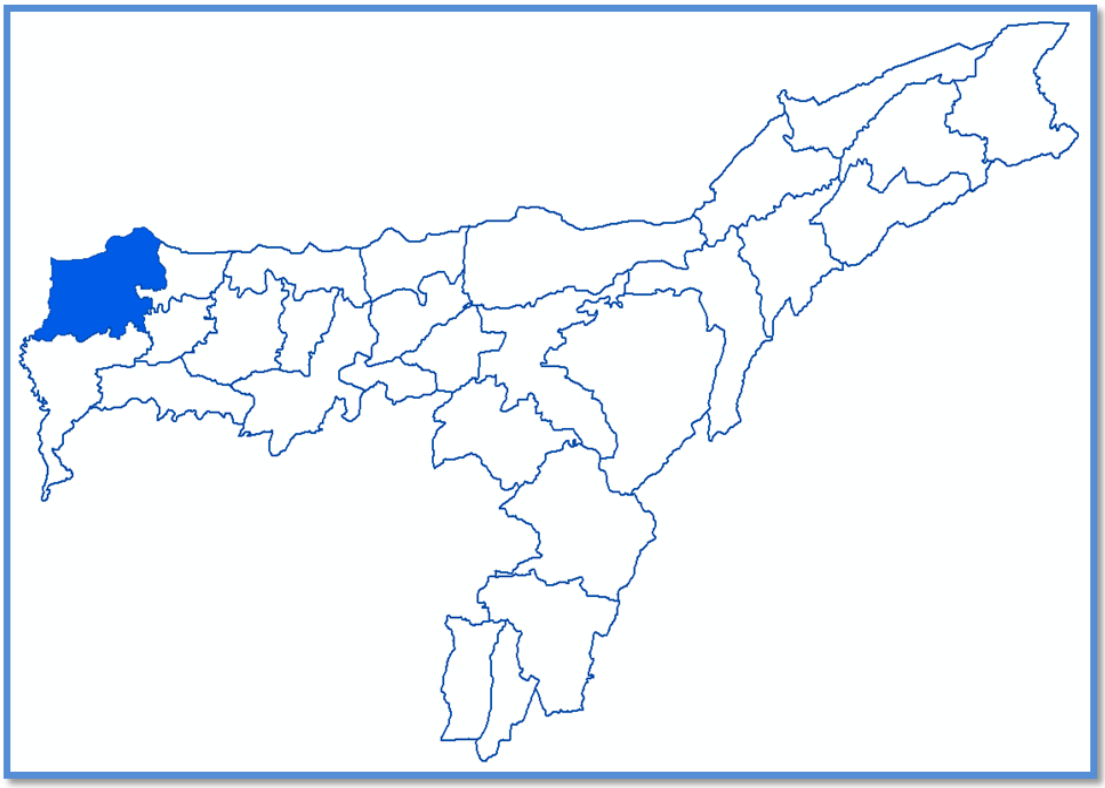
Technical Report Series: D

No:

Ground Water Information Booklet
Kokrajhar District, Assam



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

KOKRAJHAR DISTRICT, ASSAM

DISTRICT AT A GLANCE

SI No	Items	Statistics
1.	GENERAL INFORMATION i) Geographical Area (in sq.km) ii) Population iii) Average Annual Rainfall (mm)	 3,165.44 8,86,999 3,100
2.	GEOMORPHOLOGY (i) Major Physiographic units (ii) Major drainage	 Piedment plain, flat alluvial plain (older and younger alluvial) and Inselberges (Granites & Gneisses) Gangia, Paponi, Saumukha, Saralaganga and Lonya rivers and their tributaries.
3.	LAND USE (sq. km.) i) Forest Area ii) Net Area Sown iii) Total cropped area iv) Area sown more than once	 1611.95 865.56 1673.79 808.23
4.	Major soil types	Alluvial soil
5.	AREA UNDER PRINCIPAL CROPS (2008-09)	66865 ha (paddy)
6.	IRRIGATION BY DIFFERENT SOURCES (sq.km.)	52.43
7.	NUMBERS OF GROUND WATER MONITORING STATIONS OF CGWB (as on March 2013)	12
8.	PREDOMINANT GEOLOGICAL FORMATIONS	Vast river borne sediment, Older and Younger alluvium.
9.	HYDROGROLOGY i) Major water bearing formation ii) Pre-monsoon water level iii) Post monsoon water level iv) Long term water level trend	 i) Sand and pebble aquifer zone down to 300 m depth and weathered and fracture zones up to 100 m depth in consolidated rocks ii) 2.23 – 4.48 mbgl iii) 1.861 - 4.07 mbgl iv) No significant change observed
10.	GROUND WATER EXPLORATION BY CGWB (31.03.2009) i) Nos. of well drilled ii) Depth range in m iii) Discharge in m^3/hr iv) Transmissivity (m^2 /day) v) Permeability (m/day)	 2 60 to 106 33 to 38 2200 246
11.	GROUND WATER QUALITY i) Presence of Chemical Constituents beyond permissible limit (i.e. EC, F, Fe, As)	EC-Permissible limit F- Within desirable limit Fe- 0.35 -2.25 mg/l As-not detected.

