Chapter 4
Environment Baseline

CHAPTER - 4

ENVIRONMENT BASELINE

4.0 PREAMBLE

In order to assess the baseline environmental status in the study area of 10 km around the proposed plant and mining areas, site visits were made and a primary and secondary data collection programme was undertaken during the period July-September 07.

The study area has been divided into two zones, core zone and the buffer zone. The core zone comprises of the plant and the mining sites, whereas the buffer zone comprises of an area of 10 km radius around the plant and mining sites.

The baseline environmental data has been collected by **M/s MDI Consulting Engineers, Addis Ababa, Ethiopia**. The environmental components studied include:

- Physical/ chemical components: Physiography, Geology, Geomorphology, Hydrometeorology, Hydrogeology, Climatology, Meteorology, Ambient Air Quality, Water Quality, Noise Levels, Soil and Ground water resources.
- Land use, archaeology and cultural heritage
- Biological environment: Flora and Fauna
- Socio-economic components: Demography, settlement pattern, land tenure and community structure, food practices, agricultural system and livestock, education system, transportation networks and other infrastructure like sanitation, public services, and public health facilities.

The existing baseline status of major environmental components is presented below:

4.1 TOPOGRAPHY

Topography of the project area and the surrounding consists of plains, mountains and valleys. The area immediately west, SW and north of the plant site consists of a steep gorge about 700 m deep. The elevation drops about 700 m over a distance of about 7 km from the plant site to the mining area.

The topography of the project area is seen on the satellite picture of the area enclosed as **Fig. 4.1**.

The topography of Aleltu valley upto the bridge on Chancho-Derba road, which is in NW-SE direction, is plain and then the valley further narrows down by hills and mountains falling down to Mugher river. The average elevation of Alteltu valley before falling into Mugher gorge is about 2500 m above MSL.

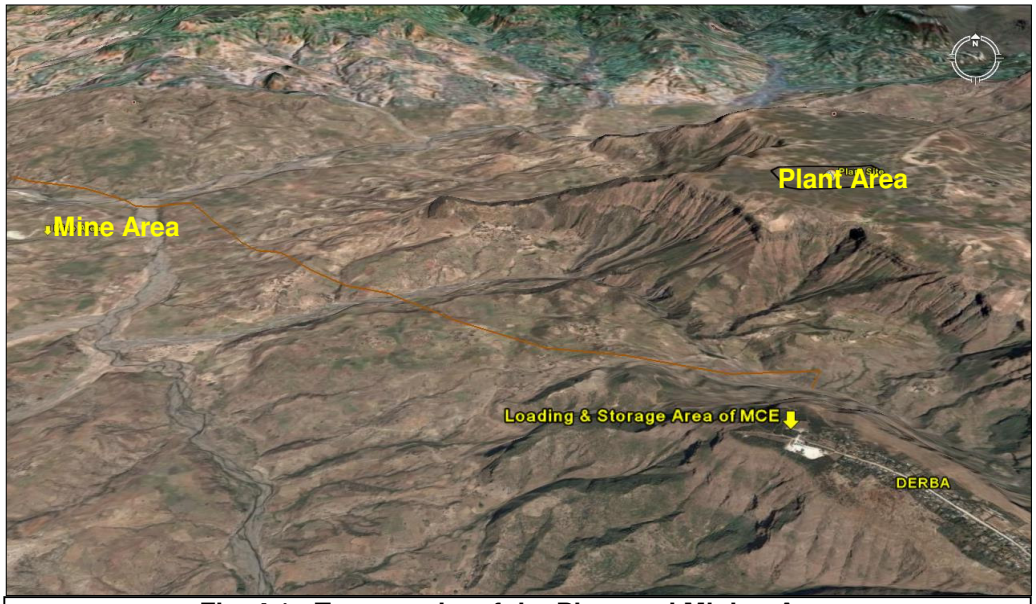

Fig. 4.1 : Topography of the Plant and Mining Area

4.2 DRAINAGE

The drainage of the project area is governed by the catchments of Blue Nile River, particularly Mugher river, which is one of the tributaries of the Blue Nile. Mugher river flows west of the proposed plant site in a deeply incised valley, which is at an elevation about 700m lower than the plant area.

The drainage density is high in the gorges and exhibits a dendritic pattern. The drainage pattern of the area can be seen in **Fig. 4.2**.

Another stream Alteltu arises from the Entoto Mountain range SE of Derba town. Alteltu river is perennial though the flow during dry seasons is scanty and joins Mugher river to the north of Derba town. The elevation ranges from 2350 m above MSL at the point where it forms a waterfall and then reaches its confluence with Mugher river. The drainage map of the study area enclosed as **Fig. 4.3**.

