Technical Report Series: D

No:

Ground Water Information Booklet
Wokha District, Nagaland

Central Ground Water Board

North Eastern Region

Ministry of Water Resources

Guwahati

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DISTRICT GROUND WATER INFORMATION BOOKLET
WOKHA DISTRICT, NAGALAND

DISTRICT AT A GLANCE

Sl No.	ITEMS	*STATISTICS*
1.	**GENERAL INFORMATION**	
	i. Geographical area (hectare)	1,62,800
	ii. Administrative Divisions	
	I) **Blocks**	5
	1. Wokha	
	2. Chukitong	
	3. Wozhuro /Ralam	
	4. Bhandari	
	5. Sanis	
	II) **Number of Villages**	129
	III) Sub division	1
	IV) Town	1
	V) Police Station	3
	iii. Population (As per 2011 census)	1,66,239
	iv. Average Annual Rainfall (mm)	2,000-2,500
2.	***GEOMORPHOLOGY***	
	Major physiographic units	Hills, denudational hills, intermontane valley and limited alluvial plains.
	Major Drainages	Doyang, Chubi, Nruk and Nzhu Rivers
3.	**LAND USE (hectare)** 2010-11	
	a) Net Irrigated area	2269
	b) Forest cover	25292
4.	**MAJORS SOIL TYPES**	Recent and Older Alluvial soil, Residual soil
5.	**AREA UNDER PRINICIPAL CROPS**	Rice, Maize, Paddy are principal crops. Area not available
6.	**IRRIGATION BY DIFFERENT SOURCES** Ground water command area (hectare)	Nil
7.	**NUMBERS OF GROUND WATER MONITORING WELLS of CGWB**	
	No of dug wells	Two
	No of Piezometers	Nil
8.	**PREDOMINANT GEOLOGICAL FORMATIONS**	Disang, Barail, Surma and Tipam formations.

9.	**HYDROGEOLOGY**	
	Major water bearing formation 1.(Pre-monsoon depth to water level during 2007) 2.(Post-monsoon depth to water level during 2007) 3.Long term water level trend in 10 years (1986 – 2005) in m/yr	Mainly semi-consolidated formation like Sandstone forms major aquifers. Valleys comprising of shale and sandstone form good ground water storage. 5.0-6.0 m bgl 2.0 -3.0 m bgl
10.	**GROUND WATER EXPLORATION BY CGWB** (As on 31.3.2008)	Nil
	No. of wells drilled (EW, OW, PZ, SH. Total)	Nil
	Depth Range (m)	Not Applicable
	Discharge (m^3/hr)	Not Applicable
11.	**GROUND WATER QUALITY**	
	Presence of chemical constituents more than permissible limits	Potable
	Type of water	Good and it can be used for domestic, irrigation and other purposes.
12.	**DYNAMIC GROUND WATER RESOURCES** (as on March 2009)	
	Net Annual Ground Water Availability	38.91 mcm
	Annual Draft	0.57 mcm
	Projected demand for domestic and industrial uses upto 2025	0.91 mcm
	Stage of Ground Water Development	1.46 %, Safe
13.	**AWARENESS AND TRAINING ACTIVITY**	
	Mass awareness Programme Organized	Nil
	Water Management Training Programme Organized	Nil
14.	**EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING**	
	Project Completed by CGWB (No. & amount spent)	Nil
	Project under technical guidance of CGWB (nos.)	Nil

15.	**GROUND WATER CONTROL & REGULATION**	
	Number of OE Block	Nil
	Number of Critical Block	
	Number of Blocks notified	
16.	**MAJOR GROUND WATER PROBLEMS AND ISSUES**	The district is basically a hilly one with intermontane valleys. Thus, the development of ground water is limited in nature. Moreover, logistic support in terms of approachable road and non-availability of valley areas are one of the main hindrances to ground water development. The lack of proper drilling machineries and expertise has compounded the problem further.

