3.0 BASELINE ENVIRONMENTAL STATUS

3.1 Introduction

This chapter illustrates the description of the existing environmental status of the study area with reference to the prominent environmental attributes. The study area covers 15 wells in SAS block, Sarupathar Tehsil, Golaghat District, Assam.

The entire block area was considered for the study, description of biological environment and Human environment such as environmental settings, demography & socio-economics, land-use/land cover, ecology & biodiversity have been carried out during study period. However, as a universally accepted methodology of EIA studies, physical environmental attributes such as climate, hydrogeological aspects, atmospheric conditions, water quality, soil quality, ecology, land use and socio-economic profiles of people in the block area have been studied at selective locations representing various land uses such as industrial, rural/residential, commercial and sensitive locations including the densely populated areas, agricultural lands, forest lands and other ecologically sensitive areas, if any falling within block area.

The existing environmental setting is considered to know the baseline environmental conditions, which are described with respect to climate, hydro-geological aspects, atmospheric conditions, water quality, soil quality, ecology, land use and socio-economic profiles of people. The baseline studies are carried out in partly winter and partly pre-mosoon season covering 15th January 2016 to 8th April 2016.

This Report incorporates the baseline data monitored for partly winter and partly pre-mosoon season and secondary data collected from various Government and Semi-Government organizations.

3.2 Geology and Hydrogeology

3.2.1 Physiography

Physiographically, the district shows a monotonous plain topography towards north and southeast, while the southwestern part of the area represents an undulating topography.

The general elevation of the elevated area is around 100 meters above Mean Sea Level (MSL) and low lying areas show altitude about 80 m above MSL. Maximum height of about 128 m above MSL is observed in the southern parts of the district, where it merges with the hills of the Nagaland as well as Karbi-Anglong district of Assam. The slope of the district is towards north east from south.

The study area as an average elevation of about 100 metres above mean sea level. It is bounded by the state of Nagaland to the east.

3.2.2 Climate and rainfall

The district enjoys sub-tropical humid climate. Average annual rainfall in the district is 2,012 mm. About 60 to 65% of the annual precipitation is received during south-west monsoon from June to September. The pattern of rainfall varies in the district, from south to north, the intensity of rainfall increases and the maximum rainfall is recorded in the north eastern parts of the district. Annual average temperature of the district during winter period varies from 6 to 14^0C and during summer, it varies from 29 to 36^0C .The relative humidity varies from 93 to 95% during morning hours and during afternoon hours it varies from 53 to 75%.

3.2.3 Drainage

The River Brahmaputra flowing in east-west direction in the extreme northern parts of the district and its tributaries flowing in northerly direction, control the entire drainage system of the district and plays an important role in the ground water occurrence and control of the district. Important Rivers of the district are Dhansiri and Dayang. These rivers have meandering courses with abandoned channels in the form of bils and ox-bow lakes along their courses.

3.2.4 Soil

Two important soil groups are seen in the district. These are (i) deep reddish coloured soil developed over older geological formation and (ii) light grey to dark grey coloured soil covering the major parts of the district. Low nitrogen, low phosphate, medium to high potash, acidic characters of the soil are representative of the soil cover found in the hills. In the plain areas, the other type of the soil covers is found to be feebly alkaline.

3.2.5 Geology

Geologically the district is underlain by Quaternary formation followed by Archaean group of rocks. Quaternary formation comprises younger and older alluvial deposits consisting of different grades of sand, pebbles, cobbles, gravel and clay in the area. Major parts in the north of NH-37 passing in the east-west direction in the district show younger alluvial deposits. The older alluvial deposits occur mainly towards southern parts of the NH-37. The hard crystalline of Archaean age covers extreme southern boundary of the district merging with Karbi-Anglong district. The rock types are granite, granite gneiss and quartzite.

Sub-surface geology as evidenced from available data infers that the potential aquifer pertaining to Quaternary formation exist down to the explored depth of 300 m. The cumulative thickness of aquifer zones has the tendency to increase towards the north and in the southeastern parts, the thickness reverses considerably.

- Geology of the Study Area

➢ *Geological Setting of South Assam Self*

The South Assam Shelf is a part of Assam & Assam-Arakan basin and situated in the Dhansiri valley separated from North Assam shelf by a major E-W trending Jorhat fault. The area represents a part of foreland basin flanked by NE-SW trending Naga Schuppen belt on the East & Southeast and Mikir Massif in the West. The area is sparsely exhibiting intra-cratonic graben filling sediments from Permian age to basaltic flows of Early Cretaceous age. The extensive Late Cretaceous-Oligocene sequence deposited in Passive margin setting witnessed differential erosion at places and overlain by a thick pile of Miocene to Recent sediments deposited in a foreland setting. The total sedimentary thickness in the area is of the order of 3500 m. Reservoirs in different stratigraphic levels starting from fractured Basement to Sylhet, Kopili, Barail, Bokabil, Tipam and Namsang have been charged in different parts of the basin depending on entrapment and are required to be probed for hydrocarbons.

3.2.6 Hydrogeology

The hydrogeological studies to understand the local geology, geomorphic features, drainage network, aquifer characteristics and yield of water. Accordingly, various components controlling the hydrogeological regime. Hydrogeology map of Golaghat district is given in **Figure-3.2.1.**

➢ *Occurrence of Ground Water*

Ground water systems are a result of the complex combination of different lithological and structural types within an area that together constitute an aquifer within which ground water accumulates and moves. Rather than describing individual lithologies and their tendencies to form aquifers or otherwise, it is useful to describe the ground water as one continuous across various lithological types (Kulkarni and Deolankar, 1995).

As per the CGWB report August-2013 of the Golaghat district. Ground water occurs under water table to confined conditions. Depth to water level in major parts of the district varies from 2 to 5 m. In the extreme southern and southwestern parts close to hills, the water level is found to be deeper and generally rests within 5 to 7 m. The movement of ground water is from south to north. The water level trend shows that there is gradual rising of water level in the district.

Pre-monsoon water level during 2007 from 3.8-7.96 m bgl and Post monsoon water level during 2007 from 3.31-6.89 m bgl in the district.

3.2.7 Ground Water Resources

➢ *Ground Water Recharge*

The main source of ground water recharge is by the rainfall by direct percolation to the zone of saturation. A significant part of the rainfall is lost as runoff from area while a limited percentage of rainfall therefore reaches zone of saturation and becomes the part of ground water storage after meeting the evaporation and

evapo-transpiration losses. There is also ground water recharge from the return flow of irrigation water from dug wells and tube wells operated by the cultivators and from canals.

The dynamic groundwater resources of Golaghat District has been estimated jointly by CGWB and SWID. Govt of Assam, following the norms laid down by GEC-1997 methodology and projected as on 31.03.2011. The ground water resources of the district is given in **Table-3.2.1.**

TABLE-3.2.1
THE DYNAMIC GROUNDWATER RESOURCES OF GOLAGHAT DISTRICT AS ON 31.03.2011

Sr.No	Particulars	Quantity (HAM)
1	Total Annual Replenishable Ground Water Resources	140734
2	Natural Discharge during Non-Monsoon Period	14073
3	Net Annual Ground Water Availability	126661
4	Total Annual Ground Water Draft	7349
5	Projected demand for Domestic and Industrial uses upto 2025	2473
6	Net Ground Water Availability for Future Irrigation use	118974
7	Stage of Ground Water Development (%)	6 **("Safe")**

Source: Dynamic Ground Water Resources of India-July 2014

3.2.8 Natural Hazards

A natural disaster during the life cycle of the project can have a significant effect on the functioning of the project in addition to affecting the local environment in the area and stressing the availability of resources for the project. Such disasters also sometimes create difficulties in access through disruption of transportation links.

- *Seismicity & Earthquakes*

The study area is located in Zone V as shown in the Bureau of Indian Standards (BIS) 2000 seismic zone map for India is given in **Figure-3.2.2**. Zone V is defined as region which might encounter earthquakes of maximum intensity.

The region has experienced a large number of earthquakes of tectonic origin. The risk probabilities of earthquake are less over the entire Brahmaputra valley. Two major earthquakes of magnitude 8.7 (occurred in 1897) and 8.6 (in 1950) causing large scale damage to lives and properties in this region. The details of the earthquakes are given in **Table-3.2.2**.

TABLE-3.2.2
SIGNIFICANT EARTHQUAKES IN ASSAM

Date of Earthquake	Location of Epicentre	Remarks
12th June 1897	Near Rangjoli, Assam	Magnitude M 8.7. This was one of the most powerful earthquakes in the Indian sub-continent. The quake wreaked havoc across the present states of Assam and Meghalaya. 1500 people were killed and hundreds more hurt.

Date of Earthquake	Location of Epicentre	Remarks
15-Aug-1950	Indo-China Border Region	Magnitude M 8.6. This "Independence Day" earthquake was the 6th largest earthquake of the 20th century. Though it hit in a mountainous region along India's international border with China, 1500 people were killed and the drainage of the region was greatly affected.

Source: Amateur Seismic Centre www.asc-india.org

- *Floods*

One of the most serious problems of Assam is the occurrence of frequent and widespread floods. The Brahmaputra and the Barak are the two main rivers, which causes major problem during the monsoon period every year in the form of floods thereby resulting in bank erosion and drainage congestion. Large areas are inundated by floods causing heavy loss in terms of life and property; and also cause extensive damage to standing crops thereby affecting local livelihood. The flood history of Assam is given in **Table 3.2.3.**

TABLE 3.2.3
FLOOD HISTORY OF ASSAM

Year	Affected Area (lakh ha)	Affected Population (Lakh)	Total Damage (in Crores INR)
1990	0.488	1.692	74.56
1991	0.997	5.307	191.15
1992	0.213	0.974	26.56
1993	1.348	5.261	0.215
1994	0.053	0.177	0.20
1998	0.972	4.698	700.00
2000	1.000	3.900	244.06
2001	0.200	0.540	11.14
2002	1.960	6.960	210.95
2004	All of the 27 districts, worst affected districts, Karimganj, Cachar, Nagaon and Golpara	122.0	NA

It was revealed from the Disaster Management Plan of Golaghat District (2011) that the entire district is Flood prone. Flood mainly occurs from May to September. The Flood Hazard Maps of Golaghat District (1998-2007) prepared by National Remote Sensing Agency (NRSA) showed that Flood primarily occurs in areas abutting the courses of Brahmaputra and Dhansiri Rivers. Flood Hazard map of Golaghat district is given in **Figure-3.2.3.**

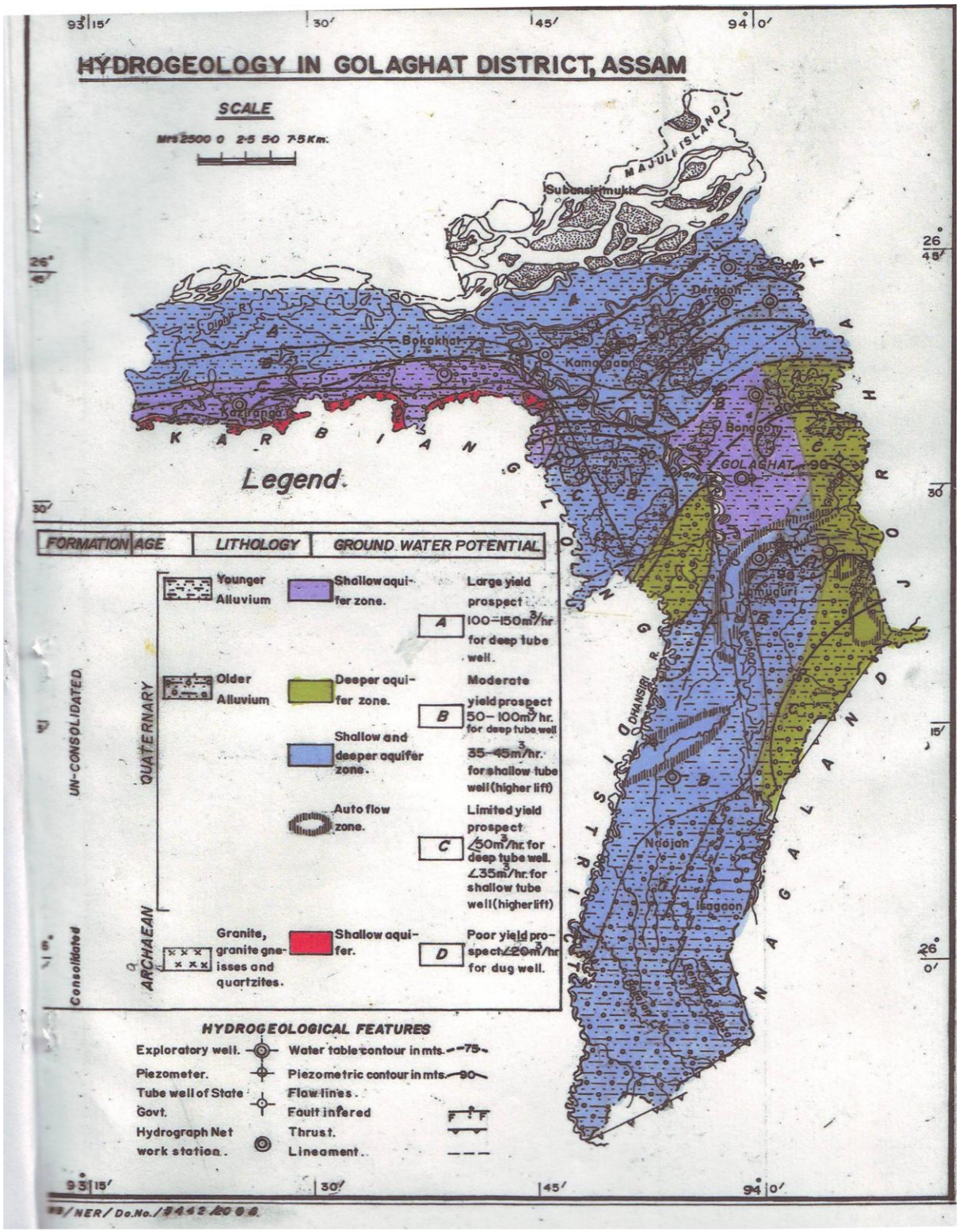
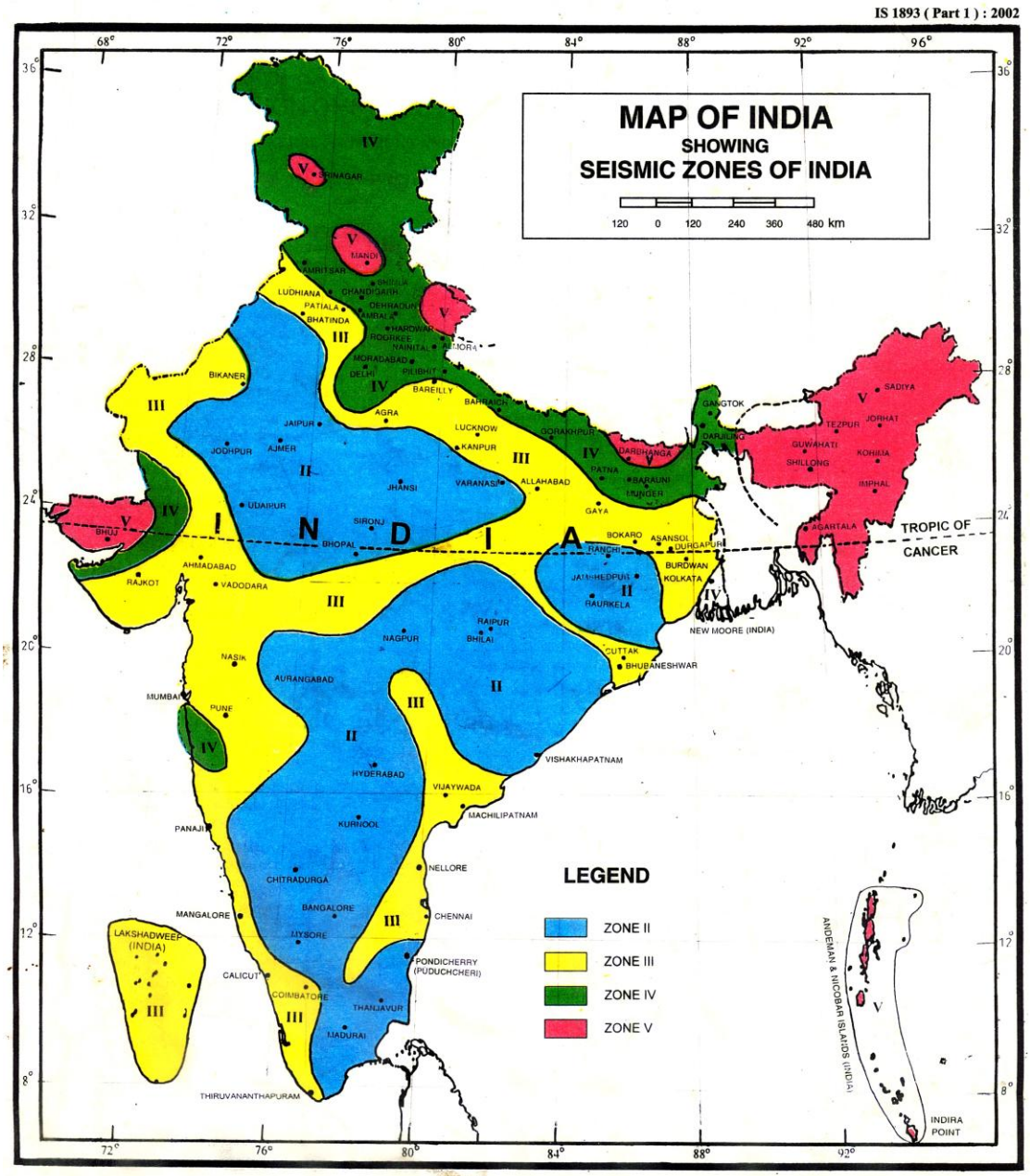


FIGURE-3.2.1
HYDROGEOLOGY MAP OF GOLAGHAT DISTRICT



NOTE : Towns falling at the boundary of zones demarcation line between two zones shall be considered in High Zone.

