

# STATE OF ENVIRONMENT, ASSAM AMBIENT AIR AND WATER QUALITY, 2014



**Pollution Control Board, Assam**  
Bamunimaidam, Guwahati-21

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*Released by Hon'ble  
Chief Minister of  
Assam*

*Sjt. Tarun Gogoi*

*on the occasion of  
World Environment Day,  
5th June 2015 at  
Assam Agriculture  
University, Jorhat*





**Pollution Control Board, Assam**  
Department of Environment & Forests  
Government of Assam

**Dr. R. M. Dubey, IFS**  
**Chairman**

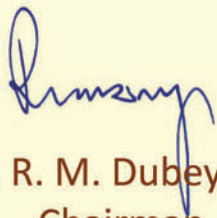
## Preface

Pollution Control Board, Assam has been engaged in the monitoring of water and ambient air quality since 1989 and 1993 respectively under National Water Monitoring Programme (NWMP) and National Air Monitoring Programme (NAMP). The Board has, by now, set up 101 NWMP stations and 22 NAMP stations all across the State. The data are being collected on monthly/quarterly/half yearly basis depending upon the anticipated pollution fluctuations at each station and are being analysed at the Central laboratory of the Board as well as in the Regional Laboratories set up at Sivasagar, Bongaigaon, Silchar and Tezpur. The Analysis reports are being submitted online to Central Pollution Control Board, Delhi for preparing National Data Bank.

The PCBA has been publishing the data and reports based on out come of analysis of samples in its Annual Reports. As a policy matter, the Board has now moved a step forward to bring the knowledge acquired on status of air and water quality in public domain by publication of "State of Environment, Assam - Ambient Air and Water Quality, 2014" on every World Environment Day starting from 2015.

The data being released through this Report are basically the summary data, but, is felt to be of immense use for planners, academicians and researchers in the field of Environmental Science.

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Dr. R. M. Dubey, IFS  
Chairman

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# **PART- I**

# **AMBIENT AIR QUALITY**



# PART – I : AIR QUALITY OF ASSAM

## 1. Introduction

Various anthropogenic activities along with the industrial activities has an irreversible impact on the air quality. It is dynamic in character and a change in air quality in certain place have impacts on places far away falling in the direction of prevailing air passage. Air pollution adversely affects the biological species in affected areas including human beings causing many diseases. The problem of pollution and its adverse ecological impacts get aggravated due to increasing industrial and anthropogenic activities. Monitoring of air quality on specific points relating to the source of air pollution is an essential exercise of the Board. In order to have a better understanding on air environment, base level information on environmental status with respect to air environment is very important. The Pollution Control Board, Assam has been monitoring air pollution in in non-polluted (ambient) areas to acquire base line data for the State, so that difference in status could give us information regarding pollution created by industries. In order to safeguard the deterioration of air quality, Government of India has enacted Air (Prevention & Control of Pollution) Act in 1981. The responsibility has been further emphasized under Environment (Protection) Act, 1986.

To realize the spirit of the said Acts, the Central Pollution Control Board (CPCB) initiated National Ambient Air Quality Monitoring (NAAQM) programme in the year 1984 with 7 stations in the country initially. Subsequently the programme has been renamed as National Air Monitoring Programme (NAMP) and the air quality monitoring network has been strengthened by increasing the number of monitoring stations. By now (2010), the total number of ambient air quality monitoring station have been increased to 439 stations covering 178 cities across the country. All State Pollution Control Board of the country, 5 Pollution Control Committees (PCCs) in various Union Territories along with the National Environment Engineering Research Institute are part of the ambient air quality monitoring network under NAMP.

### 1.1 National Ambient Air Quality Standards

The National Ambient Air Quality Standards (NAAQS) for assessment and interpretation of air quality against the parameters observed are given in the *Table No. 1*.

**Table No. 1: Revised National Ambient Air Quality Standards (NAAQS)  
(NAAQS Notification dated 18<sup>th</sup> November, 2009)**

Sl. No.	Pollutant	Time Weighted Average	Concentration in Ambient Air ( $\mu\text{g}/\text{m}^3$ )	
			Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government)
1.	Sulphur Dioxide ( $\text{SO}_2$ ), $\mu\text{g}/\text{m}^3$	Annual*	50	20
		Average**	80	80
2.	Nitrogen Dioxide ( $\text{NO}_2$ ), $\mu\text{g}/\text{m}^3$	Annual*	40	30
		Average**	80	80
3.	Suspended Particulate Matter, $\mu\text{g}/\text{m}^3$	Annual*	140	70
		Average**	200	100
4.	Particulate Matter (size less than $10\ \mu\text{m}$ ) or $\text{PM}_{10}$ , $\mu\text{g}/\text{m}^3$	Annual*	60	60
		Average**	100	100
<b>Note</b>	*	<i>Annual Arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval.</i>		
	**	<i>24 hourly/ 8 hourly values should be met 98% of the time in a year. However, 2% of the time, it may exceed but not on two consecutive days. Annual Arithmetic mean of minimum 104 measurements in a year taken twice a week at uniform interval.</i>		

## 1.2 Air Pollutants, their Sources and Effects

The major air pollutants, their sources and effects are presented in the *Table No. 2* below.

**Table No. 2: Major Sources of Air Pollutants and their Effects**

Pollutant	Possible Sources		Effects	
	Natural	Anthropogenic	Human/flora/fauna	Environment & property
<p><b>Sulphur dioxide (SO<sub>2</sub>)</b> SO<sub>2</sub> is the chemical compound produced by volcanoes and in various industrial processes and are also a precursor to particulates in the atmosphere.</p>	<ul style="list-style-type: none"> <li>• Volcanos (67%)</li> </ul>	<ul style="list-style-type: none"> <li>• Combustion of fossil fuel (coal, heavy fuel oil in thermal power plants, office, factories)</li> <li>• Paper industry</li> <li>• Extravtion &amp; distribution of fossil fuels.</li> <li>• Smelting of metals (sulfide ores to produce copper, lead and zinc)</li> <li>• Petroleum refining</li> <li>• Combustion process in diesel, petrol, natural gas driven vehicles</li> </ul>	<p>Respiratory illness Visibility impairment Aggravate existing heart and lung diseases</p>	<ul style="list-style-type: none"> <li>• Acid rain</li> <li>• Aesthetic damage</li> </ul>
<p><b>Oxide of Nitrogen (NO<sub>2</sub>)</b> Oxides of nitrogen are a generic term for a group of highly reactive gases that contain nitrogen and oxygen in varying amounts. NO<sub>x</sub> are emitted as nitrogen oxide (NO) which is rapidly oxidized to more toxic nitrogen dioxide (NO<sub>2</sub>). Nitrogen dioxide (NO<sub>2</sub>) is a reddish brown toxic gas with a characteristic sharp, biting odor and is a prominent air pollutant.</p>	<ul style="list-style-type: none"> <li>• Lightning</li> <li>• Forest fires</li> <li>• Bacterial activity of soil</li> </ul>	<ul style="list-style-type: none"> <li>• High temperature combustion (internal combustion engines, fossil fuel-fired power stations, industrial)</li> <li>• Burning of Bio-mass and Fossil Fuels</li> </ul>	<p>Irritates the nose and throat Increase susceptibility to respiratory infections</p>	<ul style="list-style-type: none"> <li>• Precursor of ozone formed in the troposphere</li> <li>• Form atmospheric fine particulate matter burden as a result of oxidation to form nitrate aerosol</li> </ul>
<p><b>Respirable Suspended Particulate Matter (PM<sub>10</sub> size ≤ 10µm, coarse fraction PM<sub>10</sub> – PM<sub>2.5</sub>), called thoracic fraction.</b> Particulate Matter (PM) is a complex mixture of suspended solid and liquid particle in semi equilibrium with surrounding gases. The major constituents of RSPM are organic and elemental carbon, metals/elements like silicon, magnesium, iron ions like sulphates, nitrates, ammonium etc. PM<sub>10</sub> can settle in the bronchi and lungs and cause health problems</p>	<ul style="list-style-type: none"> <li>• Coarse particles are produced by the mechanical break up of larger solid particles</li> <li>• Wind blown dust such as road dust, fly ash, soot, agricultural processes.</li> <li>• Physical processes of crushing, grinding and abrasion of surfaces.</li> <li>• Photochemically produced particles, such as those found in urban haze</li> <li>• Pollen grains, mould spores, and plant and insect parts</li> <li>• Non combustible materials released when burning fossil fuels.</li> </ul>	<ul style="list-style-type: none"> <li>• Road traffic emission particularly from diesel vehicles.</li> <li>• Industrial combustion plants some public power generation.</li> <li>• Commercial processes (e.g. quarrying)</li> <li>• Agricultural activities.</li> </ul>	<p>Cardio pulmonary problems Asthma, bronchitis and pneumonia in older people</p>	<ul style="list-style-type: none"> <li>• Visibility reduction</li> </ul>

Source: Central Pollution Control Board.

## 2. National Air Quality Monitoring Programme (NAMP) in Assam

### 2.1 Present Status

The Pollution Control Board, Assam (PCBA) is carrying out ambient air quality monitoring under NAMP since 1991. The programme in Assam was started with one station at Bamunimaidam (at Head Office Building of PCBA, Guwahati-21) in the year 1991. The number of monitoring stations has been increased in the subsequent years and at present there are 22 stations in Assam. All monitoring stations in Assam belong to the category of residential type. The list of monitoring stations along with their type and locations is given in *Table No. 3*.

**Table No. 3: Air Quality Monitoring in Assam under NAMP**

Sl. No.	Station Name	Station Code	Station Type	District	Location
1.	Bamunimaidam	193	Residential	Kamrup Metro	Head Office Building of PCBA, Bamunimaidam, Guwahati-21
2.	Khanapara	596	Residential		Central Dairy, Guwahati-22
3.	Gopinath Nagar	519	Residential		ITI Building, Guwahati - 16
4.	Santipur	541	Residential		Near Pragjyotish College, Bharalumukh, Guwahati
5.	Gauhati University	602	Residential		Gauhati University Campus, Guwahati
6.	Boragaon	603	Residential		IASST Campus, Boragaon, Guwahati
7.	Barpara Office Building	502	Residential	Bongaigaon	Bongaigaon Regional Lab-cum-Office, Barpara, Bongaigaon
8.	Campus of Oil India Ltd.	542	Residential		Campus of Oil India Ltd. PS-6, Bongaigaon
9.	Tezpur Office Building	536	Residential	Sonitpur	Tezpur Regional Lab-cum-Office, Darrang College Road, Opposite Law College, Tezpur-784 001
10.	Sivsagar Office Building	537	Residential	Sivasagar	Sivsagar Regional Lab-cum-Office, Melachakar, Sivasagar – 785 640
11.	Sivasagar, ONGCL Colony	604	Residential		Usha Lodge, Near ONGCL Colony, Sivasagar
12.	Dibrugarh Office Building	538	Residential	Dibrugarh	Dibrugarh Office Building, Chowkidingee, Back side of ASTC Bus Station, Dibrugarh-786001
13.	Golaghat Office	539	Residential	Golaghat	Golaghat Regional Office, College Tinali, Near Circuit House, Golaghat- 785621
14.	Daranga	566	Residential	Baksa	Daranga, Baksa District, BTAD near Indo-Bhutan Border
15.	Silchar	567	Residential	Cachar	Silchar Regional Lab-cum-Office, Ghaniwala Road, Near Itkhola Market, Silchar - 788002
16.	Janiganj, Silchar	607	Residential		Campus of Silchar govt. Boys' H.S. School, Sadarghat Road, Raniganj, Silchar
17.	Margherita	586	Residential	Tinsukia	Coal India Office Complex, Tinsukia
18.	Tinsukia	594	Residential		Digboi Carbon Factory Campus, Borguri, Tinsukia
19.	Shreepuria, Borguri	605	Residential		Shreepuria, Borguri, Tinsukia
20.	North Lakhimpur	587	Residential	Lakhimpur	Bazar Patty, North Lakhimpur Town, Lakhimpur
21.	Nagaon	595	Residential	Nagaon	Water Resource Division Office Campus, Christian, Patty, Near Nagaon College, Nagaon
22.	Nalbari	597	Residential	Nalbari	PWD Rural Division Office Complex, Near Gordon Boys' HS School, Nalbari

## 2.2 Objectives

The objectives of the NAMP are as follows:

- To determine status and trends of ambient air quality;
- To ascertain whether the prescribed ambient air quality standards are violated;
- To Identify non-attainment Cities where air pollutants are exceeded prescribed standards.
- To obtain the knowledge and understanding necessary for developing preventive and corrective measures, and
- To understand the natural cleansing process undergoing in the environment through pollution dilution, dispersion, wind based movement, dry deposition, precipitation and chemical transformation of pollutants generated.

