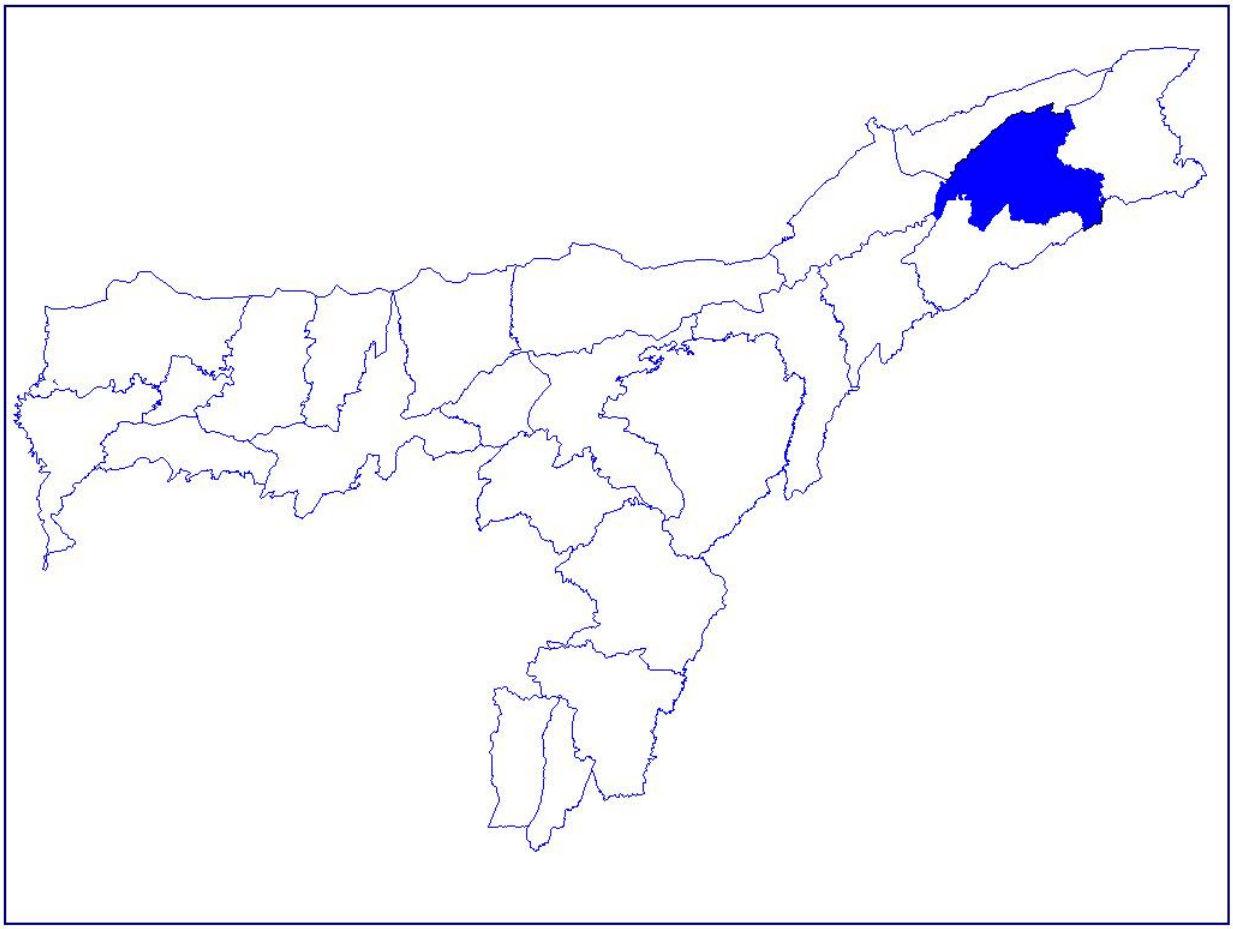
Technical Report Series: D

No:

Ground Water Information Booklet
Dibrugarh District, Assam



Central Ground Water Board
North Eastern Region
Ministry of Water Resources
Guwahati

