tomato, Toor Dal and Green Chillies
Vaddi Devandra	KA-08	Sugali Chinna Lokenaik & Vaddi Gangappa	Son of Vaddi Gangappa	S.Mallapuram	8	3.5	Agriculture	Cultivator of Groundnut and Tomato
Gauri Srinivasan	KA-09	Gowni Mallana	Son	Thimmapuram	15	3.5	Agriculture	Cultivator of Groundnut and Flowers
Marappa	KA-10	Chakali Pathappa @ Pathanna & C. Chiranjeevi & C. Vinod & Chakali Marappa @ Marenna & Chakali Basavaraju & Chakali Suddappa & Yannappa & Nagendra & Chakala Nagamani & C. Prakesh & Maranna & Chakali Hanumanthappa	Self	Thimmapuram	6	3.24	Agriculture	Cultivator of Groundnut and Agriculture Labour
Narayana Nayak	KA-11	Swugali Narayana Nayak & Sugali Bojyya Nayak	Self	S.Mallapuram	5	3.5	Agriculture	Cultivator of Groundnut
Sriramru	KA-13	Badapalleppa @ Boya Badapalleppa & Chinna Badapalleppa @ Sanna Badapalleppa & Sriramulu @ Boya Sriramula & Boya Konda Bommanna	Self	Enumuladoddi	20	3.5	Agriculture	Cultivator of Groundnut and Onion
A.Thimaa	KA-15	Avula Earanna & Avula Thimma	Self	Mulaknur	8	4	Agriculture	Cultivator of Groundnut
Venkateshwar Narayanappa	KA-16	Danda Narayanappa & Danda Govindappa & Danda Easwarappa & Danda Venkatesulu & Sakamma & Danda Syamalamma & D. Laxmi Devi & Danda Laksmi Devi	Brother of Danda Narayanappa	Mulaknur	5	3.5	Agriculture	Cultivator of Groundnut and Tomato
Ravindra	KA-24	Ramakrishna & N.Lingamaiah Chowdary & Venkatesulu @ Nadendla Venkatesulu	Son of Ramakrishna	Palluru	20	3.75	Agriculture	Cultivator of Groundnut, Tomato, Toor dal and Green Chillies.

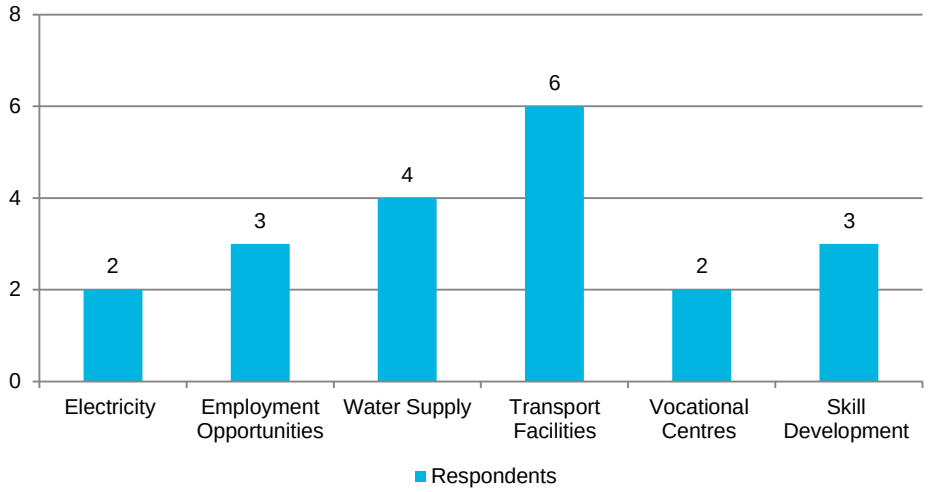
Table 6-3: Details on the Perception of the Project

Sno.	Key Questions	Broad Replies received from Interviewees
1	Awareness of the Project	All respondents consulted affirmed that they were aware about the project.
2	How was the land prices determined between the project proponent and landowners?	All respondents were uniform in their replies that land prices were determined on the basis of one to one negotiation with the Land Aggregator used by VUBPL.
3	Was negotiation of the land prices undertaken? Was it above the prevailing market value? If so, how much?	All respondents replied in the affirmative. They were unison in their replies that the land was sold above the market value. The prevailing market value of the land as informed by Project Proponent's Land Team was INR 50,000-60,000 per acre. The land prices determined were three (03) to four (04) times higher than the prevailing market value.
4	Was the payment received adequate?	All respondents confirmed in the affirmative that they are satisfied with the payment received.
5	Has the entire amount transferred to your bank account?	All respondents consulted were in the affirmative that they received the entire amount.
6	What was the payment (income received from sale of land) used for?	The replies were cumulatively provided by the respondents i.e. one respondent might have provided two to three options and not strictly just one option, • Two (02) respondents replied that they used the payment for clearing impending debts. • Five (05) respondents replied that they used the money for the purchase of new parcels of land in adjoining villages. • Three (03) respondents replied that they used the payment in a bore well. • One (01) respondent replied that he has not yet utilised the money but were planning to purchase new parcels of land and has saved some amount as a Fixed Deposit. • One (01) respondent replied that he has purchased a two wheeler with the amount received. • One (01) respondent replied that he has used the money in purchasing goats.
7	Has the land prices increased in the area with the coming of the project?	• A total of seven (07) respondents replied that the land prices have definitely increased in the area. • A total of three (03) respondents replied that there was no difference in the land prices.
8	Concerns/Issues relating to the Project	All respondents replied that they did not have any issues/concerns relating to the project.
9	Benefit/Expectation from the Project	The replies were cumulatively provided by the respondents i.e. one respondent might have provided two to three options and not strictly just one option, • One (01) respondent replied that he expected that the supply of electricity would improve in the area with the project being set up in the vicinity of their village. • Two (02) respondents were of the opinion that employment opportunities would increase in the area. • Six (06) respondents were of the opinion that road conditions in the area would improve with the operation of the project. • Four (04) respondents replied that they expected the water supply in the area would improve with more projects of the similar nature coming to the area. • Two (02) respondent s were of the opinion that skill development training in modern farming methods can be initiated by the Project Proponent so that productivity in the area can increase in turn benefitting the general population.

Source: Information collected during Site survey

Need Assessment

A need assessment was undertaken amongst the respondents to highlight the expectations of the local population in the study area from the proposed project proponent. These views were collated in order to comprehend the need of the locals so that prioritising of welfare activities by the project proponents can be better chalked out in the future in case of implementation of Corporate Social Responsibility (CSR) activities. The detail of the areas wherein utmost priority needs to be given is provided in **Figure 6-1**.



Source: Information collected during Site survey

Figure 6-1: Details of Need Assessment obtained during the Consultation

From the figure above, the following areas had been identified amongst the respondents which require utmost priority in terms of activities to be initiated for social development:

- Transport facilities in terms of bus services have been mentioned as the main area which needs utmost attention due to lack of transport services in the area. The respondents were of the opinion that with road improvement in the area due to the project the transport services would also improve.
- Water supply has been named as the main area which needs utmost attention due to the insufficient hours of water supply that is currently being provided by the Gram Panchayat. It was mentioned by the respondents that the quality of water was also poor and a bit salty. Moreover, the respondents who responded on owning a bore well also mentioned that the water level has been diminishing over the years due to erratic rainfall in the area.
- Electricity supply has also been named as an area which needs priority. The respondents were of the opinion that with coming of the project to the area, the electricity supply would improve.
- The respondents were of the opinion that employment opportunities would improve in the area and felt that the Project would up avenues for generation of employment for the local population.
- Skill development in terms of imparting of modern technology used in agriculture and vocational centres for women providing courses such as tailoring, animal care, home cooked snacks etc. would help the local population in the area to a large extent.

6.3.2 Views expressed by Mandal Parishad Territorial Constituency Representative

The Mandal Parishad Territorial Constituency Representative was contacted and consulted during the site survey to gather his view regarding the socio-economic of the villages under his jurisdiction and his perception on the project. The details of his responses have been provided in **Table 6-4**.

Table 6-4: Details provided by Mandal Parishad Territorial Constituency Representative

Sno.	Questions	Replies
1	Which villages come under the jurisdiction of the Mandal Parishad Territorial Constituency?	Four villages come under the Mandal Parishad Territorial Constituency, • Thimmapuram • Jakkireddi Palli • Obugonipalli • Yerrabonda
2	What is the main occupation pattern of the location population in the area?	The population in the area is mainly dependent upon rainfed agriculture. Besides this, agricultural labourer as an occupation is also quite prominent in the area.
3	Are you aware of the project and about the land purchase for the project in the area?	The respondent is aware of the development of the project and is informed that land parcels have been sold for the project and

Sno.	Questions	Replies
		its associated facilities through the process of negotiation.
4	What was the land use pattern of the area (of land parcels) before it was sold to the project proponent?	It was reported that the land parcels that have been sold for the project was used for agricultural purposes.
5	Was any grazing activities undertaken in the land parcels that have been sold for the purpose of the project?	Reportedly, grazing activities usually takes place in the dry season but not on a frequent basis. The land parcels were primarily used for agricultural purposes.
6	Are all the villages within the constituency have access to educational facilities?	All the four villages have primary and middle schools present.
7	Are all the villages within the constituency have access to health care facilities?	Thimmapuram village has a Government Clinic with a doctor and nurse present. Every Wednesday, a mobile health care service (104) provided by the State Government visits the villages from 9.30 to 5.30 and provides primary health care services to the local population. For any major illness and delivery related aspect, the population either travel to Kalyandurg (30 km) or Anantapur to avail health care facilities available.
8	Are there any Non-Governmental Organisations working in the area?	Rural Development Trust (RDT) has been undertaking development activities in the area in terms of establishment of driving school for rural dropouts, vocational centres for women, discount of crop cultivation and drip irrigation system, assistance in the establishment of women self-help groups in the area and livelihood programs for women, construction of water tanks and housing programs.
9	In your opinion do you think that the land prices have increased in the area due to the coming of the project?	It was reported that there has been considerable increase of land rates in the area due to coming up of the project.
10	Do you anticipate any risks associated with the project's operation?	No risks is anticipated due to the project
11	Any benefit/expectation from the Project	It was reported that employment generation would increase in the area with the project, roads would see an improvement, electricity supply in the area will improve, land value will increase and alternate employment opportunities will increase in the area.

Source: Information collected during Site survey

General Profile (Socio-Economic Status of Women)

To comprehend the existing living pattern of the local population residing across the project area, a look at the socio-economic status of women and the role that women have been playing both at the domestic and economic level needs to be taken into consideration. As the patriarchal values are entrenched in Indian society, women often play a more subordinated and dependent role. Even though they constitute almost half the population, various indicators pertaining to literacy level, labour force participation, mortality rate etc. reveal the dismal status of women to that of men.

According to the UN Gender Development Index, 2014 India ranks 132 out of 187 countries worldwide.[7] As per the 2011 Census data, Andhra Pradesh has a total female population of 4.21 lakh with sex ratio of 993 females to every 1000 males. A total of 52.93% of the female population are literates in the State.

While interacting with the Mandal Representative, information relating to the gender profile in the area was also gathered. It was reported that no government schemes for women have been introduced in any of the Gram Panchayats. The main activities undertaken by women were mostly in the form of engagement of agriculture activities and household chores. As per his opinion, women do not have any access to maternal hospitals in the area and have to travel to Kalyandurg at a distance of 30 km for child delivery related concerns. There are women Self-Help Groups (SHGs) which are prominent in the area. The SHGs usually consist of 20-25 members and funds collected within the SHGs are utilised in the agricultural activities or purchase and sale of cattle for milk and other dairy products. With the assistance received from Rural Development Trust, facilities and services in terms of vocational centres for dropouts, women, agricultural subsidy, self-help group for women, housing facility etc. have been provided for the local population for their upliftment.

[7] http://hdr.undp.org/en/content/table-5-gender-related-development-index-gdi

The representative was of the view that the need of the hour should be development of health care centres, employment opportunities for women and assistance in terms of agricultural know how. In addition, market linkages should be created for vocational centres catering to skills development of women so that the output of their work becomes productive and sustainable in the long run.

6.3.3 Views expressed by Representative of VUBPL and HFE

The Project Proponent's Land Team and Site Representatives were also contacted and an interview was held to gather their viewpoints on the project which has been presented in **Table 6-5**.

Table 6-5: Key Questions and Responses from VUBPL and HFE Representatives

Sno.	Questions	Broad Responses
1	**Land Procurement Process:** • What type of land has been purchased for the project activities? • How has the price for the land purchase determined? • Was the process of land purchase negotiated? • Was all land sellers provided payments equivalent to the prevailing market value? • Has all payments for the land disbursed to the identified 35 land sellers? • Have you obtained No Objection Certificates from the respective Gram Panchayats for the project activities?	• All land shortlisted and procured for the project activities is private agricultural land. • The price for the land purchase was determined based on the prevailing market value. • All land parcels procured for the project were directly negotiated individually by the land aggregators with the land owners. • All land sellers have been provided payments higher than the prevailing market value. • All payments have been disbursed to the identified 35 land sellers. • No Objection Certificates (NOC) from the respective Gram Panchayats is in the process of being obtained for the project activities.
2	**Community Engagement:** • How was the community informed about the proposed project? • Has any prior meeting been undertaken by HFE with the local community? • Was an information disclosure meeting conducted with the local authority?	• The community around the vicinity of the project site has been informally informed about the proposed project. The community are aware of the Site Office premises and the concerned person to contact and are free to get in touch whenever required. • There were no formal meetings conducted by HFE with the local community. • No Objection Certificates from the respective Gram Panchayats is in the process of being obtained for the project activities.
3	**Corporate Social Responsibility (CSR)/Community Development Programme** • Activities undertaken (if any) • CSR Plan for future • Documented Records (if any)	• No CSR or Community Development Programmes have been initiated till date by HFE. • Once the project becomes operational, CSR plans would be developed and activities would be initiated accordingly.
4	**Grievance Redressal Procedure** • Has any formal grievance redressal mechanism been set up by HFE for the community? • Has VUBPL identified persons responsible as contact person for handling grievances?	• Till date no formal grievance redressal mechanism has been set up for the project. However, there are plans for setting one up for the project on the lines of the mechanism developed in the Environment and Social Management System (ESMS). • The identified person from the Community will be the Sarpanch(s) of the Gram Panchayats and from VUBPL it will be the Site Supervisor. However, formal decision on this aspect is yet to be finalised and implemented.

Source: Information collected during Site survey

7. Evaluation of Impacts

7.1 Impact assessment methodology

7.1.1 Introduction

Significance as a concept is at the core of impact identification, prediction, evaluation and decision-making in an ESIA process. This section elaborates the methodology adopted to evaluate the "Significance" of Impacts associated with the project.

For the purpose of this report, "Impact Significance" has been rated as a) ***Negligible***, b) ***Minor***, c) ***Moderate***, and d) ***Major***. The evaluation has been carried out on the basis of Relative / Potential Magnitude of the Impact against Sensitivity of an environment / resource to react to external events. The Criteria for Significance have been primarily adopted and modified from methods established in Canter, L.W., 1996, and Canter L.W. and Canty, G.A., 1993. Subsequent sections present steps involved in evaluating the "Impact Significance" whilst establishing Criteria and Rating for such evaluation.

7.1.2 Approach for Impact assessment

Potential Impacts associated with the project may be ***Direct***, ***Indirect***, ***Induced***, and ***Cumulative*** and defined as below:

a) ***Direct*** impacts result from a direct interaction between the Project activity or related component and resource / receptor;

b) ***Indirect*** impacts result from direct interactions between the Project and its Environment following subsequent interactions within the Environment;

c) ***Induced*** impacts result from other activities (which are not part of the Project) but which occur as a consequence of the Project; and

d) ***Cumulative*** impacts result as a consequence of combined impact on the same resource / receptor from other ongoing developments which are also being affected by Project activities.

Figure 7-1 below presents the methodology flow adopted for evaluating the "Impact Significance" resulting from project related activities.

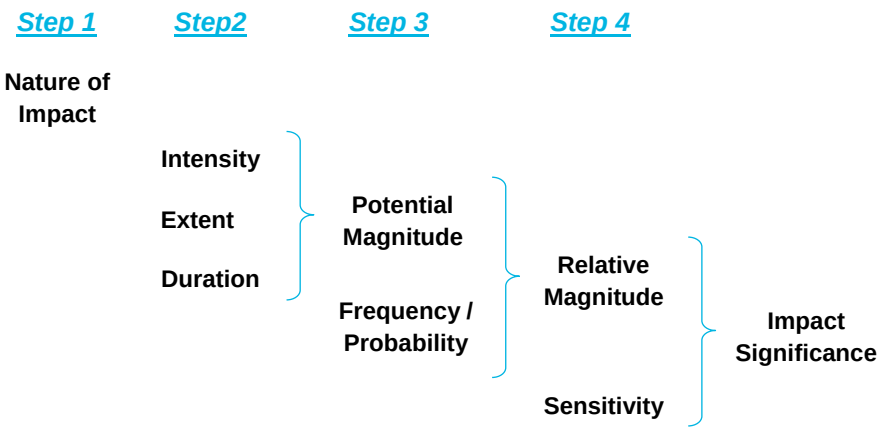


Figure 7-1: Methodology – Evaluation of Impact Significance

Various criteria have been considered to determine the "Impact significance". Criteria presented in **Figure 7-1** have been rated and defined in **Table 7-2**.

Potential Magnitude as a result of project activity is a function of one or more criteria, which include a) ***Intensity***, b) ***Extent*** and, c) ***Duration*** of Impact. ***Magnitude*** of an Impact is also dependent on the ***Frequency*** of occurrence of project associated activities or likelihood i.e. ***Probability*** of any unexpected / unintended events (unplanned incidents such as earthquake and flooding incident). However, this is expressed in relative terms with respect to ***Potential Magnitude*** of any impact that is primarily dictated by parameters such as Intensity, Duration

and Extent of Impact. ***Relative Magnitude*** therefore equals to the potential magnitude weighted by frequency or probability factors. ***Sensitivity*** of environment / resource to react to external events affecting it helps in evaluating the overall Significance of a particular Impact. Definitions of each of the parameters presented in **Figure 7-1** have been outlined in **Table 7-1** and limits / confines of ratings associated with such parameters have been presented in **Table 7-2**. Concluding "Impact Significance" criteria have been outlined in **Table 7-3**.

Table 7-1: Approach used for Impact Evaluation

Step	Criteria and Definition
Step 1: Determining whether the environmental effects are adverse	a) **Nature of Impact:** Nature of Impact is the type of change resulting as consequence of project activity. Activities may either adversely (negatively) affect, (or) cause no change / positively (beneficially) affect environmental / ecological / socio-economic components.
Step 2: Evaluating Potential Magnitude of adverse / beneficial effects of project activity by assessing Extent, Duration, and Intensity of Impact	a) **Extent or Spatial Scale of the Impact:** Extent or Spatial Scale of an impact expresses the spatial influence (geographical extent) of the effects produced by the impact; b) **Duration of the Impact:** Duration of an impact describes the time period during which a component is changed by the impact and also includes the time taken for an Environmental / Social / Ecological component to recover and return to its original or near original state; and c) **Intensity of the Impact:** Intensity of Impact or degree of disturbance to biophysical systems / components expresses the change in the health, functioning and/or role of the system or component as a result of an activity. For the purpose of this project, the "Intensity of Impact" is a change to the baseline condition that may result as a consequence of project activity. This may be either detrimental or positive affect.
Step 3: Determining whether the impact is likely and assessing Relative Magnitude of the Impact. The potential magnitude weighted by frequency or probability factors is the Impact's Relative Magnitude	a) **Frequency of activities causing the impact:** The rate (varying frequencies) at which a particular (planned) project activity is being conducted that results in impacts; and b) **Probability:** Probability relates to unexpected events (for example a traffic accident, or earthquake). The probability that an unplanned event occurs is evaluated on a qualitative scale and provides the degrees of occurrence ranges from "unlikely" to "certain".
Step 4: Determining Significance of Impact by weighing Impact Magnitude along with Sensitivity of Environmental / Ecological / Socio-Economic Component	a) **Sensitivity:** For the purpose of this project, Sensitivity has been defined in three ways. For physical (Environmental components such as water) sensitivity to change in quality will be considered. For resource / receptor that are Ecological (Marine and Terrestrial Ecology) sensitivity towards adapting to an impact and conservation / vulnerability status will be considered. And for Human and Socio-Economic factors the vulnerability of the individual / community / society towards the impact will be considered.

Source: Adopted and modified from Canadian Environmental Assessment Agency, 1992

Criteria as defined in **Table 7-1** have been rated with respect to varying scales of their severity in **Table 7-2**. Severity levels (or) Ratings assigned to Impact Criteria have defined limits. Combinations between Ratings assigned for Impact Criteria are assessed to determine 'Impact Magnitude' and subsequently evaluate overall 'Impact Significance'.

Table 7-2: Ratings of Impact Criteria

Criteria	Rating	Rating definition and limits
Nature of Impact	a) Negative (Adverse Impacts) b) Positive (Beneficial Impacts)	a) If activities associated with project at any stage result in adversely impacting Environmental / Ecological / Socio-Economic components; b) If activities associated with project at any stage result in positively impacting Environmental / Ecological / Socio-Economic components. Impacts that may be considered as benefits.
Extent or Spatial Scale	a) Low (Local spread) b) Medium Spread c) High Spread	a) Impact is restricted within 0.5 km from the project location (Impact spread < 0.5 km); b) Impact is spread beyond 0.5 km and within 2 km from each WTG location (0.5 km < Impact spread < 2 km); c) Impact spread extending beyond 2 km each WTG location (2 km < Impact spread)
Duration	a) Low (Short term) b) Medium (Medium term) c) High (Long term)	a) Impact is likely to last for duration (considered temporary) below one month or less (or) ceases on completion of project associated activity. These impacts are quickly reversible; b) Impact is likely to extend beyond one month and within three months or lasts during the construction stage. These impacts are reversible over time; c) Impact is likely to extend beyond three months and may last throughout the life span of the project. The impact may be permanent in nature or may take considerable time for the Environmental / Ecological component to recover.
Intensity	a) Insignificant b) Low c) Moderate d) Strong	a) Impact negligibly alters the quality, use and integrity of the Environmental, Socio-Economic component / system but component / system continues to function with insignificant to nil affect and maintains original integrity (nil or limited impact). These impacts are quickly reversible; b) Impact alters the quality, use and integrity of the Environmental, Socio-Economic component / system but component / system continues to function in a moderately modified manner and maintains general integrity. These impacts are reversible within short time; c) Impact affects the continued viability of the Environmental, Socio-Economic component / system and the quality, use, integrity and functionality of the component / system is weakened to a considerable extent. Involves medium to high costs of rehabilitation, and remediation and may take considerable time; d) Impact affects the continued viability of the Environmental, Socio-Economic component / system and the quality, use, integrity and functionality of the component / system permanently ceases and the impact is generally irreversible. Rehabilitation and remediation often is not feasible.
Frequency	a) Occasional b) Periodic c) Routine	a) Impact is due to one off or due to intermittent planned activity. Impact is a result of remote or one off activity or time to time / intermittent activity affecting Environmental / Socio-Economic component / system; b) Impact is due to periodic planned activity. Impact is a result periodic activity (for example an activity conducted on a weekly or a monthly basis) affecting Environmental / Socio-Economic component / system; and

Criteria	Rating	Rating definition and limits
		c) Impact is due to continuous planned activity. Impact is a result continuous ongoing (scheduled) activity affecting Environmental / Socio-Economic component / system;
Probability or Likelihood	a) Low b) Medium c) High	a) The chance of the impact occurring is considerably low; b) The chance of the impact occurring is moderately expected; and c) The chance of the impact occurring is either certain or very high i.e. the probability is 1 or close to 1. *Note: Impact is due to unplanned activity is a result of accidental events and causes failure / affects project infrastructure or Environmental / Socio-Economic component / system. This impact is assessed in terms of Risk i.e. taking into account both the consequence of the event and the probability of its occurrence (risk = probability x consequence).This criterion is only triggered in case of unplanned or accidental events (for example this may include earthquake incident etc.). Generally, for all planned activities "Frequency" will be considered and for all unplanned accidental or unforeseen events "Probability" will be considered. "Probability" is rated 'N/A' (Not Applicable) for all planned activities and vice versa.*
Sensitivity / vulnerability of resource / receptor	a) Low b) Medium c) High	***Sensitivity of Environmental Resource / Receptors*** a) Existing quality of the physical Environment is well within applicable Indian standards and / or the ecological resource that the physical Environment supports, is not sensitive to disturbance; b) Existing quality of the physical Environment is under stress and / or the ecological resources that the Environment component / system supports, could be sensitive to change either quality or physical disturbance; and c) Existing quality of the physical Environment is already under stress and exceeds applicable standards and / or the resources that the Environment component / system supports, is very sensitive to change. ***Sensitivity of Socio-Economic, Human Health Resources / Receptors*** a) Human or Socio-Economic or Cultural receptors are not likely to be affected due to the project related activities and no considerable effort (Economic or otherwise) is required in adapting to change; b) Human or Socio-Economic or Cultural receptors are likely to be affected but retain the ability to at least in part adapt to change brought by the project and opportunities associated with it. Minimal effort (Economic or otherwise) is required in adapting to change; c) Human or Socio-Economic or Cultural receptors are vulnerable and lack the ability to adapt to change brought by the project and opportunities associated with it. Significant effort (Economic or otherwise) is required in adapting to change; ***Sensitivity of Ecological Resources / Receptors*** a) Ecological receptors that are abundant, common or widely distributed and that can adapt to changing environments. Receptors are not endangered

Criteria	Rating	Rating definition and limits
		or protected and are of Least Concern (LC) conservation status; b) Ecological receptors that are relatively low in abundance, have restricted ranges, and are currently under stress in the existing conditions or are slow to adapt to changing environments. Species are valued locally / regionally or listed as Near Threatened (NT) / Vulnerable (V); and c) Ecological receptors that are relatively very low in abundance, have restricted ranges, and currently under stress in the existing conditions or highly sensitive to changing environments. Species are valued nationally / globally or listed as Endangered (EN) / Critically Endangered (CR).

Source: Adopted and modified from a) Canadian Environmental Assessment Agency, 1992; b) Canter, L.W., 1996; c) Canter L.W. and Canty, G.A., 1993; d) Haug, P.T., Burwell, R.W., Stein, A. and Bandurski, B.L.., 1984.