1. INTRODUCTION

Nagaland is the 16th state of the Indian State Union and was created in the year 1963. Wokha district is one of the seven districts of Nagaland and is the third smallest district lying at Northwestern part of the state. In 1876, the British Government occupied Wokha as the district headquarters of the Naga hills that was under Assam. By the year 1878, the headquarters was shifted to Kohima but Wokha remained as subdivision. Later in the year 1889, the subdivision was shifted to Mokokchung. In the year 1957, Wokha became a subdivision and later in 1973 Wokha became a district. The main tribes of the district are Lothas. "Wokha" means census in Lotha.

It lies between Latitudes 26° 01' and 26° 08' N and Longitudes 94°18' and 94°27' E. The total geographical area of the district is 1, 62,800 hectare. It covers about 10% of the total area of Nagaland. As per 2011 census, the total population in this hilly and tribal district is 1,66,239. The male constitutes 51.9% and the female constitutes 48.1% of the total population. The sex ratio of the Wokha district is 927 females against 1000 males. The literacy rate of Wokha district is 80% that is high compared to the national average of 59.5%. The literacy rate among the male is 82% and that of female is 77%. There are 129 villages and 5 blocks. The density of population of the district is 56 persons per square km.

The district is situated about 80 km away from both Kohima and Mokokchung district and about 58 km away from Furkating railway station of Assam. It is bounded by Mokokchung district in the North, Kohima district in the South, Zunheboto in the East and Sibsagar district of Assam in the West.

The administrative centres of Wokha district are given below in Table 1.1(Plate I).

Table 1.1 Administrative centres of Wokha district of Nagaland

Items	Statistics
District headquarter	Wokha
Blocks	Five 1. Wokha 2.Chukitong 3.Wozhuro/Ralan 4. Bhandari 5. Sanis

Town	One 1. Wokha
Villages	129
Police Stations	Three 1.Wokha 2. Bhandari 3. Sungro
EAC	Eight 1. Chukitang 2. Lotsu 3. Wozhuro 4.Changpang 5.Aitepyong 6. Sungro 7.Ralan 8.Baghty
SDO	One 1. Sanis
Border /Magistrate	Merapani

About 76.6 % of the people from the district are from rural areas and only 23.3% are from urban areas. The most important activity of the people is agriculture and it occupies 68.03% of the working force. Besides it, people are also involved in weaving. Blacksmith and handicrafts are important occupations but they do not produce for commercial purposes. In agriculture field, crops like rice, maize, and paddy are widely grown. Agricultural practices like Terrace Rice and Wet Rice cultivation are also practised. Traditional methods of jhum or shifting cultivation are still prevalent. Vegetables like peas, yam, brinjal, chilies, pumpkin, ginger, tomato, bitter-gourd are widely grown. Horticultural produce includes orange, pineapple, banana, papaya, plum, passion fruit, guava, pear etc.

2. IRRIGATION AND DRAINAGE

The status of irrigation in the district is still at nascent stage. There is no available data for annual ground water draft for irrigation and the same has been taken as nil in the ground water resource calculation.

The main rivers in Wokha district are Doyang, Chubi, Nruk and Nzhu. The district belongs to Brahmaputra basin and Dhansiri and Disang sub-basin.

3. RAINFALL & CLIMATE

The Wokha district receives considerable rainfall and monsoon commences from May and continues upto October. The climate of district is warm in the lower plains and moderately warm in the upper region during summer but cold in the winter season. The summer temperature ranges from 16 to 32°C and the minimum winter temperature falls to 2°C. The average annual rainfall of the district ranges from 2,000 to 2,500 mm.

4. GEOMORPHOLOGY & SOIL TYPE

Geomorphologically, the district is a hilly one with ridges and ranges are dissected by seasonal streams. The general altitude of the district varies from 303.3 to 1313.69 m amsl. The highest mountain peak is Tiyi Enung that is situated at 1970 m above msl. There are limited numbers of intermontane valleys. The district can be divided into three ranges.

a) **Wokha/ Upper Ranges**

   It is situated in the upper NE part of the district. The average altitude of this range is 1000-1500 m above msl.

b) **Sanis /Middle Ranges**

   It is situated in the middle part of the district.

c) **Bhandari /Lower Ranges**

   The outermost part of the district comprises the lower ranges extending from Japukong range of Mokokchung district to Assam plains in the NW parts. Some of the important fertile valleys like Baghty, Tchiying are included within these lower ranges. The average altitude varies from 400-1000 m above msl.

