CHAPTER 3

DESCRIPTION OF THE ENVIRONMENT

3.1 Preamble

Baseline Environmental status in and around the proposed project Vasanthanarasapura Industrial Development Area (IDA) depicts the existing conditions of Air, Water, Noise, Soil and Socio-economic environment. The baseline data was collected for various environmental components viz. Air, Noise, Water, Land and Socio-economics so as to compute the impacts that are likely to be arising out of the industrial activities covering an area of 10 km radially, from the proposed project Vasanthanarasapura Industrial Development Area (IDA) as the nodal center has been selected for baseline data collection. In keeping with the legislative requirements, RAMKY Enviro Engineers Ltd has performed an EIA study based on the monitoring data of Air, Water, Noise and Soil collected for the three Seasons and collected the Socio-economic data through primary and secondary sources. The prediction of impacts on the base line environment due to the proposed project development has been carried out for three seasons based on the meteorological data collected from the Indian Meteorological Department (IMD).The details of the baseline study are presented in this chapter and also an Environmental Management Plan (EMP) has been prepared to manage and mitigate these impacts in chapter 5.

3.2 Site Description

The proposed project site located in Vasanthanarsapura of Karnataka. It lies between 13^{o} 28′ N Latitude and 77^{0} 2′E Longitude at an altitude of 674 m above the Mean Sea Level (MSL). The study area comprises of semi urban and rural environment. The area earmarked for the proposed project is about 782.22 acres of land.

Presently the lands are barren with degraded shrub in most of the area, while some land is also covered by agricultural activity. The study area covering 10 km radially all around the center of the project site is fairly undulating with considerable number of small hillocks.

3.3 Meteorological Conditions

The study of meteorological conditions forms an intrinsic part of the Environment Impact Assessment (EIA) Study. The meteorological conditions of an area and the industrial process are both intertwined and each has a definite influence over the other. Favorable weather conditions and the surroundings help the successful operation of an industry, while the industrial activity influences the weather in both positive as well as negative ways.

Dispersion of different air pollutants released into the atmosphere has no significant impacts on neighborhood air environment unless it is dispersed at minimum stack height. Up on discharge of air pollutants into the atmosphere, the emission from stationary sources (point) are subjected to the following physical and chemical process

a) an initial vertical rise, called plume rise, due to initial buoyancy and momentum of discharge;
b) transport by wind in its direction;
c) diffusion by turbulence and

Gravitational settling of particles of size greater than 10 um;
Chemical reactions and decomposition
Decomposition on vegetation and other surfaces
Wash out due to rain and

A combination of complex physical and chemical process, i.e coagulation of particles, desorption of deposited vapors etc,
Atmospheric dispersion models are mathematical expressions which attempt to describe the above processes in order to relate emission rate to atmospheric concentration.

Considering the scarcity of data in Indian conditions, the Gaussian plume model (GPM) is recommended for air quality modeling calculations.

The modeling results of emissions from proposed project indicates violation or likelihood violation of ambient air quality standards (after accounting back ground levels) the location specific emission standards. For this purpose the emission rate which should ensure that the predicted air quality levels plus background levels are less than the ambient air quality standards.

The dispersion/dilution of the released pollutant over a large area will result in considerable reduction of the concentration of a pollutant. The dispersion in turn depends on the weather conditions like the wind speed, direction, temperature, relative humidity, mixing height, cloud cover and also the rainfall in the area.

A) Climate

The climate in the study region is generally hot and humid and is characterized with seasonal variations of

Winter	Dec to Feb.
Summer	March to May
Monsoon	June to August
Post Monsoon	Sep to Nov

The climate setting of the area has been arrived by collecting the existing secondary data from IMD station Bangalore among other sources and by generation of primary data to ascertain the values. The nearest IMD station is Bangalore located 60 kms aerially from the proposed project site.

Summary of the climatological data is presented here under. The data has been ascertained by establishment of a micro-meteorological station in the project area.

B) Temperature

The district has differing climatic condition in different parts of it. Gets warmer towards the interior and coolsdown in the hilly areas on account of elevation and vegetation. April to June is warmest months. The temperature at Bangalore gets

down with the onset of south west monsoon and tumble to a minimum of 15 ^{0}C by January after which there is reversal trend till the temperature reaches maximum of 34^{0}C.

C) Humidity

The air is generally humid in the region during the monsoon season when the relative humidity at 0830 hr was observed to be with a minimum and a maximum of 58% and 70% respectively. Similarly, at 1730hr, the value was observed to be with a minimum and maximum of 35% and 65% respectively. Generally, the weather during the other seasons was observed to be dry.

D) Rainfall

The district annual normal rainfall is 859 mm of which South-West monsoon account for 59.3% of the normal while North-East monsoon contributes 24.7% of the normal rainfall. Agency and inland Mandals receive larger rainfall from the South West Monsoon, while coastal Mandals get similarly larger rainfall from North-East monsoon.

Predominant rainy season (Monsoon)	: July and October
Average annual total or mean rainfall	: 859 mm
Most rainy Month	: October
Most number of rainfall occurrences	: October

3.4 Meteorological Scenario

Regional meteorological scenario helps to understand the trends of the climatic factors. It also helps in determining the sampling stations in predicting the post project environmental scenario. Meteorological Scenario exerts a critical influence on Air Quality as the pollution arises from the interaction of atmospheric contaminants with adverse meteorological conditions such as temperature inversions. Atmospheric stability and topographical features like hills, canyons and valleys.

The critical weather elements that influence air pollution are wind speed, wind direction, temperature, which together determines atmosphere stability. Hence it is an indispensable part of any Air Pollution Studies and required for interpretation of base line information.

Wind speed and direction data recorded during the study period is useful in identifying the influence of meteorology on the air quality of the area. The meteorological data was collected at the site by installing an automatic weather station.

3.4.1 Monitoring Period

Meteorological data was collected for the study area during the months of winter (December, January and February (2009 -2010). Wind Speed, Wind Direction, Temperature, and Relative Humidity were recorded on hourly basis for the total study period. Wind roses on sixteen-sector basis (N, NNE, NE, ENE, E, ESE, SE, SSE, S, SSW, SW, WSW, W, WNW, NW, NNW) have been drawn for 00-08, 09-16, 17-24 and 00-24 hours. The details of the wind pattern along with the wind speed for the study period are presented in the following sections.

3.4.2 Wind Pattern during December - 2009

December month wind in various speed categories was calculated on the basis of total number of observations recorded in that particular wind speed category during the study period and is given in **Table 3.1.** The wind rose for the month of December 2009 is shown in **Figure 3.1.**

A glance at the average 24-hour wind rose diagram for the month of December 2009 reveals that the most dominant wind direction is E followed by NE,N,NNE and ENE during this time period with percentage of 41.4 %, 27.69 %, 10.48%, 3.63 %, and 2.15% respectively. Calm conditions prevailed for 9.41% of the total time.

3.4.3 Wind Pattern during January 2009

The daily-recorded data was processed and for the 00-24 hour's average data was also calculated. In, January occurrence of wind in various speed categories was calculated on the basis of total number of observations recorded in that particular wind speed category during the study period is tabulated in **Table 3.2**. The wind rose diagram for the month of January 2009 is given in **Figure 3.2.**

Table 3.1: Frequency Distribution Table for 00-24 hours for December 2009

Wind Direction	Wind Speed m/sec					Total
	0.3 - 1.4	1.4 - 2.7	2.7 - 4.1	4.1 - 5.4	>= 5.4	
N	7.12	2.96	0.27	0.13	0.00	10.48
NNE	2.96	0.67	0.00	0.00	0.00	3.63
NE	21.10	5.91	0.67	0.00	0.00	27.69
ENE	1.48	0.54	0.13	0.00	0.00	2.15
E	30.51	10.08	0.81	0.00	0.00	41.40
ESE	0.67	0.27	0.13	0.00	0.00	1.08
SE	0.94	0.94	0.27	0.00	0.00	2.15
SSE	0.67	0.13	0.00	0.00	0.00	0.81
S	0.54	0.27	0.00	0.00	0.00	0.81
SSW	0.00	0.00	0.00	0.00	0.00	0.00
SW	0.27	0.13	0.00	0.00	0.00	0.40
WSW	0.00	0.00	0.00	0.00	0.00	0.00
W	0.00	0.00	0.00	0.00	0.00	0.00
WNW	0.00	0.00	0.00	0.00	0.00	0.00
NW	0.00	0.00	0.00	0.00	0.00	0.00
NNW	0.00	0.00	0.00	0.00	0.00	0.00
						90.59
Calms <0.3m/s)						**9.41**
Total	**66.26**	**21.91**	**2.28**	**0.13**	**0.00**	**100.00**

Note: All values are in percentages

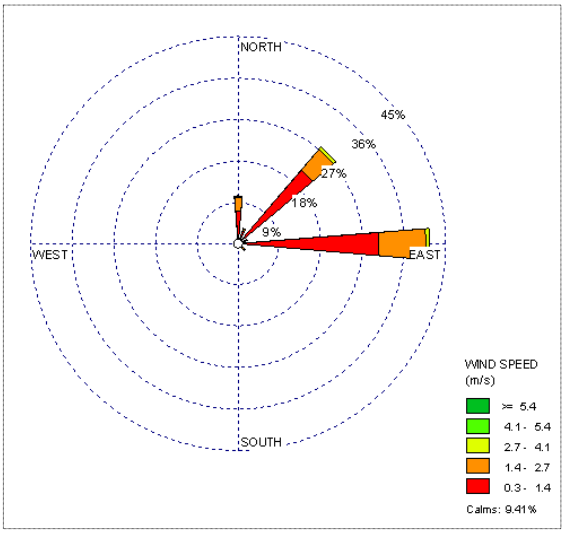

Figure 3.1: Wind Rose for the Month of December 2009 (00-24 Hours)

Table 3.2: Frequency Distribution Table for 00-24 hours for January 2010

Wind Direction	Wind Speed m/sec					Total
	0.3 - 1.4	1.4 - 2.7	2.7 - 4.1	4.1 - 5.4	>= 5.4	
N	3.76	1.34	0.27	0.00	0.00	5.38
NNE	3.23	1.75	0.27	0.00	0.00	5.24
NE	8.33	2.82	0.67	0.00	0.00	11.83
ENE	3.63	1.08	0.27	0.00	0.00	4.97
E	23.12	12.37	3.23	0.00	0.00	38.71
ESE	1.88	0.94	0.13	0.00	0.00	2.96
SE	6.99	4.97	1.48	0.00	0.00	13.44
SSE	2.55	0.94	0.27	0.00	0.00	3.76
S	1.48	0.27	0.13	0.00	0.00	1.88
SSW	0.00	0.00	0.00	0.00	0.00	0.00
SW	0.67	0.13	0.27	0.00	0.00	1.08
WSW	0.00	0.00	0.00	0.00	0.00	0.00
W	0.67	0.27	0.13	0.00	0.00	1.08
WNW	0.00	0.00	0.00	0.00	0.00	0.00
NW	0.00	0.00	0.00	0.00	0.00	0.00

NNW	0.00	0.00	0.00	0.00	0.00	0.00
						90.32
Calms <0.3m/s)						**9.68**
Total	**56.32**	**26.88**	**7.12**	**0.00**	**0.00**	**100.00**

Note: All values are in percentages

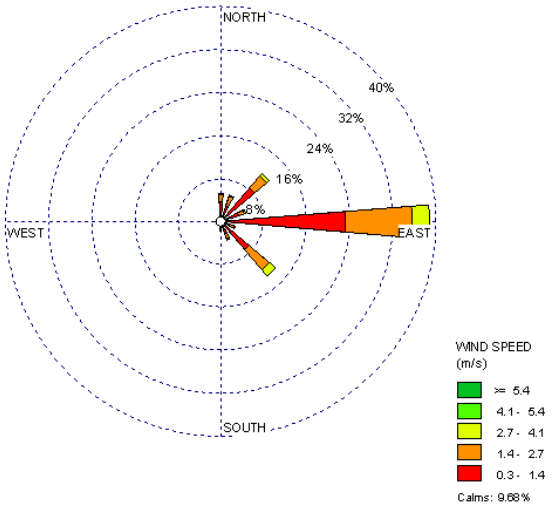

Figure 3.2: Wind Rose for the Month of January 2010 (00-24 Hours)

On keen analysis of the data recorded for this time duration reveals that the most predominant wind direction was E with the winds blowing for 38.71 % of the total time which is followed by SE, NE, N and NNE with a percentage frequency recording of , 13.44, 11.83, 5.38, 5.24. Wind was also recorded from other all direction. Calm conditions prevailed for 9.68 % of the total time.