Fig. 4.2 : Drainage System of the Area

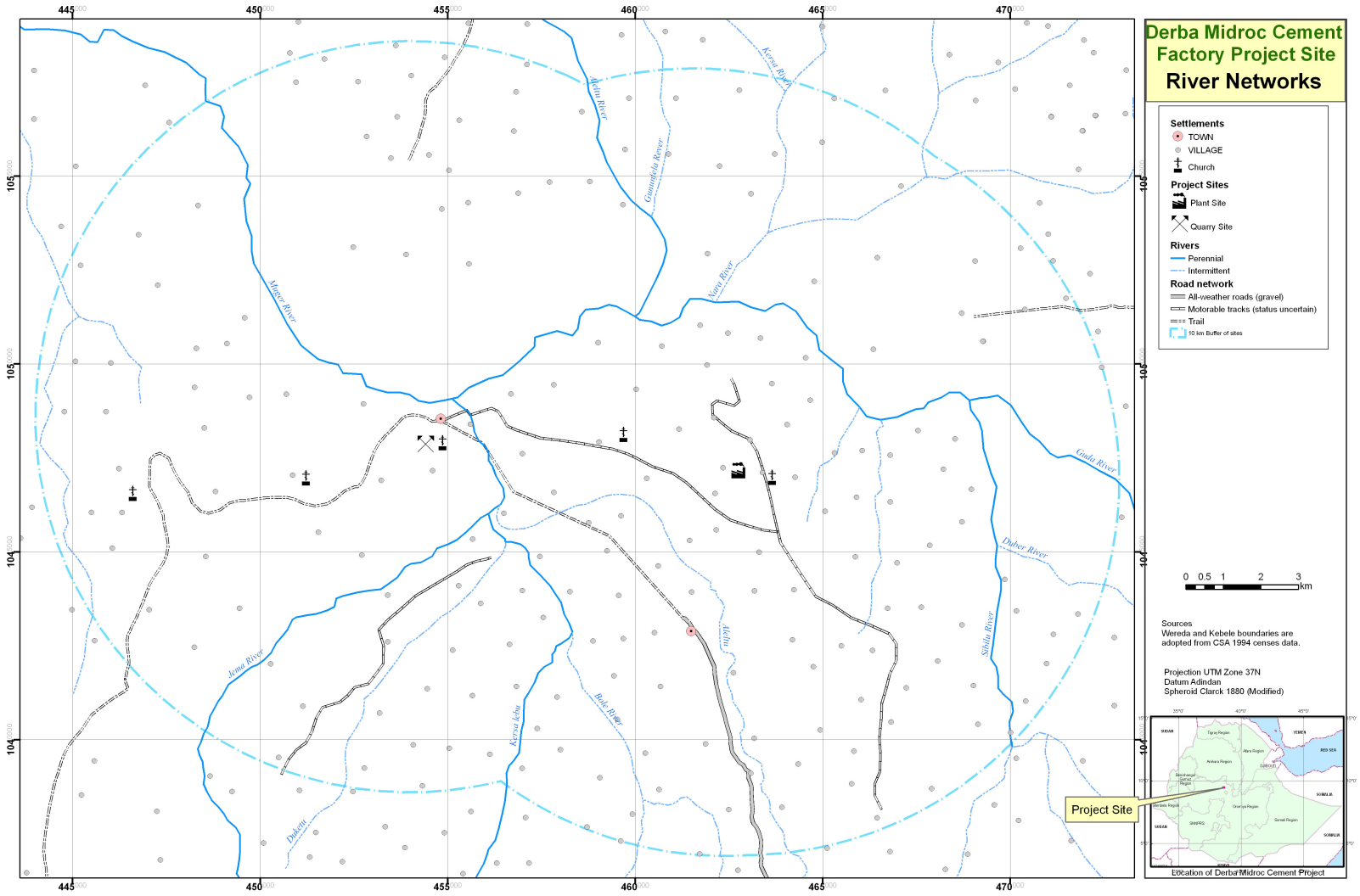

Fig. 4.3 : Drainage Map of the Study Area

4.3 GEOMORPHOLOGY

There are three geomorphologic units in the study area of 10 km around the plant and mining sites.

Plains dominate at the eastern part of the study area, while undulating plains and hills are distributed at southern, southeastern and northern part. Mugher river gorge dominates the western and the central part of the study area. The geomorphology of the study area is shown in **Fig. 4.4.**

These physiographic features have been developed through tectonic activities and associated rift-forming processes. In areas away from the rift and rift scarps, it is unlikely to expect any tectonic activity. Thus activities like earthquakes and landslides, which are associated with tectonic activities, are not expected in plateaus. Thus the proposed project site located on a plateau is not expected to be prone to earthquakes.

