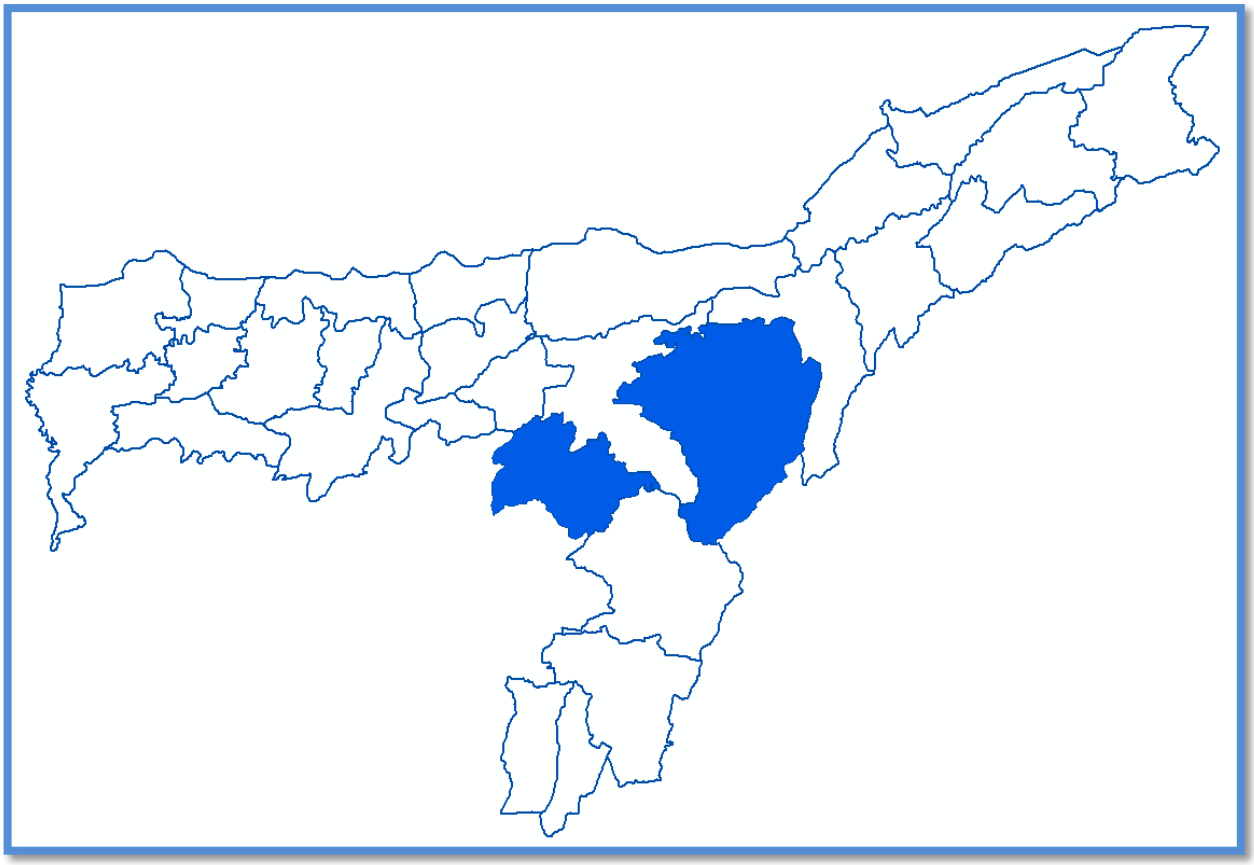
Technical Report Series: D

No:

Ground Water Information Booklet

KarbiAnglong District, Assam



Central Ground Water Board

North Eastern Region

Ministry of Water Resources

GROUND WATER INFORMATION BOOKLET
KARBIANGLONG DISTRICT, ASSAM

DISTRICT AT A GLANCE

Sl.No.	Items	Statistics
1.	**GENERAL INFORMATION**	
	i) Geographical Area (Sq.Km.)	10434
	ii) Administrative Divisions (as on 2011)	3
	Number of Tehsils/C.D.Blocks	11
	Number of Paanchayats/Villages	-
	iii) Population (as on 2011 Census)	965280
	iv) Average Annual Rainfall (mm)	1121.5
2.	**GEOMORPHOLOGY**	
	Major Physiographic Units	High hills of Archaean gneisses
	Major Drainages	Yamuna river with its tributaries
3.	**LAND USE (Sq.Km.)**	
	a) Forest Area	3136.60
	b) Net area sown	1262.06
	c) Culturable Waste Land	NA
	d) Current fallow	NA
	e) Total cropped area	1943.16
	f) Cultivable area	1262.06
4.	**MAJOR SOIL TYPES**	Alluvial Soil, pale brown weathered soil
5.	**AREA UNDER PRINCIPAL CROPS (as on 2011 in sq.km.) in ha m**	84906
6.	**IRRIGATION BY DIFFERENT SOURCES**	
	a) Surface water	28754 ha
	b) Ground water	2395 ha
7.	**NOS. OF CGWB MONITORING WELLS**	36
8.	**PREDOMINANT GEOLOGICAL FORMATIONS**	Vast alluvial formation of river borne deposit
9	**HYDROGEOLOGY**	
	Major Water bearing Formation	Sand and mixed formation
	Pre-monsoon water level	4.43 m
	Post -monsoon water level	4.24 m
	Long term water level trend (1997-2007)	4.08 m

10	**GROUND WATER EXPLORATION BY CGWB AS ON 31.03.2013**	35
	i) Nos. of wells drilled	EW -31 Nos, OW – 4 Nos.
	ii) Depth range in metre	223 – 270 m
	iii) Discharge in lps	0.25 - 40
	iii) Transmissivity (m^2/day)	15 - 573
	iv) Permeability (m/day)	0.5 - 23
11	**GROUND WATER QUALITY**	
	Presence of Chemical constituents beyong permissible limits (e.g. EC, F, Fe, As)	EC varies from 121-1168 mus/cm at 25^0C Fluoride 0.7-1.16 in dug well zone, beyond permissible limit in shallow and deep tube well up to 16 ppm. Fe – 0.29 ppm
12	**DYNAMIC GROUND WATER RESOURCES (as on March 2009) in MCM**	
	Annual Replenishable Ground Water Resources	381.99
	Net Annual Ground Water Draft	28.03
	Projected demand for domestic and industrial uses up to 2025	31.94
	Stage of Ground Water Development	8%
13	**AWARENESS AND TRAINING ACTIVITY**	
	Mass Awareness Programmes organised a) Date b) Place	Not organised
14	**EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING**	
	Projects completed by CGWB (No. & amount spent)	Nil
	Project under technical guidance of CGWB (No.)	Nil
15	**GROUND WATER CONTROL AND REGULATION**	
	No. of OE Blocks	Nil
	No. of Critical Blocks	
	No. of Blocks notified	
16	**MAJOR GROUND WATER PROBLEMS AND ISSUES**	Quality problem in respect of medium and deeper aquifers in certain part as high F content

GROUND WATER INFORMATION BOOKLET
KARBI ANGLONG, ASSAM

1.0 INTRODUCTION

The Karbi Anglong district is located on south central part of Assam and predominantly represents a hilly terrain inhabited by tribal population. The district covers an area of 10,434 sq.km. and forms an isolated hill in the core of the district, separating from the Brahmaputra alluvials. The district has three sub-divisions with eleven blocks, administrative divisions of the district is shown in Plate – I. It has total inhabited villages of 2633 Nos.