## 2.3 Parameters Monitored

- Under NAMP in Assam monitoring of four air pollutants such as – Sulphur Dioxide (SO<sub>2</sub>), Nitrogen Dioxide (NO<sub>2</sub>), Suspended Particulate Matter (SPM), and Respirable Suspended Particulate Matter (RSPM/PM<sub>10</sub>), are being carried out regularly at all the locations.
- In Assam integration of meteorological parameters such as wind speed and direction, relative humidity and temperature with air quality parameters could not be undertaken efficiently due to various reasons. It is being regularly monitored at station PCBA, Head Office, Bamunimaidam, Guwahati (Station Code 193).

## 2.4 Data Analysis and Limitations

The air quality data generated at the monitoring stations are checked, scrutinized, compiled, processed and analyzed statistically in the Central Laboratory of the Board. However, in presenting the air quality data in this report following conventions are followed:

- i. Since sampling of 24 hours in a day, twice a week, 104 days in a year could not be met due to local conditions, monitoring for 16 hours and more, 50 and more days of monitoring in a year is considered as the representative values for assessing the air quality for that day.
- ii. In Assam monitoring of air quality is being done for 16 hours duration from 6 AM to 10 PM. Four hourly sampling for gaseous pollutants and eight hourly sampling for particulate matter, and the frequency of monitoring has also been increased to 6 days a week.
- iii. In case, if no data is available in a particular month with respect to all the three parameters, the month has been excluded.

## 2.5 Quality Assurance/ Quality Control of Data Management

Quality assurance and Quality control (QA/QC) is an essential part of any monitoring system. In order to ensure the quality of data the Pollution Control Board, Assam is carrying out various exercises as mentioned below:

- i) Calibration, Servicing and Repair of Instruments and Evaluation of Ambient Air Quality Monitoring Stations as per CPCB guidelines
- ii) Training Program to field and laboratory staff of the Board involved in Ambient Air Quality Monitoring Programme
- iii) Guidelines for Ambient Air Quality Monitoring developed by CPCB are being followed.
- iv) Regular Inspection of Monitoring stations and laboratories of the Board.
- v) Review meetings to discuss various problems related to monitoring activities are regularly conducted.
- vi) Analytical quality control exercises using standard methods are regularly conducted.

### 3. Air Quality Assessment and Major Findings

#### 3.1 Air Quality Assessment

The air quality of different cities/towns has been compared with the respective NAAQS. The air quality has been categorized into four broad categories based on an Exceedence Factor (the ratio of annual mean concentration of a pollutant with that of a respective standard).

The Exceedence Factor (EF) is calculated as follows:

$$\text{Exceedence Factor} = \frac{\text{Observed annual mean concentration of criteria pollutant}}{\text{Annual standard for the respective pollutant and area class}}$$

The four air quality categories are:

- *Critical pollution (C)* : when EF is more than 1.5;
- *High pollution (H)* : when the EF is between 1.0 - 1.5;
- *Moderate pollution (M)* : when the EF between 0.5 - 1.0; and
- *Low pollution (L)*: when the EF is less than 0.5.

**Table No. 4: Pollution Level Classification\***

Pollution level*	Annual Mean Concentration Range (µg/m <sup>3</sup> )				
	Industrial (I)			Residential (R)	
	SO <sub>2</sub> & NO <sub>2</sub>	RSPM	SPM	* SO <sub>2</sub> , NO <sub>2</sub> , & RSPM	SPM
Low (L)	0-40	0-60	0-180	0-30	0-70
Moderate (M)	41-80	61-120	181-360	31-60	71-140
High (H)	81-120	121-180	361-540	61-90	141-210
Critical (C)	>120	>180	>540	>90	>210

Source: Central Pollution Control Board.

#### 3.2 Assam State Mean Concentration

The ambient air quality status with respect to annual mean concentration range for various parameters is given in Table No. 5, 6, 7 and 8.

**Table No. 5: Concentration of SO<sub>2</sub> in Ambient Air at different locations of Assam, 2008 to 2014**

Sl. No.	Monitoring Station	Year of Monitoring						
		2008	2009	2010	2011	2012	2013	2014
1.	Bamunimaidam	9.30	8.90	7.20	6.20	6.30	6.90	6.60
2.	Khanapara	8.00	8.00	7.30	5.80	6.10	7.20	7.30
3.	Gopinath Nagar	7.00	7.30	7.90	15.20	6.40	7.20	6.90
4.	Santipur	7.20	7.50	7.10	5.90	6.20	6.80	6.60
5.	Gauhati University	..	..	5.70	5.70	5.70	6.70	6.60
6.	Boragaon	..	..	6.20	5.60	6.00	6.80	6.30
7.	Barpara Office Building	4.90	5.80	6.60	6.20	6.60	6.90	6.80
8.	Campus of Oil India	4.50	6.20	6.20	5.40	5.60	6.40	6.30
9.	Tezpur Office Building	4.50	5.80	5.80	5.40	6.20	6.70	6.60
10.	Sivasagar Office Building	5.00	5.00	6.00	6.00	7.50	7.30	6.70
11.	ONGCL Colony	..	..	6.20	5.70	6.00	6.20	5.60
12.	Dibrugarh Office Building	4.60	5.40	6.40	5.70	5.80	6.60	6.40
13.	Golaghat Office Building	4.20	5.81	5.70	5.50	6.30	6.70	6.70
14.	Daranga	4.80	4.90	5.40	5.60	5.30	6.10	5.80
15.	Silchar Office Building	..	5.90	6.80	5.80	5.60	7.40	5.80
16.	Janiganj, Silchar	..	..	6.10	5.80	6.00	6.70	6.10
17.	Margherita	..	11.60	10.30	8.60	6.30	7.20	11.70
18.	Tinsukia	..	6.30	6.20	5.60	5.00	6.20	6.10
19.	Shreepuria, Borguri	..	..	6.00	5.50	5.40	6.30	6.20
20.	North Lakhimpur	..	6.20	6.40	5.70	5.74	6.80	6.20
21.	Nagaon	..	7.00	5.80	5.50	6.20	6.70	6.70
22.	Nalbari	..	..	6.70	5.80	6.00	7.20	6.60

**Table No. 6: Concentration of NO<sub>2</sub> in Ambient Air at different locations of Assam, 2008 to 2014**

Sl. No.	Monitoring Station	Year of Monitoring						
		2008	2009	2010	2011	2012	2013	2014
1.	Bamunimaidam	18.80	18.30	15.10	14.30	14.70	15.70	13.00
2.	Khanapara	..	16.20	14.70	13.10	13.40	15.30	14.80
3.	Gopinath Nagar	13.60	14.60	16.30	15.20	15.20	17.60	15.20
4.	Santipur	14.90	16.20	15.30	13.80	14.00	14.70	12.40
5.	Gauhati University	..	..	13.10	13.00	13.30	14.60	14.20
6.	Boragaon	..	..	15.40	13.90	14.00	15.50	11.80
7.	Barpara Office Building	11.00	14.80	15.20	14.50	14.70	15.00	13.70
8.	Campus of Oil India	10.20	15.24	14.60	12.40	12.60	13.50	12.50
9.	Tezpur Office Building	10.70	13.18	14.00	12.40	13.30	14.40	13.00
10.	Sivasagar Office Building	12.30	12.80	13.70	14.30	16.20	16.20	14.30
11.	ONGCL Colony			13.40	12.40	13.00	12.90	11.40
12.	Dibrugarh Office Building	11.40	13.10	13.80	12.80	13.00	15.30	13.80
13.	Golaghat Office Building	11.40	14.23	15.10	14.50	13.80	15.90	14.30
14.	Daranga	11.00	13.10	14.20	13.80	13.20	14.20	13.10
15.	Silchar Office Building	..	15.00	16.90	14.70	14.20	18.20	13.10
16.	Janiganj, Silchar	..	..	14.70	13.80	14.50	15.50	13.50
17.	Margherita	..	22.10	22.60	20.20	14.50	14.80	23.70
18.	Tinsukia	..	13.90	13.50	12.40	11.60	13.10	11.90
19.	Shreepuria, Borguri	..	..	13.30	12.20	12.90	14.10	13.50
20.	North Lakhimpur	..	14.90	14.50	13.40	14.20	15.70	14.10
21.	Nagaon	..	17.11	14.00	12.80	13.30	14.90	13.10
22.	Nalbari	..	..	15.80	15.00	15.10	16.90	15.00

**Table No. 7: Concentration of RSPM in Ambient Air at different locations of Assam, 2008 to 2014**

Sl. No.	Monitoring Station	Year of Monitoring						
		2008	2009	2010	2011	2012	2013	2014
1.	Bamunimaidam	151.00	139.90	103.80	94.60	106.30	166.30	108.00
2.	Khanapara	..	112.00	111.90	110.00	93.70	135.60	110.00
3.	Gopinath Nagar	103.20	110.90	114.10	103.20	104.30	169.50	105.40
4.	Santipur	96.30	114.60	106.30	96.90	88.60	138.80	53.70
5.	Gauhati University	..	..	64.30	70.10	84.00	117.60	74.70
6.	Boragaon	..	..	70.00	82.20	68.90	119.70	41.60
7.	Barpara Office Building	56.20	68.49	52.30	51.50	44.70	42.10	47.40
8.	Campus of Oil India	76.10	97.50	64.00	54.20	46.50	47.00	52.30
9.	Tezpur Office Building	76.10	91.95	67.10	59.70	69.30	120.10	70.30
10.	Sivasagar Office Building	80.80	100.00	78.90	99.40	114.90	111.20	63.20
11.	ONGCL Colony	..	..	26.60	159.40	103.00	129.80	97.50
12.	Dibrugarh Office Building	56.00	41.20	37.40	42.30	56.10	99.40	44.30
13.	Golaghat Office Building	71.40	64.36	72.90	63.10	55.30	101.20	63.20
14.	Daranga	69.80	78.20	57.90	56.50	56.50	98.00	76.20
15.	Silchar Office Building	..	57.60	64.50	71.30	81.90	132.40	76.20
16.	Janiganj, Silchar	..	..	96.90	84.30	99.40	138.00	90.40
17.	Margherita	..	41.70	51.70	53.10	54.20	77.20	55.30
18.	Tinsukia	..	81.40	57.50	55.50	60.40	98.10	58.60
19.	Shreepuria, Borguri	..	..	61.70	57.50	52.90	99.00	55.00
20.	North Lakhimpur	..	73.50	76.20	63.70	71.50	121.00	66.20
21.	Nagaon	..	151.80	102.50	86.30	79.10	131.90	100.10
22.	Nalbari	..	..	68.00	94.50	82.10	140.30	76.10