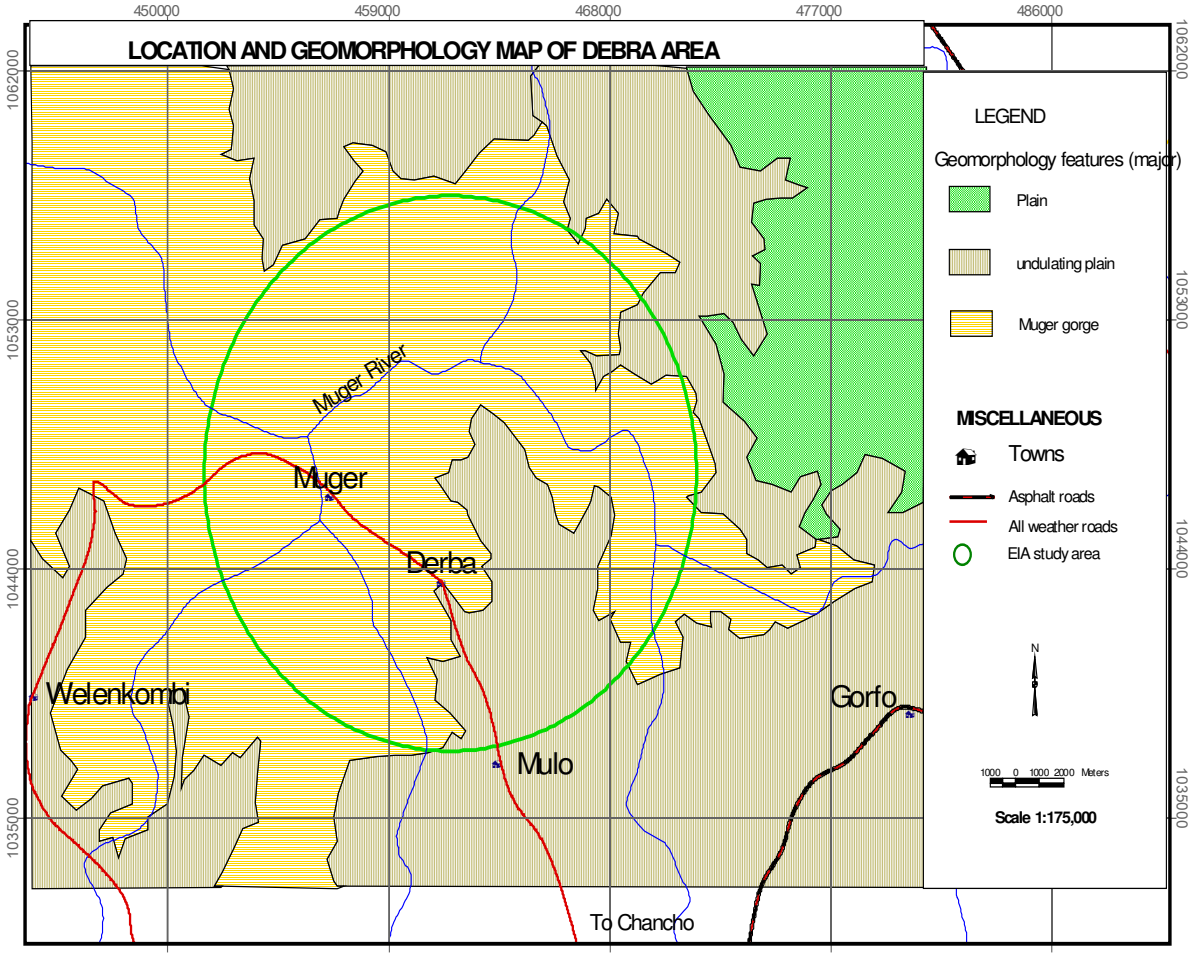

Fig. 4.4 : Geomorphology of the Study Area

4.4 CLIMATE

The climate of the area is characterized by two distinct seasonal weather patterns; the wet season extending from June to September, contributing about 70% of the annual rainfall, and the dry season which covers the period from October to May. The long-term mean annual rainfall recorded at Addis Ababa Observatory, which is about 70 km from the plant

site, is 1254 mm. The spatial distribution of rainfall is predominantly affected by altitude. Generally, the rainfall increases with elevation.

4.4.1 METEOROLOGY OF THE STUDY AREA

Meteorological data is regularly being recorded at Fiche Observatory in Grar Garsso Wereda located about 40 km from the proposed plant site. Fiche is situated at 2750 m above MSL and its coordinates are 38°42'E: 9°48'N. The meteorological data as monitored at Fiche Station, for the period 1974-2006 is presented below:

4.4.1.1 Temperature

The maximum and minimum average temperatures recorded during the period 1974-2006 are 19.9°C and 7.4 °C respectively. The average maximum and minimum temperature during the year 2006 has been recorded as 20.5°C and 8.1°C respectively. The variations in mean maximum and minimum temperatures, across the year for the period 1974-2006 are shown in **Fig. 4.5**.

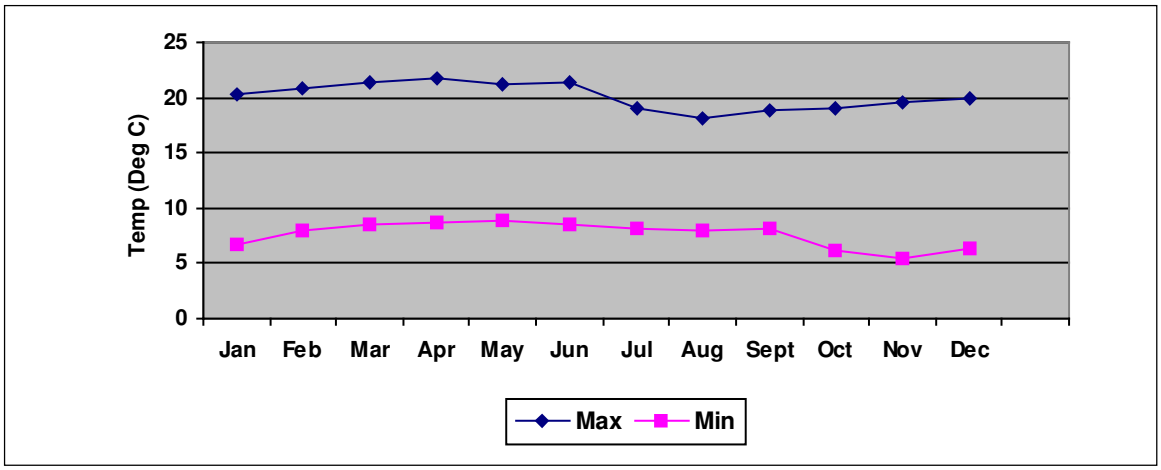

Fig. 4.5 : Temperature recorded at Fiche Observatory during the period 1974-2006

The monthly maximum, minimum and mean temperatures recorded at Fiche during the year 2006 are shown in **Fig. 4.6**.