As per 2011 Census, the population of the district is 965,280 out of which the rural population is 851258 Nos. and the rest 114,122 nos. is the urban population. As per record the district has total forest area of 3136.60 sq.km. and net area sown is 1262 sq.km. The total cropped area is 1943.16 sq.km. while the cultivable area is 1262.06 sq.km. The percentage of literacy varies from 68.19% to 87.92 % in various towns of the district.

The normal rainfall of the district is 1097 mm and the normal monsoon rainfall is 686 mm. Monsoon rainfall comprises 63% of the annual rainfall. During 2008 annual rainfall was 1209 mm, out of that monsoon rainfall was 874 mm. The temperature and humidity values are similar with other parts of the State.

Geomorphologically, the district can be divided into three units – Denudational hills, Pediment zone and valley areas. The oldest Archaean land mass is highly weathered representing a rugged topography with extensive pediment zone surrounding it. The western part of the Diphu Sub-division and north eastern part of Hamren Sub-division constitute the alluvial deposition by Jamuna and Kopili rivers.

The drainage network forms the upper catchment of Dhansiri river, Jamuna and Kopili rivers. The drainage pattern is dendritic to sub-parallel and is controlled by structural features and underlying lithology.

Geologically, the district comprises the oldest Archaean gneissic rocks followed by Precambrian Shillong Series with rock types of phyllites, schists, quartzites etc. Tertiary rocks starting from Eocene to Miocene age are available. This comprises Jaintia, Barail, Surma and Tipam series with various grades of shales, siltstone and sandstones. The recent to sub-recent alluvial deposit above it comprises clay, silt, sand and gravel admisstures with sands.

Ground water occurs under unconfined to confined conditions. Hydrogeologically these rock units occur – (1) Consolidated formation (2) Semi-consolidated formation and (3) Unconsolidated formation. The consolidated formation comprises Archaean rocks of Shillong Series and to some extent the lower part of Tertiary rocks, the Semi-consolidated group comprising sandstone, siltstone and clay restricted to Tertiary rocks and the unconsolidated group to recent to sub-recent alluvial sediments.

From quality point of view, the ground water is suitable for drinking purposes except high iron and fluoride content. The shallow zones are free from both iron and fluoride, while the deeper zones beyond 10 m depth contains high iron beyond permissible limit and the pediment zone on northern foothill zone in Diphu sub-division and eastern fringe area of Hamren sub-division contains high fluoride up to 16 ppm in deeper aquifers.

The estimated gross annual dynamic ground water resource is 340.46 mcm while net ground water resource is 20.63 mcm. The stage of ground water development is only 6%. Ground water for future provision for domestic and industrial use is 32 mcm.

The present utilisation of ground water is mostly for drinking purpose. However, for irrigation of ground water from tube wells is also used. The total area irrigated from ground water source is 2395 hectares.

2.0 RAINFALL AND CLIMATE

The average annual rainfall of the district is 1121.5 mm. The rainfall is unevenly distributed over the period of six months from April to September. About 60% of rainfall is received during July to September.

3.0GEOMORPHOLOGY AND SOIL TYPE

Geomorphologically, the area can be divided into three parts viz. (1) Denudational Hills, (2) Pediment Zone and (3) Valley Hills Areas.

The hills form a stable shield with rugged and rolling surface which represents a mature to sub-mature topography with rounded to sub-rounded crest and acquires dome shape at places. The hills are generally NE-SW trending with height acquiring maximum of 1400 m amsl.

The foothill zone of Mikir hills comprises the vast denudational pediplain known as the pediment zone. It includes surface run-off zone with moderate infiltration zone and comprises admixture of cobble, pebble and gravel with clay matrixes.

The western part of Diphu sub-division and North Eastern part of Hamren sub-division constitutes the flood plain areas of Jamuna and Kopili rivers. The thickness of sediments in these valleys is more than 250 m. Deposit constitutes coarse to fine sands, clay and occasional gravel beds.

