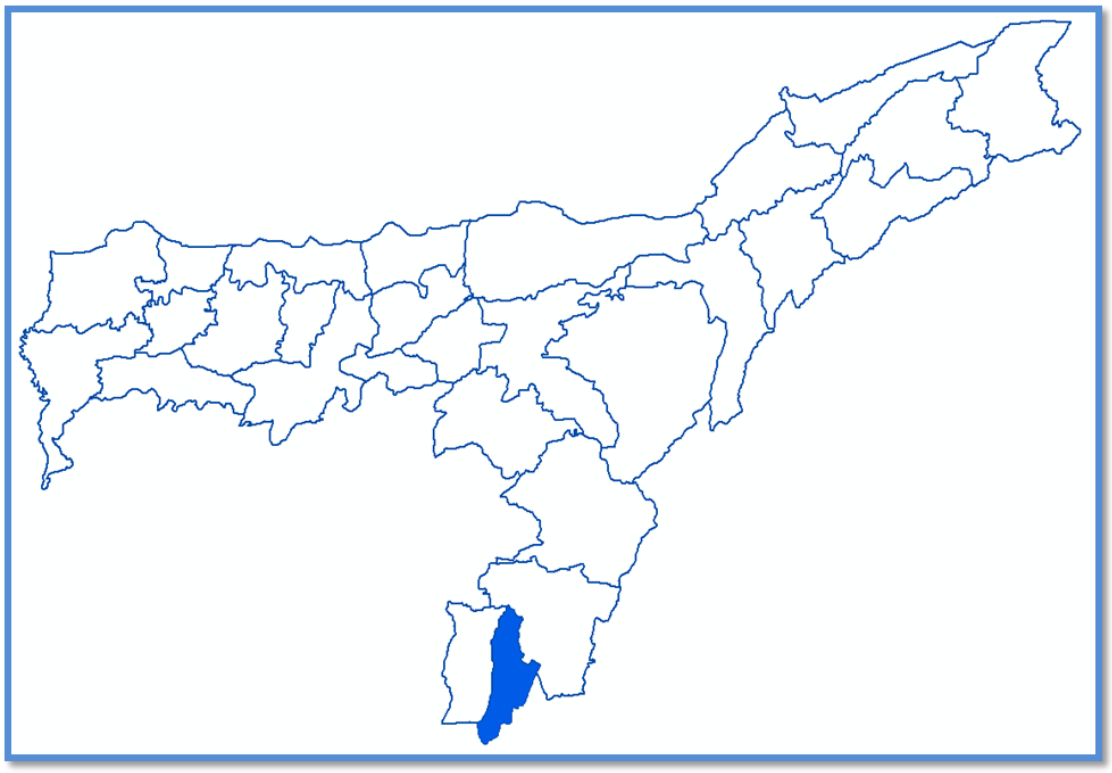
Technical Report Series: D

No:

Ground Water Information Booklet

Hailakandi District, Assam



Central Ground Water Board

North Eastern Region

Ministry of Water Resources

Guwahati

September 2013

GROUND WATER INFORMATION BOOKLET
HAILAKANDI DISTRICT, ASSAM
DISTRICT AT A GLANCE

Sl.No.	Items	Statistics
1.	**GENERAL INFORMATION**	
	i) Geographical Area (Sq.Km.)	1327.00
	ii) Administrative Divisions (as on 31.03.2011)	
	Number of Blocks	5
	Number of Gaon Panchayats	62
	Number of villages	331
	iii) Population (as on 2011 Census)	Total – 659260 Urban – 48173 Density - 497 sq.km.
	iv) Normal Annual Rainfall (mm) Actual Annual Rainfall mm (2011)	2838 mm 2322 mm
2.	**GEOMORPHOLOGY**	
	Major Physiographic Units	**Hills** : Chhatachura range, Katakhal and Innerline hills covered with forests **Valleys** : Hailakandi valley
	Major Drainages	Barak, Dhaleswari and Katakhal, Barni Bras
3.	**LAND USE (Ha) as on 2010-11**	
	a) Forest area	62420 – 47.97 %
	b) Area put for Non-Agrucultural use	8930 – 6.73 %
	c) Barren & Uncultivable land	3441 – 2.62 %
	d) Net area sown	50294 – 34.42 %
	e) Total cropped area	71672 – 50.84 %
	f) Area Irrigated more than one	21779 – 16.41
4.	**MAJOR SOIL TYPES**	Transported soils, Residual soils and Lateritic soils
5.	**AREA UNDER PRINCIPAL CROPS (2011)**	Paddy – 42500 Fruits - 1835 Bettlenut – 2860 T Rape & Mustard – 815 Turmeric – 5225 Total Pulses – 2879 Total Vegetables - 1466