September 2013

District at a Glance

Sl. No.	ITEMS	Statistics
1.	**GENERAL INFORMATION**	
	i) Geographical Area (sq.km.)	3,381
	ii) Population (as per 2011 Census)	13,27,748
	iii) Average Annual Rainfall (mm)	2,819
2.	**GEOMORPHOLOGY**	
	i) Major physiographic units	Flood plain, Terrace deposit
	ii) Major Drainages (Sub-dendritic to Sub- angular)	Brahmaputra, Burhi Dihing, Sessa, Disang, Dibru
3.	**LAND USE (sq. km)**	
	i) Forest Area	233.41
	ii) Net Area Sown	1,394.98
	iii) Total cropped area	1,589.17
	iv) Area sown more than once	194.19
4.	**MAJOR SOIL TYPES**	Entisol & Inceptisol
5.	**AREA UNDER PRINCIPAL CROPS (As on 2001-2002)**	Paddy
6.	**IRRIGATION BY DIFFERENT SOURCES (sq. km.)**	4.82
7.	**NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on March 2011)**	11
8.	**PREDOMINENT GEOLOGICAL FORMATIONS**	Alluvium
9.	**HYDROGEOLOGY**	
	i) Major Water bearing formation	Alluvium
	ii) Pre- monsoon Depth to water level during 2006 (in m bgl)	0.16 – 4.23
	iii) Post-monsoon Depth to water level during 2006 (in m bgl)	0.14 – 5.693
	Long term water level trend in 10 yrs (1997–2006) in m/yr	No significant rise or fall.
10.	**GROUND WATER EXPLORATION BY CGWB (As on 28.02.2013)**	
	i) No of wells drilled (EW, OW, PZ, SH, Total)	23 (12 EW, 9 OW & 2 PZ)
	ii) Depth Range (m)	42.0 to 253.0
	iii) Discharge (litres per second)	7.5 to 27.00
	iv) Storativity (S)	2.57×10^{-3}
	v) Transmissivity (m^2/day)	6500 to 10,350
11.	**GROUND WATER QUALITY**	
	Presence of Chemical constituents more than permissible limit	Fe
	Type of water	Fresh

12.	**DYNAMIC GROUND WATER RESOURCES (2009) in mcm** i) Annual Replenishable Ground Water Resources ii) Net Annual Ground Water Draft iii) Projected demand for Domestic and Industrial Use upto 2025 iv) Stage of Ground Water Development	 1889.11 266.76 37.45 15%
13	**AWARNESS AND TRAINNING ACTIVITY** i) Mass Awareness Programme organized ii) Date iii) Place iv) No. of Participants	 Nil
14.	**EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING** i) Projects completed by CGWB (No & Amount spent) ii) Projects under technical guidance of CGWB	 Nil
15.	**GROUND WATER CONTROL AND REGULATION** i) Number of OE Blocks ii) No of Critical Blocks iii) No of blocks notified	 Nil
16.	**MAJOR GROUND WATER PROBLEMS AND ISSUES**	Nil

GROUND WATER INFORMATION BOOKLET
DIBRUGARH DISTRICT, ASSAM

1. Introduction:

Dibrugarh district of Assam covers a geographical area of 3381 sq. km and lies between N. Latitudes 27˚ 06′ 00″ and 27˚ 58′ 18″ and East longitudes 94˚ 39′ 00″ and 95˚ 30′ 00″. The district is bounded on the West and North West by Lakhimpur district on the East by Tinsukia district on the South by Sibsagar district and on the South east by Tirap district of Arunachal Pradesh. The mighty Brahmaputra River is the northern boundary of the district. Dibrugarh district lies in the north eastern part of the state and has seven development blocks namely Khowang, Borboruah, Lahot, Tengakhat, Joypur, Tinkhong and Panitola. Administrative map of the district is given in **Plate I**. As per 2011 census report total population of Dibrugarh district is 13,27,748. Demographic profile of the district as a hole is given below in **Table 1.**

Table 1: Demographic Profile, 2011 Census

Population	13,27,748
Rural Population	10,83,984
Urban Population	2,43,764
Density (per Sq. Km.)	393

The district is a part of Brahmaputra river basin. The area is drained by Brahmaputra river and its tributaries. Important tributaries of Brahmaputra river are Burhi Dihing, Disang, Dibru, Sessa and Lekhijan. All these tributaries are pereminal and are highly meandering. The lower order streams present a dendritic pattern but higher older streams show a sub-parallel pattern.