As per the ground water resources estimation of the state, out of a total area of 1,62,800 hectare, about 8,710 hectare is considered hilly area and about 1,500 hectare is earmarked as valley area like Baghty. Apart from that, exploration activity is yet to be started in the district.

In the sub-tropical plain valley areas, alluvium is derived from the adjacent Himalaya Mountains by the rivers. These soils are moderate to highly acidic in nature having Iron and Aluminium toxicity.

5. GROUND WATER SCENARIO

5.1 Hydrogeology

The Wokha district is mainly underlain by semi-consolidated formations. Structurally, it is affected by tectonic disturbances like Disang thrust. It comprises of the following formations.

5.1.1 Disang Formation

This semi-consolidated formation consists of shale, sandstone, marl and limestone of Upper Cretaceous to Middle Eocene age. Ground water is mainly restricted to weathered mantle and in the secondary porosity like fractures that has been due to tectonic elements. The high and irregular hill ranges act as run off zone, whereas the valleys comprising of shale and sandstone are good ground water storage. The development of ground water is mainly in the valley portion.

5.1.2 Barail Formation

This type of formation consists of massive sandstone, shale, sandy shale etc. The shale is unstable and is susceptible to erosion. The ground water is found to occur mainly under water table condition in the weathered residuum.

5.1.3 Surma Formation

The Surma formation comprises of sandy shale, shale, siltstone, mudstone, conglomerate etc of Lower Miocene age. The ground water is found to occur in the weathered portion and in the secondary porosities. Dug wells and shallow tube wells are suitable ground water abstraction structures in such weathered section of semi-consolidated formation.

5.1.4 Tipam Formation

Lithologically, this formation consists of sandy shale, shale, mottled clay, ferruginous and gritty sandstone, clay and conglomerate. They are of Upper and Middle Miocene age. The valley portions those are underlain by Tipam sandstones are found to be good aquifers. Aquifers at 100 m depths are good enough to feed moderate to high yielding wells.

5.1.5 Dihing Formation

The formation consists of pebble beds, soft sandy clay, grit, sandstone and conglomerate. The valley portion comprising this formation is likely to have low to moderate yield of 10-20

m^3/hr for a draw down of more than 6 m. The aquifers are assorted and discontinuous in nature with high argillaceous matrix.

5.2 Ground Water Resources

The dynamic groundwater resources have been assessed based on methodology recommended by Ground Water Resources Estimation Committee, 1997 (GEC97). In this methodology, two approaches are recommended i.e. water level fluctuation method and rainfall infiltration method. As the data on ground water level is insufficient, the rainfall infiltration method is used for calculating the resource estimation of the district. Moreover, hilly area having slope more than 20% are not taken into consideration as these areas are not worthy for recharge. Hence, the remaining area is delineated into command and non-command area and assessment is done for both monsoon and non-monsoon seasons. As per the Rainfall Infiltration Factor method, recharge from rainfall is given by the following formula.

$(R_{f)}$ = RIF *A * NMR

Where RIF = rainfall infiltration factor

A = Area of computation for recharge

NMR = Normal monsoon rainfall

Recharge from sources other than rainfall, ground water irrigation, recharge from ponds and tanks, check dams, nalla bunds are taken as nil in the district and only surface water irrigation is taken into account. The total annual recharge is obtained as the sum of recharge from rainfall and the recharge from sources other than rainfall. Thus, Ground Water Resource Potential in the district is shown as in Table 4.1 and 4.2.

Table 4.1: Groundwater Resource Potential for Wokha District (ham)

Rainfall recharge during monsoon season	Recharge from other source during monsoon season	Recharge from rainfall during non-monsoon	Recharge from other source during non-monsoon season	Total annual ground water recharge	Natural discharge during non-monsoon season
2833	0	1490	0	4323	432

Table 4.2: Stage of Ground Water Development for Wokha District (ham)

Net Ground water availability	Existing gross ground water draft for irrigation	Existing gross ground water draft for domestic and industrial purposes	Existing gross ground water draft for all uses	Allocation for domestic and industrial requirement supply up to 2025	Net annual ground water availability for future irrigation development	Stage of ground water development (%)
3891	0	56.67	56.67	89.79	3800.9	1.46

It is found that ground water development is about 12% in the district and it is the highest amongst the other six districts. However, maximum development of ground water is seen in these valley portions only.