6.	**AREA IRRIGATED BY DIFFERENT SOURCES (ha) as on 2010-11**			
	a) Dug wells	Nil		
	b) Tube wells/Bore wells	Nil		
	c) Tanks/Ponds	Nil		
	d) Canals	Nil		
	e) Lift Irrigation (Minor Irrigation)	4189		
	f) Other sources (Medium Irrigation)	Nil		
	g) Gross irrigated area	4189		
7.	**NOS. OF GROUND WATER MONITORING WELLS OF CGWB (as on 31.03.2013)**			
	No. of Dug wells	04		
	No. of Piezometers	01		
	Total	05		
8.	**PREDOMINANT GEOLOGICAL FORMATIONS**	Recent formations of Quaternary age and Dupitila and Surma formations of Upper Tertiary age		
9	**HYDROGEOLOGY**			
	Major Water bearing Formations	Tipam and Dupitila formations		
	Pre-monsoon depth to water level during 2011	0.90 – 7.80 m bgl		
	Post -monsoon depth to water level during 2011	1.33 – 2.16 m bgl		
	Long term water level trend in 2001-1011 in m/yr	Pre-monsoon : Rise - 0.013 to 0.705 Fall – 0.052 Post-monsoon : Rise - 0.023 to 0.247 Fall – 0.024		
10	**GROUND WATER EXPLORATION BY CGWB AS ON 31.03.2013**			
	Nos. of wells drilled (EW,OW,PZ,SH, Total)	**Min**		**Max**
		Total : EW – 1, OW – 2		
		EW	OW	PZ
	Depth range (m)	0.00-299.80	18.0-50.0	-
	Discharge (lps)	23.62	-	-
	Storativity (S)	1.0×10^{-3}	-	-
	Transmissivity (m^2/day)	36.97		
11	**GROUND WATER QUALITY**			
	Presence of chemical constituents more than permissible limits (eg. EC. F, As, Fe)			
		Min	Max	
	EC in umhos/cm	115	530	
	Fluoride	BDL	0.58	
	Iron	0.33	3.01	
	Type of water	Potable		

12	**DYNAMIC GROUND WATER RESOURCES (2009) in HAM**	
	Annual Replenishable Ground Water Resources	34279
	Net Annual Ground Water Draft	2119
	Projected demand for domestic and industrial uses up to 2025	2067
	Stage of Ground Water Development	7 %
13	**AWARENESS AND TRAINING ACTIVITY**	
	Mass Awareness Programmes organised a) Date b) Place c) No. of participants	Nil
	Water Management Training Programmes organised a) Date b) Place c) No. of participants	Nil
14	**EFFORTS OF ARTIFICIAL RECHARGE AND RAINWATER HARVESTING**	
	Projects completed by CGWB (No. & Amount spent)	Nil
	Projects under technical guidance of CGWB (Nos.)	
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**	Ground water contain sporadic high iron concentration

1.0 INTRODUCTION

The Hailakandi district is started functioning from 29th September, 1989. It covers an area of 1327 sq. Km and is located between North Latitudes 24° 08 & 24° 53 and East Longitudes 92° 25" & 92°46. The study area is falls in parts of Survey of India toposheet sheet numbers 83D/7,8,9,10,11 and 12. It is bounded by Cachar district on north, Karimganj district on West, Mizoram state states on the South and east by Mizoram and Cachar district. Hailakandi is the district headquarters. Administratively the district is divided into five Community Development Blocks which contains 62 Gram Panchayats and 331 villages. The district headquarter Hailakandi is connected with the other parts of the district and state by all weather metal roads. The National Highway No. 53, 154 and railway line passes through Hailakandi district.

