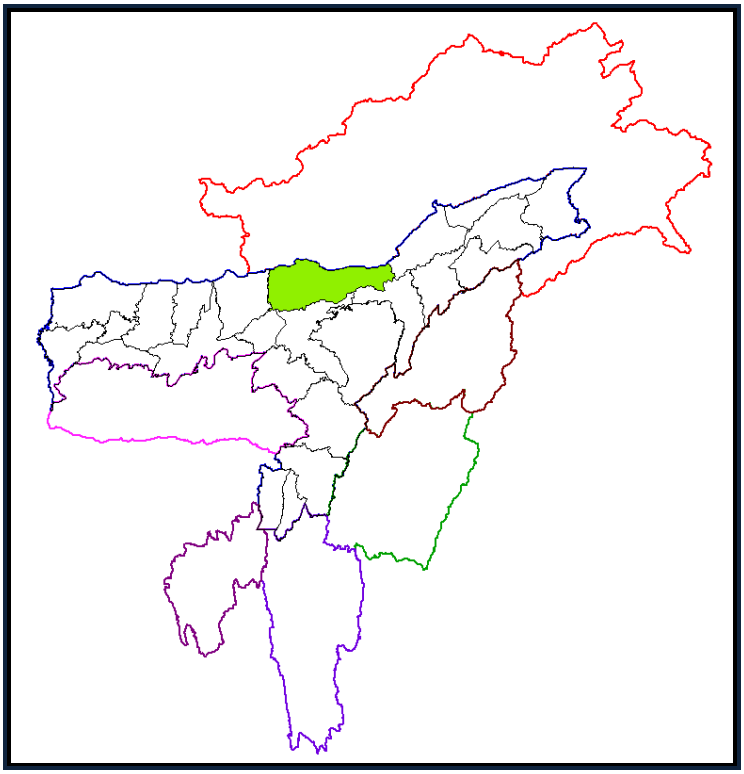
Technical Report Series: D **No:**

Ground Water Information Booklet
Sonitpur District, Assam



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

SONITPUR DISTRICT AT A GLANCE

Sl NO	ITEMS	Statistics
1.	GENERAL INFORMATION i) Geographical Area (in sq.km) ii) Population iii) Average Annual Rainfall (mm)	 5280.58 19,25,975 2,173
2.	GEOMORPHOLOGY i) Major physiographic units ii) Major drainages	 Hilly tract, the foothill region and the extensive flood plain Jia Bharali, Gabharu, Ghiladhari, Bargang, Belsiri etc.
3.	LAND USE (sq. km.) i) Forest Area ii) Net Area Sown iii) Total cropped area iv) Area sown more than once	 1478.43 1651.41 2524.60 873.19
4.	MAJOR SOIL TYPES	Red loamy soils, lateritic soil, new alluvial soils and older alluvial Soil
5.	AREA UNDER PRINCIPAL CROPS (sq. km.)	1090.19
6.	IRRIGATION BY DIFFERENT SOURCES (sq.km.)	104.76
7.	NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB (As on March 2013)	31
10.	PREDOMINANT GEOLOGICAL FORMATIONS	Archean, Siwalik and Quaternary Alluvium formation.
11.	HYDROGEOLOGY	
	i) Major Water bearing formation ii) Pre-monsoon depth to water level during 2012 iii) Post-monsoon depth to water level during 2012 iv) Long term water level trend during 2003-2012 (in m/yr)	Sand, gravel and pebbles 3 to 6 m bgl 2 to 4 m bgl Not shown any significant decline.
12.	GROUND WATER EXPLORATION BY CGWB (as on 31-3-2013) i) No of wells drilled ii) Depth Range (m) iii) Discharge (litres per second) iv) Storativity (S) v) Transmissivity (m^2/day)	 30 (21 EW,7 OW & 2 PZ) 88 to 301 m 8 to 69 m 2.7×10^{-3} to 7.56×10^{-5} 1133 to 5515