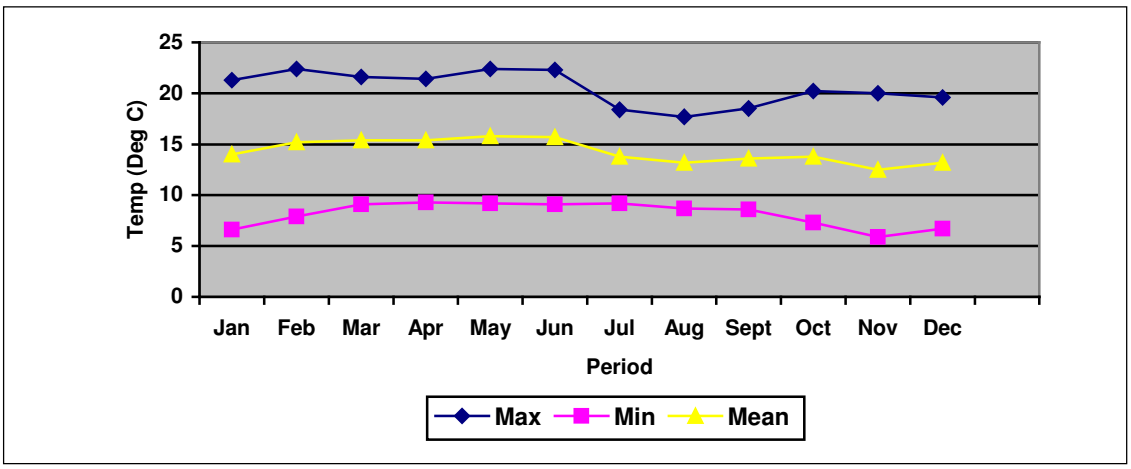

Fig. 4.6 : Temperature recorded at Fiche Observatory during the year 2006

4.4.1.2 Relative Humidity

The area experiences higher humidity levels during the months of July, August and September. The average relative humidity during the year is 62%. The variation in relative humidity in the year at Fiche during the period 1986-2005 is presented in **Fig. 4.7** below.

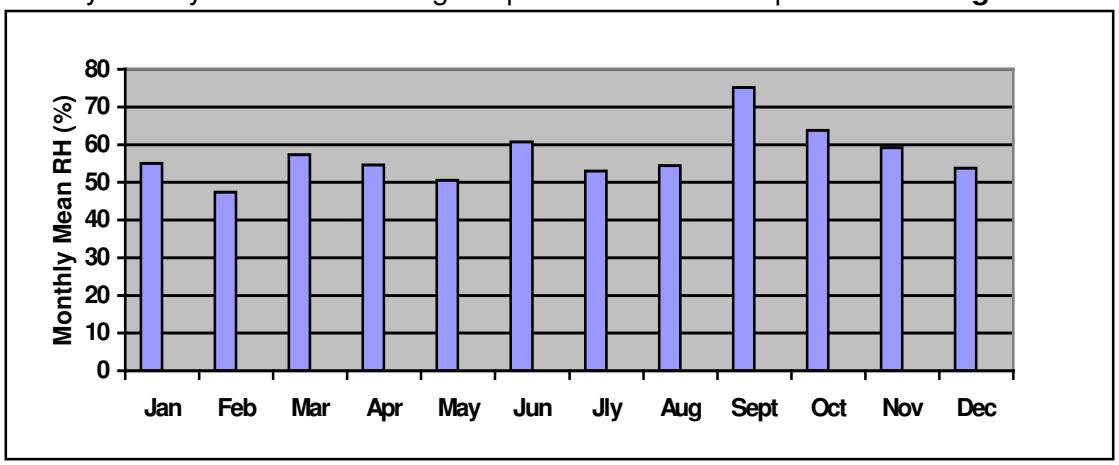

Fig 4.7 : Relative Humidity recorded at Fiche Observatory during 1986-2005

4.4.1.3 Rainfall

The average total annual rainfall recorded at Fiche station during the year for the period 1954-1999 is 970.3 mm and the monthly variation is shown in **Fig. 4.8** and the monthly average rainfall recorded during the same period is shown in **Fig. 4.9**.

It is observed that rainfall is heavy during the months July to Sept in the region.

