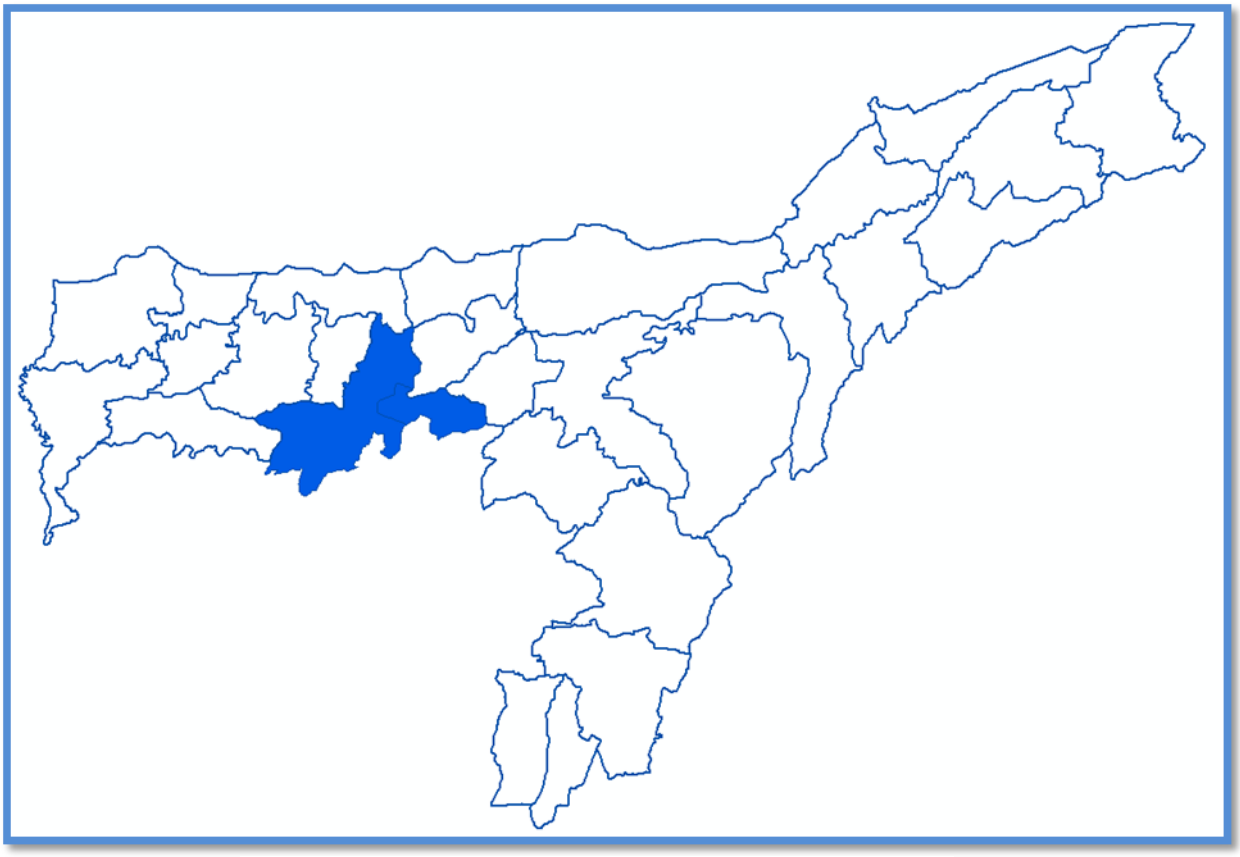
Technical Report Series: D

No:

Ground Water Information Booklet of Kamrup & Kamrup Metro District, Assam



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

GROUND WATER INFORMATION BOOKLET
KAMRUP DISTRICT

AT A GLANCE

Sl. No.	I T E M S	Statistics
1.	**GENERAL INFORMATION**	
	i) Geographical Area (sq. km.)	4,111
	ii) Administrative Division (as on 2011) Number of CD Block Number of Panchayat	 17 160
	iii) Population (As on 2011 Census)	27,77,621
	iv) Average Annual Rainfall (mm)	2,127
2.	**GEOMORPHOLOGY**	
	Major physiographic unit	Plains, hills
	Major Drainages	Brahmaputra, Puthimari, Digaru, Kulsi, Singra River
3.	**LAND USE (sq. km.)**	
	a) Forest Area b) Net Area Sown	930.25 2205.71
4.	**MAJOR SOIL TYPES**	Alluvial soil (newer and older) and soil over forest and hilly area.
5.	**IRRIGATION BY DIFFERENT SOURCES (Areas and Numbers of Structures)**	
	Dug wells	Nil
	Tube wells/Bore wells	Shallow Tube well = 17,779 Deep Tube Well = 13
	Tanks/Ponds	N.A.
	Canals	N.A.
	Other sources	53 schemes
	Net irrigated area	35,558 ha by Agri. Dept. 6,978 ha by Irrigation Dept.
	Gross irrigated area	12,290 ha by Irrigation Dept.
7.	**NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB (As on 31.3.2013)** No. of Dug Wells No. of Piezometers	 44 7
8.	**PREDOMINANT GEOLOGICAL FORMATIONS**	Alluvium, recent and older valley fill, pediment, Shillong group of rocks of Pre-Cambrian Age
9.	**HYDROGEOLOGY** ➢ Major Water bearing Formation ➢ (Pre-monsoon Depth to Water Level during 2011)	 Alluvial sediments, 1.83 to 6.55 m bgl