**Table No. 8: Concentration of SPM in Ambient Air at different locations of Assam, 2008 to 2014**

SI. No.	Monitoring Station	Year of Monitoring						
		2008	2009	2010	2011	2012	2013	2014
1.	Bamunimaidam	232.60	257.30	195.10	170.90	209.60	293.40	180.20
2.	Khanapara	..	190.20	203.60	195.60	190.70	251.40	246.80
3.	Gopinath Nagar	162.90	196.00	207.10	196.40	211.00	312.00	175.70
4.	Santipur	151.40	199.80	181.70	170.40	182.40	259.40	94.70
5.	Gauhati University	..	..	129.50	143.00	150.30	206.60	128.50
6.	Boragaon	..	..	126.70	160.50	130.90	224.10	82.30
7.	Barpara Office Building	91.40	136.90	103.50	80.00	69.20	59.30	64.30
8.	Campus of Oil India	113.20	152.30	120.60	84.10	72.40	66.90	73.00
9.	Tezpur Office Building	131.30	200.80	134.00	157.20	142.90	240.50	139.10
10.	Sivasagar Office Building	118.80	156.30	134.50	194.30	225.30	220.20	113.80
11.	ONGCL Colony	..	..	65.30	288.10	214.20	260.20	174.00
12.	Dibrugarh Office Building	92.50	74.50	80.90	86.50	104.60	181.20	82.30
13.	Golaghat Office Building	108.40	109.24	122.50	113.60	117.70	178.50	114.00
14.	Daranga	108.40	152.40	123.30	118.50	110.80	187.70	134.80
15.	Silchar Office Building	..	101.90	142.60	138.30	155.00	238.20	135.00
16.	Janiganj, Silchar	..	..	206.60	166.80	173.30	259.80	160.20
17.	Margherita	..	78.70	95.60	94.80	102.30	143.00	88.60
18.	Tinsukia	..	124.40	102.40	106.00	113.10	176.10	97.20
19.	Shreepuria, Borguri	..	..	109.70	108.50	106.50	184.60	99.30
20.	North Lakhimpur	..	135.90	143.30	126.60	137.30	214.20	127.10
21.	Nagaon	..	280.60	198.30	179.60	157.20	241.20	172.40
22.	Nalbari	..	..	138.00	188.20	160.50	250.80	139.70

The ambient air quality status of various cities/towns in Assam with respect to pollution levels (Low, Moderate, High and Critical as in *Table No. 4*) is presented in *Table No. 9* and *10*.

**Table No. 9: City/Town wise SO<sub>2</sub> and NO<sub>2</sub> concentration in Ambient Air in Assam in terms of pollution level classification/categorization for the year 2008 to 2014**

Monitoring Stations	Year of Monitoring													
	2008		2009		2010		2011		2012		2013		2014	
	SO <sub>2</sub>	NO <sub>2</sub>	SO <sub>2</sub>	NO <sub>2</sub>	SO <sub>2</sub>	NO <sub>2</sub>	SO <sub>2</sub>	NO <sub>2</sub>	SO <sub>2</sub>	NO <sub>2</sub>	SO <sub>2</sub>	NO <sub>2</sub>	SO <sub>2</sub>	NO <sub>2</sub>
Bamunimaidam	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Khanapara	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Gopinath Nagar	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Santipur	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Gauhati University	..	..	..	..	L	L	L	L	L	L	L	L	L	L
Boragaon	..	..	..	..	L	L	L	L	L	L	L	L	L	L
Barpara	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Campus OIL	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Tezpur Office	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Sivasagar	L	L	L	L	L	L	L	L	L	L	L	L	L	L
ONGCL Colony	..	..	..	..	L	L	L	L	L	L	L	L	L	L
Dibrugarh Office	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Golaghat Office	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Daranga	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Silchar Office	..	..	L	L	L	L	L	L	L	L	L	L	L	L
Janiganj, Silchar	..	..	..	..	L	L	L	L	L	L	L	L	L	L
Margherita	..	..	L	L	L	L	L	L	L	L	L	L	L	L
Tinsukia	..	..	L	L	L	L	L	L	L	L	L	L	L	L
Shreepuria	..	..	..	..	L	L	L	L	L	L	L	L	L	L
North Lakhimpur	..	..	L	L	L	L	L	L	L	L	L	L	L	L
Nagaon	..	..	L	L	L	L	L	L	L	L	L	L	L	L
Nalbari	..	..	..	..	L	L	L	L	L	L	L	L	L	L



**Table No. 10: City/Town wise RSPM and SPM concentration in Ambient Air in Assam in terms of Pollution Level classification/categorization for the year 2008 to 2014**

Monitoring Stations	Year of Monitoring													
	2008		2009		2010		2011		2012		2013		2014	
	RSPM	SPM	RSPM	SPM	RSPM	SPM	RSPM	SPM	RSPM	SPM	RSPM	SPM	RSPM	SPM
Bamunimaidam	C	C	C	C	C	H	C	H	C	H	C	C	C	H
Khanapara	..	..	C	H	C	H	C	H	C	H	C	C	C	C
Gopinath Nagar	C	H	C	H	C	H	C	H	C	C	C	C	C	H
Santipur	C	H	C	H	C	H	C	H	H	H	C	C	M	M
Gauhati University	..	..	..	..	M	M	H	H	H	H	C	H	H	M
Boragaon	..	..	..	..	H	M	H	H	H	M	C	C	M	M
Barpara	M	M	H	M	M	M	M	M	M	L	M	L	M	L
Campus OIL	H	M	C	H	H	M	M	M	M	M	M	L	M	M
Tezpur Office	H	M	C	H	H	M	M	H	H	C	C	C	H	M
Sivasagar	H	M	C	H	H	M	C	H	C	C	C	C	H	M
ONGCL Colony	..	..	..	..	L	L	C	C	C	C	C	C	C	H
Dibrugarh Office	M	M	M	M	M	M	M	M	M	M	C	H	M	M
Golaghat Office	H	M	H	M	H	M	H	M	M	M	C	H	H	M
Daranga	H	M	H	H	M	M	M	M	M	M	C	H	H	M
Silchar Office	..	..	M	M	H	H	H	M	H	H	C	C	H	M
Janiganj, Silchar	..	..	..	..	C	H	M	H	C	H	C	C	C	H
Margherita	..	..	M	M	M	M	M	M	M	M	H	H	M	M
Tinsukia	..	..	H	M	M	M	M	H	M	C	H	M	M	M
Shreepuria	..	..	..	..	H	M	M	M	M	C	H	M	M	M
North Lakhimpur	..	..	H	M	H	H	H	M	H	M	C	C	H	M
Nagaon	..	..	C	C	C	H	H	H	H	H	C	C	C	H
Nalbari	..	..	..	..	H	M	C	H	H	M	C	C	H	M

### 3.3 Number of locations/monitoring stations with Low, Moderate, High and Critical Pollution Levels.

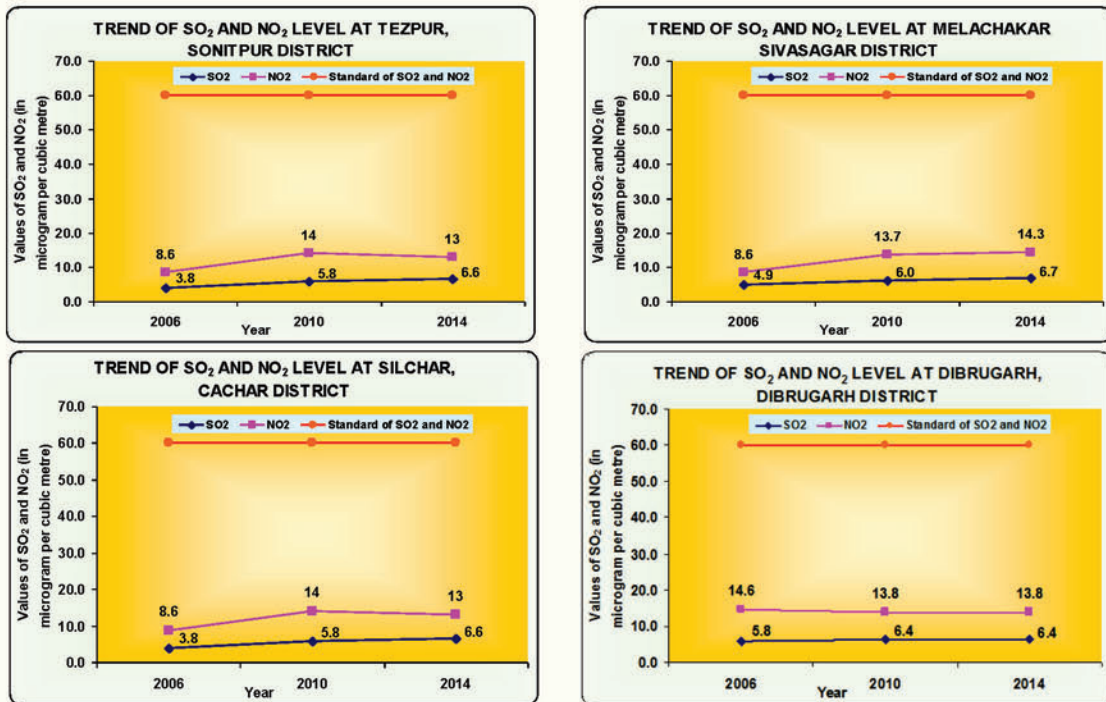
The analysis of four criteria pollutants with respect to National Ambient Air Quality Standards (NAAQS) during the year 2008 to 2014 revealed that concentrations of SO<sub>2</sub> and NO<sub>2</sub> in all monitoring stations of Assam lies in low pollution levels category as per the Pollution Level Classification (Table No. 4). The pollution level of RSPM and SPM lies in different categories as per the same classification which is shown in the Table No. 11.