As per 2011 Census, the total population of the district is 659260 persons with a density of 409 persons/sq. Km. And with sex ratio of 933 females/1000 males. The percentage decadal growth rate is 21.89 (2010-2011) The literates constitutes 78.5%. Rural and urban population constitute 91.95% and 8.05% respectively. The Schedules Caste and Schedule Tribe constitute 10.91% and 0.15% respectively.

Drainage

The anticlinal hill ranges forms the watersheds from which various drainage channels emerged. The common drainage patterns are sub-parallel to parallel and dendritic. In general, drainage pattern of the area is in conformity with the topography, which was structurally controlled. The major river in the district is Barak and its tributaries are Dhaleswari and Katakhal. The drainage of the district is shown in **Fig 1.**

Irrigation

The forests cover 63,661 sq.km. (48%) to the geographical area of the district. The net area sown is 50294 ha which is 34.43% and the total cropped area is 71672 ha and the cropping intensity is 148% to the net area sown.

There are neither major nor medium irrigation schemes in district. Agriculture is mainly depended on rainfall. A few minor irrigation schemes are available in the district. The minor irrigation schemes, such as Lift irrigation on perennial rivers and cherras, deep tube and shallow tubewells, Flow irrigation schemes (diversion of small streams/streamlets by constructing seasonal or permanent bunds across the stream and upstream water goes to paddy lands through channel by gravity).

Land Utilisation

The land utilisation pattern in the district during 2010-11 indicates, the forest cover is 63661 hectares and the net area sown is 50294 ha and the total cropped area is 71672 ha. The details of the land utilisation is presented in **Table 1.**

Sl.No.	Item	Area (in ha)	% to Geographical area
1	Forest	63661	47.97
2	Barren and uncultivable land	3441	1.92
3	Land put to non-agricultural use	8930	6.73
4	Permanent pastures and other grazing lands	932	0.7
5	Misc. Tree crops & grooves not included in net area sown	6456	4.87
6	Cultivable waste	275	0.15
7	Other fallow lands	1132	0.85
8	Current fallows	2040	1.54
9	Net area sown	50294	34.42
10	Total cropped area	71672	50.84
11	Area sown more than once	21779	16.41
12	Total Geographical area	132700	-

Studies/Activities carried out by CGWB

Geological mapping was carried out by the Officers of Geological Survey of India between 1963-64 and 1986-87. The D.K.Vaid (1974-75), Shri D. Shivane (1975-76 & 1976-77) of Central Ground Water Board has carried out systematic hydrogeological surveys. The Board has also carried out drilling activity under NEC Project during the period 1977-1980. During the period 1990-93 S/Shri P.J.S.Bhamrah, U. Gogoi, A.K.Agarwal, P. Kalita, D. Biswas and R.K.Kalita has carried out Tipaimukh Project. Ground water management studies were carried out by S/Shri R.K.Nayak (2001-02) and T. Chakraborty (2007-08).

Acknowledgements

The author is grateful to Shri G.c.Saha, Regional Director, Central Ground Water Board, NER, Guwahati for his guidance and support for compilation of this report. He is also thankful to Shri G.R.C.Reddy, Scientist-D & OIC, SUO, Agartala for his continuous guidance and extending his support in compilation of this report. He is also thankful to the State Govt. Agencies that have provided data for compilation of this report.

2.0 RAINFALL & CLIMATE

Rainfall

There are eleven number of rain gauge stations in the district located at Dholai TE, Narsingpur TE, Roopacherra TE and Barnerpur TA, Lalacherra TE, Aynakhal TE, Serispur TE, Bidyanagar TE, Lalamukh TE, Chandipur TE and South Cachar TE. The average annual rainfall of all the raingauge stations in Hailakandi district is 2993 mm. The data of 11 raingauge stations located in Tea Estates indicates the rainfall varies from 2340 mm at Bidyanagar TE to 3866 mm at Serispur TE.