FIGURE-3.2.2
SEISMIC ZONE MAP OF INDIA

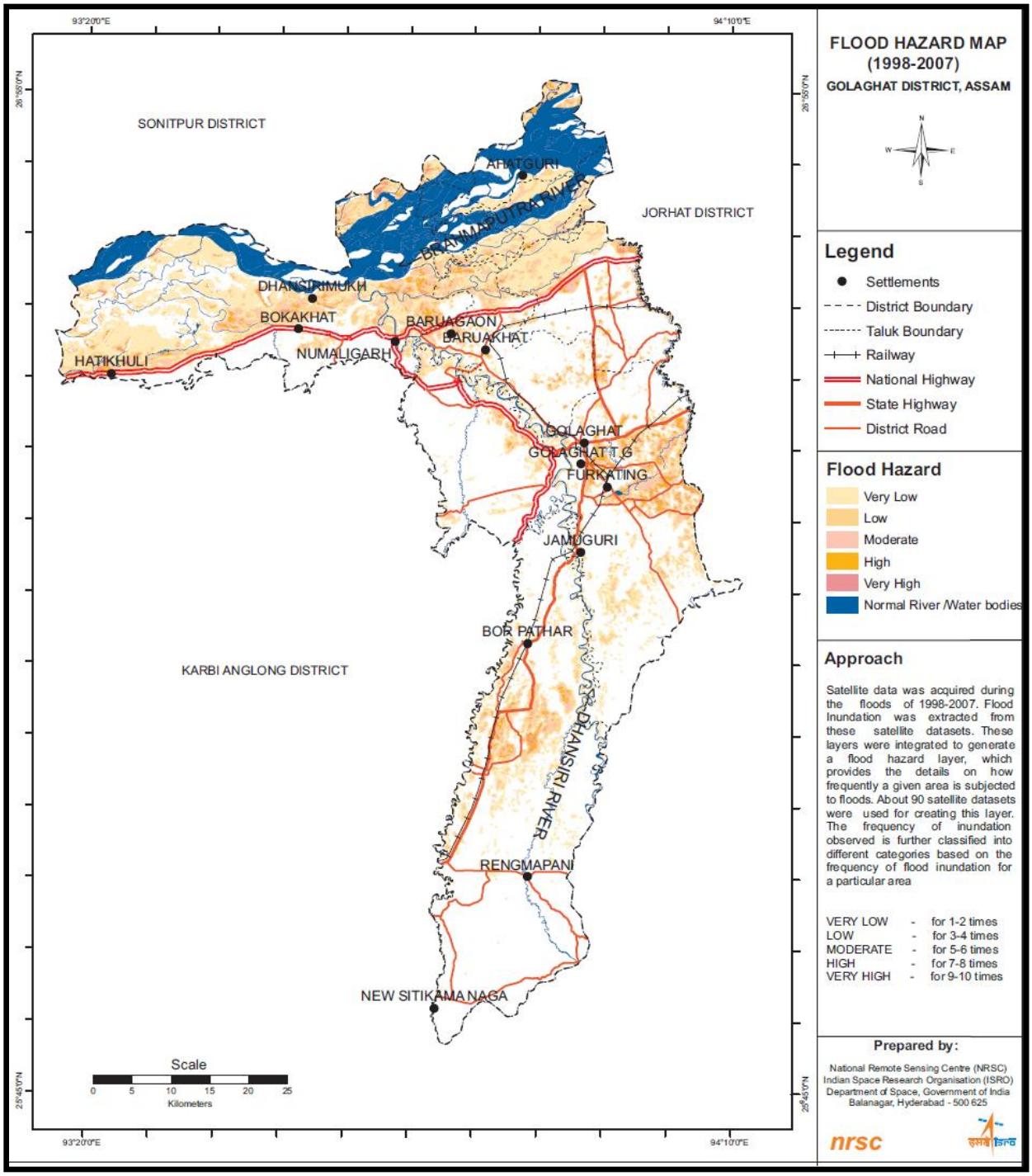


FIGURE-3.2.3
FLOOD HAZARD MAP OF GOLAGHAT DISTRICT

3.3 Land Use Studies

Studies on land use aspects of eco-system play important roles for identifying sensitive issues, if any, and taking appropriate actions for maintaining the ecological balance in the development of the region.

3.3.1 Objectives

The objectives of land use studies are:

- To determine the present land use pattern;
- To analyze the impacts on land use due to drilling activities in the study area; and
- To give recommendations for optimizing the future land use pattern vis-a-vis growth of drilling activities in the study area and its associated impacts.

3.3.2 Methodology

For the study of land use, literature review of various secondary sources such as District Census Handbooks, regional maps regarding topography, zoning settlement, industry, forest etc., were taken. The data was collected from various sources like District Census Handbook, Revenue records, state and central government offices and Survey of India (SOI) Topo-sheets and also through primary field surveys.

3.3.3 Land use Based on Secondary Data

Based on the census report, Block area was studied in detail to get the idea of land use pattern in the study area. The land use census data 2011 is presented in **Table-3.3.1.** The village wise land use data is presented in **Annexure-V**.

TABLE-3.3.1
LAND USE PATTERN IN THE STUDY AREA

Sr.No	Particulars of Landuse	SAS Block (Land in Ha)	(%)
1	Forest Area	373.64	1.01
2	**Land under Cultivation**		
a)	Area Irrigated by Source	648.00	1.75
b)	Total Unirrigated Land	26979.50	72.83
c)	Land Under Miscellaneous Tree Crops etc. Area	3868.10	10.44
3	**Area not Avialbale for Cultivation**		
a)	Area under Non-Agricultural Uses	3443.68	9.30
b)	Barren & Un-cultivable Land	194.83	0.53
c)	Permanent Pastures and Other Grazing Land	534.92	1.44
4	Culturable Waste Land	793.72	2.14
5	Fallows Land other than Current Fallows Area	82.97	0.22
6	Current Fallows Area	126.64	0.34
	Total Geographical Area	**37045.56**	**100.00**

Source: Census of India –2011

- ***Forest***

The revenue forest land under the study area consists 373.64 ha (1.01) of the total geographic area.

- ***Land under Cultivation***

Altogether 31495.60 ha cultivable land (irrigated, un-irrigated and Land Under miscellaneous tree crops etc.) was observed in the study area. The irrigated land admeasures to about 648.00 ha in the study area which works out to be 1.75% of total study area. The un-irrigated land admeasures about 26979.50 ha and works out to about 72.83% of the total study area. Land uunder miscellaneous tree crops area admeasures to about 3868.10 ha and works out 10.44% of the total study area.

- ***Land not available for Cultivation***

The land not available for cultivation is 11.27% of the total study area, which includes area of land with scrub, land without scrub, Permanent Pastures, quarry, mining area, rocky/ stony and barren area.

- ***Fallows Land other than Current Fallows Land***

This includes all land which was taken up for cultivation but is temporarily out of Cultivation for a period of not less than one year and not more than five years. The fallows land is 0.22% in the study area.

- ***Current Fallows Land***

This represents cropped area which is kept fallow during the current year. The current fallows land is 2.14% in the total study area.

- ***Cultivable Waste***

This land includes that land, which was cultivated sometime back and left vacant during the past 5 years in succession. Such lands may either be fallows or covered with shrubs, which are not put to any use. Lands under thatching grass, bamboo bushes, other grooves useful for fuel etc., and all grazing lands and village common lands are also included in this category. The study area comprises about 0.97% cultivable wastelands.

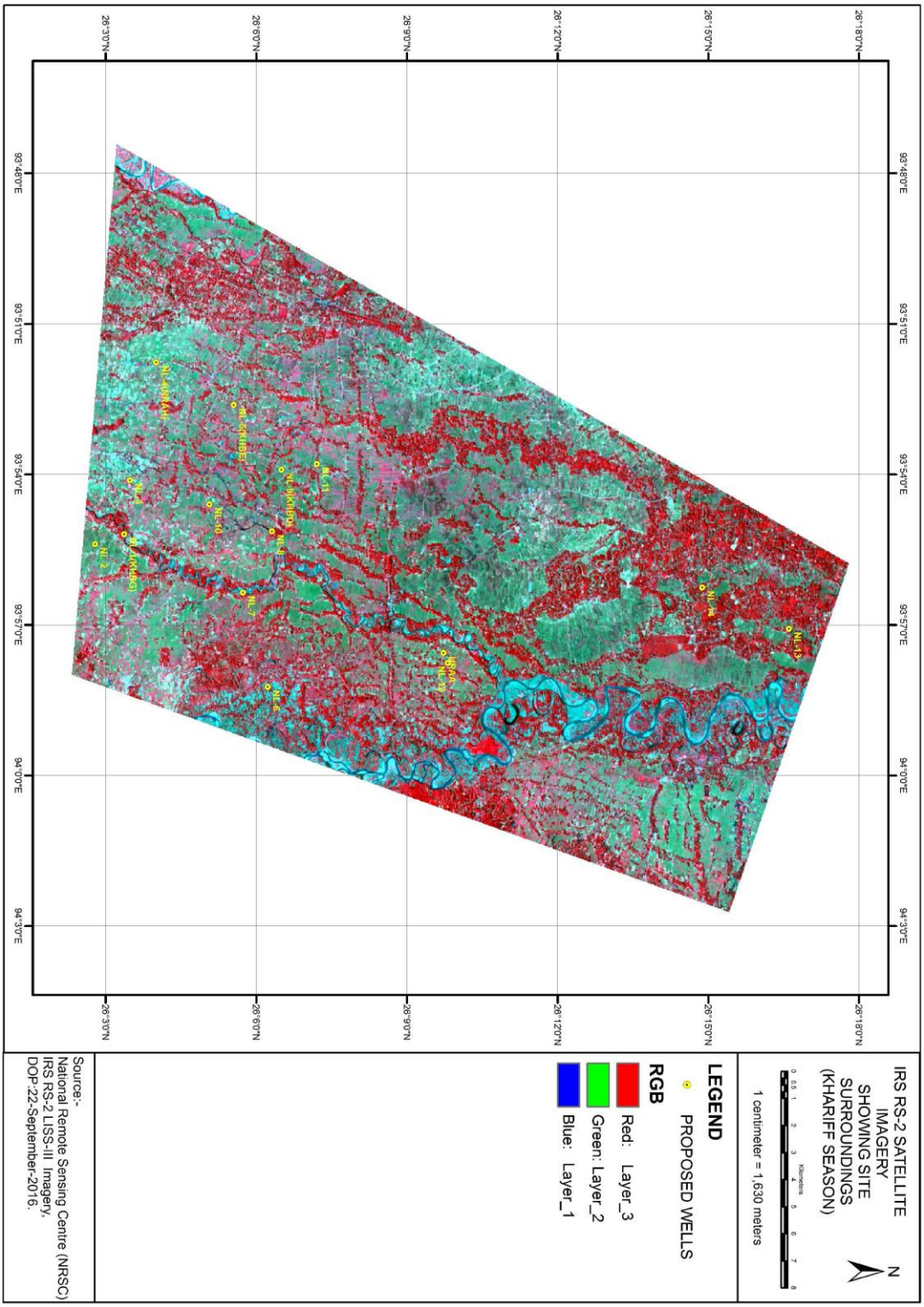


FIGURE-3.3.1
SATELLITE IMAGERY OF THE STUDY AREA

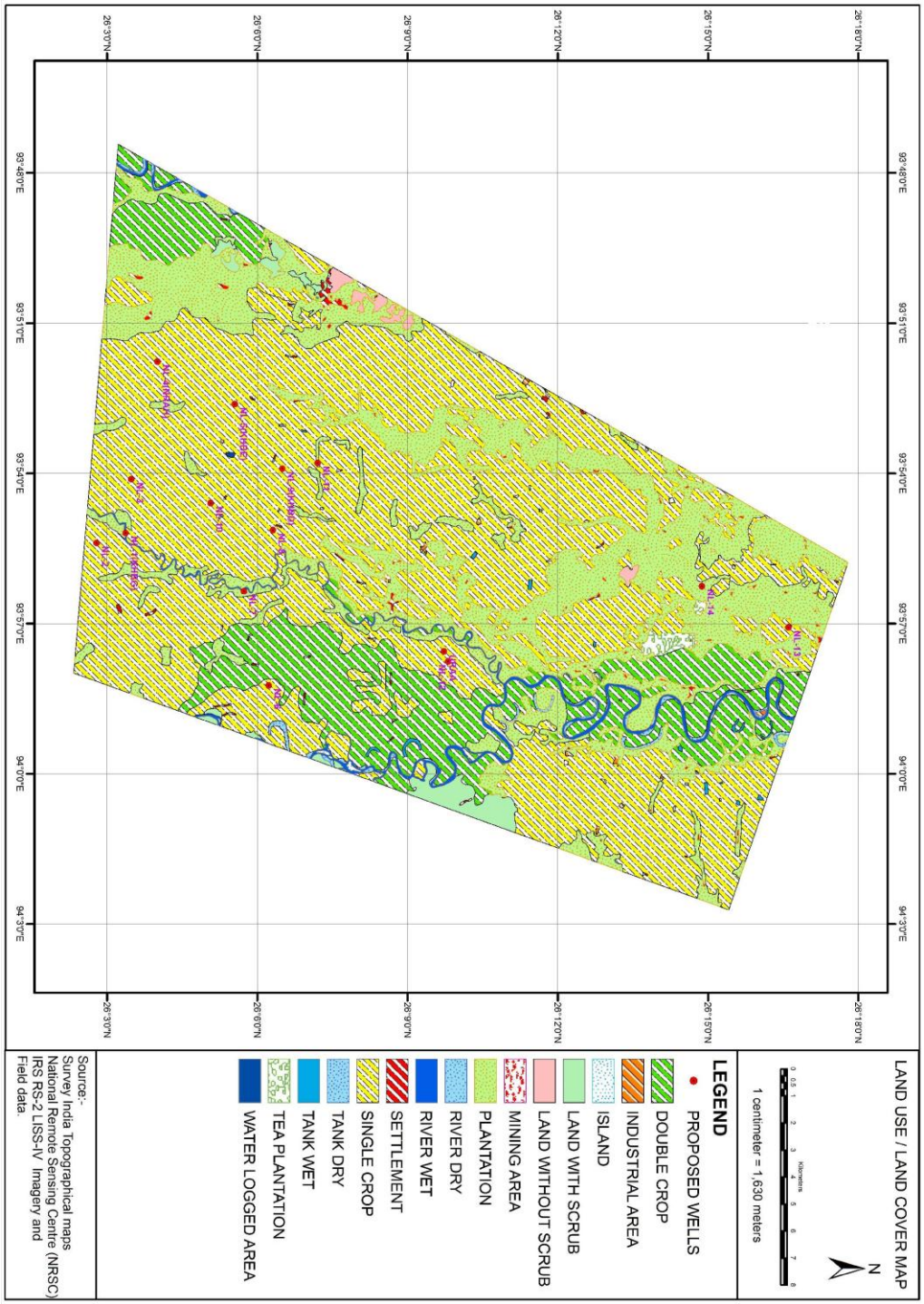


FIGURE-3.3.2
LAND USE PATTERN BASED ON SATELLITE DATA

3.4 Soil Characteristics

For studying soil profile of the region, sampling locations were selected to assess the existing soil characteristics in and around the exploratory drilling area representing various land use conditions. The physical, chemical and heavy metal concentrations were determined. The samples were collected by ramming a core-cutter into the soil upto a depth of 90 cm. A total of 10 numbers of samples within the study area were collected and analyzed. The details of the soil sampling locations are given in **Table-3.4.1** and are shown in **Figure-3.4.1**. The sampling has been carried out once in the study period representing partly winter and partly pre-monsoon season (15th January 2016 to 8th April 2016).

TABLE-3.4.1
DETAILS OF SOIL SAMPLING LOCATIONS

Sampling Station	Location
S1	Baramukhia village
S2	Langta village
S3	Gelabil village
S4	Naharani village
S5	Lakhi pathar village
S6	Rangma pathar village
S7	Dhupguri village
S8	Harldibari village
S9	Sonoval village
S10	Lachit Goan village

The soil quality at all the locations during the study period is are given in **Table–3.4.2**. The results are compared with standard classification given in **Table - 3.4.3**.

3.4.1 Baseline Soil Status

- It has been observed that the texture of soil is mostly clay type in the study area. The pH of the soil 7.1 to 8.2 indicating that is neutral to moderately alkaline in nature.
- The Electrical conductivity was recorded as 113.3 µS/cm to 330 µS/cm. Minimum concentration was observed at S1 and maximum concentration at S8 during the study period.
- The Organic Carbon content in the study area observed as 0.46 % to 1.05 %, which the soil falls under medium to more than sufficient category.
- Available potassium was observed as minimum 141.2 Kg/ha at S1 and maximum observed as 606.3 Kg/ha at at S9 indicating that the soil falls under less to more than sufficient category.
- Available Nitrogen was observed as 14 Kg/ha to 50.9 kg/ha. Minimum concentration is observed at site S7 and the maximum observed concentration observed at S2 locations. Based on the above values the soil falls under very less category.
- Available phosphorous was observed as 12.1 kg/ha to 56.2 kg/ha in the study region. The minimum value observed at S5 location and the maximum was observed at S1 location. It shows the soil falls under very less to average sufficient category.