**Table No. 11: Number of locations/monitoring stations with Low, Moderate, High and Critical Pollution Levels with respect to RSPM and SPM in Assam, 2008-2014**

Sl. No.	Monitoring Station	Number of locations/monitoring stations							
		Low		Moderate		High		Critical	
		RSPM	SPM	RSPM	SPM	RSPM	SPM	RSPM	SPM
1.	Bamunimaidam						4	7	3
2.	Khanapara						4	6	2
3.	Gopinath Nagar						5	7	2
4.	Santipur			1	1	1	5	5	1
5.	Gauhati University			1	2	3	3	1	
6.	Boragaon			1	3	3	1	1	1
7.	Barpara Office Building		3	6	4	1			
8.	Campus of Oil India		1	4	5	2	1	1	
9.	Tezpur Office Building			1	3	4	3	2	1
10.	Sivasagar Office Building				3	3	2	4	2
11.	ONGCL Colony	1	1				1	4	3
12.	Dibrugarh Office Building			6	6			1	1
13.	Golaghat Office Building			1	6	5		1	1
14.	Daranga			3	5	3		1	2
15.	Silchar Office Building			1	3	4	2	1	1
16.	Janiganj, Silchar			1			4	4	1
17.	Margherita			5	5	1	1		
18.	Tinsukia			3	5	2	1	1	
19.	Shreepuria, Borguri			3	4	1	1	1	
20.	North Lakhimpur				4	5	1	1	1
21.	Nagaon					2	4	4	2
22.	Nalbari				3	3	1	2	1

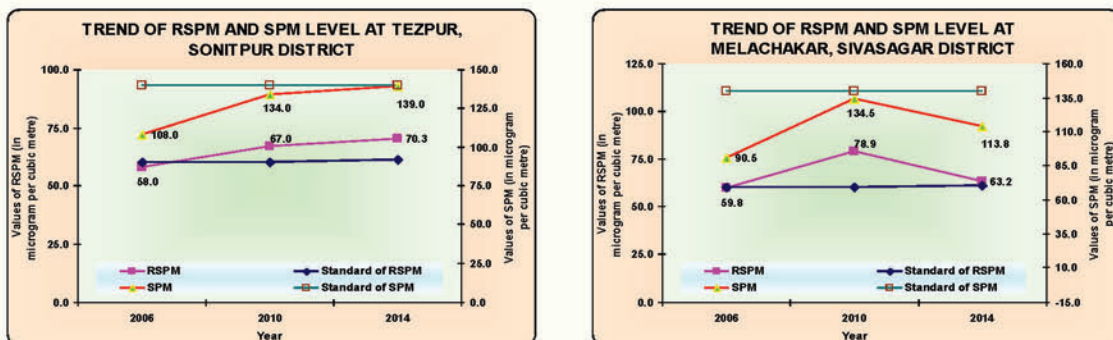
### 3.4 Air Quality Trend in Assam with respect to Sulphur Dioxide (SO<sub>2</sub>) and Nitrogen Dioxide (NO<sub>2</sub>)

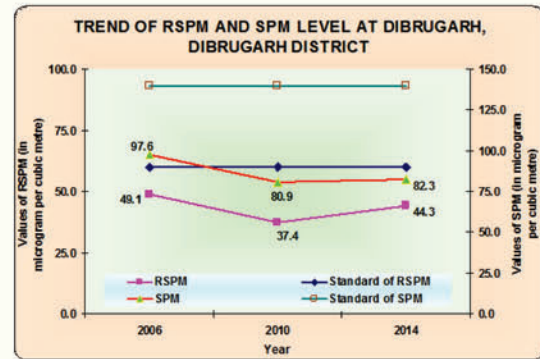
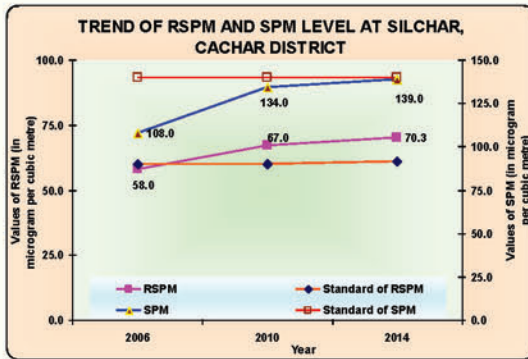
Out of total 22 air quality monitoring stations in Assam, the trend of air quality at – Tezpur, Sivasagar, Silchar & Dibrugarh with respect to SO<sub>2</sub>, NO<sub>2</sub>, RSPM and SPM are shown in the following figures.



### 3.5 Air Quality Trend in Assam with respect to RSPM and SPM

Out of total 22 air quality monitoring stations in Assam, the trend of air quality at – Tezpur, Sivasagar, Silchar & Dibrugarh with respect to RSPM and SPM are shown in the following figures:

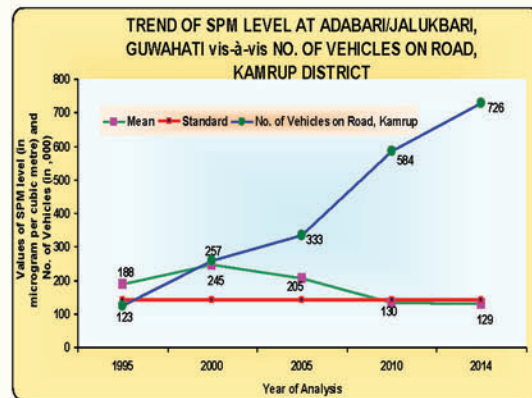
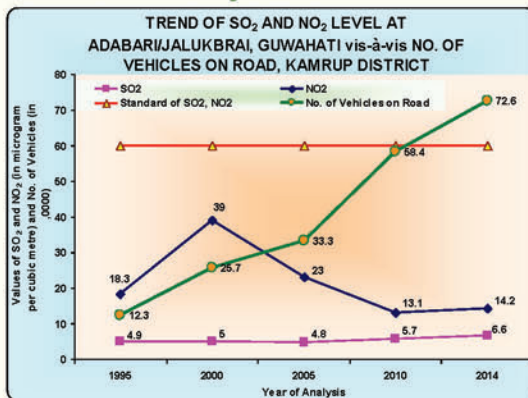




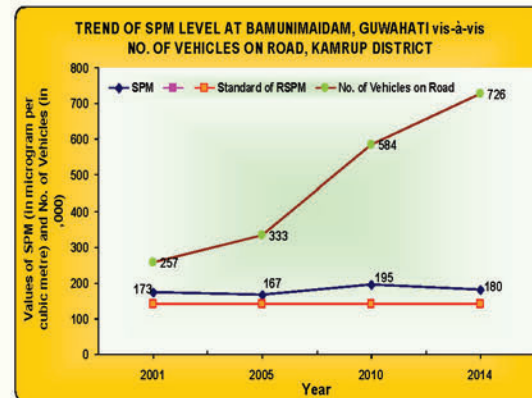
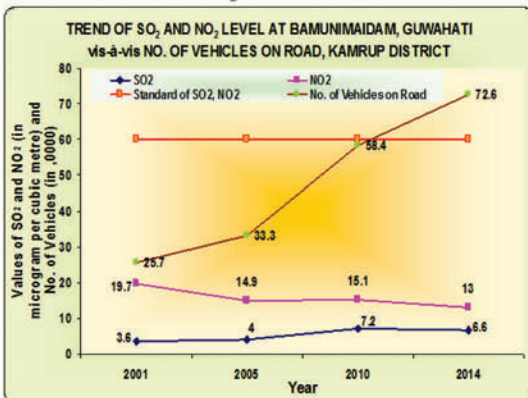
### 3.6 Air Quality Trend vis-à-vis Vehicles on Road in Assam

In this report an attempt has been made to analyse the relationship between the growth of vehicles and quality of ambient air for the period from 1995 to 2014 with respect to selected parameters in the city of Guwahati. The relationship are shown with help of following graphs.

#### 3.6.1 Ambient Air Quality at Adabari/Jalukbari



#### 3.6.2 Ambient Air Quality at Bamunimaidam



# PART- II WATER QUALITY



## **PART – II : WATER QUALITY OF ASSAM**

### **4. Introduction**

The water quality management in India is performed under the provision of Water (Prevention and Control of Pollution) Act, 1974. The basic objective of this Act is to maintain and restore the wholesomeness of national aquatic resources through prevention and control of pollution. As per the provisions of this Act, Central Pollution Control Board (CPCB) and State Pollution Control Boards/Pollution Control Committees (SPCBs/PCCs) are responsible to maintain and restore the 'wholesomeness' of our aquatic resources. Although the Act does not define the level of wholesomeness to be maintained or restored in different water bodies of the country, the Central Pollution Control Board (CPCB) has tried to define the wholesomeness in terms of protection of human uses, and thus, taken human uses of water as base for identification of water quality objectives for different water bodies in the country. The process of formulating water quality criteria for surface and groundwater resources of the country is under process in CPCB. In order to perform the functions laid down under the Water (Prevention and Control of Pollution) Act, 1974, Central Pollution Control Board (CPCB) and State Pollution Control Boards/Pollution Control Committees (SPCBs/PCCs) established a nationwide Water Quality Monitoring Network – presently called National Water Quality Monitoring Programme (NWMP), to understand the nature of water quality in the various water bodies such as rivers, lakes, ponds, tanks, creeks, canals and groundwater etc. Pollution Control Board, Assam is also carrying out water quality monitoring regularly under NWMP in the State.

### **4.1 National Water Quality Monitoring Programme (NWMP)**

To achieve the objectives as mentioned in Water (Prevention and Control of Pollution) Act, 1974, CPCB in collaboration with concerned SPCBs/PCCs established a country wide network of water quality monitoring in long back 1977-78 with 18 numbers of monitoring points. The monitoring network has expanded gradually over the years to cover most of the aquatic resources in the country. The present water quality monitoring network under NWMP comprises 2500 stations in 28 States and 6 Union Territories. The water quality monitoring under this programme is being done on monthly or quarterly basis for surface waters – Rivers, lakes, tanks, ponds, creeks/sea water, canals & drains, and on half yearly basis in case of ground water. Among the 2500 stations, 1275 are on rivers, 190 on lakes, 45 on drains, 41 on canals, 12 on tanks, 41 on creeks/seawater, 79 on ponds, 10 Water Treatment Plant (Raw Water) and 807 groundwater monitoring stations. In Assam there are 101 monitoring stations at present.

### **4.2 Parameters Analysed**

The water samples are being analysed at fixed regular frequencies for 9 core parameters and 19 general parameters. Besides this, 9 trace metals and 28 pesticides are analyzed in selected samples. Bio-monitoring is also carried out on specific locations. The list of parameters identified under the National Water Quality Monitoring Programme is given in *Table No. 12*.

**Table No. 12: List of Parameters under National Water Quality Monitoring Programme**

Sl. No.	Parameters	
A	<b>Core Parameters</b>	1. pH, 2. Temperature, 3. Conductivity, $\mu\text{mhos/cm}$ , 4. Dissolved Oxygen, mg/L, 5. BOD, mg/L, 6. Nitrate – N , mg/L, 7. Nitrite – N, mg/L, 8. Fecal Coliform, MPN/100 ml, 9. Total Coliform, MPN/100 ml
B	<b>General Parameters</b>	1. Turbidity, NTU, 2. Phenolphthalein Alkalinity, as $\text{CaCO}_3$ , 3. Total Alkalinity, as $\text{CaCO}_3$ , 4. Chlorides, mg/L, 5. COD, mg/L, 6. Total Kjeldahl - N, as N mg/L, 7. Ammonia - N, as N mg/L, 8. Hardness, as $\text{CaCO}_3$ , 9. Calcium, as $\text{CaCO}_3$ , 10. Sulphate, mg/L, 11. Sodium, mg/L, 12. Total Dissolved Solids, mg/L, 13. Total Fixed Dissolved Solids, mg/L, 14. Total suspended Solid, mg/L, 15. Phosphate, mg/L, 16. Boron, mg/L, 17. Magnesium, as $\text{CaCO}_3$ , 18. Potassium, mg/L, 19. Fluoride, mg/L,
C	<b>Bio-Monitoring</b>	1. Saprobity Index, 2. Diversity Index, 3. P/R Ratio
D	<b>Trace Metals</b>	1. Arsenic, $\mu\text{g/L}$ , 2. Cadmium, $\mu\text{g/L}$ , 3. Copper, $\mu\text{g/L}$ , 4. Lead, $\mu\text{g/L}$ , 5. Chromium (Total), $\mu\text{g/L}$ , 6. Nickel, $\mu\text{g/L}$ , 7. Zinc, $\mu\text{g/L}$ , 8. Mercury, $\mu\text{g/L}$ , 9. Iron (Total) , $\mu\text{g/L}$
E	<b>Pesticides</b>	1. Alpha BHC, $\mu\text{g/L}$ , 2. Beta BHC, $\mu\text{g/L}$ , 3. Gama BHC (Lindane) , $\mu\text{g/L}$ , 4. O P DDT, $\mu\text{g/L}$ , 5. P P DDT, $\mu\text{g/L}$ , 6. Alpha Endosulphan, $\mu\text{g/L}$ , 7. Beta Endosulphan, $\mu\text{g/L}$ , 8. Aldrin, $\mu\text{g/L}$ , 9. Dieldrin, $\mu\text{g/L}$ , 10. Carbaryl (Carbamate) , $\mu\text{g/L}$ , 11. 2-4 D, $\mu\text{g/L}$ , 12. Malathian, $\mu\text{g/L}$ , 13. Methyl Parathian, $\mu\text{g/L}$ , 14. Anilophos, $\mu\text{g/L}$ , 15. Chloropyriphos, $\mu\text{g/L}$

