Technical Report Series: D

No:

Ground Water Information Booklet
North Cachar Hills District, Assam

Central Ground Water Board
North Eastern Region
Ministry of Water Resources
Guwahati
November 2013

GROUND WATER INFORMATION BOOKLET
NORTH CACHAR HILLS DISTRICT, ASSAM

DISTRICT AT A GLANCE

Sl.No	Items	Statistics
1.	**General Information**	
	1) Geographical area (sq. km.)	4,888
	2) Administrative division (as on 2006)	2
	No. of Tehsils/ C.D. Blocks	5
	No. of Panchayats/ villages	……
	3) Population (2001 Census)	1,88,079
	4) Average Annual Rainfall (mm)	1,144.9
2.	**Geomorphology**	
	1)Major Physiographic Units	High hills of Shillong Series of rocks, linear river valley, younger and older Tertiary hill ranges
	2)Major drainage	Diyung River
3.	Land use (sq. km.)	
	1) Forest area	674.87
	2) Net area sown	283.16
	3) Cultural waste land	N.A
	4) Current fallow	N.A
	5) Total cropped area	360.95
	6) Cultivable area	283.16
4.	Major soil types	Lateritic soil & Alluvial soil
5.	Area under Principal Crops (ha, 2006)	8,305
6.	Irrigation by different sources	
	a) Surface	5,675 ha
	b) Ground Water	……..
7.	No. of CGWB Monitoring wells	NIL

8.	Predominant Geological Formations	Linear valleys with thin alluvial sediments,
9.	Hydrogeology 1)Major Water bearing formations 2) Pre monsoon water level 3) Post monsoon Water level 4) Long term Water level trend (1997-2007)	Thin sandy aquifers in valley portion and weathered and fractured/jointed consolidated rocks in the hilly terrain form moderate to poor aquifers. 3 to 10.0 m bgl 1.80 to 8.0 m bgl No significant change in ground water level is observed.
10.	Ground water exploration by GGWB as on 31.03.2008 i)No. of wells drilled ii) Depth range in meters iii) Discharge in LPS iv) Transmissivity (m2/day) v) Permeability (m/day)	 9 (7 EW & 2 OW) 23-92.05 m bgl 0.083-0.97 8-17 2
11.	Ground Water Quality i)Presence of chemical constituents ii)Beyond permissible limit (i.e. EC, F, Fe, As etc.)	EC:180-350 micromhos/cm at 25^0c Fe: 0.02-2.7 mg/l F: not detected As: not detected
12.	Dynamic Ground Water Resources (mcm)(2009) i)Annual replenishable GW Resource ii)Net annual G.W draft iii)Projected demand for domestic and industrial use up to 2025 iv)Stage of G.W. Development.	 95.51 7.14 7.45 8%
13.	Awareness and training activity (i) Mass Awareness Programmes organized a)Date b) Place	Nil

14.	Efforts of Artificial Recharge and Rainwater Harvesting i)No. of Project completed by GGWB and amount spent ii)No. of Project under technical Guidance of GGWB	Nil
15.	Ground Water Control and Regulation i)Number of OE blocks ii)Number of Critical block iii)Number of Block notified	NIL
16.	Major Ground Water Problems and Issues	Higher concentration of Iron in ground water in scattered pockets is found, so this water may be treated prior to use for domestic purposes.

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1.0 Introduction

The North Cachar Hills district is located in the South Central parts of Assam bounded by North Latitudes $24^0 58^/$ and $25^0 47^/$ and East Longitudes $92^0 32^/$ and $93^0 28^/$. It is bounded by Karbi-Anglong and Nagaon districts on North, Cachar district on South, Nagaland and Manipur states on East and Jaintia Hills district of Meghalaya on West. The district acquires an area of 4,888 sq. km. and has been sub divided into two Civil Sub-Division (CSD) and five Blocks.

The population of the district as per 2001 Census is 1,88,079 and it has low density of population. As per the land statistics, the district has total cropped area of 36,095 ha with net area sown as 28,316 ha. The district is occupied by 67,487 ha of forest and total cultivable land is 28,316 ha.

The total annual rainfall is 1,145 mm. The seasonal distribution of rainfall is 31.85% in pre-monsoon, 54.87% in monsoon, 9.77% in post monsoon and 3.56% in winter season. The area experiences sub-tropical and humid climate.