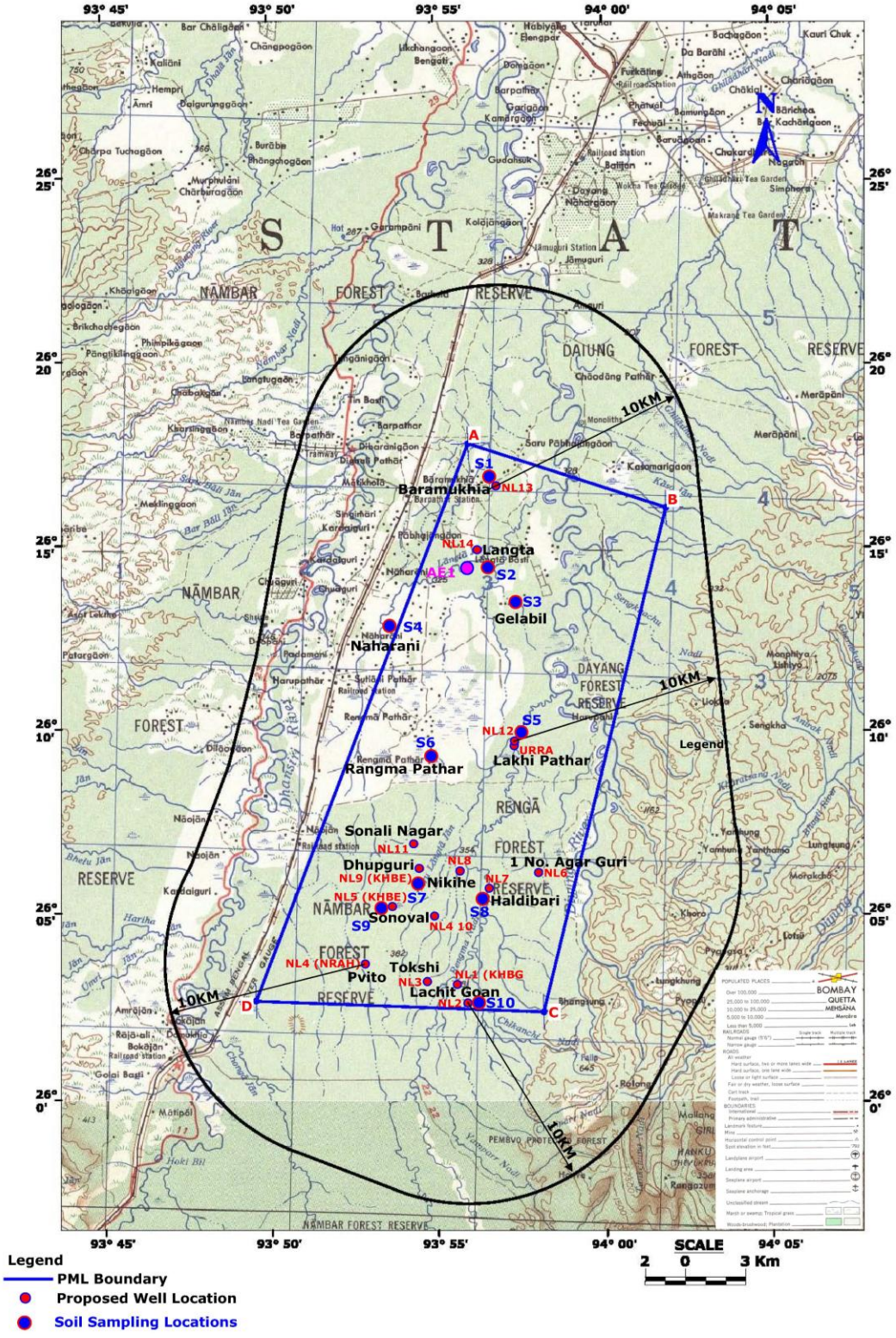


FIGURE-3.4.1
SOIL SAMPLING LOCATIONS

	
Sonval Village	**Dhupguri Village**
	
Lakhi pathar	**Harldibari village**

FIGURE-3.4.2
PHOTOGRAPHS OF SOIL SAMPLING

TABLE 3.4.2
SOIL ANALYSIS RESULTS

Sr.No	Location	Unit	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
1	pH	--	7.53	7.62	7.9	7.1	8.01	8.2	7.1	7.28	8.15	7.82
2	Conductivity	µs/cm	113.3	240	201	142.1	159.7	206.5	161	330	185.1	170.4
3	Texture	--	Silty Clay	Clay	Clay loam	Sandy Clay	Silty Clay	Sandy Clay	Clay	Clay	Clay	Silty clay
4	Sand	%	18	11	19	48	20	48	10	15	14	12
5	Silt	%	28	14	18	17	45	15	12	16	14	33
6	Clay	%	54	75	63	35	35	37	78	69	72	55
7	Bulk Density	g/cc	1.22	1.1	0.95	1.12	1.28	1.18	0.96	0.95	1.01	1.08
8	Exchangeable Calcium as Ca	mg/kg	1004	1703.4	2508.1	1896.4	1302.6	3262.4	2004.0	2701.1	2303	1202.4
9	Exchangeable Magnesium as Mg	mg/kg	304.6	486.4	305.6	281.4	121.6	825.3	547.2	364.2	486.1	304
10	Exchangeable Sodium as Na	mg/kg	28.8	208.3	92.5	137.6	12.6	198.8	21	166.7	47.1	40
11	Exchangeable Potassium as K	Kg/ha	141.2	206.6	212.8	286.6	180.2	202.7	201.6	407.9	606.3	195.9
12	Available Phosphorous as P	Kg/ha	56.2	38.5	19.8	29.8	12.1	21.7	15	42.4	32.9	25.6
13	Available Nitrogen as N	Kg/ha	38.4	49	36.6	26.2	42.8	16.8	14	46.7	50.9	19.7
14	Organic Matter	%	1.48	1.59	1.56	0.93	0.85	1.81	1.28	1.64	0.86	1.1
15	Organic Carbon	%	0.86	0.92	0.9	0.54	0.5	1.05	0.74	0.95	0.46	0.64
16	Water soluble chloride as Cl	mg/kg	70.1	212.7	141.8	58.7	105.2	199.1	106.4	123.8	175.3	70.9
17	Water soluble sulphates as SO_4	mg/kg	42.8	57.6	108.3	156.2	86.7	126.4	87.6	211.8	86.4	92.3
18	Sodium Absorption Ratio	--	0.2	1.14	0.46	0.78	0.09	0.8	0.11	0.8	0.23	0.27
19	Aluminium	%	0.68	0.92	1.02	0.88	0.94	0.79	1.16	1.27	1.03	0.76
20	Total Iron	%	1.12	1.58	1.68	1.12	1.25	1.01	1.87	1.43	1.9	1.41
21	Manganese	mg/kg	159.5	112.8	178.5	125.6	150.3	88.2	134.9	216.4	183.2	121.7
22	Boron	mg/kg	31.4	28.7	26.3	18.3	22.9	39	33.5	27.1	25.4	17.8
23	Zinc	mg/kg	54	39.4	48.3	31.5	20.7	41.2	53	57.2	40.8	64.4

TABLE-3.4.3
STANDARD SOIL CLASSIFICATION

Sr. No.	Soil Test	Classification
1	pH	<4.5 Extremely acidic 4.51- 5.50 Very strongly acidic 5.51-6.00 Moderately acidic 6.01-6.50 Slightly acidic 6.51-7.30 Neutral 7.31-7.80 Slightly alkaline 7.81-8.50 Moderately alkaline 8.51-9.00 Strongly alkaline >9.00 Very strongly alkaline
2	Salinity Electrical Conductivity (ppm) (1 ppm =640μmho/cm)	Upto 1.00 Average 1.01-2.00 harmful to germination 2.01-3.00 Harmful to crops (sensitive to salts)
3	Organic Carbon	Upto 0.20: Very less 0.21-0.40: Less 0.41-0.50: Medium, 0.51-0.80: On an avg. sufficient 0.81-1.00: Sufficient >1.00 : More than sufficient
4	Nitrogen (Kg/ha)	Upto 50 Very less 51-100 Less 101-150 Good 151-300 Better >300 Sufficient
5	Phosphorus (Kg/ha)	Upto 15 Very less 16-30 Less 31-50 Medium, 51-65 On an avg. sufficient 66-80 Sufficient >80 More than sufficient
6	Potash (Kg/ha)	0 -120 Very less 120-180 Less 181-240 Medium 241-300 Average 301-360 Better >360 More than sufficient

Source: Hand Book of Agriculture, ICAR, New Delhi

3.5 Meteorology

The meteorological data recorded during the monitoring period is very useful for proper interpretation of the baseline information as well as for input prediction models for air quality dispersion. Historical data on meteorological parameters will also play an important role in identifying the general meteorological regime of the region.

The year may broadly be divided into four seasons:

- Winter season : December to February
- Pre-monsoon season : March to May
- Monsoon season : June to September
- Post-monsoon season : October to November

3.5.1 Methodology

The methodology adopted for monitoring the surface meteorological conditions observations is as per the standard norms laid down by Bureau of Indian Standards (IS : 8829) and India Meteorological Department (IMD). On-site monitoring was undertaken for various meteorological variables in order to generate the site-specific data. Data was collected every hour continuously from 15th January 2016 to 8th April 2016.

3.5.1.1 Methodology of Data Generation

A Central Monitoring Station (CMS) equipped with continuous monitoring equipment was installed on top of a building at a height of 6 m above ground level to record wind speed, direction, relative humidity and temperature. The meteorological monitoring station was located in such a way that it is free from any obstructions and as per the guidelines specified under IS: 8829. Cloud cover was recorded by visual observation. Rainfall was monitored by using rain gauge.

The continuous recording meteorological instrument of Dynalab, Pune (Model No.WDL 1002) has been used for recording the met data. The sensitivity of the equipment is as given in **Table-3.5.1**.

Secondary information on meteorological conditions has been collected from the nearest IMD station at Golaghat. The available meteorological data of IMD, Golaghat station has been collected and analyzed.

TABLE-3.5.1
SENSITIVITY OF METEOROLOGY MONITORING EQUIPMENT

Sr. No.	Sensor	Sensitivity
1	Wind speed Sensor	± 0.02 m/s
2	Wind direction Sensor	± 3 degrees
3	Temperature Sensor	± 0.2°C

3.5.2 Presentation of Data

3.5.2.1 Meteorological Data Recorded at IMD, Golaghat

The meteorological data is collected from IMD - Golaghat, which is the nearest IMD station to the project site. The data collected from IMD includes wind speed, wind direction, temperature, relative humidity, atmospheric pressure; rainfall and cloud cover. The monthly maximum, minimum and average values are collected for all the parameters except wind speed and direction. All these parameters are recorded twice a day viz at 0830 and 1730 hours. The collected data is tabulated in **Table-3.5.2**.

3.5.2.2 Meteorological Data Generated at site

The meteorological parameters are recorded on hourly basis during the study period from 15th January 2016 to 8th April 2016 and the parameters recorded at site include wind speed, wind direction (from 0 to 360 degrees), temperature, relative humidity, rainfall and cloud cover.

3.5.3 Analysis of the Data Recorded at IMD – Golaghat

1] Temperature

The winter season starts from December and continues till the end of February. January is the coolest month with the mean daily maximum temperature at 29.2^{0}C and the mean daily minimum temperature at 6.8^{0}C. Both the night and day temperatures increase rapidly during the onset of the pre-monsoon season from March to May. During pre-monsoon season, the mean maximum temperature was observed to be 35.7^{0}C with the mean minimum temperature at 11.1^{0}C. The mean maximum temperature in the monsoon season was observed to be 36.0^{0}C in the month of June whereas the mean minimum temperature was observed to be 21.6^{0}C in the month of June. During post-monsoon season, the mean maximum temperature was observed to be 32.9^{0}C with the mean minimum temperature at 11.4^{0}C. The monthly variations of temperature are presented in **Table-3.5.2**.

2] Relative Humidity

The air is generally humid in this region during the monsoon season when the relative humidity was observed to be 86% with a maximum and a minimum of 54%. Generally, the weather during other seasons was observed to be dry. The monthly variations in the relative humidity are presented in **Table-3.5.2**.

3] Atmospheric Pressure

The maximum pressure observed was 1007.0 mb occurring during the winter season, in the month of January. The minimum pressure observed was 987.5 mb occurring during the month of July in the monsoon season. It can be seen from the data that not much variations are observed in the average atmospheric pressure levels. The pressure levels are found to be fairly consistent over the region. The monthly variations in the pressure levels are presented in **Table-3.5.2.**

TABLE-3.5.2
CLIMATOLOGICAL DATA STATION: IMD, GOLAGHAT (1951-1980)

Month	Atmospheric Pressure (mb)		Temperature (^{0}C)		Relative Humidity (%)		Rainfall (mm)
	Mean Max	Mean Min	Mean Max	Mean Min	Mean Max	Mean Min	
January	1007.0	1002.2	26.3	6.8	78	57	16.1
February	1003.6	999.4	29.2	7.9	79	58	26.3
March	1001.8	996.9	33.6	11.1	75	54	54.5
April	999.3	994.9	35.0	15.3	77	63	132.5
May	995.6	991.2	35.7	19.0	83	73	319.2

Month	Atmospheric Pressure (mb)		Temperature (^{0}C)		Relative Humidity (%)		Rainfall (mm)
	Mean Max	Mean Min	Mean Max	Mean Min	Mean Max	Mean Min	
June	992.1	988.4	36.0	21.6	85	77	270.5
July	991.7	987.5	35.8	22.7	86	77	330.7
August	992.6	988.9	35.6	22.8	86	76	299.1
September	995.8	992.0	35.6	21.9	84	77	165.7
October	1000.9	997.2	32.9	17.7	83	75	109.5
November	1004.2	1000.9	29.9	11.4	81	67	14.3
December	1005.7	1001.9	27.5	7.8	83	66	13.5
						Total Rainfall	**1751.9**

4] Rainfall

The average annual rainfall based on the 10 year IMD data, was observed to be 1751.9 mm. The monsoon sets in the month of June and continues till September and sometime extends upto mid October. The maximum amount of rainfall (330.7 mm) occurs in the month of July. Monthly variations in the rainfall are given in **Table-3.5.2.**

5) Wind Speed/Direction

Generally, light to moderate winds prevails throughout the year. Winds were light and moderate particularly during the morning hours. While during the afternoon hours the winds were stronger. The season wise discussion of the respective wind Pattern is given as below:

A) Wind Pattern during Pre-Monsoon Season

0830 Hours:

A review of the wind rose diagram shows that predominant winds are mostly from NW and SE directions followed by NE direction **(Figure-3.5.1).** Calm conditions prevailed for 71.2% of the total time.

1730 Hours:

A review of the wind rose diagram shows that predominant winds are mostly from NW and SE directions followed by NE direction **(Figure-3.5.1).** Calm conditions prevailed for 72.4% of the total time.

B) Wind Pattern during Monsoon Season

0830 Hours:

A review of the wind rose diagram shows that predominant winds are mostly from NW and SE directions followed by NE direction **(Figure-3.5.2).** Calm conditions prevailed for 75.4% of the total time.

1730 Hours:

A review of the wind rose diagram shows that predominant winds are mostly from NW and SE directions followed by NE direction **(Figure-3.5.2).** Calm conditions prevailed for 78.3% of the total time.

C) Wind Pattern during Post-Monsoon Season

0830 Hours:

A review of the wind rose diagram shows that predominant winds are mostly from NE and NW directions followed by SE direction **(Figure-3.5.3).** Calm conditions prevailed for 77.6% of the total time.

1730 Hours:

A review of the wind rose diagram shows that predominant winds are mostly from NE and NW directions followed by SE direction **(Figure-3.5.3).** Calm conditions prevailed for 83.4% of the total time.

D) Wind Pattern during Winter Season

0830 Hours:

A review of the wind rose diagram shows that predominant winds are mostly from SE and NE directions followed by NW direction **(Figure-3.5.4).** Calm conditions prevailed for 80.9% of the total time.

1730 Hours:

A review of the wind rose diagram shows that predominant winds are mostly from NE and SE directions followed by NW direction **(Figure-3.5.4).** Calm conditions prevailed for 82.1% of the total time.

E) Annual Wind Pattern

0830 Hours:

A review of the wind rose diagram shows that predominant winds are mostly from NW and SE directions followed by NE direction **(Figure-3.5.5).** Calm conditions prevailed for 76.2% of the total time.

1730 Hours:

A review of the wind rose diagram shows that predominant winds are mostly from NW and SE directions followed by NE direction **(Figure-3.5.5).** Calm conditions prevailed for 78.5% of the total time.

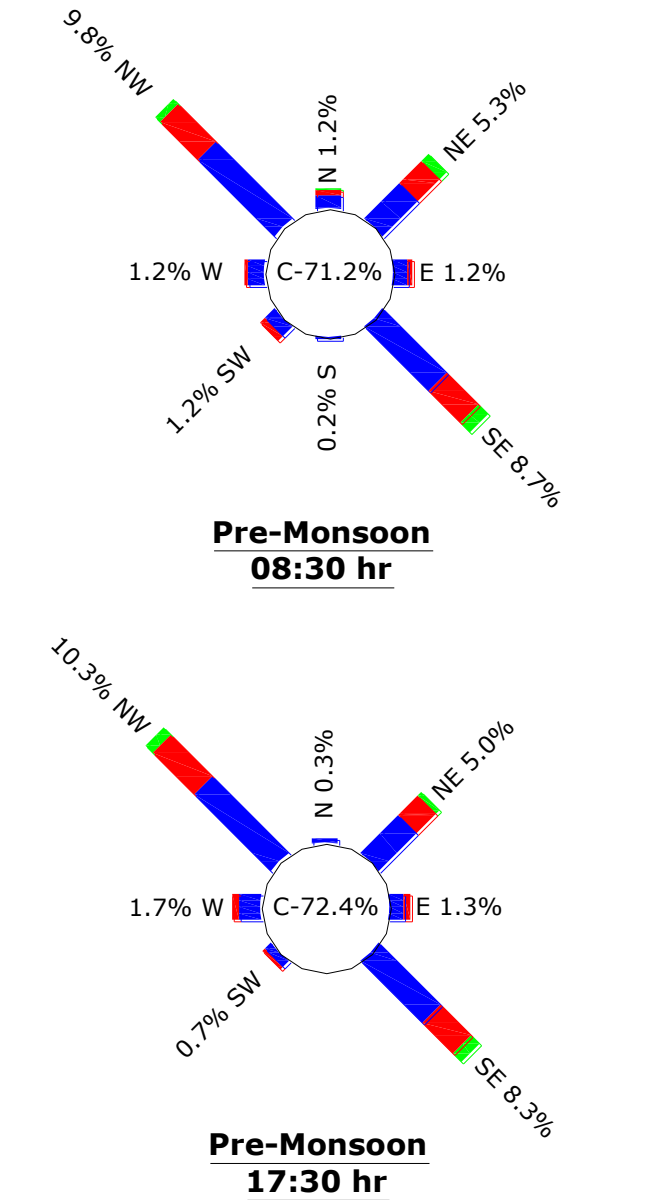


FIGURE-3.5.1
IMD GOLAGHAT-PRE MONSOON SEASON

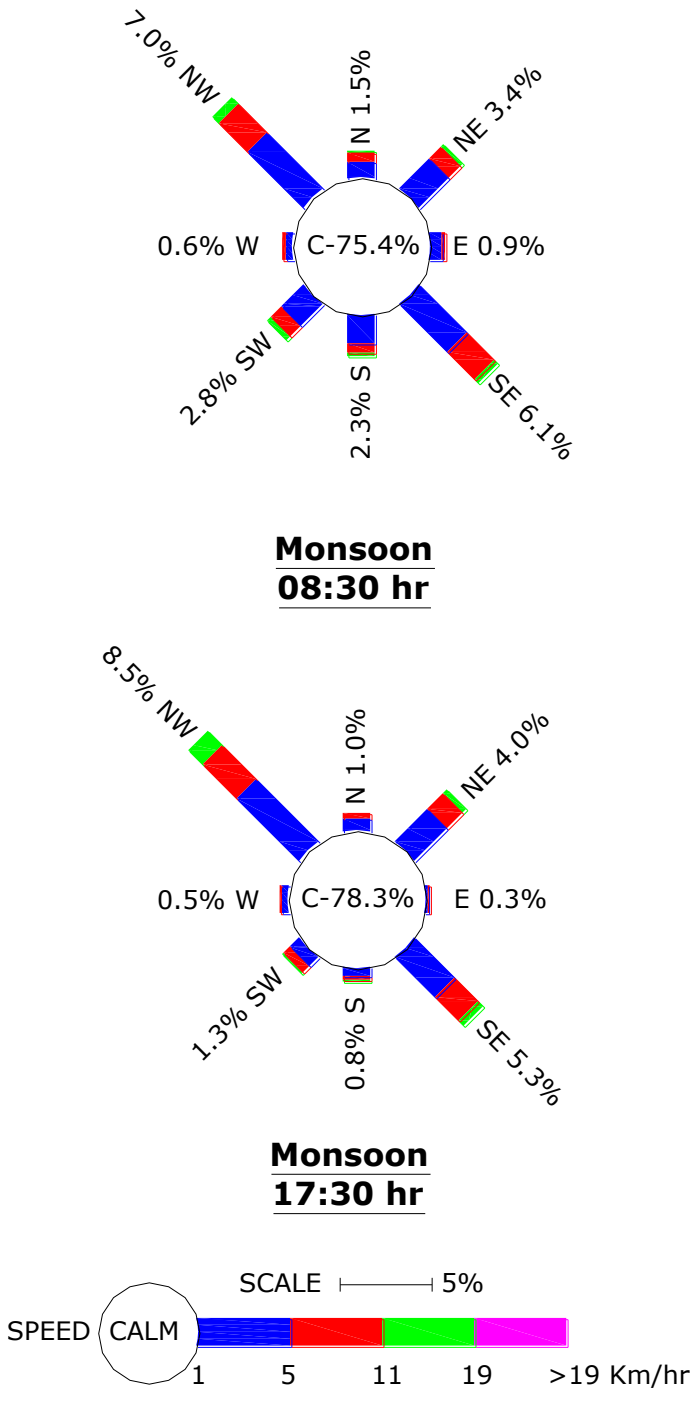
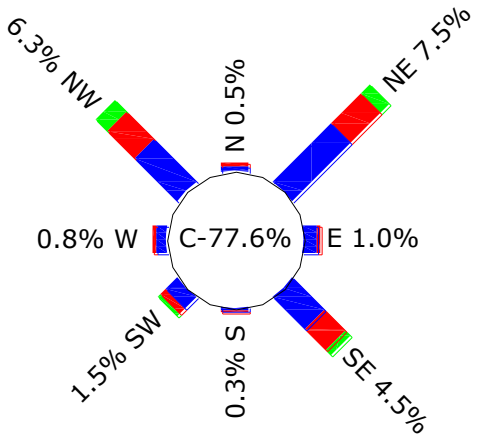
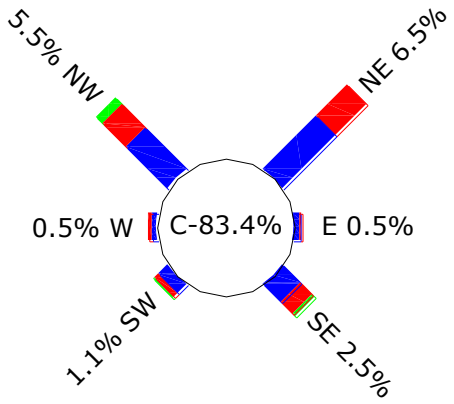