Climate

The climate in the district is characterised by moderate temperatures and is highly humid in nature. The summer season is from March to May. The rainy season is from June to September and the winter starts from November and lasts till the end of February.

Temperature

March to May constitute the summer season. In general the temperatures in the district varies from 20^0C to 34^0C. The mean maximum temperature begins to rise from March and reaches to a maximum of about 34^0 C in April/May and thereafter with the onset of pre-monsoon showers temperature decreases and the mean minimum temperature reaches to a minimum of about 6^0C in the month of January.

Humidity

The humidity is generally high throughout the year. The relative humidity is of the order of 89 to 97% in the mornings and 40 to 81% in the afternoons.

Potential Evapotranspiration

Potential evapotranspiration is lowest in December being 99 mm and increases till the end of summer. The annual potential evapotranspiration is 1757 mm.

3.0 GEOMORPHOLOGY AND SOILS

Geomorphology

Physiographically, the area can be divided into two parts, Anticlinal hill ranges and Synclinal flat-bottomed valleys. The hill ranges are tightly folded. The major hill ranges are Chatachura Range, Katakhal and Inner line hills covered with forests. The trend of the hill ranges is almost NE-SW.

The broad synclinal valleys occurring in the district are Hailakandi valley. The average elevation of the valley is about 25 m amsl. The valley become narrow and constricted towards south and widens towards north. The master slope of the valley is towards north.

Soils

Both residual transported soils a re found in the district. The hilly lateritic soils developed in the southeastern part of the district. Older alluvial soil is also developed almost entire district and is light grey to dark grey in colour. This is practically unaltered alluvium representing a broad spectrum of sand, silt and humus rich bog clay depending on land form component. The soils are mainly clay to clay-loam except in riverine tracts and hilly tracts. The soil in the district indicates acidic in nature with pH of 4.5 to 5.5, high in nitrogen, potash and medium to low in phosphorus and potassium. Younger soils or river valley soils are found along all major river courses.

4.0 GROUND WATER SCENARIO

4.1 Hydrogeology

Water Bearing Formations

There are three hydrogeological units/ water bearing formations exists in the district. They are Alluvium, Dupitila and Tipam formation and are showoon in **Fig 2**. The details of the water bearing formations are as follows :

1. **Alluvial formation** : It occurs along the banks of main rivers and its thickness varies 10 to 15 m. Ground water occurs under unconfined condition. Ground water development in the area has not been very significant because of high content of clay and sandy clay. Ground water is developed through dug wells and hand pumps.
2. **Dupitila formation** : Dupitila formation is nearly horizontal in disposition. The formation consists mainly of clay and silt with some intercalations of gritty and ferruginous sandstones. In general, it has low permeability and low storage capacity due to high clay content. It has been developed through dug wells, shallow tubewells and deep tube wells.
3. **Tipam formation** : Sandstone of Tipam formation constitute the principal aquifer in the district. The permeability of this sandstone is much higher than that of Dupitila sandstone or Surma sandstone. The recharge area of the sandstone is in the anticlinal hills. This formation consists of sub-rounded, fine to medium grained, friable sandstone with intercalated clay. In the study area exposures of Tipam formation is found mainly along the foothill areas. Ground water occurs under semi-confined to confined conditions. This sandstone is developed mainly by deep tube wells.

Occurrence of ground water

Ground water occurs under unconfined condition in alluvial formation. In Dupitilla and Tipam formations ground water occurs under unconfined, semi confined to confined conditions. In major part of the area ground water occurs under unconfined condition in shallow aquifers and under semi confined to confined conditions in deeper aquifers.

Nature and depth of aquifer system

Aquifer system of the district is divided into two types, viz shallow aquifer withiiin 50 m bgl and deep aquifer between 50-300 m bgl.

