



Ground Water Information Booklet Dhemaji District, Assam



Central Ground Water Board
North Eastern Region
Ministry of Water Resources
Guwahati
July 2007



स्वच्छ सुरक्षित जल - सुन्दर खुशहाल कल
CONSERVE WATER - SAVE LIFE

**GROUND WATER INFORMATION BOOKLET
DHEMAJI DISTRICT, ASSAM**

DISTRICT AT AGLANCE

Sl. No.	ITEMS	STATISTICS
1	GENERAL INFORMATION	
	i) Geographical Area (sq.km)	3237
	ii) Administrative Division (as on 2006) Number of Tehsil/CD Block Number of Panchayat/Village	5 65
	iii) Population (as on 2001 Census)	5,69,367
	iv) Average Annual Rainfall (mm)	3,435
2	GEOMORPHOLOGY i) Major Physiographic Units ii) Major Drainages	High level plain of Brahmaputra River and flat flood plain area. Kumotia, Jiyadhol, Kanibil, Simen, Somkhong and Royang Rivers
3	LAND USE (sq.km) i) Forest Area ii) Net Area Sown iii) Cultivable Area	646.349 1,536.66 1,636.38
4	MAJOR SOIL TYPES	New alluvial, Old alluvial, Red loamy and Lateritic soil
5	AREA UNDER PRINCIPAL CROPS in sq.km (as on 2006)	1,455.19
6	IRRIGATION BY DIFFERENT SOURCES i) Dug Wells ii) Tube /Bore Wells iii) Tanks/Ponds iv) Other Sources	7,822 44,424 N.A 210
7	NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB (as on 31-03-2007) (Dug Wells)	10
8	PREDOMINANT GEOLOGICAL FORMATIONS	Alluvial formations of Pleistocene to Recent in age
9	HYDROGEOLOGY i) Major water Bearing Formations ii) Pre-monsoon Depth to Water Level during 2006 iii) Post-monsoon Depth to Water Level during 2006 iv) Long term Water Level Trend in 10 yrs (1997 –2006) in m/yr	Alluvial sediments of Quaternary age and Piedmont deposits 0.01 to 9.40 mbgl 0.56 to 8.26 mbgl Rise/Fall during Pre-monsoon 0.01-0.23/0.02-0.08

		Rise/Fall during Post-monsoon 0.01-0.06/0.01-0.09
10	GROUND WATER EXPLORATION BY CGWB (as on 31-03-2007) i) No of Wells Drilled ii) Depth Range (m) iii) Discharge (lps) iv) Transmissivity (m ² /day)	2 Exploratory Wells i) Borola Mirigaon ii) Mohori Camp 61.5 59.5 13.49 12.42 328.30 9831.05
11	GROUND WATER QUALITY i) Presence of Chemical Constituents more than Permissible Limit (e.g. EC, F, Fe, As) ii) Type of Water	Except Fe and As, other elements are within the Permissible Limit. Fe and As are more than Permissible Limit in the shallow aquifers. -
12	DYNAMIC GROUND WATER RESOURCES (2004) in mcm i) Annual Replenishable Ground Water Resources ii) Annual Ground Water Draft iii) Projected demand for Domestic and Industrial Use up to 2025 iv) Stage of Ground Water Development	1376.96 127.73 20.83 10%
13	AWARENESS AND TRAINING ACTIVITY i) Mass Awareness Programmes Organized ii) Date iv) Place v) No of Participants	Nil
14	EFFORTS OF ARTIFICIAL RECHARGE AND RAINWATER HARVESTING i) Projects Completed by CGWB (No & amount spent) ii) Projects Under technical Guidance of CGWB (Numbers)	Nil
15	GROUND WATER CONTROL AND REGULATION i) Number of OE Blocks ii) Number of Critical Blocks iii) Number of Blocks Notified	Nil
16	MAJOR GROUND WATER PROBLEMS AND ISSUES	Higher concentration of Fe and As in ground water is observed in shallow aquifer (greater than permissible limits prescribed by BIS and WHO).

1.0 Introduction

Dhemaji district of Assam is located in the northeastern part of Brahmaputra river basin between North Latitude 27°15' to 28° 00' and East Longitude 94°05' to 95°30' covering an area of 3,237 sq.km. The district has been sub-divided into two civil sub-division (CSD), which contains four circles and five blocks.

Population of the district is 5,69,367 (as per 2001 census) having total rural and urban populations as 5,30,38 and 39,329 respectively with density of 176 per sq.km. As per the land used pattern, the net cropped area is 1,06,634 ha cultivable land is 1,24,81 ha, cultivable fallow land is 18,976 ha and the area occupied by water bodies is 24,050 ha.