FIGURE-3.5.2
IMD GOLAGHAT-MONSOON SEASON



Post-Monsoon
08:30 hr



Post-Monsoon
17:30 hr

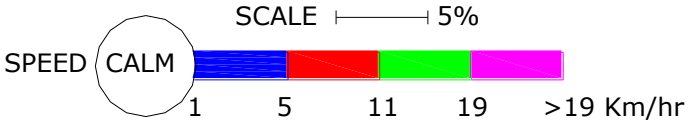


FIGURE-3.5.3
IMD GOLAGHAT-POST MONSOON SEASON

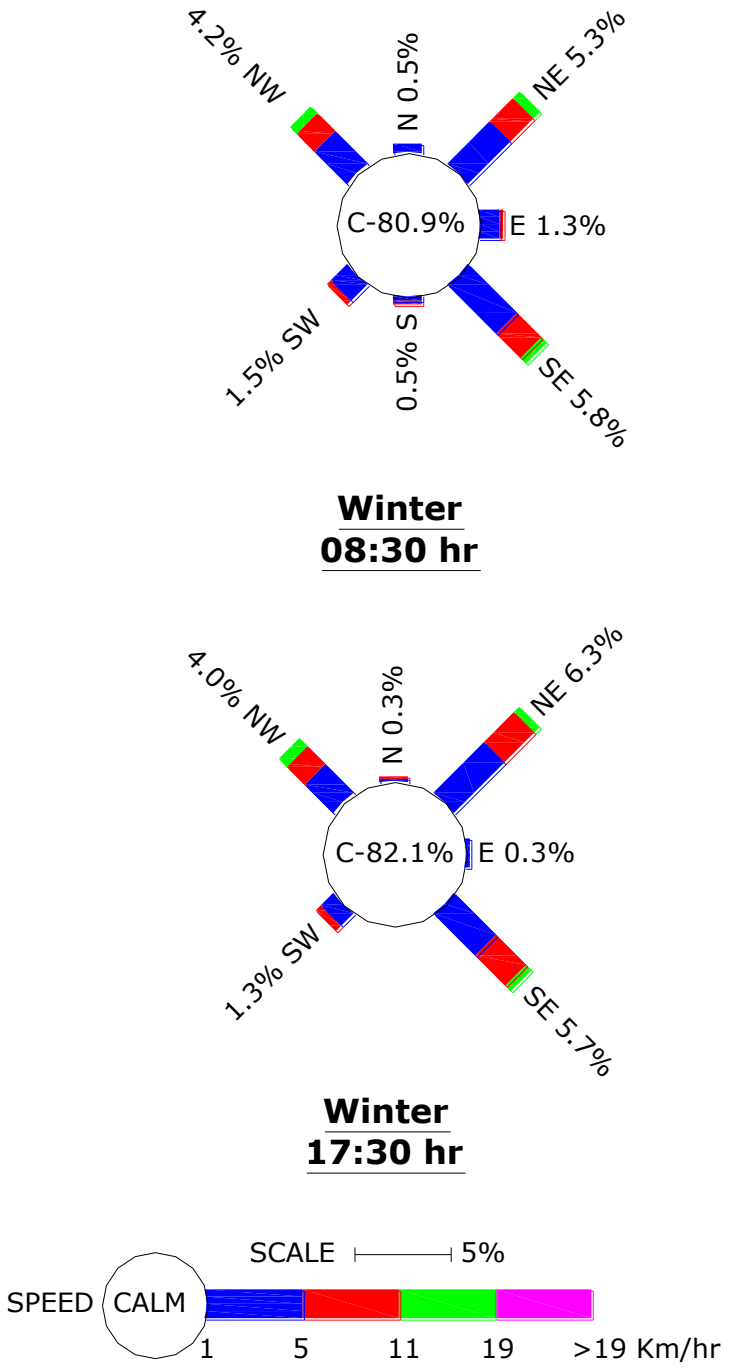
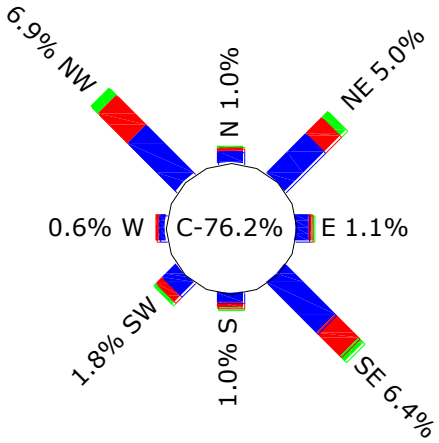
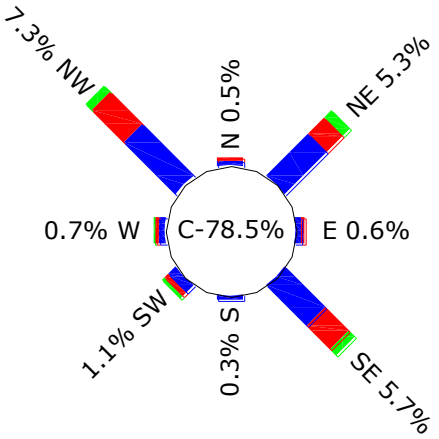


FIGURE-3.5.4
IMD GOLAGHAT-WINTER SEASON



Annual
08:30 hr



Annual
17:30 hr

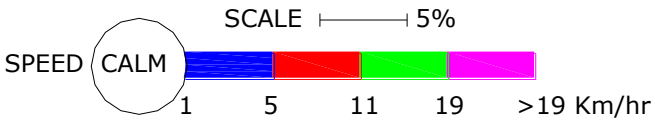


FIGURE-3.5.5
IMD GOLAGHAT-ANNUAL WINDROSE

3.5.4 Observations on Primary Data

The site specific data is presented in **Table-3.5.3** and discussed below:

TABLE-3.5.3
SUMMARY OF THE METEOROLOGICAL DATA GENERATED AT SITE

Month	Temperature (^{0}C)		Relative Humidity (%)		Rainfall (mm)
	Max.	Min.	Max.	Min.	
January-2016	27.7	8.9	80	59	10.4
Feburary-2016	31.3	9.7	79	58	19.5
March-2016	34.8	13.6	75	55	28.2
April-2016	35.4	14.3	76	56	7.4

1] Temperature

Maximum temperature of 35.4^{o}C and minimum temperature of 8.9^{o}C was recorded during the study period.

2] Relative Humidity

During the period of observation the Relative Humidity recorded ranged from 80% to 55%.

3] Rainfall

Total 28.2 mm rainfall was recorded in the month of Febraury during the study period.

4] Wind Speed/Direction

The wind rose for the study period representing partly winter season and pre monsoon season is shown in **Figure-3.5.6**. A review of the wind rose diagram shows that predominant winds are mostly from NW followed by SE. Next predominants are NE & W direction. Calm conditions prevailed for 71.1 % of the total time.

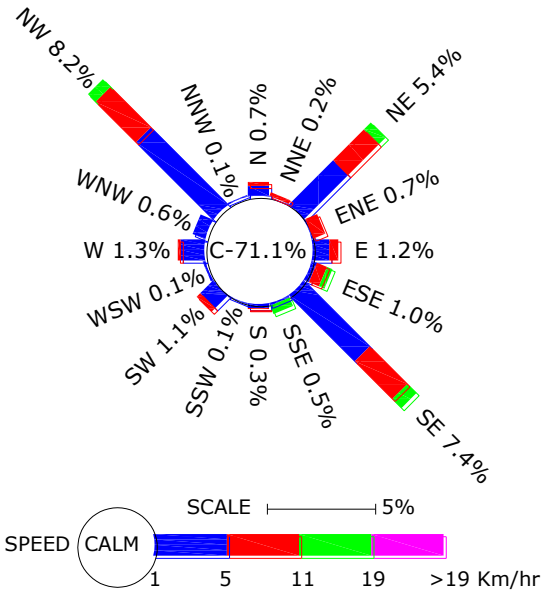


FIGURE-3.5.6
SITE SPECIFIC WINDROSE-WINTER SEASON

3.6 Ambient Air Quality

The ambient air quality with respect to the study zone around the proposed block forms the baseline information. The prime objective of the baseline air quality study was to assess the existing air quality of the area. This will also be useful for assessing the conformity to standards of the ambient air quality during the operation of proposed drilling project.

This section describes the selection of sampling locations, methodology adopted for sampling, analytical techniques and frequency of sampling. The ambient air quality monitoring was conducted from 15th January 2016 to 8th April 2016 representing partly winter and partly pre-monsoon season.

3.6.1 Methodology Adopted for Air Quality Survey

- ***Selection of Sampling Locations***

The baseline status of the ambient air quality has been assessed through a scientifically designed ambient air quality monitoring network. The design of monitoring network in the air quality surveillance program has been based on the following considerations:

- Meteorological conditions on synoptic scale;
- Topography of the study area;
- Representatives of regional background air quality for obtaining baseline status;
- Representatives of likely impact areas.

Ambient Air Quality Monitoring (AAQM) stations were set up at ten locations with due consideration to the above mentioned points. **Table-3.6.1** gives the details of environmental setting around each monitoring station. The locations of the selected stations with reference to the proposed block are given in the same table and depicted in **Figure-3.6.1**.

- ***Frequency and Parameters for Sampling***

Ambient air quality monitoring was carried out at a frequency of two days per week for three month at each location covering from 15th January 2016 to 8th April 2016 representing partly winter and partly pre-monsoon season. The baseline data of air environment was monitored for parameters mentioned below:

- Particulate Matter ($PM_{2.5}$);
- Particulate Matter (PM_{10});
- Sulphur dioxide (SO_2);
- Oxides of Nitrogen (NOx);
- Volatile Organic Carbon (VOCs);
- Total Hyderocarbon;
- Methane Hydrocarbon;and
- Non-methane Hydrocarbon

The AAQ sampling is carried out as the present revised standards mentioned in the latest Gazette notification of the Central Pollution Control Board (CPCB) (November, 2009).

TABLE-3.6.1
DETAILS OF AMBIENT AIR QUALITY MONITORING

Monitoring Station	Name of the AAQ Station
AAQ1	Baramukhia village
AAQ2	Langta village
AAQ3	Gelabil village
AAQ4	Naharani village
AAQ5	Lakhi pathar village
AAQ6	Baramukhia village
AAQ7	Dhupguri village
AAQ8	Harldibari village
AAQ9	Sonoval village
AAQ10	Lachit Goan village

3.6.2 Presentation of Primary Data

Various statistical parameters like 98th percentile, average, maximum and minimum values have been computed from the observed raw data for all the AAQ monitoring stations. The results of monitoring carried out are presented in **Annexure-VI**. The summary of these results representing part of winter season are given in **Table-3.6.2**. These are compared with the standards prescribed by Central Pollution Control Board (CPCB).

- ***Summary of Observations – partly winter and partly pre-monsoon season (2016)***

- Out of the ten locations the minimum and maximum concentration for PM_{10} and $PM_{2.5}$ were varied between 39.3 to 51.7 $\mu g/m^3$ and 12.0 to 17.6 $\mu g/m^3$ respectively during the study period. The concentrations of SO_2 and NOx were varied between 10.1 to 17.2 $\mu g/m^3$ and 12.4 to 19.8 $\mu g/m^3$ respectively. All ambient air quality parameters including $PM_{2.5}$ levels recorded are within the prescribed standards for Residential and Industrial areas.

- Co values recorded are in the range of 191-420$\mu g/m^3$.

- Out of the ten locations the minimum and maximum concentration for total hydrocarbons, methane hydrocarbons and non-methane hydrocarbons during the study period were observed as 204 to 288 $\mu g/m^3$, 122 to 165 $\mu g/m^3$ and 71 to 133 $\mu g/m^3$ respectively.

- The concentrations of VOCs were below the detectable limits in all the locations during the study period. Below detectable limit is 0.1

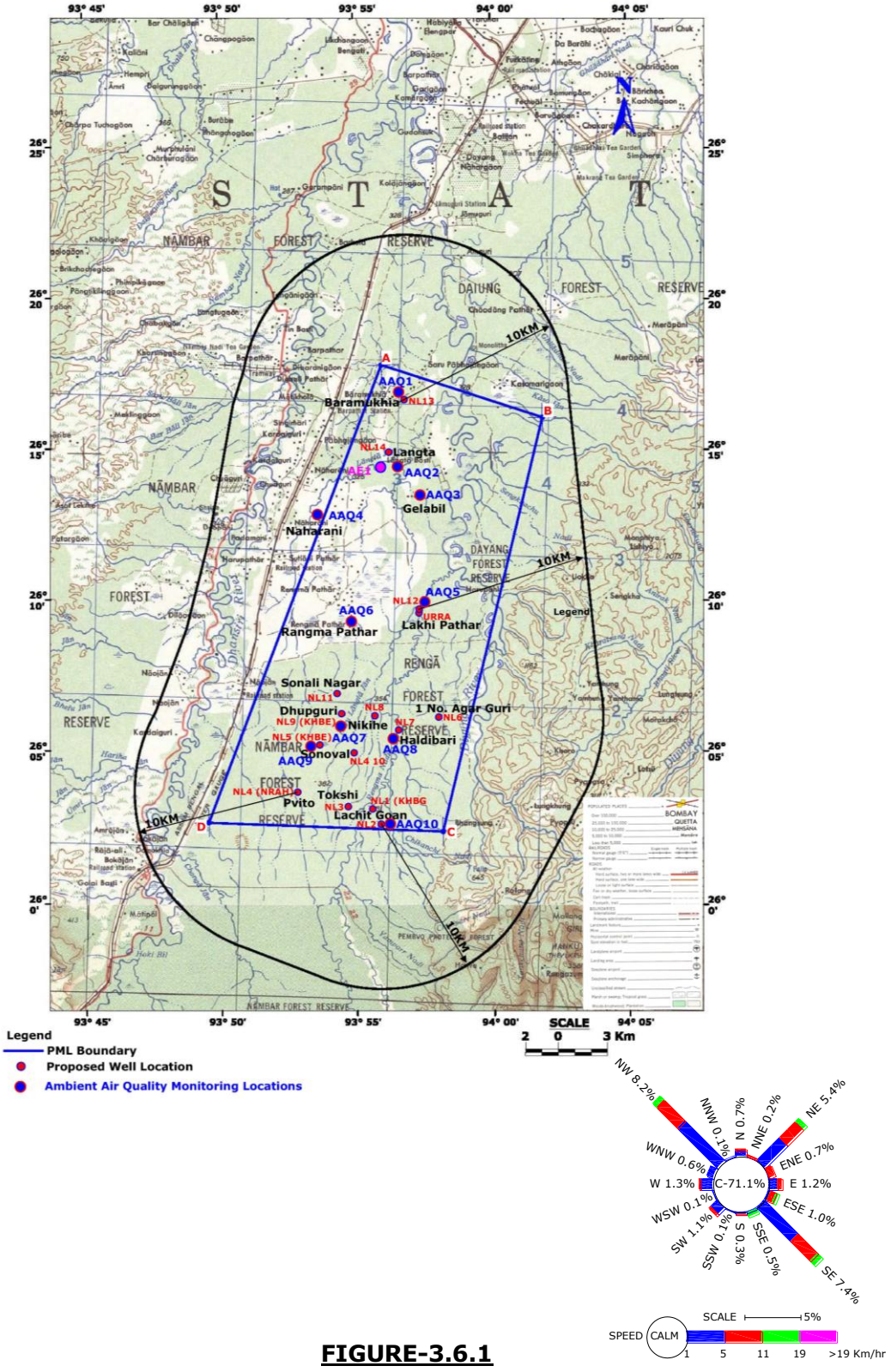


FIGURE-3.6.1
AMBIENT AIR QUALITY SAMPLING LOCATIONS

Lakhi pathar

Harlidibari village

Dhupguri Village

FIGURE-3.6.2
PHOTOGRAPHS OF AMBIENT AIR QUALITY SAMPLING

TABLE-3.6.2
SUMMARY OF AMBIENT AIR QUALITY RESULTS

Monitoring Station	Locations	PM10 (µg/m³)				PM2.5 (µg/m³)				SO_2 (µg/m³)				NOx (µg/m³)			
		Max	Min	Avg	98th %le	Max	Min	Avg	98th %le	Max	Min	Avg	98th %le	Max	Min	Avg	98th %le
AAQ1	Baramukhia	48.1	42.5	44.6	47.9	15.7	13.9	14.5	15.7	15.7	11.2	14.4	15.7	17.5	14.5	15.9	17.5
AAQ2	Langta	50.4	45.3	47.1	50.4	17.2	14.3	15.0	16.7	17.2	11.2	14.9	16.7	19.2	15.2	17.0	18.8
AAQ3	Gelabil	51.3	46.1	47.8	51.1	17.6	12.0	15.6	17.5	15.3	12.2	13.4	15.0	19.0	15.9	17.2	18.7
AAQ4	Naharani	51.7	45.4	47.8	51.5	16.6	13.8	15.3	16.5	14.1	11.2	12.5	13.7	18.6	15.8	17.2	18.6
AAQ5	Lakhi pathar	47.2	42.1	44.2	47.2	15.3	13.4	14.1	15.3	15.3	12.7	14.1	15.3	18.6	14.6	16.4	18.2
AAQ6	Rangma pathar	47.8	39.3	43.5	47.1	15.6	13.1	14.2	15.5	15.6	13.1	14.2	15.5	16.5	12.4	14.4	16.3
AAQ7	Dhupguri	44.3	40.4	41.6	44.1	14.2	12.9	13.7	14.2	14.2	10.9	13.5	14.2	19.5	15.4	17.3	19.5
AAQ8	Harldibari	45.5	41.1	42.5	45.3	16.2	13.8	14.9	16.1	16.2	11.7	14.8	16.1	19.8	16.1	17.6	19.3
AAQ9	Sonoval	45.2	40.2	42.1	44.9	14.0	12.3	12.9	14.0	14.0	10.1	12.7	14.0	17.9	13.9	15.7	17.8
AAQ10	Lachit Goan	47.7	40.5	42.5	46.9	16.3	12.8	14.8	16.3	16.3	12.1	14.7	16.3	18.4	14.4	16.3	18.3
Range		**39.3-51.7**				**12.0-17.6**				**10.1-17.2**				**12.4-19.8**			

Monitoring Station	Locations	THC (µg/m³)				CH_4 HC (µg/m³)				Non-CH_4 HC (µg/m³)				CO				VOC
		Max	Min	Avg	98th %le	Max	Min	Avg	98th %le	Max	Min	Avg	98th %le	Max	Min	Avg	98th %le	(µg/m³)
AAQ1	Baramukhia	271	204	243	270	164	131	142	162	122	71	100	121	267	191	228	264	<0.1
AAQ2	Langta	280	217	245	279	160	130	143	159	128	74	102	123	281	198	232	275	<0.1
AAQ3	Gelabil	265	216	244	264	161	131	144	160	118	76	100	117	281	198	228	267	<0.1
AAQ4	Naharani	288	225	246	282	165	130	142	161	133	82	103	127	296	201	244	293	<0.1
AAQ5	Lakhi pathar	261	212	238	259	155	129	141	154	116	71	97	115	377	206	273	330	<0.1
AAQ6	Rangma pathar	267	215	236	260	162	122	140	162	116	79	96	116	384	278	325	378	<0.1
AAQ7	Dhupguri	280	226	252	278	162	131	143	159	128	85	109	127	394	267	352	392	<0.1
AAQ8	Harldibari	279	219	244	272	159	131	141	158	130	80	103	126	396	209	338	393	<0.1
AAQ9	Sonoval	274	225	248	273	160	132	144	160	122	80	104	121	420	206	323	400	<0.1
AAQ10	Lachit Goan	280	216	247	276	151	131	142	151	131	74	105	126	361	221	316	346	<0.1
Range		**204-288**				**122-165**				**71-133**				**191-420**				<0.1

3.7 Water Quality

Selected water quality parameters of ground water and surface water resources within block area for the study has been carried out for assessing the water environment and evaluate anticipated impact of present project. Understanding the water quality is essential in preparation of Environmental Impact Assessment and to identify critical issues with a view to suggest appropriate mitigation measures for implementation.