5.3 Ground Water Quality

There is a lack of proper database on ground water quality in Wokha district. However, ground water quality studies may be targeted.

5.4 Status of Ground Water Development

The valley areas are recognized as the most promising zone for ground water development. Because of the presence of valley like Baghty in Wokha district, the stage of ground water development is. about 5 %.

6.0 GROUND WATER MANAGEMENT STRATEGY

As the district is characterized by hilly and undulating terrain, the scope for development of ground water lies in low lying depression or valley that holds good prospects for ground water development. However, the problem of approachability is a big constraint for the development of ground water in the steep and rugged terrain like this.

Spring plays a pivotal role in meeting the water requirement of the people in the district. Further development of springs in the hilly areas can improve the water scenario. This can also play an important role in rural water supply scheme in the district. Proper and scientific approach is required to augment the existing water supply. Moreover, roof top rainwater harvesting may be encouraged to augment water resources for domestic uses.

7.0 GROUND WATER RELATED ISSUES AND PROBLEMS

Hilly, rugged and mountainous district of Wokha with steep slopes and inapproachability makes the biggest hindrance for proper development and management for ground water. Only 15% of the total area is valley that can be taken up for exploration activity. Moreover, the lack of proper scientific data and suitable drilling rig and expertise has impounded the problem more.

8.0 RECOMMENDATION

Development of ground water in the district is 5 % that is mainly restricted to the valley portion. Ground water development is being done through dug wells and bore wells in the low-lying intermontane valleys. Valleys like Baghty, Tchiying can be targeted for exploration activities. Structures like ring/dug well, shallow and deep bore well are the feasible recommended ground water structures.

The development of spring is also seen and it is used for drinking purpose. But, proper utilization, management and conservation of these springs are a must. The water should be made free from all sorts of pollution and surface contaminants.

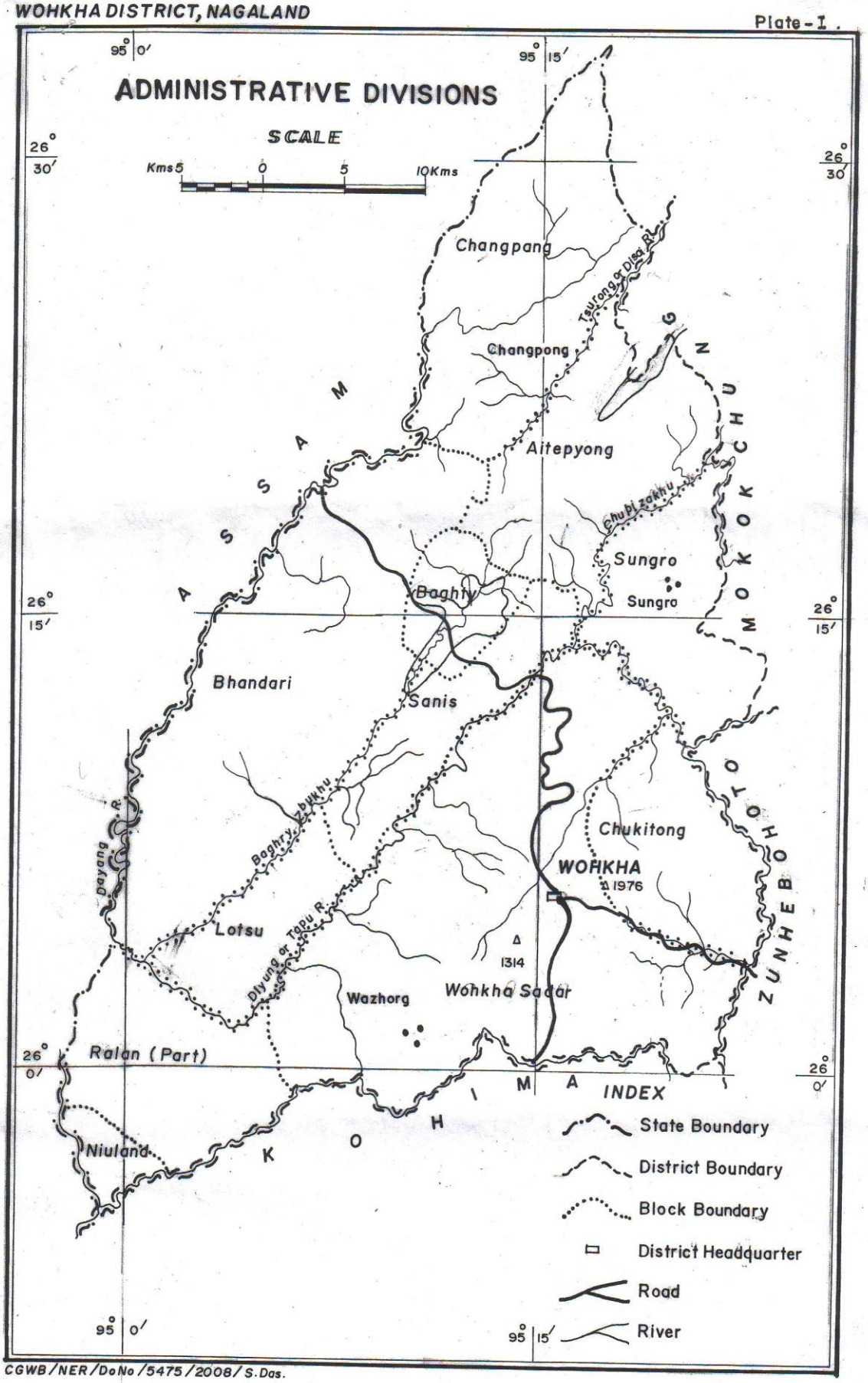
Special studies can be taken up in the virgin areas of the district to enrich the scientific information on geology, lineaments and hydrogeology. Imageries can be studied to delineate the potential lineaments, structures that holds good prospect of ground water. Simultaneously, studies can also been taken up for ground water quality.