3.4.4 Wind Pattern during February 2010

The daily-recorded data was processed and for the 00-24 hour's average data was also calculated. The occurrence of wind in various speed categories was calculated on the basis of total number of observations recorded in that particular wind speed category during the study period and given in **Table 3.3**. The wind roses for the month of February 2010 are shown in **Figure 3.3.**

Table 3.3: Frequency Distribution Table for 00-24 Hours for February 2010

Wind Direction	Wind Speed m/sec					Total
	0.3 - 1.4	1.4 - 2.7	2.7 - 4.1	4.1 - 5.4	>= 5.4	
N	15.33	2.83	0.30	0.00	0.00	18.45
NNE	1.34	0.30	0.00	0.00	0.00	1.64
NE	9.82	3.42	0.15	0.00	0.00	13.39
ENE	3.13	0.45	0.00	0.00	0.00	3.57
E	35.57	10.12	0.30	0.00	0.00	45.98
ESE	2.38	0.00	0.00	0.00	0.00	2.38
SE	1.79	1.04	0.00	0.00	0.00	2.83
SSE	0.00	0.00	0.00	0.00	0.00	0.00
S	0.89	0.00	0.00	0.00	0.00	0.89
SSW	0.00	0.00	0.00	0.00	0.00	0.00
SW	0.15	0.15	0.00	0.00	0.00	0.30
WSW	0.00	0.00	0.00	0.00	0.00	0.00
W	0.30	0.15	0.00	0.00	0.00	0.45
WNW	0.30	0.00	0.00	0.00	0.00	0.30
NW	0.00	0.00	0.00	0.00	0.00	0.00
NNW	0.00	0.00	0.00	0.00	0.00	0.00
						90.18
Calms <0.3m/s)						**9.82**
Total	70.98	18.45	0.74	0.00	0.00	**100.00**

Note: All values are in Percentages

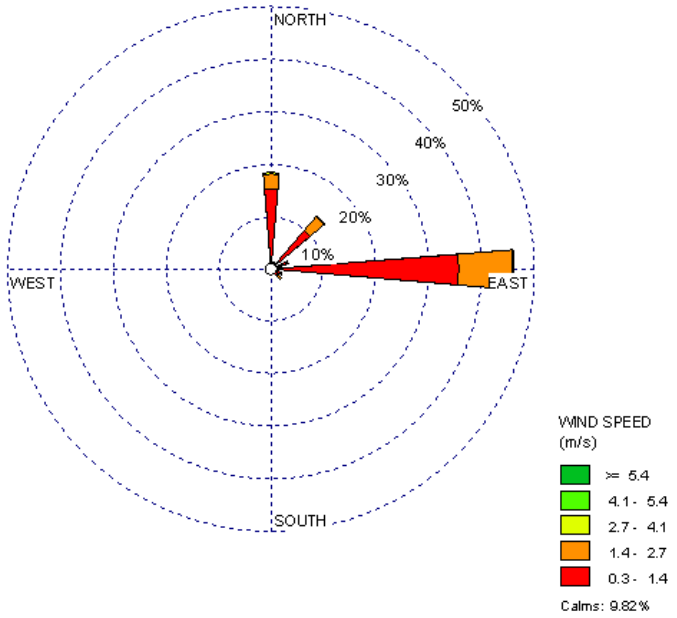

Figure 3.3: Wind Rose for the Month of February 2010 (00-24 Hours)

Keen observation of the data recorded for this period reveals that the most predominant wind direction was E with the winds blowing for 45.98 % of the total time which is followed by N,NE,ENE and SE with a percentage frequency recording are 18.45%, 13.39%, 3.57%, 2.83% respectively. Calm conditions prevailed for 9.82 % of the total time.

3.4.5 Wind Pattern during Monitoring of Winter Season 2009 - 2010

The meteorological data-recorded for 00-24 hours with hourly interval with reference to wind speed and wind direction and the average data is interpreted and the table has been given in **Table 3.4.** The wind rose for the monitoring summer season 2009 is shown in **Figure 3.4**

Table 3.4: Frequency Distribution Table for 00-24 Hours for winter 2009 - 2010

Wind Direction	Wind Speed m/sec					Total
	0.3 - 1.4	1.4 - 2.7	2.7 - 4.1	4.1 - 5.4	>= 5.4	
N	7.12	2.96	0.27	0.13	0.00	10.48
NNE	2.96	0.67	0.00	0.00	0.00	3.63
NE	21.10	5.91	0.67	0.00	0.00	27.69

ENE	1.48	0.54	0.13	0.00	0.00	2.15
E	30.51	10.08	0.81	0.00	0.00	41.40
ESE	0.67	0.27	0.13	0.00	0.00	1.08
SE	0.94	0.94	0.27	0.00	0.00	2.15
SSE	0.67	0.13	0.00	0.00	0.00	0.81
S	0.54	0.27	0.00	0.00	0.00	0.81
SSW	0.00	0.00	0.00	0.00	0.00	0.00
SW	0.27	0.13	0.00	0.00	0.00	0.40
WSW	0.00	0.00	0.00	0.00	0.00	0.00
W	0.00	0.00	0.00	0.00	0.00	0.00
WNW	0.00	0.00	0.00	0.00	0.00	0.00
NW	0.00	0.00	0.00	0.00	0.00	0.00
NNW	0.00	0.00	0.00	0.00	0.00	0.00
						90.59
Calms <0.3m/s)						**9.41**
Total	**66.26**	**21.91**	**2.28**	**0.13**	**0.00**	**100.00**

Note: All values are in percentages

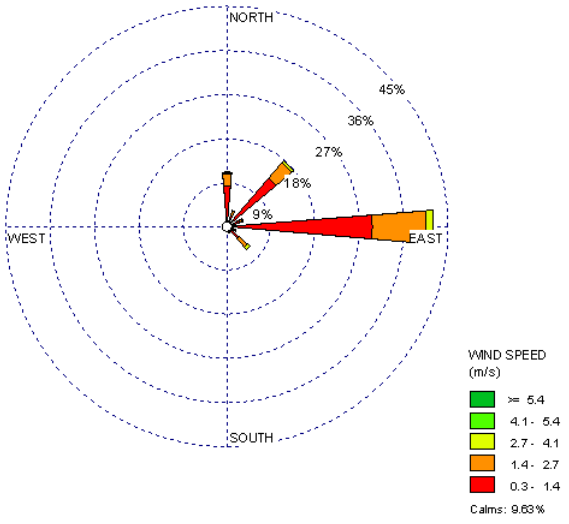

Figure 3.4: Wind Rose for the Month of winter 2009 (00-24 Hours)

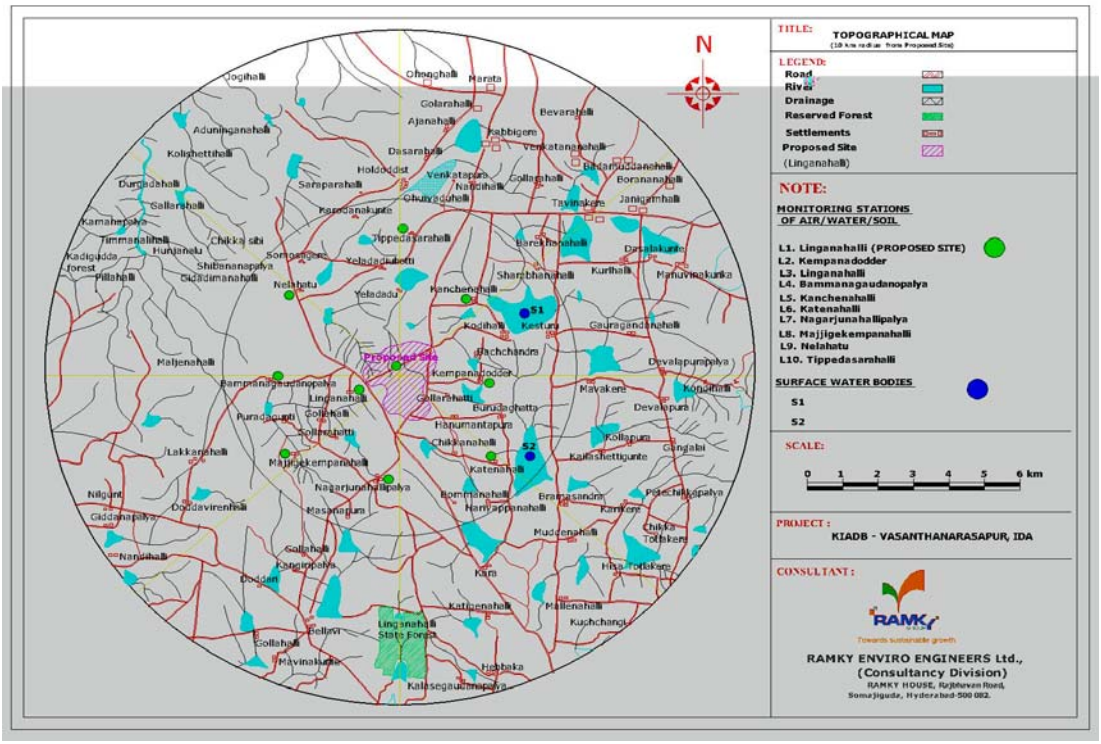

Figure 3.5: Sampling Locations (Air, Water and Soil)

3.4.6 Description of the Sampling Locations

a) Kempanadodderi

The location was selected to assess the ambient air quality levels in the core zone representing the project site at this village towards E as an Up Wind, about 3.3 km from the project site. The sampler was placed on top of a residential building belonging to Mr. Rangappa. The sampler was placed at a height of 4.0m above the ground ensuring free flow of winds from all directions.

b) Linganahalli

The location was selected to assess the ambient air quality levels in the core zone representing the project site at this village towards W as an Down Wind, about 3.9 km from the project site. The sampler was placed on top of a residential building belonging to Mr. Srinivas. The sampler was placed at a height of 4.0m above the ground ensuring free flow of winds from all directions.

c) Bammanagaudanopalya

The selected location was to assess the ambient air quality levels in the core zone representing the project site at this village towards W as a down wind, about 2.2 Km from the project site. The sampler was placed on top of a residential building belonging to Mr. Rajappa. The sampler was placed at a height of 4.0m above the ground ensuring free flow of winds from all directions to evaluate the baseline air quality.