12.	DYANMIC GROUND WATER RESOURCES (2009) in mcm. i) Net GW Availability ii) Net annual G.W draft iii) Project demand for domestic and industrial use up to 2025 iv) Stage of G. W. development	 1609.70 150.54 31.43 9 %
13.	AWARENESS AND TRAINING ACTIVITY i) Mass awareness programmes organized ii) Date iii) Place	 Not organized
14.	EFFORTS OF ARTIFICIAL RECHARGE AND RAINWATER HARVESTING i) Project completed by GCWB (Nos and amount spent) ii) Project under technical guidance of CGWB	 Nil
15.	GROUND WATER CONTROL AND REGULATION i) Number of OE block ii) Number of critical blocks iii) Number of block notified	 Nil
16.	MAJOR GROUND WATER PROBLEMS AND ISSUES	Higher conc. of iron in ground water in some pockets.

1.0 INTRODUCTION

Kokrajhar district of Assam is located on northern part of the mighty Brahmaputra River and bounded by North Latitudes $26^0 13' 30''$ and $26^0 53' 20''$ East Longitudes $89^0 52' 30''$ and $90^0 33' 10''$ covering area of 3165.44 sq. km. The district has been sub-divided into 3 sub-divisions and 1014 panchayats. As per 2001 census, the total population of the district is 8, 86,999

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The land use data (2007-08) reveals that the district has total forest land of 1,61,195 ha. The net area sown is 85,557 ha and current fallow land is 3,242 ha. The district has total cropped area of 162,821 ha and the area sown more than once is 77,264 ha. Irrigation potential created is 23685 ha and net irrigated area is 6325 ha.

The district is situated in a humid sub-tropical climate that is characteristic of the lower Brahmaputra Valley of Assam. The soils of district are fertile and suitable for paddy cultivation. The soil throughout the district is composed of sand and clay in varying proportion ranging from sand in the riverbed to soft clay in different parts.

Physiographically, the district can be divided into two units (1) Northern alluvial region (between 120 – 140 m amsl) and (2) the Southern swamps or flood plain of River Brahmaputra. The general gradient is towards the River Brahmaputra in the south. A major portion of the district is constituted by vast alluvial area formed by Bramhaputra and its river system. The alluvial plain has southerly slope with flat topography and the elevation generally varies from 40 to 300 m above MSL. The alluvial plain can be broadly classified into piedmont plain and Terraced alluvial plain. The former forms the highest terrace of Quaternary landscape characterized by high relief with dense forest and thinly populated. The latter covers the major part of the district occupies a large portion of cultivable land with moderate population.

The water that flows along natural nalas and canals are the main source of irrigation for the agricultural fields. The Bhutan hills are the source of a number of rivers that flow through the district and act as tributaries to the mighty Brahmaputra that flows from east to west. The important rivers of the district that flow from north to south are Champamati, Saralbhanga and the Sonkosh. The River Brahmaputra along with its tributaries like Gangia, Laponi, Saumukha, Lonya etc control the main drainage system of the district. These rivers emerge from the Himalayan foot hills and are perennial in nature and flow in north – south direction. They often flow in meandering courses developing ox-bow lakes and a number of lakes or beels formed as a result of change in river courses. The drainage density is very high

and drainage pattern is more or less parallel. Water logged area in the district is 332 ha and area under still water is 2052 ha.