Two types of soils are mainly observed in the district. These are (1) Brown to pale brown soil developed on the top of the hills, lateritic in places and (2) the alluvial soil, sandy loam or clayey developed on the low lying terrain.

4.0GROUND WATER SCENARIO

4.1 Hydrogeology

Hydrogeologically, the entire district can be divided into three units (1) Consolidated formations comprising oldest granite rock, gneisses etc. (2) Semi-consolidated rocks constituting the Tertiary rocks and (3) the unconsolidated alluvial sediments.

In the consolidated formation, ground water is confined to the top weathered zone and the fractures and fissures of the fresh hard rock. The thickness of the weathered zone depends on compactness and topography of rock types and other climatic effects. The depth to water level varies from 4 to 6 m in low terraced zone and 8 to 10 m in high terraced zones. In small valleys within denudational

hills, the static water level is 5 to 7 m bgl with water level fluctuation ranging from 2 to 3 m. The depth of the weathered materials generally is from 10 – 20 m. About 13 nos. borewells were drilled in hard rock and yield of the boreholes are limited. The depth to water level varies from 1 m to as much as 14 m or more up to 28 m bgl.

Based on the tube well data drilled by CGWB the sub-surface aquifer geometry is described as follows :

The shallow aquifer constitutes mixture of sand, clay with little gravel. Its thickness varies from 15 to 30 m. Ground water occurs under water table to semi-confined conditions.

The deeper aquifers consist of fine to coarse sand and gravel with intercalation of clay bands. 3 to 6 aquifer zones are demarcated within stipulated depth. Auto flow conditions are observed in Ongaon and Nathgaon areas in Howraghat block with piezometric head within 0.5 m to 1.5 m agl with auto flow discharge of 30 to 60 lpm. Auto flow condition is also observed around Bokajan area with fluctuation of piezometric head from 0.3 to 0.5 m in Bokajan, Howraghat and Rongkhong blocks respectively. Hydrogeology of the district has been depicted in Plate – II.

A total of 31 nos. of exploratoroy tubewells have been drilled by CGWB. The summarised result is as follows :

1. Depth to drilled	177 to 270 m
2. Depth of construction	145 to 227 m
3. Total thickness of aquifer tapped	18 – 51 m
4. Static water level	0.5 m agl – 11.55 m bgl
5. Discharge (m^3/hr)	6.3 – 138
6. Drawdown (m)	2.45 – 24.56 m
7. Transmissivity (m^2/day)	15.44 to 331
8. Permeability (m/day)	0.48 to 9.29
9. Storage co-efficient (s)	9.76×10^{-4} to 4.34×10^{-6}

4.2 GROUND WATER RESOURCES

Methodology adopted for ground water resources estimation for Karbi-Anglong district is as per GEC 1997 i.e. considering ground water level fluctuation and rainfall infiltration factor method.

The annual replenishable ground water resource of the district is 381.99 mcm and net annual draft is 28.03 mcm. The projected demand for domestic and industrial uses up to 2025 is 31.94 mcm. The stage of ground water development is 8%.

4.3 GROUND WATER QUALITY

The chemical constituents in ground water like TDS, bicarbonates, carbonate, chloride, calcium, magnesium, nitrate etc. are with permissible limit for domestic purposes except iron and fluoride. The water is slightly alkaline in nature, the pH value being up to 8.13.

The iron content of ground water is found to vary from negligible to 5.0 ppm in shallow zone and 1 to 7.9 ppm in deeper zone. In most of the cases, it exceeds the permissible limit of 0.3 ppm in both shallow and deeper zones.

The fluoride (F) content of some parts of the district is high and exceeds the permissible limits. The high concentration of fluoride observed in deeper zones beyond 10 m on the pediment zones. High concentration up to 16 ppm is observed at Napak Killing, Ramsapather, Akashiganga as well as Kehang, Englang villages. Recently, CGWB has surveyed the areas for fluoride content and demarcated five zones with high concentration of fluoride. These are (1) Bagpani area, (2) Dengaon – Parokhowa – Akashiganga area, (3) Doboka area, (4) Taradubi area and (5) Ramsapathar – Rankanthre area. The alluvial part of the district is generally from fluoride and suitable for drinking and irrigation except high iron content is places which requires removal before use.