### 4.3 Objectives

Water quality monitoring is an important exercise, which helps in evaluating the nature and extent of pollution, and to assess the required pollution control measures and to evaluate the effectiveness of pollution control measures already in existence. It also helps in drawing the water quality trends and prioritizing pollution control efforts. The water quality monitoring is performed with following main objectives -

- For rational planning of pollution control strategies and their prioritization;
- To assess nature and extent of pollution control needed in different water bodies or their part;
- To evaluate effectiveness of pollution control measures already is existence;
- To evaluate water quality trend over a period of time;
- To assess assimilative capacity of a water body thereby reducing cost on pollution control;
- To understand the environmental fate of different pollutants.
- To assess the fitness of water for different uses.

### 5. Water Quality Monitoring in Assam

The State is very rich in water resource both in terms of surface water and ground water. The dense network of drainages, the numbers of lakes/beels, ponds, swamps and marshes, and the rich aquifer speaks about the vastness of its water resources. The economy as well as the life style of the people of the State is closely linked with the water resources and therefore the monitoring of water quality and maintenance of its wholesomeness is of paramount important.

**Table No.13: Inland Water Resources in Assam**

Rivers/Canals (Length in Km)	Other Water Bodies (Lakh Hectares)			Total Water Bodies
	Reservoir	Tanks, Lakes and Ponds	Beels, Oxbow Lakes & Derelict Water	
4820	0.02	0.23	1.10	1.35

Source: Status of Water Quality in India - 2007, Central Pollution Control Board

The Pollution Control Boards, Assam is carrying out its mandatory responsibility of restoration and maintenance of the wholesomeness of aquatic resources in the State from the day of its inception. The Board besides being involved in the National Water Quality Monitoring Programme (NWMP) of CPCB is also carrying out need based other surface water and ground water quality monitoring programmes in the State.

### 5.1 Monitoring Mechanism

As per the format of NWMP, water quality monitoring is being done on monthly or quarterly basis for surface waters – Rivers, lakes, tanks, ponds, creeks/sea water, canals & drains, and on half yearly basis in case of ground water. The frequency of monitoring in different monitoring stations in the State is given in *Table No. 14*.

**Table No. 14: Frequency of Water Quality Monitoring at different sources**

Frequency of Monitoring	No. of Monitoring Station	Name/Type of Water Body
Monthly	06	Brahmaputra River
Quarterly	63	Rivers and Ponds
Half yearly	32	Well (Ground Water)

The Board has its strong institutional network and infrastructure to carry out the water quality monitoring across the State. The eight Regional Offices of the Board located at Dibrugarh, Sivasagar, Golaghat, Nagaon, Tezpur, Silchar, Bongaigaon, Guwahati and the Central Laboratory at Head Office (Bamunimaidam, Guwahati) are involved in the entire process of said monitoring programme in Assam. The water samples are generally collected by the Regional Offices/Central Laboratory whereas the analyses are mostly done at the Central Laboratory at Head Office.

### 5.2 Parameters Analysed

The water samples are analysed for 8 core parameters and 16 other general parameters. The list of parameters observed in water quality monitoring in Assam out of the given parameters under the National Water Quality Monitoring Programme (*Table No. 12*) are given in *Table No. 15*.

**Table No. 15: List of Parameters under National Water Quality Monitoring Programme**

Sl. No.	Parameters	
A	<b>Core Parameters</b>	1. pH, 2. Temperature, 3. Conductivity, $\mu$ mhos/cm, 4. Dissolved Oxygen, mg/L, 5. BOD, mg/L, 6. Nitrate – N, mg/L, 7. Fecal Coliform, MPN/100 ml, 9. Total Coliform, MPN/100 ml
B	<b>General Parameters</b>	1. Turbidity (NTU), 2. Chloride as Cl (mg/L), 3. COD (mg/L), 4. Phosphate as P(mg/L), 5. Sulphate as $SO_4$ (mg/L), 6. Total Alkalinity (mg/L), 7. Hardness as $CaCO_3$ (mg/L), 8. Calcium, as $CaCO_3$ (mg/L), 9. Magnesium, as $CaCO_3$ (mg/L), 10. Total Dissolved Solids (mg/L), 11. Total Fixed Dissolved Solids (mg/L), 12. Total suspended Solid (mg/L), 13. Sodium (mg/L), 14. Potassium (mg/L), 15. Boron (mg/L) 16. Fluoride(mg/L).

In this report the interpretation of water quality data and drawing of conclusion on water quality have been done based on the “designated best use” criteria developed by CPCB. According to this concept, out of several uses a water body is put to, the use which demands highest quality of water is termed as

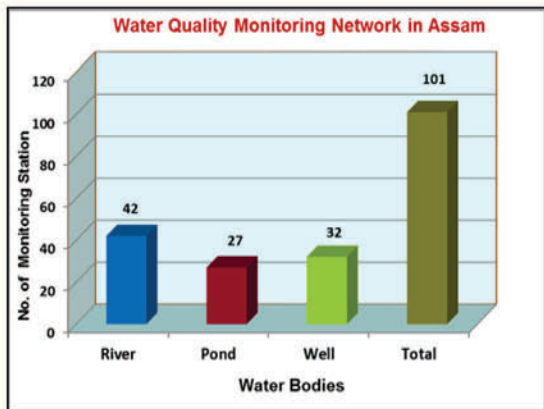
“designated best use”, and accordingly the water body is designated. A summary of the use based classification system is presented in *Table No. 16*.

**Table No.16: Use Based Classification of Surface Waters in India**

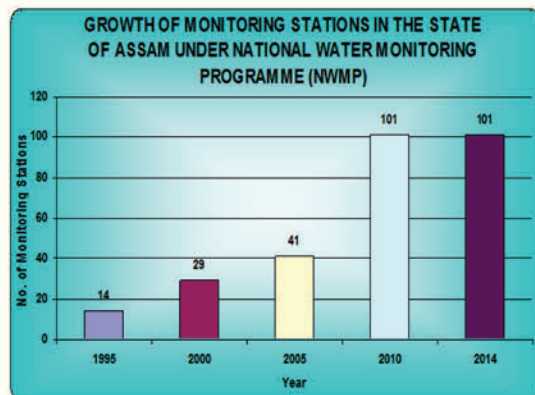
Sl. No.	Designated-Best-Use	Class of Water	Criteria
1.	Drinking Water Source without conventional treatment but after disinfection	A	1.Total Coliforms Organism MPN/100ml shall be 50 or less
			2. pH between 6.5 and 8.5
			3. Dissolved Oxygen 6 mg/l or more
			4.Bio-chemical Oxygen Demand 3 days 27°C 2 mg/l or less
2.	Outdoor bathing (Organised)	B	1.Total Coliforms Organism MPN/100ml shall be 500 or less
			2. pH between 6.5 and 8.5
			3. Dissolved Oxygen 5 mg/l or more
			4.Bio-chemical Oxygen Demand 3 days 27°C 3 mg/l or less
3.	Drinking water source after conventional treatment and disinfection	C	1.Total Coliforms Organism MPN/100ml shall be 5000 or less
			2. pH between 6 to 9
			3. Dissolved Oxygen 4 mg/l or more
			4.Bio-chemical Oxygen Demand 3 days 27°C 3 mg/l or less
4.	Propagation of Wildlife and Fisheries	D	1. pH between 6.5 to 8.5
			2. Dissolved Oxygen 4 mg/l or more
			3. Free Ammonia (as N) 1.2 mg/l or less
5.	Irrigation, Industrial Cooling, Controlled Waste disposal	E	1. pH between 6.0 to 8.5
			2.Electrical Conductivity at 25°C micro mhos/cm Max.2250
			3. Sodium absorption Ratio Max. 26
			4. Boron Max. 2 mg/l

## 6. Water Quality Monitoring Stations in Assam

The PCBA has established 101 monitoring stations across the State for monitoring of both surface and ground water quality under the NWMP. Among the 101 stations – 42 are on rivers, 27 on ponds, and 32 are groundwater stations. The monitoring network in Assam is shown in *Figure No. 1*. The growth of water quality monitoring stations under PCBA during 1995-2014 is shown *Figure No. 2*.



**Figure No. 1**



**Figure No. 2**



The monitoring network in Assam covers 29 Rivers, 27 Ponds, and 32 Wells. A detailed list of monitoring stations under NWMP in Assam is given in *Table No. 17*.