13.	GROUND WATER QUALITY Presence of chemical constituents more than permissible limit (e.g., EC, F, As, Fe)	Most of the chemical parameters are within the permissible limit set by BIS, except higher content of iron.
14.	DYNAMIC GROUND WATER RESOURCES (2009) in ham i) Net Ground Water Availability ii) Net Annual Ground Water Draft iii) Projected Demand for Domestic and Industrial Uses upto 2025 iv) Stage of Ground Water Development	 235209 37647 5998 16%
15.	AWARENESS AND TRAINING ACTIVITY i) Mass Awareness Programmes organized a) Date b) Place c) No of participants	 NA NA
16.	EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING i) Projects completed by CGWB (No & Amount spent) ii) Projects under technical guidance of CGWB (Numbers)	 NA NA
17.	GROUND WATER CONTROL AND REGULATION i) Numbers of OE Blocks ii) No of Critical Blocks iii) No of Blocks notified	N.A
18.	MAJOR GROUND WATER PROBLEMS AND ISSUES	High iron concentrations.

GROUND WATER INFORMATION BOOKLET
SONITPUR DISTRICT, ASSAM

1.0 INTRODUCTION

Sonitpur district of Assam is located between $26^0$42'03'' and $27^0$01'00'' North Latitude and $92^0$16'00'' and $93^0$43'00'' East Longitude. The district is bounded on the north by Arunachal Pradesh and on the east by Lakhimpur District. River Brahmaputra flowing East-west-direction stands on the southern side and Darrang district is on the west.

The district is divided into three sub divisions viz. Tezpur, Biswanath and Gohpur and seven revenue circles, 14 civil blocks and 159 Gaon Panchayats.

Drainage System: The Brahmaputra river controls the main drainage system in the district. The Jai Bharali-Gabharu-Ghiladhari-Bargang-Belsiri–System that debouches in Brahmaputra forms an intricate drainage network in the district. Jai Bharali is the largest tributary of river Brahmaputra originating from the Himalaya. The tributaries are in general meandering as well as braided in nature. Peak discharge observed during monsoon and generally perennial in nature. However, near the foothills small streams generally dry up during the month of March/April. The riverbed and the bank materials are boulders, cobbles, pebbles and sands of various grades with very low clay materials concentration.

Irrigation: Irrigation facilities in the district are not upto the mark. Agriculture mainly depends on rainfall and the farmers are accustomed to raise a single crop only. However, the State Govt. has formulated some irrigation facilities through Irrigation and Agriculture Depts. The Agriculture Dept. has constructed shallow tube wells and encouraged the farmers to utilize the ground water resources through registered Farmers Management Committee (FMC).

The Assam irrigation Dept., which is responsible for the implementation of the major / medium irrigation schemes, has taken up different schemes in the district. But most of the schemes are defunct due to improper planning, poor maintenance etc. As per 2011 provisional census report total irrigated area for both Kharif and rabi-pre-kharif crops is 5998 hectre of which irrigated area for kharif crop is 5973 hectres.

Previous Studies by CGWB: Systematic hydrogeological studies in the area were carried out by Sri A.M. Khan, Asst. Hg., K.N. Murthy, Abhijit Ray and G.C. Saha, Jr. Hg. A number of short term water supply investigations were carried out by Scientist from CGWB especially for defence establishments located in different parts of the area. Groundwater Management studies in the district was carried out by Lt. Neikokholie Chusi, Sc-B in the year 2008 and the report has been prepared by Anlanjyoti Kar, Sc-D, CGWB in the year 2009.

2.0 Rainfall and Climate

The climate of the district is subtropical and humid characterized by high rainfall. The annual rainfall is 2,173 mm and relative humidity 65 to 85 percent. The district receives SW monsoon rainfall from the month of june and continues up to September/October. The highest rainfall areas of the district are located near the foothills of Arunachal Himalayas, i.e., in the

northern part of the district. The maximum temperature goes up to 37.5^{o}C during June / July and minimum temperature falls to 7.6^{o}C in December and January.

3.0 Physiography and Soil

3.1 Physiography

Phisiographically the area can broadly be divided into three parts, i.e., the hilly tract, the foothill region and the extensive flood plain created by the river Brahmaputra and its tributaries. The hilly tracts comprise Siwalik sediments of lesser Himalayas. The southern limit of the sub-Himalaya is marked by Himalayan Frontal Fold (HFF). The foothill region is characterised by older terrace deposit. These terrace deposits are characterised by undulating surface comprising boulders, pebbles of quartzitic and gneissic rocks with fine sand, silt and clay act as matrix. The alluvial flood plain consists of younger and older alluvial deposits. It represents various sub-features, viz., palaeochannel, swampy/marshy land, river terraces, flood plains, point bars, channel bar and river channel. The general slope of the entire district is from north to south.