d) Katenahalli

The air quality station was fixed on top of the residence belonging to Mr. Appana at a height of about 3.5 m above the ground ensuring free flow of winds. This location was selected to assess the ambient air quality levels in the Cross Wind direction of the proposed project site considering the prevailing wind conditions. This site is located at a distance of about 2.7 Km in the NS direction.

e) Nagarjunahallipalya

The air quality station was fixed on top of the residential building bearing Manjappa number at a height of about 3.5 m above the ground ensuring free flow of winds. This location was selected to assess the ambient air quality levels. This location fall under the cross wind direction of the proposed project site considering the prevailing wind conditions. This site is located at a distance of about 2.1 Km in the SE direction.

f) Majjigekempanahalli

The sampler was placed on top of a residential building. The sampler at a height of about 3.5 m above the ground ensuring free flow of winds. Nelahatu is located at a distance of 3.6 km NW of the proposed Project site. This location was selected to assess the air quality levels in the cross wind direction considering the prevailing meteorological conditions and the direction of the village from the proposed project site.

g) Nelahatu

High volume sampler was placed on top of a residential building belonging to Mr.Ramappa at a height of 3.5 m above the ground level. The sampling station is located about 4.0 Km from the center of the proposed project site area towards NW. This location was selected to assess the air quality levels in the downwind direction of the study area considering the prevailing wind conditions.

h) Tippedasarahalli

The air quality station was fixed on top of the a residential building belonging to Mr.Narsimha at a height of about 3.5m above the ground ensuring free flow of winds. This location was selected to assess the cross wind dispersion of the ambient pollutants considering the prevalent meteorological conditions during summer season. This site is located at a distance of about 2.8 Km in the NE direction.

i) Kanchenahalli

The sampling station was fixed on top of a residential building belonging to Mr. Narasim Nayaka at a height of about 3.5m above the ground level ensuring there are no obstructions to the free flow of winds.Shambhanahalli lies at about 4.9 km towards NE of the project site. This location was selected to assess the cross wind dispersion of the pollutants considering the prevalent meteorological conditions.

j) Project Site

The sampling station was fixed on top of a residential building at a height of about 4.0m above the ground level ensuring there are no obstructions to the free flow of winds in project site. This location was selected to assess the cross wind dispersion of the pollutants considering the prevalent meteorological conditions.

At each sampling station monitoring was carried for 2 days per week for 12 weeks during study period. The major air pollutants namely suspended particulate matter (SPM), Sulphur Dioxide (SO_2) Oxides of Nitrogen (NO_x), Ammonia (NH3)

and Carbon Monoxide (CO) were sampled on 24 hourly average basis to meet the requirements of Ministry of Environment and Forests and compared with the standards stipulated by CPCB.

The locations of the sites have been determined primarily based on the wind pattern presented before and also to reflect the windward, leeward and crosswind directions of the proposed project site and thus the overall monitoring scenario including Air, Water, Noise and Soil from the proposed project impact area carried out ,

3.5 Air Environment

The ambient air quality status with respect to the study zone of 5 km radius from the center of the project site located in Vasanthanarasapura Industrial Development Area (IDA). The baseline information over which the predicted impacts due to the development of proposed project can be superimposed to find out the net impacts on the surrounding air quality. The baseline ambient air quality can be assessed through a scientifically designed ambient air quality network. The design of monitoring network in the air quality surveillance programme has to be based on the following considerations:

- Meteorological conditions on synoptic scale
- Topography of the study area.
- Representation of regional background levels.
- Representation of plant site.
- Influence of the existing sources (if any) are to be kept at minimum
- Inclusion of major distinct villages to collect the baseline status.
- Comparison of previous study results to interpret air quality over a period of time.

Air pollution in the project area is considerable and is primarily due to Industrial activities. The pollutants of concern are Suspended Particulate Matter (SPM), Sulphur Dioxide, Oxides of Nitrogen, Ammonia and Carbon Monoxide. Ambient

Air Quality in the project impact area has been carried out for the pollutants of concern and as per the requirements of an EIA and is presented in this section.

Ambient air quality in the study area has been assessed through a network of Ten Ambient Air Quality Monitoring Stations fixed using screening models within 5 km radius keeping in view the Topographical and Meteorological conditions. The monitoring has been performed for three seasons. The locations of the AAQ stations are described in **Table 3.5**

Table 3.5: Ambient Air Quality Monitoring Stations

S. No	Location	Code	Direction w.r.t the plant site	Direction w.r.t Wind from the plant site	Distance w.r.t the plant site Km
1	Kempanadodderi	L1	E	Up Wind	3.3
2	Bammanagaudanopalya	L2	W	Down Wind	3.9
3	Katenahalli	L3	W	Down Wind	2.2
4	Katenahalli	L4	SE	Cross Wind	2.7
5	Nagarjunahallipalya	L5	S	Cross Wind	2.1
6	Majjigekempanahalli	L6	SW	Cross Wind	3.6
7	Nelahatu	L7	NW	Cross Wind	4.0
8	Tippedasarahalli	L8	N	Cross Wind	2.8
9	Kanchenahalli	L9	NE	Cross Wind	4.9
10	Project site	L10	-	-	-

The range of maximum concentrations reflects the low levels of pollution in the existing status of Ambient Air Quality representing the baseline scenario. An analysis of the data of the plant site with respect to downward side in particular and other monitoring sites in general represent the background levels. It can be observed from the data that the project proposed area and the impact zone reflect a fairly clean environment with respect to the pollutants of concern.

Spatial and temporal variations in the air quality occur as a result of the air basin and the prevailing meteorological conditions of the study area. To assess the existing sub regional air status during the three seasons, the above factors govern the status at all the Ambient Air Quality sampling stations.

Table 3.6: Ambient Air quality in the Study Area

S. No	Location	Code	Direction w.r.t the plant site	Direction w.r.t Wind from the plant site	Distance w.r.t the plant site Km
1	Kempanadodderi	L1	E	Up Wind	3.3
2	Bammanagaudanopalya	L2	W	Down Wind	3.9
3	Katenahalli	L3	W	Down Wind	2.2
4	Katenahalli	L4	SE	Cross Wind	2.7
5	Nagarjunahallipalya	L5	S	Cross Wind	2.1
6	Majjigekempanahalli	L6	SW	Cross Wind	3.6
7	Nelahatu	L7	NW	Cross Wind	4.0
8	Tippedasarahalli	L8	N	Cross Wind	2.8
9	Kanchenahalli	L9	NE	Cross Wind	4.9
10	Project site	L10	-	-	-

Table 3.7: Ambient Air quality in the Study Area

S. No	Location	Code	Direction w.r.t the plant site	Direction w.r.t Wind from the plant site	Distance w.r.t the plant site Km
1	Kempanadodderi	L1	E	Up Wind	3.3
2	Bammanagaudanopalya	L2	W	Down Wind	3.9
3	Katenahalli	L3	W	Down Wind	2.2
4	Katenahalli	L4	SE	Cross Wind	2.7
5	Nagarjunahallipalya	L5	S	Cross Wind	2.1
6	Majjigekempanahalli	L6	SW	Cross Wind	3.6
7	Nelahatu	L7	NW	Cross Wind	4.0
8	Tippedasarahalli	L8	N	Cross Wind	2.8
9	Kanchenahalli	L9	NE	Cross Wind	4.9

S. No	Location	Code	Direction w.r.t the plant site	Direction w.r.t Wind from the plant site	Distance w.r.t the plant site Km
10	Project site	L10	-	-	-

Table 3.8: Ambient Air quality in the Study Area

S. No	Location	Code	Direction w.r.t the plant site	Direction w.r.t Wind from the plant site	Distance w.r.t the plant site Km
1	Kempanadodderi	L1	E	Up Wind	3.3
2	Bammanagaudanopalya	L2	W	Down Wind	3.9
3	Katenahalli	L3	W	Down Wind	2.2
4	Katenahalli	L4	SE	Cross Wind	2.7
5	Nagarjunahallipalya	L5	S	Cross Wind	2.1
6	Majjigekempanahalli	L6	SW	Cross Wind	3.6
7	Nelahatu	L7	NW	Cross Wind	4.0
8	Tippedasarahalli	L8	N	Cross Wind	2.8
9	Kanchenahalli	L9	NE	Cross Wind	4.9
10	Project site	L10	-	-	-

Table 3.9: Ambient Air quality in the Study Area

Code	Name of the Station	NOx - µg/m³			
		Min	Max	Mean	98th percentile
L1	Kempanadodderi	12.3	23.5	15.9	22.5
L2	Bammanagaudanopalya	13.1	22.7	15.9	22.1
L3	Katenahalli	12.7	21.8	16.5	21.7
L4	Katenahalli	12.5	24.5	17.9	24.4
L5	Nagarjunahallipalya	13.2	25.6	16.4	25.1
L6	Majjigekempanahalli	10.9	24.7	17.9	24.6
L7	Nelahatu	11.8	17.3	14.3	16.9
L8	Tippedasarahalli	12.2	21.7	15.9	21.6
L9	Kanchenahalli	13.20	23.4	16.2	22.5

L10	Project site	14.2	22.4	17.9	22.4

Note: NH3 values were found to be less than 2 mg/m^3 for 8 hours and Ammonia less than 0.1 mg/m^3

3.5.1 Regional Scenario

a) Suspended Particulate Matter & Respirable Particulate Matter

Suspended Particulate Matter/Respirable Particulate Matter in general terms is the particulate matter in suspension in ambient air. It includes dust, etc. In general some of the important sources of suspended particulate matter are **mines, quarries, pottery**. The following sources of suspended particulate matter in the study area are identified:

1. Emissions due to vehicular movement
2. Dust generation from ground
3. Fire wood and litter burning

Excessive exposure to dust causes breathing related diseases as it effects the lungs. Excessive concentration of smoke and dust also reduces the visibility. Particulate matter affects the plants by settling on the leaves and preventing natural growth. The chemical matter in the dust will affect the structures due to slow reaction over a period of time.

The minimum and maximum level of SPM recorded within the study area was in the range of 62.3 to 154.3 µg/m^3 with the 98th percentile ranging between 114.3 µg/m^3 to 151.7 µg/m^3. The minimum and maximum level of RSPM recorded within the study area was in the range of 30.1 to 60.5 µg/m^3 with the 98th percentile ranging between 48.1 µg/m^3 to 59.5 µg/m^3.

The 24 hourly average values of SPM and RSPM were compared with the National Ambient Air Quality Standards and found that all sampling stations

recorded values within the applicable limits of residential and rural areas for all locations in study area.

b) Sulfur Dioxide

Sulfur dioxide gas is an inorganic gaseous pollutant. Sulfur dioxide emissions are expected to be emitted wherever combustion of any fuel containing sulfur takes place. The sulfur in the fuel will combine with oxygen to form sulfur dioxide. Sulfur trioxide and sulfuric acid mist are the other important pollutants in the sulfur group. In general some of the important sources of sulfur dioxide are Power stations, sulfuric acid plants, oil refining, boilers in utilities in any industry and domestic use of coal. The following sources of Sulfur dioxide in the study area are identified:

1. Emissions from domestic fuel (coal, diesel, etc.)
2. Emissions from DG sets used by industries and local residents

Information in the literature has indicated that the presence of sulfur dioxide in the photochemical smog reaction enhances the formation of visibility enhancing aerosols.

Sulfur dioxide in atmosphere is significant because of its toxicity. Sulfur dioxide is capable of producing illness and lung injury. Further it can combine with water in the air to form toxic acid. Aerosols can corrode metal surfaces, fabrics and the leaves of plants. Sulfur dioxide is irritating to the eyes and respiratory system. Excessive exposure to sulfur dioxide causes bronchial asthma and other breathing related diseases as it affects the lungs.