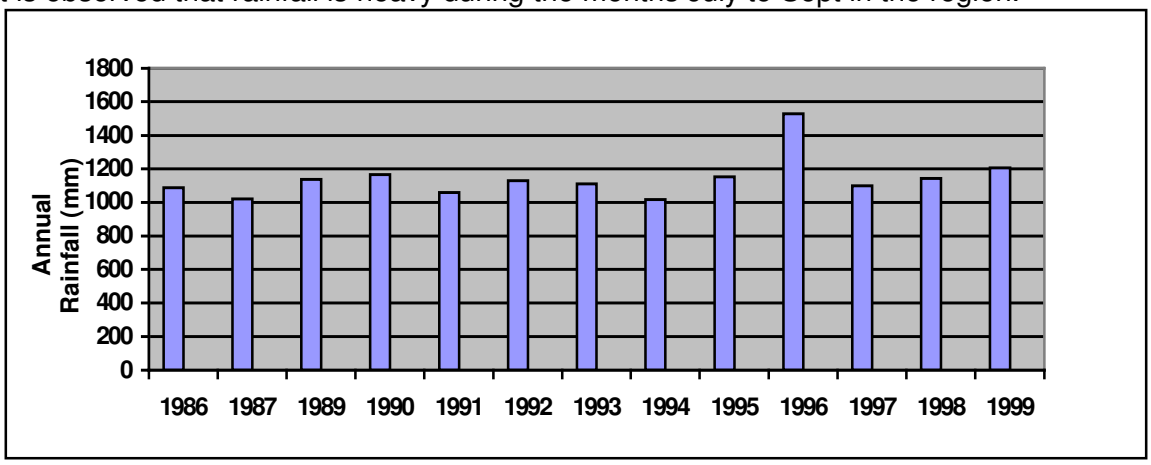

Fig. 4.8 : Total Annual Rainfall recorded at Fiche Observatory during 1986-1999

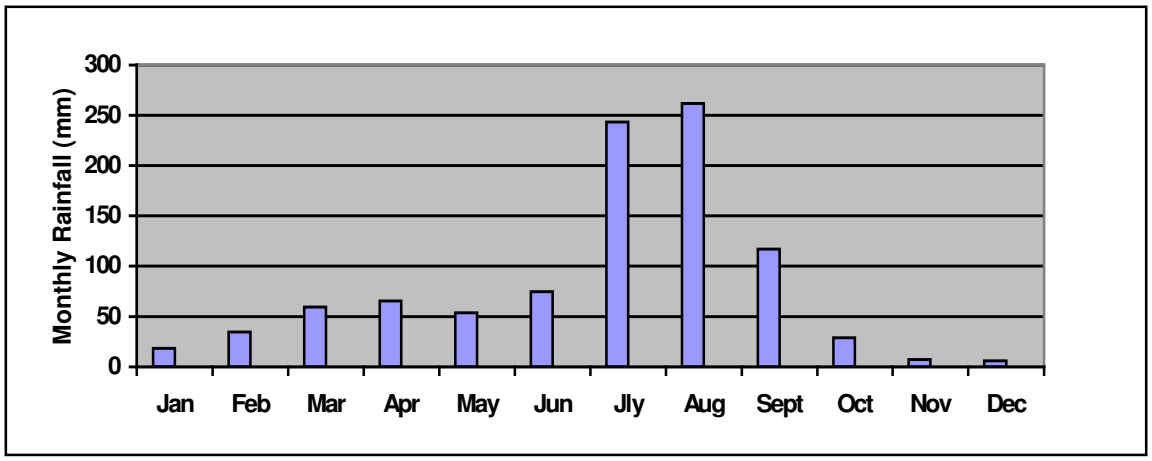

Fig. 4.9 : Monthly Average Rainfall at Fiche during the period 1954-1999

4.4.1.4 Wind Speed

The average wind speed during the year for the period 1981-2005 as recorded at Fiche Observatory is 2.3 m/ s. The mean wind speed variation across the year is shown in **Fig. 4.10**.

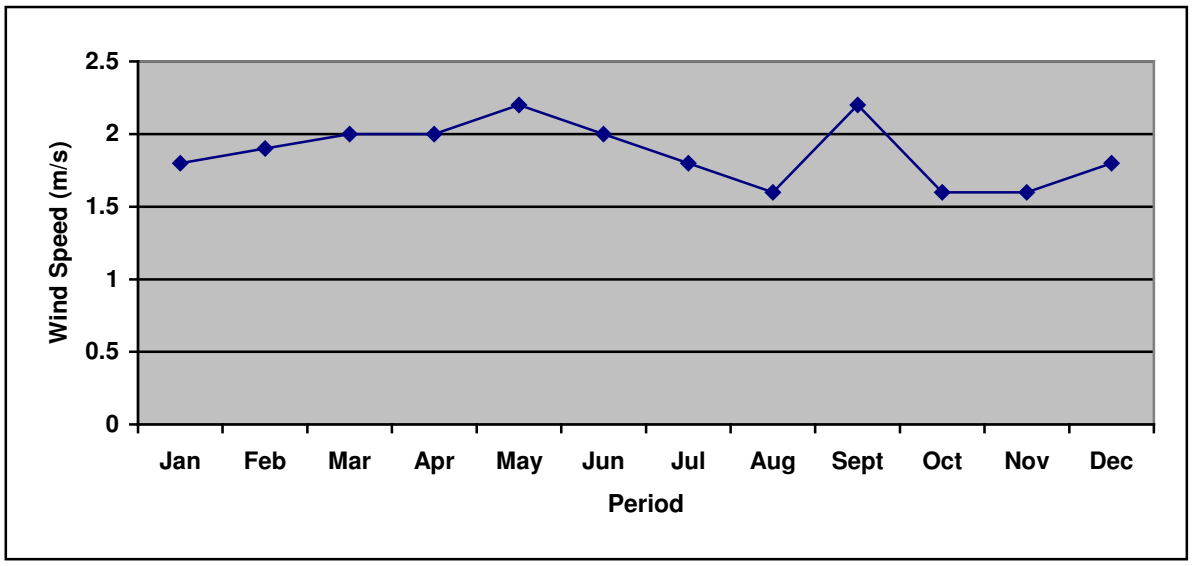

Fig. 4.10 : Wind Speed recorded at Fiche Observatory during 1980-2005

4.4.1.5 Sunshine

Sunshine hours as recorded at Fiche Observatory during the period 1980-1993 are given in **Fig. 4.11**. The sunshine hours vary from 7-9 hours during most part of the year excepting the rainy season.