4.4 STATUS OF GROUND WATER DEVELOPMENT

Based on the estimated ground water resource available for development and considering yield capacity of 20 m^3/hr and 60 m^3/hr for shallow and deep tube wells respectively, the spacing of the wells are recommended as 400 m and 1600 m. The tube wells should be designed in such a way that maximum volume of ground water may rush into the well with steady flow without sand rushing.

Shallow tube wells are feasible in limited alluvial tracts of Howraghat, Bokajan, Rongkhong, Samalangaso and Nilip blocks. The hydraulic gradient in Bokajan block is 1.76 m/km, in Howraghat block is 1.62 m/km and Rongkhong block is 1.61 m/km. Auto flow conditions are are observed in Ongaon and Nathgaon areas in Howraghat block with piezometric head varying from 0.5 m to 1.5 m agl with auto flow discharge of 30 – 60 lpm.

The use of shallow tube wells for irrigation is very limited and confines mainly in Howraghat and Rongkhong blocks. Small areas of 1 to 2 hectares are irrigated by such shallow tube wells of average 20 m^3/hr yield for rice and other Rabi crops.

Ground water development in much more created by shallow structures down to 50 m depth with 3 to 4 nos. aquifer zones than the deeper aquifers down to 200 m depth with limited aquifer thickness. Considering the cost factors of such constructions, shallow tubewells are cheaper and more productive.

5.0GROUND WATER MANAGEMENT STRATEGY

Based on the available ground water resources and effective areas available, spacing between the tubewells has been calculated. It is worked out that spacing between two shallow tubewells with discharge of 20 m^3/hr should be 400 m and for deep tubewells with discharge of 60 m^3/hr it is 1000 m respectively.

Shallow tubewells are considered feasible in limited areas of alluvial tracts in Howraghat, Bokajan, Rongkhong, Samalangso and Nilip blocks. In Howraghat block, granular zone exists of 10 – 25 m thickness exists within 50 m depth while around Ampukhuri – Dengaon area it is less than 10 m.

In Bokajan block, shallow tubewells are feasible around Deopani area tapping 20 – 30 m of aquifer in Rongkhong block 10 – 20 m aquifer thickness is expected to be encountered in Khanjan on northeast part. In the Central part around Baptlong, shallow tubewells are not feasible owing to deep static water level. A total of 574 sq. Km. Area is available for ground water development in the district.

6.0GROUND WATER RELATED ISSUES AND PROBLEMS

High iron in groundwater in selected places can be treated by iron removal processes like aeration and can be used for drinking. The main problem in ground water is the high content of fluoride in selected places. Hydrogeological survey carried out by CGWB, NER, Guwahati demarcate five such high concentration areas along the pediment (foothill zones) and little away in alluvial formation in deeper zones. Zones detected are (1) Bagpani area, (2) Dengaon – Parokhowa – Akashiganga area, (3) Doboka area, (4) Taradubi area and (5) Ramsapathar – Rankanthre area. The concentration of fluoride rises up to 16 ppm in some places. Emanation of gaseous substones is also noticed in shallow zones around Akashiganga area.

7.0 RECOMMENDATION

Existing hydrogeological setup of the district with huge ground water resources suggest for deep tubewells down to 200 m in alluvial plain and shallow tubewells down to 50 m depth with sufficient aquifer thickness and discharges of the tubewells ranging from 20 m^3 to 50 m^3/hr.

Iron treatment plants need to be installed with PHED Water Supply Schemes before using for drinking water.