Geologically, the district is occupied by older alluvium on north and Younger Alluvium of flood plain deposit on southern reach near the Brahmaputra River. The alluvium comprises thick beds of clay. The flood plain deposit is characterized by fine to very fine grained silty sand and loose clay bands. In the southernmost part of district there are one small hill composed of metamorphic rocks.

Ground water occurs under unconfined condition in the district and being a mono aquifer system, the water level is almost directly related to the amount of precipitation received. The pre-monsoon average water level is 4.07 m bgl, while the post monsoon value is 1.64 m bgl. The long term water level trend does not show any significant change. A single aquifer system occurs in the district.

Ground water is used mainly for domestic and irrigation purposes. From quality point of view, the ground water is neutral to slightly alkaline in nature with low to moderate salinity with soft to moderate hardness.

2.0. RAINFALL AND CLIMATE

The district experiences a Sub-tropical and Humid climate with heavy rainfall and hot summer. The average temperature ranges from minimum 10^0C to maximum 35^0C throughout the year. The average humidity remains almost same with variation from 62% in winter to 87% in post monsoon period.

The average annual rainfall of the district is 3102.4 mm with 110 annual average rainy days. The maximum rainfall occurs during the period from April to August. Heavy rainfall starts from April with the onset of monsoon and continues till September. July month receives highest rainfall in a year.

3.0. GEOMORPHOLOGY AND SOIL TYPES

Physiographically, the district is divided into two units- i) Northern alluvial region and 2) Southern swamps or flood plains of the river Brahmaputra.

The northern alluvial part forms a flat land with heights of 40-300 m above MSL with a gentle slope towards south the river Brahmaputra. The regional gradient is from east to west which indicates the general flow direction of the Brahmaputra River.

The Brahmaputra River flows from east to west and form the main regional drainage. Its tributaries like Gangia, Laponi, Saumukha, Saralaganga and Lonya etc originating from

Northern Himalayan foothill have a steep slope and shallow braided channels for considerable distances. The elevation of land near the Brahmaputra is 5-10 m amsl and the flood water in the flood plain area is detained in low depression forming beel and marshy land along the main river course.

SOILS

The soil of the district can broadly be classified into two groups.

(I) Deep reddish clayey soil in forest and hilly area and (2) Alluvial soil of Recent age occurring along the alluvial plains of the Brahmaputra river. The red clayey alluvial highlands of the district are ideally suited for the tea and sugarcane cultivation. The swampy and very low lands are characterized by deep grey silty soil suitable for jute cultivation.

Soils are mainly alluvial in nature composed mixture of sand, clay and silt in varying proportions. The soils in Peidmont Plain have sandy in nature, alkaline to slightly acidic and highly permeable. The soils in flood plains have loamy soil, moderately permeable and are less acidic than piedmont plain soils.

AGRICULTURE

The prominent crops of the area are paddy, pulses, mustard and jute. The low land soils –clayey loams mostly suitable for rice cultivation and red clayey sandy alluvial high lands are suitable for tea cultivation.

The irrigation schemes are mostly lift, flow irrigation, shallow and deep tube wells. Up to 2009-10, irrigation potential created is 23685 ha and net irrigated area is 6325 ha. During Kharif season 6325 ha land irrigated under paddy and during Rabi and Pre-Kharif season only 16 ha area is irrigated.

4.0 GEOLOGY

The entire Kokrajhar district is occupied by alluvial sediments of Quaternary age. The alluvium comprises unconsolidated sediments of clay, silt, sand, gravel, cobbles and boulders of quartz, feldspars etc. The younger alluvial cover deposited during the period comprises thick beds of clay, sand and gravel. The upper layer of the alluvial formation comprises clayey/sandy soil followed by coarse sand gravel beds at depth. This formation is a very good potential zone for ground water extraction.

5.0 HYDROGEOLOGY

Hydrogeologically, the district is divided into 2 units viz., (1) Piedmont plain which occupy in the north and elevated portion along the foothills of Himalayas and (2) Flood plain in the lower part comprise of Newer Alluvium forms in southern part of the district. Ground water in the district occurs under unconfined to semi-confined conditions. The district is underlain by thick alluvium having uniform porosity and permeability of 10-15%. Water level records of the ground water monitoring stations show very little variation. The average pre-monsoon water level of the district is 4.07 m bgl while that of post monsoon is 1.64 mbgl.