The district receives heavy rainfall during May to July with an average annual rainfall of 3,435 mm under the influence of southwest monsoon. In general temperature varies from 10° to 37°C and during winter, temperature goes down to as low as 2° to 5°C. Humidity is very high throughout the year being 70 % during winter and rises up to 90% during rainy season.

Physiographically, the district is more or less flat and the area can be divided into high-level plain of Brahmaputra river (between altitudes 107 m & 122 m AMSL) and flat flood plain area (between altitudes 89 m & 96 m AMSL)

Numbers of perennial streams flow through the district from north to south and join the Brahmaputra River. Thus the River Brahmaputra is effluent in nature. The major streams that drain the area are Kumotia, Gai, Kanibil, Sisi, Simen, Dikari and Royang.

Geologically, Older and Newer Alluvium occupy the area. Piedmont deposits of Older Alluvium consist of boulders, cobbles, gravel, sand and silt. Flood plain and younger alluvial plains of Newer Alluvium consist of gravel, pebble, coarse to medium sand, silt and clay.

Ground water occurs under phreatic condition in the shallow aquifer zone and under semi-confined condition in the deeper aquifer. Flow of ground water is from north to south. Pre-monsoon water level varies from 0.01 to 9.40 mbgl and during post-monsoon period, water level varies from 0.56 to 8.26 mbgl. In locales, Long-term water level shows no significant change in the area.

Other than higher arsenic (As) and iron (Fe) concentration in ground water, most of the chemical constituents are within the permissible limit.

The estimated gross annual dynamic groundwater resource is 1,376.96 mcm while net ground water resource is 1,308.11 mcm. The stages of development are 10%. Future provision for domestic and industrial use is 20.83 mcm and for irrigation use, it is 1,172.13 mcm.

The present ground water utilization is for domestic and to some extent for agriculture purpose as there is no major industry in the district. Out of 48 PWSS under Dhemaji PHE Division, only 23 schemes are functioning. As per report, Department of Irrigation creates irrigation potential of 4,895 ham by 21 schemes but most of the schemes are presently inoperative due to paucity of fund and occurrence of severe flood damage every year in the area. At present 47 STW under the Department of Agriculture is creating 38.91 ham ground water draft per year.

2.0 Rainfall and Climate

The district is located near the foothills of Arunachal Pradesh; it exhibits difference in temperature, rainfall, fog, wind etc. The climate of the district is characterized by high rainfall, mild summer and winter and falls under cool to warm sub-humid thermic-agro ecological sub-zone.

The annual rainfall of the district ranges from 2,600 to 3,200 mm with a monthly maximum rainfall of 1,110.25 mm and minimum rainfall of 1.0 mm. The maximum rainfall occurs during the month of July and December is the dry month. Rainfall generally begins from April and continues till the end of September. On an average, there are about 200 days with 3.5 mm or more rainfall in a year. Humidity is very high throughout the year being more than 70 %. During rainy season, from May to October, humidity varies from 80 to 90 %.

The temperature varies between 39.9°C in summer and 5.9°C in winter.

3.0 Geomorphology and Soil Types

Physiographically the district is more or less flat and the area can be divided into two distinct geomorphic units.

The high-level plain of Brahmaputra River covers the northern part, which is gentle towards southwest in the eastern part and towards south in western part. High-level terraces or piedmont plains at altitude of 122 m and low level terraces at altitude between 107 and 122 metres above mean sea level are the main characteristic features of the area. The area bordering the north of the district is hilly terrain.

The altitude of flat flood plain area with one or two sand mounds in between central and southern part occupying the Brahmaputra River bank varies from 89 to 96 metres above mean sea level.

Numbers of perennial streams originates in the northern hill ranges in Arunachal Pradesh and flow through the district before joining the Brahmaputra River. Because of very high amount of rainfall in the catchments area, these rivers bring lot of sediments and flash floods during monsoon period, which plays an important role in most parts of the district.

The soil of the district is broadly classified into four groups, namely New Alluvial, Old Alluvial, Red Loamy and Lateritic Soil. The New Alluvial Soil is found in the flood plain areas subjected to occasional flood and consequently receives annual silt deposit when the flood recedes. The Old Alluvial Soils are developed at higher level and are not subjected to flooding. Red Loamy soils are formed on hill slopes under high rainfall conditions.

4.0 Ground Water Scenario

4.1 Hydrogeology

Hydrogeologically, the entire area of Dhemaji district is occupied by alluvial sediments of Quaternary age. Piedmont deposits comprising of coarse clastic sediments like boulder, pebble, cobble, gravel associated with minor fraction of sand and silt are the main repository in the foothill zone. The piedmont zone extends up to 4 – 6 km from the foothills. The floodplain area comprising sand, silt, clay, gravel and pebble received from the rivers coming from the upper reaches are the main deposits next to the piedmont deposits. All these formations act as good reservoirs of ground water in the area.