Hailakandi Valley

Five major aquifers are present in addition of phearic aquifer. The cumulative thickness of granular zones down to a depth of 230 m varies from 69-100 m. All these aquifers are persistent and uniformly extensive in nature. The aquifer materials are more clayey around Hailakandi. The thickness of surfacial clay increases steadily from 27 m in the south to 52 m in the north. The granular zones that comprise fine to medium grained sand have effective grain size of 0.08 to 0.16 mm in the depth range upto 100 m. The effective grain size however, increases towards noroth. By and large, the sediments are predominantly clayey beyond a depth of 200 m down to the explored depth of 300 m.

Aquifer Parameters of Confined/Deeper Aquifers

Under ground water exploratory programme, the Board has constructed one exploratory wells and 2 nos. of observation wells. The discharge of the well is 23.6 lps in deep tube wells

4.2 Ground Water Resources

Ground water resources for year 2009 were estimated by the GEC ’97 methodology. During resource estimation, the district is as unit of computation. The main source of ground water recharge in the district is precipitation (Rain). Other sources of ground water recharge in the area are return flow from irrigation and seepage from ponds/tanks.

Recharge from rainfall in the area accounts for 99.6% of the total annual recharge. Comparison of monsoon and non-monsoon rainfall recharge shows that monsoon recharge accounts for 89.9% and non-monsoon recharge accounts for 10.1% of total rainfall recharge.

Ground water in the area is mostly used for domestic and irrigational purposes. Ground water draft for industrial purpose is negligible and has not been considered. Net ground water available in the district is 308.51 MCM and ground water draft for all uses is

21.19 MCM. Ground water draft for irrigation and drinking purposes accounts for 34.5% and 65.5% of total ground water draft respectively. The stage of development of the district is only 7% categorised as **"Safe".**

4.3 Ground Water Quality

Suitability of Ground Water for Drinking and Domestic Use

Ground water quality in the district is potable and range of all the chemical constituents are within the permissible limit set by BIS (1991), except iron. The pH values of the ground water range from 7.39 to 8.15. The EC values ranges from 128 to530. The fluoride content in ground water ranges from BDL to 0.58 ppm. The content of iron in ground water ranges from 0.33 to 2.34 ppm.

Suitability of Ground Water for Irrigation Use

In general, ground water in the area is suitable for irrigation purpose.

5.0 STATUS OF GROUND WATER DEVELOPMENT

Ground water developed ibn the district mainly by deep tube wells for drinking, domestic and irrigation purposes. Other ground water abstraction structures are shallow tube wells (hand pumps) and dug wells. Deep tubewells are tapping the granular zones between 50-200 m bgl. Shallow tubewells tapping granular zones from 40-120 m bgl. Ordinary hand pumps and dug wells were constructed within a depth range of 5 35 m bgl.

Drinking Water Scenario

In urban areas water supply is mainly from surface water sources through piped water supply schemes. In rural areas, piped water supply schemes are mainly dependent on 72 surface water schemes in addition there are 27 deep tube wells for piped water supply in the rural areas. In addition to piped water supply schemes there are 2137 Tara pumps, 406 Singur hand pumps and 354 ring wells in the district to meet the domestic water demand in rural areas. Water from deep tubewells is treated in water treatment plants before supply.

Irrigation Scenario

Irrigation is mostly done by utilising surface water in the district. During the year 2010-11 the surface water irrigates 98% of the total irrigation. Ground water irrigates only 2% of the total irrigation which shows that the ground water utilisation is negligible for irrigation in the district. Ground water developed for irrigation purpose is through deep and

shallow tube wells fitted with pump sets. As on 31.03 2013, there are 12 nos. lift irrigation schemes, 2 nos. DTW in the district, most of the minor irrigation sources are not in use.

GROUND WATER RELATED ISSUES AND PROBLEMS

Water Quality Problems

The major ground water related problems in the district are high concentration of iron in the ground water. The content of iron in ground water ranges from 0.33 to 2.34 ppm. The earlier hydrogeological surveys indicates the concentration of iron in ground water is generally higher than the prescribed desirable limit of 0.3 ppm and maximum permissible of 1 ppm in major part of the district. The enrichment of iron in ground water is due to ferruginous nature of Tipam sandstones, which forms the major aquifers. The high contents of iron renders ground water unsuitable for drinking purpose, hence the level of concentration should be brought down to the desirable limit before use for drinking purpose.