The flood plain area constitutes a major part of the district is underlain by alluvial formation. The depth to water level varies from 2 to 4 mbgl. The seasonal fluctuation has been in the range between 1 to 2 m. The movement of ground water is towards south. The ground water recharge by rainfall infiltration is much slower in the zone as compared to the piedmont zone. The average value of permeability of shallow aquifer is about 40 m/day.

6.0 GROUND WATER RESOURCES

Methodology adopted for ground water resource estimation of Kokrajhar 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 1609.70 mcm. The existing gross ground water draft 150.54 mcm and the stages of development are 9% only. Future provision for domestic and Industrial use is 31.43 mcm and for Irrigation use is 1450.93 mcm.

Assessment unit can be categorized into 4 categories as SAFE, SEMI-CRITICAL, CRITICAL, and OVER-EXPLOITED. In Kokrajhar district stage of ground water development is 9%, 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.

7.0 GROUND WATER QUALITY

The chemical analysis shows that the ground water in general is neutral to alkaline in nature with pH ranging between 7.94 and 8.53. The Electrical Conductivity value (48 -245 micro mhos at 25^0C) is within permissible limit. Calcium content is from 6 to 24 mg/l and well within permissible limit. The alkalinity value governed by anion content of carbonates and bicarbonates is within range of 18 to 146 mg/l. The hardness of groundwater ranging from 20 to 150 ppm indicates that ground water is of soft to moderately hard in nature.

The analysis of ground water samples from deep aquifer indicates its suitability for its domestic & irrigation use. The ground water in general is alkaline as pH of ground water ranges from 7.9 to 8.4. The water is of medium salinity and contains low sodium.

The ground water quality data indicate that in general it is suitable for domestic and irrigation purposes. There is not much appreciable variation in quality of ground water in shallow and deep aquifers. Abundant rainfall and relatively insolvable matter of the aquifer material makes the ground water of the district remarkably fresh in nature.

8.0 STATUS OF GROUND WATER DEVELOPMENT

Ground water development in the district is in primary stages. A few deep and shallow tube wells have been constructed. Rural water supply by Public Health Department covers almost entire district. Irrigation wells by ASMIDC, Irrigation department, and Agriculture department have covered a few schemes with constructing of shallow tube wells.

9.0 GROUND WATER MANAGEMENT STRATEGY

As stated above, the Kokrajhar district as a whole is represented by a mono-aquifer system- alluvial formation with thickness varying from 50 to 250 m. Ground water development in the district is almost in nascent stage. Shallow tube wells down to the depth of 50 m and deep tube well down to the depth of 200 m or more can be constructed in almost all parts of the district with proper hydrogeological investigation, with expected discharge of 3,500 m^3/day and draw down of 5 - 6 m in the alluvial area.

The area adjacent to the Brahmaputra River is feasible for shallow tube wells with depth range of 30 to 50 m depending on availability of granular zones. Such tube well is expected to yield from 35 to 45 m^3/hr tapping 15 m of aquifer zone with drawdown of 2.5 to 5 m.

Deep tube wells can be constructed in all parts of the district especially on northern parts where water requirement is more. Low cost ground water structures can be constructed to a depth of 50 m and tapping 10-15 m granular zone using standard strainer /slot pipes.

6.0 GROUND WATER RELATED ISSUES AND PROBLEMS

Almost every year the district gets inundated by floods during monsoon season. The effect of flood and soil erosion is much more in southern part than in the northern part of the Brahmaputra River.

The frequent flood affects the ground water regime of the district with water logging problem along with rising of water table which recedes in post-monsoon period due to porous and monotonous nature of the aquifer.

No ground water quality problem is recorded except, high iron content in certain pockets. The problems of arsenic and fluoride have not been reported.