The purpose of this study is to:

- Assess the water quality characteristics for critical parameters; and
- Predict the impact of water quality due to the proposed exploratory drilling well and related activities.

Three surface water and five ground water samples covering entire block area were examined for physico-chemical, heavy metals and bacteriological parameters.

The samples were collected and analysed once during the study period. The samples were analyzed as per the procedures specified in 'Standard Methods for the Examination of Water and Wastewater' published by American Public Health Association (APHA).

3.7.1 Water Sampling Locations

In the study area, three surface and five ground water samples were collected for winter season (15th January 2016 to 8th April 2016).These samples were taken as grab samples and were analyzed for various parameters to compare with the standards. The water sampling locations are listed below in **Table-3.7.1** and are depicted in **Figure-3.7.1**. The results of surface water and ground water samples carried out for the study are presented in **Table-3.7.2** and **Table 3.7.3**.

TABLE-3.7.1
WATER SAMPLING LOCATIONS

Sr. No.	Sampling Location	Location
Surface Water		
1	SW1	Langta jan (river)
2	SW2	Haru Langta jan (river)
3	SW3	Rangma (river)
Ground Water		
1	GW1	Baramukhia village
2	GW2	Lakhi pathar village
3	GW3	Ramgma Pathar village
4	GW4	Dhupguri village
5	GW5	Haldibari village

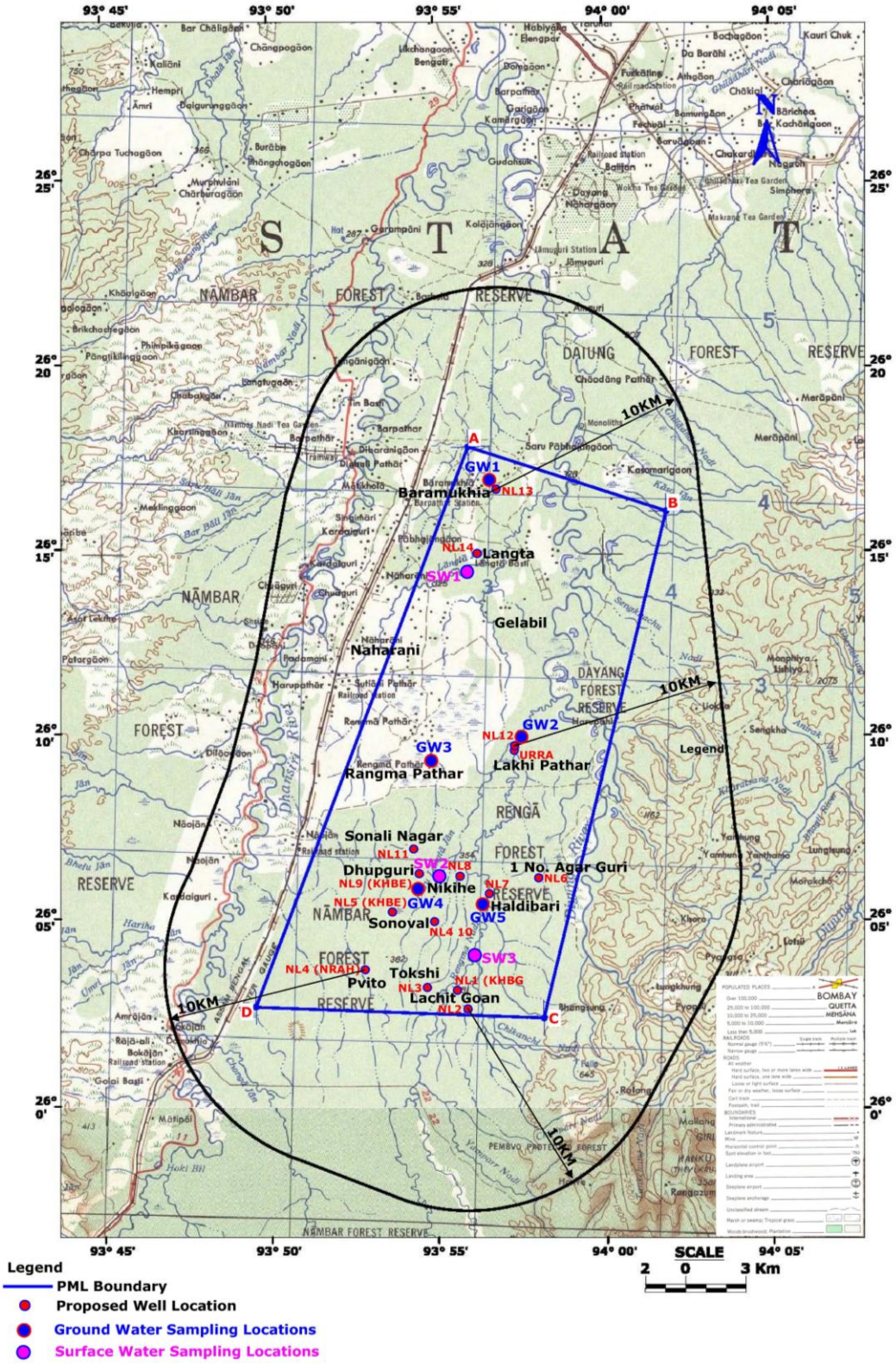


FIGURE-3.7.1
WATER SAMPLING LOCATIONS

	
Lakhi Pathar	**Dhupguri Village**

FIGURE-3.7.2
WATER SAMPLING LOCATIONS

3.7.2 Presentation of Results

Surface Water Quality

The results for the surface water samples analysed are presented in **Table 3.7.2**.

- The analysis results of surface water samples indicate that the pH value was observed to be 7.4 - 7.8.
- Electrical conductivity of surface water samples was observed to be 108 - 195.
- The Dissolved solids were observed about 70 - 130 mg/l.
- Sulphates were found to be in the range of 2.0 – 7.0 mg/l, and Nitrates were found to be in the range of 1.0 – 1.9 mg/l which are with in the prescribed limits only.
- Fluoride concentration was found to be 0.2 – 0.4 mg/l the samples.

Ground Water Quality

The results for the ground water samples analysed are presented in **Table 3.7.3.**

- The analysis results of ground water samples showed the pH in range of 7.1-7.9. The maximum value was observed at GW1 and the minimum value observed at GW2 whereas the prescribed limit of is 6.5 to 8.5.
- Colour and Turbidity of the samples ranged from 4-6 Hazens and 5-8 NTU respectively.
- Electrical conductivity of the samples ranged from 115 – 548 µS/cm.
- The Total Hardness of the samples ranged from 30.0 – 137 mg/l. The maximum value was observed at GW2 and the minimum value observed at GW5 whereas the prescribed limit of 200 mg/l.
- Calcium and Magnesium concentrations ranged from 6.6 – 26.4 mg/l and 3.2 – 17.2 mg/l respectively.
- The Total Dissolved solids of the samples ranged from 75 - 360 mg/l. The maximum TDS was observed at GW2, and where as the minimum value observed at GW5. The TDS values are well with in the prescribed limit of 500 mg/l
- Range of Chlorides and Sulphates concentrations at all the locations 2.9 -18.5 mg/l and sulphate concentration as 3.2 – 9.4 mg/l. Similarly, Nitrates are also found to be ranging between 1.1 – 10.8 mg/l.
- Fluoride concentrations are ranging in between 0.2 – 1.0 mg/l and are found to be within the permissible limits.

- Iron concentrations in ground waters varied from 0.09 – 0.24 mg/l. All other metal concentrations are observed to be below detectable limits.

Based on the above results it is evident that all of the parameters in ground water fairly meet the desirable standard limits of IS: 10500.

TABLE-3.7.2
SURFACE WATER QUALITY

Sr. No.	Parameters	UOM	SW1	SW2	SW3
1	pH	--	7.6	7.4	7.8
2	Color	Hazen	5	4	7
3	Conductivity	µS/cm	150	108	195
4	Total Dissolved Solids	mg/l	100	70	130
5	Dissolved Oxygen	mg/l	6.1	5.9	6.0
6	Biological Oxygen Demand	mg/l	<3	<3	<3
7	Chemical Oxygen Demand	mg/l	<5	<5	<5
8	Total Hardness	mg/l	30	24	40
9	Total Alkalinity	mg/l	48	36	64
10	Calcium as Ca	mg/l	7.2	6.0	10.2
11	Magnesium as Mg	mg/l	2.8	2.2	3.6
12	Chlorides as Cl	mg/l	15.4	9.6	15.5
13	Residual Chlorine	mg/l	<0.2	<0.2	<0.2
14	Sulphates as SO_4^{2-}	mg/l	2.2	2.0	7.0
15	Fluorides as F	mg/l	0.3	0.2	0.4
16	Nitrates as NO_3	mg/l	1.0	1.2	1.9
17	Sodium as Na	mg/l	18.5	12.4	23.1
18	Potassium as K	mg/l	3.1	1.8	4.4
19	Total Boron as B	mg/l	0.09	0.06	0.08
20	Cyanides	mg/l	<0.02	<0.02	<0.02
21	Phenolic Compounds	mg/l	<0.001	<0.001	<0.001
22	Mineral Oil	mg/l	<1.0	<1.0	<1.0
23	Cadmium as Cd	mg/l	<0.01	<0.01	<0.01
24	Arsenic as As	mg/l	<0.003	<0.003	<0.003
25	Copper as Cu	mg/l	<0.01	<0.01	<0.01
26	Lead as Pb	mg/l	<0.01	<0.01	<0.01
27	Iron as Fe	mg/l	0.21	0.18	0.15
28	Chromium as Cr^{+6}	mg/l	<0.05	<0.05	<0.05
29	Selenium as Se	mg/l	<0.01	<0.01	<0.01
30	Zinc as Zn	mg/l	0.28	0.64	0.35
31	Aluminium as Al	mg/l	0.06	0.05	0.01
32	Mercury as Hg	mg/l	<0.001	<0.001	<0.001
33	SAR	--	1.48	1.1	1.58
34	Insecticides	mg/l	Absent	Absent	Absent
35	Anionic Detergents as MBAs	mg/l	<0.2	<0.2	<0.2
36	Total Coliform	MPN/100ml	16	25	18

$: Limits not specified as per IS: 10500, UO: Un-Objectionable, Ag-Agreeable, NR-No Relaxation

TABLE-3.7.3
GROUND WATER QUALITY

Sr. No.	Parameter	Unit	Limits as per IS10500	GW1	GW2	GW3	GW4	GW5
1	pH	-	6.5-8.5 (NR)	7.9	7.1	7.65	7.42	7.55
2	Colour	Hazen	5(25)	5	5	6	5	4
3	Taste	-	Agreeable	Ag	Ag	Ag	Ag	Ag
4	Odour	-	Agreeable	Ag	Ag	Ag	Ag	Ag
5	Conductivity	µS/cm	$	220	548	334	430	115
6	Turbidity	NTU	1(5)	6	8	7	5	5
7	TDS	mg/l	500(2000)	140	360	220	280	75
8	Total Hardness as $CaCO_3$	mg/l	300(600)	66	137	97	116	30
9	Total Alkalinity	mg/l	200(600)	100	230	140	190	42
10	Calcium as Ca	mg/l	75(200)	13.8	26.4	21	24.6	6.6
11	Magnesium as Mg	mg/l	30(100)	7.6	17.2	10.8	13.2	3.2
12	Residual Chlorine	mg/l	0.2(1.0)	<0.2	<0.2	<0.2	<0.2	<0.2
13	Boron	mg/l	0.5(1.0)	0.03	0.01	0.05	0.04	0.08
14	Chlorides as Cl	mg/l	250(1000)	2.9	18.5	10.2	10.6	7.2
15	Sulphates as SO_4	mg/l	200(400)	3.1	9.4	3.2	4.4	4.2
16	Fluorides as F	mg/l	1.0(1.5)	0.4	1.0	0.8	0.5	0.2
17	Nitrates as NO_3	mg/l	45(NR)	1.1	5	10.8	3.2	2
18	Sodium as Na	mg/l	$	19	58	30	41.5	12.4
19	Potassium as K	mg/l	$	2	8	5.5	6.5	1.8
20	Phenolic Compounds	mg/l	0.001(0.002)	<0.001	<0.001	<0.001	<0.001	<0.001
21	Cyanides	mg/l	0.05(NR)	<0.02	<0.02	<0.02	<0.02	<0.02
22	Anionic Detergents	mg/l	0.2(0.1)	<0.2	<0.2	<0.2	<0.2	<0.2
23	Mineral Oil	mg/l	0.5(NR)	<0.01	<0.01	<0.01	<0.01	<0.01
24	Cadmium as Cd	mg/l	0.03(NR)	<0.003	<0.003	<0.003	<0.003	<0.003
25	Arsenic as As	mg/l	0.01(0.05)	<0.01	<0.01	<0.01	<0.01	<0.01
26	Copper as Cu	mg/l	0.05(1.5)	<0.01	<0.01	<0.01	<0.01	<0.01
27	Lead as Pb	mg/l	0.01(NR)	<0.01	<0.01	<0.01	<0.01	<0.01
28	Manganese as Mn	mg/l	0.1(0.3)	<0.01	<0.01	<0.01	<0.01	<0.01
29	Iron as Fe	mg/l	0.3(NR)	0.15	0.09	0.24	0.21	0.16
30	Chromium as Cr+6	mg/l	0.01(NR)	<0.05	<0.05	<0.05	<0.05	<0.05
31	Selenium as Se	mg/l	0.01(NR)	<0.01	<0.01	<0.01	<0.01	<0.01
32	Zinc as Zn	mg/l	5(15)	0.04	0.06	0.08	0.02	0.05
33	Aluminium as Al	mg/l	0.03(0.2)	0.01	<0.01	<0.01	<0.01	<0.01
34	Mercury as Hg	mg/l	0.001(NR)	<0.001	<0.001	<0.001	<0.001	<0.001
35	Pesticides	mg/l	Absent	Absent	Absent	Absent	Absent	Absent
36	E.Coli	-	Absent	Absent	Absent	Absent	Absent	Absent
37	Total Coliforms	MPN/100ml	10	NIL	NIL	NIL	NIL	NIL

$: Limits not specified as per IS: 10500, UO: Un-Objectionable, Ag-Agreeable, NR-No Relaxation

3.8 Noise Level Survey

The physical description of sound concerns its loudness as a function of frequency. Noise in general is sound which is composed of many frequency components of various types of loudness distributed over the audible frequency range. Various noise scales have been introduced to describe, in a single number, the response of an average human to a complex sound made up of various frequencies at different loudness levels. The most common and universally accepted scale is the A weighted Scale which is measured as dB (A). This is more suitable for audible range of 20 to 20,000 Hz. The scale has been designed to weigh various components of noise according to the response of a human ear.

The impact of noise sources on surrounding community depends on:

- Characteristics of noise sources (instantaneous, intermittent or continuous in nature). It can be observed that steady noise is not as annoying as one which is continuously varying in loudness;
- The time of day at which noise occurs, for example high noise levels at night in residential areas are not acceptable because of sleep disturbance; and
- The location of the noise source, with respect to noise sensitive landuse, which determines the loudness and period of exposure.

The environmental impact of noise can have several effects varying from Noise Induced Hearing Loss (NIHL) to annoyance depending on loudness of noise. The environmental impact assessment of noise from the existing exploratory drilling, construction activity, and vehicular traffic can be undertaken by taking into consideration various factors like potential damage to hearing, physiological responses and annoyance and general community responses.

The main objective of noise monitoring in the study area is to establish the baseline noise levels, and assess the impact of the total noise generated by the drilling operations around it.

3.8.1 Identification of Sampling Locations

A preliminary reconnaissance survey has been undertaken to identify the major noise generating sources in the area. Noise at different noise generating sources has been identified based on the activities in the village area, ambient noise due to traffic and the noise at sensitive areas like hospitals and schools.

The noise monitoring has been conducted for determination of noise levels at ten locations in the study area for winter season (15th January 2016 to 8th April 2016). The noise levels at each location were recorded for 24 hours. The environment setting of each noise monitoring location is given in **Table-3.8.1** and depicted in **Figure-3.8.1**.