The shallow and deep tube wells in areas marked for high fluoride content should be completely avoided. However, dugwells down to 10 m depth and other surface water sources may be utilised for drinking in such areas. The samples of water must be tested for fluoride in any cases in such areas before use.

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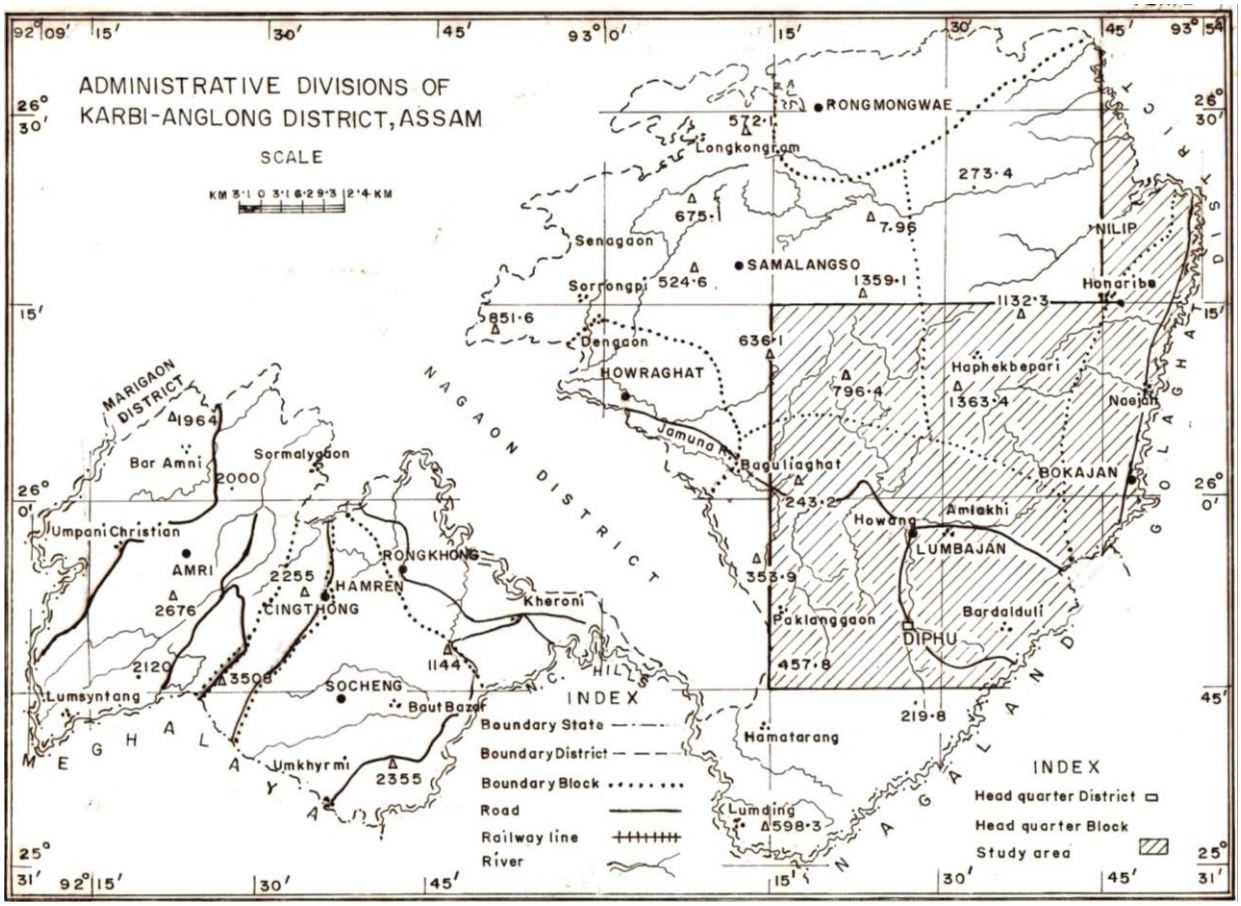
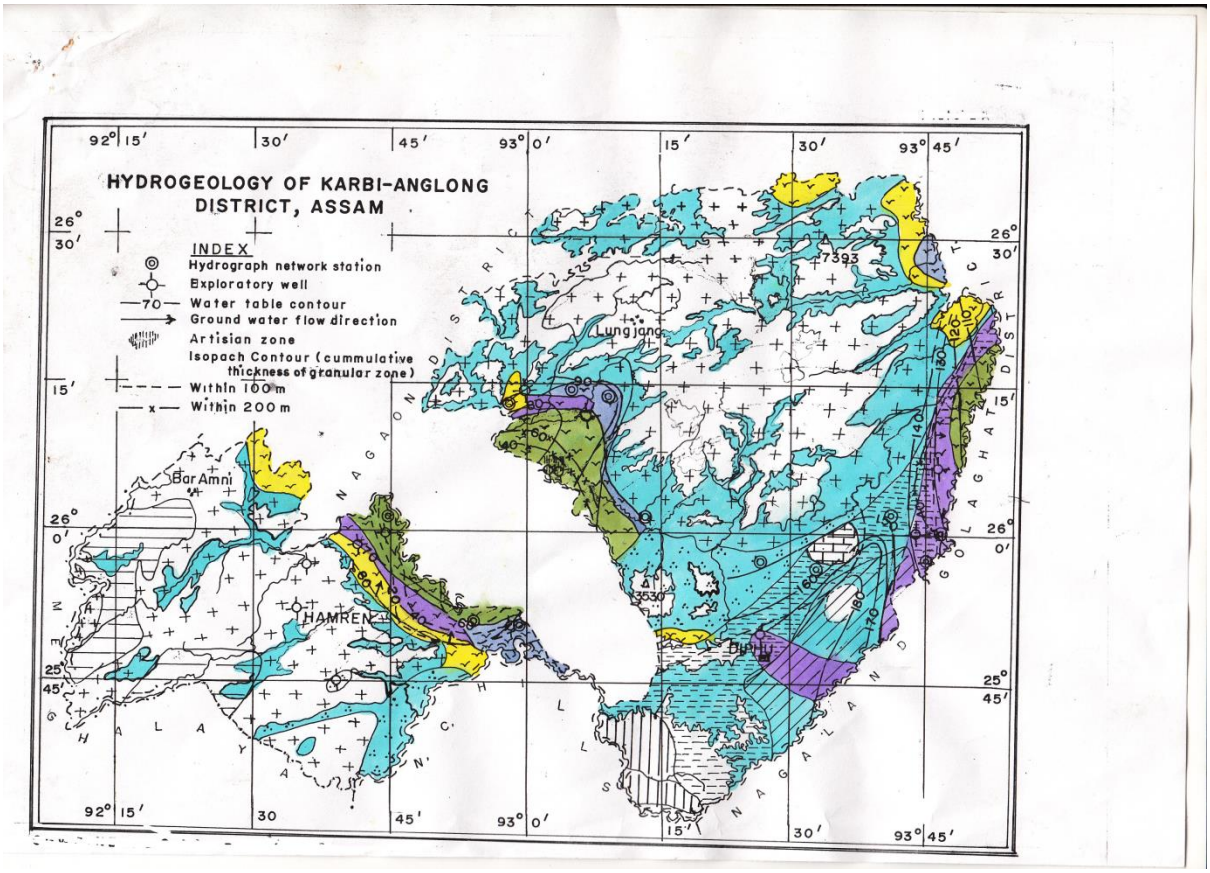