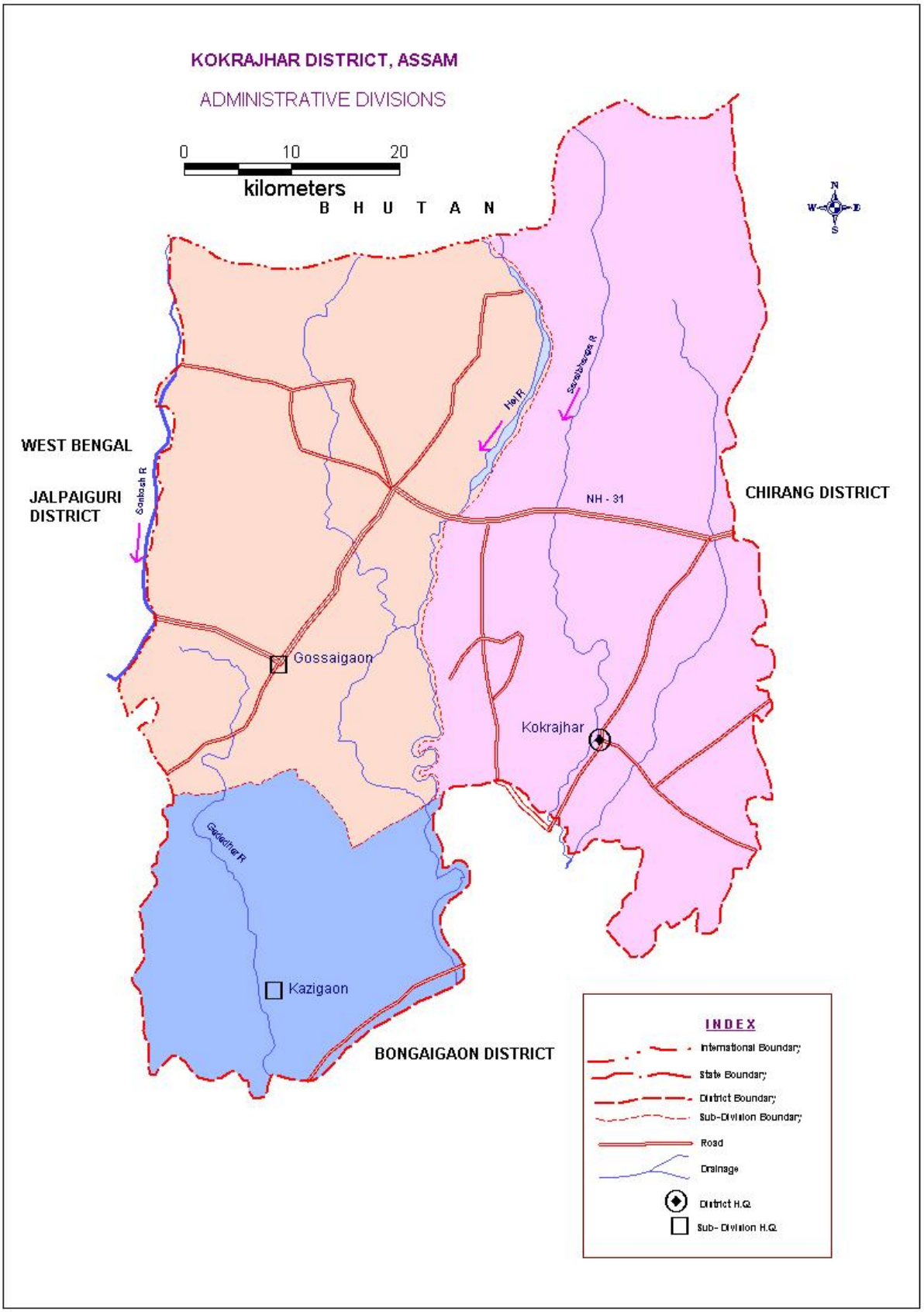
7.0 RECOMMENDATIONS

Existing hydrogeolgical setup and availability of huge potential aquifer zones down to the depth of 300 m indicate much scope for ground water development by shallow and deep abstraction structures.

Both shallow tube wells down to the depth of 50 m and deep tube wells down to 250 m are feasible in the district, particularly deep tube wells in northern part and shallow tube wells in southern part near the Brahmaputra River. The shallow tube wells in such cases can yield average 30 m^3/hr while the deep tube wells can yield 100 to 120 m^3/hr. The selection of sites in both the cases may be done after proper investigation.

Low cost ground water development structures in the alluvial part of the district can be constructed to a depth of 50 m tapping 10-15 m saturated granular zones through standard strainers.

Ground water is suitable for domestic, industrial and irrigation purposes except in a few localities where iron content is high. Iron Removal Plant should be installed to remove iron from ground water.