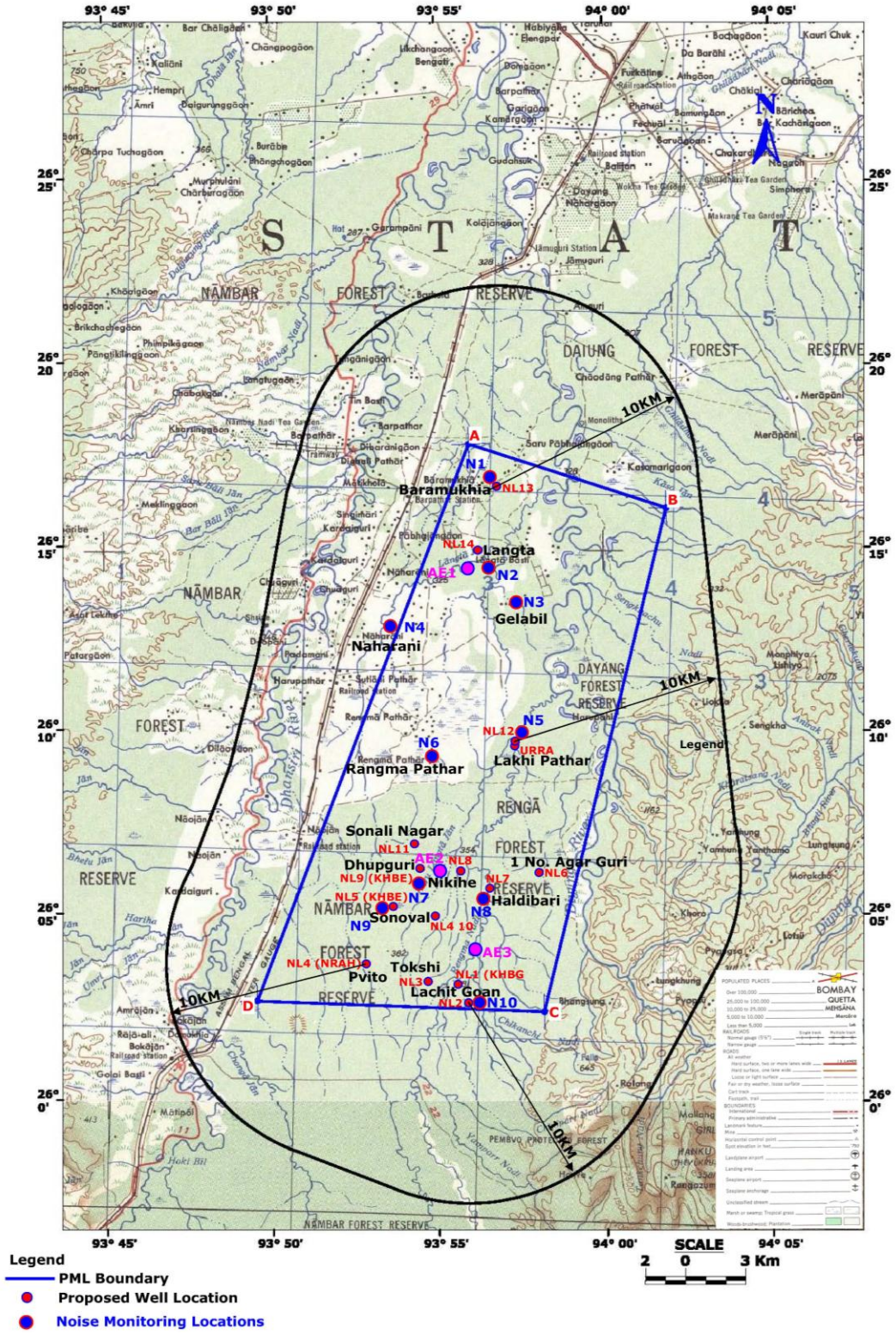
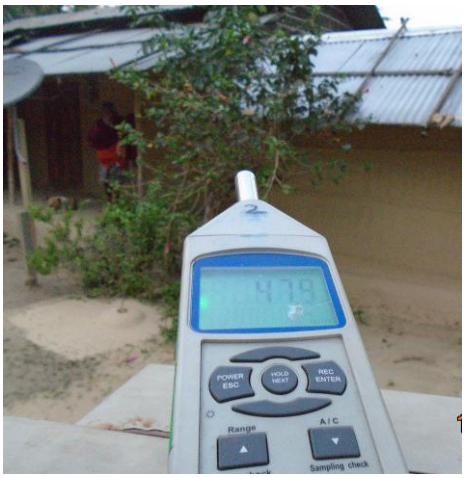


FIGURE-3.8.1
NOISE MONITORING LOCATIONS

Lakhi Pathar



Harlidibari Village

Dhupguri Village

FIGURE-3.8.2
NOISE MONITORING PHOTOGRAPHS

TABLE-3.8.1
DETAILS OF NOISE MONITORING LOCATIONS

Monitoring Station	Name of the Station
N1	Baramukhia village
N2	Langta village
N3	Gelabil village
N4	Naharani village
N5	Lakhi pathar village
N6	Rangma pathar village
N7	Dhupguri village
N8	Harldibari village
N9	Sonoval village
N10	Lachit Goan village

3.8.2 Method of Monitoring

Sound Pressure Level (SPL) measurements were measured at all locations. The readings were taken for every hour for 24 hours. The day noise levels have been monitored during 6 am to 10 pm and night levels during 10 pm to 6 am at all the locations covered in the block area for the study.

3.8.3 Presentation of Results

The statistical analysis is done for measured noise levels at ten locations during parly winter and pre monsoon season. The parameters are analyzed for L_{day}, L_{night}, and L_{dn}. These results are tabulated in **Table-3.8.2.** Standard noise limits are given in the **Table 3.8.3**

TABLE-3.8.2
NOISE LEVELS IN THE STUDY AREA

Monitoring Station	Location	L10	L50	L90	Leq	Lday	Lnight	Ldn
N1	Baramukhia	44.3	40.2	36.4	41.3	42.1	38.4	45.8
N2	Langta	44.5	40.5	36.7	41.5	42.3	38.7	45.9
N3	Gelabil	45.4	41.5	37.8	42.5	43.3	39.7	46.8
N4	Naharani	46.1	41.9	38.0	43.0	43.9	40.0	47.6
N5	Lakhi pathar	44.2	40.4	36.8	41.4	42.1	38.6	48.8
N6	Rangma pathar	44.0	40.2	36.6	41.2	41.9	38.4	48.6
N7	Dhupguri	42.6	38.9	35.4	39.9	40.6	37.2	43.9
N8	Harldibari	43.3	39.5	35.8	40.5	41.2	37.7	44.7
N9	Sonoval	43.9	39.8	35.9	40.8	41.7	37.9	45.4
N10	Lachit Goan	43.6	39.6	35.8	40.6	41.4	37.7	46.1

TABLE-3.8.3
AMBIENT NOISE STANDARDS

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

Ambiant Noise Standards of CPCB

3.8.4 Observation of Results

The daytime (L_{day}) noise levels at all the locations are observed to be in the range of 40.6 dB (A) to 43.9 dB (A). The nighttime (L_{night}) noise levels at all the locations were observed to be in the range of 37.2dB (A) to 40.0 dB (A). It is observed that the noise levels at residential locations are within the prescribed limit of CPCB ambient noise standard.

3.9 Ecological Studies

3.9.1 Introduction

During the primary ecological survey, Sr Scientist (ecologisit) of Vimta had interacted with the Assistant Divisional Forest Officer of Golaghat district, Assam. Ecological studies are one of the important aspects of Environmental Impact Assessment with a view to conserve environmental quality and biodiversity. Ecological systems show complex inter-relationships between biotic and abiotic components including dependence, competition and mutualism. Biotic components comprise of both plant and animal communities, which interact not only within and between themselves but also with the abiotic components a viz. physical and chemical components of the environment.

Generally, biological communities are good indicators of climatic and edaphic factors. Studies on biological aspects of ecosystems are important in Environmental Impact Assessment for safety of natural flora and fauna. The biological environment includes terrestrial and aquatic ecosystems.

The animal and plant communities co-exist in a well-organized manner. Their natural settings can get disturbed by any externally induced anthropological activities or by naturally occurring calamities or disaster. So, once this setting is disturbed, it sometimes is either practically impossible or may take a longer time to come back to its original state. Hence, changes in the status of flora and fauna are an elementary requirement of Environmental Impact Assessment studies, in view of the need for conservation of environmental quality and biodiversity. Information on flora and fauna was collected within the study area. Relevant details on aquatic life within the study area were collected from related government offices.

The present report gives the review of published secondary data and the results of field sampling conducted during January – April 2016.

3.9.2 Objectives of Ecological Studies

The present study was undertaken with the following objectives:

- To assess the nature and distribution of vegetation in and around the block area;
- To assess the distribution of animal life spectra;
- To study inventory of flora and fauna in proposed block area
- To prepare status report of flora and fauna in proposed block area
- To understand the productivity of the water bodies; and
- To ascertain migratory routes of fauna and possibility of breeding grounds.

3.9.3 Methodology adopted for the Survey

To achieve the above objectives, a detailed study of the entire block area was undertaken. The different methods adopted were as follows:

- Compilation of secondary data with respect to the study area from published literature and Government agencies;
- 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; and
- Gathering data for ethno-biology.

3.9.4 Forest block with in the study area

ONGC proposes 15 exploratory drilling wells within Nambar reserve forest, Renga reserve forest blocks and Dayang forest blocks in which proposed ONGC wells are located Golaghat district, Assam as given in the **Table-3.9.1**.

TABLE-3.9.1
FOREST BLOCKS WITHIN STUDY AREA

Sr. No	Forest Blocks
1	Nambar Reserve Forest
2	Renga Reserve Forest
3	Dayang Reserve Forest

3.9.5 Terrestrial Ecological Status: Primary Survey

A preliminary survey was made in the study block area. The primary data was generated through:

1. Preparing a general checklist of all plants encountered in the study area. This would indicate the biodiversity for wild and cultivated plants.
2. Determining the bird population of migratory and local birds by taking 10 random readings at every location;
3. Observing mammals, amphibians and reptiles, noting their calls, droppings, burrows, pugmarks and other signs; and
4. Local inhabitants were interviewed for use of plants and animals and to get ethno biological data.

The list of Terrestrial Ecological Locations located in the forest block as given in the **Table- 3.9.2**.

TABLE -3.9.2
TERRESTRIAL ECOLOGICAL SAMPLING LOCATIONS

Station Code	Name of the Station
TE-1	Baramukhia village
TE-2	Langta village
TE-3	Gelabil village
TE-4	Naharani village

Station Code	Name of the Station
TE-5	Lakhi Pathar village
TE-6	Rangma Pathar village
TE-7	Dhupguri village
TE-8	Haldibari village
TE-9	Sonoval village
TE-10	Lachit Gaon village

3.9.5 Wildlife Areas Near The Study Area

Daigrung Nambor Wildlife Sanctuary and Kalaphar Elephant Corridor & Garampani Wildlife Sanctuary

Santuary areas near the oil blocks are as follows with distance and directions marked in the toposheet of the study area map.

Nambor - Doigrung Wildlife Sanctuary is situated at distance of 25 km from most of the individual proposed drilling well locations. The nearest well locations from the sanctuary are; NL- 14 is 11.6 km away and NL -13 is 10.3 km away, NL-12 is 20.7 km away. Located in Morangi area of Golaghat district of Assam. Sanctuary covers an area of 97. 15 km^2. It is located 25 km from Golaghat town and about 318 km from Guwahati LGBI Airport. The forest type is tropical semi-evergreen with pockets of pure evergreen, interspersed with small forest marshes. The area was declared as a Wildlife sanctuary on April 17th 2003.

Nambhar Wildlife Sanctuary is situated at the Distance of 11.7 Km at the direction of North North West direction from the block.

Sanctuary covers an area of 37 km^2. The area was declared as a sanctuary in July 27th, 2000. It is located 25 km from Golaghat district and 65 km from the Kaziranga National Park.

Kalaphar Daigurung Elephant corridor is notified corridor found in the during the field visit at distance of 18.3 km at the direction of North West from the block.

Garmapani Wildlife Sanctuary (6 km^2) is situated about distance of 10.8 km, in South West direction from the block area.

Hollongapar Gibbon Wildlife Sanctuary is situated at about 63 km from study area at North East direction from the block area.

3.9.5.1 Flora in the Study Area

The vegetation in the study area falls under six categories as per the Champion and Seth's revised classification. Most of the area is covered by tea gardens. These are Himalayan Lower Bhabar Sal, Cachar Tropical Evergreen Forest, Moist Mixed Deciduous Forest, Low Alluvial Savannah Woodland, Moist Mixed Deciduous Forest, Dry Bamboo Brakes and Secondary Moist Bamboo Brakes.

The proposed exploratory drilling wells are proposed in Nambar ML, Khoraghat Ext ML, Golaghat district PEL and Golaghat Ext IIA PML blocks in Golaghat district.

The upper canopy consists mostly of *Dipterocarpus macrocarpus* rising 12 to 30 m (39 to 98 ft) and having straight trunks. Other species found in the top canopy include Sam *(Artocarps chaplasha*), Amari (*Amoora wallichi*), Sopas (*Mcheliai spp.),* Bhelu (*Tetramels mudiflora*), Udal (*Sterculia villosa*) and Hingori (*Castanopsis spp*.). Nahar (*Mesua ferrea*) dominates the middle canopy with its spreading crown, casting fairly heavy shade over a wide area. Other species that make up the middle canopy include Bandordima (*Dysoxylum procerum*), Dhuna (*Conarium resiniferum*), Bhomora (*Terminalia belerica*), Ful Gomari (*Gmelina sp*.) Bonbogri (*Pterospermum lanceafolium)*, Morhal (*Vatica lanceafolia*), Selleng (*Sapium baccatum*), Sassi (*Aqualari agolacha*), and Otenga (*Dillenia indica*).

A variety of evergreen shrubs and herbs make up the lower canopy and ground layers. The most common of these are Dolu bamboo (*Teinosstachyum dullooa*), Bojal bamboo (*Pseudostachyum polymorphum*), Jengu (Calamus erectus), Jati bet (*Calamus spp.*), Houka bet (*Calamus spp*.), Tora (*Alpinia allughas*), Kaupat The most common and valuable species found were *Shorhea robusta, Syzigium cuminii, Dipterocarpus turbinatus, Anogeissus latifolia, Terminalia bellarica, Dendrocalamus sps., Gmelina arborea, Artocarpus* sp., etc, that forms the uniform density on favorite sites.

The undergrowth consists mainly of *Lantana camara, Cassia tora, Bambusa offinis, Bambusa teres, Calotropis procera, Tephrosia hamiltonii, Woodfordia fructicosa, Hyptis suaveolens and, Clerodendron* species.

During the floristic survey, a total of 118 plant species were recorded during the field survey.

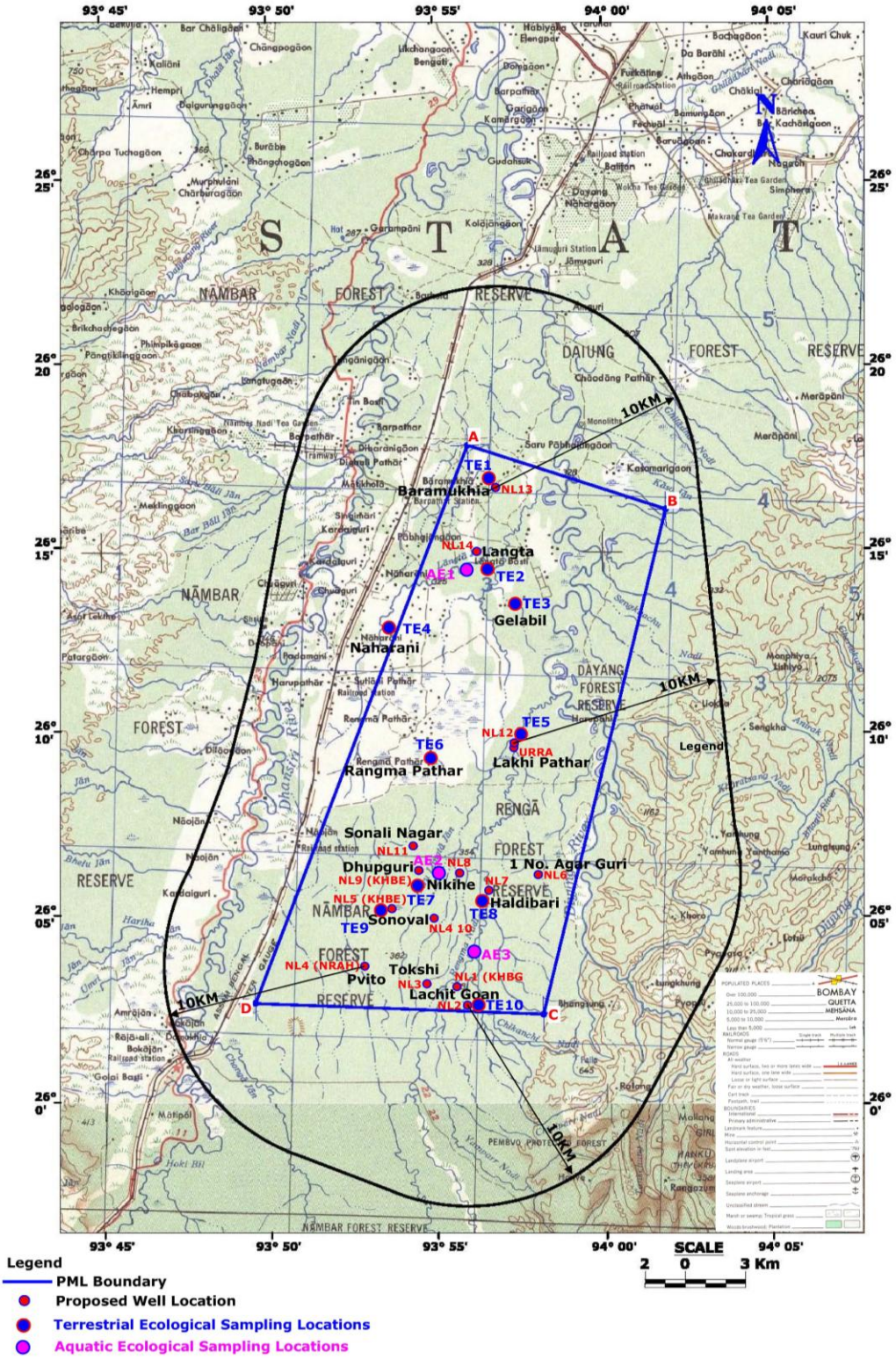


FIGURE-3.9.1
ECOLOGICAL SAMPLING LOCATIONS

The list of recorded plant species in the block area are presented in **Table-3.9.3**.