Table 7-3: Impact significance rating

Criteria	Rating	Interpretation
Impact significance	a) Negligible b) Minor c) Moderate d) Major	a) Impact is of an insignificant order and therefore likely to have no real effect. In case of adverse impacts, mitigation may not be required. Social, Cultural and Economic activities of communities have near to nil or nil effect; b) Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts, mitigation is either easily achieved or little will be required, or both. Measures and solutions for mitigation are easily implementable and costs associated with such measures are not significant. Social, cultural and economic activities of communities can continue unchanged. In case of beneficial impacts, alternative means of achieving this benefit are likely to be easier, cheaper, more effective and less time-consuming; c) Impact is real, but not substantial in relation to other impacts that might take effect within the bounds of those that could occur. In the case of adverse impacts, mitigation is both feasible and practically possible. Social, cultural and economic activities of communities are changed, but can be continued (whilst providing alternatives to complement losses). Modification of the project design or considerable mitigation measures or alternative action / planning may be required. In case of beneficial impacts, other means of achieving this benefit requires equal time, cost and effort; d) Impact is of the highest order possible within the bounds of impacts that could occur. In the case of adverse impacts, there is limited possible mitigation that could offset the impact, or mitigation is difficult, expensive, time-consuming or some combination of these. Social, cultural and economic activities of communities are disrupted to an extent that cause unrest and may halt such activities. In case of beneficial impacts, the impact is of a substantial order within the bounds of impacts and benefits either Environmental or Socio-Economic aspects more than other alternatives can.

7.2 Impact evaluation matrix for determining "Impact Significance"

With respect to Criteria outlined in **Table 7-1**, **Table 7-2** and **Table 7-3**, "Impact Significance" for "Adverse" and "Beneficial" impacts has been developed as per significance matrix presented in **Table 7-6** and **Table 7-7** respectively.

Impact matrix in **Table 7-4** outlines the ratings assigned for "Potential Magnitude", which is in turn determined through ***Spread / Spatial Extent*** of Impact, ***Duration*** of Impact and ***Intensity*** of Impact. Criteria presented in **Table 7-2** have been taken into consideration for adverse impacts. However, for project associated activities that may generate beneficial impacts, ***Potential Magnitude*** and ***Sensitivity*** have been considered to determine corresponding "Impact Significance".

Table 7-4: Determining Potential Magnitude for adverse impacts

Spread	Duration	Intensity	Potential Magnitude
Low	Low	Insignificant	**Insignificant**
Low	Low	Low	
Low	Medium	Insignificant	
Medium	Low	Insignificant	
Low	Low	Moderate	**Low**
Low	Medium	Low	
Medium	Low	Low	
Medium	Medium	Insignificant	
Low	High	Insignificant	
High	Low	Insignificant	
Medium	High	Insignificant	
High	Medium	Insignificant	
Low	Low	Strong	**Medium**
Low	Medium	Moderate	
Low	High	Low	
Low	High	Moderate	
Medium	Low	Moderate	
Medium	Medium	Low	
Medium	Medium	Moderate	
Medium	High	Low	
Medium	High	Moderate	
High	Low	Low	
High	Low	Moderate	
High	Medium	Low	
High	High	Insignificant	
Low	Medium	Strong	**High**
Low	High	Strong	
Medium	Low	Strong	
Medium	Medium	Strong	
Medium	High	Strong	
High	Low	Strong	
High	Medium	Moderate	
High	Medium	Strong	
High	High	Low	
High	High	Moderate	
High	High	Strong	

Table 7-5: Impact Matrix for determining Relative Magnitude of adverse impacts

		Frequency / Probability *		
		Occasional / Low	*Periodic / Medium*	*Routine / High*
Potential Magnitude	*Insignificant*	Insignificant	Insignificant	Insignificant
	Low	Insignificant	Low	Low
	Medium	Low	Medium	Medium
	High	Medium	Medium	High

* ***Note:*** *Probability is only triggered in case of unplanned or accidental events (for example this may include earthquake incident or occurrence of flooding onsite). Generally, for all planned activities "Frequency" will be considered and for all unplanned accidental or unforeseen events "Probability" will be considered. "Probability" is rated 'N/A' (Not Applicable) for all planned activities and vice versa.*

Table 7-6: Impact Matrix for determining Significance of adverse impacts

		Sensitivity / vulnerability of resource / receptor		
		Low	*Medium*	*High*
Relative Magnitude	*Insignificant*	Negligible	Negligible	Negligible
	Low	Negligible	Minor	Minor
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

Table 7-7: Impact Matrix for determining Significance of Beneficial Impacts

		Sensitivity / vulnerability of resource / receptor		
		Low	*Medium*	*High*
Potential Magnitude	*Insignificant*	Negligible	Negligible	Negligible
	Low	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

7.3 Activity – Aspect interaction and associated impacts

The project will have the following key activities; associated interaction matrix has been presented in **Table 7-8**.

Pre-construction	Construction	Operation	Decommissioning
• Execution of land procurement • Clearance of vegetation from identified activities	• Construction and setting up of auxiliary facilities such as storage yard. • Foundation excavation and erection of each WTG • Construction of internal / access roads connecting each WTG • Transportation of components / materials to each WTG location • Erecting WTG, and internal electrical lines between each WTG location • Construction of pooling substation and transmission line	• Operations associated with power generation from WTGs • Scheduled maintenance activities (at WTGs and at sub-station)	• Removing internal transmission lines • Restoration of land

Table 7-8: Matrix for impacts identified resulting from Activity – Aspect interaction

Sno	Project phase	Project activity	Land use	Land and Soil Environment	Water Environment	Ambient Air Quality	Ambient Noise Quality	Ecology	Settlements and community access	Land based livelihoods	Social and demographic	Economy and Employment	Cultural Environment	Community/ Occupational Health and Safety
1.	Pre-construction phase	Execution of land procurement							☒	☒				
		Clearance of vegetation from identified activities	☒	☒		☒		☒		☒				
2.	Construction Phase	Construction and setting up of auxiliary facilities such as storage yard.	☒	☒	☒	☒	☒	☒		☒	☒	☒	☒	☒
		Foundation excavation and erection of each WTG	☒	☒	☒	☒	☒	☒				☒		☒
		Construction of internal / access roads connecting each WTG	☒	☒	☒	☒	☒	☒	☒			☒		☒
		Transportation of components / materials to each WTG location				☒	☒		☒					☒
		Erecting WTG	☒	☒		☒	☒	☒				☒		☒
		Erecting internal electrical lines between each WTG location	☒	☒		☒	☒	☒				☒		☒
		Construction of pooling substation	☒	☒	☒	☒	☒	☒	☒		☒	☒		☒
		Construction of transmission line from pooling substation to grid	☒	☒		☒	☒	☒				☒	☒	☒
3.	Operation phase	Operations associated with power generation from WTGs					☒							
		Scheduled maintenance activities (at WTGs and at sub-station)		☒	☒									☒
4.	Decommissioning	Removing WTG parts and other ancillary facilities	☒	☒	☒	☒	☒	☒				☒		☒
		Removing internal transmission lines	☒	☒	☒	☒	☒	☒				☒		☒
		Restoration of land	☒		☒	☒			☒		☒		☒	☒

7.4 Environmental Impacts

7.4.1 Soil Environment

7.4.1.1 Pre-construction and Construction phase

During construction phase, following are the prevalent negative impacts on land/soil:

- Considerable disturbance to soil and nearby superficial geology due to activities such as excavations for foundations, construction of access roads and drainage, etc;
- Removal of existing vegetation for construction will decrease the rigidity of soil and make it loose and open to erosion. Since the region is windy, scouring of exposed soil might happen due to high velocity of wind;
- Top soils and sub soils will be extracted during excavation which will lead to loose soil generation and its subsequent dispersal by wind. Excavation can disturb the original topography of the area and consequently lead to soil erosion;
- Direct and indirect impact on the landscape of the region such as modification of initial appearance of the site, abandoning of certain parts of the site by its users due to installation of wind turbines;
- Construction debris, excavated soils or solid waste generated when workers are on site, if dumped in nearby fields will affect the quality of soil;
- Random disposal of excavated soil and construction debris in nearby fields and private land; and
- Soil contamination due to oil leaks/spillage from machinery and vehicles.

Impact significance

<table>
<tr><th>Criteria</th><th>Rating</th><th>Potential Magnitude</th><th>Relative Magnitude</th><th>Impact Significance</th></tr>
<tr><td>Spread</td><td>Low</td><td rowspan="3">Low</td><td rowspan="5">Low</td><td rowspan="6">Negligible</td></tr>
<tr><td>Duration</td><td>Medium</td></tr>
<tr><td>Intensity</td><td>Low</td></tr>
<tr><td>Frequency</td><td colspan="2">Periodic</td></tr>
<tr><td>Likelihood</td><td colspan="2">N/A</td></tr>
<tr><td>Sensitivity</td><td colspan="3">Low</td></tr>
</table>

7.4.1.2 Mitigation measures for Pre-construction and Construction phase

- Demarcate an area which is less wind-prone for storage of construction materials and should use tarpaulin sheets to avoid dispersal or kept in an enclosed space;
- Limit construction activities to months having moderate climate conditions when there is no heavy wind or rainfall, to avoid top soil removal;
- To minimise runoff, channels and drains are to be fully established and bedded as quickly as possible;
- While transporting, construction materials such as sand, cement and other such fine-grained materials should be covered;
- Construction debris and excavated material can be used for filling low-lying areas;
- Paved spaces should be constructed for handling machineries or vehicles, while refuelling etc. if there is a spillage, that portion of the soil is to be cut out and stored separately to be disposed with the hazardous waste
- Re-vegetate the area surrounding turbine locations as early as possible, to reduce the negative effect on soil; and
- All construction material shall be stored in a designated/demarcated storage area within the site and covered with tarpaulin sheet to avoid dispersal with wind.

7.4.1.3 Operation Phase

During the operation phase, 60 turbines of 2.0 MW each will be functioning at the same time. Hazardous waste such as waste/used oil and waste cotton/rug (used for cleaning of turbine parts) containing oil will be generated especially during maintenance works due to the presence of mechanical parts in wind turbine generators and usage of diesel generators. Improper storage, handling and disposal of these hazardous wastes can lead to contamination of soil at storage yard or at the project site office.

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	Medium	Low	Minor
Duration	High			
Intensity	Moderate			
Frequency	Occasional			
Likelihood	N/A			
Sensitivity	Medium			

7.4.1.4 Mitigation measures for Operation phase

- Hazardous waste generated shall be stored in a defined space and should be accessible only to authorised personnel;
- The storage space should be an impervious paved surface and should have a secondary containment area and spill control toolkit;
- Quantity of hazardous waste handled should be clearly documented as per Hazardous Waste Management rules and documents should be updated regularly; and
- Hazardous waste should be sold to an authorised vendor from Andhra Pradesh Pollution Control Board (APPCB) on a periodic basis, documents of which should be maintained as per requirements under the Hazardous Waste (Management, Handling and Trans-boundary Movement) Rules, 2016.

Impact significance post adoption of Mitigation Measures

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	Insignificant	Insignificant	Negligible
Duration	Low			
Intensity	Low			
Frequency	Occasional			
Likelihood	N/A			
Sensitivity	Medium			

7.4.2 Noise quality

7.4.2.1 Pre-Construction and Construction phase

Noise and vibration will be caused during site preparation, operation of earth moving and excavation equipment, concrete mixers, cranes and the transportation of equipment, materials and people. There is potential for disturbance to habitations in proximity of WTG locations. Use of diesel generator sets may also lead to incremental noise however, that will be limited to a very short duration of 10 -15 days. Movement of traffic during night hours can also disturb the local community. Approximately 90-92 dB (A) of noise is expected to be generated from construction activity. The exact methodology and the timing of construction cannot be predicted at this time; however the construction activities will be temporary in nature and will not last for more than 15-20 days for a particular turbine site.

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Medium	Medium	Medium	Minor
Duration	Medium			
Intensity	Low			
Frequency	Periodic			
Likelihood	N/A			
Sensitivity	Low			

7.4.2.2 Mitigation Measures during Pre-Construction and Construction Phase

- Construction activities shall be planned in consultation with local communities (if required);
- Adequate precautions and information will be provided prior to execution of blasting activity (if any);
- Construction equipment will be maintained in good working order and properly muffled;
- Integral noise shielding to be used where practicable and fixed noise sources to be acoustically treated, for example with silencers, acoustic louvers and enclosures;
- Provision of rubber paddings/noise isolators at equipment/machinery used for construction;
- Construction vehicles shall be well maintained and idling time will be minimized for vehicles when not in use;
- Site workers working near high noise equipment use personal protective equipment (PPEs) to minimize their exposure to high noise levels;
- Construction activities will be limited during night time to reduce disturbance to community.

Impact significance post adoption of Mitigation Measures

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	Low	Low	Negligible
Duration	Medium			
Intensity	Low			
Frequency	Periodic			
Likelihood	N/A			
Sensitivity	Low			

7.4.2.3 Operation Phase

Noise from WTGs

The sources of noise generation from operating wind turbines can be divided into two categories, mechanical sounds, from the interaction of turbine components, and aerodynamic sounds, produced by the flow of air over the blades.

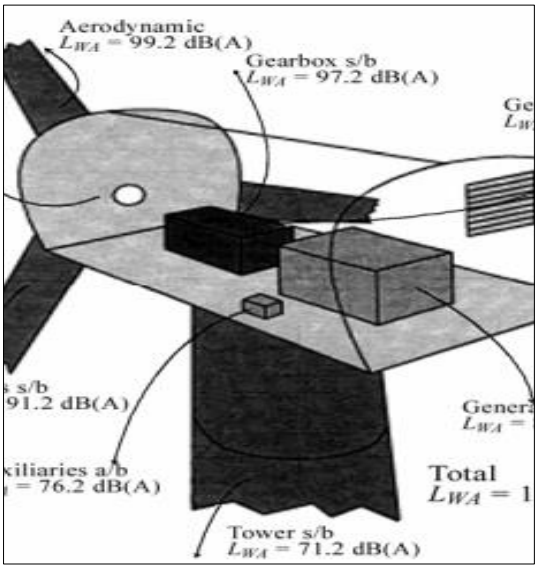
Mechanical Sounds

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

- Gearbox;
- Generator;
- Yaw Drives;
- Cooling fans; and
- Auxiliary Equipment

Since the emitted sound is associated with the rotation of mechanical and electrical equipment, it tends to be tonal (i.e., of a common frequency), although it may have a broadband component.

Figure 7-2 below illustrates the total sound power from components of a wind turbine.

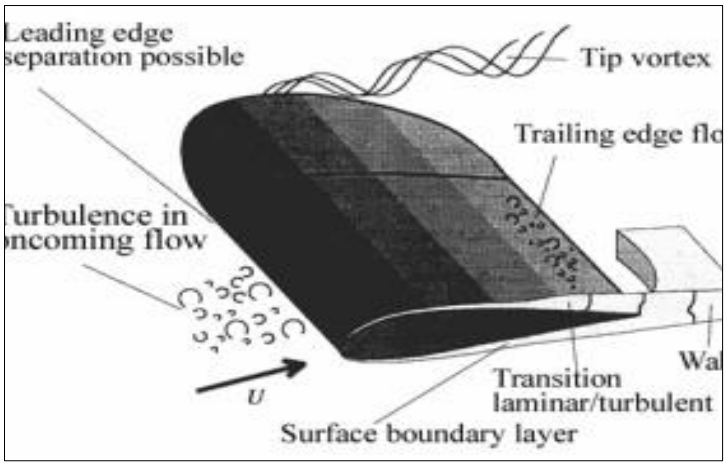


Source: Source: Center for Energy Efficiency and Renewable Energy. (2002), RERL (Renewable Energy Research Laboratory). White paper on Wind Turbine Noise Issues. Retrieved from http://www.windcows.com/files/WindTurbineNoiseIssues.pdf

Figure 7-2: Components and Total Sound Power Level of a Wind Turbine

Aerodynamic Sounds

Aerodynamic noise originates from the flow of air around the blades. It increases with the rotor speed and can be classified into three groups namely; Low Frequency, Inflow Turbulence and Air Foil Self Sounds. Low frequency sound is generated when the rotating blade encounters localized flow deficiencies such as wind speed changes, flow around the turbines etc. Inflow Turbulence depends on the amount of atmospheric turbulence which tends to result in local pressure fluctuations around the blade. And finally, Air Foil Self Sounds includes the sound generated by the air flow right along the surface of the air foil with broadband characteristics. **Figure 7-3** below shows the schematic representation of flow around a rotor blade.



Source: Center for Energy Efficiency and Renewable Energy. (2002), RERL (Renewable Energy Research Laboratory). White paper on Wind Turbine Noise Issues. Retrieved from http://www.windcows.com/files/WindTurbineNoiseIssues.pdf

Figure 7-3: Schematic of Flow around a Rotor Blade

The proposed project comprises of 37 identified locations for WTGs of Gamesa make, G-114 model of 2.0MW unit rated capacity with rotor diameter of 114 m and hub height of 106 m and Tubular tower. Noise impact due to operation of the proposed project, was analysed using numerical calculations from EMD's WindPRO Software

version 2.7 which is specifically designed for wind turbine noise. WindPRO contains pre-configured noise calculation models in order to calculate predicted noise levels at each of the selected noise receptor plus a ready built catalogue of wind turbines and noise emission data.

Methodology for prediction of noise levels

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.

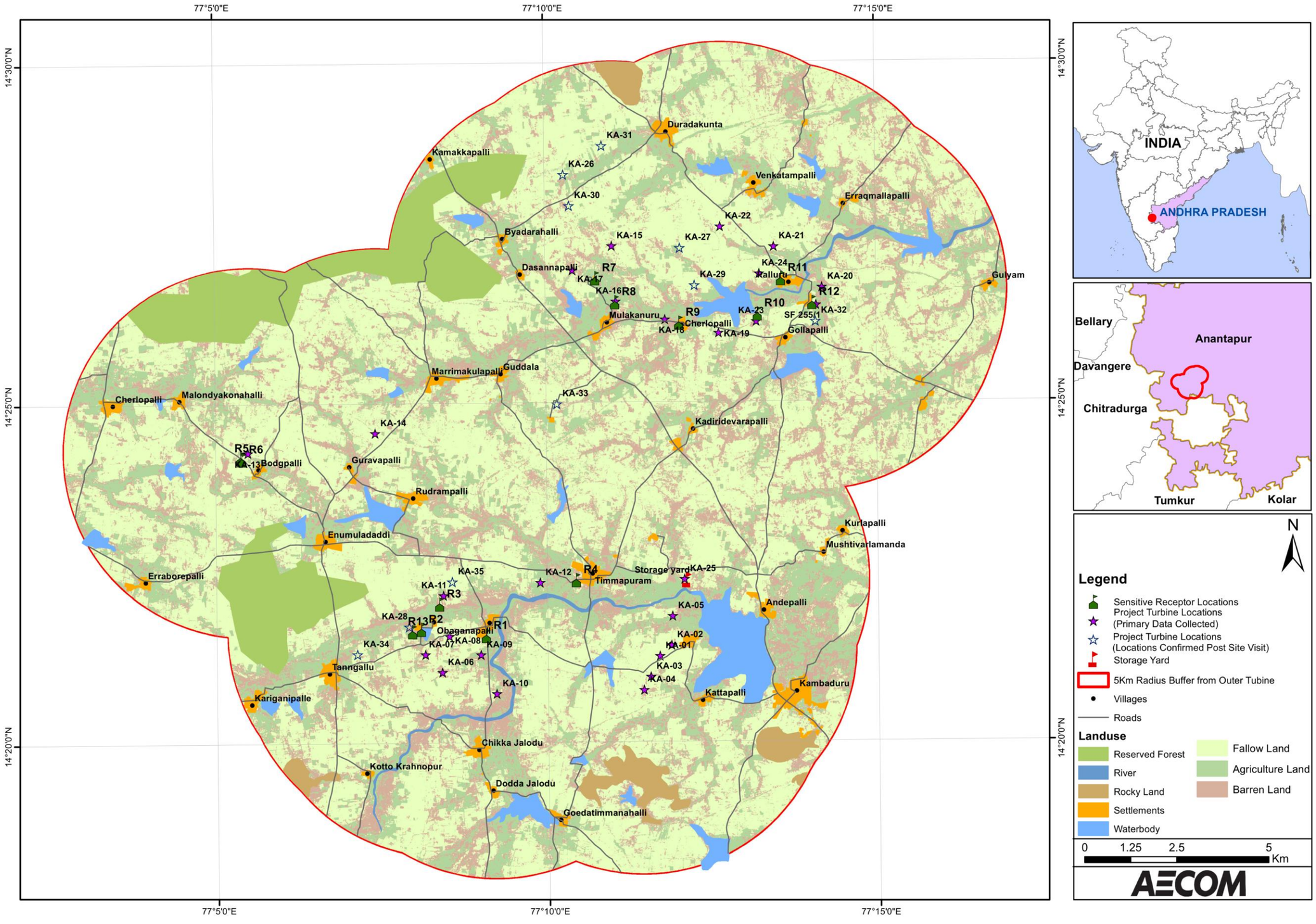
The numerical results were then used to produce a noise map that visually plots the extent of the incremental noise emissions from the Project site. The noise emissions were modelled for estimated wind speed from private wind monitoring station located at Guravalli (727797.20 m E, 1593301.93 m N) in Anantapur by M/s. Vayu Urja Bharat Private Ltd., Hyderabad. The estimated wind speed in the Project area is i.e. 6.07 m/s at a hub height of 80 m. The direction of the wind is not taken into consideration as the wind could blow from any direction.

The results of the modelling exercise have been presented in below. Detailed Noise Modelling report has been attached as **Appendix C**.

Identified Noise Receptors

During the site survey, residential properties, workplaces, learning and places of worship and or health care spaces/facilities located within 2000 m[8] of the project turbines were identified as sensitive receptors. About 13 such receptors were identified as potential noise and shadow receptors. The details of the noise and shadow receptors are provided in **Table 7-9** and the same have been represented in **Figure 7-4**.

[8] IFC guidelines on Environmental, Health, and Safety Guidelines - Wind Energy dated 7th August 2015



Source: AECOM India Pvt. Ltd., December 2016

Figure 7-4: Map showing receptor locations from R1 through R13

Table 7-9: Description of the Identified Noise Receptors

Receptor ID	Noise Receptor ID	Baseline Noise Monitoring Location ID	Geographical Coordinates	Description	WTGs within 2000 m from the Noise Receptor
R1	PN1	NQ6	0731984 m E, 1588582 m N	Settlements of Obuganapalli village (30+ families)	KA 06, 07,08,09,10,11, 35
R2	PN2	NQ5	0730223 m E, 1588750 m N	Settlements of S. Mallapuram village (50+ families)	KA 06, 07, 08, 09, 11, 28, 34, 35
R3	PN3	NQ5	0730716 m E, 1589435 m N	Temple - 1 in S. Mallapuram Village	KA 06, 07, 08, 09, 11, 28, 35
R4	PN4	NQ6	0734428 m E, 1590102 m N	Settlements of Thimmapuram village (30+ families)	KA 12
R5	PN5	NQ4	0725306 m E, 1593385 m N	Residential Unit – 1 in Yenumulapalli Village	KA 13
R6	PN6	NQ4	0725339 m E, 1593353 m N	Residential Unit – 2 in Yenumulapalli Village	KA 13
R7	PN7	NQ3	0734926 m E, 1598293 m N	Srivenkateshwara Swami Temple in Mulakanur Village	KA 15, 16, 17
R8	PN8	NQ3	0735467 m E, 1597643 m N	Temple - 2 in Mulakanur Village	KA 15, 16, 17
R9	PN9	NQ3	0737203 m E, 1597086 m N	Settlements of Cherlapalli village (30+ families)	KA 16, 18, 19, 29
R10	PN10	NQ2	0739336 m E, 1597339 m N	Temple – 3 in Pallur Village	KA18, 19, 20, 21, 23, 24, 29, 32, KA 37
R11	PN11	NQ2	0739973 m E, 1598300 m N	Settlements of Pallur Village (50+ families)	KA20, 21, 23, 24, 32, KA 37
R12	PN12	NQ1	0740821 m E, 1597652 m N	5 families in Pallur Village	KA 20, 21, 23, 24, 32, KA 37
R13	PN 13	NQ5	0729981 m E, 1588682 m N	Store house - one unit in S. Mallapuram Village	KA07, 08, 09, 11, 28, 34, 35

Source: AECOM Survey

Ambient baseline sound levels is the function of activities such as movement of vehicles, operation of local machinery and the interaction of wind with ground cover, buildings, trees, power lines, etc. It varies with the time of day, wind speed and direction and the level of human activity in the area. As discussed in **Section 5.1.9** the baseline noise levels at all the sampling locations were found to be exceeding the prescribed noise standards for Residential Area. The results of the modelling exercise have been presented and illustrated in **Table 7-10**:

Table 7-10: Resultant Noise Levels at Receptor Locations

Receptor	Baseline Noise dB(A)		Incremental Noise dB (A)	Resultant Noise dB (A)		Additional Exposure dB (A)	
	Day	Night	From WTG	Day	Night	Day	Night
PN1	70.9	64.4	43.7	70.9	64.4	0.0	0.0
PN2	68.2	61.6	47.8	68.2	61.8	0.0	0.2
PN3	68.2	61.6	49.2	68.3	61.8	0.1	0.2
PN4	68.2	61.6	37.3	70.9	61.6	0.0	0.0
PN5	67.8	61.0	48.6	67.9	61.2	0.1	0.2
PN6	67.8	61.0	48.8	67.9	61.3	0.1	0.3
PN7	67.6	63.2	42.9	67.6	63.2	0.0	0.0
PN8	67.6	63.2	56.7	67.9	64.1	0.3	0.9
PN9	67.6	63.2	40.2	67.6	63.2	0.0	0.0
PN10	66.0	64.1	51.9	66.2	64.4	0.2	0.3

Receptor	Baseline Noise dB(A)		Incremental Noise dB (A)	Resultant Noise dB (A)		Additional Exposure dB (A)	
	Day	Night	From WTG	Day	Night	Day	Night
PN11	66.0	64.1	43.8	66.0	64.1	0.0	0.0
PN12	71.4	66.0	55.5	71.5	66.4	0.1	0.4
PN 13	68.2	61.6	52.4	68.3	62.1	0.1	0.5
CPCB Prescribed Limits	**55.0**	**45.0**	**--**	**55.0**	**45.0**	**--**	

Inference

The results from the modelling exercise indicate that the incremental noise due to operation of WTGs at is in the range of 37.3-56.7 dB (A). The additional exposure to noise will be in the range of 0.0 - 0.9 dB (A) during night time and 0.0 – 0.3 dB (A) during day time due to operation of the WTGs.

The estimated resultant noise levels exceeds the prescribed noise limits for the day and night time i.e. 55 dB (A) and 45 dB (A) at all the identified noise receptors. The ability to hear wind turbine noise depends on the existing ambient noise levels.

It is to be noted that the baseline noise recorded already exceeds the CPCB prescribed standard at all the receptor locations. The incremental noise from the wind turbines do not contribute significantly to the estimated resultant noise of the area if the background/baseline noise is higher than wind turbine noise.