KOKRAJHAR DISTRICT, ASSAM
ADMINISTRATIVE DIVISIONS
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kilometers
B H U T A N
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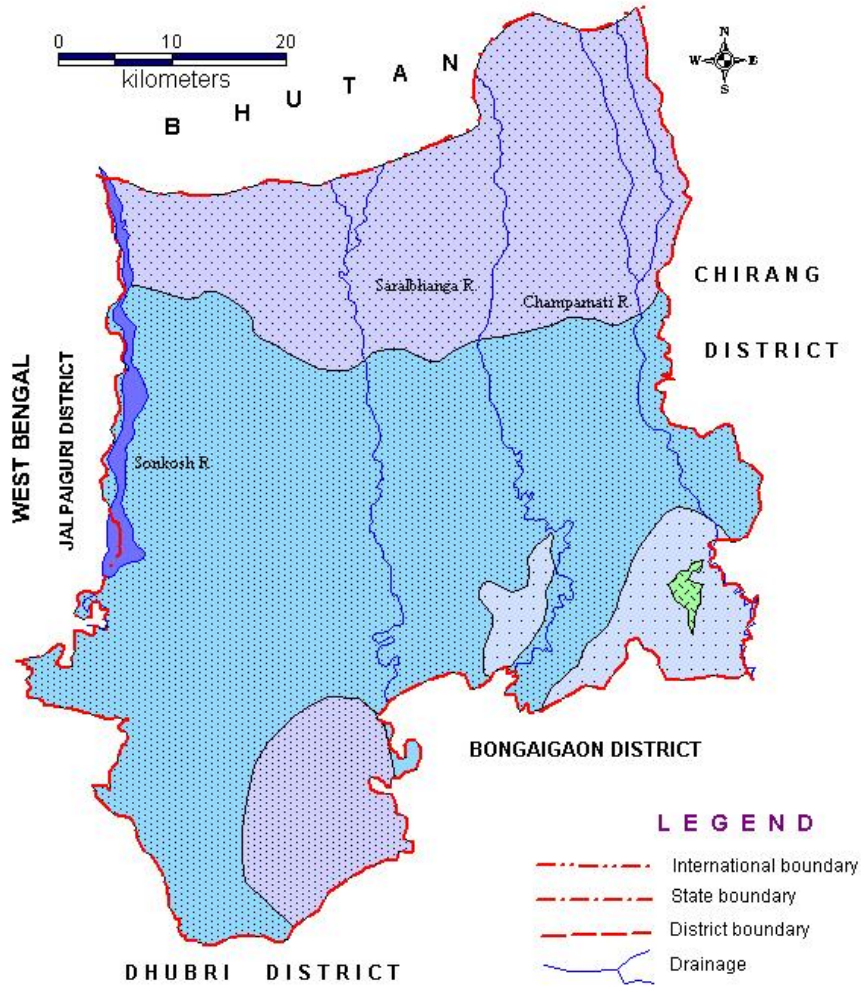
WEST BENGAL
JALPAIGURI DISTRICT
Sankosh R
Hor R
Saralbhanga R
NH - 31
CHIRANG DISTRICT
Gossaigaon
Kokrajhar
Gadadhar R
Kazigaon
BONGAIGAON DISTRICT
INDEX
International Boundary
State Boundary
District Boundary
Sub-Division Boundary
Road
Drainage
District H.Q.
Sub- Division H.Q.

KOKRAJHAR DISTRICT, ASSAM

HYDROGEOLOGY



MAP UNIT	FORMATION	LITHOLOGY	GROUND WATER DEVELOPMENT POTENTIAL
	Piedmont Zone (Older Alluvium)	Sand & clay with embedded boulders, cobbles and pebbles	Deep Water Table, Shallow Tube wells not feasible Large diameter dug wells feasible. Deep Tube wells yields 100-150m3/hr upto 6m drawdown.
	Newer Alluvium	Sand, gravel, pebble with silt and clay	Shallow Tube wells, yield 20 - 40 m3/hr at 3 - 4m drawdown. Deep Tube wells with yield 170 - 200m3/hr at drawdown within 6m
	High Level Alluvium	Sand, gravel& silt with more percentage of clay	Large diameter dug wells feasible. Shallow Tube wells with 10 - 20m3/hr.discharge at 4 - 5m drawdown and deep tube wells with yield 80 - 170 m3/hr,at 6m drawdown feasible
	Archaean Gneissic Complex	Quartzites, mica schist, biotite gneiss, granites	Not feasible for large scale development