The minimum and maximum level of SO_2 recorded within the study area was in the range of 7.3 $\mu g/m^3$ to 18.3 $\mu g/m^3$ with the 98^{th} percentile ranging between 13.6 $\mu g/m^3$ to 18.3 $\mu g/m^3$.

The 24 hourly average values of SO_2 were compared with the national ambient air quality standards and it was found that all sampling stations recorded values much lower than the applicable limit of 80µg/m^3 for residential and rural areas.

c) Oxides of Nitrogen

Oxides of Nitrogen are also an inorganic gaseous pollutant like Sulfur dioxide. Oxides of Nitrogen emissions are expected to be emitted wherever combustion at high temperatures takes place. Nitrous oxide and Nitric Acid Mist are the other important pollutants in the inorganic nitrogen group.

In general some of the important sources of oxides of Nitrogen are Boilers (utilities) in any industry and Auto exhaust. In a metropolitan town NO_x levels are predominantly due to automobile emissions.

The following sources of oxides of nitrogen in the study area are identified:

1. Emissions from industrial and domestic burning of coal.
2. Emissions from automobiles.

Oxides of nitrogen have far greater significance in photochemical smog reaction than any of the other inorganic gaseous contaminants**.** NO_x in the presence of sunlight will undergo reactions with a number of organic compounds to produce all the effects associated with photochemical smog. NO_x has inherent ability to produce deleterious effects by themselves like toxicity. It acts as an asphyxiate when in concentrations great enough to reduce the normal oxygen supply from the air.

The minimum and maximum level of NOx recorded within the study area was in the range of 10.9 µg/m^3 to 25.6 µg/m^3 with the 98th percentile ranging between 16.9 µg/m^3 to 25.1 µg/m^3.

The 24 hourly average values of NO_x were compared with the national ambient air quality standards and it was found that all the sampling stations recorded

values much lower than the applicable limit of 80 µg/m^3 for residential and rural areas.

3.6 Water Quality

Surface and groundwater samples were collected from different sources within the study area and some important physical and chemical parameters including heavy metals were considered for depicting the baseline status of the study area.

3.6.1 Water Quality Assessment

Selected water quality parameters for water resources of the study area have been used for describing the water environment and assessing the impacts on it. To assess the water quality impacts, water resources in the impact area have been grouped into 2 classes.

a. Ground water resources in the deeper strata of the ground
b. Surface water resources

About 10 ground and 2 surface water samples were collected from the study area to assess the water quality during the study period. The ground water samples were drawn from the hand pumps and open wells being used by the villagers for their domestic needs. Surface water sampling was carried out from major tanks / Ponds within 5 Km of the proposed project site. The details of the locations are given in **Table 3.10.**

Table 3.10: Water Sampling Locations

Code	Name of the Station	W.R.T. Site		Remarks
		Distance in Km	Direction	
W1	Kempanadodderii	3.3	E	Ground waters
W2	Bammanagaudanopalya	3.9	W	
W3	Katenahalli	2.2	W	
W4	Katenahalli	2.7	SE	
W5	Nagarjunahallipalya	2.1	S	
W6	Majjigekempanahalli	3.6	SW	

W7	Nelahatu	4.0	NW	
W8	Tippedasarahalli	2.8	N	
W9	Kanchenahalli	4.9	NE	
W10	Project site	-	-	
S1		3	NE	Surface waters
S2		2.5	SE	

The water samples collected from the above locations were analyzed for important major and minor ions, and the analytical results of the water samples were compared with World Health Organization (WHO) drinking water standards and the results are shown in **Table 3.11.**

Table 3.11: Water Sample Analysis Results

S.No	Parameter	Unit	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	S1	S2	WHO Standards
1	Colour	Hazen units	8	8	6	7	8	6	7	6	6	10	10	10	5.0 - 25.0
2	pH		7.48	7.78	7.98	7.84	7.26	7.65	7.58	8.26	8.04	7.64	8.42	7.97	6.5 - 8.5
3	Turbidity	NTU	6	6	6	6	6	6	6	6	6	6	8	7	5.0 - 10.0
4	Elec. Cond	umhos/cm	1134	1334	1196	1558	1252	2610	2985	3325	1142	1012	613	224	
5	Sus. Solids	mg/L	<10	<10	<10	6	7	8	8	5	<10	7	8	7	
6	Total Dissolved solids	mg/L	765	865	724	946	756	1684	1845	1987	695	626	380	142	500-2100
7	Alkalinity as CaCO3	mg/L	246	257	302	295	245	365	488	356	334	254	145	85	200-600
8	Chlorides as Cl	mg/L	192	212	115	240	180	564	440	678	126	125	85	18	250-1000
9	Sulphates as SO4	mg/L	116	126	108	110	85	124	355	349	78	65	36	5.7	200-400
10	Nitrate as NO3	mg/L	8.2	10.2	9.3	14	20	16	13	0.7	8.4	5.8	0.73	0.01	45-100
11	Phosphates as PO4	mg/L	0.18	0.14	0.16	0.18	0.17	0.12	0.14	0.13	0.17	0.19	0.12	0.11	
12	Total Hardness as CaCO3	mg/L	339	439	408	304	443	597	601	595	428	172	96	65	300-600
13	Calcium as Ca	mg/L	124	114	98	85	134	122	112	118	98	42	25	13	75-200
14	Magnesium as Mg	mg/L	27	37	39	22	26	70	77	72	44	16	8	7.7	30-100
15	Sodium as Na	mg/L	124	110	84	202	82.5	314	376	475	75	146	94	17	
16	Potassium as K	mg/L	6	9	7	7	14	16	26	22	6	9	5	4	

17	Flouride as F	mg/L	1.08	1.02	0.91	1.17	0.77	1.03	0.93	1.04	1.09	0.58	0.96	0.32	1.0-1.5
18	Iron as Fe	mg/L	0.56	0.51	0.21	0.26	0.32	0.39	0.14	0.26	0.25	0.27	0.32	0.18	0.5-1.0
19	Dissolved Oxygen	mg/L											5	4.5	
20	MPN count												3.2×10^4	7.8×10^4	

Note: Heavy metal Pb, Mn, Cd, Cr, Cu, Zn were below detectable limits

3.6.2 Regional Scenario

- The pH limit fixed for drinking water samples as per WHO Standards is 6.5 to 8.5 beyond this range the water will affect the mucus membrane and or water supply system. During the study period, the pH was varying for ground waters from 7.26 to 8.26 and in surface water the pH was varying between 7.97 to 8.42. The pH values for all the samples collected in the study area during study period were found to be within the limits.

- The desirable limit for total dissolved solids as per WHO Standards is 500 mg/l where as the permissible limits in absence of alternate source is 2100 mg/l, beyond this palatability decreases and may cause gastro intestinal irritation. In ground water samples collected from the study area, the total dissolved solids are varying from 626 mg/l to 1987 mg/l. The TDS of all the samples were above the desirable limit but within the permissible limit of 2100 mg/l. In surface waters the total dissolved solids were in the range of 142 mg/l to 380 mg/l which were within the desirable limit.

- The desirable limit for chloride is 250mg/l as per WHO Standards where as the permissible limit of the same is 1000 mg/l beyond this limit taste, corrosion and palatability are affected. The Chloride levels in the ground water samples collected in the study area were ranging from 115 mg/l to a maximum of 678 mg/l. All are within the desirable limits. In surface waters the chlorides were in the range of 18 mg/l to 85 mg/l, which are within the desirable limits.

- The desirable limit as per WHO Standards for hardness is 300 mg/l where as the permissible limit for the same is 600 mg/l beyond this limit encrustation in water supply structure and adverse effects on domestic

use will be observed. In the ground water samples collected from the study area, the hardness is varying from 172 mg/l to 601 mg/l. In surface waters the hardness is varying between 65 mg/l to 96 mg/l.

- Fluoride is the other important parameter, which has the desirable limit of 1 mg/l and permissible limit of 1.5 mg/l. However the optimum content of fluoride in the drinking water is 0.6 to 1.5 mg/l. If the fluoride content is less than 0.6 mg/l it causes dental carries, above 1.5 mg/l it causes staining of tooth enamel, higher concentration in range of 3 - 10 mg/l causes fluorosis. In the ground water samples of study area the fluoride value were in the range of 0.58 mg/l to 1.17 mg/l. where as in the surface waters the fluoride was in range of 0.32 mg/l to 0.96 mg/l.

Overall all the samples collected from the study area were found to be fit for human consumption, however the hardness, dissolved solids. Most of ground water samples seem to be above desirable limit but well within the permissible limits. Most of the heavy metals in all samples are below detectable limits. The MPN count of the surface waters is very high.

3.7 Noise Environment

Noise can be defined as unwanted sound or sound in the wrong place at the wrong time. It can also be defined as any sound that is undesirable because it interferes with speech and hearing, is intense enough to damage hearing or is otherwise annoying. The definition noise as unwanted sound implies that it has an adverse effect on human beings and their environment, including land, structures, and domestic animals. Noise can also disturb natural wildlife and ecological systems.

Sound can be transmitted through gases, liquids, and solids. Noise impacts can be of concern during the construction and the operational phases of projects. Noise should also be considered in relation to present and future land use zoning and policies.

Construction noise can be a significant source of community noise. Of concern are impacts on people near the construction site, who are totally unrelated to construction activities (e.g. area residents, office workers, school children, staff, etc.) Factors which are important in determining noise levels that will potentially impact such populations include distance from the noise source, natural or man-made barriers between the source and the impacted population, weather conditions which could potentially absorb, reflect, or focus sound (such as wind speed, direction, temperature inversions), and the scale and intensity of the particular construction phase (excavation, erection, or finishing). The Environment/health impacts of noise can vary from Noise Induced Hearing Loss (NIHL) to annoyance depending on loudness of noise levels and tolerance levels of individual.

3.7.1 Sources of Noise

The main sources of noise in the study area are domestic activities, industrial activities and vehicular traffic. The main occupation of the villagers in the study area is agriculture, business.