Ground water in the floodplain area occurs under phreatic condition in the shallow aquifer zone and under semi-confined condition in the deeper aquifer. The flow of ground water is from north to the south. The occurrence and movement of ground water is controlled by topography, geomorphology, climate, geology etc. Rainfall is the main source of ground water recharge, although seepage from canal, return flow from applied irrigation, seepage from surface water body etc. takes place.

On the basis of tube well data received from the State Government Departments and discussion with the people engaged in construction of filter point tube well, the following shallow aquifer geometry has been inferred. There is a great lateral and vertical variation of aquifer indicating various degrees of depositional agencies both in space and time. Aquifer horizon in the shallow zone comprises sand of various grades, pebble and boulder. Sand and clay mixed with sand is encountered within 0 to 6 m depth and pebble, boulder are encountered from 16 to 20 m onward.

Table 2: Summarised Hydrogeological data of EW of CGWB

Well Location	Depth Of construction (m)	Aquifer Zone Tapped (m)	SWL (mbgl)	Discharge (LPM)	Draw Down (m)	Transmissivity (m ² /day)	Permeability (m/day)	Hydraulic Conductivity (m/hr)
Borola Mirigaon	61.5	(36-48) (54-60) Total=18	1.62	809.99	0.855	3283.20	14.62	126.896
Mohori Camp	59.5	(26-29) (32-38) (42-46) (49-54) (58-59) Total=19	1.25	745.641	2.45	9831.05	258.71	55.858

4.2 Ground Water Resources

Methodology adopted for ground water resource estimation of Dhemaji District of Assam is as per GEC 1997 i.e. following Ground Water Level Fluctuation and Rainfall Infiltration Factor Method.

The estimated gross annual dynamic groundwater resource is 1,376.96 mcm while net annual ground water draft is 127.73 mcm. The stage of ground water development is 10%. Natural discharge during non-monsoon season is 68.85 mcm. Future provision for domestic and industrial use is 20.83 mcm and for Irrigation use, it is 1,172.13 mcm.

Dhemaji district is under the SAFE category.

4.3 Ground Water Quality

In recent year, arsenic (As) in ground water has been reported from various parts of Assam and adjoining areas, which are mostly, fall in the vast riverine tracts of Brahmaputra River. However, reports have also come from Barak River valley areas. Chakraborty et al. (2004) reported that Dhemaji district is worst affected. North Eastern Regional Institute of Water and Land Management (NERIWALM) based on their own study claimed that most of the districts are affected. Public Health Engineering Department has conducted its own study partly in collaboration with UNICEF; however detailed findings are yet to be published. Thus, Assam has been identified as the 5th State of India with As contamination. However clinical manifestation of *arsenicosis* is quite uncommon till date among the people living in the area.

High concentration of iron (Fe) and arsenic (As) content in the ground water of the district is observed which is greater than permissible limit of BIS and WHO standards.

Study in Dhemaji district undertaken by CGWB during 2005-06 indicates that concentration of arsenic ranges from 0.025 to 0.55 ppm for samples collected from hand pumps tapping aquifer at depth range of 6 to 30 m (analysed by NERIWALM). However, the analytical results shows wide range of variations for samples from same wells collected at different time. Hence, in this context, during 2006-07, the area has been resampled and analysed at referral laboratory of CGWB, SR as well as at NERIWALM.

Analysis results from CGWB, SR shows that concentration of iron (Fe) during pre-monsoon ranges from 0.31 to 69 ppm and that of arsenic (As) ranges from Below Detectable Limit to 0.249 ppm during pre-monsoon. The highest Fe content is detected from the shallow aquifer of 4.88 m depth (hand pump) at Teliajan, whereas the lowest Fe is from a 91.44 m depth deeper aquifer at Likhabali. Arsenic concentration is higher in Dhemaji, Bordoloni and Sisiborgaon blocks and less in Merkong Selek block. The highest concentration of As is recorded from the shallow aquifer zone with a depth of 5.49 m at Bhekeli.

The concentration of iron (Fe) and arsenic (As) during post monsoon period in Dhemaji district follows the same trend of higher concentration in the shallow aquifer. The concentration of iron (Fe) ranges from 0.2 to 49.2 ppm and that of arsenic (As) ranges from < 0.001 to 0.109 ppm respectively during post-monsoon period. The highest concentration of Fe is detected from a hand pump of 7.93 m feet depth at Jaidhol Tingharia and highest As content is also detected from a shallow hand pump of 13.72 m depth at Moridhol. Other chemical constituents are within permissible limit. Present system of water supply and sanitation system need improvement.