TABLE-3.9.3
PLANT SPECIES RECORDED IN BLOCK AREA

Sr. No.	Common Name	Botanical Name	Family
Tree			
1	Aam	*Mangifera indica*	Anacardiaceae
2	Sapeda	*Manilkara zapota*	Sapotaceae
3	Kaju	*Anacardium occidentale*	Anacardiaceae
4	Palas	*Butea monosperma*	Fabaceae
5	Taal	*Borassus flabellifer*	Arecaceae
6	Kanthal	*Artocarpus heterophyllus*	Moraceae
7	Neem	*Azadirachta indica*	Meliaceae
8	Babla Gaach	*Acacia nilotica*	Mimosaceae
9	Piara	*Psidium guajava*	Mrytaceae
10	Bel	*Aegle marmelos*	Rutaceae
11	Baut Gaach	*Ficus bengalensis*	Moraceae
12	Umber	*Ficus racemosa*	Moraceae
13	Pipal, Ashathya	*Ficus religiosa*	Moraceae
14	Gulmohar	*Delonix regia*	caesalpiniaceae
15	Aatha	*Annona squamosa*	Annonaceae
16	Australian Wattle/	*Acacia auriculiformis*	Mimosaceae
17	Rabar	*Ficus elastica*	Moraceae
18	Lakshmi	*Mangifera sylvatica*	Anacardiaceae
19	Amlaki	*Phyllanthus emblica*	Euphorbiaceae
20	Arahar	*Cajanus cajan*	Leguminosae
21	Asoka	*Saraca indica*	Leguminosae
22	Awal	*Stereospermum cholonides*	Verbenaccae
23	Baghachra ilata	*Dalbergia stipulacea*	Leguminosae
24	Mera (medda)	*Trewia nudiflora*	Euphorbiaceae
25	Bahera	*Terminalia belerica*	Combretaceae
26	Minijiri	*Cassia siamea*	Leguminosae
27	Nageswar	*Mesua ferrea*	Guttiferae
28	Nour	*Bursera serrata*	Burseraceae
29	Padauk	*Pterocarpus indicus*	Leguminosae
30	Pitraj (rahena)	*Ammoora rohituka*	Meliaceae
31	Poma (rangi)	*Cedrela toona*	Meliaceae
32	Poma, markatya	*Schleichera trijuga*	Sapindaceae
33	Pyinkade	*Xylia dolabriformis*	Leguminosae
34	Rata (lali)	*Amoora walichii*	Meliaceae
35	Segun	*Tectona grandis*	Verbenaceae
36	Simul	*Salmalia malabarica, Bombax malabaricum*	Malvaceae
37	Sissoo	*Dalbergia sissoo*	Leguminosae
38	Sonal	*Cassia fistula*	Leguminosae
39	Tetul	*Tamarindus indica*	Leguminosae
40	Tejpat	*Cinnamomum tamala*	Lauraceae
41	Udal	*Sterculia villasa*	Sterculiaceae
42	Urium	*Bischofia javanica*	Euphorbiaceae
43	Pani	*Terminalia myriecarpa*	Combretaceae
44	Jam, geda	*Eugenia operacalta*	Myrtaceae
45	Jam, kala	*Eugenia jambolana*	Myrtaceae
46	Jam, tita	*Eugenia cymosa*	Myrtaceae
47	Jinari	*Premna bengalensia*	Verbenaceae
48	Jinari	*Premna barbata*	Verbenaceae
49	Jiol	*Odina wodier*	Anacardiaceae
50	Kadam	*Anthocephalus indicus*	Rubiaceae
51	Kajikara	*Garuga pinnata*	Burseraceae
52	Kanta-kui	*Bridelia retusa*	Euphorbiaceae

Sr. No.	Common Name	Botanical Name	Family
53	Kendu	*Diospyros melanoxylon*	Ebenaceae
54	Kheta (chegarashi)	*Chukrasia tabularis*	Meliaceae
55	Karai, Siris	*Albizzia procera*	Mimosaceae
56	Lichu	*Litchi chinensis*	Sapindaceae
57	Nilgiri	*Eucalyptus* sp	Myrtaceae
58	Karanj	*Pongamia pinnata*	Fabaceae
59	Supari	*Areaca catechu*	Arecaceae
60	Kajur	*Phoenix sylvestris*	Areacaceae
61	Narikel	*Cocos nucifera*	Arecaceae
62	Balati /amli	*Pithecelobium dulce*	Mimosaceae
63	Kul	*Zizyphus jujuba*	Rhamnaceae
64	Saal	*Shorea robusta*	Dipterocarpaceae
65	Bish-lata	*Millettia psehycarpa*	Leguminosae
66	Boga-medoloa	*Tephrosia candida*	Leguminosae
67	Chalta	*Dillenia indica*	Dilleniaceae
68	Chamal	*Artocarpus chaplasha*	Moraceae
69	Chandul (maina, rairal)	*Tetrameles nudiflora*	Datisaceae
70	Chatiwan	*Alstonia scholaris*	Apocynaceae
71	Debdaru/ False Ashoka	*Polyalthia longifolia*	Anonaceae
72	Dhup	*Canarium bengalense*	Burseraceae
73	Garjan	*Dipterocarpus turbinatus*	Dipterocarpaceae
74	Gorak-narikel (Bandarpela, Cach)	*Sterculia alata*	Sterculiaceae
75	Haldu	*Haldina-Adina cordifolia*	Rubiaceae
76	Harguza	*Dillenia pentagyna*	Dilleniaceae
77	Harish	*Albizzia stipulate*	Mimosaceae
78	Haritaki	*Terminalia chebula*	Comtretaceae
79	Hizal	*Barringtonia acutangula*	Lecy thidaceae
80	Mahogany	*Swietenia mahogeni*	Sterculiaceae
81	Mandar	*Erythrina suberosa*	Leguminosae
Shrub			
82	Bajna	*Zanthoxylum budrunga*	Rutaceae
83	Bankadam	*Hymenodictyon excelsum, Wall*	Rubiaceae
84	Bans, barak (barua)	*Bambusa baleeoa*	Gramineae
85	Cha, Chai	*Camellia sinensis*	Theaceae
86	Lantana	*Lantana camara*	Verbenaceae
87	Buno tulsi	*Hyptis suaveolens*	Lamiaceae
88	Malabar nut	*Adhatoda vasica*	Acanthaceae
89	Railway creeper	*Ipomea fistulosa*	Convolvulaceae
90	Aakanda	*Calotropis procera*	Asclepiadaceae
91	Bans, Kalyai	*Oxytenanthera nigrocilista*	Gramineae
92	Nirgundi	*Vitex negundo*	Verbenaceae
93	Gokru	*Xanthium stromarium*	Tiliaceae
94	Kul	*Zizyphus mauritiana*	Rhamnaceae
95	Jaba Phool	*Hibiscus rosa-sinensis*	Malvaceae
96	Bans, Kanak-kai	*Bambusa affinis*	Gramineae
97	Bans, Makal	*Bambusa pallida, Munro*	Gramineae
98	Bans, Mitinga	*Bambusa tulda*	Gramineae
99	Bans, Muli	*Melocanna bambusoides*	Gramineae
100	Bans, Parwa	*Bambusa teres*	Gramineae
101	Barai, ban	*Zizyphus rugosa*	Rhamnaceae
Shrubs/ Herbs			
102	Bandar-hola	*Mucuna pruriens*	Leguminosae
103	Bans, Pocha	*Dendrocalamus hamiltonii*	Gramineae
104	Bans rupai (orah)	*Dendrocalamus longispathus*	Gramineae
105	Til	*Sesamum indicum*	Pedaliaceae
106	Haldi	*Curcuma* sp	Zingiberaceae
107	Khagra	*Saccharum spontaneum*	Graminae

Sr. No.	Common Name	Botanical Name	Family
108	Bata	*Erianthus ravennas*	Graminae
109	Binna (khus-khus)	*Andropegon squarrrous*	Graminae
110	Dhutra	*Datura metel*	Solanaceae
111	Copper Leaf Pod	*Alternantera sessilis*	Asteraceae
112	Athibala/ Indian Mallow	*Abutilon indicum*	Malvaceae
113	Uttareni/Prickly Chaff flower	*Achyranthes aspera*	Amaranthaceae
114	Mexican Daisy	*Tridax procumbens*	Asteraceae
115	Chhan	*Imperate arundinacea*	Graminae
116	Hogla	*Typha elephantina.*	Typhaceae
Climbers			
117	Sonbel	*Bauhinia vahlii*	Caesalpiniaceae
Parasites			
118	Amarbel	*Cuscuta reflexa*	Convolvulaceae

- **Tea Gardens**

The commercial tea gardens comprised of *Camilia sinensis* –Tea, shrubs are which are normally pruned from time to time.

- **Floristic Structure and Composition**

The region covered under the study area is totally non-urbanized area such as villages, agricultural lands and forest areas etc. Vegetation along this is good due to suitable condition viz; water, soil and geography. Vegetation is mixed and varying in condition, composition and density. Dependence of villagers on natural vegetation in this region is more for timber and firewood. Presence of 'Tea gardens' in front of homesteads and in the sporadic patches are found in the study area were observed.

The nature of vegetation cover is mixed, moist, evergreen and deciduous type with the dominance of *Shorea robusta, Tectona grandis, Artocarpus species, and Bambusa* sp, *Albizzia* sp. etc*.* Most of the human population is dependent on agriculture for their livelihood. The grazing is a common practice because of more number of cattle and openly available land for grazing. Some medicinal plants were also recorded, amongst which *Aegle marmelos, Azadirachta indica, Acacia nilotica, Emblica officinalis, Magnifera indica, Madhuca longifolia* and *Casia fistula* are important one*.*

The density and composition of vegetation is more near the forest area whereas low in the agricultural and village areas. Grasses mainly cover open degraded land. Herbs and shrubs are abundant mostly during monsoon whereas during the summer land turns dry and herb withers.

The vertical structure of the vegetation shows three distinct stories viz; top, middle and ground. *Tectona grandis, Albizzia lebbek, Terminalia* sp*., Shorea robusta*, comprise top story of vegetation. *Dendrocalamus* sp, *Bambusa* sp*., Lagerstroemia parviflora, Artocarpus* sp*., Aegle marmelos* and *Dalbergia latifolia* form the middle canopy whereas *Zizyphus glaberrima, Holerrhena pubescens, Woodfordia fructicosa*, *Cassia fistula* and others form the lower story in the study area. The ground vegetation is composed of herbs such as *Calotropis procera, Cassia tora, Hyptis suaveolens, Tephrosia hamiltonii, Sida rhombifolia, and Vitis* species.

- **Threatened Plant Species**

No – Rare and endangered species of the plants are found in the study area. As per the records of the Botanical Survey of India.

- **Agriculture**

The staple food of the people in the study region is rice and wheat. Agro-climatic conditions of the area provide a range of potentialities for growing cash crop like off seasonal vegetable i.e. onion, chilly, brinjal, bhindi, fruits and flowers. Kitchen gardening is also common because of sufficient available space around house.

The commercial cultivation of tea gardens (*Camellia sinensis)* is found in the study area.

Main agricultural crop production in study area is paddy (*Oriza sativa*) supplemented by wheat (*Triticum aestivum*). The common rabbi crops grown in the study area are wheat, gram, mustard, turmeric, potato, carrot, pea etc. whereas rice, jowar, arhar, tur, moong, til, groundnut, soyabean, chilly and, ginger, etc are kharif crops. Other than cereals, fruits like mango, pineapple, orange, jackfruit, banana, litchi, lemon, papaya, sapota and guava are also grown in large quantity. The list of the agricultural crops in the study area is given in **Table-3.9.4**.

TABLE-3.9.4
LIST OF AGRICULTURAL CROPS

Sr. No.	Scientific Name	Common Name
Rabi		
Cereals		
1	*Triticum aestivum*	Wheat
2	*Zea mays*	Maize
Pulses		
1	*Phaseolus sp*	Gram
Oil Seeds		
	Brassica juncea	Mustard
Vegetables		
1	*Coriandrum anum*	Coriander
2	*Allium sativum*	Garlic
3	*Capsicum anum*	Chilly
4	*Solanum tuberosum*	Potato
5	*Daucus carata*	Carrot
6	*Pisum sativum*	Pea
Kharif		
Cereal		
1	*Oriza sativa*	Rice
2	*Sorghum vulgarum*	Jowar
3	*Cajanus cajan*	Arhar
4	*Phaseolus angularis*	Urd
5	*Phaseolus mungo*	Moong
Oil seed		
1	*Seasamum* sp	Til
2	*Arachys hypogea*	Groundnut
3	*Glycine max*	Soya bean
Vegetables		
1	*Capsicum anum*	Chilly

Sr. No.	Scientific Name	Common Name
2	*Zingiber officinale*	Ginger
Others		
1	*Solanum tuberosam*	Potato
2	*Saccarum officianalis*	Sugarcane
3	*Corchorus* sp	Jute

Source: Directorate of Agriculture, Golaghat Assam

3.9.5.2 Fauna in Study Area

The study of fauna was undertaken at the proposed site and within the block area. The land is mostly occupied with non-urban settings, agricultural and natural vegetation. The climatic conditions vegetation's and presence of some water bodies highly supports the population of birds as well as some mammals at the nearby vegetation areas. Domestic animals mainly cow, goat and buffalos were observed in study area.

The study area mainly consists of *Bambusa species* (Bamboo) and *Areca catechu* (Areca palms) and interspersed with paddy fields. Therefore, biodiversity in this region is fragmented with presence of plantations and tea gardens comprising of home steads of areca plantations found in the study area.

Presence of mammals like monkeys, squirrels, mongoose, rabbits and rats are common in the study area. List of fauna, along with mammals, avifauna, reptiles and amphibians is presented in the **Table-3.9.5.**

TABLE-3.9.5
LIST OF FAUNA

Sr. No.	Common Name	Scientific Name	Schedule of the Indian Wildlife (Protection) Act
A) Mammals			
1	Rhesus Macaque	*Macaca radiata*	Sch-II
2	Common flying fox of India	*Pteropus giganteaus*	Sch-V
3	Large bamboo rats	*Rhizomys sinensis*	Sch-V
4	Indian Hare	*Lepus nigricollis*	Sch-IV
5	Wild boar	*Sus scrofa*	Sch-III
B) Aves (Birds)			
1	The common house crow	*Corvus splendens*	Sch-V
2	Jungle Crow	*Corvus macrorhynchos*	Sch-IV
3	The red Vented Bulbul	*Pycnonotus cafer*	Sch-IV
4	The red whiskered Bulbul	*Pynonotus jocosus*	Sch-IV
5	Common Drongo	*Dicrurus adsimilis*	Sch-IV
5	Common House Myna	*Acridotheris tristis*	Sch-IV
6	The pied Myna	*Sturnus contra*	Sch-IV
7	House sparrow	*Passer domesticus*	Sch-IV
8	Indian Tree pie	*Dendrocitta vagabunda*	Sch-IV
9	Common Babbler	*Turdoides caudatus*	Sch-IV
10	The Great Racket tailed Drongo	*Dicrurus paradiseus*	Sch-IV
11	The Jerdons Chloropsis	*Chloropsis jerdoni*	Sch-IV
12	The Striated Green Bulbul	*Ploceus phillippinus*	Sch-IV
13	The shama	*Copsychus malabaricus*	Sch-IV
14	Indian Wren Warbler	*Prinia subflava*	Sch-IV
15	The streaked fantail warbler	*Cisticola juncidis*	Sch-IV
16	The Tailor bird	*Orthotomus sutorius*	Sch-IV
17	The jungle Myna	*Acredotheres fuscus*	Sch-IV
18	The Hill Myna	*Gracula religiosa*	Sch-IV
19	The black headed oriole	*Oriolus xanthornus*	Sch-IV
20	Baya weaver Bird	*Ploceus philippinus*	Sch-IV

Sr. No.	Common Name	Scientific Name	Schedule of the Indian Wildlife (Protection) Act
21	The white Wagtail	*Motacilla alba*	Sch-IV
22	The yellowheaded wagtail	*Motacila citreola*	Sch-IV
23	The Grey Wagtail	*Motacila cinerea*	Sch-IV
24	Spotted Munia	*Lonchura punctulata*	Sch-IV
25	The Red-Munia	*Amandava amandava*	Sch-IV
26	The white Munia	*Lonchura striata*	Sch-IV
27	The purple sunbird *	*Nectarinia asiatica*	Sch-IV
28	The purple rumped sunbird	*Nectarina zeylonica*	Sch-IV
29	The Indian Yellow backed sunbird	*Aethopyga siparaja*	Sch-IV
30	The scarlet Minivet	*Pericrocotus flammeus*	Sch-IV
31	The Indian Roller or the blue jay	*Coracias benghalensis*	Sch-IV
32	The common Bee Eater	*Merops orientalis*	Sch-IV
33	White breasted king fisher	*Halcyon smyrnenssis*	Sch-IV
34	The common king fisher	*Alcedo atthis*	Sch-IV
35	The black capped king fisher	*Halcyon pileata*	Sch-IV
36	The Indian Hoopoe	*Upupa epops*	Sch-IV
37	Indian cuckoo	*Cuculus micropterus*	Sch-IV
38	The pied crested cuckoo	*Clamator jacobinus*	Sch-IV
39	The Crow Pheasant	*Centropus sinensis*	Sch-IV
40	The common Koel	*Eudynamis scolopacea*	Sch-IV
41	Blossom-headed parakeet	*Psittacula cyanocephala*	Sch-IV
42	Indian Red breasted Parakeet	*Psittacula fasciatus*	Sch-IV
43	Eastern Rose Ringed parakeet	*Psittacula krameri*	Sch-IV
45	The Brown fish owl	*Ketupa zeylonensis*	Sch-IV
46	The scops owl	*Otus scops*	Sch-IV
47	The Indian Spotted Dove	*Spilopelia chinensis*	Sch-IV
48	The Red jungle fowl	*Gallus gallus*	Sch-IV
49	Water cocks	*Gallicrex cinera*	Sch-IV
50	Sarus Crane	*Grus antigone*	Sch-IV
51	The Bronze winged jacana	*Metopidius indicus*	Sch-IV
52	The pheasant tailed jacana	*Hydrophasianus chirurgus*	Sch-IV
53	Stone Curlew	*Burhinus oedicnemus*	Sch-IV
54	Red Wattled Lapping	*Vanellus indicus*	Sch-IV
55	The white necked stork	*Ciconia episcopus*	Sch-IV
56	The Cattle Egret	*Bulbulcus ibis*	Sch-IV
57	The paddy Bird or the pond Heron	*Ardeola grayii*	Sch-IV
58	The Night Heron	*Nyclricorax nucticorax*	Sch-IV
59	The Chestnut Bittern	*Ixobrychus cinnamomeus*	Sch-IV
60	The Little Green Bittern	*Ixobrychus minutus*	Sch-IV
61	Shovellers	*Anas clypeata*	Sch-IV
62	The Common Teal	*Anas crecca*	Sch-IV
63	The Cotton Teal	*Nettapus coromandelianus*	Sch-IV
64	Lesser Golden Backed Woodpecker	*Dinopium benghalense*	Sch-IV
Reptiles			
1	Cobra	*Naja naja*	Sch-II
2	Rat snake	*Ptyas mucosus*	Sch-II
3	Common Krait	*Bungarus coeruleus*	Sch-II
4	Russell's viper	*Vipera russellii*	Sch-II
5	Garden lizard	*Calotes versicolor*	Sch-IV
6	Indian Chameleon	*Chameleon zeyalanicus*	Sch-II
Amphibians			
1	Cricket Frog	*Fejervarya limnocharis*	Sch-IV
2	Indian Bull Frog	*Hoplobatrachus tigerinus*	Sch-IV

3.9.6 Aquatic Ecological Status: Primary Survey

The impact of pollution on aquatic ecosystem manifests itself first on the biotic aquatic communities. The species composition of aquatic organisms in natural communities is directly influenced by ambient water quality. The responses of plants to pollutants, when measured quantitatively give an insight about the conditions of existing aquatic ecosystem.

3.9.6.1 Plankton Study

Protecting the environment and making efficient use of natural resources are two of the most pressing demands in the present stage of social development. The task of preserving the purity of the atmosphere and water basins is of both national and global significance since there are no boundaries to the propagation of anthropogenic contaminants in the water. An essential pre requisite for the successful solution to these problems is to evaluate ecological impacts from the baseline information and undertake effective management plan. So the objective of aquatic ecological study may be outlined as follows:

- To characterize water bodies like fresh waters;
- To understand their present biological status;
- To characterize water bodies with the help of biota;
- To understand the impact of industrial and urbanization activities; and
- To suggest recommendations to counter adverse impacts, if any on the ecosystem.

To meet these objectives following methods were followed:

- Generating data by actual field sampling and analysis in these areas through field visits during study period; and
- Discussion with local people to get the information for aquatic plants and aquatic animals.

To fulfill these objectives and to understand the present status of aquatic ecosystem, samples were collected from different fresh water system (river). In order to get a clear picture and to assess the various parameters of water, three samples were collected during study period. The sampling locations are presented in **Table-3.9.6** and shown in **Figure-3.9.1**.

TABLE-3.9.6
DETAILS OF AQUATIC SAMPLING LOCATIONS

Sr. No.	Code	Aquatic Ecological Locations
1	AE-1	Langta
2	AE-2	Haru Langta
3	AE-3	Rengma Nadi

3.9.6.2 Methodology Adopted for Aquatic Studies

The biological species specific for a particular environmental conditions are the best indicators of environmental quality. This includes different biological species such as phytoplankton, zooplankton and bacteria.

Diatoms, desmids and dinophyceaen members are indicative of clean water conditions. Increasing dominance of diatoms, ciliates, flagellates, chlorophycean and cyanophycean species indicates progressively increasing trophic conditions. Presence of *Euglenophyceae* indicates high eutrophic conditions. Planktonic rotifers are usually more abundant in fresh water than estuarine waters

The plankton samples were collected by using plankton net. The filamentous algae and debris were avoided by filtering through the plankton net. The collected sample was condensed to 100 ml by filtration and the samples were preserved using pinch of Rose Bengal and 10 ml of 4% formaldehyde solution.