Geomorphologically, the district is divided into eleven (11) units. The units are classified on the basis of alluvial plains and structural valleys and structural and denudation hills of Tipam, Surma, Barail, Jaintia / Disang groups, Shillong group of rocks and the gneissic complex. The district represents a tectonically disturbed zone with numbers of lineaments, joints, fractures and the dominating Haflong – Disang thrust. The main direction of the major thrusts is NE – SW to ENE – WSW.

Physiographically, the district consists of mainly hilly tracts and valleys with extent of plain area. It can be divided into main physiographic divisions which are as follows.

a) The low lying areas of river valley
b) The high hills of Barail range and
c) The plateau of Ganjung and Umrangso area

The main rivers of the district are Diyung, Kapili, Jiri and Dhansiri Rivers with their tributaries. The soil of the district varies from non-lateritic soil to lateritic red soil ranging from sandy loam to clayey loam in texture. The major lands are (i) Built up land (ii) Agriculture land and (iii) Land of shifting cultivation. ‘Jhum’ is the main practice of cultivation of cereals, pulses, oil seeds, sugarcane etc in cultivable area. The district under

National Watershed Development Project for Rain fed Area (NWDPRA) covers a total area of 4,113 ha covering 559 families. There are numbers of minor irrigation schemes in the district.

Geologically, the district comprises of rock formations ranging in age from Achaean to Quaternary. The alluvial sediments constitute a very small area. The main geological domain is the tertiary rocks of Oligocene and Miocene periods.

Hydrogeologically, the district is divided into two groups i.e. i) Unconsolidated rocks in narrow valleys comprising gravel, pebble, sand, silt and clay and ii) Semi-consolidated rocks like shale, siltstone, sandstone, limestone etc. Ground water emanates as springs and seepages through joints, cracks and fissures present in semi-consolidated rocks. In general, ground water occurs under water table to semi-confined condition. Pre-monsoon water level in alluvial area ranges from 3.80 16.00 m bgl while in Tertiary rocks; it varies from 1.77 to 17.63 m bgl. Water level fluctuation ranges from 0.22 to 4.88 m.

Chemical analysis of ground water samples collected indicates that the ground water is suitable for both the drinking and other purposes. However, higher iron concentration is observed in localized pockets, in general, it is within permissible limit.

The estimated Ground Water Resource of the district is 110.51 mcm while the net annual draft is 5.75 mcm. The projected demand upto 2025 for domestic and industrial uses of ground water is 7.45 mcm. The stage of ground water development in the district is only 6% and it falls under 'SAFE' category.

The present ground water utilization is mainly for domestic purpose and to some extent for irrigation purpose. The area under principal crops is 8,305 ha. Out of which 5,675 ha are with irrigation facilities. No shallow tube wells are used for irrigation purposes.

2.0 Rainfall and Climate

Although the average annual rainfall of the district is 1,145 mm, there is wide range of disparity in rainfall distribution from place to place. Diyungmukh area represents a dry belt. The winter season commences from the month of October and continues up to February. The average maximum temperature is 26^0 C while the average minimum temperature is 14^0 C. The temperature is lowest in the month of January and is recorded as 6^0C. The relative humidity values from 73% to 84% (1994-95). The area represents a sub-tropical climate.

3.0 Geomorphology and Soil

The district is divided into 11 units on the basis of different geomorphic characters. These are classified as follows.

a) Alluvial plains of Northern foothills
b) Structural valleys
c) Denudation hills of Tipam Group
d) Structural hills of Tipam Group of rocks
e) Denudation hills of Surma Group of rocks
f) Structural hills of Surma Group of rocks
g) Denudation hills of Barail Group of rocks
h) Structural hills of Barail Group of rocks
i) Denudation hills of Jaintia/ Disang Group of rocks
j) Denudation hills of Shillong Group of rocks
k) Denudation hills
l) Hills of Gneissic complex

The alluvial plains of northern foothills are formed due to fluvial action of rocks and comprise of gravel, sand, silt and clay. The structural valley resulting from Haflong-Disang thrust trending ENE-WSW forms a curvy-linear valley along southwestern part. The structural and denudation hills of Tipam, Surma, Barail, Disang, Jaintia and Shillong groups represent characteristic features separating each other.