The additional exposure to noise meets the noise guideline specified in IFC's Environmental, Health and Safety Guidelines of Wind Energy viz., maximum increase in background levels of 3 dB (A) at the receptor location.

Impact Significance

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	Medium	Medium	Moderate
Duration	High			
Intensity	Low			
Frequency	Routine			
Likelihood	N/A			
Sensitivity	Medium			

Project:
120 MW_Vayu Urja Bharat Pvt Ltd

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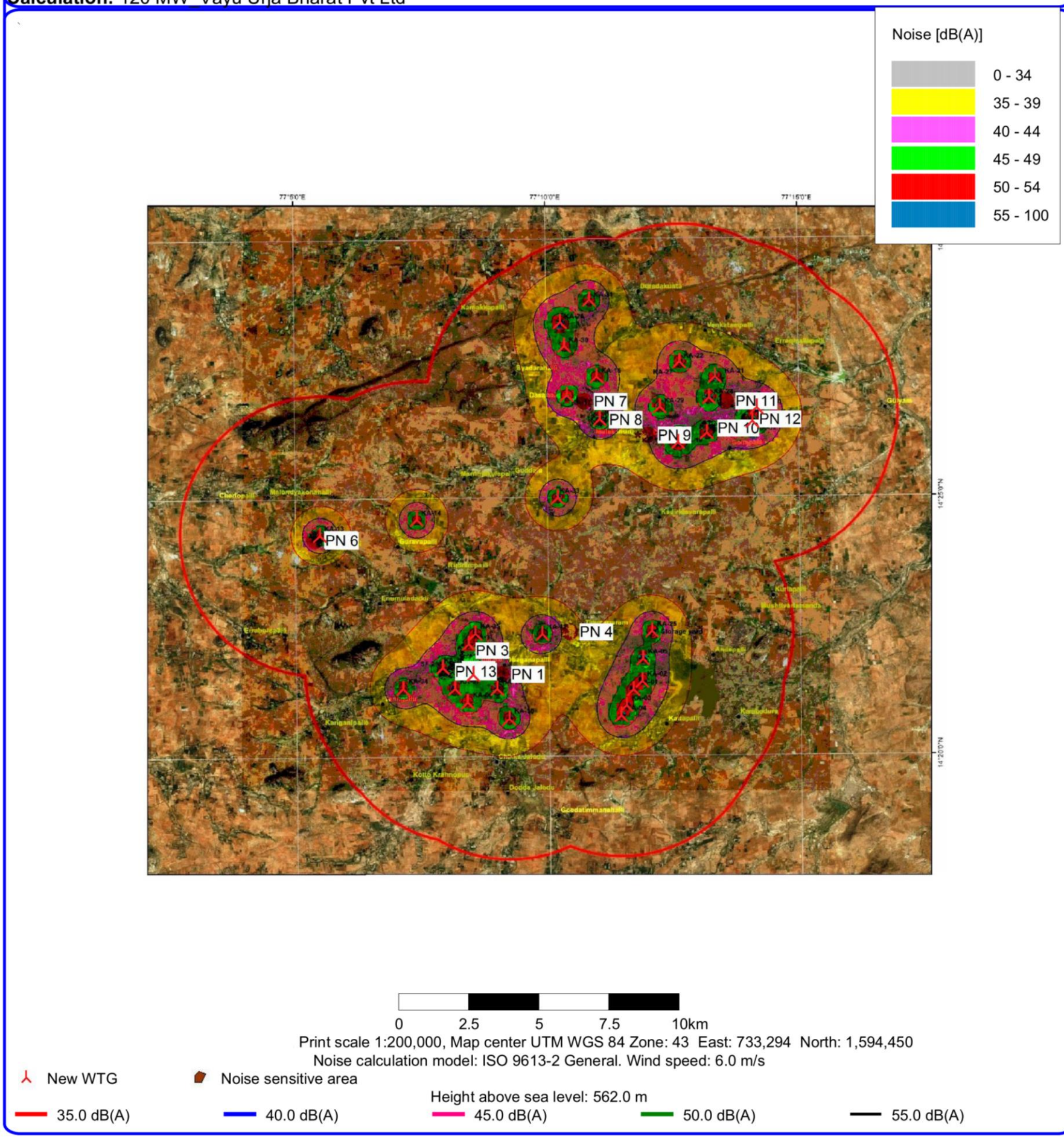

Figure 7-5: Noise level distribution during Operation phase

7.4.2.4 Mitigation Measures for Impacts from Noise generation during operation phase

Following mitigation measures are suggested to be implemented during operation phase of the proposed Project:

- Increase in dense vegetation coverage around the receptor locations which shall act as noise barrier;
- Wind turbines shall be designed in accordance with the international acoustic design standards and maintained throughout the operational life so as to limit noise generation;
- The wind turbines shall be maintained in good running conditions 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;
- It is suggested that ground vegetation such as shrubs and bushes are cleared to the minimum extent possible during site clearance activities;
- Consult with the locals periodically to assess noise generation and set up a procedure to locate source of noise and steps taken to minimize them;
- Implement a complaint resolution procedure to assure that any complaints regarding operational noise are promptly and adequately investigated and resolved;
- Undertake ambient noise level monitoring from NABL/MoEFCC accredited laboratories on an annual basis in order to understand the increase in noise levels due to the project operation;

Impact significance post adoption of Mitigation Measures

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	Medium	Medium	Minor
Duration	High			
Intensity	Low			
Frequency	Routine			
Likelihood	N/A			
Sensitivity	Low			

7.4.3 Shadow Flicker

7.4.3.1 Impact during Operation Phase

Shadow flicker occurs when the shadow cast by the moving blades of a wind turbine passes through a window or a door. The effect of the shadow moving around with the blade makes it seem as if a shadow is flickering with each blade passing by (most large wind turbines have three blades, so three times per rotation) - comparable to someone turning on and off the light in rapid succession.

There is anecdotal evidence inter nationally that shadow flicker could lead to stress and headaches. There is also a fear that shadow flicker, especially in the range of 2.5-50 Hertz (2.5-50 cycles per second) could lead to seizures in epileptics and may also scare away livestock.

Shadow flicker is most pronounced at sunrise and sunset when shadows are the longest, and at high wind speeds (faster rotating blades leading to faster flicker). There are no uniform standards defining what distance from the turbine is regarded as an acceptable limit beyond which the shadow flicker is considered to be insignificant. There are also no uniform standards in India for the number of hours of flicker that are deemed to be acceptable. However, IFC on Environmental, Health and Safety Guidelines for Wind Energy recommends that that predicted duration of shadow flicker effects experienced at a sensitive receptor not exceed ***30 hours per year and 30 minutes per day*** on the worst affected day, based on a worst-case scenario. The details of the shadow receptor are provided in the **Table 7-11**:

Table 7-11: Details of Shadow Receptor Locations

Receptor ID	Software ID	Type of Receptor	Geographical Coordinates
R1	PS1	Settlements of Obuganapalli village (30+ families)	0731984 m E, 1588582 m N
R2	PS2	Settlements of S. Mallapuram village (50+ families)	0730223 m E, 1588750 m N
R3	PS3	Temple - 1 in S. Mallapuram Village	0730716 m E, 1589435 m N
R4	PS4	Settlements of Thimmapuram village (30+ families)	0734428 m E, 1590102 m N
R5	PS5	Residential Unit – 1 in Yenumulapalli Village	0725306 m E, 1593385 m N
R6	PS6	Residential Unit – 2 in Yenumulapalli Village	0725339 m E, 1593353 m N
R7	PS7	Srivenkateshwara Swami Temple in Mulakanur Village	0734926 m E, 1598293 m N
R8	PS8	Temple - 2 in Mulakanur Village	0735467 m E, 1597643 m N
R0	PS9	Settlements of Cherlapalli village (30+ families)	0737203 m E, 1597086 m N
R10	PS10	Temple – 3 in Pallur Village	0739336 m E, 1597339 m N
R11	PS11	Settlements of Pallur Village (50+ families)	0739973 m E, 1598300 m N
R12	PS12	5 families in Pallur Village	0740821 m E, 1597652 m N
R13	PS13	Store house - one unit in S. Mallapuram Village	0729981 m E, 1588682 m N

Source: Site survey

Shadow flicker modelling was performed using EMD's WindPRO Software version 2.7, a wind modelling software program. WindPRO is used to calculate detailed shadow flicker map across an area of interest with site-specific locations using shadow receptors.

Shadow maps, which indicate where shadows will be cast and for how long, can be calculated at varying resolutions. Normal resolution was used for this study; it represents shadow flicker calculations that determine the sun angle every 5 minutes, every 7th day, over the period of an entire year, over a grid resolution of 20 meters by 20 meters.

Shadow flicker at each shadow receptor location is calculated every minute of every day throughout the entire year. Shadow receptors can be configured to represent an omni-directional window of a specific size (greenhouse mode) or a window facing a single direction of a specific size (single direction mode). The shadow receptors used in this analysis were configured as single direction-mode receptors representing a 1.5 meter wide by 1.5 meter high window.

The inputs for the WindPRO shadow flicker model include the following:

- The geographic locations and characteristics of the proposed WTGs;
- The locations of identified shadow receptors; and
- Turbine Model Specifications; and
- Topography was assumed to be flat as a *theoretical 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 *theoretical worst case* scenario, with the following conditions:

- The sun is shining all day, from sunrise to sunset with clear skies;
- Rotor is perpendicular to the incident direction of the sunlight;
- Distances between the rotor plane and the tower axis are negligible;
- There are no obstructing features such as trees and vegetation;
- Light refraction in the atmosphere is not considered; and

- The wind turbines are always operating i.e. there is continuous wind of sufficient speed and no maintenance or down time.

The result of the modelling exercise is given below in **Table 7-12** and the Shadow flicker map showing shadow hours at identified receptors has been presented in **Figure 7-6**.

Table 7-12: Results of Shadow Flicker Modelling

Software Label	Shadow hours per year	Shadow days per year	Max shadow hours per day	Shadow Causing WTG	Distance from WTG
	h/year	days/year	h/day		m
PS1	3:36	16	0:21	KA 08	1000
PS2	27:32	110	0:34	KA 08	783
PS3	0:00	0	0:00	--	--
PS4	0:00	0	0:00	--	--
PS5	4:22	16	0:21	KA 13	242*
PS6	0:00	0	0:00	--	--
PS7	0:00	0	0:00	--	--
PS8	27:07	102	0:29	KA 16	30**
PS9	4:06	33	0:10	KA 16	1812
PS10	10:37	86	0:10	KA 32, KA 20, KA37	1612, 1893, 1612
PS11	8:46	32	0:20	KA 20	494
PS12	4:40	26	0:14	KA 23	1585
PS13	12:50	55	0:25	KA 08, 09	1010, 910

*

IFC guidelines on Wind Energy (August, 2015) have suggested ***30 hours of shadow flicker per year*** and ***30 minutes of shadow flicker per day*** as the threshold of significant impact, or the point at which shadow flicker is commonly perceived as an annoyance. Accordingly, the above threshold parameters were used in this analysis to evaluate potential shadow flicker impacts on the receptors. As seen in the Table above, flickering shadows are caused at receptor locations **PS1, PS2, PS5, PS8, PS9, PS10, PS11, PS 12 and at PS 13**. However, it is within the threshold limit at all the locations.

The modelling exercise accounts for the placement of turbines, receptors and sun angle such that the time when the turbine is in between the sun and the receptor is included in the total minutes per day and hours per year that shadow flicker could occur. However, this is a conservative analysis that does not account for maintenance time, calm winds when the turbines will not operate, light permeable obstacles such as trees and other structures, or the cloud covered days of the year. Therefore, the estimated theoretical worst case scenario certainly overstates the actual frequency of shadow flicker that would be experienced at any given receptor location at any given time of the year.

WindPRO version 2.7.486 Jan 2011

Project:
120 MW_Vayu Urja Bharat Pvt Ltd

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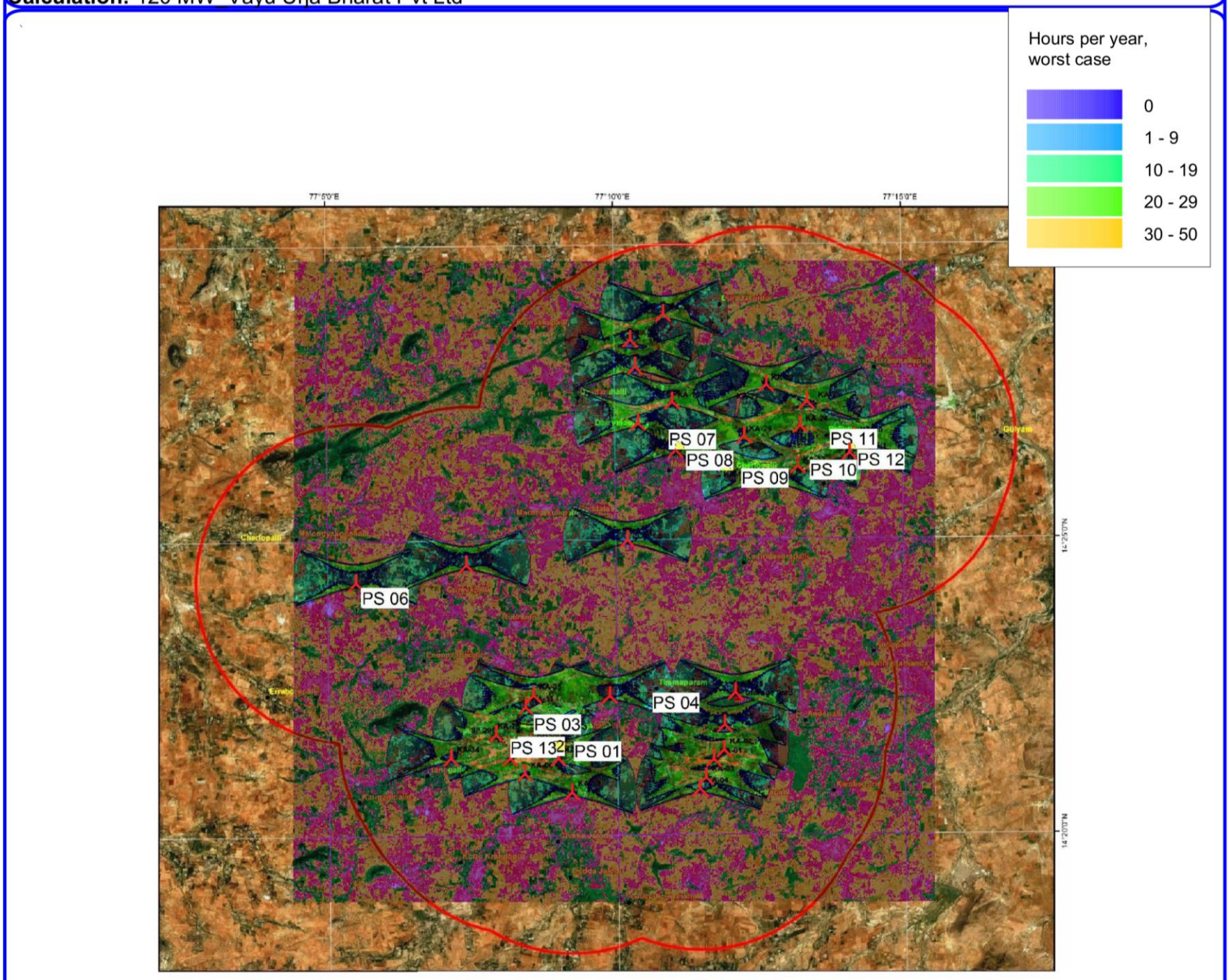
Calculated:
22-12-2016 18:23/2.7.486

SHADOW - Map

Calculation: 120 MW_Vayu Urja Bharat Pvt Ltd



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

Figure 7-6: Shadow flicker map showing shadow hours at identified receptors

Impact significance:

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Medium	Medium	Medium	Minor
Duration	Medium			
Intensity	Low			
Frequency	Periodic			
Likelihood	N/A			
Sensitivity	Low			

7.4.3.2 Mitigation measures during Operation Phase

With the possibility of shadow flickering on identified receptor locations, it can be mitigated by the following suggestions:

- Planting trees and ensure increase in dense vegetation coverage to screen the impacted receptor locations from sun;
- Installation of blinds such as curtains at the concerned window facing the turbines;
- Formulation of a complaint resolution procedure for the local community so that any issues or concerns associated with shadow flicker are reported to the site staff. Also, appropriate and timely action taken in case of receipt of such complaints will be documented and maintained for records; and

Impact significance post adoption of Mitigation Measures

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Medium	Low	Low	Negligible
Duration	Low			
Intensity	Low			
Frequency	Periodic			
Likelihood	N/A			
Sensitivity	Low			

7.4.4 Air Quality

7.4.4.1 Impacts during Pre-construction and Construction phase

During the construction phase of project, there will be direct and indirect activities which will negatively impact the environment and deteriorate the quality of air. Following are some such activities:

- Earthwork which generates dust to the highest degree
- Emissions from road traffic – While transporting filling materials and the like to the project site there are chances of dust formation, considering the small size of cement particles, sand etc., and windy nature of the region. Primary pollutant like particulate matter is also generated from re-suspended dust from roads.
- Exhaust fumes from Heavy Good Vehicles (HGV) containing primary pollutants like Sulphur dioxide and from machineries used for lifting and erection of turbine parts, diesel generators etc. Incomplete combustion of fossil fuels or oil spillage from poorly maintained vehicles, will also release pollutants

Impact Significance

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	Low	Low	Negligible
Duration	Medium			
Intensity	Low			
Frequency	Periodic			
Likelihood	N/A			
Sensitivity	Low			

7.4.4.2 Mitigation measures during Pre-construction and Construction phase

- To avoid spillage during transit, fine-grained and loose construction materials should be covered;
- Storage area of construction materials has to be in an area which is least wind-prone;
- Vehicles are to maintained properly by conducting regular checks to minimise the emission of pollutants from exhausts and obtaining Pollution Under Control certificate from pollution control board on a periodic basis;
- Idling time of vehicles should be minimised to the extent possible, to reduce burning of fossil fuel;
- Daily inspection of construction site to check the effectiveness of the above mentioned activities.

The construction work of a windfarm is only for a short duration of time and temporary. Hence, adhering to the above mentioned mitigation measures, the impact of project on air quality during construction phase will not substantial.

7.4.4.3 Air Quality – Impacts during Operation phase

The baseline air quality will not vary to a considerable extend as the operation of wind turbines doesn't involve any significant air polluting activities. Except for the minor emissions such as carbon monoxide and nitrogen oxides released from Diesel Generators during preventive maintenance period which are not likely to exceed air quality standards, there are no direct emissions from the wind turbines. Hence the overall impact on air quality during operation phase is expected to be negligible.

Impact significance

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	Insignificant	Insignificant	Negligible
Duration	Low			
Intensity	Insignificant			
Frequency	Routine			
Likelihood	N/A			
Sensitivity	Low			

7.4.5 Water Quality

7.4.5.1 Impacts during Construction phase

During construction phase of the project, negligible quantity of wastewater is expected to be generated due to the following activities:

- Highly alkaline cement when mixed with concrete, any accidental spill during transfer may lead to changes in pH of underground water in the area;

- Spillage of fuels, waste oil or lubricants from vehicles and machinery or runoff from disturbed soils may cause sediment load in underground water during the construction of drainage channels, or excavation for foundation;
- Water from temporary toilets constructed for construction workers, if not properly channelized or stagnated can lead to contamination of underground water;
- Baseline water quality results of the ground water from project villages suggest that ground water in the project area is contaminated with faecal coliform bacteria which can be a potential health risk for individuals exposed to this water. It is therefore recommended for project related staff to not use the ground water in the project area for drinking purpose.

Impact significance

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Medium	Medium	Low	Negligible
Duration	Low			
Intensity	Moderate			
Frequency	Occasional			
Likelihood	N/A			
Sensitivity	Low			

7.4.5.2 Mitigation measures during construction phase

- Portable toilets with septic tanks and soak pits will be provided;
- If there is any leakage, drip pans will be provided in those vehicles;
- Storage area for oil, cement and other construction materials will be paved and impervious with secondary containment for fuel storage tanks;
- RO systems to be installed onsite to provide safe drinking water to working staff;

Impact significance post adoption of Mitigation Measures

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Medium	Low	Insignificant	Negligible
Duration	Low			
Intensity	Low			
Frequency	Occasional			
Likelihood	N/A			
Sensitivity	Low			

7.5 Ecological Impacts

7.5.1 Introduction

The project construction and installation operations are likely to involve activities such as clearing of land for site preparation and access roads, excavation, blasting, filling, concretization. Vehicular movement and heavy machinery operations will take place throughout the construction and installation phase. These activities are likely to cause degradation or complete loss of habitats and the ecosystem services being provided by the area. Besides the impacts caused due to these activities, windfarms are also known to pose impact on aerially moving faunal species, through collision with turbines.

This section gives details of potential ecological impacts of the project during construction and operation phases and mitigative measures for these impacts.

7.5.2 Loss / Degradation / Fragmentation of Habitats

7.5.2.1 Construction phase

The natural vegetation in and around the proposed turbine sites and road alignments will be removed for site preparation. The removal of vegetation cover will result in direct loss or fragmentation of hitherto contiguous habitats. The resources associated with natural vegetation which provide food and shelter to faunal species, are likely to get degraded or lost permanently. The wildlife corridors connecting the various faunal populations in the region would be degraded due to habitat fragmentation. The clearing activities, in themselves, may result in death or injury to the ground organisms occupying the affected land areas.

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	Medium	Low	Negligible
Duration	High			
Intensity	Moderate			
Frequency	Occasional			
Likelihood	N/A			
Sensitivity	Low			

7.5.2.2 Mitigation measures for construction phase

- Degradation and loss of habitats caused by removal of natural vegetation could be minimized by removing only the most obstructive plants and conserving the existing ground cover of the area as much as possible. There shall be no clearing of vegetation cover of lands which are not directly under construction footprints.
- The site clearance for tower erection, access road and ancillary facilities shall be restricted only to the minimal area required for the respective purpose.
- The number and width of access roads shall be kept to the minimal possible. The use of existing roads should be preferred.
- Compensatory plantation of native species to be done in all suitable areas around turbines and along roads.

7.5.3 Avian mortality / injury to Birds or Bats

7.5.3.1 Operation phase

The principal direct risk posed by windfarms to birds is the potential for individuals to be injured or killed as a result of collision with moving rotors. Raptors, which are relatively large-sized birds adapted for soaring and relatively less capable of manoeuvring in flight, and migratory waterfowl, which tend to carry out migratory flights by night when they are unlikely to spot and avoid wind-turbines, are the two groups of birds which are especially vulnerable to collision-risk with operating wind-turbines. During cloudy weather, night-flying migratory birds tend to get attracted towards lights around their flight-height, such as those installed around ridge-top windfarms, leading to collisions with the turbines or other windfarm infrastructure.

Bats, besides being vulnerable to injury or death from direct collision with wind turbines, are also vulnerable to Barotrauma, that is, internal haemorrhaging induced by flying through the low-pressure zone around an operational turbine, leading to disruption of natural life-processes and eventual death. A correlation has been observed between low wind-speed nights and increased bat-fatalities around wind farms. Some evidence also suggests that bats may be attracted to turbines and that migratory and tree-roosting bats may have a higher risk of mortality. Other risks posed by windfarms to both, birds and bats, in general, include potential of entanglement with guy-wires or over ground transmission lines and electrocution by contact with uninsulated wiring.

Impact significance

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	High	High	Medium	Moderate
Duration	High			
Intensity	Moderate			
Frequency	Occasional			
Likelihood	N/A			
Sensitivity	Medium			

7.5.3.2 Mitigation measures for Operation phase

The following mitigation measures should be considered for avoiding injury or death of birds and bats during the operation phase:

- Designing the project layout to provide adequate spaces between turbines for movement of birds, thereby reducing the potential for accidental collision.
- Underground intra-farm wiring, thereby reducing the hindrance to birds.
- Insulating over ground wiring, if any, thereby avoiding any chance of electrocution.
- Providing daytime visual markers on any guy wires used to support wind-masts or towers, thereby enhancing visibility of the wires to birds;
- Installing visibility-enhancing objects, such as marker balls, bird deterrents or diverters along any over-ground transmission lines, thereby enhancing visibility of the transmission lines to birds;
- Keeping windfarm lighting switched off when not needed;
- Opting for lighting fixtures that are hooded and directed downward to minimize the skyward and horizontal illumination that could attract night-flying birds to the vicinity of wind turbines;
- Moving potential rodent-habitats, such as heaps of rocks or earthen mounds, away from the wind-farm-area, thereby avoiding attracting raptor bird-species into the area;
- Removing any carcasses from the site, thereby avoiding attracting scavenging raptors, such as vultures, into the area; Instituting appropriate storm-water management measures, thereby avoiding creating potential migratory waterfowl habitats, such as pools or bogs, in the windfarm area;
- Keeping the wind-turbines in operational on low wind-speed nights, thereby minimizing risk of barotrauma to bats flying in/through the windfarm area. It is recommended that a long-term programme, designed to monitor avifaunal activity with reference to wind-turbines, be instituted at the project-site. The main purpose of such a monitoring programme should be to generate the base-line data required for prediction of collision-risk for the bird-species utilizing the wind-turbine envelope around the year, and, assessment of the significance of such risk to the concerned bird-populations.

Impact significance post adoption of Mitigation Measures

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	High	Medium	Low	Minor
Duration	High			
Intensity	Insignificant			
Frequency	Occasional			
Likelihood	N/A			
Sensitivity	Medium			

7.6 Impacts on Socio-Economic Environment

This section describes the potential socio-economic impacts during various phases of the project.

7.6.1 Impact on community and nearby settlements owing to land procurement

7.6.1.1 Impacts during pre-construction

The land identified for the WTGs and its associated facilities comprises of private agricultural land. Based on the consultation undertaken with the land owners, all of them have sold a portion of their land holdings and still have a sizeable amount of land with them. It was mentioned that due to lesser rainfall over the years, rising cost of cultivation activities and lesser profits, these land owners decided to sell their land parcels. As the land parcels purchased till date are on private land, no impact on surrounding land areas is envisaged. None of the access roads to the turbines are obstructing access to settlements and sites of cultural heritage within the project area.

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	Insignificant	Insignificant	Negligible
Duration	Low			
Intensity	Insignificant			
Frequency	Periodic			
Likelihood	N/A			
Sensitivity	Low			

7.6.1.2 Mitigation measures

The project will have minimal impact due to loss of land. The following mitigation measures will however be incorporated to reduce the impact due to loss of land:

- The site clearance for tower erection, access road and ancillary facilities should be restricted to the necessary footprint area. The remaining area should be accessible for grazing or cultivation once the construction activities are completed.
- A formal consultation should be undertaken to apprise the villagers of the project activities on a regular basis.
- The EPC contractor should map access roads and implement strict driving instructions to adhere to such roads without going off-road thus destroying agricultural activities.