**Table No. 17: List of Monitoring Stations under NWMP Programme**

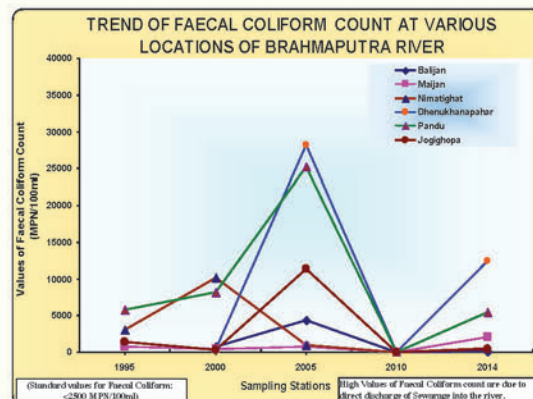
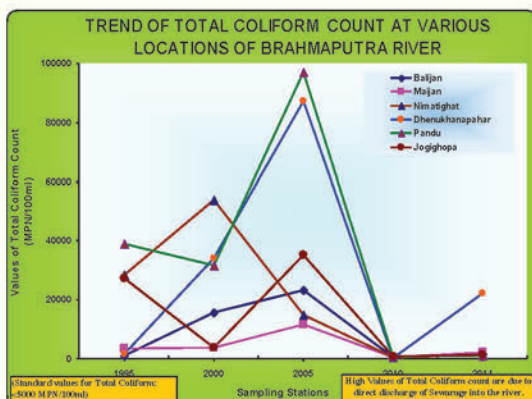
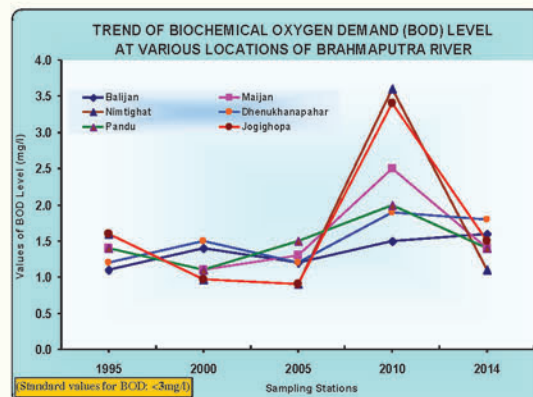
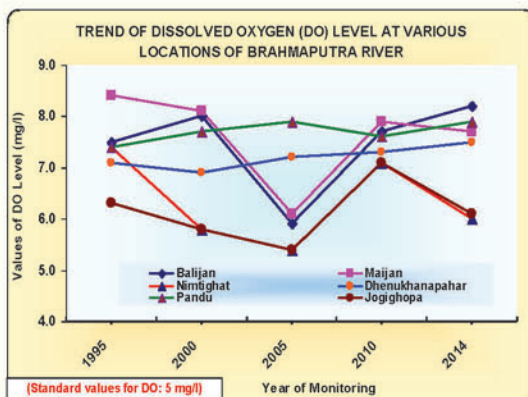
Sl. No.	Name of Rivers	Station Code	Type	Freq. of Monitoring	Location of Monitoring Points
1.	Brahmaputra River	1030	River	Monthly	i) at Maijan, Dibrugarh
2.		1260			ii) at Balijan
3.		1262			iii) at Nimatighat, Jorhat
4.		1030			iv) at Pandu, Guwahati
5.		1526			v) at Dhenukhana Pahar, Tezpur
6.		1299			vi) at Jogighopa, Bongaigaon
7.	Brahmaputra River	2064	River	Quarterly	vii) at Chandrapur, Guwahati
8.		2066			viii) at Dhubri
9.		2067			ix) at Sualkuchi, Dist-Kamrup
10.		2069			x) at Guwahati near Water Intake Point at Kacharaighat
11.	Jhanji river	1258	River	Quarterly	at Jhanji, Sibsagar.
12.	Dhansiri river	1259			at Golaghat.
13.	Subansiri river	1261			at Gerukamukh, Lakhimpur
14.	Elenga Beel	1263	Pond		after confluence with HPC effluent at Jagiroad.
15.	Desang river	1298	River		at Gudamghat, Sapekhati
16.	Buridihing river	1422			at Margherita
17.	Borak river	1423			after confluence with HPC effluent at Panchgram, Cachar.
18.	Bhogdoi river	1527			at NH crossing, Jorhat.
19.	Bharalu river	1528			near Pragjyotish College before confl. with Brahmaputra River at Guwahati.
20.	Deepar beel	1529	Pond		at Guwahati.
21.	Digboi river	1530	River		at Lakhpathar
22.	Morabharali	1531	River		before confluence with Brahmaputra River at Tezpur
23.	Joysagar Tank	1532	Pond		at Sibsagar.
24.	Disang river	2058	River		at Dillighat, Dibrugarh District.
25.	Kolong river	2059			at Marigaon.
26.	Manas river	2060	River		at NH-31 crossing, Barpeta District.
27.	Kharsang river	2061			before confluence with Buridihing near Kharsang (Assam-Arunachal Border)
28.	Buridihing river	2062			near Duliajan at D/s, Tinsukia district
29.	Jia Bharali river	2063			near Biswanath Charali, Sonitpur
30.	Pagladia river	2065			near Nalbari Town, District Nalbari
31.	U/s of Kathakal	2068			at Matijuri, District Hailakandi
32.	Well	1533			Groundwater
33.	Well	1534	Groundwater		from Karbi Anglong
34.	Well	1535	Groundwater		from Sibsagar
35.	Well	1536	Groundwater		from Sibsagar
36.	Well	1537	Groundwater		from Jorhat
37.	Well	1538	Groundwater		from Silchar
38.	Well	1539	Groundwater		from Barpeta
39.	Well	1540	Groundwater		from Bongaigaon
40.	Well	1541	Groundwater		from Guwahati
41.	Well	1542	Groundwater		from Guwahati
42.	Mer Beel	2205	Pond	Quarterly	at Madhabpur
43.	Daloni Beel	2206	Pond		near Jogighopa
44.	Bar Beel	2207	Pond		at Jakai
45.	Borpukhuri	2208	Pond		at Nazira
46.	Gaurisagar Tank	2209	Pond		at Gaurisagar
47.	Rajmaw Pukhuri	2210	Pond		at Jorhat
48.	Padum Pukhuri	2211	Pond		at Tezpur
49.	Gahpur Tank	2212	Pond		at Gahpur
50.	Jaipal Pukhuri	2213	Pond		at Sipajhar, Darrang
51.	Batodrawa Satra Pond	2214	Pond		

Sl. No.	Name of Rivers	Station Code	Type	Freq. of Monitoring	Location of Monitoring Points
52.	Saran Beel	2215	Pond	Quarterly	at Morigaon
53.	Dighali Pukhuri	2216	Pond		near District Library
54.	Soubhagya Kunda Pond	2217	Pond		at Kamakhya
55.	Deepar Beel	2218	Pond		at Boragaon near IASST, Guwahati
56.	Bishnu Puskar Pukhuri	2219	Pond		at Hayagriv Madhab Temple, Hajo
57.	Chandubi Beel	2220	Pond		at Chandubi, Kamrup
58.	Ganga Pukhuri	2221	Pond		at Nalbari
59.	Rajadinia Pukhuri	2222	Pond		at Abhayapuri
60.	at Mahamaya Mandir Pukhuri	2223	Pond		at Bagaribari, Kokrajhar
61.	Raja Pukhuri	2224	Pond		at Gauripur
62.	Baskandi Pond	2225	Pond		inside the Baskandi Madrasa, Baskandi
63.	Sivasagar Tank	2226	Pond		(Borpukhuri) near Sivaldal
64.	Hardai Pukhuri	2227	Pond		at Charaidew
65.	Gala Beel	2228	Pond		at Dergaon
66.	Kundil river	2229	River		at Kundil /Sapakhowa
67.	Buridihing river	2230	River		at intake point of Oil India Ltd., Duliajan
68.	Dikhow river	2231	River		at Dikhow bridge, Sivasagar
69.	Kohara river	2232	River		at NH crossing, Kohora
70.	Boginodi river	2233	River		near bridge NH-52, Lakhimpur
71.	Ranga Nadi river	2234	River		down stream of Hydel Project
72.	Panchnai river	2235	River		at NH-52 crossing, Orang, Sonitpur
73.	Kapili river	2236	River		at Dharamtul bridge, NH-31, Nagaon
74.	Kalong river Down Stream of	2237	River		at Ananda Ram Dhekiyal Phukan Bridge, Nagaon
75.	Beki River	2238	River		at NH-37 crossing near Barpeta Road
76.	Sankosh river	2239	River		at Dhubri
77.	Borak river (Down Stream)	2240	River		at Silchar
78.	Sonai River	2241	River		at Sonai
79.	Kushiara river	2242	River		at Karimganj
80.	Well	2243	Ground water		Half Yearly
81.	Well	2244	Ground water	from Nazira	
82.	Well	2245	Ground water	from Numaligarh	
83.	Well	2246	Ground water	from Simen Chapari, Dhemaji	
84.	Well	2247	Ground water	from Silapathar, Dhemaji	
85.	Well	2248	Ground water	from Lakhimpur Town, Lakhimpur	
86.	Well	2249	Ground water	from Mission Chariali, Tezpur	
87.	Well	2250	Ground water	from Panigaon, Nagaon	
88.	Well	2251	Ground water	from Jagiroad near HPC effluent discharge point	
89.	Well	2252	Ground water	near MSW dumping site at Garchuk, Gwahati	
90.	Well	2253	Ground water	from Nalbari	
91.	Well	2254	Ground water	from Barpeta Road	
92.	Well	2255	Ground water	from near BRPL, Dhaligaon	
93.	Well	2256	Ground water	from Kokrajhar District	
94.	Well	2257	Ground water	from Dhubri College Nagar, Dhubri	
95.	Well	2258	Ground water	from Goalpara College, Goalpara	
96.	Well	2259	Ground water	from Diphu	
97.	Well	2260	Ground water	from Hamren, NC Hills	
98.	Well	2261	Ground water	from Haflon NC Hills	
99.	Well	2262	Ground water	Groundwater from Karimganj College, Karimganj	
100.	Well	2263	Ground water	Ground water from Hailakandi near ASTC Bus Stand	
101.	Well	2264	Ground water	Ground water from Panchgram market near Cachar Paper Mill	

## 7. Water Quality Trend of some important Rivers of Assam with respect to certain Physiochemical Parameters

### 7.1 Water Quality Trend of Brahmaputra River

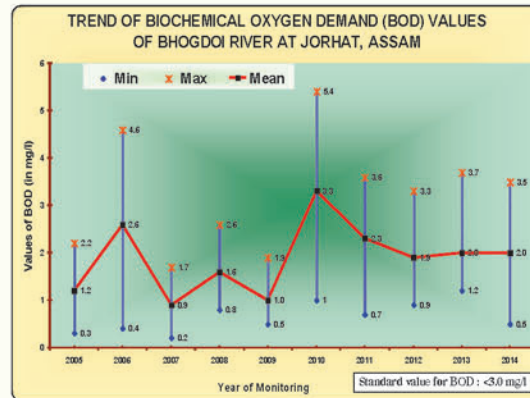
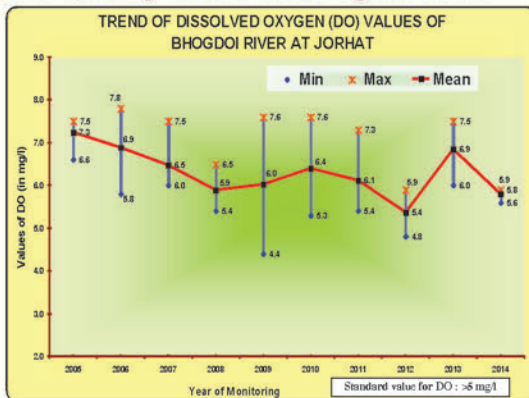
To ascertain the water quality of Brahmaputra, Pollution Control Board, Assam has established 10 water quality monitoring stations under NWMP. Of the total 10 monitoring stations monthly water quality monitoring is being done in 6 stations i. e. at – Balijan, Maijan, Nimatighat, Djhenukhana Pahar, Pandu, and Jogighopa for the core parameters; and in 4 other stations i. e. at – Chandrapur, Guwahati (at Kacharighat), Sualkuchi and Dhubri monitoring is being done on quarterly basis for core parameters. The water quality of Brahmaputra River observed at Balijan, Maijan, Nimatighat, Djhenukhana Pahar, Pandu, and Jogighopa with respect to selected core parameters such as –DO, BOD, Total Coliform (TC) and Faecal Coliform (FC) for the years 1995 to 2014 are presented in the following figures for the purpose of assessing the present water quality as well as its trend over the years.