The district is covered by a variety of soil types which varies with different topographical conditions, composition of parent rock, palaeogeography and variation of climatic conditions (rainfall, temperature, degree of weathering etc). The soil is non-lateritic in flat alluvial area to lateritic in topographically high areas. It ranges from sandy to clayey loam in nature. The soil is acidic in reaction with pH ranging from 4.1 to 6.2 and very rich in organic carbon, medium to poor contents of phosphorus and high in potash content.

4.0. Ground Water Scenario

4.1. Hydrogeology

Hydrogeologically, the district of North Cachar Hills is divided into two distinct groups, i.e. i) semi-consolidated and ii) unconsolidated group.

Semi-consolidated rocks occupying the major parts of the district constitutes claystone, shale, siltstone ferruginous compact sandstones, fossiliferrous limestone etc. The

southern part is more argillaceous and represents poor permeability. The rock unit is well jointed and highly fractured. Ground water manifests in the forms of perennial and seasonal springs and the discharge of the spring and seepage depends on the amount of precipitation in the area. The area represents a high run-off zone.

Unconsolidated sediments constitute Recent to Sub-Recent alluvial sediments which are very restricted in nature and confined to small linear valleys. These are gravel, pebble, sand of various grades, silt and clay.

Central Ground Water Board has drilled as many as 10 tube wells in the semi-consolidated rocks, out of which 5 tube wells are successful and rests are abandoned. The drilling depth of the tube well ranges from 23.00 to 89.45 m bgl at Umrangso. The yield of tube well ranges from 5.3 to 58 lpm with drawdown of 3.11 to 4.22 m. The transmissivity value ranges from 7.96 to 172 m^2/day. The aquifer materials are sandstone, light grey to yellowish and grey limestone.

4.2. Ground Water Resources

Methodology adopted for ground water resource estimation of N.C.Hills 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 85.96 mcm. The existing gross ground water draft 7.14 mcm and the stages of development are 8% only. Future provision for domestic and Industrial use is 7.45 mcm and for Irrigation use is 76.84 mcm.

Assessment unit can be categorized into 4 categories as SAFE, SEMI-CRITICAL, CRITICAL, and OVER-EXPLOITED. In N.C. Hills district stage of ground water development is 8%, 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	= 85.96 mcm
Gross Ground Water Draft	= 7.14 mcm
Stage of Ground Water Development	= 8%
Future provision for Domestic & Industrial Use	= 7.45 mcm
Future Provision for Irrigation Use	= 76.84 mcm

4.3. Ground Water Quality

Chemical quality of ground water is studied from the various sources like dug wells, tube wells, springs etc in the laboratory to assess its suitability in use for domestic as well as industrial and agricultural purposes. As a whole, the ground water is slightly alkaline in nature. Its pH is within 7.7 to 8.3.

Electrical conductivity is low (180 to 350 micromho/cm at 25^0 C) and accordingly the total dissolved solid content is also low within the range of 115 to 224 mg/l. Carbonate content is nil while bicarbonate is between 67-153 mg/1. Thus, bicarbonate content is 34 to 100 mg/l and Mg^{++} is from 10 to 25 mg/l.

The total hardness varies within 44 and 115 mg/l and forms a temporary hardness with Calcium – Magnesium bicarbonate.

In general, the Iron content in ground water ranges from 0.04 to 2.7 mg/l, but exceptionally high as 10.2 mg/l in Lanku area. The drinking standard for Iron is 0.3 to 1 ppm and ground water bearing Iron content beyond this limit should be treated before use. Broadly speaking, the formation water of shallow aquifer is generally suitable for drinking and irrigation purposes.

4.4. Status of Ground Water Development

Ground water development in the hilly district is mainly confined to the northern alluvial plain. Good yield is expected in this northern alluvial patch with tubewell of depth range of 250-300 m. Around Umrangso area, moderate discharge of tube well is expected. Two types of aquifer systems have been determined, i) Within 20 m depth in sandstone & shale with primary porosity and ii) In fractured sandstone, solution cavity etc. having secondary porosity. Ground water development in other parts of the district is very limited and can only be achieved through large diameter dug well in small valleys & weathered zones. Development of spring can also solve the water problems in small localities. Rainwater harvesting in such areas can be of great help.