7.6.2 Labour rights and welfare

7.6.2.1 Impacts during construction phase

It is anticipated that during the construction phase, the labour requirement will range from 130 to 150 workers during construction activities.

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Low	Insignificant	Insignificant	Negligible
Duration	Low			
Intensity	Insignificant			
Frequency	Periodic			
Likelihood	N/A			
Sensitivity	Low			

The workforce as reported will be engaged both from surrounding areas and from other states. It was reported that the migrant workers would be provided accommodation within the villages in the vicinity of the project area on rented arrangement basis. The standards pertaining to labour accommodation will be applicable and hence, accordingly implemented by the EPC Contractor and Sub-Contractors. The EPC Contractor will require to provide the minimum wages due to the labourers including overtime wage as per the Building and Others Construction Workers Act. In addition, benefits in terms of Employee State Insurance should be provided to each worker engaged on site. The workers should be aware of their rights and benefits due to them so that no issues emerge. Toilet facilities and drinking water should be provided to all workers on site as well. Grievance Redressal Mechanism for workers should be developed and communicated to the workers so that the workers can approach the management if any concerns or issues are faced by them without any fear of retribution or intimidation.

7.6.2.2 Mitigation measures

The following measures shall be adopted:

- The Contractor shall provide accommodation facilities to the migrant workers as per requirements mentioned in IFC Performance Standard 2 and standards mentioned in EBRD's and IFC's "Worker's Accommodation: Processes and Standards."
- The contractor shall provide adequate information to workers on expected social behaviour and hygiene practices to be followed at site.
- VUBPL through the contractor agreement shall ensure that the construction contractors commit and adhere to social obligations including community relations, handling complaints and grievances, adherence to labour laws and international commitments etc.
- The water usage amongst the labourers shall be monitored and controlled to minimize generation of wastewater.
- VUBPL shall ensure that no child or forced labour is engaged by contractors and all wage payments are done without any discriminations or delays by the contractors.
- VUBPL to ensure that adequate sanitation and waste disposal facility shall be provided at project site.
- VUBPL should undertake medical test of the contract workers prior to engagement to identify any communicable disease.

7.6.3 Impact on local Economy and Livelihoods

7.6.3.1 Impacts during project lifecycle

As reported during consultations with land owners, the project will create employment opportunities for the local population in terms of direct and indirect work. This will benefit the population in terms of developing a new skill set as well as diversifying the local economy. Subsidiary employments in terms of shops, eateries, garages, etc. would also see an increase with the development of the project in the area. Job creation in relation to petty vendors and contractors would also see an increase with the various project activities envisaged to be initiated.

Potential Magnitude	Sensitivity	Impact Significance
Medium	Low	Minor

7.6.3.2 Mitigation measures

The following measures should be adopted,

- VUBPL should give preference to local vendors and contractors.
- VUBPL should give first preference to the local population in sourcing for the required vacancies that will emerge during the project life cycle.

- Skill development trainings should be provided to the local population in terms of welfare activities to be initiated by the Project Proponent so that the local population can apply for vacancies that might emerge in the project.

7.6.4 Blade Throw

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

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

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

- Design or manufacturing defect;
- Poor maintenance regime;
- Excessive winds during a storm (the region usually experiences frequent mild dust storms);
- Exceeding maximum design loads;
- Rotor over-speed; or
- Lightning or fire.

The WTG model (G-114) has a cut out speed of 25 m/s; in comparison, the average wind speed in the project area has been monitored to be approximately 6m/s; additionally, the project area does not experience heavy wind storms that may lead to wind speeds exceeding the cut-out speed. Risks associated with blade throw therefore is limited.

7.6.5 Community Health and Safety

The living standards of neighbouring community and local villagers from nearby villages are likely to be disturbed due to the increased road traffic movement during the construction phase of the project.

The traffic density on the roads in the proposed Project area is medium. However, with the commencement of the construction activities for the Project, the traffic movement will increase due to transportation of turbine components and site personnel. The turbine components such as blades, tower nacelle will be brought to the yard site and will then be sent to the individual turbine locations as per the requirement.

On an average, about 7-8 trucks/trailers will be required to bring the components of one turbine. Considering that at a particular instant of time, construction works for 10 turbines will be carried out simultaneously, a maximum of 70-80 trucks/trailers will ply on these roads. This kind of traffic movement may disturb the local population in the area and also pose increased risks of road accidents. Impacts during construction phase owing to traffic

- Increase in traffic movement on the road network linked to the project leading to traffic congestion and delays;
- Short term closure of existing transport routes during proposed construction/widening of access roads thereby causing disruption and delays in traffic;
- Increase in traffic related noise and emissions;
- Damage to existing roads and related structures due to heavy vehicular/ equipment movement;
- Increase of probability of road accidents to livestock and people; and
- Parking of vehicles in open fields and other non-project locations.
- As the existing panchayat roads (internal access roads) will be used, therefore the impact on community health and safety is assessed to be moderate

Impact Significance

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Medium	Medium	Medium	Moderate
Duration	Low			
Intensity	Moderate			
Frequency	Periodic			
Likelihood	N/A			
Sensitivity	Medium			

As the existing panchayat roads (internal access roads) will be used, therefore the impact on community health and safety is assessed to be moderate.

7.6.5.1 Mitigation Measures during Construction phase

- Signage shall be erected to identify site access routes and to inform motorists that local roads will be accommodating construction traffic;
- Widening and strengthening of village roads shall be undertaken where necessary, to accommodate the turbine delivery vehicle wheel tracks;
- When practicable, construction traffic movements (equipment and materials) shall be scheduled to avoid the peak traffic periods at the beginning and end of each day and other sensitive periods, in order to minimise any potential disturbance to local traffic.
- Appropriate speed limits for various motor vehicles and construction equipment shall be determined as part of the traffic management based on type of roads available;
- Regular inspection of access roads' conditions and whenever, necessary, repair of construction traffic related damages shall be done;
- Appropriate supervision shall be provided to control flow of traffic when machinery needs to cross roads;
- The project traffic or any project activity shall not obstruct the access to neighbouring properties;
- Dedicated parking area shall be provided around the project site for parking the private vehicles owned by construction personnel and other onsite staff; and
- Temporary concrete paved areas will be provided for parking of vehicles and overhaul provisions will be made for any accidental spill of oil or fuel during parking or whenever the vehicle is idling.
- Avoidance of passage through and near settled areas during night time hours;
- Oil and fuel leaks must be addressed within 24 hrs of observation or reporting on any vehicle or construction equipment;
- Vehicle maintenance and management parameters will form a critical component of key performance indictor for the contractor responsible to maintain their vehicles; and
- All heavy vehicles like cranes, battery operated trolleys etc. will be provided with reversing siren.
- The micro-siting guidelines recommended by National Institute of Wind Energy (NIWE), under the Ministry of New and Renewable Energy (MNRE), suggests wind farm developers to maintain a minimum distance of WTGs from sensitive receptors such as residential settlement/ house, highways, schools, religious structure, to ensure minimization of potential noise, shadow flicker and blade throw risks. Based on the formula, 168.0 m is the minimum distance[9] between the project turbines (G-114, Gamesa make, Hub Height 106 m and Rotor Diameter of 114 m) and receptors. It was observed that all the identified project turbine locations have ensured clearances as per the formula in order to adopt best Industry practices and all the locations are within the calculated safe minimum distance from the receptor locations.

Impact significance post adoption of Mitigation Measures

[9] Minimum distance = Height of the turbine + ½ x rotor diameter + 5 m

Criteria	Rating	Potential Magnitude	Relative Magnitude	Impact Significance
Spread	Medium	Low	Low	Minor
Duration	Low			
Intensity	Low			
Frequency	Periodic			
Likelihood	N/A			
Sensitivity	Medium			

8. Analysis of Alternatives

8.1 Introduction

As per IFC Performance Standards, a detailed analysis of probable alternatives for the chosen technology and location of project site along with other similar factors that contribute to the project as a whole is carried out prior to selection of each one of them. In order to make the process of arriving at the best alternative as transparent as possible, the following scenarios are taken into consideration:

- Project vs No Project scenario;
- Alternate Location for Project Site;
- Alternate Source for Power Generation;
- Alternate Technology for the project; and
- Alternate Route for Transmission Lines

8.2 Project vs No Project Scenario

Access to energy is a fundamental enabler for economic development and prosperity of any region. A survey conducted by the World Energy Council states that as the population increases and as the growing rate of electrification places huge requirements on energy supplies, the total primary energy demand of India is expected to increase by almost 150% by 2035.

After the bifurcation of Andhra Pradesh state, there is a rising demand for power in the successor state to build a new economy, attract investments and accelerate growth. The demand – supply scenario in Andhra Pradesh as obtained from the daily reports of the State Load Dispatch Centers (SLDC) is presented in the **Table 8-1**. The average over a two month period between June 14th and July 14th has been used to calculate the values provided.

Table 8-1: Existing Demand – Supply scenario in Andhra Pradesh

Parameter	Unit	Value
Average Daily Requirement	MU	135.6
Average Daily Supply	MU	125.6
Average Daily Shortage	MU	10
Average Daily percentage shortage	%	7.37
Unrestricted Maximum Demand reached	MW	6859
Maximum shortage	MW	1025

Source: Joint advisory document for Andhra Pradesh and Telangana, Andhra Pradesh Electricity Regulatory Commission

The anticipated power supply position of Andhra Pradesh in terms of Energy requirement and Peak demand for the year 2016-17 is given in the **Table 8-2** below:

Table 8-2: Power supply position of Andhra Pradesh

State	Energy				Peak			
	Requirement	Availability	Surplus (+)/ Deficit (-)		Requirement	Availability	Surplus (+)/ Deficit (-)	
	(MU)	(MU)	(MU)	%	(MW)	(MW)	(MW)	%
Andhra Pradesh	54,215	50,079	-4,136	-7.6	7,859	6,773	-1,086	-13.8

Source: Load Generation Balance Report 2016-17, Central Electricity Authority

Based on the data extracted from Load Generation Balance Report, provides Month-wise anticipated power supply position of Andhra Pradesh during the year 2016-17 in terms of peak demand and energy.

Table 8-3: Month-wise anticipated power supply position of Andhra Pradesh in terms of peak demand and in terms of energy

	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17
Month-wise power supply position of Andhra Pradesh during the year 2016-17 (in terms of peak demand)												
Peak Demand (MW)	7,047	7,247	7,333	7,283	6,976	6,888	7,179	7,041	6,765	7,045	7,317	7,859
Peak Availability (MW)	6,773	6,707	6,046	6,472	6,708	6,220	5,858	6,196	5,903	6,610	6,738	6,746
Surplus (+)/Deficit (-) (MW)	-274	-540	-1,287	-811	-268	-668	-1,321	-845	-862	-435	-579	-1,113
(%)	-3.9	-7.5	-17.6	-11.1	-3.8	-9.7	-18.4	-12.0	-12.7	-6.2	-7.9	-14.2
Month-wise power supply position of Andhra Pradesh during the year 2016-17 (in terms of energy)												
Requirement (MU)	4,516	4,691	4,567	4,732	4,593	4,265	4,540	4,030	4,278	4,534	4,499	4,970
Availability (MU)	4,366	4,523	3,909	4,370	4,444	3,967	3,908	3,938	3,896	4,358	3,990	4,411
Surplus (+)/Deficit (-) (MU)	-150	-168	-658	-362	-149	-298	-632	-92	-382	-176	-509	-559
(%)	-3.3	-3.6	-14.4	-7.7	-3.2	-7.0	-13.9	-2.3	-8.9	-3.9	-11.3	-11.2

Source: Load Generation Balance Report 2016-17, Central Electricity Authority

Table 8-3 above illustrates, it is anticipated that there will be power deficiency of 18.4% in the month of October 2016. Even though the percentage of power deficiency is lesser in all other months, the state is foreseeing a deficit power supply throughout the year.

The state of Andhra Pradesh has been procuring power from Andhra Pradesh Power Generation Corporation Ltd (APGenco), central government-run power generation companies like National Thermal Power Corporation Ltd (NTPC) and private sources.

It can be inferred from Table above that the power deficit scenario is anticipated to continue in 2016-17, with an annual deficit of more than 13% during peak demand. **Figure 8-1** and **Figure 8-2** and below gives an account of the anticipated scenario demand vs availability of power in Andhra Pradesh for 2016-17.

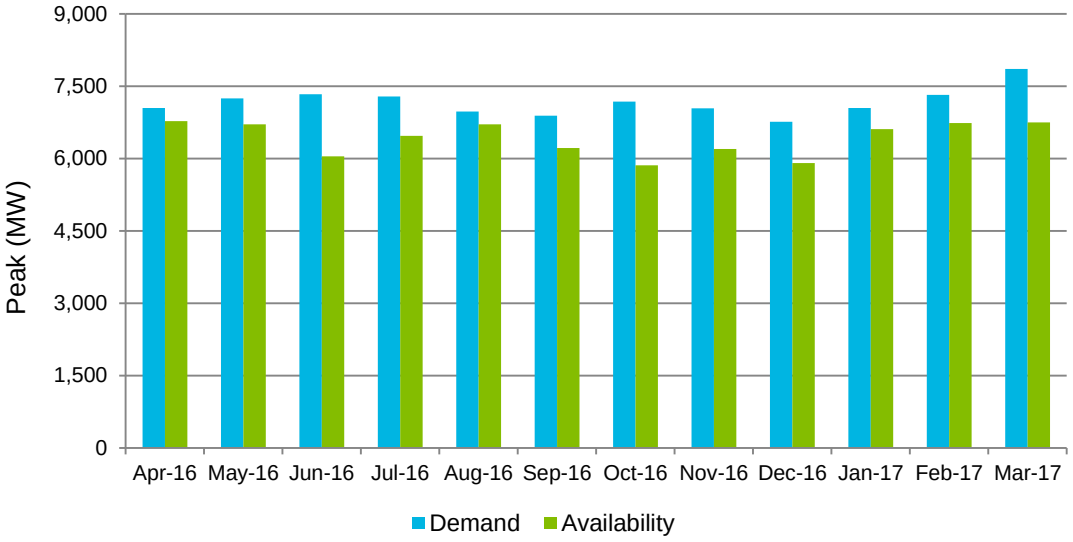
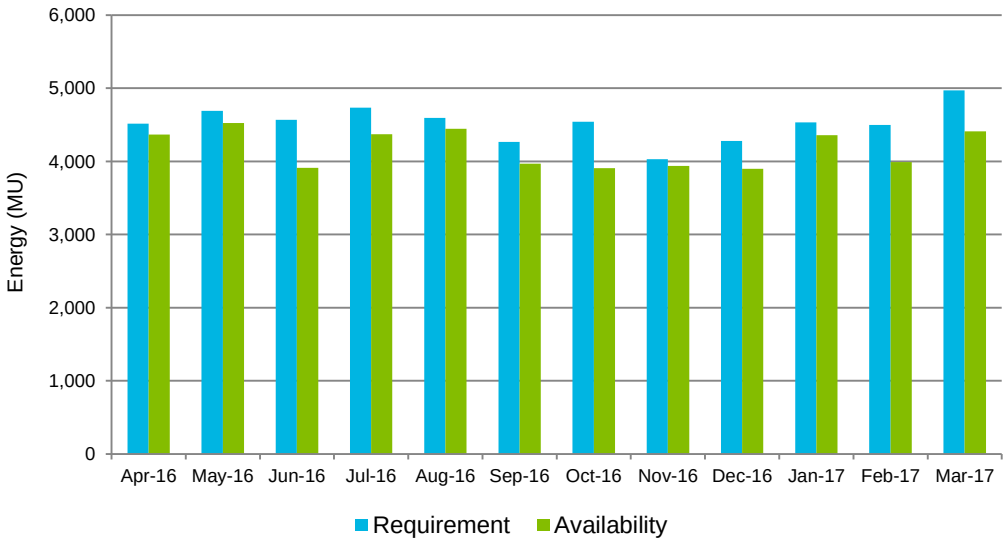


Figure 8-1: Peak Power Demand vs Availability in Andhra Pradesh (2016-17)



Source: Load Generation Balance Report; Central Electricity Authority

Figure 8-2: Energy Requirement vs Availability in Andhra Pradesh (2016-17)

It can be observed from the Figure above that the demand is always higher than the expected supply in all months, even though the anticipated deficit is highest during the months of June and July. These numbers clearly indicate the anticipated energy deficit scenario in the state and the need for increased production of electricity.

Andhra Pradesh is one among the three pioneer states in the country where the state and central Governments have rolled out a Programme under the name “Power for All”, aimed at providing access to electricity to each household, round the clock. This will lead to economic development of the state in primary, secondary and tertiary sectors resulting in inclusive development of the state. CRISIL (Credit Rating Information Services of India) had ranked Andhra Pradesh as No.1 based on the state’s performance in power sector, among all the states in 2003.

The Wind Power policy of Andhra Pradesh mentions that the wind power projects are exempted from obtaining any NOC/Consent for Establishment under pollution control laws from Andhra Pradesh Pollution Control Board. All approvals/clearances shall be disposed within 30 days from the date of registration. These are highly encouraging moves from the part of state Government to promote wind power generation in the state in an environmentally friendly manner, with a view to meet the growing energy demand.

Globally, India is the fifth largest producer of electricity but still an energy deficit nation and it is also estimated that around 295 million people today live in energy poverty in India. The requirement for more energy is quite apparent from these details and there is a huge significance for the proposed project, and hence the "*No Project*" scenario is not a viable option.

8.3 Alternate Source of Power Generation

India is a large and fast growing economy, and according to Planning Commission of India, the country's primary energy use is expected to increase by four to five times by 2031-32. Even though India's energy basket has a mix of all resources such as coal, lignite, oil, natural gas, LNG, nuclear, hydro, and wind power, the dominance of coal is conspicuous with a prominent share of approximately 50%.

The efficiency of fuels is compared on the basis of their energy content and oil is considered as the standard for this comparison. One tonne of oil can generate 42 billion Joules or 10 Billion calories of energy whereas one tonne of Indian thermal coal can generate only 4.1 Billion calories. Thus 1 Mt of Indian coal is 0.41 Mtoe (Million tonnes of oil equivalent). Taking the thermal efficiency of the power plant and other losses in the system into consideration, in the case of coal-fired boilers, the equivalence between electricity and fossil fuels is 1 Billion kWh = 0.28 Mtoe. Electrical energy in kWh can be converted to kJ or kcal and can be expressed as Mtoe. One billion KWh of energy generated from wind power is equivalent to 0.086 Mtoe, since the intermediate stages of energy production don't generate any heat.

Table 8-4: Life-cycle Emissions from Power Sources

LCA Emissions (g CO_2 equivalent/kWh)	Wind	Solar	Nuclear	Coal
Implementation	13.7	37.5	1.2	3.6
Operation	4.7	12.0	12.4	918.8
Decommissioning	0.6	0.5	0.4	52.2
Total	19	50	14	975.3

Source: Report on developmental impacts and sustainable governance aspects of renewable energy projects, Ministry of New and Renewable Energy

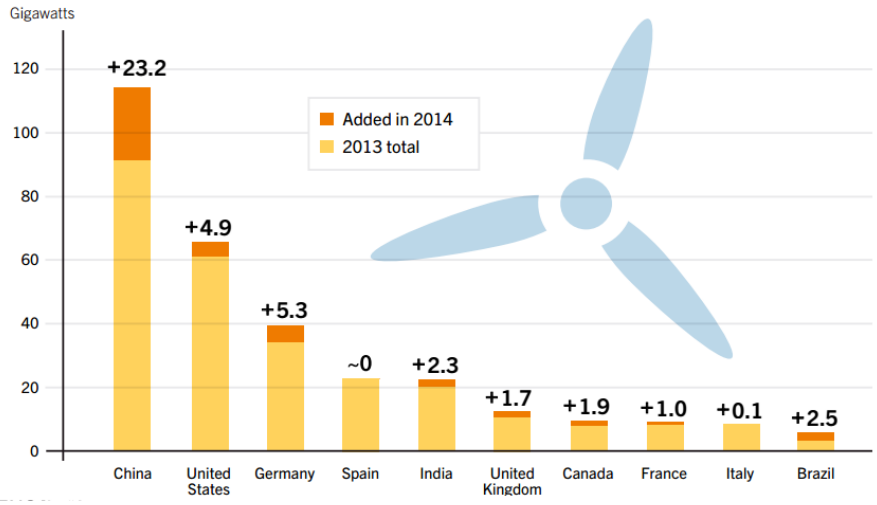
As evident from the Table above, the emission of CO_2 per kWh of energy generated from a Coal based power plant is more than 50 times that of the emission from a wind based power plant. The only emissions from the Renewable energy technologies are the emissions from fossil sources used in the production and manufacturing of equipment, waste disposal during construction, recycling etc. These life-cycle emissions are significantly lower as indicated in the table above.

As wind turbines don't produce any emissions that pollute the environment during its operation, unlike other power generating processes like burning of fossil fuels such as coal or natural gas, it is a clean fuel source and a power solution for remote areas like Anantapur. Wind is the only energy form which doesn't require water for the production of electricity and also the one which generates negligible amount of waste, i.e. only during the construction period. A recent International Renewable Energy Association (IRENA) study found that countries like India would be able to greatly reduce water withdrawals and use in the electricity sector by increasing the share of renewables.

Over the past few years, the capital costs of wind power have declined, primarily through competition as well as through technological advances that have increased capacity factors. Onshore wind power is now cost-competitive, or nearly so, on a per kWh basis with new coal or gas fired plants, even without compensatory support schemes. (Source: Renewables 2015 Global Status Report). Turbine designs for use on- and offshore continued to evolve to improve wind's economics in a wider range of wind regimes and operating conditions.

Recognizing the importance of renewable energy and its role in sustainable development, the United Nations General Assembly declared 2014 the first year of a decade of Sustainable Energy for All (SE4All), which aims to

double the share of renewable energy in the global energy mix from a baseline share of 18% in 2010 to 36% by 2030.



Source: Renewables 2015 global status report

Figure 8-3: Wind Power Capacity and Additions, Top 10 Countries, 2014

Figure 8-3 clearly points to the fact that as compared to developed nations such as China and United states, the wind power capacity addition in India is very less. Although India stands fifth in wind power generation, it generates less than 20% of China's wind energy production.

In India, the Ministry of New and Renewable Energy has announced generation based incentive for grid connected wind power projects. The total potential for wind power generation in the country as on 31.03.2014 is estimated to be 102772 MW, which is approximately 69.6% of the renewable power. The new Andhra Pradesh Government is keen to promote clean energy and has a welcoming approach towards wind power generation. The state's Wind power policies has always been generous and hence have always attracted the wind power companies for turbine siting to regions like Anantapur.

As per the prevailing Ministry of Environment and Forest laws, (the Schedule 1 of Ministry of Environment and Forests (Government of India) notification dated January 19, 2009), 38 activities are required to undertake environmental impact assessment studies. Since wind is one of the cleanest sources of energy, Environmental Impact Assessment study is not required for wind mill projects as there is no negative environmental impact due to the project activity. According to the International Renewable Energy Association (IRENA), wind power sector has generated 48,000 jobs (direct and indirect) in India.

Considering all the above mentioned favorable scenarios existing nationally and locally for wind power generation, there is no requirement of an alternative method. Wind power is the most suitable and environmental friendly option for power generation.

8.4 Alternate Location for the Project

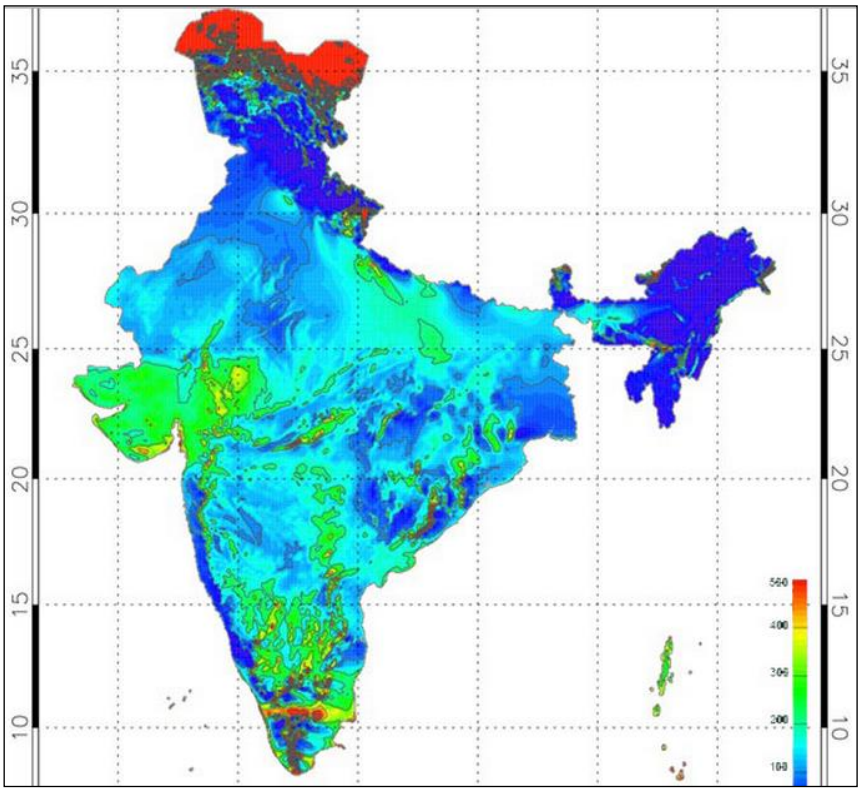
The location of any wind based power generating project is finalised based on several factors which allow the project to operate in a technically and economically viable manner. Some of these factors include:

- Availability of optimum wind speed, which is the primary requirement for a wind power project
- The distance between the transmission line route and project area should be less, for easy transportation of energy
- No substantial negative impact on environment or socio-economic conditions of the region
- Ability to build the project on a site fulfilling national and state compliances
- Andhra Pradesh Wind Power policy states that the wind power potential in the combined state of Andhra Pradesh as estimated by the National Institute of Wind Energy (NIWE), is around 14,497 MW at 80 m above ground level.

It also mentions that a region like Anantapur is one of the ear-marked zones because of its high wind power potential. The region is dry as it faces scarcity of rainfall, wind is a naturally available resource, and farming is the main occupation of people in the region.

Andhra Pradesh is one of the States in India having windy locations, identified for wind power generation. While interviewing the forest official of Anantapur during site survey, he mentioned that there are no Reserve Forests, or any other ecologically sensitive areas around the region. Also, there was neither a requirement to relocate the native people nor any destruction of flora-fauna occurred as part of the project.