Eighty percent of the people of the district are either agriculturists or engaged in related activities. Paddy is the dominant crop of this area and is grown in low land area while high land supports a good number of tea gardens. Other crops of the district are gram, tur, cotton, jute, Mesta, mustard etc.

Central Ground Water board took up detailed hydrogeological surveys of the district in 1976-77. Subsequently reappraisal survey, short term water supply investigation for Central and State department as well as groundwater exploration activities in various block of the district also has been carried out.

2. Rainfall and climate:

The district experiences 2300 to 3000 mm. rainfall per year. Average annual rainfall of the district is 2819 mm. while normal rainfall (1901-1950) is 2796.4 mm. It is observed that on an average 64 to 68% of annual rainfall is received during the monsoon period (June-September) and 22-26%of annual rainfall during pre-monsoon period (March-May).

Highest temperature is generally observed in the months of July/August (35˚C) and lowest is in the months of December/January (7-8˚C). Humidity is the morning hour's ranges from 90-95% and 50-70% in the afternoon hours. Wind speed ranges generally from 30-60km/hour. Sunshine hours range from 3 to 7. The climate of the region is sub-tropical wet and is characterized by hot and humid summer and dry cool winter.

3. Geomorphology and Soil type:

The district is occupied with two different land forms namely- (1) Flood plain of Brahmaputra river and (2) the terrace deposits and denudational hills in the southern part.

(1) Flood plains: The alluvial flood plains occupying the maximum part of the district is almost flat, except gentle undulations at places. Land elevation of the land ranges between 86.88 m and 152 m above msl. General slope is towards west and south west.

(2) The terrace deposits and denudational hills: This present in the south eastern part of the district, range in elevation from 115 to 350m AMSL and rise upto 500m AMSL in Tikak Parbat area. The regional trend of the hills is NE-SW.

Soils of the area are sandy to clayey loam type and grayish is color. They are acidic in reaction with PH ranges from 4.6 to 5.9. They are also characterized by low to medium phosphate and medium to high potash content. Based on pedogenic and pedological characters, soils of this area may be classified into following classes

a) Recent riverine alluvial soils (Antisol)
b) Old riverine alluvial soils (Inceptisol)
c) Old mountain valley alluvial soils (Alfisol)

4. Ground water scenario:

4.1 Hydrogeology: Unconsolidated alluvial deposits of Quaternary Age covers major part of the district. Only about 4 % area of the district is underlain by semi consolidated formation of Tertiary Age belongs to Disang and Barail Groups of rock. A single system of aquifer (granular zone) below a thin clay cover on top is present mainly in the southern part of the district. In the northern part, this single aquifer system is separated into a multiple aquifer system by thick clay partings. Thickness of aquifer increases from east to west.Ground water in the shallow aquifer group exists in unconfined to semi confined condition. In general depth of tube wells varies from 35 to 45 m. The tube wells constructed down to a depth of 50 m yields 27 to 45 m^3/hour. Hydrogeology of the district is depicted in **Plate-II.** Pre-monsoon depth to water level ranges from 0.16 to 4.23 m bgl. It is observed that Pre-monsoon depth to water level ranges from 2 to 4 m bgl in the southern part of the district i.e. Khowang, Joypur area and in a limited area in the northern part of the district i.e. parts of Lahoal, Borboruah and Tengakhat. But, in parts of Lahol and Panitola blocks, depth to water level goes upto 4 m bgl. Post-monsoon depth to water level ranges in this district from 0.14 to 5.693 m bgl. Block wise water level behavior in different flood plains of the district is given below in **Table 2.**