3.7.2 Noise Levels in the Study Area

Baseline noise levels have been monitored at 10 locations within the study zone, using a spot noise measurement device. At random noise level measurement locations were identified for assessment of existing noise level status, keeping in view the land use pattern, residential areas in villages, schools, bus stands, etc., the day levels of noise have been monitored during 6 AM to 9 PM and the night

levels during 10 PM to 5 AM. The noise monitoring stations are shown in **Figure 4.5a** and represented in **Table3.12.**

Table 3.12: Noise Monitoring Locations

Code	Name of the Station	W.R.T. Site	
		Distance km	Direction
L1	Kempanadodderi	3.3	E
L2	Bammanagaudanopalya	3.9	W
L3	Katenahalli	2.2	W
L4	Katenahalli	2.7	SE
L5	Nagarjunahallipalya	2.1	S
L6	Majjigekempanahalli	3.6	SW
L7	Nelahatu	4.0	NW
L8	Tippedasarahalli	2.8	N
L9	Kanchenahalli	4.9	NE
L10	Project site	-	-

Table 3.13: Noise Levels in the Study Area – dB (A)

Time Hours	N1	N2	N3	N4	N5
1.00	36.7	38.6	36.7	38.5	35.9
2.00	37.8	40.7	38.9	38.4	37.5
3.00	40.3	41.2	42.0	39.8	45.6
4.00	41.8	42.8	43.1	42.9	45.6
5.00	42.9	43.1	44.2	44.5	46.6
6.00	44.8	46.2	43.2	44.8	48.9
7.00	48.6	48.6	52.3	52.4	53.2
8.00	53.6	53.6	57.6	54.6	55.9
9.00	54.2	54.6	55.3	56.3	56.7
10.00	54.6	55.3	54.7	55.3	54.6
11.00	52.3	56.4	56.3	52.8	52.3

12.00	51.4	54.3	50.2	51.6	54.6
13.00	52.7	50.8	53.2	53.6	51.3
14.00	52.6	52.4	52.4	51.7	56.3
15.00	52.6	51.6	51.4	53.6	54.2
16.00	54.6	55.6	56.7	54.6	52.3
17.00	52.6	54.6	55.6	53.9	51.6
18.00	50.6	54.7	53.6	52.4	52.6
19.00	49.8	49.3	55.4	51.4	51.4
20.00	48.9	48.7	49.1	50.6	48.9
21.00	45.6	48.3	48.6	48.6	49.6
22.00	42.5	42.5	44.3	40.2	40.1
23.00	39.8	40.8	42.5	42.9	38.9
24.00	37.8	37.6	38.9	38.4	36.4
Minimum	36.7	37.6	36.7	38.4	35.9
Maximum	54.6	56.4	57.6	56.3	56.7
Day Equivalent	**52.0**	**53.1**	**54.0**	**53.1**	**53.4**
Night Equivalent	**39.4**	**40.4**	**41.0**	**40.0**	**41.2**
Day Night Equiv	**51.3**	**52.4**	**53.2**	**52.3**	**52.8**

Table 3.14: Noise Levels In The Study Area – dB(A)

Time Hours	N6	N7	N8	N9	N10
1.00	40.3	38.7	40.2	38.6	40.5
2.00	41.5	40.3	39.7	42.3	39.6
3.00	43.8	42.8	43.5	43.2	45.6
4.00	43.6	45.6	44.6	44.6	46.8
5.00	45.8	48.6	45.9	45.6	47.8
6.00	47.8	49.7	46.8	46.8	48.9
7.00	54.2	52.3	54.1	52.3	53.4
8.00	55.6	54.6	55.6	53.6	57.6
9.00	56.8	56.7	56.8	54.6	57.8
10.00	54.9	57.6	57.1	52.3	57.6
11.00	54.8	58.6	55.2	51.2	53.4

12.00	54.3	56.3	52.7	50.6	54.2
13.00	54.8	55.4	52.3	52.9	55.1
14.00	51.2	52.3	50.1	53.6	55.2
15.00	50.7	53.9	49.6	54.2	52.1
16.00	53.9	52.4	55.3	57.4	52.1
17.00	52.4	54.6	56.4	54.3	50.2
18.00	50.6	50.3	50.3	52.9	53.6
19.00	48.3	51.9	48.6	51.4	49.2
20.00	46.2	48.3	47.5	51.2	50.2
21.00	43.2	44.3	46.1	45.3	51.3
22.00	42.3	42.3	41.3	41.2	41.2
23.00	40.2	40.1	42.6	39.6	38.9
24.00	37.2	39.8	40.2	39.8	36.8
Minimum	37.2	38.7	39.7	38.6	36.8
Maximum	56.8	58.6	57.1	57.4	57.8
Day Equivalent	**53.1**	**54.3**	**53.5**	**53.0**	**54.2**
Night Equivalent	**41.2**	**41.4**	**41.5**	**41.2**	**42.1**
Day Night Equiv	**52.5**	**53.5**	**52.9**	**52.4**	**53.6**

3.7.3 Regional Scenario

The values of noise observed in some of the rural areas are primarily owing to vehicular traffic and other anthropogenic activities. In rural areas wind blowing and chirping of birds would contribute to noise levels especially during the nights. Assessment of day and night noise levels around the study area are ranging between 35.9 to 58.6 dB(A) during study period. The day equivalents during the study period are ranging between 52 to 54.20 dB(A). Where as the night equivalents were in the range of 39.4 to 42.1 dB(A). From the results it can be seen that the Day equivalents and the Night equivalents were within the Ambient Noise standards of residential areas standards.

3.8 Land Environment

Studies on land and biological aspects of eco-system is important for Environment Impact Assessment to identify sensitive issues and take appropriate action to maintain "Ecological Homeostasis" in the early stages of development of the project. The objective of this session is to define the present environment in which the proposed action is to occur, to evaluate all possible eventualities, to ensure that all negative impacts are minimized and to demonstrate that the proposed project has been appropriately announced to all interested parties so that their concerns are addressed.

In order to understand the factors governing the Eco-system both abiotic and biotic factors have been described.

3.8.1 Ecosystem

Ecosystem is an integrated unit that contains both animals and plants whose survival is dependent on biotic and abiotic structure. Base on the type of distribution of organisms and its physical setting the study area can be classified in to cropland, terrestrial and aquatic ecosystems. In order to understand the factors governing the system both abiotic (physical setting) and biotic factors (flora and fauna) have been described.

A preliminary survey was made to get general information of flora and fauna. Fresh plant species were collected from field by trained biologists and later identified. Tentative fauna is noted with the help of local information and personal assessment. At times professional judgment was used to overcome the field deficiency.

3.9 Geology

The area earmarked for the development of Vasantha Narasapura IDA exhibits plain terrain with undulations.

The region exhibits ridge valley and undulating plain terrain topographical features. The highly dissected structural ridges and structural hills are common in central and east central parts of the study area. The coastal plains observed in the east are wider but undulating in nature. Scattered residual hills are observed in north central parts of the area.

3.9.1 Groundwater

Groundwater is an important resource of the country, which is contributing substantially for the Indian economy. Nearly 80% of drinking and domestic water needs are met through groundwater. With more than 17 million energized wells nationwide, groundwater now meets more than 15% of the country's irrigation demand. The rapid development of groundwater utilisation has also brought in new problems, viz. over exploitation associated with quality deterioration, seasonal fluctuation of water table affecting shallow wells and also pollution problems.

Water is the vital element of life and a truthful companion of humanity. It is the most abundant element on earth, covering about 1400 million cubic kilometers of which only 0.003percent is actually usable, the rest forming part of oceans and polar ice caps. Urban, domestic and industrial consumers are using larger amount of water and consequently depleting the available resources. The goal should be to promote water use and management in such a way that society's needs are met while at the same time water resources are protected. Non-availability of adequate drinking water due to progressively depleting surface and groundwater is a big challenge to the water management system.

Even today more than 90% of our rural population is primarily dependent on groundwater. Water supplies from groundwater sources are becoming increasingly important, but they are threatened by unplanned exploitation and contamination from many sources. Protection and conservation of groundwater is, therefore, a top priority task, particularly in regions of limited available water resources.

Groundwater recharge in general sense is the downward flow of water reaching the water table, forming an addition to the groundwater reservoir. Recharge of groundwater may occur naturally from precipitation, rivers, canals and lakes and as man –induced phenomenon via such activities as irrigation and urbanization.

Urbanization has profound impacts on the hydrological cycle; effecting changes in groundwater recharge mechanisms. The provision of water supply sanitation and drainage are the key elements of the urbanization process. A common factor to most urbanization is that it results in-

(i). Impermeabilisation of a significant proportion of the land surface, and

(ii). Major water imports from outside the urban limits.

Urbanization also causes major changes in the frequency and volume of recharge, although these changes cannot be measured directly and are thus difficult to quantify. The changes in recharge caused by urbanization in turn influence the groundwater levels and flow regime in underlying aquifers.

3.9.2 Physiography and Drainage

The ground is very undulating and has ridges at centre and eastern part of the layout. The terrain is sloping towards Northwest, Southwest direction and has central dip. Major nallas pass through the industrial area which emerges to tank near Nelahalu and Sorakunte.

3.9.3 Soils

The soils of Tumkur district are broadly classified into: (i) Red loamy soil, (ii) Red sandy soil (iii) Laterite soil and (iv) Laterite gravelly soil.

3.9.4 Geology

The terrain is very undulating and has many rocky out crops in the Eastern region as well as Northern region. The soil strata being with boulders and gravels, the sub soil is of dark red to reddish brown clayey sand with gravels and boulders. This is followed by brownish yellow dense silty and sand with gravels upto an investigated depth of about 1.7m.

3.10 Lithology

The Lithology presented in the project area was under the influence of natural agents and thus is weathered and fractured. It can be concluded that the area is underlain by one of the oldest formations in the geological history. It is noticed that the formation is getting harder and impervious with depth. The topsoil in the area is followed by weathered rock that is underlain by fractured rock, the thickness of which is not considerable. This fractured rock is followed by a basement rock that is the fine-grained granite.

3.11 Soil

The common soil is reddish to brown colored comprising red sandy-to-sandy loam soils. The area in particular is generally red sandy with patches of silty

loam and red loamy soils. Due to this factor water quickly percolates in to the soil with out causing any marshy conditions. The cultivable soils are spread over the area.

3.11.1 Soil Quality

The present study on soil quality establishes the baseline characteristics in the study area surrounding the project site. The study has been addressed with the following objectives.

- To determine the base line characteristics
- To determine the soil characteristics of proposed project site.
- To determine the impact of industrialization/urbanization on soil characteristics
- To determine the impacts on soils from agricultural productivity point of view.

3.11.2 Criteria Adopted for Selection of Sampling Locations

For studying the soil types and soil characteristics, 10 sampling locations were selected to assess the existing soil conditions representing various land use conditions and geological features.

3.11.3 Methodology and Sampling

The homogenized soil samples collected at different locations were packed in a polyethylene plastic bag and sealed. The sealed samples were sent to laboratory for analysis. The important physical, chemical parameter concentrations were determined from all samples.

3.11.4 Soil Sampling Locations

Details of the soil sampling locations are given in **Table 4.17**.

Table 3.17: Soil Sampling Locations

Code	Name of the Station	W.R.T. Site	
		Distance km	Direction
S1	Kempanadodderi	3.3	E
S2	Bammanagaudanopalya	3.9	W
S3	Katenahalli	2.2	W
S4	Katenahalli	2.7	SE
S5	Nagarjunahallipalya	2.1	S
S6	Majjigekempanahalli	3.6	SW
S7	Nelahatu	4.0	NW
S8	Tippedasarahalli	2.8	N
S9	Kanchenahalli	4.9	NE
S10	Project site	-	-

Table 3.18: Soil Analysis Results

SNo	Parameter	Unit	L1	L2	L3	L4	L5
1	EC (1:2 water extract)	umhos/cm	193	185	225	284	246
2	pH (1:2 water extract)		7.75	7.86	7.95	7.92	7.38
3	Available Nitrogen as N	Kg/Ha	31.7	98.4	90.36	23.83	32.51
4	Available Phosphorus as P	Kg/Ha	7.05	4.71	5.46	10.57	8.26
5	Available Potassium as K	Kg/Ha	30.03	40.96	55.11	41.95	98.55
6	Org. Matter	%	1.01	0.45	0.35	1.17	1.01
7	Calcium as Ca	mg/kg	2219	2163	1798	1354	1462
8	Magnesium as Mg	mg/kg	769	689	684	824	354
9	Sodium as Na	mg/kg	293	91	126	456	142
10	Chlorides as Cl	mg/kg	63	58	48	129	68
11	Boron as B	mg/kg	0.32	0.45	0.56	0.48	0.41
12	Iron	mg/kg	26	29	23	22	24
13	Bulk density	g/cm3	1.34	1.26	1.28	1.24	1.34
14	Total Carbon	%	2.68	2.85	3.58	3.11	2.68
15	Texture		Sandy soil	Loamy sand	sandy loam	sandy loam	Sandy loam

Table 3.19: Soil Analysis Results

SNo	Parameter	Unit	L1	L2	L3	L4	L5
1	EC (1:2 water extract)	umhos/cm	193	185	225	284	246
2	pH (1:2 water extract)		7.75	7.86	7.95	7.92	7.38
3	Available Nitrogen as N	Kg/Ha	31.7	98.4	90.36	23.83	32.51
4	Available Phosphorus as P	Kg/Ha	7.05	4.71	5.46	10.57	8.26
5	Available Potassium as K	Kg/Ha	30.03	40.96	55.11	41.95	98.55
6	Org. Matter	%	1.01	0.45	0.35	1.17	1.01
7	Calcium as Ca	mg/kg	2219	2163	1798	1354	1462
8	Magnesium as Mg	mg/kg	769	689	684	824	354
9	Sodium as Na	mg/kg	293	91	126	456	142
10	Chlorides as Cl	mg/kg	63	58	48	129	68
11	Boron as B	mg/kg	0.32	0.45	0.56	0.48	0.41
12	Iron	mg/kg	26	29	23	22	24
13	Bulk density	g/cm3	1.34	1.26	1.28	1.24	1.34
14	Total Carbon	%	2.68	2.85	3.58	3.11	2.68
15	Texture		Sandy soil	Loamy sand	sandy loam	sandy loam	Sandy loam

3.11.5 Regional Scenario

The analytical results of the soil samples collected during the study period are summarized below.