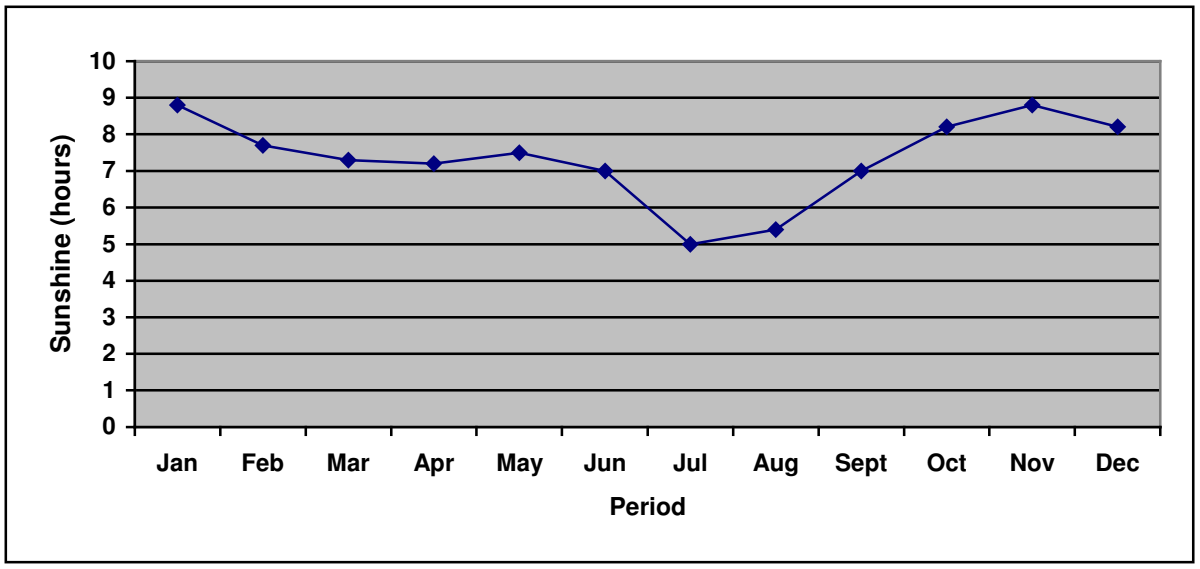

Fig. 4.11 : Sunshine hours at Fiche during the period 1980-1993

4.4.1.6 Evaporation

The total monthly evaporation as recorded at Fiche Observatory during the period 2001-05 is given in **Fig. 4.12** below.

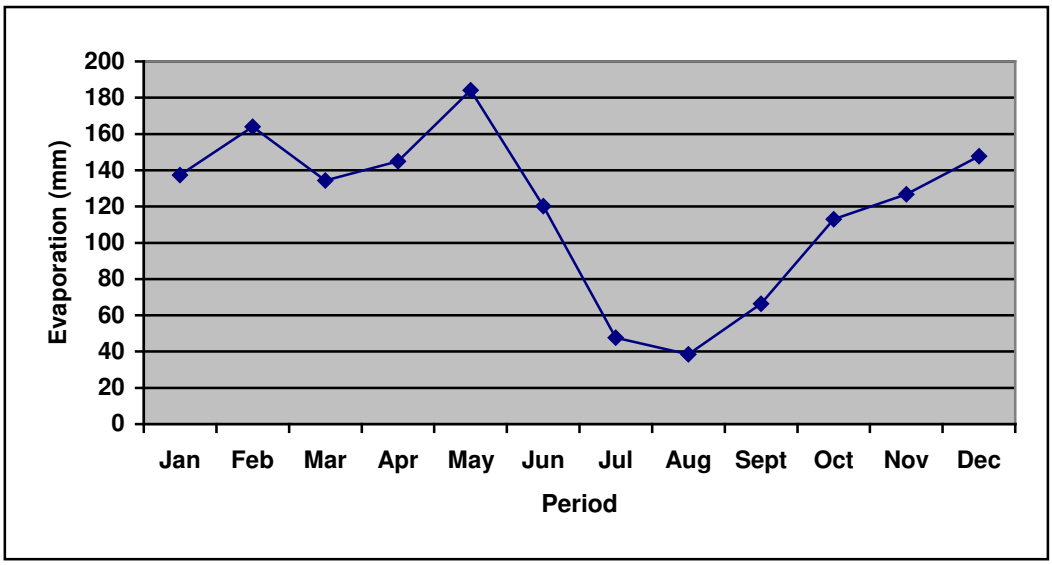

Fig. 4.12 : Monthly Evaporation recorded at Fiche Observatory during 2001-05

4.4.2 METEOROLOGY AT PROJECT SITE

Rains occur during the spring and summer seasons. The meteorological parameters have been monitored at the proposed project site during the period Aug-Sept 07. The measured climatic condition of the project area during the monitoring period is summarized in **Table 4.1.**

One month data has been considered adequate for the purpose of EIA, however, it is recommended that one full year meteorological monitoring be carried out at the plant site.

Meteorological Monitoring in Progress at site

Description	Value
Temperature (^{0}C)	
Maximum	23.5
Minimum	9.0
Average	17.0
Relative Humidity (%)	
Maximum	100
Minimum	58
Average	90
Wind Speed (m/s)	
Maximum	11.0
Minimum	0.0
Average	1.22
Distribution of Wind Speed (%)	
Calm	45
0.5 to 2.1 m/ s	42.7
2.1 to 3.6 m/ s	4.1
3.6 - 5.7 m/ s	5.0
5.7 – 8.8 m/ s	2.4
8.8 –11.1 m/ s	0.8
> 11.1 m/ s	0
Vapour Pressure (mm Hg)	
Maximum	18.2
Minimum	10.9
Average	14.3
Cloud Cover (Oktas)	
Maximum	8.0
Minimum	1.0
Average	6.0

Table 4.1 : Meteorological data monitored at site for the period Aug-Sept 07

Table 4.2 presents the distribution of wind directions during the one month monitoring period. The predominant wind direction during the monitoring period of Aug-Sept 07 is from North. Derba village is not located in the predominant wind direction.

Sn	Direction	Wind Direction Distribution (%)
1	N	18.7
2	NNE	6.1
3	NE	1.2
4	ENE	1.9
5	E	0.5
6	ESE	0.1
7	SE	1.8
8	SSE	0.8
9	S	0.5
10	SSW	0.1
11	SW	0.0
12	WSW	0.1
13	W	0.8
14	WNW	3.7
15	NW	7.8
16	NNW	10.3