Apart from so many small schemes of surface water irrigation, utilization of groundwater is very less being only 10 ha for irrigation in Diyunmukh block. Apart from tube wells constructed by CGWB, state Directorate of Geology & Mining has also constructed 11 tube wells down to maximum depth of 257.3 m bgl at Chotawashling. The discharge of the tube well varies from 83 lpm to as much as 695 lpm at Chotawashing where it is proved to be free flowing in nature.

Scientific exploration technique in selection of tube well sites may change the ground water scenario of the district. Deep drilling down to the depth of 200 m or more by DTH Rig may be successful in construction of bore well in the area.

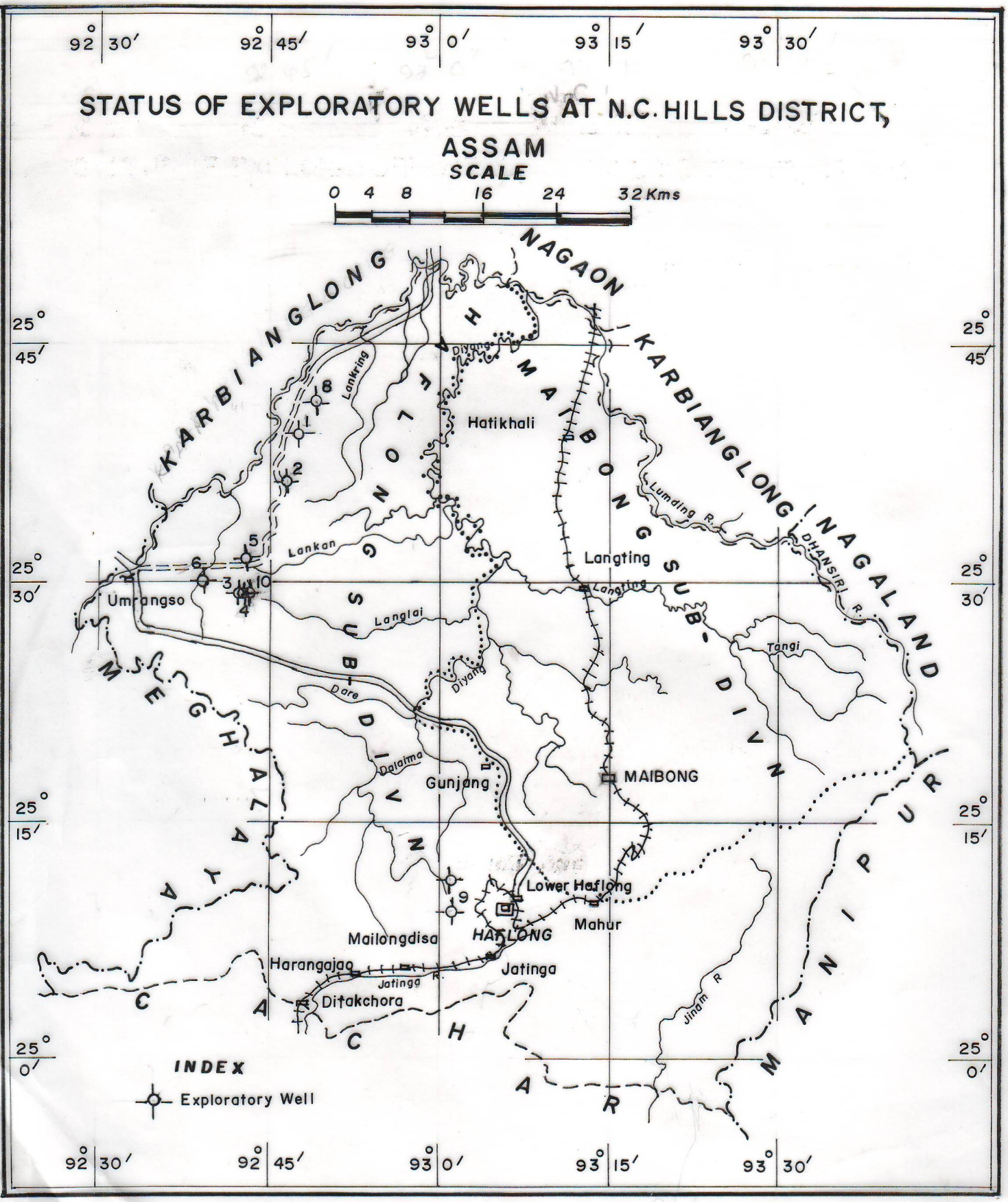
4.5. Ground Water Related Issues and Problem

There is no such remarkable ground water problem in the district. Ground water exploration in the hilly terrain is problematic considering approachability, the road condition and localities etc. Qualitative problems are almost nil with a few exception of high Iron content in ground water. Other than Iron, most of the chemical constituents are within permissible limit for use for drinking purpose.