The local community has a positive approach towards upcoming wind energy projects in the region as there are similar projects by the same company as well as other companies, which have already made ingress into the neighbouring villages and are functioning without any encumbrance. They have helped improve quality of local infrastructure like construction of new roads. Apart from these factors, the villagers are of the expectation that such projects will elevate the standard of economy and provide them jobs like that of a security guard and other contractual opportunity of providing building materials and man-power.



Source: Data on estimation of Installable Wind Power Potential at 80 m level in India, National Institute of Wind Energy

Figure 8-4: Wind Power Density map at 80 m level

8.5 Alternate Route for Transmission Lines

Even though the construction of transmission line has very less impact on environment and socio-cultural resources, this can be reduced by careful selection of route.

Construction and commissioning of the power evacuation system from the wind farm sub-station is the responsibility of the power purchaser. The voltage delivered to APTRANSCO at the interconnection point and the voltage delivery at 33kV level will be interfaced from the wind project to existing 33/11 kV DISCOM Substation with a proposed wind power capacity of 8 MW on each 33 kV line. At the EHT level (220 kV) the project interfacing from the pooling substation to proposed APTRANSCO EHT substation at Borampalli village. A transmission line of length 24 km will be installed from the WTGs to switchyard, which will be later stepped up from 132 kV to 220 kV and evacuated at through APTRANSCO EHT line. The land required for the transmission line has already been procured through EHV line contractor engaged by APTRANSCO. Map outlining exact transmission route was not been made available.

The multiple components that are interlinked with the selection of route for transmission lines include landowners' concerns, habitats of local species, seasonal water bodies or any other topographical or cultural features that could pose conflict. A careful multifarious approach is taken to reach a consensus on the routes that will do least damage and contain costs.

The following factors are generally considered while selecting the route for transmission line:

- The line should not infringe with any area of natural resources, forest lands;
- Any route which has the presence of a monument of cultural or historical importance, community structures, or houses is exempted;
- If selection of an area involves extensive removal of vegetation, that is averted;
- No environmentally sensitive sites are to be damaged during the process of installing transmission lines and access roads;
- Right of way/access roads to the substation will be shared with local residents and other users;
- The proposed route should not affect any public utility service such as schools, playgrounds, etc;
- There should not be threat to the survival of any community, while selecting the route.

Land procured has been on a willing buyer / willing seller basis (please refer to Section 3.6 for more details on the land procurement process). The project area is rain fed region and agriculture is limited during rainy season only, and it was reported that habitations, community structures, or residential areas have been avoided and by passed during the procurement stage. The transmission route therefore has been chosen considering the above social conditions, in addition distance to be covered, financial benefits.

8.6 Conclusion

United Nation's Intergovernmental Panel on Climate Change (IPCC) has projected that renewable energy can provide approximately 77% of global primary energy supply by 2050. The state level incentives provided by the new government of Andhra Pradesh are attractive enough to influence the wind power companies.

As mentioned in the sections above, the project has many advantages like elevating the standard of rural economies, increasing the power supply of the energy deficit state of Andhra Pradesh in an environmentally friendly manner. The project with existing options for site, mode of power generation, route of transmission line etc., is the appropriate alternative and is beneficial for the region.

9. Stakeholder Engagement and Grievance Redressal

Stakeholders are persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project and/or the ability to influence its outcome, either positively or negatively. They can comprise individuals, communities, social groups, organizations etc. It is often observed that the poor and the marginalized are often ignored either due to the fact that they are unaware or do not have a forum to voice their opinion.

The purpose of the Stakeholder Engagement Plan (SEP) is to ensure that the direct and indirect impacted stakeholders of the project are regularly apprised of the project activities. The plan has been developed in order to draw out an outline wherein the communication process associated with the activities of the project cycle is to be undertaken.

9.1 Stakeholder Engagement

The stakeholders in the project were identified based on their level of interest and influence over the project activities. The stakeholders were primarily divided into direct and indirect and further regrouped as internal and external. In the table below, the types of stakeholders as per their level of interest and influence have been provided.

Table 9-1: Types of Stakeholder as per their interest and influence

Sno.	Types of Stakeholders	Description	Groups + Individuals
1	Direct Internal Stakeholders	Direct internal stakeholders comprise the parent company or the project proponent and the employees of the company that are directly controlled by the parent company.	• HFE (Project Owner) • Gamesa (EPC Contractor)
2	Direct External Stakeholders	Direct external stakeholders comprise the project affected people/families, contractors, supply chain and financial intermediary who are directly affected by the project activities but are not directly controlled by the project proponent.	• Project Affected Persons/Families (Land Owners) • Andhra Pradesh State Power Department • Andhra Pradesh Power Transmission Corporation Limited (APTRANSCO) • Financial Intermediary • Contractors • Vendors
3	Indirect Internal Stakeholders	Indirect internal stakeholders consist of the secondary stakeholders who would have a more indirect interest but within the direct influence of the project.	• Families of Direct Employees
4	Indirect External Stakeholders	Indirect external stakeholders comprise of those stakeholders who might be not be involved directly in the day to day operation of the project but have an interest in the activities of the project.	• Local Community residing within the 8 villages of the project area • Opinion Leaders of local communities residing within the 8 villages of the project area • Local Government Institutions of 8 Villages • Andhra Pradesh State Pollution Control Board • Centre for Wind Energy Technology • New & Renewable Energy Department Corporation of AP limited (NREDCAP) • Local Media

9.1.1 Stakeholder Analysis

Stakeholder analysis takes a more comprehensive view of the stakeholder's group interests, how they would be affected and to what extent and influence they could have on the project. These aspects cumulatively provide the basis for constructing the stakeholder engagement strategy. The key stakeholders identified in the previous section have been categorised into four major groups: Government Agencies, Positively Influenced Stakeholders, Critical to Engage and Donors. The categorisation list of key stakeholders has been provided in the following table.

Table 9-2: Categorization List of Key Stakeholders

Categorization	Key Stakeholders
Government Agencies	• Andhra Pradesh State Power Department • Andhra Pradesh Power Transmission Corporation Limited (APTRANSCO) • Andhra Pradesh State Pollution Control Board • Centre for Wind Energy Technology • New & Renewable Energy Department Corporation of AP limited (NREDCAP)
Positively Influenced Stakeholders	• Project Affected Persons/Families (Land Owners) • Families of Direct Employees • HFE (Project Owner) • Gamesa (EPC Contractor) • Local Community residing within the 8 villages of the project area • Contractors • Vendors
Critical to Engage	• Opinion Leaders of local communities residing within the 8 villages of the project area • Local Government Institutions of 8 Villages • Local Media
Lenders	• Financial Intermediary

In order to map the interest/influence of the stakeholders on the project activities, a matrix showcasing the stakeholders and their interest/influence has been developed. This step is to assess the interest/influence into high, medium and low levels. In the table below, **Table 9-3** the interest matrix has been provided.

Table 9-3: Interest Matrix of Stakeholders

Categorisation	Key Stakeholders	Influence Power to facilitate or impede project	Interest in the Project
Government Agencies	Andhra Pradesh State Power Department	High	High
	Andhra Pradesh Power Transmission Corporation Limited (APTRANSCO)	High	High
	Andhra Pradesh State Pollution Control Board	High	High
	Centre for Wind Energy Technology	High	High
	New & Renewable Energy Department	High	High
	Corporation of AP limited (NREDCAP)	High	High
Positively Influenced Stakeholders	Project Affected Persons/Families (Land Owners)	Low	High
	Families of Direct Employees	Low	High
	HFE (Project Owner)	Low	High
	Gamesa (EPC Contractor)	Low	High
	Local Community residing within the 8 villages of the project area	Low	High
	Contractors	Low	High
	Vendors	Low	High
Critical to Engage	Opinion Leaders of local communities residing within the 8 villages of the project area	Low	High
	Local Government Institutions of 8 Villages	Low	High
	Local Media	Low	Medium

Categorisation	Key Stakeholders	Influence Power to facilitate or impede project	Interest in the Project
Lenders	Financial Intermediary	High	High

9.1.2 Communicative Method

Stakeholder engagement becomes a successful exercise when proper and participatory communicative methods are used. This ensures that the stakeholders are kept engaged and well informed of the project development at every stage. A combination of communicative methods is usually used to engage with the stakeholders. To determine which option is best suited to the various stakeholders, a benefit analysis of each option has been carried out. The communicative methods are:

- General Information consisting of the project's various activities, the operation stage and impacts that might arise shall be made available:
  - on information board of the Gram Panchayat's office within the project area
  - on information board of VUBPL's site office
  - on HFE's website
  - in local newspaper
- Detailed information including documents like ESIA report; Environment, Health & Safety and Social Policy, Environment Management Plan, Social Management Plan including environmental decisions shall be in hard copies and disseminated to:
  - VUBPL's site office
  - Electronic version of these documents will be made available at HFE's website.
- In addition to this, a host of tools and techniques can be adopted to engage with the stakeholders in a transparent and accountable manner. Below a list of the tools and techniques which can be adopted are mentioned:
  - Public Meeting: This tool can be used to disclose information on a large scale involving the stakeholders of a particular village. A schedule of the meeting can be circulated well in advance and discussions can involve feedback session from the stakeholders. The meeting can be conducted in the premise of the village school for proximity and familiarity purposes. Once the meeting concludes, minutes of the same should be kept as a record with the site office and a copy given to the village head. Schedules of future meetings should be discussed and finalised so that the stakeholders can gauge the seriousness of the project proponent in continuing the engagement process.
  - Focus Group Discussion (FGDs): FGDs are important when gauging with a particular group of stakeholder on issues related to the project activities. It can be used to understand the needs, perceptions and concerns of the group. The discussion will give space for the members to voice their concerns and suggestions. The moderator of the discussion should be impartial in his/ her view and should encourage everyone present to participate in the discussion. Records of the FGDs should be maintained and updated regularly.
  - Participatory Workshops: Participatory workshops are meetings which enable local people to analyse, share and enhance their knowledge to plan, manage and evaluate development projects and programmes. Visual aids – such as mapping, videos, illustrations, timelines, card sorting and ranking, Venn diagrams, seasonal calendar diagramming and body maps are often used in participatory workshops to engage participants and capture knowledge. They are often an effective means of getting participants to reflect on issues and their own personal experiences. These workshops also pay particular attention to group dynamics and breaking down distinctions between 'uppers' – those with power, standing, influence etc. within a community – and 'lowers' – those with less power, influence and standing within a community. To initiate such a workshop, an expert familiar with participatory tools and conducting such workshops shall be engaged.
  - Participatory Rural Appraisal (PRA) Techniques: PRA techniques are usually adopted to emphasize local knowledge by enabling local people to make their own appraisal, analysis and plan. PRA uses group animation and exercises to facilitate information sharing, analysis and action among stakeholders. This process can be useful when the project proponent initiates any developmental

activities in the area and uses the local knowledge to plan and strategize so that they feel responsible for delivery of the objectives.

9.1.3 Stakeholder Engagement Program

The consultation with the stakeholders will be conducted by the Community Liaison Officer/Social Officer (VUBPL) and Social/CSR Officer (Gamesa) who will work in collaboration with the nominated (Grievance Officer) and Site Incharge (Gamesa) and Project Manager (VUBPL) at the site level. Any grievances from the community relating to any issues that might arise from the project activities will be managed by the nominated Grievance Officer based at the Site Office. The Community Liaison Officer is to report directly to the Project Manager based at the Site level.

Consultations with the government agencies will be conducted as per the schedule that will be created with the Community Liaison Officer and Project Manager. These stakeholders will be informed in advance of the planned project activities. The development of the facilities will be based on the ESIA procedures and mitigation issues once an ESIA study has been completed.

Consultations with the direct internal stakeholders will involve meetings, information boards announcements and an Intranet system to apprise the direct employees of VUBPL and Gamesa regarding the procedures of emergency response system, incident/accident reporting, grievance redressal mechanism, HR Policies and Procedures, welfare measures etc. In addition, communication of general employment conditions, company's code of conduct for work site, EHS concerns, use of PPEs, information and awareness about the requirements of labour laws and minimum wages, working hours, grievance redressal, retrenchment process etc. should be also be conducted with workers engaged with contractors.

Project related information will be posted on the informational boards at the site office as well as at the Corporate Level. Information on the project milestones will be published in advance on the company's website to be available for the public and non-governmental organizations in the area to comprehend the attitude of the external stakeholders. In addition, the company will publish information on the project in the local newspapers.

In turn, if any issues are raised by the stakeholders, the project proponent management comprising of the Grievance Redressal Committee at the Site Level will respond accordingly in the shortest possible time. Details of which have been provided in the Grievance Redressal Mechanism section of the report.

The responsibility for the SEP implementation will be held by the Community Liaison Officer (VUBPL) based at the Site Office. He will be supported by the Project Manager (VUBPL), Social/CSR Officer (Gamesa), Site Incharge (Gamesa) and nominated Grievance Officer at the site level.

A summary of the consultation activities that the project proponent shall undertake as part of the Engagement Plan pertaining to the villages around the project area and other stakeholders have been provided below:

Table 9-4: Summary of Consultation Activities

Stakeholder	Objective and Consultation Method	Proposed Timeline	Responsibility
Local Community, Opinion Leaders, Local Media at Project Site	• Disclosure of the project at all 8 villages within the project area and progress of the work to be displayed at the Information Board of Gram Panchayats office within the project area. • Website of the Company	Before the commissioning of the Project	Community Liaison Officer from the Company and Local Leaders of the 8 villages.
Government Authorities	• Information meetings and consultations	On-going on a permanent basis (every six monthly)	Company: Head-Projects (HFE), Project Manager / HSE Supervisor (VUBPL), EHS Officer (Gamesa) and Community Liaison Officer (VUBPL)
Direct Employees	• Internal meetings of direct employees and managers	• On-going process on a permanent basis: monthly	• Company: Project Manager/ EHS Officer & Community Liaison Officer

Stakeholder	Objective and Consultation Method	Proposed Timeline	Responsibility
	• Day to day contact	• On-going on a permanent basis	• EHS Officer
Contractors (Third Party)	• Meetings with contractors and their respective managers	On-going on a permanent basis: monthly basis	EHS Officer, Project Manager and Community Liaison Officer
Lenders	• Information on project status • Submission of annual reports, information on any project-related events that could potentially create an increased risk of the project	On-going process on a permanent basis	Company: Project Manager; designated person from HFE, EHS Officer and Community Liaison Officer.

The stakeholder engagement process should be carried out at two levels, namely, local community and local governing bodies. A summary of the proposed plans that is to be initiated by VUBPL have been described below:

Table 9-5: Summary of Proposed Plan of Activities

Sl. No.	Key Stakeholders	Proposed Plan of Activities
1	Positively Influenced Stakeholders/ Local Communities	• Announcement of vacancies (skilled/unskilled) at proposed site • Announcement of contract work for small scale work associated with the proposed project • CSR Activities to be initiated by Project Proponent • Consultation with village panchayats about movement of heavy vehicles • Information on route and timing of vehicle movement to be provided to village administrations • Set up a grievance redress mechanism and inform the community about the procedure • Discuss the management plan with the community and incorporate the comments
2	Local Governing Bodies	• Compliance with legal requirements • Involvement of various CSR Activities
3	Lenders	• Compliance with International Guidelines (IFC Sustainability Framework & other national and local legal requirements) • Regular Reporting

It is to be noted that the proposed plan of activities relating to the stakeholder engagement can change as per the future planning of activities by VUBPL.

9.1.4 Monitoring and Evaluation

Monitoring: Monitoring of project activities is necessary to cater to the stakeholder's concerns by ensuring transparency in guaranteeing the project proponent's commitment in implementing the mitigation measures that addresses the environmental and social impacts arising from the project.

Through this information flow, the local stakeholders feel the sense of responsibility for the environment and welfare in relation to the project and feel empowered to act on issues that might affect their lives.

Internal monitoring of project related activities as well as associated activities involving the local communities should be contemplated upon on a regular yearly basis (by identified staff from the Corporate level) to bring in openness in the company's commitment. In addition, external monitoring of a company's environmental and social commitments can strengthen stakeholder engagement processes by increasing transparency and promoting trust between the project and its key stakeholders.

VUBPL should undertake a commitment in undertaking internal audits every once in a year. All related information shall be readily maintained at the site office and produced at the time of the audits.

Audit reports shall be accordingly created after every yearly audit and submitted to Head-Projects. All records of these reports shall be maintained at the site office as well as the Corporate Office. In addition, an external auditor

shall be engaged every six monthly to assess the activities of the project and its mitigation measures. The auditor shall accordingly submit a report to the company for review and this should be forwarded to the lender financing the project as well.

Reporting: Performance of VUBPL will be reviewed yearly against the Stakeholder Engagement Plan. The report will include, but not be limited to, the following:

- Informative materials disseminated, its types, frequency, and location
- Place and time of formal engagement events and level of participation
- Activities of community welfare undertaken
- Feedback on CSR initiatives
- Other interactions with the community; and
- Numbers and types of grievances (both from the community and workers) and the nature and timing of their resolution.

9.2 Grievance Redressal Mechanism

Grievance Redressal Mechanism (GRM) is an important criterion for development projects wherein ongoing risks and impacts of projects are probable. The GRM provides a way to reduce risks for projects, offer communities an effective avenue for expressing concerns and achieving remedies and promote a mutually constructive relationship.[10] It is an important tool through which the communities concerns and complaints are registered and addressed. This mechanism is a significant pillar of the stakeholder engagement process as it creates opportunities for the project proponent and communities to identify problems and determine solutions together. The mechanism tends to meet the requirements of stakeholder engagement process, prevent and address community concerns, reduce risk, and assist the processes that create positive social change.

The GRM has been developed with an intention of it being an effective tool for early identification, assessment and resolution of complaints during project implementation. It is a means through which acceptance, assessment and resolution of community complaints concerning the performance or behaviour of the project proponent are ascertained and addressed. The GRM prepared should be implemented to the entire life cycle of the proposed project.

9.2.1 Steps for Developing a Grievance Mechanism

VUBPL/ Gamesa while developing the Grievance Mechanism are required to adhere to the following steps:

- **Development of Procedures**: VUBPL/Gamesa should ensure that procedures for lodging and registering of grievances are in place before the plan is implemented at the site level. The procedures of Grievance Mechanism should comprise of identifying the personnel (Grievance Officer at Site level) who will be responsible for receiving and addressing the grievances at the site level and handle the cases at the escalation level. The procedures to be developed should include assessment procedures, procedure to determine the appropriate resolution process, procedures for making decisions on proposed settlements, appropriate time frames for each step in the grievance resolution process and notification procedure to the complainant about eligibility, assessment results, proposed settlements and the like.
- **Develop Resolution Options and Response:** Once VUBPL/Gamesa developed procedures, formal and informal resolution options should also be developed along with preparation of formulating a response. General approaches to grievance resolution many include proposing a solution, reaching a resolution through discussion or negotiation, using a third party to either informally or formally resolve the matter through mediation and through traditional and customary practices.
- **Publicise the Grievance Mechanism**: Once the procedures for Grievance Mechanism has been developed by VUBPL/Gamesa, it has to be publicised through various stakeholder engagement activities as detailed out in the Stakeholder Engagement Plan. VUBPL /Gamesa should inform the local community in the first instance and then remind them of this mechanism on a regular basis during the project construction and operation phases. Various communicative methods can be adopted in disseminating the information like printed materials, displays, face to face meetings and website updation. The grievances redress

[10] A Guide to Designing and Implementing Grievance Mechanisms for Development Projects by The Office of the Compliance Advisor/ Ombudsman for IFC and MIGA, 2008.

mechanism (GRM) shall be documented in English and Telugu and copies shall be kept at the project site office and corporate office. The GRM is also to be displayed at notice board at the project site office and training on the GRM shall also be provided during induction. VUBPL /Gamesa is to ensure that the contractor would keep the workers informed about the grievance mechanism at the time of recruitment and make it easily accessible to them. All the relevant contact numbers to be made available to them.

- **Training/ Workshops on Grievance Redressal Mechanism**: A separate training/ workshop should be undertaken by VUBPL/ Gamesa at the community and worker level to discuss the process of how a grievance gets registered, the local contact person's/grievance officer details of receiving grievances, the significance of grievance boxes, the timelines for addressing the grievances and the personnel involved in the redressal process. These trainings should be held every half yearly and feedback/suggestions from the community should be acknowledged and changes to the GRM should accordingly be undertaken to make it more user friendly.
- **Recording of Grievances:** Once the stakeholders are aware of the mechanism and access it to raise grievances, VUBPL/Gamesa is required to acknowledge the same and keep the complainant's identity anonymous. Consequently, VUBPL/Gamesa is required to collect grievances by checking the grievance boxes once every fifteen days, record and register the grievances that have come in as per the identified formats and track them throughout the redressal process to reflect on their status and important details. A Grievance Log or database emphasising the records and status of the grievance is to be maintained by the identified Grievance Officer at the site level. The Grievance Log can be used to analyze information about grievance and conflict trends, community issues and project operations to anticipate the kinds of conflicts that the project proponents might expect in the future both to ensure that the grievance mechanism is set up to handle such issues and to propose organizational or operational changes.[11]
- **Appeal:** If the grievance redressal solution is not acceptable or agreed by the project proponent, the complainant should be offered to an appeal process. Circumstance revolving around when an appeal can be made should be set by VUBPL/Gamesa so that accountability and transparency is promoted by them in every step. National Court or convening of a senior and independent panel of individuals to seek appropriate resolution of the case with representation from both government and civil society is often encouraged. This panel may also play the role of providing strategic oversight and assurance of the mechanism through review monitoring and tracking data.
- **Resolve and Follow Up:** Once the corrective action has been agreed upon, a good practice is to collect proof of those actions in terms of taking photographs, documentary evidence, getting confirmation from the complainant and filing the same within the case documentation. In addition, monitoring and follow up on the resolution agreed upon should be conducted once to close the case accordingly. VUBPL/Gamesa are required to provide regular (yearly) reports to the public that track the number of complaints received, resolved, not resolved and referred to a third party. In addition, the funding agency also needs to be constantly apprised of the yearly reports in order to support VUBPL/Gamesa in early identification of developing risks.

9.2.2 Proposed Grievance Redressal Mechanism for VUBPL/Gamesa

VUBPL/Gamesa in order to implement the Grievance Redressal Mechanism are required to identify the contact person/grievance officer involved at the site level for registering the grievances, the process of registering and action taken thereon for the resolution of the grievance, the timeline required in each step and criteria in escalation of the case to the higher level.

A site level approach is proposed to be developed for redressal of all cases of grievances. The steps of grievance redressal for VUBPL/Gamesa have been provided below:

Receive and Register a Complaint

- Any stakeholder with concerns pertaining to onsite work such as community health and safety, local employment, community risk, migrant labour etc. may register their complaint in writing to the nominated person/grievance officer at site level;
- Secured grievance boxes shall be placed at the entrance of the site office;

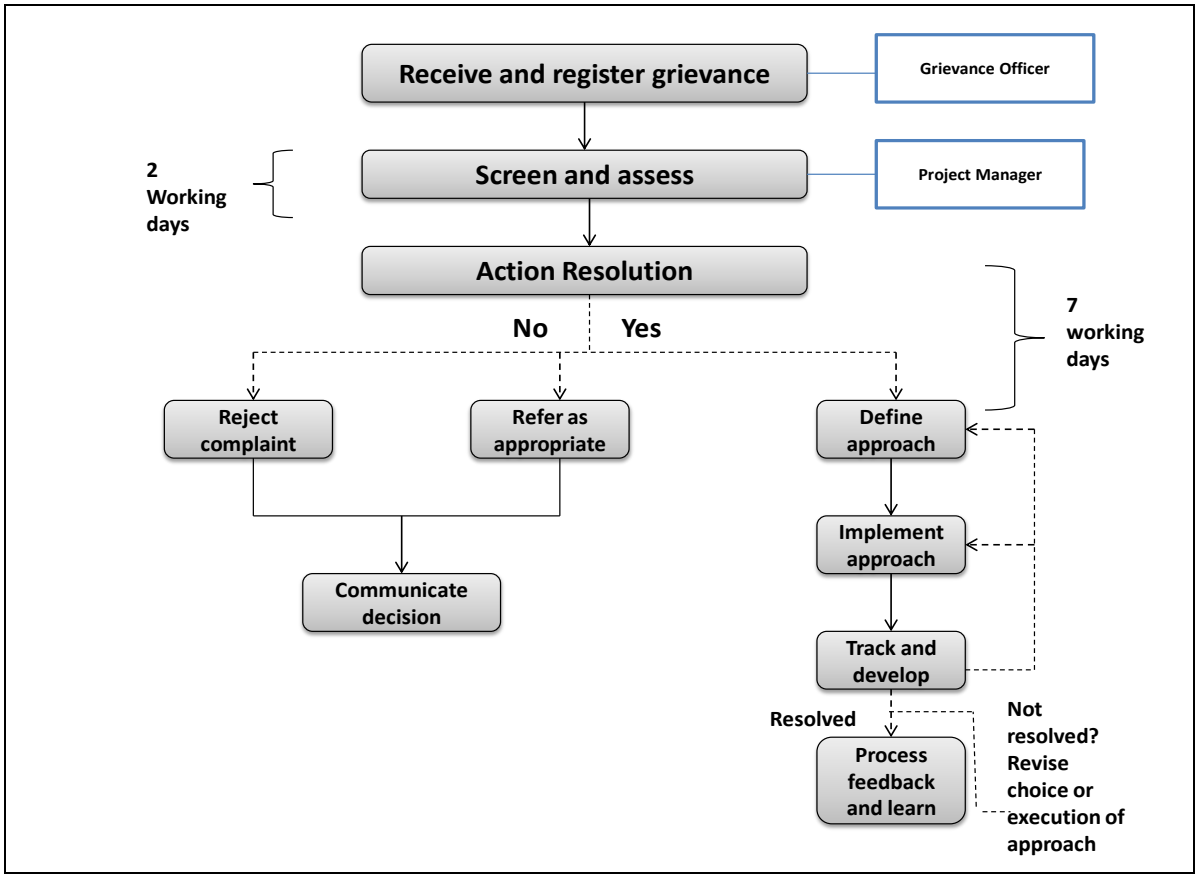
[11] A Guide to Designing and Implementing Grievance Mechanisms for Development Projects by 'The Office of the Compliance Advisor/ Ombudsman' for IFC and MIGA, 2008.

- If any stakeholder or community member wishes to remain anonymous, he/she can write down the grievances and drop in the available complaint box;
- Once a complaint has been received it shall be recorded in the grievance log register or data system.