4.4 Status of Ground Water Development

The southern part of the district adjacent to River Brahmaputra is proved to be much more potential from ground water point of view. A fairly thick and regionally extensive aquifer system down to depth of 200m exist, where shallow and deep tube well can be constructed having yield range of 30 to 35m³/hr. and 150 to 250m³/hr. for draw down within 6 meters respectively. In the Bhabar zone, covering the northern parts of the district construction of shallow tube well poses problem due to occurrence of deep water level. However deep tube wells can be constructed in this zone down to 200 meters tapping aquifer zone comprising boulders, cobbles and pebbles with yield varying from 100 to 150m³/hr for a reasonable draw down.

Ground water is used for drinking and irrigation purpose only in the district. As there is no major industry in this district. Ground water utilization for the same may be considered as negligible.

Depending upon agro climatic conditions and rainfall distribution in the district, paddy is the main crop, which is cultivated during three seasons i.e. autumn paddy (March to June), winter paddy (June to November) and summer paddy (November to April). In this district autumn paddy is grown over 21,404 ha, winter paddy over 1, 13,093 ha and summer paddy over 1005 ha respectively. It is apparent that winter paddy is the main crop, which covers 82% of the total rice production. Summer and autumn paddy production is 0.74% and 15.8% of the total rice production.

Table 4: Statement Showing Irrigation Potential Created in Dhemaji district

Irrigation Potential Created up to 2003 (In Ha)								
Sl. No.	Type of Irrigation Scheme	Dhemaji CSD		Jonai CSD		District total		Remarks
		No. of Schemes	Gross Area (ha)	No. of Schemes	Gross Area (ha)	No. of Schemes	Gross Area (ha)	
1	Surface LIS	07	2040	06	1387	13	3427	At present the Schemes are inoperative due to lack of fund
2	Shallow Tube Well	05	144	05	138	10	282	

3	Deep Tube Well	09	1146	01	40	10	1186	
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Source: Office of the EE, Dept. of Irrigation, Dhemaji, Assam

Department of Irrigation, Dhemaji district creates irrigation potential of 4895 ha by 21 Nos of irrigation schemes (LIS, STWS and DTWS). But most of the schemes are inoperative due to lack of fund and constant flood damage. At only 47 Nos of STW are running in the district. As per ground water resources estimation of Dhemaji district it is observed that 12773ham/year draft is created for irrigation purpose against 1,17,213 ham net ground water availability for the district.

5.0 Ground Water Management Strategy

Thick and extensive alluvial deposits with excellent hydraulic properties in southern portion of Dhemaji district is very suitable locale for ground water development where shallow and deep tube well can be constructed having yield range of 30 to 35m³/hr. and 150 to 250m³/hr.respectively for draw down within 6 meters.

Open wells and filter point wells are feasible in all area of the district. In unconsolidated sediments ring well may be constructed by excavating down to the saturated horizon. Cement or earthen rings from 0.80 to 1.20 placed one above another with weep holes in the bottom rings are likely to hold sufficient quantity of water. Depth may range from 05 to 15 m depending upon the topographic elevation. Expected discharge will be 3 to 5 cubic meters per day.

Filter Point Wells with a total depth of 10 to 20 mbgl by providing galvanized iron or mild steel pipe and at bottom slotted pipe against aquifer zone either made from bamboo or MS pipe or P.V.C pipe are suitable. Bamboo as pipe and screen are very much within the reach of small and marginal farmers, as bamboo is locally available in the district. This type of well is low cost and long lasting. Expected discharge varies from 10 to 15 cubic meters per day.

Deep tube wells are feasible in the entire district. These tube wells are expected to tap the granular zones occurring beyond 50 mbgl. Housing pipe should be large enough to accommodate the pump. Based on the static water level, maximum draw down and seasonal fluctuation, length of housing pipe ranges from 30 to 40 m bgl. For avoiding corrosion and clogging of well screen, the entrance velocity should be less than 2 cm/sec.

6.0 Ground Water Related issues and problems

Frequent floods ravage the district every year during the monsoon months from May to September. About 70% area of the district is affected by

floods in one way or other. Flood affected area during 1996 was 1656sq.km and during 2003 it was only 365.18sq.km. Flood accompanied with soil erosion and sand deposition cause maximum damage to standing crops and to the agricultural lands.