The pH of the soil is an important property; plants cannot grow in low and high pH value soils. The normal range of the soils in 6.0 to 8.5 is called as normal to saline soils. Most of the essential nutrients like N, P, K, Cl and SO_4 are available for plant at the neutral pH except for Fe, Mn and Al which are available at low pH range. The soils having pH below 7 are considered to be acidic from the practical standpoint, those with pH less than 5.5 and which respond to liming may be considered to qualify to be designated as acid soils. On the basis of pH measurements, the degree of soil acidity may be indicated. The pH values in the study area are varying from 7.26– 8.02 indicating that the soils are falling in normal to saline class.

Based on the electrical conductivity, the soils are classified into 4 groups (Normal, Critical for germination, Critical for growth of the sensitive crops, Injurious to most crops). The electrical conductivity in the study area is varying from 185 – 285 μ mhos/cm indicating that soils falling under Normal category.

The Total Carbon in the study area is varying from 0.35 - 2.53 %.

The other important parameters for characterization of soil for irrigation are N,P,K. Nitrogen, Phosphorus and Potassium are known as primary nutrients, Calcium, Magnesium and sulphur as secondary nutrients. The primary and secondary nutrient elements are known as major elements. This classification is based on their relative abundance, and not on their relative importance.

Nitrogen encourages the vegetative development of plants by imparting a healthy green color to the leaves. It also controls, to some extent, the efficient utilization of phosphorus and potassium. Its deficiency retards growth and root development, turns the foliage yellowish or pale green, hastens maturity, causes the shriveling of grains and lowers crop yield. The older leaves are affected first. An excess of nitrogen produces leathery (and sometimes crinkled), dark green leaves and succulent growth. It also delays the maturation of plants, impairs the quality of crops like barley, potato, tobacco, sugarcane and fruits increases susceptibility to diseases and causes ”lodging” of cereal crops by inducing an undue lengthening of the stem internodes. The available Nitrogen as N in the study area is varying from 28.83 to 98.4 kg/ha indicating that it requires addition of nitrates for proper growth.

Phosphorus influences the Vigor of plants and improves the quality of crops. It encourages the formation of new cells, promotes root growth (particularly the

development of fibrous roots), and hastens leaf development, the emergence of ears, the formation of grains, and the maturation of crops. It also increases resistance to disease and strengthens the stems of cereal plants, thus reducing their tendency to lodge. It offsets the harmful effects of excess nitrogen in the plant. When applied to leguminous crops it hastens and encourages the development of nitrogen fixing nodule bacteria. If phosphorus is deficient in the soil, plants fail to make a quick start, do not develop a satisfactory root-system, remain stunted and sometimes develop a tendency to show a reddish or purplish discoloration of the stem and foliage owing to an abnormal increase in the sugar content and the formation of anthocyanin. However the deficiency of this element is not so easily recognized as that of nitrogen. It has also been observed that cattle feeding on the produce of phosphorus deficient soils become dwarfed, develop stiff joints and lose the velvety feel of the skin. Such animals show an abnormal craving for eating bones and even soil itself. In the study area available Phosphorus is varying from 4.46 to 13.72 kg/ha, which indicates that all samples are falling in medium range.

Potassium enhances the ability of the plants to resist diseases, insect attacks, and cold and other adverse conditions. It plays an essential part in the formation of starch and in the production and translocation of sugars, and is thus of special value to carbohydrates rich crops, e.g. sugarcane, potato and sugar beet. The increased production of starch and sugar in legumes fertilized with potash benefits the symbiotic bacteria and thus enhances the fixation of nitrogen. It also improves the quality of tobacco, citrus, etc. With an adequate supply of potash, cereals produce plump grains and strong straw. But an excess of the element tends to delay maturity, though not to the same extent as nitrogen. Plants can take up and store potassium in much larger quantities than what is needed for optimum growth and this excess uptake is known as luxury consumption. With the maturity or death of plants, potassium is washed out from the plant body

readily. Vegetables and legumes are particularly heavy consumers of potassium. The deficiency of potassium produces the characteristic ringing of alfalfa leaves with rows of small white spots, reddish brown decolouration of cotton leaves, the drying, scorching and curbing of leaf margins of potato, and intravenal chlorosis and flaring along the edges of maize leaves. The older leaves are affected first. The available potassium in the study area is varying between 29.54 to 98.55 kg/ha which indicates that all samples are falling in medium category.

3.12 Traffic Study

Anthropogenic emissions not only contribute to the green house effect but also participate in the reaction that results in photochemical oxidants. The effect of photochemical oxidants is well known for forming smog particularly in the urban areas.

Among the anthropogenic sources of pollutants forming the green house gases, burning of fossil fuels constitute a major source. Highway mobile sources that contribute significantly to poor quality have been regulated for the past two decades in countries like India. The absence of regulation in developing countries has caused a global concern regarding potential environmental damage on a larger scale.

In countries like India automobiles especially two-wheelers are a very popular mode of personal transport for socio-economic reasons. They constitute to about 70-95% of the total passenger's vehicles. About the same percentage of two-wheeler vehicles are powered by two-stroke engines because of low initial and maintenance costs. However these two stroke engines have high emission levels which are of the major concern. Moreover, these emissions are concentrated in urban area, further contributing to already polluted "heat islands". Poor public transportation and high transportation fares, increasing cost of living and greater

demand for mobility may be attributed to a surge in the number of personal vehicles during the last decade.

The objective of traffic study and emission quantification is to assess the magnitude of the emissions resulting from two-wheelers, three wheelers, and four wheelers that are extensively used as a means of common transport within the urban areas.

A detailed traffic survey was conducted in the study area and also to evaluate the impacts of the increased traffic due to the proposed activity.

Vehicular emissions are the major source of air quality impacts in the study area. The principal cause of air pollution during the construction phase is the diesel-powered vehicles used in haulage of aggregates, earth and other construction material. Air quality could be affected by dust & particulate matter arising due to site clearing, vehicular emissions etc. Gaseous emissions like Sulphur dioxide, Nitrous oxide, CO and HC might be released from the vehicular movement, which has a direct impact on the environment.

Increase in the traffic in the study area has a direct impact on the resources as a heavy release of automobile exhaust is envisaged which has a direct impact on the air quality and the ambient noise levels in the study area.

The methodology adopted for carrying out the traffic study was to select the major roads around the project site and count the various categories of vehicles moving on these roads given in **Table 3.20.**

Table 3.20: Details of Traffic Monitoring Locations

S.No	Code	Location	W.R.T the Site Epicenter	
			Direction	Distance in Km
1	TF1	NH-4	N	2
2	TF2	Proposed site Near Kempanadodderi Junction Connecting to bypass road	S	4

3.12.1 Traffic Studies - Conclusion

The methodology adopted for carrying out the traffic study was to select the major roads around the project site and count the various categories of vehicles moving on these roads. The traffic survey was carried out on the approach road to the project from the national highway NH4 The details of the vehicles movement recorded. From the study it is observed that there is no major impact on traffic due to the proposed project. Traffic

Table 3.21: Traffic Study (NH-4)

Time in hrs	Two Wheelers Motor cycle	Passenger Car	Auto Rickshaw	Truck/Buses	Total
10:00-11:00	158	196	136	130	620
11:00-12:00	168	150	152	148	618
12:00-13:00	110	80	138	110	438
13:00-14:00	190	94	168	86	538
14:00-15:00	178	148	114	124	564
15:00-16:00	158	70	100	62	390
16:00-17:00	192	156	108	92	548

17:00-18:00	178	156	138	110	582
18:00-19:00	150	88	102	72	412
19:00-20:00	138	66	82	56	342
20:00-21:00	114	62	56	70	302
21:00-22:00	80	40	28	82	230
22:00-23:00	40	10	6	16	72
23:00-00:00	4	6	2	10	22
00:00-01:00	6	0	0	8	14
01:00-02:00	0	10	8	0	18
02:00-03:00	2	0	4	4	10
03:00-04:00	2	0	2	8	12
04:00-05:00	0	0	0	8	8
05:00-06:00	4	2	4	16	26
06:00-07:00	26	10	20	12	68
07:00-08:00	36	40	38	54	168
08:00-09:00	196	54	128	150	528
09:00-10:00	178	160	102	148	588
Sub Total	**2308**	**1598**	**1636**	**1576**	**7118**

Table 3.22: PCU count Traffic Survey report at Near Kempannadodderi Junction (NH-4)

Time in hrs	Two Wheelers Motor cycle or scooter @0.75 PCU	Passenger Car @1.0 PCU	Auto Rickshaw @2.0 PCU	Truck/Buses @ 3.7 PCU	PCU's / Hr
10:00-11:00	118.5	196	272	481	1067.5
11:00-12:00	126	150	304	547.6	1127.6
12:00-13:00	82.5	80	276	407	845.5
13:00-14:00	142.5	94	336	318.2	890.7
14:00-15:00	133.5	148	228	458.8	968.3
15:00-16:00	118.5	70	200	229.4	617.9
16:00-17:00	144	156	216	340.4	856.4
17:00-18:00	133.5	156	276	407	972.5
18:00-19:00	112.5	88	204	266.4	670.9
19:00-20:00	103.5	66	164	207.2	540.7
20:00-21:00	85.5	62	112	259	518.5
21:00-22:00	60	40	56	303.4	459.4
22:00-23:00	30	10	12	59.2	111.2
23:00-00:00	3	6	4	37	50
00:00-01:00	4.5	0	0	29.6	34.1
01:00-02:00	0	10	16	0	26
02:00-03:00	1.5	0	8	14.8	24.3
03:00-04:00	1.5	0	4	29.6	35.1
04:00-05:00	0	0	0	29.6	29.6
05:00-06:00	3	2	8	59.2	72.2
06:00-07:00	19.5	10	40	44.4	113.9