Assessment and Addressal of Complaint

- The identified Grievance Officer will open the complaint boxes every fifteen (15) days and forward the grievances to the Project Manager for further action;
- The grievance will be assessed by the Project Manager within two (2) working days to determine if the issues raised by the complaint fall within the mandate of the grievance mechanism or not;
- During the assessment of complaints, the GRC team (Site Incharge, EHS Officer, Project Manager, Community Liaison Officer and CSR Officer of Gamesa) will gather information about the key issues and concerns and helps determine whether and how the complaint might be resolved;
- The grievances will be redressed at the Site Level by the GRC within 7 working days;
- If the grievance fails to be addressed at this level the complainant will have the option to approach the appropriate court of laws for redress;
- The complainant will have the opportunity to be present at the committee meetings and discuss the grievance faced by him/her.

The Grievance Mechanism proposed for VUBPL/Gamesa to consider and implement has been provided in the figure below:



Source: Adapted from CAO's Guide to Designing and Implementing Grievance Mechanisms for Development Projects

Figure 9-1: Proposed Grievance Mechanism Structure for VUBPL/Gamesa

9.2.3 Resources Required for Grievance Mechanism Implementation

A Grievance Mechanism becomes successful if adequate resources are assigned in its implementation. Adequate resources here refer to people, systems and processes and associated financial resources. In order to

incorporate the responsibility of designing, implementing and monitoring the grievance mechanism, the senior management at the corporate level of HFE should be involved in executing the various tasks.

For a grievance mechanism to function effectively, it is important to establish a governance structure and assign responsibilities for the mechanism's implementation. The following roles and responsibilities have been identified for grievance mechanism implementation:

Nominated Grievance Officer

The Community Liaison Officer (VUBPL) based at the Site Level is to be nominated as the Grievance Officer. The incumbent is to work in tandem with the Project Manager, EHS Officer, CSR Officer and Site Incharge. They cumulatively form the Grievance Committee at the site level.

9.2.4 Engagement of Third Party

To maintain ultimate transparency and accountability for the grievance mechanism process, third parties such as local governments, local community etc. can at times be involved in the grievance redressal process. These parties can serve as process organizers, places to bring a complaint to be passed on to the company or as facilitators, witnesses, advisors or mediators. Third parties can assist in enhancing the trust level from communities as well as overcome limitations of project-level mechanism.

Through the involvement of third parties as facilitators, the community's confidence in project level grievance mechanism can be increased and the project proponent can gain a better reputation with and greater trust from stakeholders. In addition, cost-efficiency and supplement of internal resources can also be achieved if this step is contemplated upon.

9.2.5 Monitoring and Reporting

Monitoring and reporting are requisite tools of measuring the effectiveness of the grievance mechanism, the efficient use of resources, determining broad trends and acknowledging recurring problems so that they can be resolved before they reach a higher level of contention. They also create a base level of information that can be used by the project proponent to report back to the stakeholders.[12]

Monitoring

Depending on the extent of project impacts and the volume of grievances, monitoring measures like internal (by identified Corporate level staff) and external audits (third party consultants) every once in a year based on the complexity of the nature of grievances can be adopted by VUBPL. Grievance records maintained should provide the background information for these regular monitoring exercises. Through the review of each grievance and analysis of its effectiveness and efficiency, VUBPL can draw on the complaints to evaluate systematic deficiencies. In addition, monitoring of the grievance mechanism helps to ensure that the design and implementation of the mechanism is adequately responding to stakeholder's comments in a cost effective manner.

Reporting

All grievances registered have to be recorded and regularly updated. The site management or Grievance Officer is responsible to discharging this responsibility and he should be able to produce this document whenever any audits take place. All minutes of meetings with stakeholders, complainants and Grievance Committee are to be recorded and documented regularly for reference purposes. In addition, through the process of monitoring and the reports produced thereafter, assurance of continual improvement of the company's operations is guaranteed. The company can also use these monitoring reports to report back to the community on its implementation of the mechanism and the modification/ changes proposed to make it more user-friendly.

[12] IFC's Good Practice Note on Addressing Grievances from Project-Affected Communities

10. Environmental and Social Management Plan

This chapter addresses the requirement of IFC Performance Standard-1 which highlights the importance of managing the social and environmental performance throughout the life of the project. The purpose of an Environmental and Social Management Plan (hereinafter referred as 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. The key objectives of the ESMP are to:

- Formalize and disclose the program for environmental and social management;
- Provide a framework for the implementation of environmental and social management initiatives.

The Environmental and Social Management Plan (ESMP) is specified in order to describe the mitigation measures for all the impacts associated with the project during its construction, operation and maintenance phase. The ESMP intends to delineate the monitoring and management measures to minimize such impacts by allocating management responsibility and suggesting skill requirement for implementation of these measures during the operational phase.

VUBPL is committed to ensure compliance to all the commitments towards Environment, Social, Health and Safety Standards while executing all the project related activities for the 120 MW Wind Power Project. This ESMP is applicable to all the employees of Gamesa and the other sub-contractors if any, engaged during the project lifetime. VUBPL shall ensure that Gamesa, the O&M contractor of this project shall follow the mitigation measures and ESMP.

10.1 Project Organization structure

HFE has established a project specific organizational structure. **Figure 10-1** presents VUBPL's organizational structure. As reported by VUBPL site management, the EPC and subcontractors have deployed dedicated HSE officers who will be responsible for overseeing ongoing construction related activities. VUBPL has engaged one site in-charge and other technical staff (not shown in Figure 10-1) to monitor EPC's and its subcontractors' activities. The HSE officer and Site in-charge of EPC directly report to the VUBPL Site in-charge who in turn reports to the HSE Manager at the corporate level. The HSE Manager at the corporate level is responsible for overseeing EHS aspects associated with project. The land team undertakes land related proceedings through land aggregators.

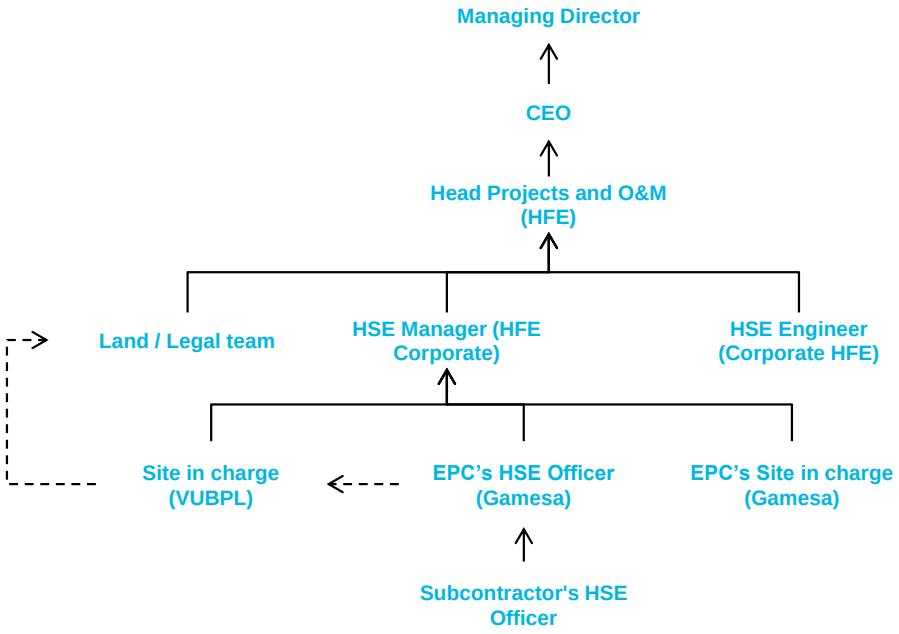


Figure 10-1: Project organization structure

10.2 Roles and Responsibilities

This section describes the roles and responsibilities of the key persons responsible for management of onsite activities of the project:

Site In-charge

The Site In-charge is responsible for overall management of the project and ESMP implementation. The following tasks will fall within his/her responsibilities:

- Monitor site activities on weekly basis for compliance;
- Conduct internal audits of the construction site against the ESMP; and
- Confine the construction site to the demarcated area;
- Keeping a check on operation and maintenance services of WTGs required during operation phase;

Apart from the project related aspects, Site In-charge will also have additional responsibilities of community liasoning such as:

- Managing all grievances of the project and their outcomes;
- Implementing, monitoring and updating the ESMP;
- Undertaking community development initiatives in the project villages in coordination with Gamesa;
- Keep record of all the CSR activities being undertaken for the project;
- Keep the Regional EHS Manager informed on the progress of CSR activities undertaken at project site;
- Conduct periodic (formal and informal) meetings with local community for understanding their grievances and outcomes of the CSR activities; and
- Inform the local community about the Grievance Redressal Mechanism and ensure effective implementation.

HSE Engineer

The HSE Engineer will have the following responsibilities and will report to Site In-charge and the HSE Manager from HFE Corporate:

- Ensure availability of resources and appropriate institutional arrangements for implementation of ESMP;
- Compliance of legislative and IFC PS requirements;
- Carry out audits, and inspection of all the project activities with Project Manager;
- Conduct training programs and awareness activities on health and safety for site staff and community;
- Preparation of necessary documents and record keeping system; and
- Review and updating of ESMP for its effective implementation.
- He will have the authority to issue the work permit system for working at heights during O&M phase of the project;
- Arrangement of first aid and firefighting equipment at the site office;
- Maintenance of the records of near miss and incidents that can happen at site, if any;
- Maintenance of records of hazardous waste generated on site on monthly basis and ensuring its proper disposal to authorized vendors of APPCB only.

EHS Officer-Gamesa

The EHS officer from Gamesa will be responsible for implementation of this ESMP and any other environmental requirements that may be identified by the Site In-charge during the course of the contract. The EHS officer will have received the basic EHS training either as part of the contract or previously. In addition to any other responsibilities, the general duties of the contractor's EHS 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;
- Imparting of tool-box training and other health and safety trainings required during different phases of the project;

10.3 Monitoring and Audit

The ESMP will have to be monitored on a regular basis in order to ensure effective implementation. The EHS team of HFE/VUBPL, along with Gamesa, will undertake inspection and monitoring of the environmental and social impacts of construction and operation phase activities in order to ensure the effectiveness of suggested mitigation measures.

- VUBPL will ensure that Gamesa complies with the requirements of conditions for all applicable permits and guidelines;
- The ESMP will be monitored on a regular basis, quarterly or half yearly all outcomes would need to be audited in accordance with EHS commitments of HFE/VUBPL.
- The monitoring process will cover all stakeholders including the local community impacted by the project activities and associated facilities.
- The inspections and audits will be undertaken by a trained team of external agencies/experts or from HFE/VUBPL.
- The inspection and audit findings will be implemented by Gamesa in the areas of concern.
- The entire process of inspections and audits will be documented.

Sub-Contractors will be required to fully comply with the reporting requirements in terms of timely report submission with acceptable level of details. Reporting will be done in the form of environmental, health, safety and social check list, incident record register, environmental, health, safety and social performance reports (weekly, monthly, quarterly, half yearly, yearly etc).

10.4 Documentation and Record Keeping

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

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

10.5 Required Training

The training and competence of personnel working remotely and the readiness of all necessary safety equipment in the location is needed to be assessed. Hence, HFE/VUBPL shall ensure that the job specific training and EHS Induction Training needs are identified based on the specific requirements of ESMS and project personnel (including the Contractors and Sub-contractors) to undertake the required actions and monitoring activities. Gamesa is responsible for ensuring that their workers are provided HSE training as stipulated. In addition to formal training, the contractor should undertake tool-box talks. A training register should be kept on site for all training conducted onsite.

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

A basic occupational training program and specialty courses shall be provided, as needed, to ensure that workers are oriented to the specific hazards of individual work assignments. Training shall be provided to management, supervisors, workers, and occasional visitors to areas of risks and hazards. Workers with rescue and first-aid duties must receive dedicated training so as not to inadvertently aggravate exposures and health hazards to themselves or their co-workers. Through appropriate contract specifications and monitoring, the employer shall ensure that service providers, as well as contracted and subcontracted labour, are trained adequately before assignments begin.

Table 10-1: Training Requirements for the project

Topic	Training Content	Targeted Audience
General Project Awareness	• Benefits of the Project • Type of land required for the project • Possible employment Opportunities	Local Communities
Environmental and Social Management training	• Purpose of action plan for the project activities; • Requirements of the specific Action Plans • Understanding of the sensitive environmental and social features within and surrounding the project areas; and • Understanding of the potential risks from the project activities;	Site Level Officers of Gamesa and HFE/VUBPL and Contract Workers
Occupational Health & Safety Training	• The importance of conforming with 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 EMP including associated procedures and emergency preparedness and response requirements; • Mitigation measures required to be implemented when carrying out their work activities. • Use of PPE; – Job Safety analysis – First aid trainings and awareness regarding medicines; – Fire drills and usage of fire extinguishers at the time of emergency; – Maintaining accident and incident investigation reports	Site Level Officers of Gamesa and HFE/VUBPL and Contract Workers First Aiders and Fire Fighters

The Environmental and Social Management Plan covering monitoring and training requirements has been presented in **Table 10-2.**

Table 10-2: Project Specific Environmental and Social Management Plan

S.No.	Aspects	Potential Impacts	Suggested Mitigation/ Management Measures	Monitoring / Training Requirement	Management Responsibility
Pre-Construction Phase and Construction Phase					
1.	Soil Environment	• Disturbance to soil and geology due to excavations and foundation works • Decrease the rigidity of soil • Disturbance to the original topography of the area leading to soil erosion • Modification of initial appearance of the site • Construction wastes if not managed properly can degrade soil quality • Soil contamination due to oil leaks/spillage from machinery and vehicles	• Demarcate an area which is less wind-prone for storage of construction materials and should use tarpaulin sheets to avoid dispersal or kept in an enclosed space; • Limit construction activities to months having moderate climate conditions when there is no heavy wind or rainfall, to avoid top soil removal; • To minimise runoff, channels and drains are to be fully established and bedded as quickly as possible; • While transporting, construction materials such as sand, cement and other such fine-grained materials should be covered; • Construction debris and excavated material can be used for filling low-lying areas; • Paved spaces should be constructed for handling machineries or vehicles, while refuelling etc. if there is a spillage, that portion of the soil is to be cut out and stored separately to be disposed with the hazardous waste • Re-vegetate the area surrounding turbine locations as early as possible, to reduce the negative effect on soil; and • All construction material shall be stored in a designated/demarcated storage area within the site and covered with tarpaulin sheet to avoid dispersal with wind.	• Inspect area which are re-vegetated and maintain records on monthly basis. • Inspection of storage of areas where construction material is stored. • Details of any oil spill , if happens on monthly basis • Undertake training on soil contamination and pollution aspects at least once in a year to Projects team, Vehicle fleet operators and Sub Contractor staff.	Site In-Charge of VUBPL/Sub-Con HSE Officer
2.	Noise Quality	• Disturbance to habitations in proximity of WTG locations • Incremental noise due to use of diesel generators • Disturbance to the local community	• Construction activities shall be planned in consultation with local communities (if required); • Adequate precautions and information will be provided prior to execution of blasting activity (if any); • Construction equipment will be maintained in good working order and properly muffled; • Integral noise shielding to be used where practicable and fixed noise sources to be acoustically treated, for example with silencers, acoustic louvers and enclosures; • Provision of rubber paddings/noise isolators at equipment/machinery used for construction; • Construction vehicles shall be well maintained and idling time will be minimized for vehicles when not in use; • Site workers working near high noise equipment use personal protective equipment (PPEs) to minimize their exposure to high noise levels.	• Undertake ambient noise level monitoring at one of the construction locations when construction work is ongoing on quarterly basis. • Monitor the usage of PPE on monthly basis. • Monitor the working of construction equipment which should be restricted to day time only.	Site In-Charge of VUBPL/Sub-Con HSE Officer
3.	Air Quality	• Earthwork generating dusts and deteriorate the micro level air quality of the	• To avoid spillage during transit, fine-grained and loose construction materials should be covered;	• Undertake ambient air quality monitoring at one of the construction locations when construction work is	Site In-Charge of VUBPL/Sub-Con HSE

S.No.	Aspects	Potential Impacts	Suggested Mitigation/ Management Measures	Monitoring / Training Requirement	Management Responsibility
		project area • Emissions from road traffic and Heavy Good Vehicles (HGV)	• Storage area of construction materials has to be in an area which is least wind-prone; • Vehicles are to be maintained properly by conducting regular checks to minimise the emission of pollutants from exhausts and obtaining Pollution Under Control certificate from pollution control board on a periodic basis; • Idling time of vehicles should be minimised to the extent possible, to reduce burning of fossil fuel; • Daily inspection of construction site to check the effectiveness of the above mentioned activities	ongoing. • Monitor the pollution levels at the nearest sensitive receptor	Officer
4.	Ecology	• Loss / Degradation / Fragmentation of Habitats	• Degradation and loss of habitats caused by removal of natural vegetation could be minimized by removing only the most obstructive plants and conserving the existing ground cover of the area as much as possible. There shall be no clearing of vegetation cover of lands which are not directly under construction footprints. • The site clearance for tower erection, access road and ancillary facilities shall be restricted only to the minimal area required for the respective purpose. • The number and width of access roads shall be kept to the minimal possible. The use of existing roads should be preferred. • It is recommended that the compensatory plantation of native species be done in all suitable areas around turbines and along roads	• The entire workforce shall be sensitized (by the construction contractor) to possible adverse ecological impacts during the construction phase by conducting awareness programs.	Site In-Charge of VUBPL/Sub-Con HSE Officer
5.	Socio-Economic	• Loss of Land	• The site clearance for tower erection, access road and ancillary facilities should be restricted to the necessary footprint area. The remaining area should be accessible for grazing or cultivation once the construction activities are completed. • A formal consultation should be undertaken to apprise the villagers of the project activities on a regular basis. • The EPC contractor should map access roads and implement strict driving instructions to adhere to such roads without going off-road thus destroying agricultural activities.	• Monitor the land procurement process and compensation paid on monthly basis. • Maintain a record of all sale deeds executed. • Monitor excavated areas which are needed to be cordoned off. • Monitor the site preparation activities on weekly basis and document the progress.	Site In-Charge of VUBPL/Sub-Con HSE Officer
6.	Socio-Economic	• Labour Rights and welfare	• The contractor shall provide adequate information to workers on expected social behaviour and hygiene practices to be followed at site. • VUBPL through the contractor agreement shall ensure that the construction contractors commit and adhere to social obligations including community relations, handling complaints and grievances, adherence to labour laws and international commitments etc. • The water usage amongst the labourers shall be monitored and controlled to minimize generation of wastewater. • VUBPL shall ensure that no child or forced labour is engaged by contractors and all wage payments are done without any discriminations or delays by the	• Legal Register maintained by the Construction Contractor – Record of wages given to Labours – Age of Workers to be maintained to ensure no engagement of child labour. • Details of any awareness programmes conducted for workers.	Site In-Charge of VUBPL/Sub-Con HSE Officer

S.No.	Aspects	Potential Impacts	Suggested Mitigation/ Management Measures	Monitoring / Training Requirement	Management Responsibility
			contractors. • VUBPL to ensure that adequate sanitation and waste disposal facility shall be provided at project site. • VUBPL should undertake medical test of the contract workers prior to engagement to identify any communicable disease.		
Operation Phase					
7.	Ecology	• Avian mortality / Injury to Birds or Bats	• Designing the project layout to provide adequate spaces between every two turbines for movement of birds, thereby reducing the potential for accidental collision. • Underground intra-farm wiring, thereby reducing the hindrance to birds. • Insulating over-ground wiring, if any, thereby avoiding any chance of electrocution. • Providing daytime visual markers on any guy wires used to support wind-masts or towers, thereby enhancing visibility of the wires to birds; • Installing visibility-enhancing objects, such as marker balls, bird deterrents or diverters along any over-ground transmission lines, thereby enhancing visibility of the transmission lines to birds; • Keeping windfarm lighting switched off when not needed; • Opting for lighting fixtures that are hooded and directed downward to minimize the skyward and horizontal illumination that could attract night-flying birds to the vicinity of wind turbines; • Moving potential rodent-habitats, such as heaps of rocks or earthen mounds, away from the wind-farm-area, thereby avoiding attracting raptor bird-species into the area; • Removing any carcasses from the site, thereby avoiding attracting scavenging raptors, such as vultures, into the area; • Instituting appropriate storm-water management measures, thereby avoiding creating potential migratory waterfowl habitats, such as pools or bogs, in the windfarm area; • Keeping the wind-turbines in operational on low wind-speed nights, thereby minimizing risk of barotrauma to bats flying in/through the windfarm area. • It is recommended that a long-term programme, designed to monitor avifaunal activity with reference to wind-turbines, be instituted at the project-site. The main purpose of such a monitoring programme should be to generate the base-line data required for prediction of collision-risk for the bird-species utilizing the wind-turbine envelope around the year, and, assessment of the significance of such risk to the concerned bird-populations.	• Periodic Bird/Bat carcass survey to be undertaken during operation phase	Site In-Charge of VUBPL/ EHS Officer of Gamesa
8.	Noise Levels	• Noise resulting from Wind turbines	• Increase in dense vegetation coverage around the receptor locations which shall act as noise barrier;	• Ambient noise levels at all nearby villages to be monitored once every	Site In-Charge of VUBPL/ EHS Officer

S.No.	Aspects	Potential Impacts	Suggested Mitigation/ Management Measures	Monitoring / Training Requirement	Management Responsibility
			• Wind turbines shall be designed in accordance with the international acoustic design standards and maintained throughout the operational life so as to limit noise generation; • The wind turbines shall be maintained in good running conditions 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; • It is suggested that ground vegetation such as shrubs and bushes are cleared to the minimum extent possible during site clearance activities; • Consult with the locals periodically to assess noise generation and set up a procedure to locate source of noise and steps taken to minimize them; and • Implement a complaint resolution procedure to assure that any complaints regarding operational noise are promptly and adequately investigated and resolved; • Undertake ambient noise level monitoring from NABL/MoEFCC accredited laboratories on an annual basis in order to understand the increase in noise levels due to the project operation;	six months. • O&M records of WTGs are to be maintained.	of Gamesa
9.	Hazardous Waste and Soil Quality	• Waste oil will be generated from the turbine gear box • Improper disposal and handling of waste oil can lead to soil and ground water contamination	• Hazardous waste generated shall be stored in a defined space and should be accessible only to authorised personnel; • The storage space should be an impervious paved surface and should have a secondary containment area and spill control toolkit; • Quantity of hazardous waste handled should be clearly documented as per Hazardous Waste Management rules and documents should be updated regularly; and • Hazardous waste should be sold to an authorised vendor from Andhra Pradesh Pollution Control Board (APPCB) on a periodic basis, documents of which should be maintained as per requirements under the Hazardous Waste (Management, Handling and Trans-boundary Movement) Rules, 2016.	• Site engineers and maintenance staff need to be aware and trained about the procedure for proper storage and disposal waste oil and how to act in case of accidental oil spillage. • Ground water sample and soil sample testing needs to be undertaken at the waste oil handling and storage location once in every three years.	Site In-Charge of VUBPL/ EHS Officer of Gamesa
10.	Socio-Economic	• Shadow Flicker	• Planting trees and ensure increase in dense vegetation coverage to screen the impacted receptor locations from sun; • Installation of blinds such as curtains at the concerned window facing the turbines; • It is recommended that VUBPL should ensure formulation of a complaint resolution procedure by Gamesa for the local community so that any issues or concerns associated with shadow flicker are reported to the site staff. Also, appropriate and timely action taken in case of receipt of such complaints need to be documented and maintained for records; and	• Any community development activities will be guided and implemented in accordance with the CSR policy of VUBPL	Site In-Charge of VUBPL/ EHS Officer of Gamesa
11.	Socio-Economic	• Change in Local Economy and Livelihoods	• VUBPL should give preference to local vendors and contractors. • VUBPL should give first preference to the local population in sourcing for the	• Any community development activities will be guided and implemented in accordance with the	Site In-Charge of Site In-Charge of VUBPL/

S.No.	Aspects	Potential Impacts	Suggested Mitigation/ Management Measures	Monitoring / Training Requirement	Management Responsibility
			required vacancies that will emerge during the project life cycle. • Skill development trainings should be provided to the local population in terms of welfare activities to be initiated by the Project Proponent so that the local population can apply for vacancies that might emerge in the project.	CSR policy of VUBPL	EHS Officer of Gamesa
12.	Occupational health & safety	• Working at height during maintenance • Electrical hazards • Structural collapse due to natural hazards	• Only trained workers should be allowed to work at heights. • Workers handling electricity and related components will be provided with shock resistant gloves, shoes and other protective gears. • Implementation of work-permit system for working at height, electric and hot jobs. • Personal protective equipment to be provided for all personnel during maintenance work. • The switchyard building will be provided with fire extinguishers and sand buckets at all strategic locations to deal with any incident of fire. • Health and safety training is given on regular basis to all the employees	• All safety related incidents will be recorded and monitored, in order to ultimately achieve “zero incidences” level. • Adequate training to be provided to the workers regarding health and safety procedures. • Workers to be trained for use of Personal Protection Equipment and its importance.	Site In-Charge of VUBPL/ EHS Officer of Gamesa

11. Conclusion and Recommendations

The ESIA has assessed overall impacts on Environmental and Social components as a result of construction and operation of the 120 MW wind power project for VUBPL. The impacts due to the project is minimal, site specific and has reversible impacts on the micro environment of the project site owing to the construction activities, noise generation from the project turbines and shadow flickering effect which can be readily be addressed through mitigation measures. Mitigation measures for potential impacts on physical, social and biological aspects of the environment have been specified through:

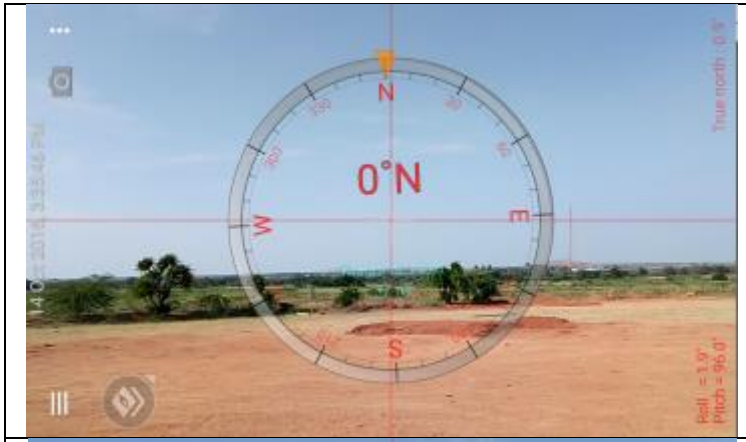
- Adequate arrangements for construction safety, stakeholder engagement and grievance redress mechanism;
- Stringent adherence to Health and Safety requirements; and
- Obtaining requisite permits for the proposed project.

Based on the ESIA study conducted and as per IFCs categorisation of projects the proposed project can be categorized as **Category B**, which specifies that the project can cause potential and limited adverse social or environmental impacts which are generally site-specific, largely reversible and readily addressed through mitigation measures.