Table 2: Water level behavior in different flood plains

Block	Pre-monsoon depth to water (in m bgl)	Post-monsoon depth to water (in m bgl)	Flood plain/Area traverses by major rivers
Khowang	0.67 to1.78	1.24 to 2.80	**Burhi Dihing River:** Flowing in the Northern boundary of the block (flowing in NE to SW direction)
Borboruah	0.90 to 1.79	1.27 to 2.20	**Brahmaputra River:** Flowing in the extreme North (flowing from NE to SW) **Sessa River:** Flowing through the central part of the block, flowing from NE to SW

			Burhi Dihing River: Flowing in the southern boundary of the block, flowing from NE to SW
Lahoal	0.30 to 0.86	1.06 to 2.64	**Brahmaputra River:** Flowing in the extreme Northern part of the block **Mai Jan River:** Flowing in the northern part of the block (flowing from East to West) **Dibru River:** Flowing from NE to SW and meets with Brahmaputra River in the West.
Tengakhat	0.16 to 1.66	0.14 to 2.90	**Sessa River:** Flowing in the extreme Northern part of the block, (flowing from East to West) **Burhi Dihing River:** Flowing in the Southern boundary of the block (flowing from SW to NE and then at the middle of southern boundary, from NE to SW)
Panitola	0.82 to 0.86	2.47 to 4.34	**Brahmaputra River:** Flowing in the extreme Northern part of the block (flowing from NE to SW) **Dibru River:** Flowing through central part of the block from East to West **Sessa River:** Flowing in the Southern part of the block from East to West)
Jaipur	0.42 to 4.23	0.92 to5.693	**Disang or Dilli River:** (Flowing from South to North and then NE to SW **Burhi Dihing River:** Flowing from ESE to WSW
Tingkhong	1.24 to 1.73	3.11 to 3.79	**Disang or Dilli River:** Northern Boundary of the block and flowing from NE to SW direction).

On the basis of ground water exploration data it can be inferred that in the northern part of the district, it is mainly a single aquifer system. But, in the southern part of the district, there is multi-aquifer system where individual aquifers are separated by thick clay layers. Thickness of aquifer increases from east to west.

The water table contour ranges in elevation from 97 m above msl in western part to 113 m above msl in the eastern part. The gradient varies between 0.30 to 0.55 m/km. Seasonal fluctuation in most part of the district is within 1 to 2 m .But, along the Burhi-Dihing river and Brahmaputra river, the fluctuation is less than 1m. In semi-consolidated Tertiary formation, water level fluctuation is 2 to 4 m. The piezometric surface rests between 1.25 and 4 m bgl. A number of shallow bamboo tubewells constructed in this district down to a depth of 36 m by tabbing 12 to 15 m of saturated medium to coarse grained sand zone. Yield of these wells varies from 27 to 31.5 m^3/ hour. Deep tube wells constructed down to 253 m bgl yield around 82 - 164 m^3/ hour for a nominal drawdown of 2 – 3 m. Transmissivity in the area ranges from 6,500 to 10,350 m^2/day. Storage coefficient ranges from 2.57 X 10^{-3} while specific capacity ranges from 798 to 915.

4.2 Ground Water Resources:

Methodology adopted for ground water resource estimation of Dibrugarh District of Assam is as per GEC 1997 Report, i.e. Ground Water Level Fluctuation and Rainfall infiltration factor Method.

The net ground water availability estimated in the year 2009 is 1794.65 mcm. The existing gross ground water draft 266.76 mcm and the stages of development are 15% only. Future provision for domestic and Industrial use is 31.08 mcm and for Irrigation use is 1519.49 mcm.

Assessment unit can be categorized into 4 categories as SAFE, SEMI-CRITICAL, CRITICAL, and OVER-EXPLOITED. In Dibrugarh district stage of ground water development is 12%, which shows under the SAFE category. As long-term water level trend does not show any major change so the whole district may be considered as SAFE.