Awareness and Training Activity

Mass Awareness programme (MAP) and water management training programme by CGWB

MAP and WMPT are yet to be conducted in this district.

Areas Notified by CGWA/SGWA

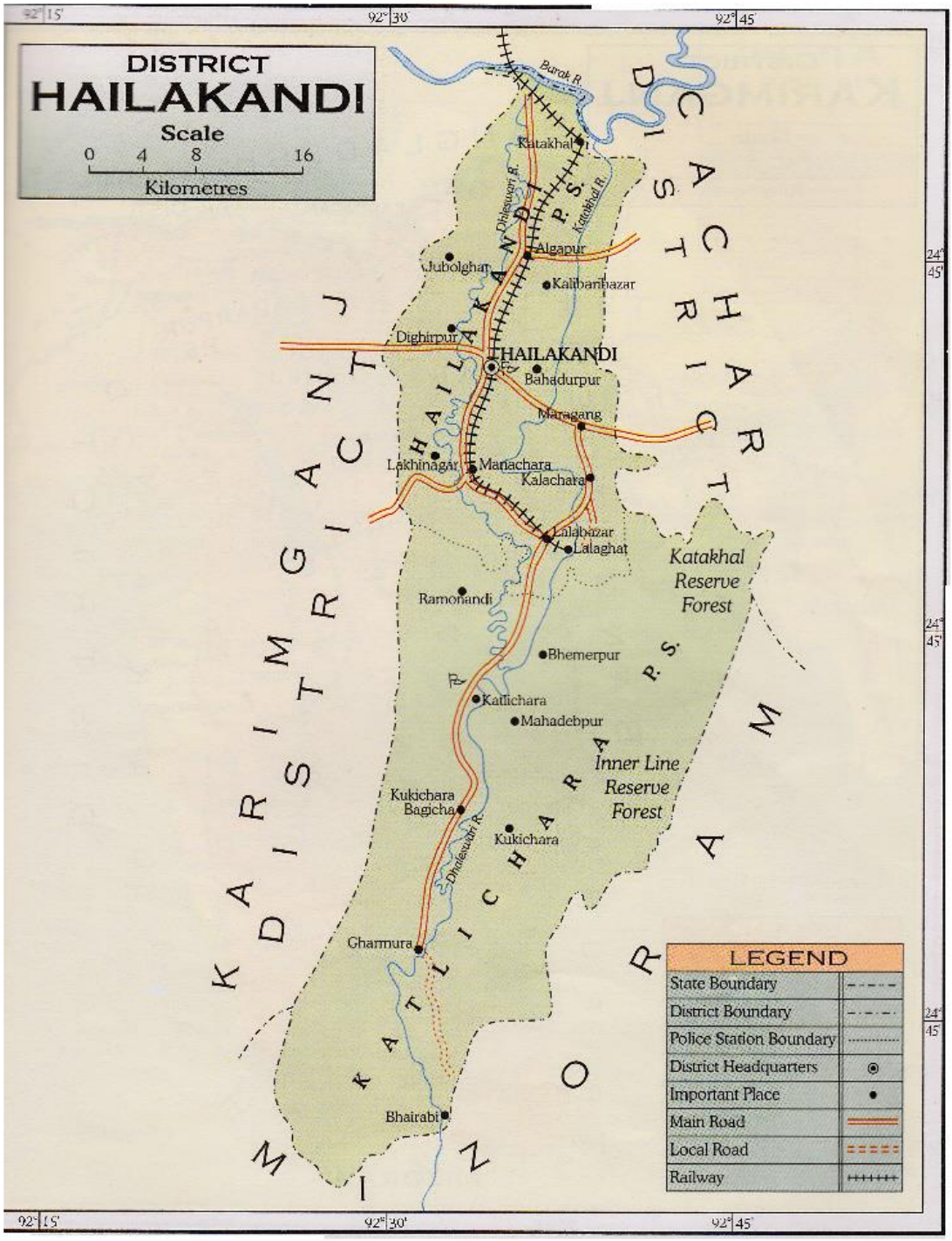
No area has been notified.