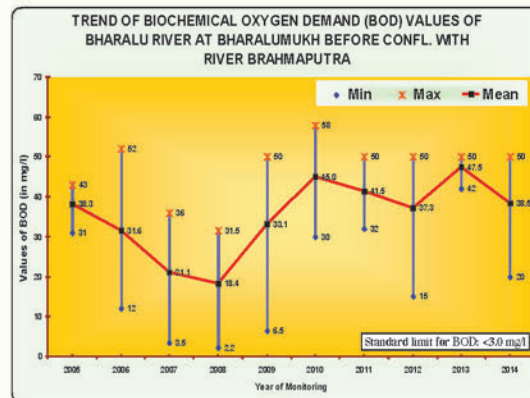
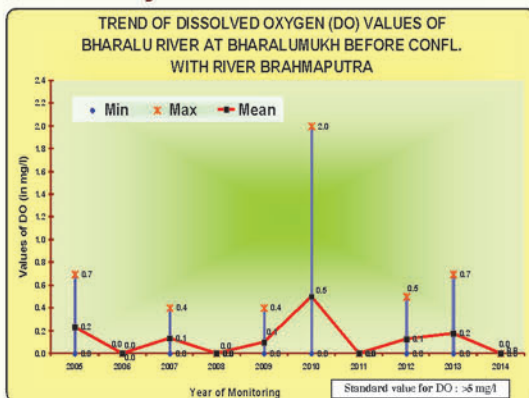
## 7.2 Water Quality Trend of selected Tributaries of Brahmaputra River

The water quality monitoring programme of the Board covers most of the important tributaries of the State. However, considering the scope of this report, water quality trend of few selected tributaries with respect to selected criteria are presented graphically below -

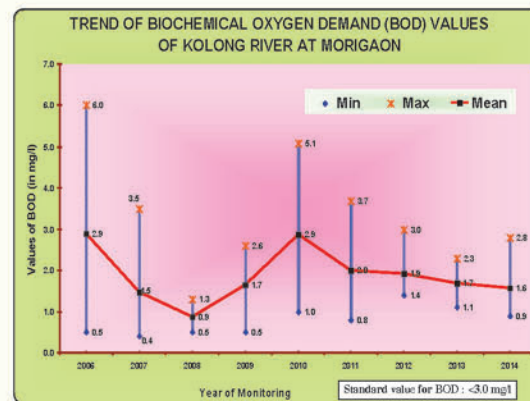
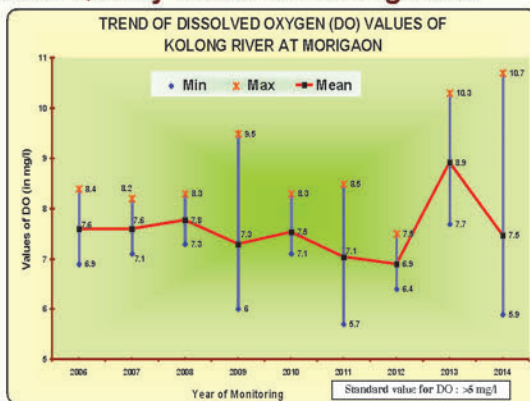
### 7.2.1 Water Quality Trend of Bhogdoi River



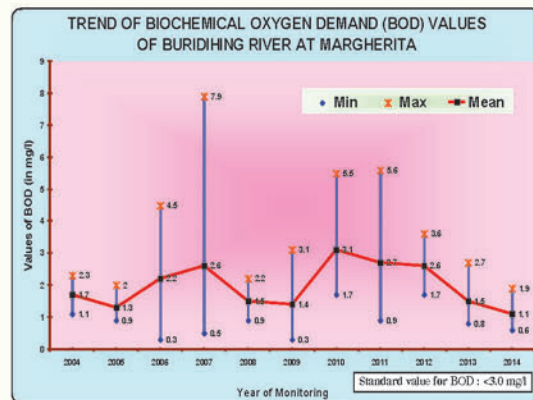
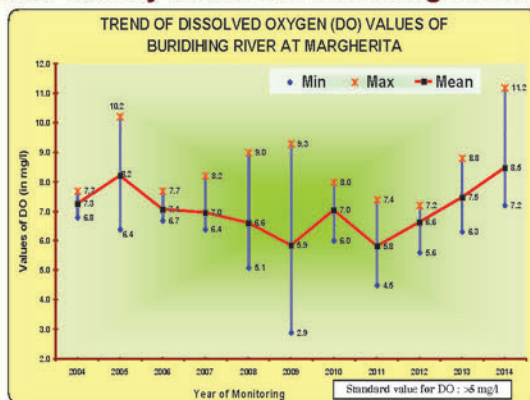
### 7.2.2 Water Quality Trend of Bharalu River



### 7.2.3 Water Quality Trend of Kolong River

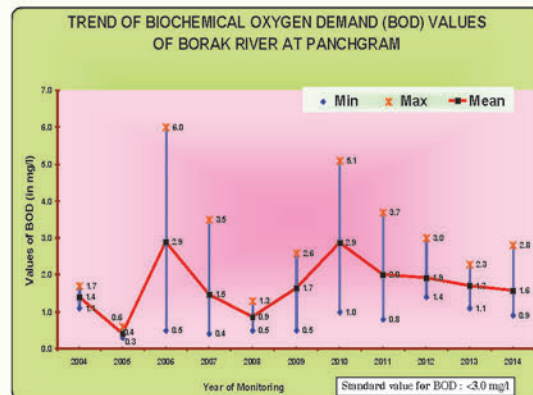
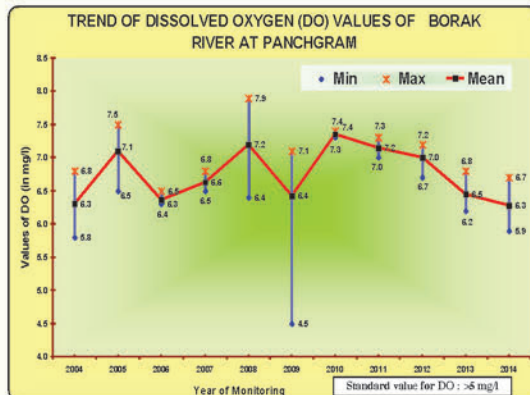


## 7.2.4 Water Quality Trend of Buridihing River



## 7.3 Water Quality Trend of Borak River

Barak is the second largest river system in Assam and like Brahmaputra, the Barak is also a perennial river with large number of tributaries. The water quality trend of Barak river with respect to selected criteria is given below -



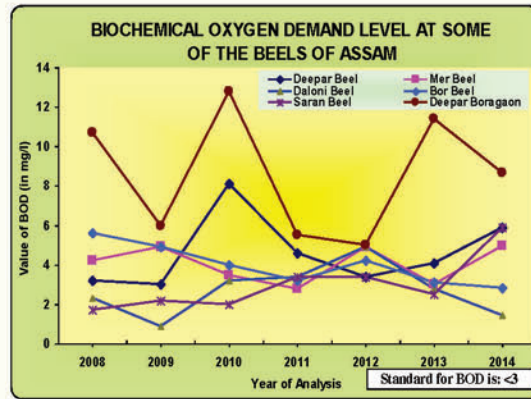
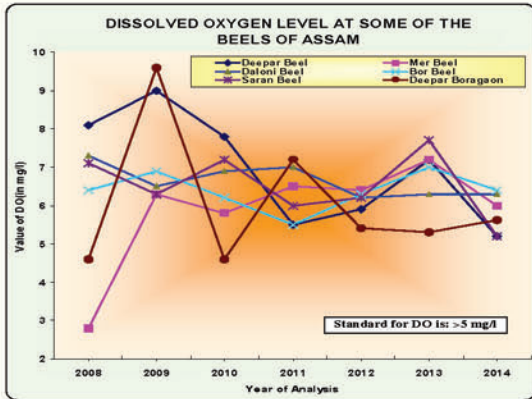
## 8. Water Quality Trend of Beels, Ponds and Wells

Assam is well known by the presence of large number of Beels, Tanks and Ponds dotted all over the State. There are hundreds of water bodies under these categories and most of them are found in the Brahmaputra Valley. These categories of water bodies occupies about 0.23 Lakh Hectares of area in the State. Among the said three categories of water bodies lakes are naturally originated, whereas the tanks and ponds were dug by the people. There are many historically significant tanks and pukhuries in Assam and those are mostly dug under the patronages of ancient rulers and the religious saints.

The water quality monitoring of Beels, Tanks and Pond in Assam is being carried out by the State Pollution Control Boards of Assam regularly under NWMP and also under its other water quality monitoring programmes.

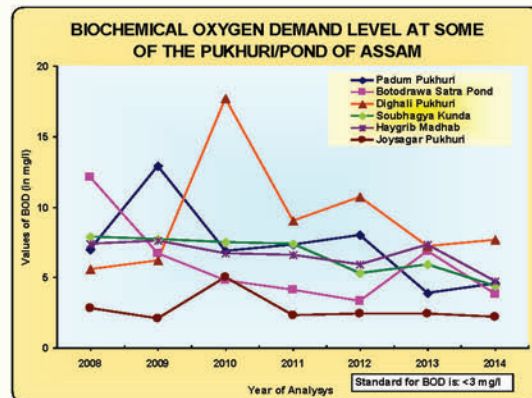
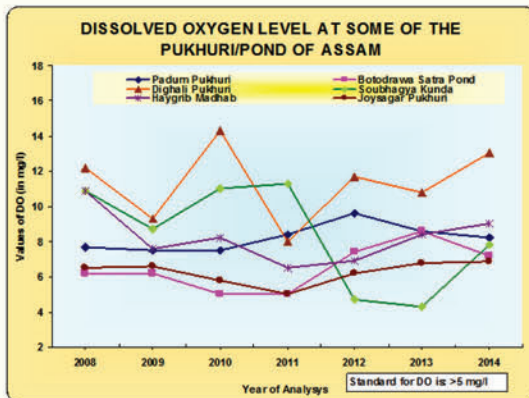
### 8.1 Water Quality of Beels

The beels selected for water quality assessment are – Elenga Beel, Deepar Beel, Mer Beel, Daloni Beel, Bor Beel, Saran Beel, Chand Dubi Beel and Gela Beel. In this report, the trend of water quality of Deepar Beel, Mer Beel, Daloni Beel, Bor Beel, Saran Beel and Daloni Beel with respect to selected parameters for the period from 2008 to 2014 have been included and are shown in the following graphs-



## 8.2 Water Quality of Pukhuries/Ponds

In this category a total number of 18 ponds/pukhuries/tanks were selected across the State for water quality assessment of these types of water bodies. These ponds are - Borpukhuri a Nazira, Rajmaw Pukhuri at Jorhat, Padum Pukhuri at Tezpur, Jaipal Pukhuri at Sipajhar, Batodrawa Satra Pond at Nagaon, Dighali Pukhuri at Guwahati, Soubhagya Kunda Pond at Kamakhya (Guwahati), Bishnu Puskar Pukhuri at Hajo, Joysagar Tank at Sivasagar, Gaurisagar Tank at Sivasagar, Gahpur Tank at Gahpur, Ganga Pukhuri at Nalbari, Rajadinia Pukhuri at Abhayapuri, Mahamaya Mandir Pukhuri at Bagribari, Raja Pukhuri at Gauripur, Baskandi Pond at Baskandi, Sivasagar Tank at Sivasagar and Hardai Pukhuri at Charaidew. Out of the said pukhuries, in this report, the trend of water quality of Padum Pukhuri, Batodrawa Satra Pond, Dighali Pukhuri, Soubhagya Kunda Pond, Bishnu Puskar Pukhuri and Joysagar Tank with respect to selected parameters for the period from 2008 to 2014 have been included and are shown in the following graphs-



## 9. Ground Water Quality of Assam

To assess the problem of groundwater quality deterioration, network of groundwater quality monitoring is extended to 490 locations in the country under NWMP of CPCB. The PCBA is carrying out ground water quality monitoring in the State under this programme. At present there are 32 numbers of ground water quality monitoring stations across the State. These stations are either well or tube well.