CHART OF GROUND WATER RESOURCE ESTIMATION

Net Ground Water Availability	= 1794.65 mcm
Gross Ground Water Draft	= 266.76 mcm
Stage of Ground Water Development	= 15%
Future provision for Domestic & Industrial Use	= 37.45 mcm
Future Provision for Irrigation Use	= 1519.49 mcm

4.3 Ground water Quality:

Chemically, the water to be used for domestic purpose should preferably be soft, low in dissolved solids and free from poisonous constituents. Ground water of the district is colorless, odor-less and free from turbidity. Presence of TDS within 150 to 1000 ppm, SAR within 0.30 to 1.97, RSC value within 0.01 to 1.01 meq /lt and Fe content in most part of the district is below 5 ppm in ground water. But, in and around Tengakhat area, concentration of iron is found more than permissible limit for drinking purpose. Moreover, goiter has been reported in some of the villages like Kalakhowa, Lejai and Sessa area which is due to deficiency of iodine in ground water. Thus, in general, the area is safe in all respect for utilizing of ground water.

4.4 Status of Ground Water Development:

As per report of state department, considerable numbers of shallow tube wells and a few deep tubewells constructed in Dibrugarh district for irrigation purposes. A huge number of dug wells are also available in this district. Considering average annual draft of 0.03 MCM and 0.1MCM for shallow and deep tube well respectively, total draft from both shallow and deep tube well comes out 140.29 mcm. So the total ground water draft for irrigation, domestic and industrial purposes in the district comes up to 167.66 mcm.

5.1Scope of Ground Water Development:

As major part of the district is underlain by unconsolidated alluvial sediments, water level in 2-4 m bgl and as per exploration activity carried out by CGWB, state department as well as private party, whole district is feasible for construction of tube well for ground water development. As major part of the district covered by unconsolidated formation therefore, Rotary Rig is suitable for this area. In and around Namrup area covering Dillighat, Nagamati,Nagahat, Charaipung etc area bordering Dilli River/ Dilli R.F where boulder will encounter and therefore Percussion Rig is suitable. DTH rig with ODEX facility may be deployed but, this may restrict depth of drilling and therefore construction of shallow tube well is feasible in this area with such type of rig. As this area is acting as a recharge zone therefore, at least 25 to 30 m housing provision need to be kept during construction of well as

expected drawdown will be high in this foot hill area. Depths of encountering boulder will vary from place to place. Beside Dilli River, bouldery formation starts almost from surface while boulders encounter approx. from 120 m bgl onwards as recorded at Dirialgaon at Joypur as per ground water exploration record of CGWB, NER.

As major part of the district covered by loose formation the well assembly becomes essential to case the borehole with housing & slotted pipe. The range of slot size for the district varies from 1 to 1.5 mm. A shallow well assembly of 102 mm (4″) diameter with 10 to 15 m slotted pipe is likely to yield upto 30 - 40 m^3 /hr.for a drawdown of 3 to 4 m. This type of shallow tube well will command 3 to 4 ha land. In the southern part of the district i.e. in Khowang block, this type of well is likely to yield 15 to 30m^3 / hour. The housing pipe for deep tube well drilled down to a depth of 100-150 m bgl and screening 30 to 50 m granular zone is likely to yield 90-120 m^3/ hour for a drawdown of within 10 m. Pumping of shallow tube wells can be done by centrifugal pump. Only turbine or submersible pumps should be commissioned in deep tube wells because of higher lift involvement. The H.P. of prime movers for both shallow and deep tube wells is given in **Table 3**.

Table 3. H.P. of Prime Movers

Tubewell	Discharge (lit/sec)	Total head (m)	Efficiency (y)	H.P.
Shallow	8.33	7.5	60	1.5
Deep	27.78	15.0	60	10

5.2 Water Conservation and Artificial Recharge:

Depth to water level data shows that in most part of the district it is 2-4 m bgl while in some parts it is 4-6 m bgl. As the water level (DTW) is within 6 m bgl therefore, artificial recharge is not required for this district. High iron problem, specifically in hand pumps and water logged areas with water borne diseases during rainy days suggest to choose roof top rain water harvesting in specific areas but ground water recharging need not require for the district.

6.0 Ground Water related issues and problems:

Presence of high iron content specifically in hand pumps, bacteriological problem in the rainy days, water logging condition are some of the ground water related problem of Dibrugarh district, Assam.