Table 4.2 : Distribution of Wind Direction during monitoring period-Aug-Sept 07

The wind speed frequency distribution is shown in **Fig. 4.13.**

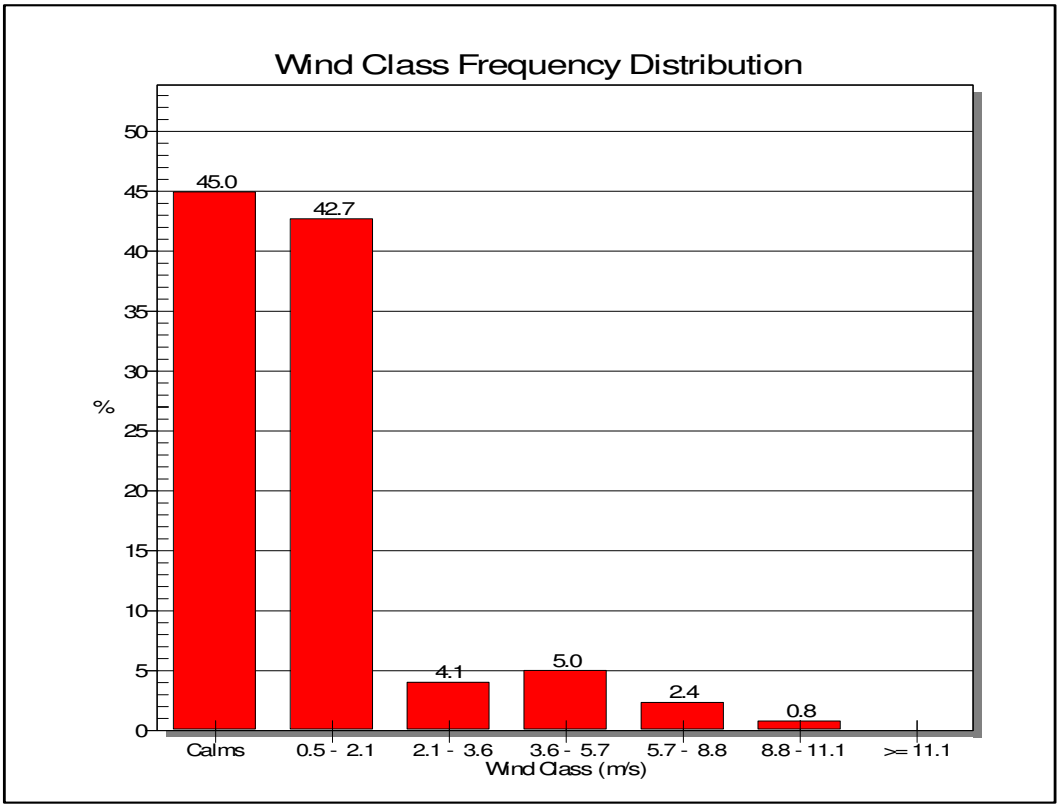

Fig. 4.13 : Wind speed frequency distribution

The Windrose diagram for the monitoring period of August to September 2007 is shown in **Fig 4.14**.

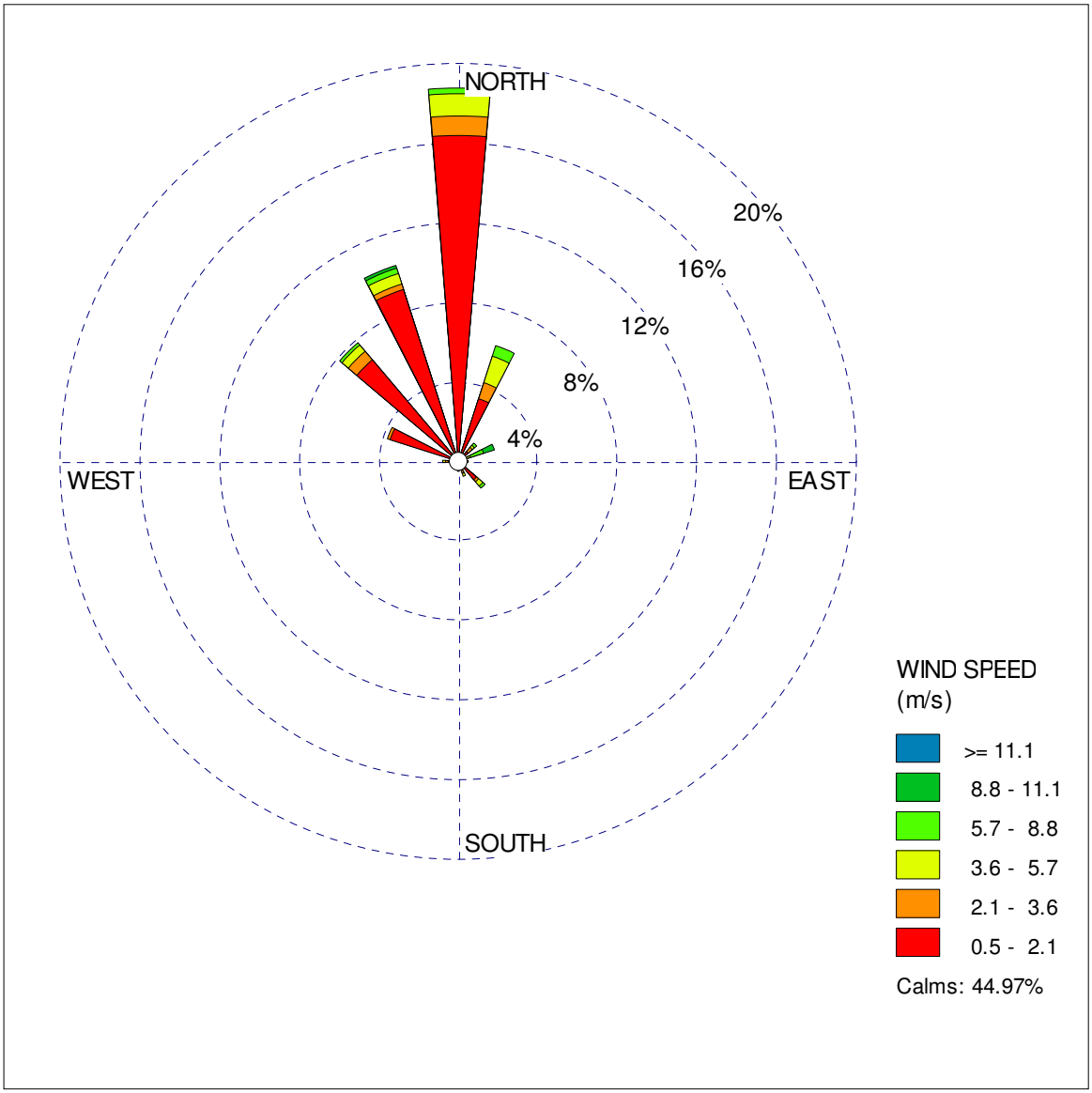

Fig. 4.14 : Windrose diagram at plant site for the period Aug-Sept 07

4.5 GEOLOGY

The stratigraphy of the study area consists of three rock types namely, the Precambrian basement, Mesozoic sediments and the Tertiary basalts.