ADMINISTRATIVE DIVISIONS OF
KARBI-ANGLONG DISTRICT, ASSAM
SCALE
KM 5·1 0 3·1 6·2 9·3 12·4 KM
RONGMONGWAE
Longkongram
572·1
273·4
675·1
7·96
NILIP
Senagaon
SAMALANGSO
Sorrongpi 524·6
1359·1
Honaribe
1132·3
5851·6
Dengaon
636·1
HOWRAGHAT
Haphekbepari
1363·4
796·4
Naejan
MARIGAON DISTRICT
1964
Bar Amni
Sormalygaon
2000
NAGAON DISTRICT
Jamuna R.
Baguliaghat
243·2
BOKAJAN
GOLAGHAT DIST.
Howang
Amlakhi
Umpani Christian
AMRI
2676
2255
HAMREN
CINGTHONG
RONGKHONG
Kheroni
LUMBAJAN
353·9
Paklanggaon
Bardalduli
DIPHU
2120
3508
1144
SOCHENG
Lumsyntang
Baut Bazar
457·8
219·8
Hamatarang
MEGHALAYA
Umkhyrmi
2355
Lumding
598·3
NAGALAND
INDEX
Boundary State
Boundary District
Boundary Block
Road
Railway line
River
INDEX
Head quarter District
Head quarter Block
Study area
92° 09′
15′
30′
45′
93° 0′
15′
30′
45′
93° 54′
26° 30′
26° 0′
25° 31′
92° 15′
30′
45′
15′
30′
45′
25°