7.0 Awareness and Training Activity:

7.1 Mass awareness programme (MAP) and Water Management Training Programme (WMTP) by CGWB : Nil

7.2 Participation in Exhibition, Mela, Fair etc : Nil

7.3 Presentation and Lectures : Nil

8.0 Areas Notified by CGWA / SGWA : Nil

9.0 Conclusion & Recommendations:

Dibrugarh district of Assam covers a geographical area of 3381 sq. km and lies between N. Latitudes 27° 06′ 00″ and 27° 58′ 18″ and East longitudes 94° 39′ 00″ and 95° 30′ 00″.

Dibrugarh district of Assam is a part of Brahmaputra river basin covers a geographical area of 3381 sq. km. The area is drained by Brahmaputra River and its tributaries. Important tributaries of Brahmaputra river are Burhi Dihing, Disang, Dibru, Sessa and Lekhijan. The lower order streams present a dendritic pattern but higher older streams show a sub-parallel pattern.

The district experiences 2300 to 3000 mm. rainfall per year. Average annual rainfall of the district is 2819 mm. while normal rainfall (1901-1950) is 2796.4 mm. The district is occupied with two different land forms namely- (1) Flood plain of Brahmaputra river and (2) the terrace deposits and denudational hills in the southern part.

Soils of the area are sandy to clayey loam type and grayish is color. They are acidic in nature. pH value ranges from 4.6 to 5.9.

Major part of the district is underlain by unconsolidated alluvial sediments of Quaternary Age. Only about 4 % area of the district is underlain by semi consolidated formation of Tertiary Age belongs to Disang and Barail Groups of rock.

A single system of aquifer (granular zone) below a thin clay cover on top is present mainly in the southern part of the district. In the northern part, this single aquifer system is separated into a multiple aquifer system by thick clay partings. Thickness of aquifer increases from east to west. Ground water in shallow aquifer group exists in unconfined to semi confined condition. Depth of tube wells varies from 35 to 45 m. The tube wells tap 12 to 24 m of saturated sands generally between the depth of 24 and 36 m or even down to 45 m and yields 27 to 45 m^3/hour. Pre-monsoon depth to water level in southern part and in limited areas of northern part is in between 2 to 4 m bgl. Deepest water level in few pockets recorded upto 9.4 m bgl. The piezometric surface rests between 1.25 and 4 m bgl. Seasonal fluctuation in most part of the district is 1to2 m. Deep tubewells constructed from >50 m to 215 m bgl yield around 82 - 164 m^3/ hour for a drawdown of 2 to 3 m. Transmissivity in the area ranges from 6500 to 10,350 m^2/ day. Storage coefficient in this area is 2.57 X 10^{-3} while specific capacity ranges from 798 to 915. As the district is covered by alluvial formation, rotary rig is recommended for this area.

Ground water of the district is found to be colorless, odor-less and free from turbidity. Other chemical constituents are also found well within permissible limit and thus, the area possesses potable water for domestic use except in some parts of Tengakhat area where higher concentration of iron has been recorded. Iron removal plant should be there with each PWSS. Local people can themselves prepare low cost iron removal structure in there own houses to mitigate this problem. Goiter has been reported in some of the villages like Kalakhowa, Lejai and Sessa area which is due to deficiency of iodine in ground water. People of the villages are advised to use iodized salt to mitigate the problem. Presence of TDS within 150 to 1000 ppm, SAR within 0.30 to 1.97, RSC value within 0.01 to 1.01 meq/ lt and Fe content below 5 ppm in ground water indicates that the area is safe in all respect for utilizing ground water for irrigation purpose also.

Depth to water level data shows that in most part of the district it is 2-4 m bgl while in some parts it is 4-6 m bgl. As the water level (DTW) is within 6 m bgl and seasonal fluctuation in most part of the district is within 1to2 m therefore, artificial recharge need not required for this district. High iron problem, specifically in hand pumps and water logged

areas with water borne diseases during rainy days in some parts of the district suggest to choose roof top rain water harvesting in selected localities.