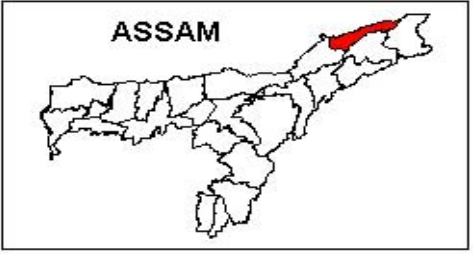
Other than Iron (Fe) and arsenic (As) content, most of the constituents are within permissible limit, both for drinking and irrigational use. In some part of the district, fluoride (F) is within permissible limit during Post-monsoon, but in the Pre-monsoon period, concentration is higher than permissible limit.

8.0 Recommendations

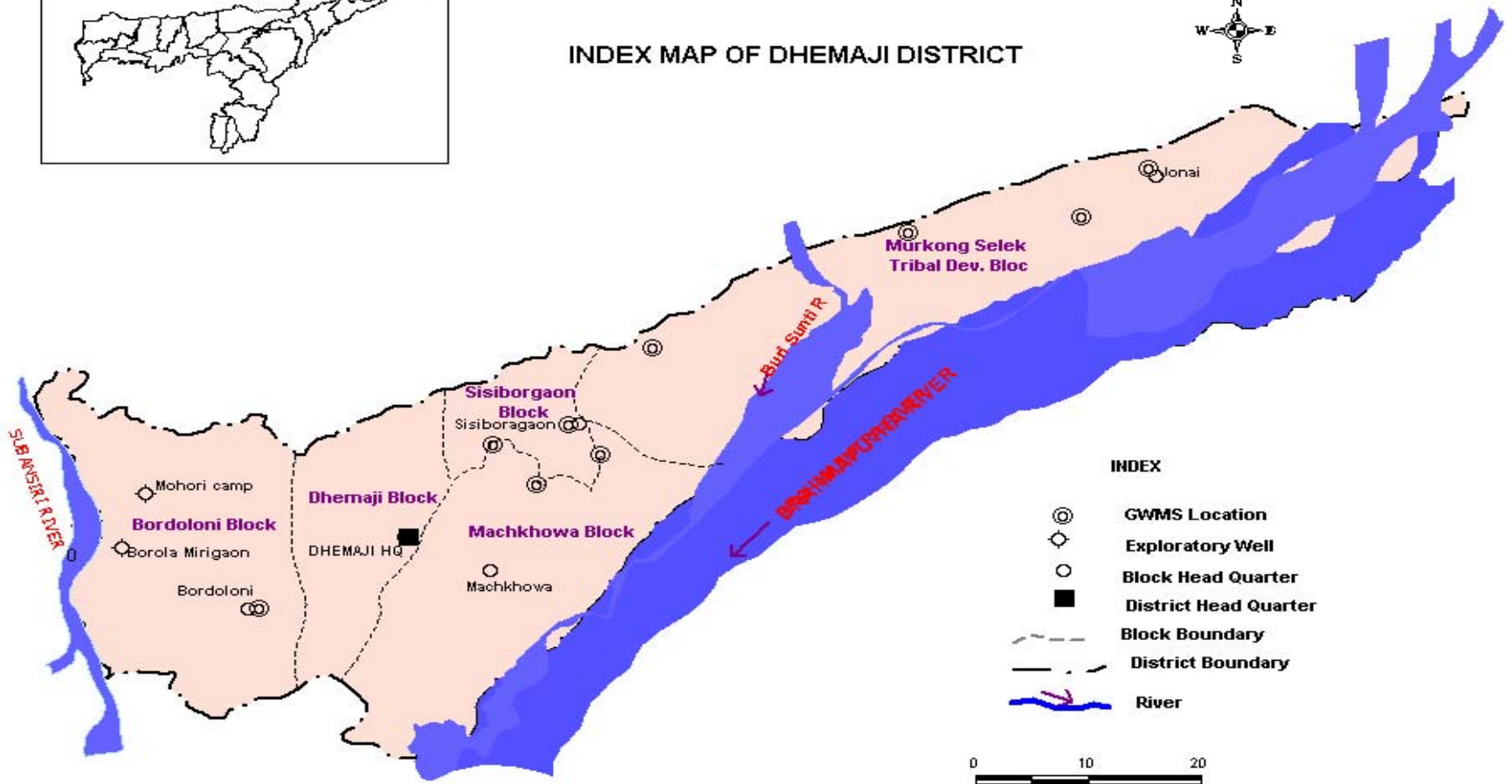
Existing hydrogeological set up and availability of huge ground water resource indicate that there is much scope for the development of ground water by constructing ground water abstraction structures in a planned way for ground water development.

Iron treatment plants need to be installed with PHED water supply station for drinking purpose very urgently.

Recent reporting on presence of Arsenic in shallow ground water need an urgent study to delineate the arsenic (As) free aquifer at deeper depth.