3.2 Soil

The soils of the district can broadly be classified into the following groups:

1. Red Loamy soils: These are found in the northern border of the district. This soil type develops in the hill slopes under high rainfall condition. This soil is characterized by low nitrogen, low phosphate and medium to high potash. P^{H} is acidic.
2. Lateritic Soil: The lateritic soils are the product of high leaching and found in hilly region. Soil P^{H} is acidic due to intensive leaching of bases and formation of clay minerals and ferric hydroxides. The lateritic soils are characterized by brick red to brownish red colour and poor plant nutrient.
3. New Alluvial Soils: The new alluvial soils are found in the flood plain area and are subjected to occasional floods and consequently receive considerable silt deposit after the flood recedes. These are yellow to yellowish grey in colour and are admixtures of sand, silt and clay in varying proportions. Mineral weathering and geo-chemical changes are nominal. But incipient changes in the top layer have been noticed due to biological activity. Soil P^{H} is feebly alkaline and moderately rich in plant nutrient.
4. Older Alluvial Soil: It develops at higher levels and practically unaltered alluvium representing a broad spectrum of sand, silt and humus rich clay depending on landform. The soils are comparatively more acidic than the newer alluvial soil and hence more crop sensitive.

4.0 Ground Water Scenario

4.1 Hydrogeology

The district can be divided into two distinct hydrogeological units, *viz*., semi-consolidated and unconsolidated formations based on geology and hydrogeological character. The semi-consolidated formation composed of Neogene Siwalik Group of rocks bordering the northern boundary of the district. The Siwalik rocks are not suitable for ground water development. A very small area in the extreme southern part is occupied by consolidated Archean rocks.

The major water bearing formations include alluvial sediments in foothills and flood plain that constitute the unconsolidated formation. The piedmont zone extends over 8-10km from the foothill, which is laterally followed by younger flood plain area extending up to northern bank of the Brahmaputra River in south. The alluvial formations in the foothills are composed of sand, pebble, cobble and boulders. These materials have high permeability. In the flood plain area, however, little gravel mingles with different grades of sand.

Shallow Aquifer

The water bearing horizons occur within 30-50mbgl is considered to constitute shallow aquifer system. Ground water in this aquifer occurs under unconfined to semi-confined conditions. The aquifer materials comprise sands of different grades with varying proportions of gravels. The grain size of the aquifer materials is found to decrease towards the southern part of the district. The semi-confining layers are not persistent throughout the district. The development of groundwater from the aquifer for domestic and irrigational purpose is by open wells (Dug wells) and shallow tube wells. The performance of the shallow tube wells constructed by State Government for irrigation purpose indicates that the shallow aquifer system is quite potential. A shallow tube well constructed down to the depth of 30 to 40 m, tapping 6 to 15 m of aquifer giving discharge of 10-36 m^3/hr.

Deeper Aquifer

In the deeper aquifers, ground water occurs under semi-confined to confined conditions. The aquifer materials are composed of sands and gravels of different size grade. In this district, CGWB, NER had explored the subsurface down to the depth of 301 m at Erabari. The cumulative thickness of the granular zones in the deeper aquifer varies from 60 to 150m. There is a clear distinction of grain size of aquifer materials in the northern, southern and western part of the district. Presence of multi aquifer system in the western part of the district around Dholpur, Narayanpur is deciphered from lithologs. The confining layers are not persistent.

However, towards east, around Panigaon and Dhakuakhana areas, single aquifer zone is found down to the depth of 130 mbgl. The grain size of the aquifer material increases towards north, i.e., towards the foothill.

Ground Water Movement

As mentioned earlier the district is bounded in the north by Arunachal Himalayas and the south by the Brahmaputra River, evidently the ground water flow direction is from the higher elevation in north towards the plain area in the south. In the western part of the district the ground water flow is from northwest to southeast. In general the gradient of flow is high towards west as compared to the gradient in the eastern part. In the northern foothill region, the water table gradient is steeper (1.5m/km) and it forms the recharge zone for the entire district.