Net available ground water resource of the district is 1406.96 mcm. Gross draft of the district is 167.66 mcm. Net 1235.59 mcm ground water will be available for future irrigation use after allocating 31.08 mcm, ground water for domestic and industrial purpose upto 2025.

Single cropping pattern persists in this district because of non-availability of assured irrigation (Only 3.9%) facility. Out of 1, 35,806 ha sown area, net irrigated area is only 13,019 ha. For double cropping and for cultivation during winter (Ravi crops) shortage of surface water is the main bottleneck. Moreover, comparatively resourceful farmers are only uses shallow tube wells for irrigation. So to boost up the agricultural growth and thereby economic growth of the district, practice of irrigation by utilizing ground water need to be raised.

Plate I

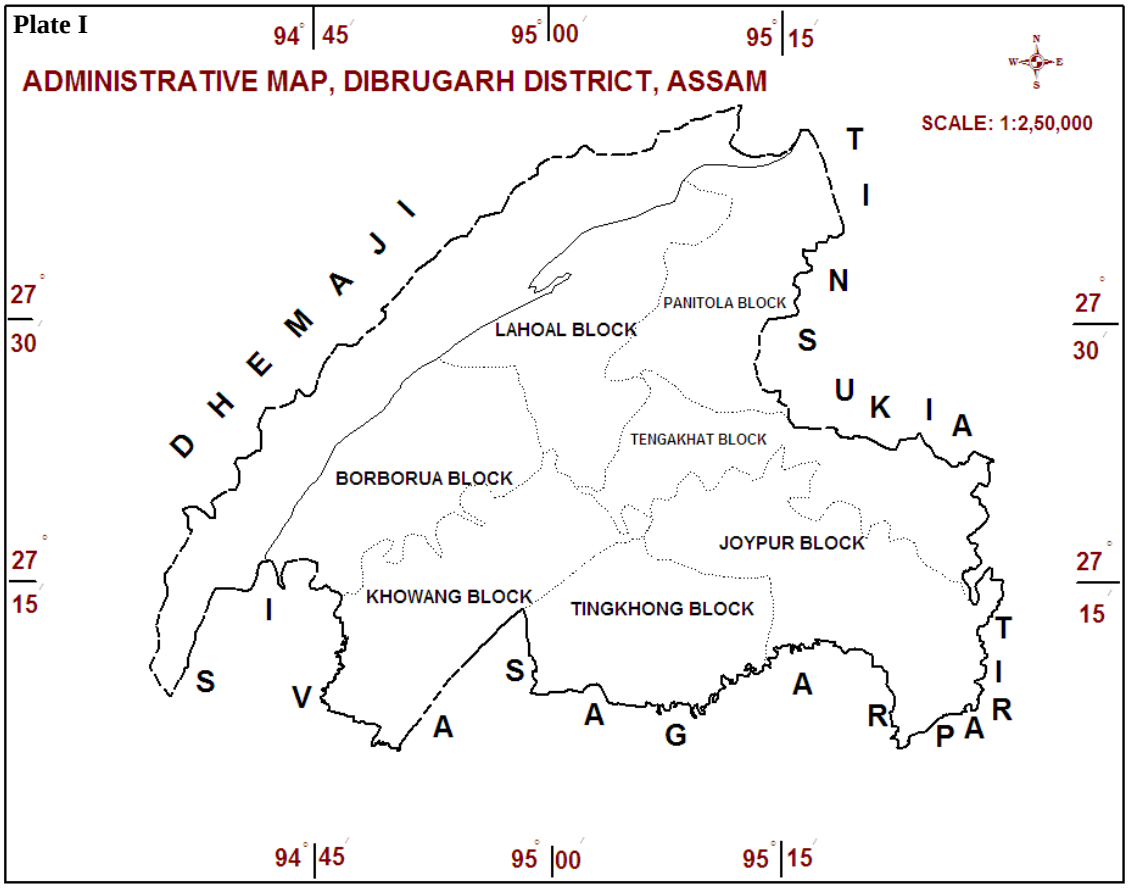
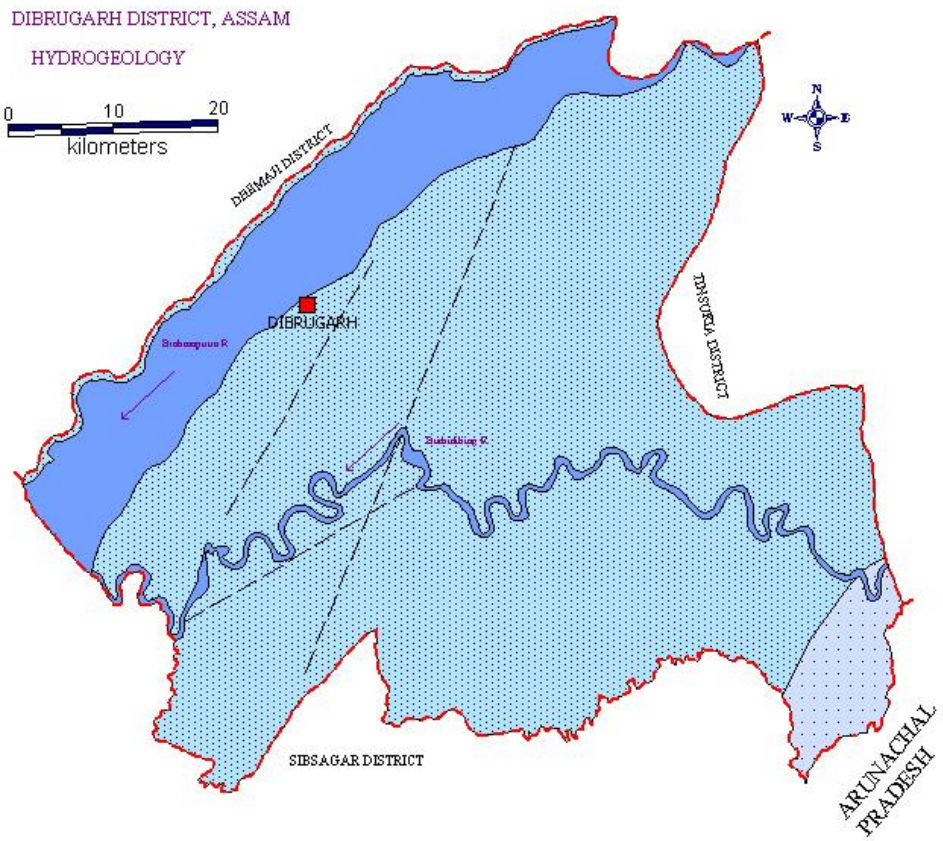