Recommendations

- The stage of ground water development in the district is only about 3% which indicates that there is ample scope for ground water development in the district.
- Ground water contains high concentration of iron in northern part of the district. So, iron removal plants are required to be installed wherever necessary for water supply schemes.
- Ground water quality should be monitored both during pre-monsoon and post-monsoon period, especially for iron.
- Research may be taken up on the impact of high iron waters on the soil, growth of various crops, plants etc. and their yield because of continuous supply of iron rich ground water for irrigation and also its impact on human health.
- Conjunctive use of surface and ground water should be taken up in the area for better utilisation of available resources.
- Rainwater harvesting should be encouraged, particularly in hilly terrains. Roof top rainwater harvesting may be taken up in the areas where settlements are located on higher reaches for domestic purpose in the southern part of the district.

- Safe distance of 500 m between two deep tube wells and 150 m between two shallow tube wells should be maintained while constructing tube wells in the district.
- While constructing tube wells sufficient gravel packing is a must because the grain size of sandstones (granular zones) is very small. The slot size should be within 0.5 to 1 mm and size of gravel between 2 – 4 mm. Gravels should be composed of quartz and should be sub rounded to sub-angular.
- Ground water regime including deeper aquifer should be monitored by the State Govt. in view of increasing demand due to urbanisation and ever increasing population.
- In hilly areas where springs exist should be developed. Nearby Springs, deforestation should be discouraged, spring mouth should remain clean/no clogging should occur to have good discharge.
- Public awareness should be created for proper use and conservation of water.
- At suitable locations installation of low lift points may be intensified throughout the district.
- Water logged areas may be converted into integrated farm ponds.
- Emphasis has to be given for school children regarding water and its importance of water conservation, harvesting techniques in their curriculum.