a) Precambrian rocks

The bottom part of the stratigraphy is constituted at depth by the Archaean gneisses of the Alghe Group intruded by younger granites.

b) Mesozoic Sediments

Unconformably overlying the Archaean rocks are a succession of the Mesozoic sedimentary rocks, which occur at an elevation of 1,000 m in the Abbay and Mugher gorges. The oldest unit is the Adigrat sandstone, which comprises of sandstones, siltstones and conglomerates of Triassic to Middle Jurassic age.

Overlying the Adigrat sandstone is the Abbay formation (middle Jurassic) comprising of limestone, calcareous sandstone, shale and gypsum, which are overlain by middle to Jurassic limestone of Antalo formation.

Conformably overlying the limestone are sandstone, shale and marl of the Amba Aradom Formation of late Cretaceous age occurring at the top of the sedimentary sequence up to an elevation of 2100 m.

All the Abbay, Antalo and Amba Aradom formations occur within the study area. The geological map of Mugher area is enclosed as **Fig. 4.15**.

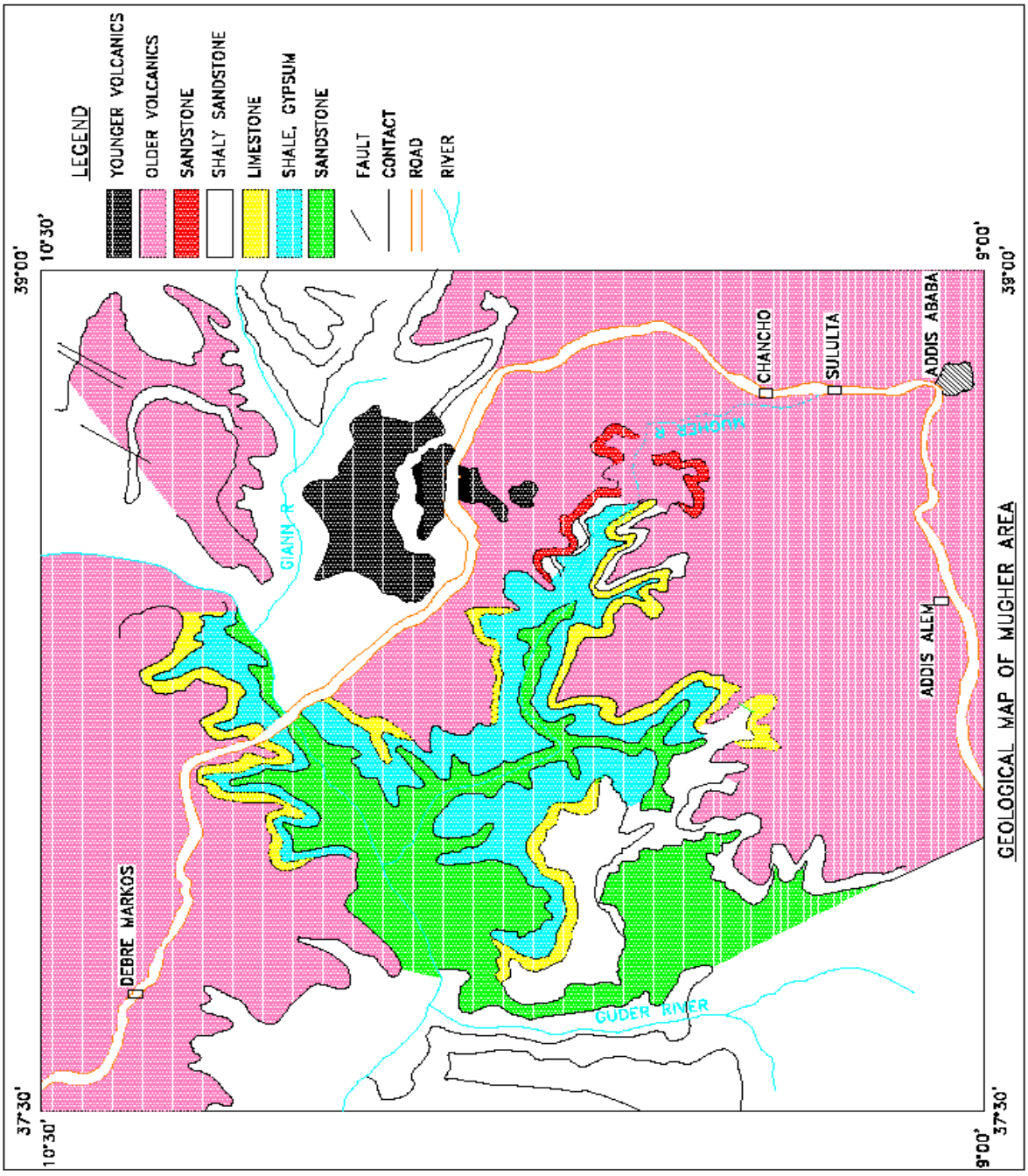

Fig. 4.15 : Geological Map of Mugher Area