Depth to Water Level

CGWB is monitoring 31 ground water wells (GWW) in Sonitpur district. During 2012, pre-monsoon depth to water level varied from 2.16 to 9.21 mbgl (Fig. 3) and post-monsoon depth to water level varied from 0.76 to 4.57 mbgl.

During pre-monsoon period about 67% of GWM stations showed water level between 2-5 mbgl and rests showed water level below 5-10 mbgl. During post-monsoon period about 43% of GWM stations showed water level above 3mbgl and rests showed water level between 2-5 mbgl.

Water Level Fluctuations

The study of the water level data has revealed that the general fluctuation of water table during pre and post-monsoon is in between 0 to 2 m in plain area and more than 2 m in Biswanath (occupied by Archean rocks) area adjacent to river Brahmaputra. The major parts of the gross rise in water table during April to July dissipates quickly. Low ground water fluctuation in the area is due to low ground water draft and rapid ground water movement through the aquifer where by and large scale draft at one place is compensated by ground water recharge from other places.

Long Term Water Level Trend

Long term ground water level trend for post-monsoon period (Nov, 2001 to 2010), shows that 3 GWMS indicate rise in water level whereas 14 GWMS indicate fall. Rise in water level ranges from 0.003 to 0.081 m/year while fall in water level ranges from 0.004 to 0.388 m/yr.

4.2 Ground Water Resources

Methodology adopted for ground water resource estimation of Sonitpur 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 5324.04 mcm. The existing gross ground water draft 376.47 mcm and the stages of development are 16% only. Future provision for domestic and Industrial use is 59.98 mcm and for Irrigation use is 1958.72 mcm.

Assessment unit can be categorized into 4 categories as SAFE, SEMI-CRITICAL, CRITICAL, and OVER-EXPLOITED. In Sonitpur district stage of ground water development is 6%, 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	= 5324.04 mcm
Gross Ground Water Draft	= 376.47 mcm
Stage of Ground Water Development	= 16%
Future provision for Domestic & Industrial Use	= 59.98 mcm
Future Provision for Irrigation Use	= 1958.72 mcm

4.3 Ground Water Quality

Water samples were collected from Ground Water Monitoring Stations (GWMS) of the district for assessing the chemical quality of ground water and determining the suitability for drinking and irrigation purposes.

From the chemical analysis data of ground water samples, it can be said that the ground water of dug well of the district is slightly acidic to slightly alkaline (pH= 7.1 to 8.0). Electrical conductance (EC) of ground water varies from 295 to 870 µS/cm. The ground

water is soft. Fluoride content is in general within permissible limit (0.2-0.4 mg/l). Iron content is generally high which varies from 1.8 to 2.2 mg/l.

4.4 Status of Ground Water Development

Drinking and Domestic

Groundwater is the main source for supply of water for drinking and domestic uses both in urban and rural areas. Public Health and Engineering Department (PHED), Sonitpur district has constructed various ground water abstraction structures for supply of water.

The Public Health Engineering Department (PHED), Assam is providing with drinking water facilities to 2562 habitations/villages till 01.04.2011 In addition to this most of the people have their own dug wells / hand pumps for domestic use.

Industry

There is no major industry in the district. The tea industries located in different parts of the district are utilizing ground water through dug wells and deep tube wells for drinking and tea plantation.

Irrigation

The Irrigation potentiality created in the district through flow irrigation, lift irrigation and Ground water lift. Shallow tube wells are the most common ground water abstraction structures used for irrigation with yields ranging from, 10 to 30 m^3/hr for a drawdown of less than 2 m. The net area irrigated in the district during 2010-2011 is 5973 ha. The total ground water draft for irrigation in the district has been worked out to be about 6585 ham.

5.0 Ground Water Management Strategy

The district can be divided into three sectors based on the subsurface geology and yield potential of different groundwater abstraction structures. This division will help to formulate rational and judicious plan for groundwater development in the district.