A brief summary on the ground water quality of Assam based on the monitoring data of the said monitoring stations for selected parameters for the period from 2008 to 2013 is presented below –

## pH

- pH of groundwater is observed in the range of 4.7 to 8.3 and the lowest value is observed at Karbi Anglong District in the year 2011 (4.7)
- pH observed below the desired range in one or more occasions during the study period at-  
Ledo (5.0), Nazira (6.3), Numaligarh (5.0), Semanchapori (6.2), North Lakhimpur (5.6), Tezpur (Mission Chariali) (6.0), Nagaon (6.4), Jagiroad (5.8), Barpeta Road (5.8), Kokrajhar (5.8), Dhubri (6.3), Goalpara (Goalpara College) (6.1), Diphu (Diphu College) (5.6), Haflong (5.6), Hailakandi (5.9), Panchgram Market (near Cachar Paper Mill) (5.0), Digboi (5.9), Sivasagar (6.2), Sivasagar (Sonari) (6.0), Jorhat (6.1), Silchar (5.8), Barpeta (6.0), Bongaigaon (6.0), Guwahati (6.4), Guwahati (6.0).

## Biochemical Oxygen Demand

- BOD ranges from 0.2 to 50.0 mg/l.
- Highest value of BOD is observed at Guwahati (50.0 mg/l),
- BOD is not meeting the desired criteria in one or more occasions during the study period at-  
Ledo (3.0 mg/l), Nazira (3.7 mg/l), Numaligarh (3.2 mg/l), Semanchapori (3.1 mg/l), North Lakhimpur (14.6 mg/l), Tezpur (Mission Chariali) (13.4 mg/l), Nagaon (4.8 mg/l), Jagiroad (6.0 mg/l), Garchuk (Guwahati)(5.0 mg/l), Nalbari (4.2 mg/l), Barpeta Road (3.7 mg/l), Bongaigaon (BRPL)(4.2 mg/l), Kokrajhar (3.9 mg/l), Dhubri (4.8 mg/l), Goalpara (Goalpara College) (5.8 mg/l), Haflong (6.5 mg/l), Karimganj (5.4 mg/l), Hailakandi (3.4 mg/l), Panchgram Market (near Cachar Paper Mill) (6.6 mg/l), Digboi (5.4 mg/l), Karbi Anglong (4.6 mg/l), Sivasagar (Sonari) (3.9 mg/l), Jorhat (4.3 mg/l), Silchar (6.5 mg/l), Barpeta (3.5 mg/l).

## Fecal Coliform

- Fecal Coliform (FC) ranges from 0 to 360 MPN/100 ml.
- Fecal Coliform is meeting the desired criteria at all monitoring stations.

## Total Coliform

- The Total Coliform count varies from 0 to 2800 MPN/100 ml.
- Total Coliform is meeting the desired criteria at all monitoring stations.

## 10. Findings of special studies on contamination of underground water with Fluoride and Arsenic

The Pollution Control Board, Assam with the financial support of Central Pollution Control Board, Delhi carried out the study of estimation of fluoride and arsenic content in ground water of eleven (11) nos. of Districts of Assam and results reported in the study report are given in the following *Table No. 18*.

**Table No. 18: Estimation of fluoride and arsenic content in ground water of 11 nos. Districts in Assam**

Sl. No.	District	No. of Samples	Fluoride Conc. (mg/l)		Arsenic Conc. (µg/l)		No. of samples having concentration higher than permissible limit	
			Max	Min	Max	Min	Fluoride	Arsenic
1	Golaghat	37	1.73	0.38	107.08	1.97	10	24
2	Karimganj	37	0.91	0.25	102.2	0.488		10
3	Karbi-Anglong	7	3.47	0.04	0.80	0.35	2	
4	Cachar	11	0.54	0.331	34.12	0.04		1
5	Lakhimpur	16	0.84	0.64	11.42	2.89		1
6	Nagaon	44	0.96	0.31	9.53	0.22		
7	Kamrup	122	2.1	0.06	15.62	0.01	17	2
8	Dhubri	30	0.78	0.44	9.27	1.29		
9	Hailakandi	19	0.851	0.25	40.49	1.43		2
10	Dhemaji	13	0.71	0.50	5.80	1.89		
11	Jorhat	19	1.01	0.69	90.03	47.46	1	8 (Titabor area)
<b>Total</b>		<b>355</b>						

It has been observed from the results that in Golaghat district fluoride content in ground water ranges from 0.38 to 1.73 mg/l and in 27% of the collected samples fluoride content is more than maximum permissible limit. Similar is the case with Arsenic content also. In about 72.9% of the water samples, Arsenic content was found to be more than that of maximum permissible limit of 10 µg/l. Arsenic content in the ground water samples from Golaghat district ranges from 1.97 µg/l to 107.28 µg/l.

In Titabor area of Jorhat district, 42% of Water samples collected for analysis revealed that Arsenic content is higher than permissible limit and 13.9% ground water samples has been identified for fluoride content more than permissible limit of 1.0 mg/l.

In Kamrup district, 17 nos. of ground water sample out of 122 nos. has fluoride content more than permissible limit.

Furthermore, on getting information about suffering of a large number of people of Haldiati village located on Doboka-Diphu Road due to fluorosis the Pollution Control Board, Assam deputed a team of Scientists to collect water sample from various drinking water sources as well as soil from different parts of Haldiati village. The sample collection party of the Pollution Control Board, Assam collected sample from Tapajuli, Nizparkhowa and main Haldiati village areas. The drinking water from following types of sources available in the village were collected:



- (i) Kacha Well.
- (ii) Deep Tube Well.
- (iii) Ring Well fitted with Tara pump under UNICEF Project.
- (iv) Flowing stream water.
- (v) Water being supplied by PHE from Urdha Ganga Pani Jogan Asoni

The samples were analysed for pH, Conductivity, Iron and Fluoride contents at Central Laboratory of Pollution Control Board, Assam and the results are tabulated in *Table No. 19*.

**Table No. 19 : Water Quality of Haldiati, Tapajuli and Nizparkhowa villages located along Doboka-Diphu Road**

Lab. Ref No.	Date of Receipt	Source	Date & Time of Collection	pH	Cond (µS/cm)	T. Fe (mg/L)	F (mg/L)
GW-30/12	12/10/2012	Water from Kacha Well from the residence of Mrs. Bhagwati Malakar, Tapajuri Haldiati	11-10-2012 at 12-24 PM	6.10	132	3.16	0.34
GW-31/12	12/10/2012	Water from Deep Tube Well from the residence of Md. Abdul Rahim, Tapajuri, Haldiati	11-10-2012 at 12-38 PM	7.10	269	0.88	12.9
GW-32/12	12/10/2012	Water from Deep Tube Well from the residence of Md. Hasen Ali, Tapajuri, Haldiati	11-10-2012 at 12-50 PM	6.95	233	1.60	7.14
GW-33/12	12/10/2012	Water from Deep Tube Well from the residence of Md. Fazar Ali, Tapajuri Haldiati	11-10-2012 at 1-06 PM	7.05	277	1.28	11.10
GW-34/12	12/10/2012	Water from Deep Tube Well from the residence of Md. Monuddin, Tapajuri, Haldiati	11-10-2012 at 1-15 PM	7.15	254	1.24	9.20
GW-35/12	12/10/2012	Water from Ring Well (TARA Pump, UNICEF) from the Tapajuri Senior Madrassa, Haldiati	11-10-2012 at 1-21 PM	6.30	238	3.00	0.42
GW-36/12	12/10/2012	Water from stream water, Tapajuri, Haldiati	11-10-2012 at 1-46 PM	6.80	75	2.40	0.32
GW-37/12	12/10/2012	Water from Deep Tube Well from the residence of Mr. Paban Rangsang, Tapajuri, Haldiati	11-10-2012 at 1-51 PM	7.00	253	0.84	10.70
GW-38/12	12/10/2012	Water from Kacha Well from the residence of Mrs. Pranita Tisupi, Tapajuri	11-10-2012 at 2-09 PM	5.20	43	0.28	0.24
GW-39/12	12/10/2012	Water from Deep Tube Well from the residence of Moneswar Eupti, Tapajuri	11-10-2012 at 2-15 PM	6.70	243	3.96	6.43
GW-40/12	12/10/2012	Water from Deep Tube Well from the residence of Mr. Botin Ch. Rangsang, Tapajuri	11-10-2012 at 2-25 PM	5.75	159	0.06	0.90
GW-41/12	12/10/2012	Water from Kacha Well from the residence of Mr. Chandra Tisu, Tapajuri	11-10-2012 at 2-35 PM	6.10	188	0.94	0.62
GW-42/12	12/10/2012	Water from Urdha Ganga Pani Jogan Achani, Urdha Ganga	11-10-2012 at 3-00 PM	6.50	163	0.32	0.35
GW-43/12	12/10/2012	Water from Urdha Ganga Juri near KNLF Designated Camp, Para khowa	11-10-2012 at 3-10 PM	6.35	32	0.62	0.33
GW-44/12	12/10/2012	Water from Ring Well (Tara pump, UNICEF) from the residence of Mrs. Ketiki Betri, Nizpara Khowa	11-10-2012 at 3-20 PM	6.50	376	1.72	1.62
GW-45/12	12/10/2012	Water from Deep Tube Well from the residence of Mr. Pitaram Terang, Nizpara Khowa	11-10-2012 at 3-25 PM	7.10	281	0.98	3.40
GW-46/12	12/10/2012	Water from Ring Well (Tara Pump, UNICEF) near Karbi Namghar, Nizpara Khowa	11-10-2012 at 3-40 PM	6.55	254	2.96	1.27
GW-47/12	12/10/2012	Water from Deep Tube Well from the residence of Mr. Ajoy Krow, Nizpara khowa	11-10-2012 at 3-50 PM	7.25	275	0.60	4.59

## 9.1 Analysis of results:

The results confirm the following:

1. All the 3 samples of the water from Kacha wells have fluoride contents in the range of 0.24 to 0.62 mg/l which is below the permissible limit and safe in respect of fluoride concentration. But there is risk of higher concentration of Coliform and Faecal Coliform bacteria in this water, making it not safe for drinking as such without treatment.
2. 2 samples collected from free flowing stream (Urdha Ganga Juri) have fluoride concentration of approx. 0.33mg/l which is quite in safe range.
3. Out of 3 samples collected from Ring wells fitted Tara Pump by PHE Deptt. under UNICEF project two samples tested to have fluoride contents higher than permissible limit in the range of 1.27 to 1.62 mg/l. Thus the water of 67% of ring wells fitted with Tara Pump is not safe for drinking.
4. The sample of water collected from Urdha Ganga Pani Jogan Asoni of PHE was found to contain fluoride within the permissible limit and thus was found to be safe for drinking but the quantity of water being made available to the people is too meager.
5. The worst results were found in respect of samples collected from Deep Tube Wells. Out of 9 samples, 8 samples i.e. 88% of samples were found to have fluoride content in the range of 3.40 to 12.90 mg/l which is 240 to 1200 % higher than the permissible limit of 1mg/l and incidently the largest number of people of the village (~80%) depend on Deep Tube Wells for drinking water and many of the wells have been provided to people under Government schemes.