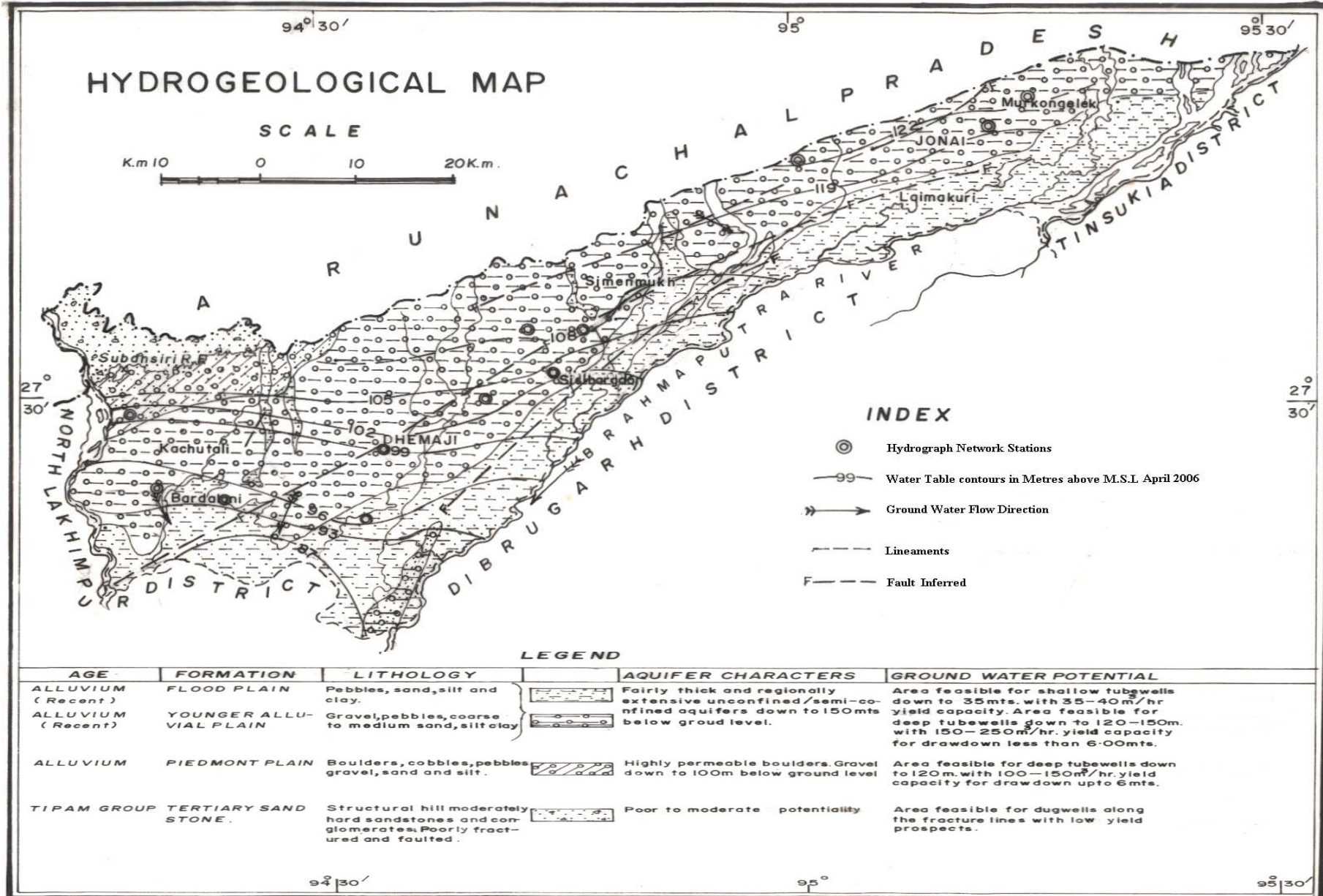
INDEX MAP OF DHEMAJI DISTRICT



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 - ◇ Exploratory Well
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 - District Head Quarter
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 - - - District Boundary
 - River