Sector I: This unit is characterized by unconsolidated sand and gravel of Quaternary alluvium. Sand is fine to coarse and gravel size ranges from granule to pebbles. The grain size decreases southwards. This unit is fairly thick and regionally extensive. The aquifers are unconfined to semi-confined and shallow tube wells down to the depth of 30 to 50mbgl with 30-35m^3/hr yield capacity are feasible. The recommended distance between two shallow tube wells is 200m. Deep tube wells are feasible down to the depth of 200m tapping an average cumulative thickness of 30-35m aquifer with yield 50 to 300m^3/hr for a drawdown of less than 5m. The minimum distance between two adjacent well should not be less than 1000m. In this sector, deployment of rotary or reverse rotary rig is advisable for construction of deep tube wells.

Sector II: The aquifers in this sector are discontinuous but thick. The aquifer materials in this unit are comprised of unconsolidated materials of gravel, sand and clay. Gravel size ranges from granule to boulder. The aquifer has very high hydraulic conductivity value. Occurrence of bouldery materials at shallow depth make this unit unsuitable for the construction of shallow tube wells. Deep tube wells are feasible down to the depth of 100-120mbgl, tapping an aquifer thickness of 20-30m. The yield of tube wells are expected to be 40 to 100 m^3/hr for

drawdown more than 5 m. Percussion or combination rig are necessary for construction of deep tube wells.

Sector III: This unit comprises the hilly area and covered by forest and is not suitable for ground water development.

6.0 Water Conservation and Artificial Recharge

In Sonitpur district, the foothill region is suffering from sustainable supply of water particularly in lean period. Various types of water conservation structures can be constructed in the foothill regions after conducting a thorough feasibility study. However, in the flood plain area rain water-harvesting, through construction of storage tank may be taken up for domestic uses. Since post monsoon water level in this hydrogeologic unit is less than 5 mbgl, artificial recharge is not feasible.

7.0 Ground Water Related issues and Problems

The area has high Ground Water Resources potential with a net Ground Water availability of 111178 Ha m. Nearly 37% of the district is under water logging condition throughout the year where there is no sign of water level decline for a decade. The chemical analysis of the water samples collected quality of the water collected from the GWMS and established key wells has revealed that the chemical parameters are within the permissible limit specified by B IS (2003) except high concentration of iron which ranges from 0.16 to 3.76 mg/l in most of the area. As per the information available in National Rural Drinking Water Mission, there are 354 habitats affected by iron contamination (source: http://indiawater.gov.in\IMIS Report).

8.0 Awareness & Training Activity

8.1 Mass awareness programme (MAP) & Water Management Training programme (WMTP) by CGWB

8.2 CGWB has not organized any Mass Awareness (MAP) and Water Management Training Programme (WMTP) in the district.

8.3 Participation in Exibition, Mela, Fair etc

In the district ground water related exhibition, mela, fair, etc. are not organized.

8.4 Presentation & Lectures delivered in public forum/ Radio/ T.V./ Institution of repute/ Grassroots associations/ NGO/ Academic institutions etc.

8.0 Areas notified by CGWB/ SGWA

Nil.

9.0 Recommendations

a) The alluvial tracts of Sonitpur district form prolific aquifers. Only a negligible amount of the district vast ground water resources are in use for various purposes. Therefore, plan should be formulated for optimum exploitation of this ground water resource which will boost the agricultural economy of the district.

b) The net ground water resource available for future irrigation is estimated to be 1663.01 mcm. For optimum utilization of this resource, different ground water abstraction structures can be constructed. Shallow tube wells are feasible in large part of the district.