07:00-08:00	27	40	76	199.8	342.8
08:00-09:00	147	54	256	555	1012
09:00-10:00	133.5	160	204	547.6	1045.1
Sub Total:	**1731**	**1598**	**3272**	**5831.2**	**12432.2**
Worst case Baseline PCU /hr					**1127.60**
Total width of the Road in meters (Arterial Roads)					**7.5**
Carrying capacity of the road (the road is 4 lane 2 way road) As per IRC:106-1990 (PCU's per hour)					**3600**

Table 3.23: Traffic Study at Proposed Site

Time in hrs	Two Wheelers Motor cycle	Passenger Car	Auto Rickshaw	Truck/Buses	Total
10:00-11:00	17	8	18	8	51
11:00-12:00	19	12	20	2	53
12:00-13:00	28	12	22	17	79
13:00-14:00	29	14	20	12	75
14:00-15:00	27	16	15	22	80
15:00-16:00	28	12	16	11	67
16:00-17:00	34	14	12	14	74
17:00-18:00	13	20	16	10	59
18:00-19:00	4	2	3	2	11
19:00-20:00	3	2	2	1	8
20:00-21:00	3	2	1	2	8
21:00-22:00	2	1	1	2	6
22:00-23:00	1	0	0	0	1
23:00-00:00	0	0	0	0	0

00:00-01:00	0	0	0	0	0
01:00-02:00	0	0	0	0	0
02:00-03:00	0	0	0	0	0
03:00-04:00	0	0	0	0	0
04:00-05:00	0	0	0	0	0
05:00-06:00	2	0	0	0	2
06:00-07:00	5	7	14	8	34
07:00-08:00	9	25	20	9	63
08:00-09:00	40	11	15	15	81
09:00-10:00	18	16	10	8	52
Sub Total	**282**	**174**	**205**	**143**	**804**

Table 3.24: PCU count Traffic Survey report at Proposed Site

Time in hrs	Two Wheelers Motor cycle or scooter @0.75 PCU	Passenger Car @1.0 PCU	Auto Rickshaw @2.0 PCU	Truck/Buses @ 3.7 PCU	PCU's / Hr
10:00-11:00	12.75	8	36	29.6	86.35
11:00-12:00	14.25	12	40	7.4	73.65
12:00-13:00	21	12	44	62.9	139.9
13:00-14:00	21.75	14	40	44.4	120.15
14:00-15:00	20.25	16	30	81.4	147.65
15:00-16:00	21	12	32	40.7	105.7
16:00-17:00	25.5	14	24	51.8	115.3
17:00-18:00	9.75	20	32	37	98.75
18:00-19:00	3	2	6	7.4	18.4
19:00-20:00	2.25	2	4	3.7	11.95

20:00-21:00	2.25	2	2	7.4	13.65
21:00-22:00	1.5	1	2	7.4	11.9
22:00-23:00	0.75	0	0	0	0.75
23:00-00:00	0	0	0	0	0
00:00-01:00	0	0	0	0	0
01:00-02:00	0	0	0	0	0
02:00-03:00	0	0	0	0	0
03:00-04:00	0	0	0	0	0
04:00-05:00	0	0	0	0	0
05:00-06:00	1.5	0	0	0	1.5
06:00-07:00	3.75	7	28	29.6	68.35
07:00-08:00	6.75	25	40	33.3	105.05
08:00-09:00	30	11	30	55.5	126.5
09:00-10:00	13.5	16	20	29.6	79.1
Sub Total:	211.5	174	410	529.1	1324.6
Worst case Baseline PCU /hr					**147.65**
Total width of the Road in meters (Arterial Roads)					**5.5**
Carrying capacity of the road (the road is 2 lane 2 way road) As per IRC:106-1990 (PCU's per hour)					**1500**

3.13 Ecology

A preliminary survey was made to get general information of flora and fauna. Fresh plant species were collected from field by trained biologists and later identified. Tentative fauna is noted with the help of local information and personal assessment. At times professional judgment was used to overcome the field deficiency.

The proposed project is allotted in the Vasantha Narasapura IDA. The crops grown are Kharif and Rabbi, however, the crop Kharif dominates over Rabbi. The crop yield is moderate to good based on the rainfall and irrigation facilities.

Biogeography of the area has very undulating topography with steep to moderately steep sloping hills with red soil type and sandy loam texture.

3.13.1 Aim of Ecological Studies

The present study was undertaken with the following objectives:

- To assess the nature and distribution of vegetation in and around the project site;
- To assess the distribution of animal life spectra;
- To understand the productivity of the water bodies;
- To asses the biodiversity and to understand the resource potential;
- To ascertain migratory routes of fauna if any; and
- Possibility of presence of breeding grounds, if any

3.13.2 Methodology

A detailed study of the area was undertaken with the proposed plant site as its centre. The different methods adopted as follows:

- Compilation of secondary data with respect to the proposed project area from published literature and Government agencies;
- Gathering secondary data for ethno biology.
- Generation of primary data by undertaking systematic ecological studies in the area;
- Discussion with local people so as to elicit information about local plants, animals and their uses;

The ecological survey gives the review of published secondary data and the results of field sampling conducted during March -2009 to May -2009.

3.13.3 Secondary Published Data

The common species available are Guggilam, Tangedu, Sirimanu, Kamba, Yagisa, Nallamaddi, Gandra, Vepa ect. Bamboo shrubs are sparsely scattered.

3.14 Land Use Classification

3.14.1 Barren, Uncultivable and Non Agricultural Lands

This area includes the area of barren and uncultivable lands put to non-agricultural purpose like village sites, roads, water, rocks and hills etc.

3.14.2 Crop Land Ecosystem

This is also known as 'man made ecosystem 'or artificial ecosystem' because man tries to control biotic community and physical environment. The most important of these is an artificial force from man to maintain uniformity in the species composition of the producers, in addition to maintain a moisture level of the soil and replenishing nutrients at times. In such an ecosystem the animals also tend to be limited in diversity. In this ecosystem a particular animal species finds enough food and multiplies and become a pest. Here usually single species dynamics assumes a great prominence.

The area falls under predominantly agriculture oriented. Rainfed farming and bore well irrigation characterize the agriculture in the area. The soils in the area are predominantly Red – sandy soils with moderate fertility.

Most of the rainfall is received from southwest or northeast monsoon period during which the main kharif crops are grown. The crop yield is moderate to good based on the irrigational facilities.

In this cropland eco-system in addition to the crop raised, a number of weeds like Cynodon dactylon, Launaea nudicaulis, Euphorbia hirta, Cyperus rotundus,

Digetaria sp. and Alysicarpus sp, contribute to the primary production and also cause damage to the crops. Insecticidal and pesticidal diseases are common.

3.14.3 Terrestrial Ecosystem

The proposed project is situated near Bangalore. Most of the population in these villages use LPG and some use Kerosene, firewood and cow dung cakes as fuel. The land in the surrounding villages is cultivated for paddy, Maize, Jowar, Bajra, groundnut, and occasionally red gram. There is no suitable habitat for more diversification of flora. However, one can see plant species that have wide ecological amplitude. There is no important germplasm that need to be conserved or preserved.

Other than domestic animals and few reptiles no suitable habitat is found for wild animals. Similarly no migration route for any fauna is observed in this direction. There are no endangered or endemic species observed in the study area. No important sanctuaries or ecologically sensitive areas are located nearby to take any special attention.

Table 3.25: Flora in the Study Area

Technical Name	Family
Mangefera indica	*Anacardiaceae*
Parthenium hysterophorus	*Asteraceae*
Tridax procumbens	*Asteraceae*
Polyalthia longifolia	*Annobaceae*
Calotropis gigantia	*Aslepiadaceae*
Pongamia pinnata	*Caecalpinaceae*
Cassia auriculata	*Caecalpinaceae*

Cassia fistula	*Caecalpinaceae*
Bauhinia purpuria	*Caecalpinaceae*
Tamarindus indica	*Caesalpinaceae*
Euphorbia hirta	*Euphorbiaceae*
Desmodium triflorum	*Fabaceae*
Lawsonia innermis	*Lythraceae*
Asparagus racemosus	*Liliaceae*
Aloe barbedensis	*Liliaceae*
Ocimum americanum	*Labiatae*
Azadirachta indica	*Meliaceae*
Ficus bengalensis	*Moraceae*
Ficus glomarata	*Moraceae*
Ficus reliosa	*Moraceae*
Pithacolobium dulce	*Mimosaceae*
Albizia lebbek	*Mimisaceae*
Melia Azadirachta	*Meliaceae*
Mimosa pudica	*Mimosaceae*
Borassus flabellifera	*Plamae*
Datura Stramonium	*Solanaceae*
Ziziphus zyzuba	*Rhamnaceae*

Table 3.26: Fauna in the Study Area

Sl. NO	Name of the Animal
Carnivora Quadrupeds	
1	Jackal
2	Common Mongoose
Herbivora Quadrupeds	
1	Rabbit
2	Squirrel

Table 3.27: Birds

S.No	Common Name	Scientific Name
1	Pariah kite	Black winged kite
2	Kestrel	Vultures (white backed)
3	Grey partridge	Common quail
4	Crane (common & domeselle)	Lappings (red & yellow)
5	Dove (spotted, ring necked)	House martin
6	Blue jay	King fisher (pied)
7	Sun bird	Drango
8	Golden oriole	Shrike
9	Sky lark	Munia
10	Crow – pheasant	Red vented bul bul
11	Common babbler	Hoopoe
12	Crimson throated barbet	

Table 3.28: Reptiles

SNO	Name of the Reptile
1	Cobra
2	Krait
3	Grass snake
4	Green tree snake
5	Russels viper

From the study it has been observed that there are no endangered, endemic or threatened sp. Observed.

3.15 Demographic Status in the Study Area

3.15.1 Population

The study area is not densely populated as most of the study area is rural in nature.

3.15.2 Housing

The term "House Hold" is defined in census as a group of persons who live together and would take their food from a common kitchen. Housing requirements directly depend on expected household sizes. If for instance, five persons per dwelling unit is normal, then the number of houses required can be calculated at least ten years in advance directly from this. Consideration is needed to be given for any possibility of residential sprawl and the area of land, which might be affected because of the subsequent impacts on agriculture and other activities.

Expansion of commercial and industrial activities will also have implications on land use. Considering the existing density, the demand for houses is alarming as there is lot of migration of the village population towards the more urbanized areas in and around Vasantanarasapura.

The establishment of industry is a developmental activity which is having positive impacts on the socio-economic conditions of the population in the region and thereby on the quality of life. Development of projects goes hand in hand with environmental impact hence before any project is undertaken the damages in relation to the benefits should be measured. Unfortunately environmental issues are interdisciplinary, interactive, biological and probabilistic and because information is always deficient, the outcome has a considerable degree of uncertainty or risk. This conflict between development and conservation is difficult to reconcile. Environmental baseline, ecological reconnaissance and environmental impact studies provide data bases and quantitative assessment of environmental factors related to development projects.

Socio-Economic Impact Assessment helps to get an idea of changes on social, economic and cultural status. Baseline data for Occupational status and Health amenities existing in study area has been collected by personal interaction with the villagers in the study area.

3.15.3 Socio – Economics & Demography

The construction activities will normally benefit the local populace in a number of ways, which include the requirement of construction laborers - skilled, semi-skilled and un-skilled, and provision of goods and services for daily needs including transport. Some more recommendations which the company has been following over the years and will follow for the proposed expansion are given below;

1. Eligible local people shall be given preference for employment,

2. All the applicable guidelines under the relevant Acts and Rules related to labor welfare and safety shall be implemented during the construction work,

3. The construction site shall be secured with safety fencing till construction is completed and shall have guarded entry points.