5. Recommendations

Study in the existing hydrogeological set up of the district reveals that there is enough scope for the development of groundwater. The northern alluvial part of the district and the structural valley in the south can be developed with moderate to deep tube wells down to the depth of 250 m bgl with expected discharge of 40 m^3/hr. The structural valley has less potential with yield of 10-15 m^3/hr. The perennial springs with discharge of 3 – 5 lpm (lean period) can also be developed with construction of suitable structures. Large diameter dug wells of 2-3 m dia can be constructed in the area having suitable hydrogeological conditions in hard rock area. Bore wells down to the depth of 90 m or so are feasible in fractured, jointed hard rock area with expected discharge of 5 m^3/hr. Ground water emanated from springs with storage tanks may cater rural folk in the villages.

STATUS OF EXPLORATORY WELLS AT N.C. HILLS DISTRICT, ASSAM

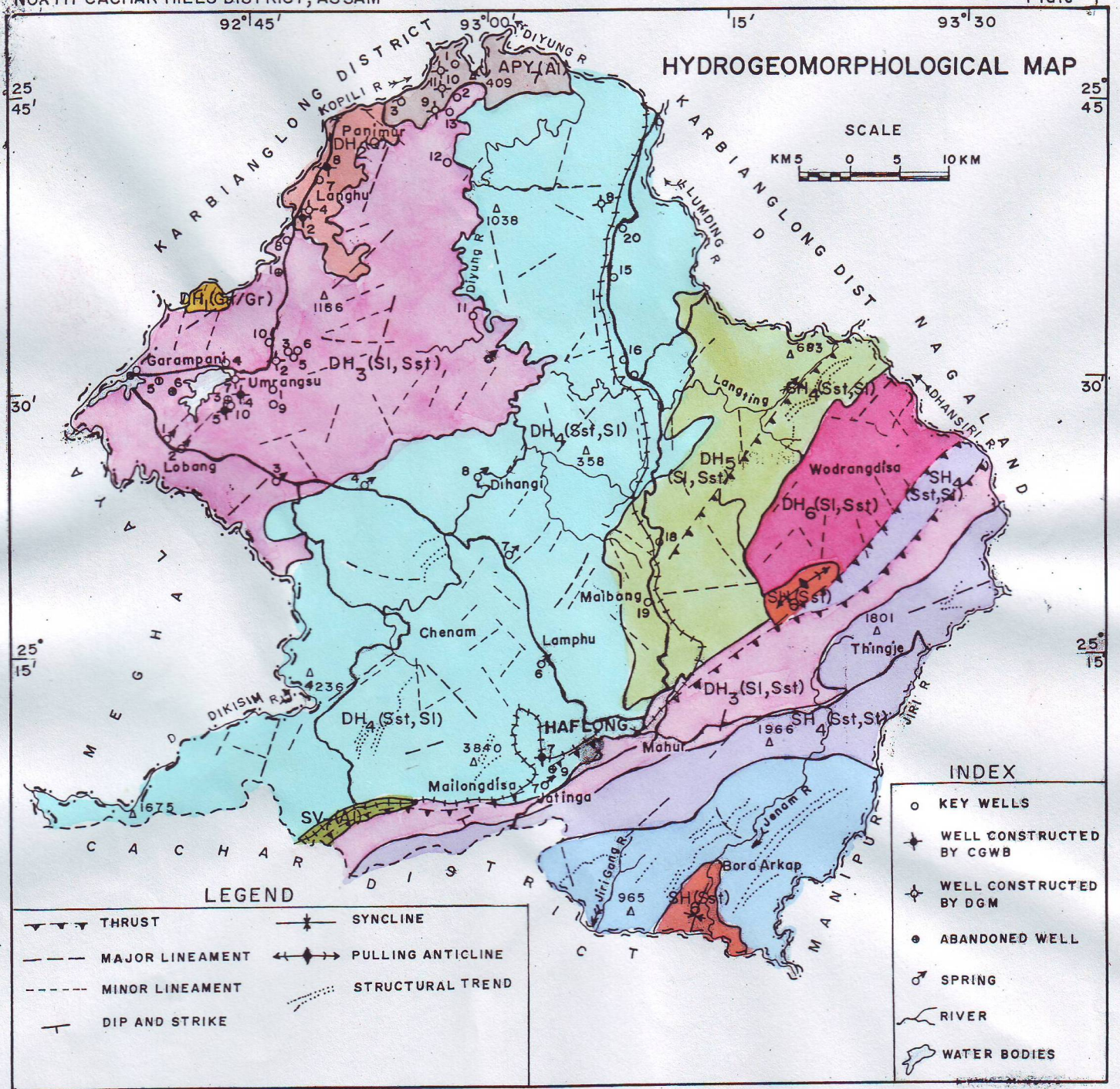


C. G. W. B / N. E. R / Do No / 5356 / 2008

NORTH CACHAR HILLS DISTRICT, ASSAM

Plate - I

HYDROGEOMORPHOLOGICAL MAP



LEGEND

- THRUST
- MAJOR LINEAMENT
- MINOR LINEAMENT
- DIP AND STRIKE
- SYNCLINE
- PULLING ANTICLINE
- STRUCTURAL TREND

INDEX

- KEY WELLS
- WELL CONSTRUCTED BY CGWB
- WELL CONSTRUCTED BY DGM
- ABANDONED WELL
- SPRING
- RIVER
- WATER BODIES

CGWB/NER/D.O.NO-3481/2000

N.C.HILLS DISTRICT, ASSAM.

LEGEND

Plate-I

AGE	FORMATION	LITHOLOGY (With Geomorphic Features)		GROUND WATER POTENTIAL
Recent to Sub Recent	Alluvium	Younger alluvium plain (Gravels, Pebbles, Sand, Silts)	$APY_7(Al)$	Moderate to high potential of 40 – 45 m^3/hr through deep tube well of greater depth within 250 m.