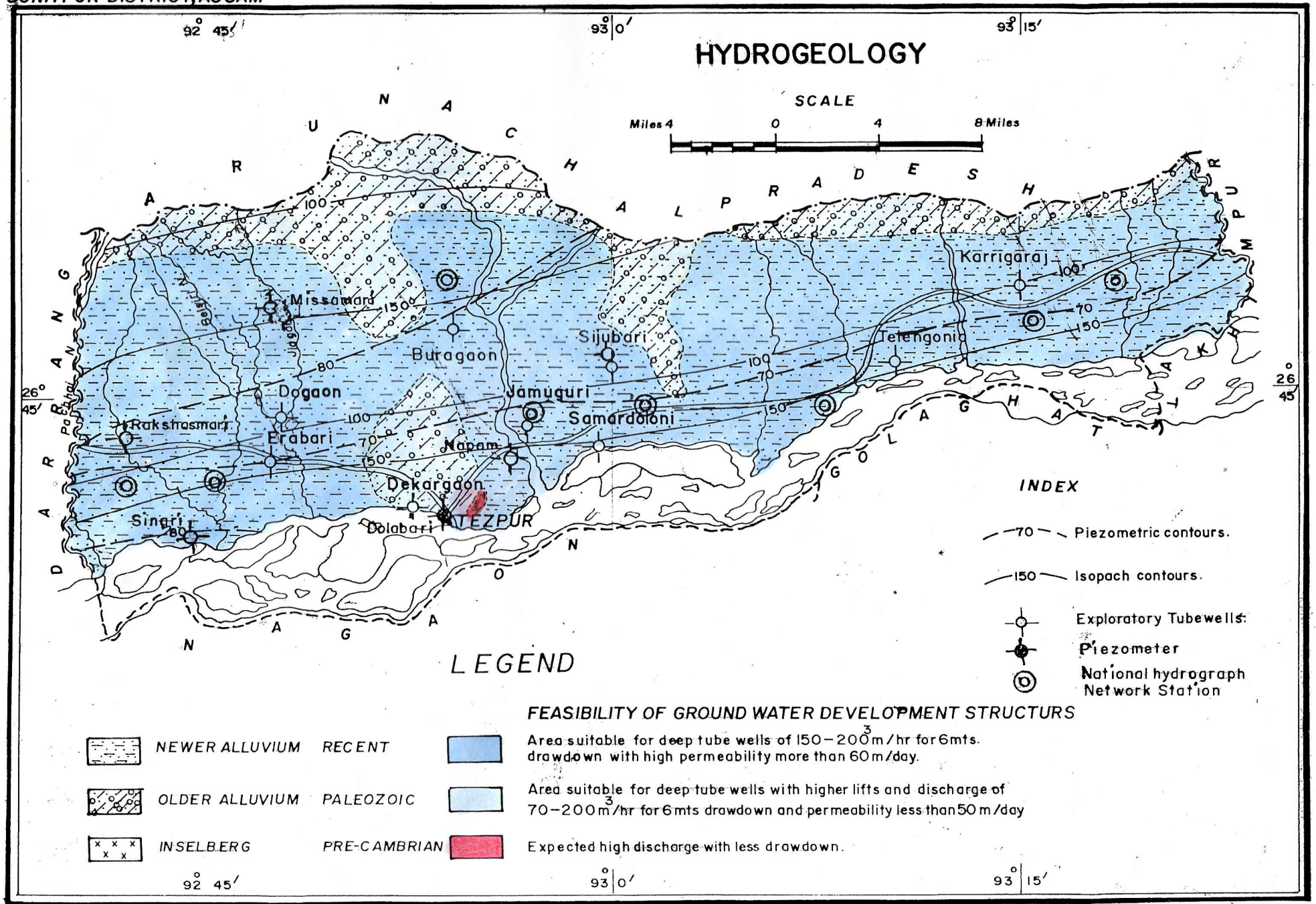
If the annual average unit ground water draft for one shallow tube well is considered to be 0.03 MCM then 55433 shallow tube wells are feasible in the district. Construction of these shallow tube wells will irrigate nearly 74862 Ha lands, if the command area created by one shallow tube well is considered to be 2Ha. Construction of deep tube wells should also be emphasized to tap the static ground water resources. However, caution must be exercised in maintaining the spacing norms.

c) Construction of large diameter dug wells, dug-cum-bore wells and deep tube wells are more suitable in the foot hill region for ground water development. Percussion or reverse rotary rig can be deployed to construct deep tube wells of 100-150 depth.

d) A considerable area of the district is under water logging condition. To mitigate this problem lowering of water table is very much essential and for this additional number of tube wells should be constructed. Lined irrigation canals should be planned.

e) Various types of water conservation structures can be constructed in the foot-hill regions after conducting a thorough feasibility study. People should be encouraged to construct low cost rainwater harvesting structures especially in the iron-affected areas.

SONITPUR DISTRICT, ASSAM



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