The rationale for categorisation being:

- Overall the project being a wind power project is a green project and does not have significant adverse impacts associated with the construction or operation activities;
- The land required for the project is taken on “willing seller-willing buyer” basis and individual negotiation with the land owners and the project does not involve any physical or displacement;
- Based on the consultations conducted with the landowners, it was noted that there are two (02) landowners belonged to the Scheduled Tribe (ST) category (Sugalis Tribe). They are legal titleholders of the land parcels owned by them and are engaged as in agriculture, similar to the occupational pattern of the mainstream general society. As the project area does not fall under the scheduled area, the landowners belonging to the ST category are legal titleholders of their land. The ST category landowners provided their consent voluntarily to sell their land for the proposed project without any force and have received payments in full in lieu of the land sold. Therefore, project does not involve any direct social issues associated with land procurement.
- The results from the noise modelling exercise indicate that the incremental noise due to operation of WTGs at is in the range of 37.3-56.7 dB (A). The additional exposure to noise will be in the range of 0.0-0.2 dB (A) during night time and no exposure during the day time due to the operation of the wind turbines.
- None of the project turbines are located within the vicinity of the reserve forest and does not involve any forest land. Therefore, ensuring minimal impact on ecology during the construction and operation phase of the project.

Appendix A Site surroundings of WTG Locations



Location number: KA01

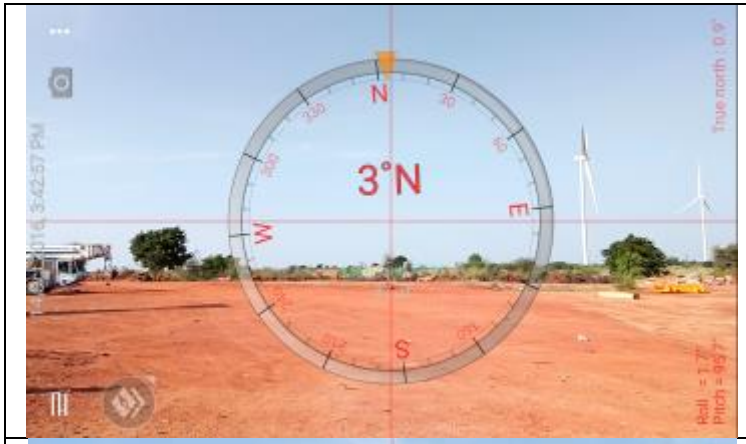
In clockwise direction: N, S, E, W

Village name: Thimmapuram

Location number: KA02

In clockwise direction: N, S, E, W

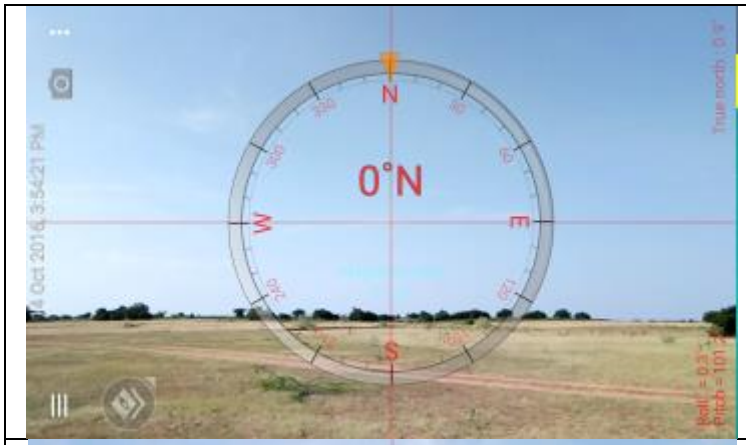
Village name: Thimmapuram

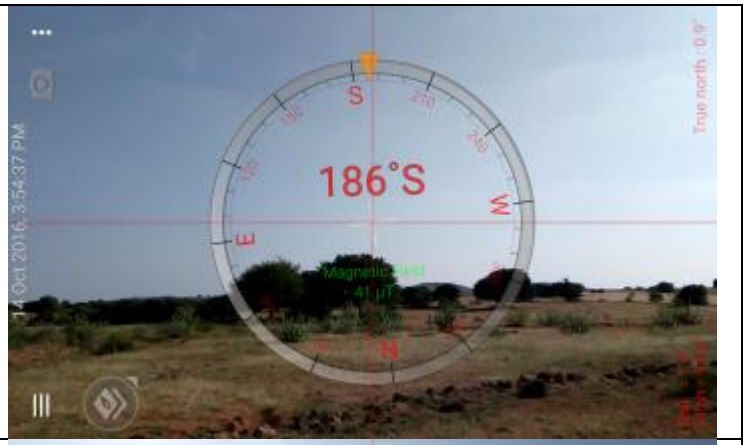


Location number: KA03

In clockwise direction: N, S, E, W

Village name: Thimmapuram

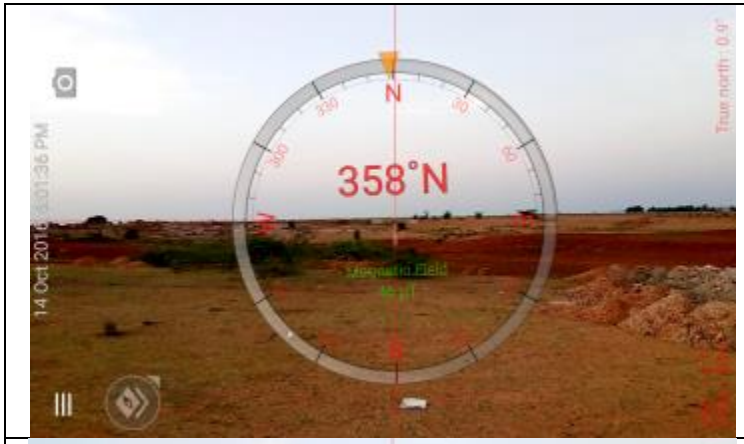




Location number: KA04

In clockwise direction: N, S, E, W

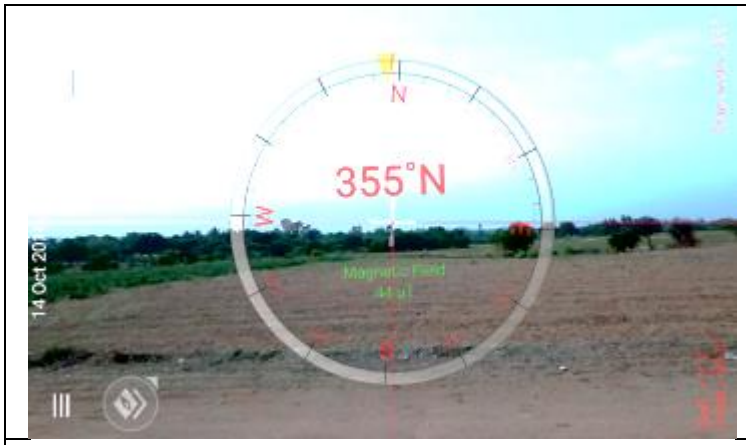
Village name: Thimmapuram

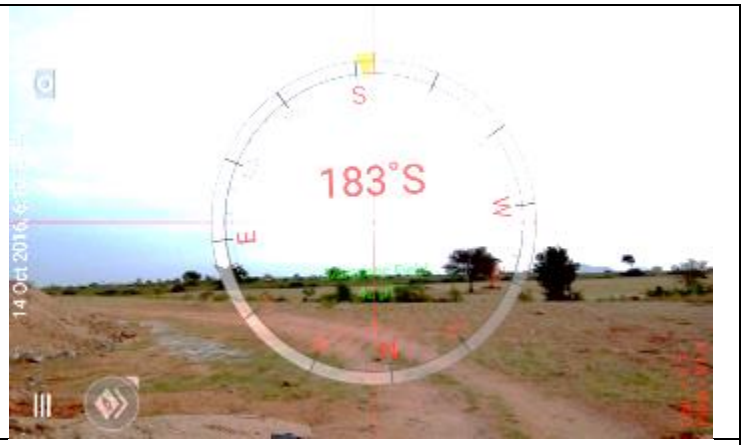


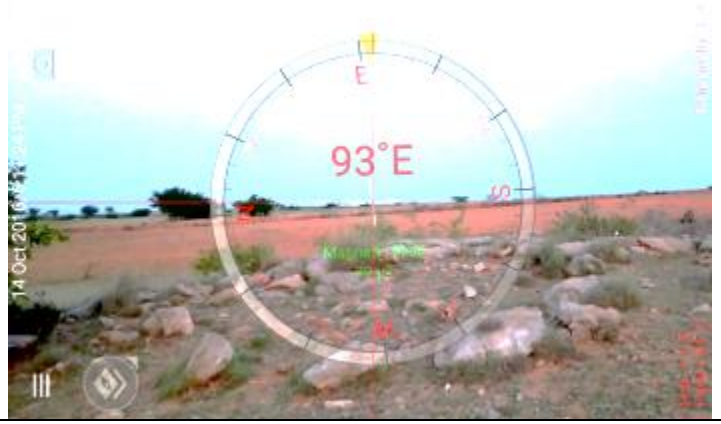
Location number: KA06

In clockwise direction: N, S, E, W

Village name: S. Mallapuram



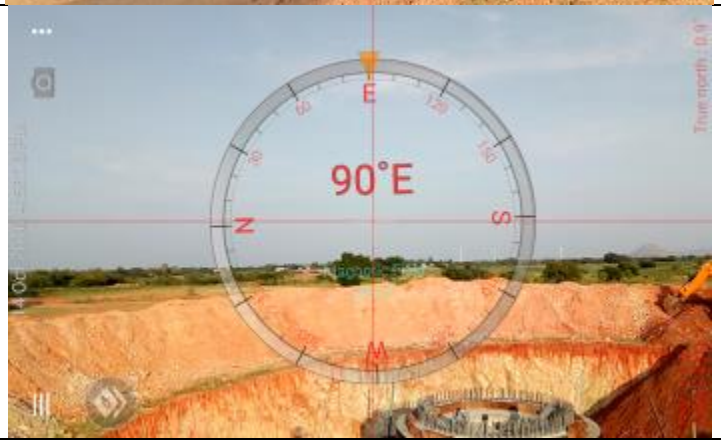




Location number: KA07

In clockwise direction: N, S, E, W

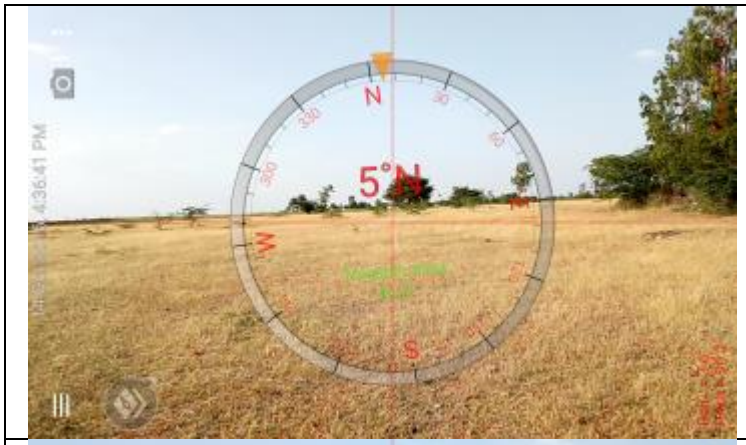
Village name: S. Mallapuram

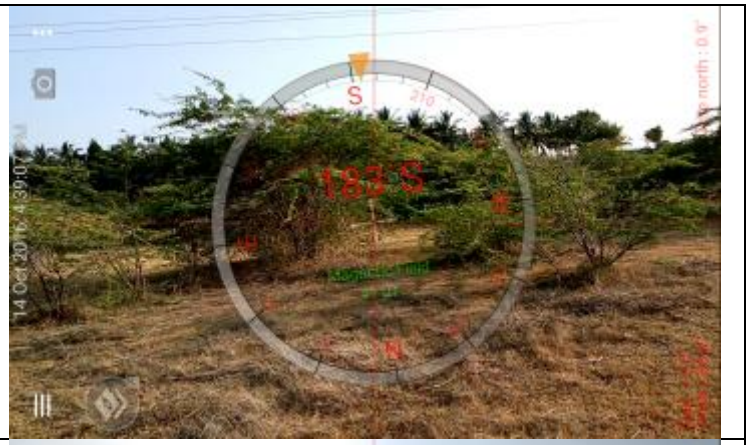


Location number: KA08

In clockwise direction: N, S, E, W

Village name: S. Mallapuram

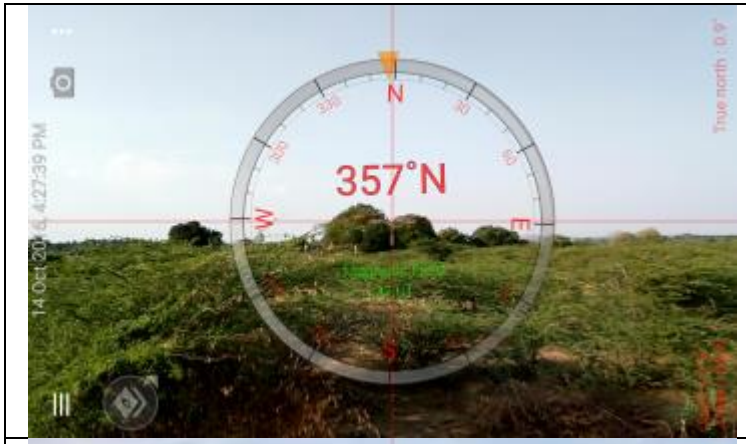




Location number: KA09

In clockwise direction: N, S, E, W

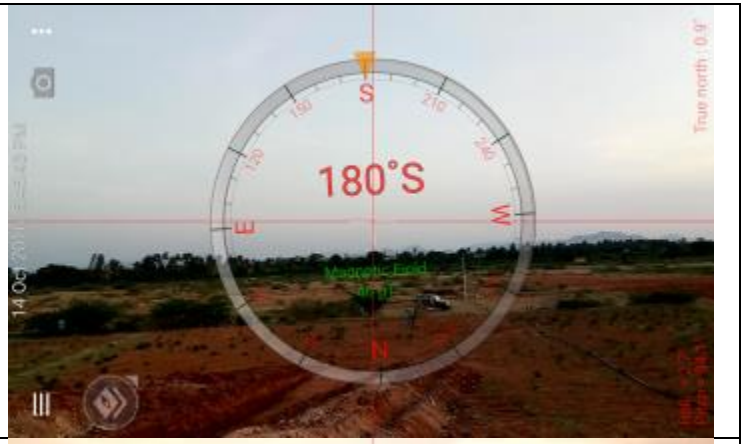
Village name: Thimmapuram



Location number: KA10

In clockwise direction: N, S, E, W

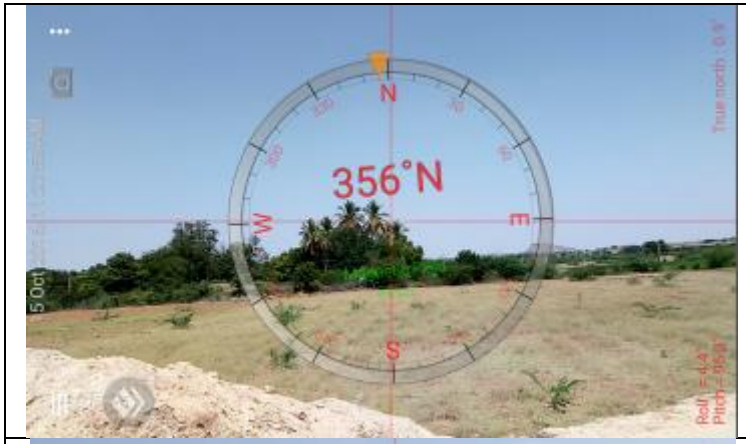
Village name: Thimmapuram



Location number: KA11

In clockwise direction: N, S, E, W

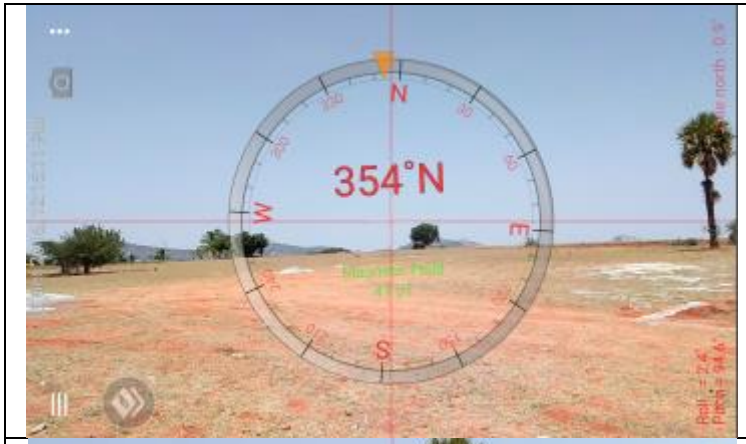
Village name: S. Mallapuram



Location number: KA12

In clockwise direction: N, S, E, W

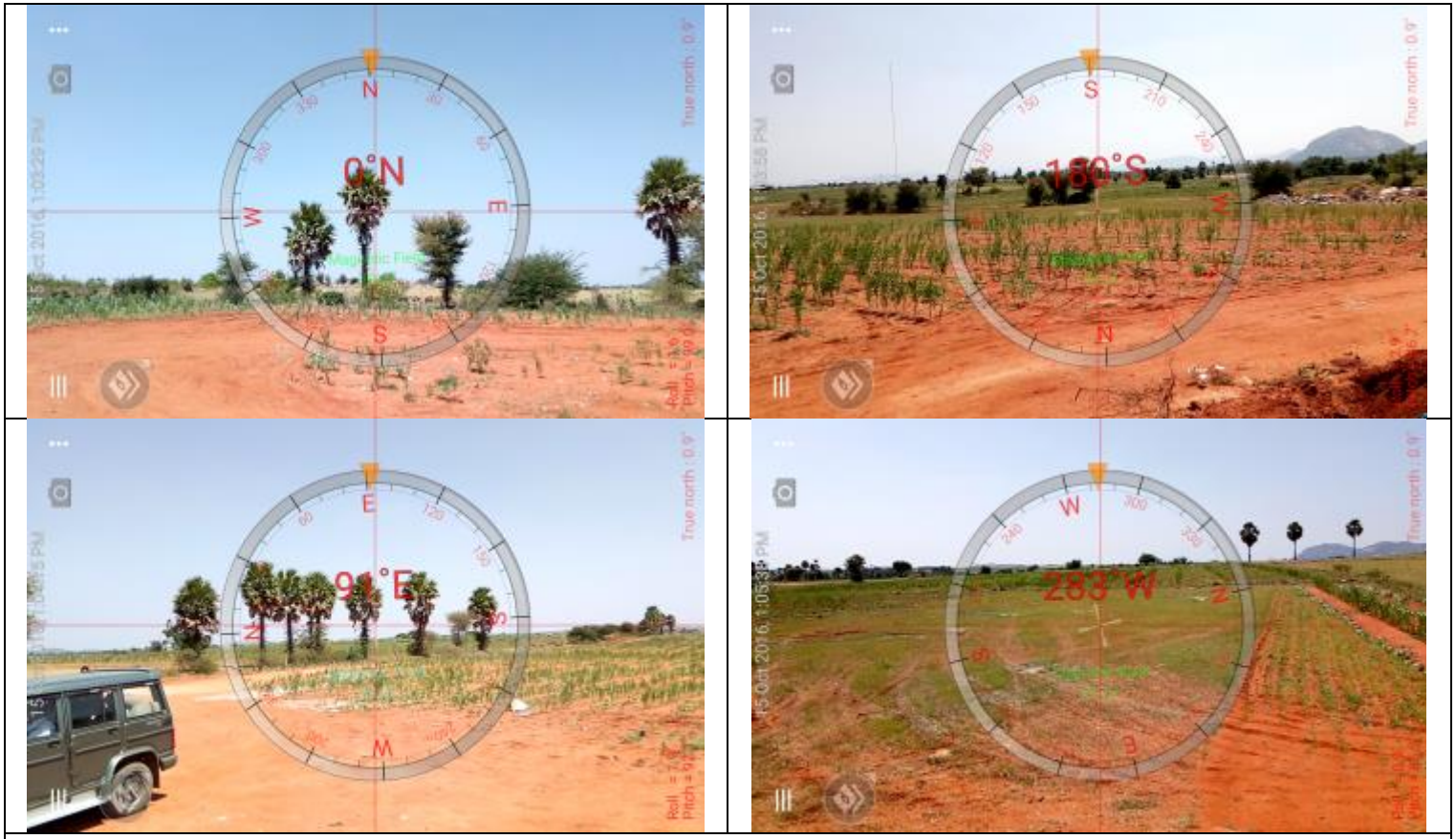
Village name: Thimmapuram



Location number: KA13

In clockwise direction: N, S, E, W

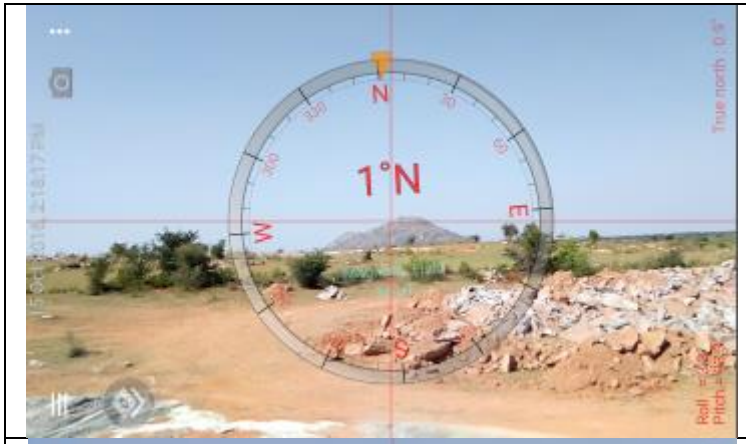
Village name: Yenumulapalli



Location number: KA14

In clockwise direction: N, S, E, W

Village name: Enumuladoddi



Location number: KA15

In clockwise direction: N, S, E, W

Village name: Mulakanur

Location number: KA16

In clockwise direction: N, S, E, W

Village name: Mulakanur

Location number: KA17

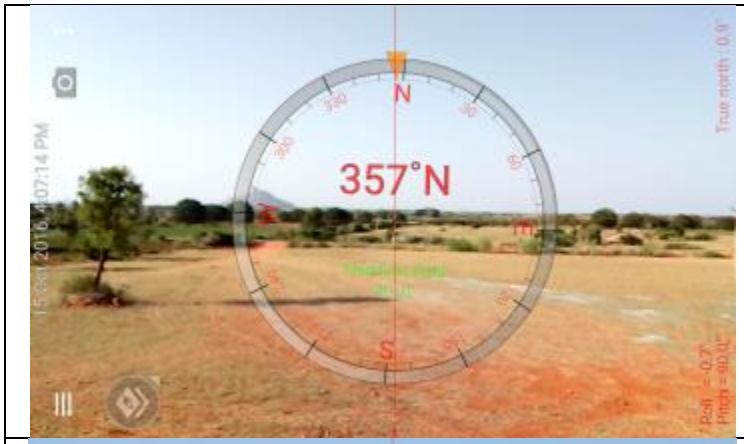
In clockwise direction: N, S, E, W

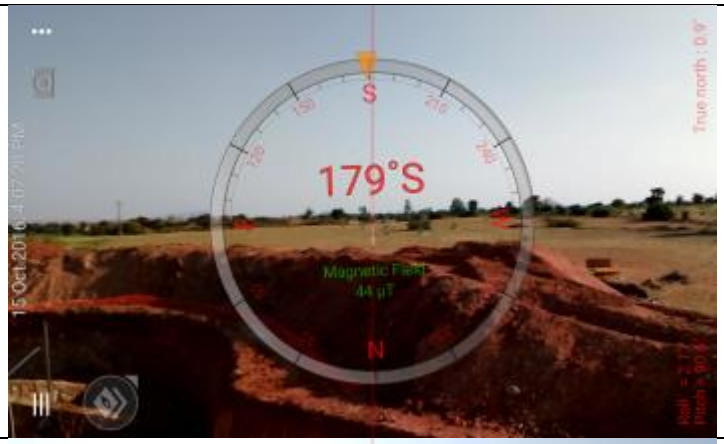
Village name: Mulakanur

Location number: KA18

In clockwise direction: N, S, E, W

Village name: Pallur





Location number: KA19

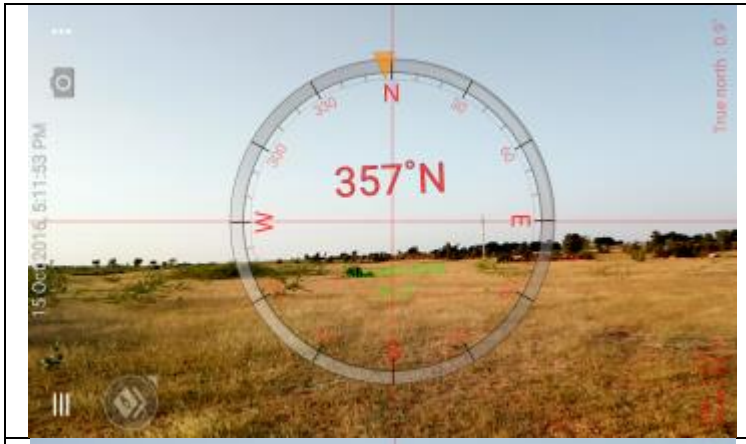
In clockwise direction: N, S, E, W

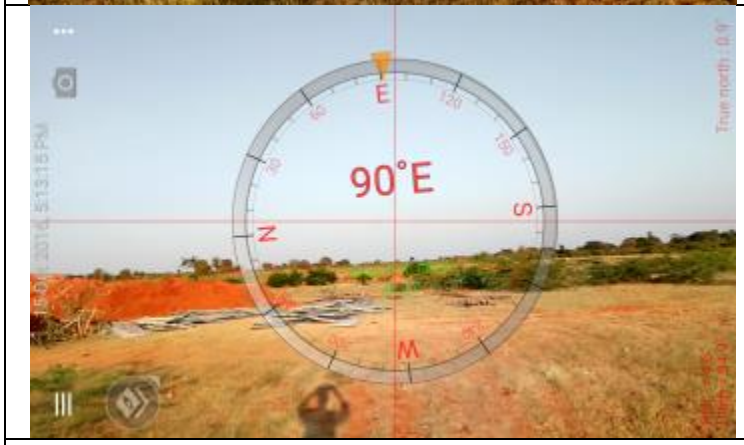
Village name: Pallur

Location number: KA20

In clockwise direction: N, S, E, W

Village name: Pallur

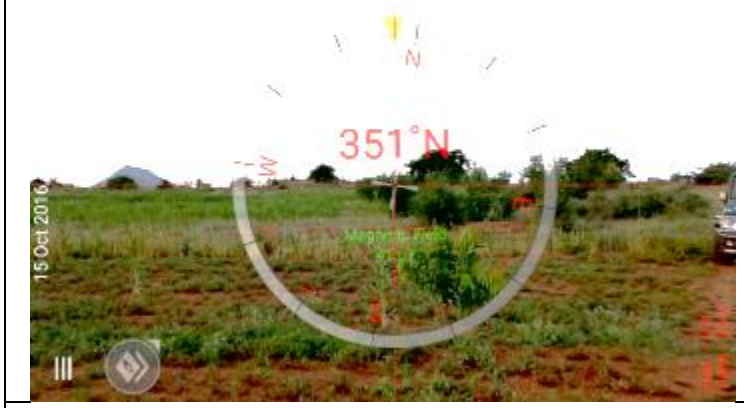


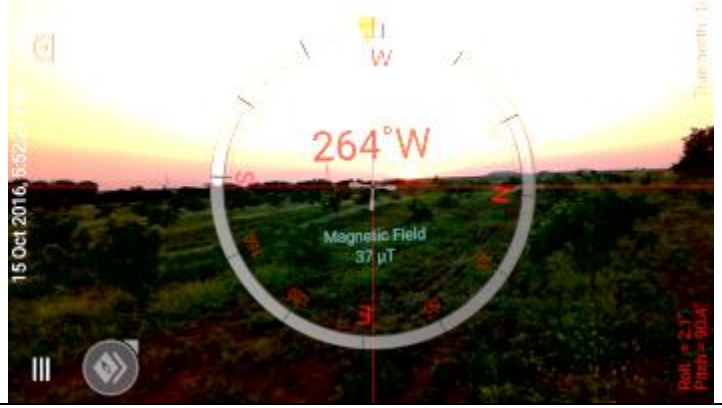


Location number: KA21

In clockwise direction: N, S, E, W

Village name: Pallur

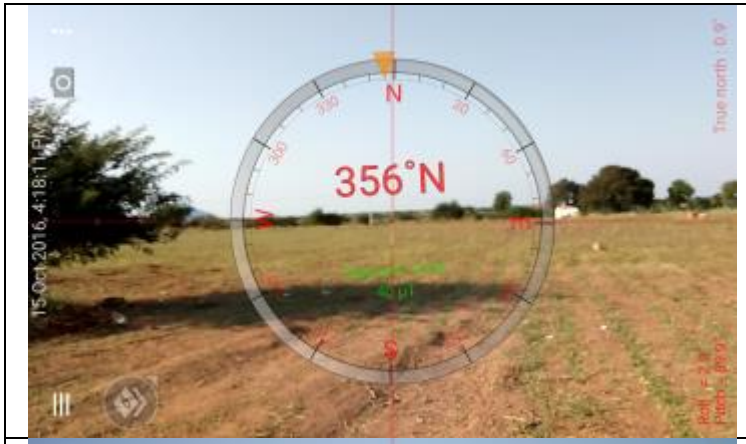


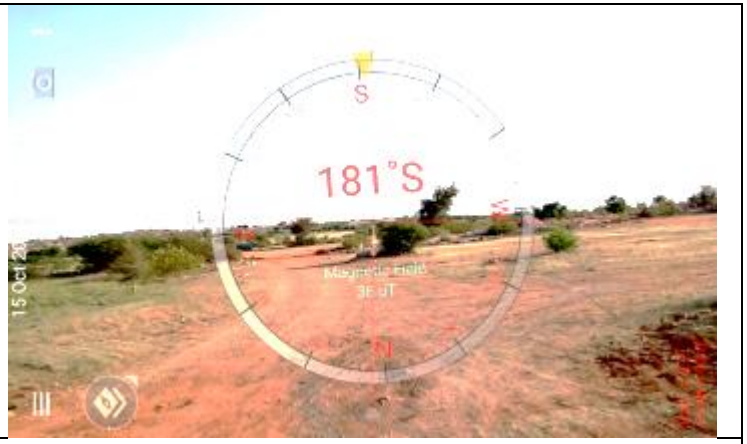


Location number: KA22

In clockwise direction: N, S, E, W

Village name: Pallur

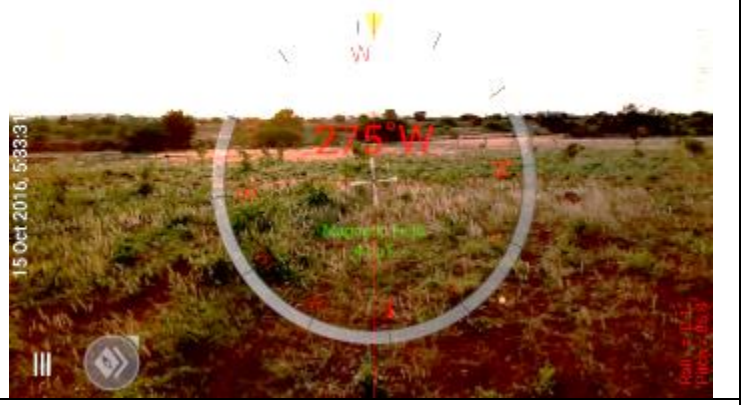




Location number: KA23

In clockwise direction: N, S, E, W

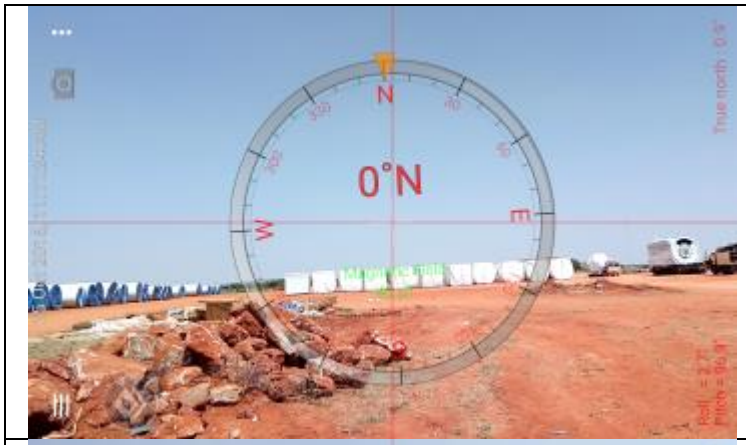
Village name: Pallur



Location number: KA24

In clockwise direction: N, S, E, W

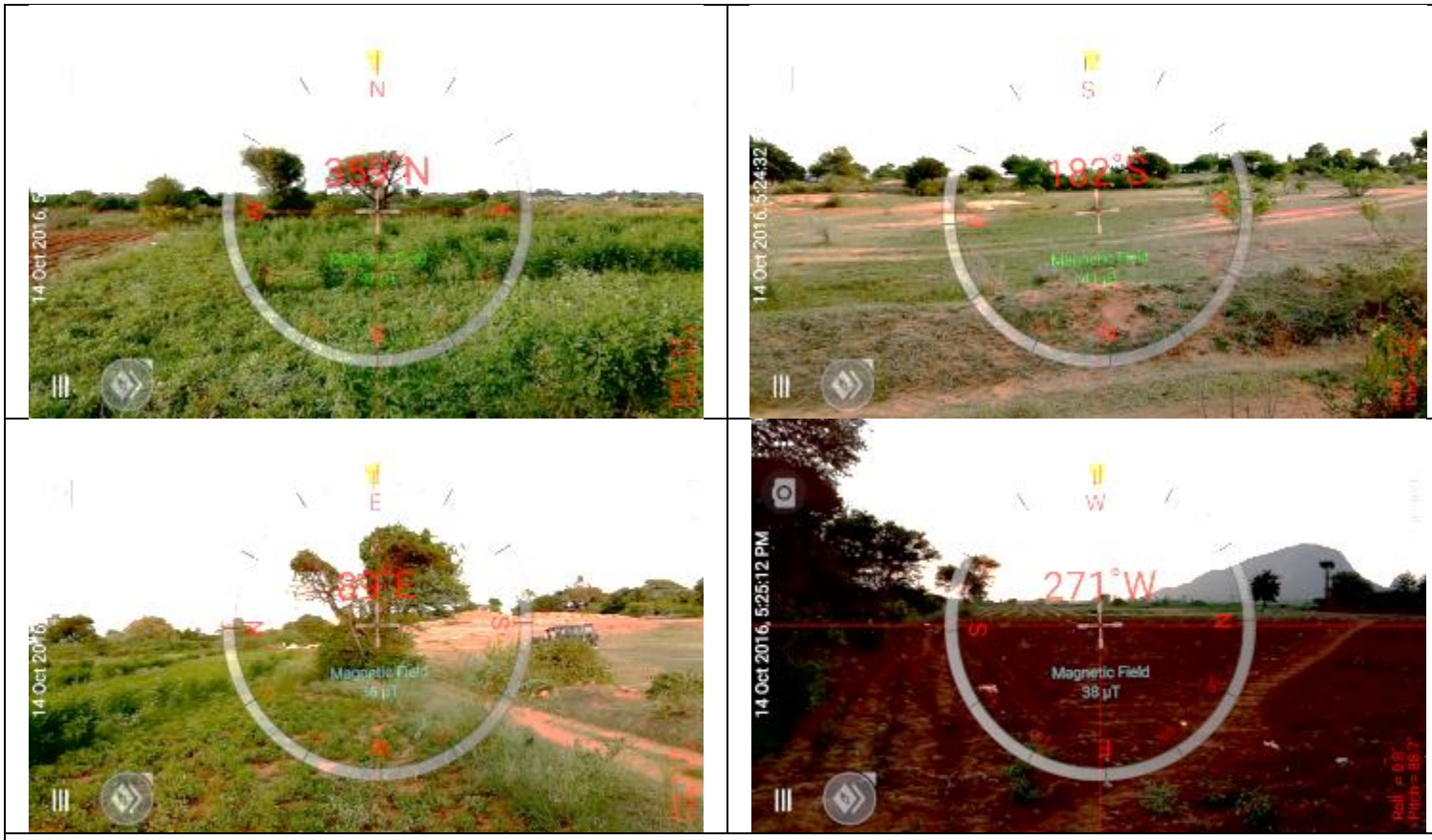
Village name: Pallur



Location number: KA25

In clockwise direction: N, S, E, W

Village name: Thimmapuram



Location number: KA27

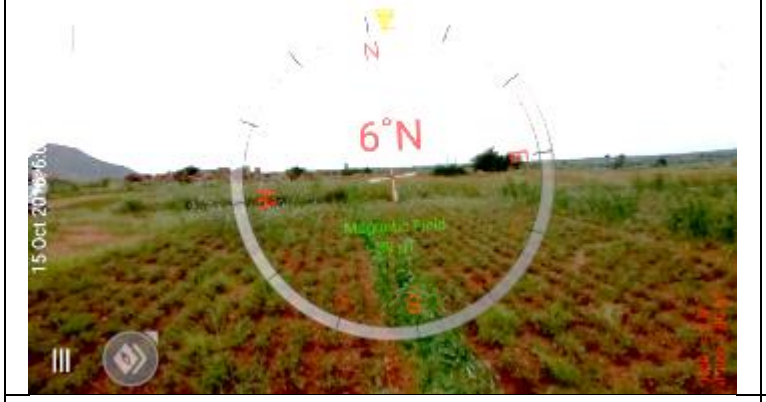
In clockwise direction: N, S, E, W

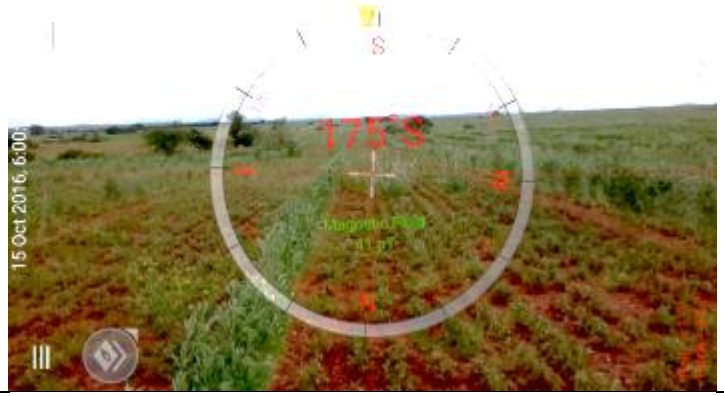
Village name: Pallur

Location number: KA37

In clockwise direction: N, S, E, W

Village name: Pallur





Location number: SF12
In clockwise direction: N, S, E, W
Village name: Pallur

A. Location Related Information

1. Name of the Village:	2. Panchayat:	3. Taluka:	4. District:

B. Respondent and Family Details

1. Name of the Respondent:		2. Relationship with Head of Household (HOH):	
3. Name of HOH:		4. Religion:	
5. Ethnic Group:			
6. Respondent Type:	Owner:	Tenant:	Sharecropper:
7. Household Type:	Joint:	Nuclear:	Extended:
8. No. of Family Members:		Adult Males:	Adult Females:
9. No. of Children:		Males:	Females:
10. Female Head, if any:	Name:		Age of Head:

C. Literacy Level (No Education -1, Primary-2, Secondary -3, Higher Secondary-4, Graduate & above-5,Technical-6, Others-7)

S. No.	Name of Family Members	Age	Gender	Marital Status	Literacy Level
1.					
2.					
3.					
4.					
5.					
6.					

D. Land Ownership Details in Total Owned (tick any and mention exact land area)

Landless (< 0.05 acre/ < 0.02 hectare)	
Functionally Landless (0.05 – 0.5 acres/ 0.02 -0.20 ha)	
Marginal (0.5- 1.5 acres/ 0.20 -0.60 ha)	
Small (1.5 – 2.5 acres/ 0.60 - 1.01 ha)	
Medium/Large (2.5 acres & more/ 1.01 ha & more)	

E. Basic Assets & Amenities (tick any or answer yes/no)

Livestock Ownership	Total:	Cows:	Buffaloes:	Goats:	Poultry (Hens/Ducks):	Others:

Dwelling structure (wall):	Concrete:	Mud:	Others:
Dwelling structure (roof):	Tin:	Thatched:	Others:
Housing	Owned:	Rented:	
Sanitation Facility:		Electricity Connection:	
Source of Water Supply:	Tap:	Tube Well:	Others:
Television:		Mobile:	
Tractor:		Car:	
Two Wheeler:		Refrigerator:	
Others (specify):			

F. Occupation & Income Details (tick any)

1. Employment Sector:	Agriculture*	Industry	Manufacturing	Service
2. Occupation Type:	Agricultural Labours	Self employed in Farm	Self employed in non farm	Salaried
3. Income Level (monthly):	Below 5000 INR	5000-10000 INR	10000-20000 INR	20000 INR & above

* If agriculture, details of agricultural crops, yield per acre, cost of cultivation per acre and details of agricultural labourers employed should be noted.

G. Amenities present in Area

1. Drinking Water Facility: (Borewell-1, Rain Water Harvesting-2, supply water-3, river water-4, others-5)	
2. Transport Connectivity: (Bus-1, Rail-2, Boat-3, Air-4) & Distance to nearest bus stop, train station and airport (city)	
3. Irrigation Facility:	
4. Bank Account :(Government -1; Private-2)	
5. Road Condition: (Paved-1; Unpaved-2)	
6. Post Office: (Distance & Location)	
7. Educational Institutions (Primary -1; Secondary-2; Higher Secondary-3; College/University-4; Technical School-5, Others (specify) -6)	

H. Perception about the Project

1. Awareness of the project?	
2. Total Area sold for the project?	
3. Status of the land prior to the purchase/ procurement?	
4. How was the land price determined?	
5. Was negotiation on the land prices undertaken? Is it above the prevailing market value? If so, how much?	
6. Has the entire amount been transferred?	
7. Was the payment received adequate?	
8. What was the payment (income received from sale of land) used for?	
9. Has the land prices increased in the area with the coming of the project?	
10. Concerns/Issues relating to the project	
11. Benefit/Expectation from the project	

I. Need Assessment (very important -5; somewhat important- 4; neutral- 3; not very important- 2; not at all important - 1)

Educational Institutions			Health Centres	
Infrastructure (roads, electricity etc.)			Employment	
Water Supply			Transport Facilities	
Skill Development			Women Empowerment (vocational centres, jobs, healthcare, education etc.)	
Agricultural Improvement			Recreational/Community Hall etc.	
Others (specify) :		Remarks:		

Project:

120 MW_Vayu Urja Bharat Pvt Ltd

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22-12-2016 17:42 / 1