ADMINISTRATIVE MAP, DIBRUGARH DISTRICT, ASSAM
SCALE: 1:2,50,000
94° 45′
95° 00′
95° 15′
27° 30′
27° 15′
DHEMAJI
TINSUKIA
LAHOAL BLOCK
PANITOLA BLOCK
TENGAKHAT BLOCK
BORBORUA BLOCK
JOYPUR BLOCK
KHOWANG BLOCK
TINGKHONG BLOCK
SIVASAGAR
TIRAP

Plate-II



L E G E N D

AGE	MAP UNIT	FORMATION	LITHOLOGY	AQUIFER DISPOSITION	GROUND WATER POTENTIAL
QUATERNARY		Unconsolidated (Alluvium)	Gravel, sand, silt, clay, calcareous concretions, laterite, ferruginous concretions & lithomargic clay	Extensive, moderately thick. Often discontinious, un-con -fined to confined aquifers.	High permeability. Suitable for Shallow tubewlls wth yield 30-40m3/hr for 3m drawdown & deep tube wells with yield 150-200m3/hr. within 12m drawdown
TERTIARY		Semi-consolidated	Sandstone, conglomerate, shale with intercaleted limestone, quartzite, siltstone and claystone	Thick, often regionally extensive, semiconfined to confined aquifers	Suitable for Shallow tubewlls wth yield 25-30m3/hr for high drawdown & deep tube wells with yield 50-150m3/hr. within 15m drawdown

State Boundary

District Boundary

Drainage

Lineament