DHEMAJI DISTRICT, ASSAM



HYDROGEOLOGICAL MAP

SCALE



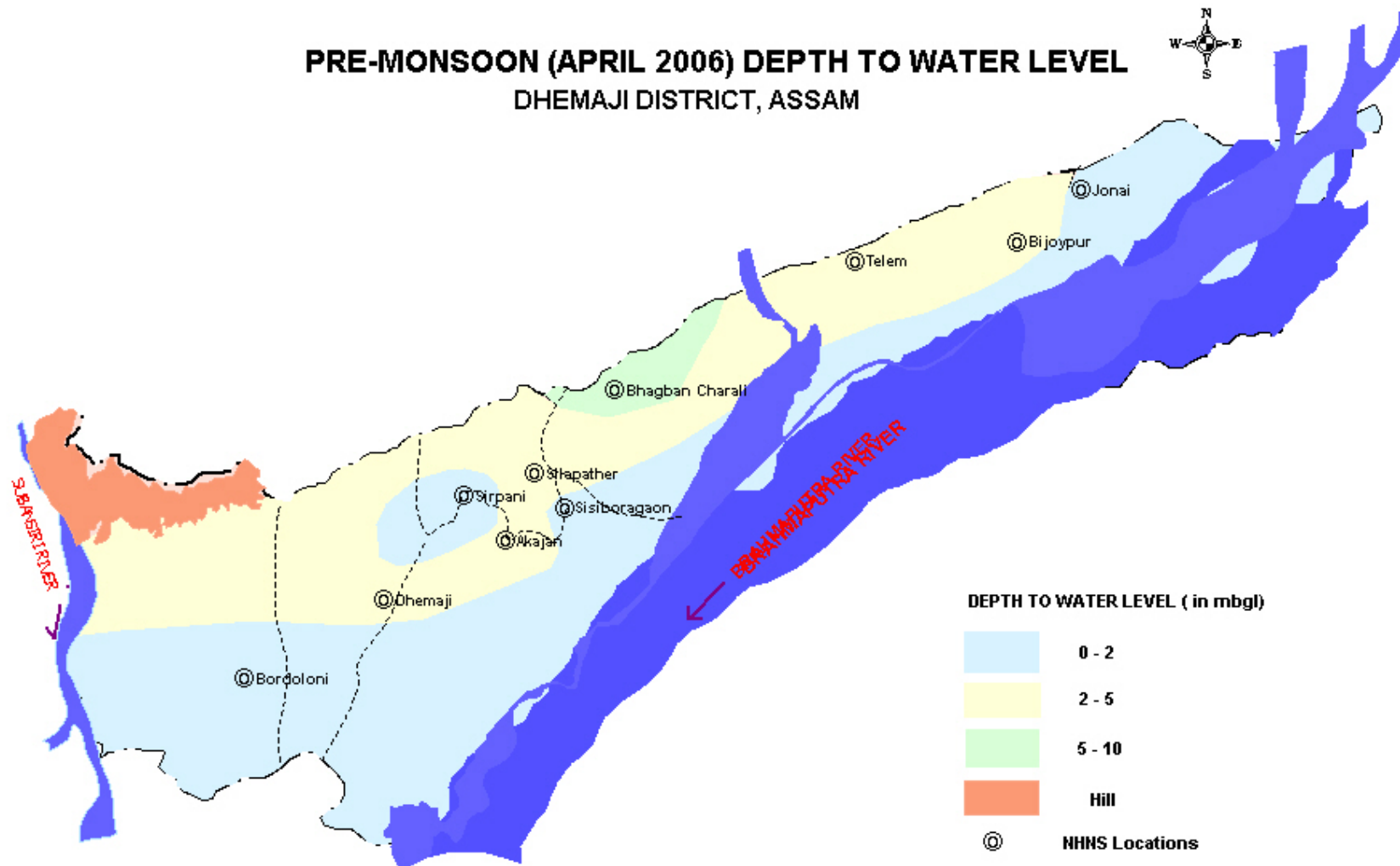
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- ⊙ Hydrograph Network Stations
- 99 — Water Table contours in Metres above M.S.L. April 2006
- Ground Water Flow Direction
- Lineaments
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LEGEND

AGE	FORMATION	LITHOLOGY	AQUIFER CHARACTERS	GROUND WATER POTENTIAL
ALLUVIUM (Recent)	FLOOD PLAIN	Pebbles, sand, silt and clay.	Fairly thick and regionally extensive unconfined/semi-confined aquifers down to 150mts below ground level.	Area feasible for shallow tubewells down to 35mts. with 35-40m ³ /hr yield capacity. Area feasible for deep tubewells down to 120-150m. with 150-250m ³ /hr. yield capacity for drawdown less than 6.00mts.
ALLUVIUM (Recent)	YOUNGER ALLUVIAL PLAIN	Gravel, pebbles, coarse to medium sand, silt clay		
ALLUVIUM	PIEDMONT PLAIN	Boulders, cobbles, pebbles, gravel, sand and silt.	Highly permeable boulders. Gravel down to 100m below ground level	Area feasible for deep tubewells down to 120m. with 100-150m ³ /hr. yield capacity for drawdown upto 6mts.
TIPAM GROUP	TERTIARY SANDSTONE.	Structural hill moderately hard sandstones and conglomerates. Poorly fractured and faulted.	Poor to moderate potentiality	Area feasible for dugwells along the fracture lines with low yield prospects.