HYDROGEOLOGY OF KARBI-ANGLONG DISTRICT, ASSAM
INDEX
Hydrograph network station
Exploratory well
70 Water table contour
Ground water flow direction
Artisian zone
Isopach Contour (cummulative thickness of granular zone)
Within 100 m
x Within 200 m
92° 15′
30′
45′
93° 0′
15′
30′
93° 45′
26° 30′
26° 0′
25° 45′
15′
Bar Amni
HAMREN
Lungjang
Bumo
7393
3530
NAGAON DIST
GOLAGHAT DIST
NAGALAND
GHALAYA
HILLS

KARBI-ANGLONG DISTRICT, ASSAM

LEGEND

GROUP	AGE	FORMATION	LITHOLOGY		GROUND WATER CONDITIONS	GROUND WATER PROSPECTS
QUATERNARY	Recent	Alluvium	Sand, Gravel & Clay		Discontinuous lensoidal type of aquifers having limited thickness, ground water under unconfined/confined condition.	A — Suitable for dug wells down to depth of 10m with yield potential of 10m^3/day. B — Suitable for shallow tubewells down to 30-50m with yield potential of 12-18m^3/hr. for normal drawdown. C — Suitable for deep tube wells down to 90-100m with yield potential of 80-90 80-90m^3/hr for drawdown upto 6m. D — Suitable for deep tube wells down to 170-200m with yield potential of 60-80m^3/hr upto 6m drawdown. E — Suitable for shallow & deep tube wells of above category.
TERTIARY	Miocene	Tipam	Sandstone, Siltstone, Shale, mottled clay		Discontinuous clayey type moderatly thick semiconfined to confined aquifers.	F — Suitable for dug wells down to 20 m. Topographic lows weathered zone with 9-10m^3/day yield potential.
		Surma	Sandstone, Shale		Thin lensoid cidyey sand aquifers of limited extenstion with semi-confined confined ground water.	G — Suitable for deep tube wells down to 200m low yield capacity to 5-10 m^3/hr.
	Oligocene	Barail	Shale, Siltstone		Hilly tract.	Ground water exploration considered suitable for low yield dug well limited to small intermontane valley, areas of limited yield potetial of 5m^3/day.
	Eocene	Jaintia	Shale, Sandstone		Hilly tract	-do-
			Limestone		Compact limestone with superficial weathering	-do-
	Pre-cambrian	Shillong Group	Quartzite, phyllite & Schist.		Ground water occurs in water table conditions in weathered/fractured zone of shallow depth of 20-30m.	H — Suitable for dug wells with 8-10m^3/day in selected weathered portion.
			Gneises/Granite			Not considered suitable for ground water development.