Although the district receives moderate rainfall, in the hilly portion people face acute scarcity of water. This is because of high surface run off in the hilly and steep areas leading to less recharge of ground water. In such areas, roof top rainwater harvesting may be adopted effectively to meet the demand of the people residing on hilltops. Rainwater can be collected from the rooftops and can be diverted to storage tanks. This water can be used for domestic uses and drinking purposes after proper treatment.

There is sufficient scope for development of ground water resources in the district as the stage of development is only 5 %. Creating public awareness for effective use of water resources is essential for proper management of ground water resources. Hence, the co-operation and awareness of public is vital for achieving the target.

WOHKHA DISTRICT, NAGALAND

Plate - I



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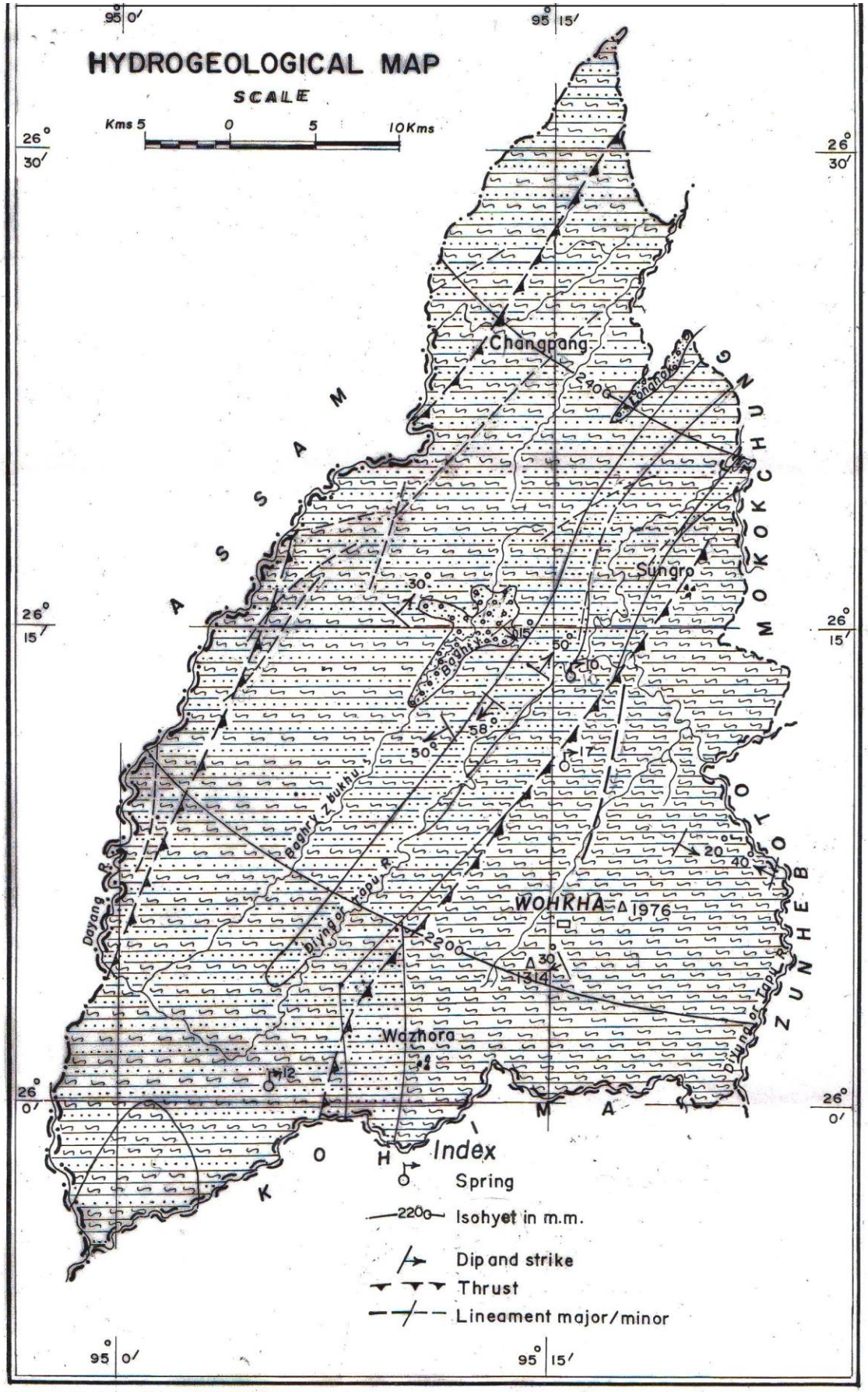

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Legend

	FORMATION	LITHOLOGY (with geomorphic unit)		AQUIFER DISPOSITION	GROUND WATER POTENTIAL
					Porous Media
		—UNCONFORMITY—			
Pliocene-Pleistocene	DIHING	Denudational and low lying hills and mounds, consisting of pebble bed, soft sandy clay, grit, sandstone and conglomerate		Valleys underlain by Dihing formations is likely to yield. Low to moderate, assorted and discontinuous aquifer with high argillaceous matrix.	Low to moderate yield prospects of 10-20 m³/hr for drawdown more than 6m.
		—UNCONFORMITY—			
Upper & Middle Miocene	TIPAM	Moderate structural hills, consisting of clay shale, coarse to gritty ferruginous sandstone and conglomerate.		The valleys underlain by Tipam sandstones from good aquifers.	Good recharge zone for high and moderate yield aquifer system at deeper depth.
Lower Miocene	SURMA	Low to moderate structural hills, consisting of shale, siltstone, mudstone and ferruginous sandstone with sandy shale and conglomerate		Ground water restricted to weathered mantle and fracture development.	Fissured Media
		—UNCONFORMITY—			
Upper Eocene to Oligocene	BARAIL	Denudo—structural hills; Long linear ridges and highly dissected round to flat topped hills consisting of beded compact, fine to medium grained sandstone mostly less susceptible to erosion.		—— Do ——	Run off zone, Ground water occurs as spring, in filtration to ground water is controlled by development of secondary porosity in rocks caused due to action of tectonic elements.
Upper Cretaceous -Middle Eocene	DISANG	High structural hills, linear, curvilinear and at places irregular hill ranges and narrow montane valleys consisting of shale and sandstone.			

Semi — Consolidated