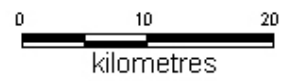
PRE-MONSOON (APRIL 2006) DEPTH TO WATER LEVEL DHEMAJI DISTRICT, ASSAM



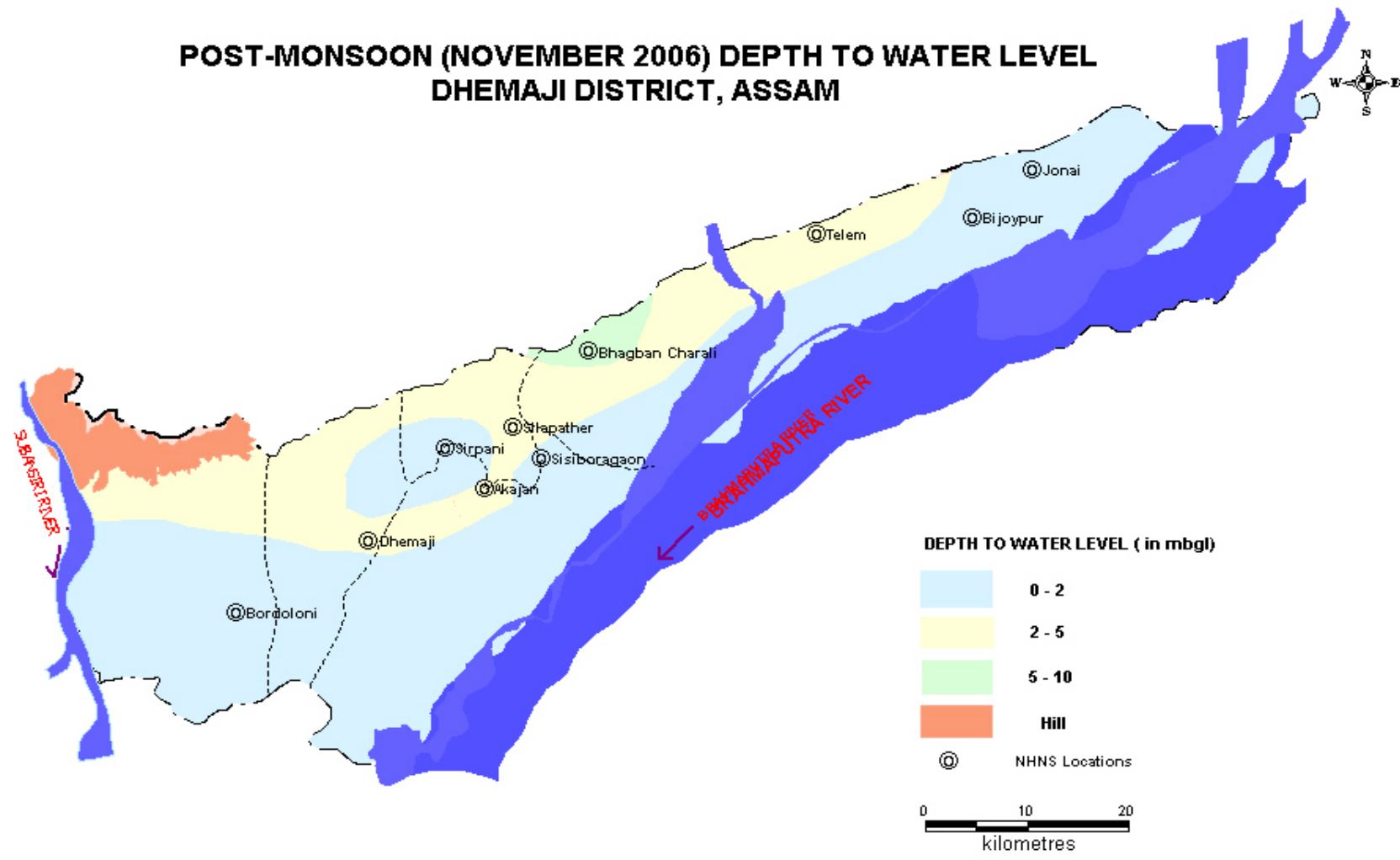
DEPTH TO WATER LEVEL (in mbgl)

- 0 - 2
- 2 - 5
- 5 - 10
- Hill

⊙ NHNS Locations



POST-MONSOON (NOVEMBER 2006) DEPTH TO WATER LEVEL DHEMAJI DISTRICT, ASSAM



IRON CONCENTRATION RANGE IN DHEMAJI DISTRICT, ASSAM