Plate-I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HAILAKANDI
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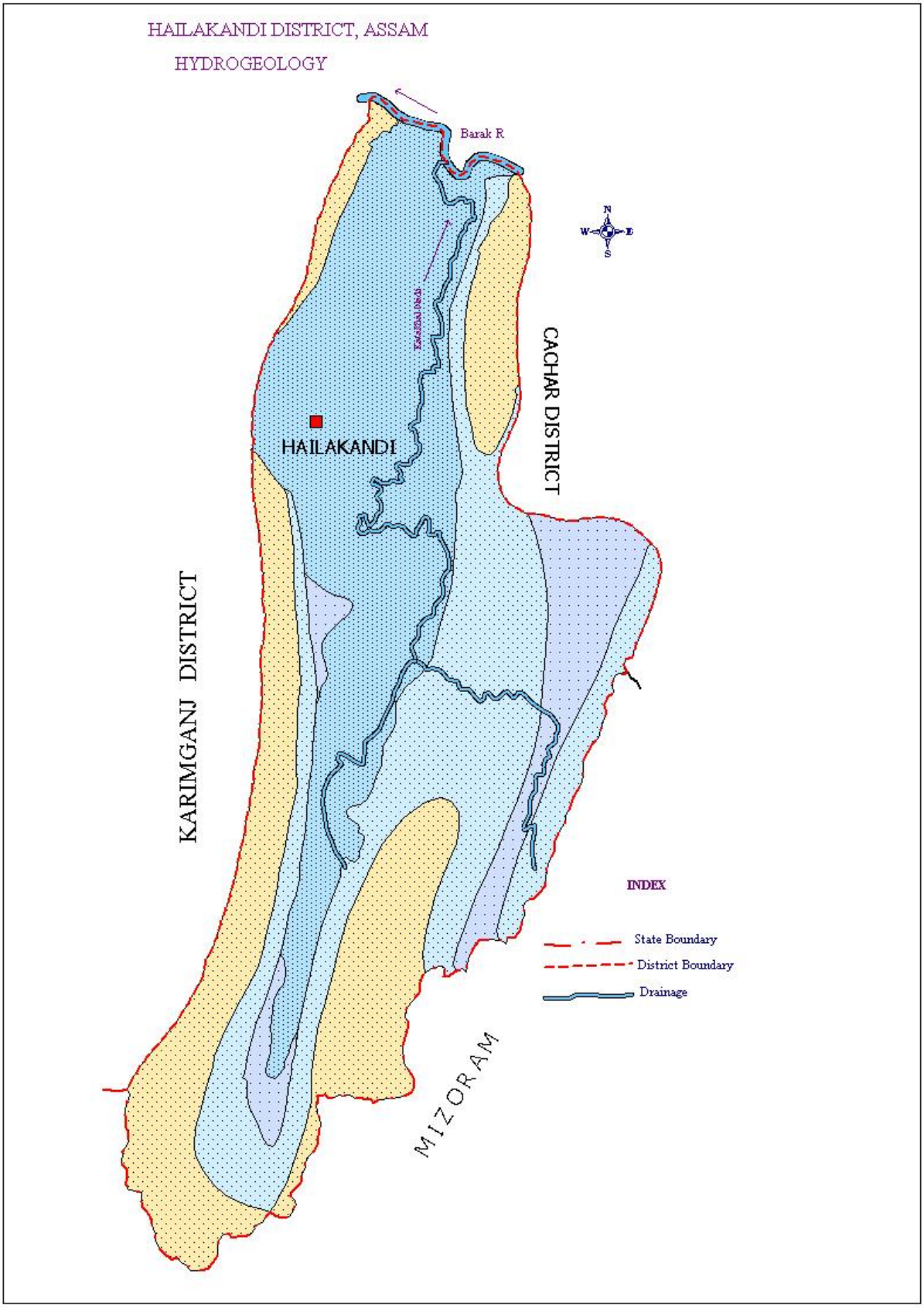
Kilometres
92° 15'
92° 30'
92° 45'
24° 45'
KARIMGANJ DISTRICT
CACHAR DISTRICT
MANIPUR
Burak R.
Katakhal
Dhaleswari R.
Katakhal R.
P.S.
Algapur
Jubolghat
Kalibaribazar
Dighirpur
HAILAKANDI
Bahadurpur
Maragang
Lakhinagar
Manachara
Kalachara
Lalabazar
Lalaghat
Katakhal Reserve Forest
Ramonandi
Bhemerpur
Katlichara
Mahadebpur
Inner Line Reserve Forest
Kukichara Bagicha
Kukichara
Ghanmura
Bhairabi
LEGEND
State Boundary
District Boundary
Police Station Boundary
District Headquarters
Important Place
Main Road
Local Road
Railway

Plate-II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KARIMGANJ DISTRICT
MIZORAM
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State Boundary
District Boundary
Drainage

HAILAKANDI DISTRICT, ASSAM

HYDROGEOLOGY

L E G E N D

MAP UNIT	FORMATION	LITHOLOGY	GEOMORPHOLOGIC CHARACTERS	GROUND WATER POTENTIAL
	ALLUVIUM	Clay, sands of various grades, silt	Synclinal valley, structurally controlled, occasionally flooded	Moderate to high yield, semi-confined to confined aquifer.Development restricted to synclinal, tectonic & intermontane valleys
	DUPITILA	Mottled clay, ferruginous sandstone & conglomerate	Undulating Plain with low lying flat topped mound & narrow and wide valleys	Suitable for deep tube wells, yield upto 100m3/hr. High drawdown upto 25m
	TIPAM	Medium to fine grained feldspathic ferruginous friable sandstone & well sorted mottled clay	Closely parellel round topped serrated residual ridges, low lying highle dissected hills with steep valleys	
	SURMA	Alternating shale, mudstone, siltstone, ferruginous sandstone & conglomerate	Hills sharp crested & low lying; moderate to highly dissected	Hilly area, not suitable for ground water development