For the measurement of frequencies of various forms of Phytoplankton and Zooplankton, one drop of the sedimented plankton was mounted on a micro-slide, as many as 20 different microscopic fields situated at more or less even distances from each other were examined, and numbers of individual organisms are counted. The plankton forms were identified up to species level and expressed as organisms per milliliter of the sample.

It should also be noted that diversity is also susceptible to other parameters such as turbidity, colour, nutrients and flow rates etc., particularly in hilly rivers. A widely accepted ecological concept is that community with larger number of species i.e. with high diversity will have high stability that can resist adverse environmental factors.

Phytoplankton group reported from three locations, belonging to bacillariophyceae and cyanophycese followed by chlorophyceae and euglenophyceae members. About 11 species of phytoplankton were reported from three locations.

3.9.6.3 Zooplankton

About 6 zooplankton species are recorded from all the sampling locations. The list of plankton recorded in fresh water bodies in study area during study period are presented in **Table-3.9.7** and **Table-3.9.8**.

TABLE-3.9.7
LIST OF PHYTOPLANKTON SPECIES IDENTIFIED FROM STUDY AREA

Sr. No	Family	Species
1	***Bacillariophyceae***	*Navicula* sp D*iatoma* sp *Synedra* sp *Cyclotella* sp *Gomphonema sp* Nitischia sp
2	***Cyanophyceae***	Chlorella sp *Scenedesmus* sp *Ankistodesmus* sp
3	***Chlorophyceae***	*Merismopidia sp*
4	***Euglenophyceae***	*Euglena* sp

TABLE-3.9.8
LIST OF ZOOPLANKTON SPECIES IDENTIFIED FROM STUDY AREA

Family	Zooplankton Species
Rotifera	*Brachinous* sp
Arthropoda	*Nauplius* sp
	Acroperus sp
	Macrothrix sp
	*Ceriodaphnia s*p
	Simocephalus sp

3.9.7 Fishes

The list of fish found in the study area.

TABLE-3.9.9
LIST OF SPECIES OF FISHES FOUND IN THE STUDY AREA

Sr. No.	Scientific Name	Local Name	English Name
1	*Catla catla*	Katal / Catla	Katla
2	*Labeo rohita*	Rui	Rohu
3	*Labeo calbasu*	Baush kalibaush	Calbasu / Black rohita
4	*Labeo gonius*	Goinya	Goania
5	*Cirrhinus mrigala*	Mrigal / mikra	Mrigal
6	*Labeo bata*	Bata	Bata
7	*Cirrhinus reba*	Bhagna	Reba
9	*Rhinomugil corsula*	Corsula / Nadir bata	Corsula mullet
8	*Hypophthalmichthys molitrix*	Silver carp	Silver carp
9	*Hypophthalmichthys nobilis*	Big head	Big head
11	*Ctenopharyngodon idellus*	Grass carp	Grass carp
12	*Puntius javanicus*	Japani Puti	Java Puti
13	*Cyprinus carpio var communis*	Carpio / Japani rui	Common carp / Scale carp.
14	*Oreochromis mossambica*	Tilapia	Tilapia / Mozambique cichlid
15	*Pangasins sutchi*	Pungas	Pungas
16	*Clarias batrachus*	Magur / Jhagur	Magur
17	*Clarias gariepinus*	Atrican magur	African giant magur
18	*Heteropneustes fossilis*	Singhi / singi	Stinging catfish

Source: Directorate of Fisheries, Golaghat, Assam

3.9.8 Conclusion

The area is rich in agrarian biodiversity, with 'Tea cultivation', paddy cultivation which dominate the landscape of the study area.

There are no presence of the Schedule–I animals, and also the elephant corridor is situated away at a distance of 18.3 km.

Nambhar Doigrung Wildlife Sanctuary is situated at distance of 25 km from the actual well locations and about 11.6 km distance from the nearest block area.

Also the Garampani Wildlife Sanctuary is situated at about a distance of 30 km away from the study area.

The study area is dotted with tea gardens and plantation areas comprising of Areca palms (Betel nut palms) which are found in the study area. The study area is fragmented due to anthropogenic interventions.

3.10 Demography and Socio-Economics

The demographic and socio- economic conditions prevailing in the block of the proposed drilling of exploratory wells in the SAS block area located in Lachit gaon-1, Lachit gaon-2, Tokshi, Pvito, Sonowal, Azarguri-1, Haldibari, Nikihe, Dhupguri, Sonali nagar, Lakhi pathar, Baramukhia, Langta villages in Sarupathar revenue circle, Golaghat revenue circle, Golaghat district of Assam" is analyzed. The socio-economic data forms the basis for developing a suitable enterprise social responsibility plan to address the needs of the population.

The project proponent is committed to take up the socio-economic development initiatives not only to minimize the negative impact on the population and also improve the socio-economic status of population living in the block of the area as its sustained effort as part of corporate social responsibility.

3.10.1 Methodology Adopted for the Study

The methodology adopted for the study mainly includes primary survey, review of published secondary data (District Census Statistical Handbooks-2011 and Primary Census Abstract of Census-2011) with respect to population, density, household size, sex ratio, social stratification, literacy rate and occupational structure for block in the study area.

3.10.2 Review of Demographic and Socio-Economic Profile-2011

The village wise demographic data of 238 villages falling with in the SAS block as per the 2011 census is given in **Annexure-VII**. The salient features of the demographic and socio-economic conditions are analyzed and described in the following sections.

3.10.3 Demography

As per the 2001 census the total population of the study area is 1,24,406 persons. The population reported as per the 2011 census is 1,35,280 persons. Overall around 8.7% more decennial growth is reported in the study area.

The growth rate of population in the study area comparatively reported less than the growth rate of state (Assam Rural 15.5). The reason for less growth rate is due to migration to urban areas like Jorahat and Golaghat for employment.

- **Distribution of Population**

As per 2011 census the study area consisted of 1,35,280 persons inhabited in study area. The distribution of population in the study area is shown in **Table-3.10.1**.

TABLE-3.10.1
DISTRIBUTION OF POPULATION

Particulars	Block area
No. of Households	28412
Male Population	68643
Female Population	66637
Total Population	135280
Male Population (0-6 years)	9195
Female Population (0-6 years)	8899
Total Population (0-6 years)	18094
% of 0-6 years population	13.38
Average Household Size	4.76
% of males to the total population	50.74
% of females to the total population	49.26
Sex Ratio (no of females per 1000 males)	971
Density	365

Source: District Census Hand Book –2011

- **Average Household Size**

The study area has a household size of 4.76 as per 2011 census, which has decreased from 5.49 in 2001. This is mainly due to population control measures, health awareness programs.

- **Population Density**

The density of population reveals that the study area has an overall density of 365 persons per km^2 (PP km^2) as per 2011 census reports. As per the census the density of population of state is 398.

The density of population in the study area comparatively reported less than the density of state, this is mainly due to migration to urban areas like Jorahat, and Golaghat for employment.

- **Sex Ratio**

The configuration of male and female indicates that the males constitute to about 50.74% and females to 49.26% of the total population as per 2011 census records. The study area on an average has 971 females per 1000 males as per 2011 census reports. In comparison to the Assam state rural sex ratio, the state (Assam rural 960) the study area has recorded higher sex ratio. The sex ratio in the study area indirectly reveals certain sociological and cultural aspects in relation with female births.

3.10.4 Social Structure

In the study area, as per 2011 census 0.83% of the population belongs to Scheduled Castes (SC) and 17.33% to Scheduled Tribes (ST). Overall the data of social stratification reveals that the SC and ST % to population is more than 18%, The SC and ST community are marginalized and they are at considered at low level of social strata and calls for a special attention in Social Impact Management

Plan for improving their socio-economic status apart from preservation and protection of their art, culture and traditional rights of livelihood. The distribution of population by social structure is shown in **Table-3.10.2**.

TABLE-3.10.2
DISTRIBUTION OF POPULATION BY SOCIAL STRUCTURE

Particulars	Block area
Schedule caste	1128
% To the total population	0.83
Schedule Tribes	23446
% To the total population	17.33
Total SC and ST population	24574
% To total population	18.17
Total population	1,35,280

Source: District Census Hand Book –2011

3.10.5 Literacy Levels

The data of study area reveals that literacy rate of 75.06% as per 2011 census, which is found to be less than the district rate of literacy (Golaghat 77.4%). The distribution of literate and literacy rate in the study area is given in **Table-3.10.3**.

TABLE-3.10.3
DISTRIBUTION OF LITERATE AND LITERACY RATES

Particulars	Block area
Male Population	68643
Female Population	66637
Total Population	135280
Male Population (0-6 years)	9195
Female Population (0-6 years)	8899
Total Population (0-6 years)	18094
Total Population above 7 years	117186
Male literates (7+ years)	48548
Female literates (7+ Years)	39413
Total literates (7+ Years)	87961
Male literacy rate (%) to the total literates	55.19
Female literacy rate (%) to the total literates	44.81
Average Male Literacy to the total population (%)	41.43
Average female Literacy to the total population (%)	33.63
Total Literacy rate (%) to the total population	75.06

Source: District Census Hand Book–2011

The percentage of male literates to the total literates of the study area works out to be 55.19%. The percentage of female literates to the total literates, which is an important indicator for social change, is observed to be 44.81% in the study area as per 2011 census records.

3.10.6 Occupational Structure

The occupational structure of residents of work participation rate in the study area is studied with reference to main workers, marginal workers and non-

workers. The main workers include 10 categories of workers defined by the Census Department consisting of cultivators, agricultural laborers, those engaged in live-stock, forestry, fishing, mining and quarrying; manufacturing, processing and repairs in household industry; and other than household industry, construction, trade and commerce, transport and communication and other services.

The marginal workers are those workers engaged in some work for a period of less than six months during the reference year prior to the census survey. The non-workers include those engaged in unpaid household duties, students, retired persons, dependents, beggars, vagrants etc.; institutional inmates or all other non-workers who do not fall under the above categories.

Total work participation in the project study areas is 47.99% and the non-workers constitute 52.01% of the total population respectively. The distribution of workers by occupation indicates that the non-workers are the predominant population. The main workers to the total workers are 59.42% and the marginal workers constitute to 40.58% to the total workers. The occupational structure of the study area is shown in **Table-3.10.4.**

TABLE-3.10.4
OCCUPATIONAL STRUCTURE

Particulars	Block area
Total Population	135280
Total workers	64927
Work participation rate (%)	47.99
Total main workers	38580
% of main workers to total workers	59.42
Marginal workers	26347
% of marginal workers to total workers	40.58
Non-workers	70353
% of non-workers to total population	52.01

Source: District Census Hand Book-2011

3.10.7 Infrastructure Facilities

The infrastructure and amenities the proposed drilling of exploratory wells block area Lachit gaon -1, Lachit gaon -2, Tokshi, Pvito, Sonowal, Azarguri-1, Haldibari, Nikihe, Dhupguri, Sonali nagar, Lakhi pathar, Baramukhia, Langta villages in Sarupathar revenue circle, Golaghat revenue circle, Golaghat district of Assam" is analyzed." It is observed that infrastructure facilities are poor in the project study area, which consists of education, health care, drinking water facilities, communications, transportation, etc.

A review of infrastructure facilities available in the area has been done based on available secondary data published in Golaghat district primary census abstract 245 villages are considered for data analysis and assessment within the study area.

3.10.7.1 Educational Facilities

The educational facilities are found to be moderate in the proposed drilling of exploratory wells SAS block area. There are 185 Government primary schools, 95 Private Primary Schools, 54 Government Middle Schools, 23 Private Middle Schools, 10 Government secondary schools, 16 Private Secondary Schools, 02 Government Senior Secondary Schools and 03 Private Senior Secondary Schools are available . There is no Government and private, art and science, Government engineering colleges on SAS Block area. The available educational facilities in the area are given in **Table-3.9.5** and **Annexure-VIIA.**

TABLE-3.10.5
EDUCATIONAL FACILITIES IN THE SAS BLOCK AREA

Sr.No	Institution	SAS Block
1	Govt. Primary School (Numbers)	185
2	Private Primary School (Numbers)	95
3	Govt. Middle School (Numbers)	54
4	Private Middle School (Numbers)	23
5	Govt Secondary School (Numbers)	10
6	Private Secondary School (Numbers)	16
7	Govt Senior Secondary School (Numbers)	2
8	Private Senior Secondary School (Numbers)	3
9	Govt Arts and Science Degree College (Numbers)	0
10	Private Arts and Science Degree College (Numbers)	0
11	Govt Engineering College (Numbers)	0
12	Private Engineering College (Numbers)	0

Source: District Census Statistics –2011

3.10.7.2 Health Facilities in Rural Area

The national norm for population coverage per sub-center is 3000 for tribal areas and 5,000 for plain areas. Similarly, it is recommended to have a Primary Health Centre (PHCs) for population of 20,000 to 30,000 and CHC (community Health Center) for population in the range 80,000 to 1, 20,000. The number of PHCs served by a CHC is yet another indicator by which the physical accessibility can be judged. As per national norms, 1 PHCs should be served by one CHC.

The types of health facilities available in the SAS Block area is include, 03 Primary Health centers, 15 primary health sub centers, 11 Maternity and child welfare center, 01 family welfare center overall 245 villages in the SAS block area. The community health centers, Mobile health clinics, TB clinics, Hospital Alternative Medicine, Dispensaries, Veterinary Hospitals, Family Welfare Centers and Mobile Health Clinic are nil as per census 2011, the health facilities are found to be very poor in the rural villages in the SAS block area. The available Health facilities in the study area are given in **Table-3.10.6 and Annexure-VIIB.**

TABLE- 3.10.6
HEALTH FACILITIES IN THE RURAL VILLAGES OF SAS BLOCK AREA

Sr.No	Institution	SAS Block
1	Community Health Centre (Numbers)	0
2	Primary Health Centre (Numbers)	3
3	Primary Health Sub Centre (Numbers)	15
4	Maternity And Child Welfare Centre (Numbers)	11
5	TB Clinic (Numbers)	0
6	Hospital Allopathic (Numbers)	0
7	Hospital Alternative Medicine (Numbers)	0
8	Dispensary (Numbers)	0
9	Veterinary Hospital (Numbers)	0
10	Mobile Health Clinic (Numbers)	0
11	Family Welfare Centre (Numbers)	1

Source: District Census Statistics –2011

3.10.8 Drinking Water facility in the rural villages of the SAS Block area

One of the most important factors responsible for the emergence of a settlement is availability of water. Many water sources such as wells, hand pumps, tube well, tank etc. are available in rural areas. In the villages under study, the main source of water is tank, followed by tap. The water of the hand-pump is used for drinking for animals, bathing and household purposes. There are fewer ponds in the area and are mostly dry except for monsoon months. The water from the ponds is generally not used by the villagers except for bathing animals.

It was reported that during the summer season, large number of wells become dry and the major source of water in the villages during lean season are the hand pumps and some deep borings. However, more than half the hand pumps in these villages were not functional and required repair.

245 villages are covered in the total SAS block area; the study area of all villages does not have tap water facilities from treated source. 44 villages are having Tap Water Untreated sources, 77 villages are having covered well sources, 126 villages are having un-covered well sources, 198 villages are having hand pump facilities, 128 villages are having Tube Wells/Borehole sources, 61 villages are having River/Canal source, 18 villages are having spring sources and 116 villages are having Tank/Pond/Lake sources. All villages are mostly dependent about hand pump water, tube well and borehole. The list of water sources in the SAS Block area is given in **Table-3.10.7 and Annexure-VIIC.**

TABLE-3.10.7
DRINKING WATER FACILITY IN THE RURAL VILLAGES OF SAS BLOCK AREA

Sr.No	Source of Drinking Water source (Availability of number of villages)	SAS Block
1	Tap Water-Treated	61
2	Tap Water Untreated	44
3	Covered Well	77
4	Uncovered Well	126
5	Hand Pump	198
6	Tube Wells/Borehole	128

Sr.No	Source of Drinking Water source (Availability of number of villages)	SAS Block
7	Spring	18
8	River/Canal	61
9	Tank/Pond/Lake	116
10	Others	5
Source: Census of India 2011		

3.10.8.1 Transport Facilities

The study area is served by rail and road transport facilities. While other villages are having approaches only with mud roads.

As a whole, the study area has moderate level of transport and connectivity network.

3.10.8.2 *Communication Infrastructure*

In the SAS block area 245 villages, 03 villages is having post office services, 04 villages are having are having sub post office services, 38 villages are having land line facilities, 01 villages having Public Call Office /Mobile (PCO), 146 villages are having mobile phone network courage and 02 villages are having Internet Cafes/Common Service Centre (CSC), private courier facilities post and Telegraph Offices are not available in the rural area of the SAS block area as per 2011 census. The list of communication infrastructure details in SAS Block area is given in **Table-3.10.8 and Annexure-VIID.**

TABLE-3.10.8
COMMUNICATION INFRASTUCTURE ON THE SAS BLOCK AREA

Sr.No	Communication Infrastructure (Availability in number of villages)	SAS Block
1	Post Office	3
2	Sub Post Office	4
3	Post And Telegraph Office	0
4	Telephone (landlines)	38
5	Public Call Office /Mobile (PCO)	1
6	Mobile Phone Coverage	146
7	Internet Cafes / Common Service Centre (CSC)	2
8	Private Courier Facility	0
Source: Census of India 2011		

3.10.8.3 Electrification in Rural Area

In the SAS block area total 245 villages, 174 villages are having Power Supply for domestic use, 12 villages are having Power Supply for agriculture use, 22 villages are having Power supply for commercial use and 5 villages are having Power Supply for all users. Electricity was supplied for domestic, agricultural and public lighting purposes. The power supply in the SAS block area is considered be poor because Power supply for all users is only 5 villages. The list of power supply details are given in **Table-3.10.9 and Annexure-VIIE.**

TABLE-3.10.9
AVAILABILITY OF POWER SUPPLY IN THE SAS BLOCK AREA

Sr. No	Availability of power supply in rural study area	SAS Block
1	Power Supply For Domestic Use	174
2	Power Supply For Agriculture Use	12
3	Power Supply For Commercial Use	22
4	Power Supply For All Users	5
Source: Census of India 2011		

3.10.9 Needs Identified in the Study Area

- Overall around 8.7% more decennial growth is reported in the study area. The growth rate of population in the study area comparatively reported less than the growth rate of state (Assam Rural 15.5). The reason for less growth rate is may be due to migration to urban areas like Jorahat, Golaghat for employment.

- The study area has a household size of 4.76 as per 2011 census, which has decreased from 5.49 in 2001.

- The study area on an average has 971 females per 1000 males as per 2011 census reports. In comparison to the Assam state rural sex ratio, the state (Assam rural 960)

- The SAS Block area literacy rate of 75.06% as per 2011 census, which is found to be less than the district rate of literacy (Golaghat 77.4%).

- The distribution of workers by occupation indicates that the non-workers are the predominant population.

- There is no Government and private, art and science, Government engineering colleges on SAS Block area.

- The health facilities are found to be very poor in the rural villages in the SAS block area.

- 245 villages are covered in the total SAS block area; the study area of all villages does not have tap water facilities from treated source.

- In the SAS block area 245 villages, 03 villages is having post office services, 04 villages are having are having sub post office services.

- In the SAS block area total 245 villages, 174 villages are having Power Supply for domestic use, 12 villages are having Power Supply for agriculture use, 22 villages are having Power supply for commercial use and 5 villages are having Power Supply for all users.