Licensed user:

Aecom
5th Floor, Building 10 B, DLF Cybercity, DLF Phase 2,
IN-122002 Gurgaon
+91 1244830100

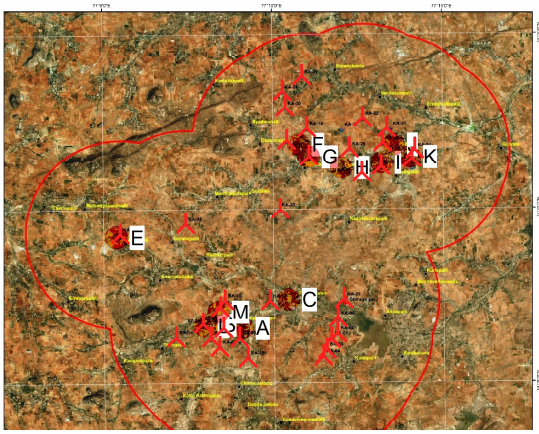
Calculated:

22-12-2016 17:01/2.7.486

DECIBEL - Main Result

Calculation: 120 MW_Vayu Urja Bharat Pvt Ltd

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



Scale 1:400,000

New WTG Noise sensitive area

WTGs

	UTM WGS84 Zone: 43 East	North	Z	Row data/Description	Valid	WTG type Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Noise data Creator	Name	Wind speed	Status	Hub height	LwA,ref	Pure tones	Octave data	
	UTM WGS84 Zone: 43		[m]					[kW]	[m]	[m]			[m/s]		[m]	[dB(A)]			
KA 01	736,706	1,588,047	567.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 02	737,023	1,588,342	563.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 03	736,459	1,587,484	566.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 04	736,274	1,587,125	565.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 05	737,044	1,589,136	553.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 06	730,794	1,587,586	588.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 07	730,337	1,588,068	579.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 08	730,984	1,588,565	579.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 09	731,845	1,588,067	571.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 10	732,276	1,587,010	572.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 11	730,820	1,589,668	571.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 12	733,448	1,590,030	577.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 13	725,507	1,593,519	603.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 14	728,959	1,594,073	598.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 15	735,372	1,599,175	567.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 16	735,486	1,597,666	548.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 17	734,306	1,598,512	567.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 18	738,282	1,596,825	554.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 19	738,282	1,596,825	547.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 20	741,081	1,598,072	530.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 21	739,587	1,599,185	536.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 22	738,317	1,599,708	548.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 23	739,307	1,597,183	542.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 24	739,380	1,598,433	539.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 25	737,369	1,590,138	554.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 26	734,056	1,601,103	565.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 27	734,056	1,601,103	551.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 28	729,901	1,588,808	582.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 29	737,629	1,598,111	545.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 30	734,211	1,600,257	572.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 31	735,093	1,601,890	559.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 32	740,928	1,597,591	532.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 33	733,987	1,594,858	578.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 34	728,489	1,588,067	584.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
KA 35	731,062	1,590,044	575.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)
SF 255/1	740,928	1,597,591	534.0	GAMESA G114 2000 114.0 !O! hub: 10...	Yes	GAMESA	G114-2,000	2,000	114.0	106.0	EMD	Level 0 - Estimated - 106 dB(A) - 05-2013	6.0	From other hub height	106.0	106.0	0 dB	Generic	*)

***)Notice: One or more noise data for this WTG is generic or input by user**

Calculation Results

Sound Level

Noise sensitive area No.	Name	UTM WGS84 Zone: 43 East	North	Z	Imission height	Demands Ambient noise	Additional exposure	Sound Level Ambient+WTGs	From WTGs	Ambient+WTGs	Additional exposure	Demands fulfilled ? Noise
				[m]	[m]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	
PN 1	Settlement of Obuganapalli Village (30+ Families)	731,984	1,588,582	571.0	0.0	64.4	3.0	67.4	43.7	64.4	0.0	Yes
PN 10	Temple – 3 in Pallur Village	739,336	1,597,339	540.0	0.0	64.1	3.0	67.1	51.9	64.4	0.3	Yes
PN 11	Settlements of Pallur Village (50+ families)	739,973	1,598,300	537.0	0.0	64.1	3.0	67.1	43.9	64.1	0.0	Yes
PN 12	5 families in Pallur Village	740,821	1,597,652	533.0	0.0	66.0	3.0	69.0	56.3	66.4	0.4	Yes
PN 13	Store house - one unit in S. Mallapuram Village	729,981	1,588,682	581.0	0.0	61.6	3.0	64.6	52.4	62.1	0.5	Yes
PN 2	Settlements of S. Mallapuram village (50+ families)	730,223	1,588,750	576.0	0.0	61.6	3.0	64.6	47.8	61.8	0.2	Yes
PN 3	Temple - 1 in S. Mallapuram Village	730,716	1,589,435	571.0	0.0	61.6	3.0	64.6	49.2	61.8	0.2	Yes
PN 4	Settlements of Thimmapuram village (30+ families)	734,428	1,590,102	562.0	0.0	61.6	3.0	64.6	37.3	61.6	0.0	Yes
PN 5	Residential Unit – 1 in Yenumulapalli Village	725,306	1,593,385	605.0	0.0	61.0	3.0	64.0	48.6	61.2	0.2	Yes
PN 6	Residential Unit – 2 in Yenumulapalli Village	725,339	1,593,353	605.0	0.0	61.0	3.0	64.0	48.8	61.3	0.3	Yes
PN 7	Srivenkateshwara Swami Temple in Mulakanur Village	734,926	1,598,293	596.0	0.0	63.2	3.0	66.2	42.9	63.2	0.0	Yes

To be continued on next page...

Project:
120 MW_Vayu Urja Bharat Pvt Ltd

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Licensed user:
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IN-122002 Gurgaon
+91 1244830100

Calculated:
22-12-2016 17:01/2.7.486

DECIBEL - Main Result

Calculation: 120 MW_Vayu Urja Bharat Pvt Ltd

...continued from previous page

Noise sensitive area		UTM WGS84 Zone: 43			Demands			Sound Level				Demands fulfilled ?
No.	Name	East	North	Z	Imission height	Ambient noise	Additional exposure	Ambient+WTGs	From WTGs	Ambient+WTGs	Additional exposure	Noise
				[m]	[m]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]	
PN 8	Temple - 2 in Mulakanur Village	735,467	1,597,643	548.0	0.0	63.2	3.0	66.2	56.7	64.1	0.9	Yes
PN 9	Settlements of Cherlapalli village (30+ families)	737,203	1,597,086	544.0	0.0	63.2	3.0	66.2	40.2	63.2	0.0	Yes

Distances (m)

WTG	PN 1	PN 2	PN 4	PN 5	PN 6	PN 7	PN 8	PN 9	PN 10	PN 11	PN 12	PN 13	PN 3
KA 01	4752	6521	3068	12588	12544	10399	9676	9053	9657	10761	10449	6755	6149
KA 02	5045	6812	3136	12756	12713	10170	9430	8746	9290	10386	10055	7050	6401
KA 03	4608	6363	3313	12618	12574	10917	10207	9631	10266	11373	11064	6588	6065
KA 04	4531	6265	3503	12629	12584	11249	10549	10004	10663	11771	11467	6483	6019
KA 05	5090	6832	2789	12483	12441	9399	8652	7952	8517	9621	9316	7078	6335
KA 06	1552	1297	4420	7984	7938	11477	11090	11460	12965	14108	14208	1365	1851
KA 07	1725	691	4569	7320	7274	11208	10863	11334	12920	14055	14204	710	1419
KA 08	1000	783	3771	7448	7402	10496	10125	10549	12114	13250	13392	1010	910
KA 09	533	1760	3288	8429	8383	10680	10238	10490	11920	13068	13132	1963	1774
KA 10	1599	2691	3767	9446	9400	11590	11101	11216	12511	13664	13648	2839	2883
KA 11	1592	1095	3634	6650	6605	9552	9230	9786	11462	12581	12797	1295	255
KA 12	2059	3470	983	8806	8763	8394	7876	7993	9386	10534	10605	3720	2796
KA 13	8144	6707	9553	242	236	10560	10780	12228	14347	15236	15862	6589	6619
KA 14	6269	5471	6759	3717	3691	7308	7423	8777	10879	11797	12390	5487	4960
KA 15	11122	11627	9122	11612	11600	988	1535	2778	4369	4683	5658	11797	10796
KA 16	9736	10353	7638	11044	11026	841	30	1812	3864	4532	5335	10536	9513
KA 17	10198	10581	8411	10358	10345	658	1450	3229	5165	5671	6572	10739	9761
KA 18	10374	11408	7749	13424	13401	3663	2931	1110	1173	2244	2670	11628	10576
KA 19	10374	11408	7749	13424	13401	3663	2931	1110	1173	2244	2670	11628	10576
KA 20	13146	14311	10382	16457	16434	6159	5630	4001	1893	1131	494	14539	13492
KA 21	13047	14020	10446	15414	15395	4746	4399	3176	1863	966	1968	14233	13182
KA 22	12802	13623	10363	14466	14450	3674	3519	2849	2579	2174	3240	13823	12779
KA 23	11296	12395	8599	14507	14484	4519	3867	2106	159	1300	1585	12619	11569
KA 24	12318	13327	9692	14952	14932	4456	3992	2560	1095	608	1639	13543	12491
KA 25	5605	7280	2941	12492	12452	8513	7742	6950	7465	8567	8269	7530	6690
KA 26	12691	12934	11007	11667	11664	2942	3737	5103	6484	6547	7594	13072	12137
KA 27	12691	12934	11007	11667	11664	2942	3737	5103	6484	6547	7594	13072	12137
KA 28	2095	327	4708	6486	6440	10734	10442	11038	12720	13840	14052	149	1028
KA 29	11076	11936	8625	13198	13179	2709	2212	1110	1873	2352	3225	12141	11093
KA 30	11886	12178	10157	11248	11242	2090	2900	4360	5897	6085	7105	12324	11372
KA 31	13666	14013	11807	12966	12962	3601	4263	5247	6222	6058	7125	14163	13202
KA 32	12695	13884	9916	16178	16155	6043	5461	3759	1612	1189	123	14114	13069
KA 33	6588	7175	4776	8805	8778	3561	3154	3912	5896	6905	7383	7361	6333
KA 34	3533	1864	6278	6198	6153	12083	11849	12541	14270	15382	15619	1614	2614
KA 35	1728	1542	3366	6655	6611	9109	8783	9344	11031	12148	12374	1739	700
SF 255/1	12695	13884	9916	16178	16155	6043	5461	3759	1612	1189	123	14114	13069

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