		Structural valley (Boulder, Gravel, Sand, Silts)	$SV_7(Al)$	Poor to moderate potential of 10 – 15 m^3/hr through deep tube well along the valley.
		UNCONFORMITY		
Miocene	Tipam Group	Denudational Hills (Coarse grity sand stone inter-bedded)	$DH_6(Sl,Sst)$	Poor to moderate potential 5 — 10 m^3/hr through Dug wells and hand pumps in weathered sand stone.
		Structural Hills (Sand stone, Shale and Clay)	$SH_6(Sst)$	Ground water potential is very low because of run off zone.
		Denudational Hills (Sand stone, Conglomerate, Mud stone, and Ferruginous Sand stone)	$DH_5(Sl,Sst)$	Poor to moderate yielding Dug well is feasible in the valley.
	Surma Group	Structural Hills (Sand stone, Silt stone, Shale and Clay)	$SH_5(Sst,Sl)$	Very poor yield through tube wells, restricted to joints
		UNCONFORMITY		
Oligocene	Barail Group	Denudational Hills (Flaggy Sand stone with shale, Carbonaceous shale, Sandy shale)	$DH_4(Sst,Sl)$	Poor to moderate yield of 5 — 10 m^3/hr through Dug wells in the weathered portion
		Structural Hills (Sand stone, Shale)	$SH_4(Sst,Sl)$	Very low potential area because of very high run off zone.
Eocene	Jaintia Group	Denudational Hills (Grey splintary Shale, Coal, Clay, Lime stone,)	$DH_3(Sl,Sst)$	Poor to moderate yield of 3 — 6 m^3/hr through tube wells in Lime stone areas and Dug well feasible in the sand stone area.
		UNCONFORMITY		
Pre-cambrian	Shillong Group	Denudationa Hills (Quartzite)	$DH_2(Q)$	Poor yield of 2 — 5 m^3/hr through tubewells in the fractured rocks.
		UNCONFORMITY		
Arehaean	Gneissic Complex	Denudational Hills (Gneissic granite)	DH_1Gn/Gr	Primarilly run off zone, Ground water Occurence and potential is controlled through fractures.