3.15.4 Reconnaissance

Detailed socio-economic survey was carried out within 10 kms radius of the proposed project site in Vasantanarasapura. Secondary information was compiled from the 2001 Census of Vasantanarasapura on Socio-Economic profile. Test check survey was also carried out by conducting interviews with local people and village sarpanchs.

Detailed socio-economic survey was carried out with in 10 km radius of the existing industrial area to assess the baseline status. All villages falling under the 10 km radius of the industrial area have been selected for study of the socio-economic profile.

The information on the above parameters was collected from the villages in the study area by means of personal interaction with the villagers and sarpanch of the village. The information was also collected from the district handbooks.

3.15.5 Salient Observations

The study area is not densely populated which covered most of the rural area is surrounding the city of Bangalore. The literacy rate in the urban areas is very high compared to the villages.

Most of the population in the study area belongs to the category of Main workers, which includes Cultivators, Agriculture Labourers, workers those engaged in Household industries, Construction activities, Forestry and other allied activities. Most of the houses in the villages are electrified.

Main sources of water supply are wells, hand pumps, lakes and taps in few villages while the entire urban area is covered by municipal water supply system. Market facilities are available in most of the villages.

Communication facilities in the villages are quite good with all villages having Branch Post offices and Telephones. Police stations exist in all Mandals.

3.15.6 Power and Energy

Almost all the villages in the study area are electrified. Almost all the households are equipped with modern amenities for cooking purposes. However, it was observed that at some places traditional methods were used i.e. use of firewood, coal etc. Firewood, cow dung cakes and cooking gas both LPG & Bio-Gas are the chief sources of cooking fuels.

Environmental Impacts on land environment have been classified primarily into 2 broad aspects, i.e. direct impacts on the soil and land in the area and impacts on the flora and fauna of the area. Land environment in the area has potential for contamination vis-à-vis water discharges directly on to the land and from impacts arising out of solid waste discharge on to the land.

Impact of the transport of the raw materials and end products on the surrounding environment should be minimum.

3.15.7 Agriculture

The area is having two main cropping viz. khariff (June- September) and Rabi (October-march). Due to insufficient irrigation facilities, the productivity of land is moderate only. As there is lot of influx of people from the surrounding areas to the city, the boundaries of the urban areas are fast expanding radially and in the process most of the agriculture lands are being developed as plots for housing.

Compounding the problem is the moderate to poor yields and failing monsoon year after year. The lands under the irrigation projects have good yields.

3.15.8 Occupation

Main occupation of the residents of urban areas is the service in the industry while in villages it is still agriculture and allied activities. There is a great demand for houses due to the yearly increase in population. In urban areas most of the females are also turning towards service in the industry and other professions. The village womenfolk are still caught up in the daily household chores.

3.15.9 Education and Literacy

A person who can read and write with understanding in any one language is termed as "Literate". The percentage of literacy is very high in the urbanized areas of the study area. The literacy percentage is increasing day by day owing to increase in the education institutions and also the increase in education options. The children from the surrounding villages are sent to the city for schooling and higher education.

3.15.10 Medical Amenities

People in general appear to be healthy in villages compared to the people in the urban areas. Almost all the villages have medical facilities and due to improvement in transport and communication have access to the multi specialty and corporate hospitals in the city. There is no dearth of private medical practitioners in the urban areas in addition to the big hospitals.

3.15.11 Transport & Communication

All the villages are approachable either by tar road or cement roads. Government bus service is available for approaching the villages. Bus routes

connect almost all villages in the study area. Apart from the Government transport private transport is also available to almost all the villages. The study area being part of the city, the transport network is very well spread with the area being connected to many major cities in India and world by land, air and water.

3.15.12 Culture

People of various cultures are residing in this area. The percentage of Hindus is dominating in this area followed by Muslims and Christians. Each religion has its own share in this overall cultural development. No communal problems have been noticed in the villages.

3.15.13 Administrative Details of the Study Area

The project site falls under the Tumkur Taluk & District of Karnataka State. The distribution of population according to Census 2001 is given in the **Table 3.29.**

Table 3.29: Geographical Profile of District

Area	Sq.km.	10,598	Census 2001
Population	Lakh	25,84,711	
Urban Area	%	19.62	
Rural Area	%	80.38	
Literacy	%	76.88	
Forest Area	Hectares	10,64,755	
Irrigated Area	%	52 - 63	
Unirrigated Area	%	4.22	
Total Villages	-	3485	

Table 3.30 : Socio Economic Details of the Study Area – Census 2001

Villages	1	2	3	4	5	6	7	8	9
Kempanadodderii	184	874	456	418	109	54	55	149	75

Katenahalli	100	464	248	216	45	29	16	183	101
Kenchenahalli	61	260	144	116	27	19	8	1	1
Nagarjunahalli	55	297	163	134	41	23	18	159	88
Majjige Kempanahalli	37	165	76	89	18	10	8	0	0
Nelahal	257	1165	592	573	160	76	84	159	83
Thippedasarahalli	58	243	128	115	27	13	14	19	11
Linganahalli	18	72	34	38	7	4	3	0	0
Total	**770**	**3540**	**1841**	**1699**	**434**	**228**	**206**	**670**	**359**

Villages	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Kempanadodderii	74	168	82	86	428	265	163	446	191
Katenahalli	82	25	15	10	273	164	109	191	84
Kenchenahalli	0	14	9	5	171	109	62	89	35
Nagarjunahalli	71	30	18	12	163	101	62	134	62
Majjige Kempanahalli	0	0	0	0	98	46	52	67	30
Nelahal	76	516	243	273	554	345	209	611	247
Thippedasarahalli	8	223	116	107	113	72	41	130	56
Linganahalli	0	0	0	0	43	24	19	29	10
Total	**311**	**976**	**483**	**493**	**1843**	**1126**	**717**	**1697**	**715**

Villages	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**
Kempanadodderii	255	475	284	191	463	278	185	420	246
Katenahalli	107	298	157	141	127	88	39	79	50
Kenchenahalli	54	173	96	77	118	85	33	55	45
Nagarjunahalli	72	177	100	77	80	78	2	38	38
Majjige Kempanahalli	37	111	55	56	59	48	11	57	47
Nelahal	364	672	363	309	294	265	29	165	157
Thippedasarahalli	74	120	73	47	71	66	5	55	52
Linganahalli	19	47	19	28	36	19	17	25	12
Total	**982**	**2073**	**1147**	**926**	**1248**	**927**	**321**	**894**	**647**

Villages	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**
Kempanadodderii	174	9	6	3	2	1	1	32	174
Katenahalli	29	13	9	4	0	0	0	35	29
Kenchenahalli	10	33	13	20	0	0	0	30	10
Nagarjunahalli	0	1	1	0	5	5	0	36	0
Majjige Kempanahalli	10	0	0	0	0	0	0	2	10
Nelahal	8	18	16	2	3	1	2	108	8

Thippedasarahalli	3	5	4	1	0	0	0	11	3
Linganahalli	13	1	0	1	0	0	0	10	13
Total	**247**	**80**	**49**	**31**	**10**	**7**	**3**	**264**	**247**

Villages	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
Kempanadodderii	25	7	12	6	6	3	0	3	5
Katenahalli	29	6	171	69	102	86	30	56	84
Kenchenahalli	27	3	55	11	44	34	9	25	10
Nagarjunahalli	34	2	97	22	75	1	0	1	0
Majjige Kempanahalli	1	1	52	7	45	51	7	44	1
Nelahal	91	17	378	98	280	14	7	7	330
Thippedasarahalli	10	1	49	7	42	33	2	31	15
Linganahalli	7	3	11	0	11	0	0	0	11
Total	**224**	**40**	**825**	**220**	**605**	**222**	**55**	**167**	**456**

Villages	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**
Kempanadodderii	2	3	2	1	1	1	0	399	172	227	2
Katenahalli	46	0	0	0	1	1	0	166	91	75	46
Kenchenahalli	10	0	0	0	11	2	9	87	48	39	10
Nagarjunahalli	0	7	0	7	89	22	67	120	63	57	0
Majjige Kempanahalli	1	0	0	0	0	0	0	54	21	33	1
Nelahal	257	13	2	11	21	16	5	493	229	264	257
Thippedasarahalli	11	0	0	0	1	1	0	123	55	68	11
Linganahalli	11	0	0	0	0	0	0	25	15	10	11
Total	**338**	**23**	**4**	**19**	**124**	**43**	**81**	**1467**	**694**	**773**	**338**

Source: Census 2001 data

1.	Number of House holds	29.	Main Agricultural Labourers – Total
2.	Total Population	30.	Main Agricultural Labourers - Male
3.	Total Male Population	31.	Main Agricultural Labourers – Female
4.	Total Female Population	32.	Main House Hold - Total
5.	Population age group 0-6	33.	Main House Hold – Male
6.	Male Population age group 0-6	34.	Main House Hold – Female
7.	Female Population age group 0-6	35.	Main Others - Total

8.	Schedule caste – Total	36.	Main Others - Male
9.	Schedule caste – Male	37.	Main Others - Female
10.	Schedule Case – Female	38.	Marginal workers – Total
11.	Schedule Tribe – Total	39.	Marginal workers – Male
12.	Schedule Tribe – Male	40.	Marginal workers – Female
13.	Schedule Tribe – Female	41.	Marginal Cultivators - Total
14.	Literates – Total	42.	Marginal Cultivators – Male
15.	Literates – Male	43.	Marginal Cultivators – Female
16.	Literates – Female	44.	Marginal Agricultural Labourers - Total
17.	Illiterates – Total	45.	Marginal Agricultural Labourers – Male
18.	Illiterates – Male	46.	Marginal Agricultural Labourers – Female
19.	Illiterates – Female	47.	Marginal House Hold - Total
20.	Total Workers	48.	Marginal House Hold - Male
21.	Total Workers – Male	49.	Marginal House Hold – Female
22.	Total Workers – Female	50.	Marginal Others – Total
23.	Main Workers – Total	51.	Marginal Others – Male
24.	Main workers – Male	52.	Marginal Others - Female
25.	Main Workers – Female	53.	Non workers – Total
26.	Main Cultivators – Total	54.	Non Workers – Male
27.	Main Cultivators – Male	55.	Non Workers – Female
28.	Main Cultivators – Female		

1.	Sex
2.	Age
3	Ward No
4	Community
5	Religion

6	Since How long you are residing in this area Since Birth (years)
7	Type of house
8	Owner of the House
9	Total Family members
10	Total Earning Members
11	Do you feel the factory improve your Domestic Water Supply and Sanitation Facilities?
12	Water Sources
13	Do you have sanitation facilities at home and in your village
14	Roads are maintenance in your area
15	What are the common diseases you or family members usually get during different seasons?
16	Do you or your family members suffer from hereditary diseases?
17	Do you or your family members suffer any chronic diseases?
18	To whom do you refer for your Health Problems
19	What is your average monthly Income?
20	What is your average monthly expenditure?
21	Do you feel that due to establishment Industries in your area, life of the people in this area will be improved?
22	Do you feel that due to establishment of proposed Industry, the infra structure of your area will be developed?
23	Opinion about the industry going to Improve and maintain The Infrastructure Like Drinking Water, Environmental Sanitation, Parks, Community Halls, Assistance to Women & Youth Groups near by
24	The Industrial operations are accepted in this area by one and all
25	Opinion about the industry going to develop and maintain the internal & external environment around this area

26	Industries has cordial relations with the public in an around the industries.
27	Hospital facilities