	➢ (Post – monsoon depth to water level during 2011) ➢ Long term water level trend in 10 yrs (2002-2011) in m/yr	0.52 to 5.92 m bgl. No significant rise/fall observed
10.	**GROUND WATER EXPLORATION BY CGWB (As on 31.3.2013)**	
	No. of wells drilled (EW, OW, PZ, SH, Total)	EW=73; OW=16; PZ=13; SH-1, DW=13
	Depth Range (m)	50.0-300
	Discharge (litres per second)	5 – 20
	Storativity (S)	2.17×10^{-3} to 8.6×10^{-4}
	Transmissivity (m^2/day)	41 – 5963
11.	**GROUND WATER QUALITY**	
	Presence of Chemical constituents more than permissible limit (e.g. EC, F, As, Fe)	Fe and F
	Type of water	Fresh and potable
12.	**DYNAMIC GROUND WATER RSOURCES (2009) in MCM**	
	Net Annual Ground Water Draft	715.97
	Projected Demand for Domestic and Industrial Uses up to 2025	105.16
	Ground water availability for future irrigation	912.64
	Stage of Ground Water Development	43 %
13.	**Mass Awareness Programmes Organized** Date: Place:	8 nos. of MAP conducted in the district 1. Rani, 1997; 2. Mathgharia, Guwahati, 9.11.1999. 3. Mathgharia, Guwahati, 1.02.2002. 4. Hajo, Kamrup, 28.3.2003, 5. Sonapur College, Kamrup, 11.07.2003, 6. Agriculture Research Center, Kahikuchi, Kamrup, 2.3.2006, 7. Guwahati, Kamrup, 29.03.07, 8. Madanpur, Kamrup, 12.01.09.

	Water Management Training Programme Organized Date: Place:	5 WMTP organized in the district 1. Hengrabari, Guwahati, 2. Khanapara, Kamrup, 24th - 26th September, 2003, 3. Institution of Engineers, Panbazar, Guwahati, 27th –28th February, 2006, 4. Guwahati, Kamrup, 22nd March, 2007, 5. Brahmaputra Board, Guwahati, 11-12, Feb. 09.
14.	**ARTIFICIAL RECHARGE AND RAINWATER HARVESTING**	Under Central Sector Scheme during IXth Plan, a total of 12 structures were constructed in Hajo and Sonapur areas in Kamrup District.
15.	**MAJOR GROUND WATER PROBLEMS AND ISSUES**	High iron and fluoride content in some places

GROUND WATER INFORMATION BOOKLET
KAMRUP DISTRICT, ASSAM

1.0 INTRODUCTION

Kamrup district of Assam established in 1970 is situated in the west central part of the state of Assam, covering an area of 4111 sq. km. on both sides of Brahmaputra River. It lies between North latitudes 25^{o} 42′ 03″ and 26^{o} 50′ 10″ and East longitudes 91^{o} 00′ 01″ and 92^{o} 10′ 04″ and falls in the Survey of India Degree Sheet No. 78 W and O. For administrative convenience, it has been recently sub-divided into 2 (two) districts as Kamrup (Metro) and Kamrup (Rural). A map showing the administrative divisions of the district has been given in **Plate-I.**

The district occupies part of the basin formed by mighty river Brahmaputra passing through the central part with a westerly course. The perennial tributaries like Puthimari, Digaru, Kulsi, Singra etc. drain the district and join the River Brahmaputra.

The irrigation facilities have mostly been confined to a few lift and flow irrigation schemes. Moreover, farmers are accustomed with single rainfed irrigation. Single paddy crop has now switched over to multiple cropping practices by utilizing ground water through shallow tube wells.

Central Ground Water Board as an apex organization in the country has carried out studies like systematic and reappraisal hydrogeological surveys, ground water exploration and monitoring of National Hydrographic Network Stations etc. In addition, the ground water development potential of the district has been assessed in the district. A number of investigations have been carried out for the feasibility study of construction of tube well for various user agencies and also it has provided required supports to State Government.

2.0 RAINFALL AND CLIMATE

The climate of the area has been classified as sub-tropical humid climate with heavy rainfall, hot summer and high humidity. Average temperature ranges from 12 to 38^{o}C during the year. In winter, temperature ranges from 15 to 25^{o}C during day and 8 to 15^{o}C during night. The summer temperature ranges from 25 to 38^{o}C during day and 15 to 25^{o}C during night.

Average annual rainfall of the district is 1752 mm and co-efficient of variation is 15.3%. The annual normal rainfall of the district as compiled from IMD data is 2125.4 mm with 96.5 rainy days.

3.0 GEOMORPHOLOGY AND SOIL TYPE

Physiographically the district can be divided into three units; i.e. the hilly region in the south, the alluvial plain in the central and western part and the swampy areas along Brahmaputra plains. The distinguishable geomorphic units are as follows.

a) Flood plain of river Brahmaputra and its tributaries.
b) Younger alluvial plain which occupies major part of the area, having slightly higher elevation than flood plain.
c) Older alluvium/valley fill, gently sloping plain, having higher elevation than the younger alluvial plain.
d) Piedmont, gently sloping plain along the foothills.
e) Inselberg occurs as very small isolated hills.
f) Denudational hills considering of granite, gneissic rocks

The different rock formation occurring in the district has been subjected to various soil forming processes through agents of weathering and transportation during different geological ages. Soils comprising various proportions of sand, silt, clay and organic material in the district are grouped into three broad categories – a) newer alluvial soil, b) valley fill/older alluvial soil and c) soils over forest and hilly terrain.

4.0 GROUND WATER SCENARIO

4.1 Hydrogeology

The area consists of two broad hydrogeological units – 1) Pre-Cambrian consolidated rocks and 2) Quaternary alluvium consisting of unconsolidated sediments (Plate-2).

Pre-Cambrian consolidated rocks are confined to hilly areas and inselbergs, where ground water occurs in shallow weathered zone and this can be developed through open wells. The joints and fractures developed due to tectonic activities form potential water bearing zones and suitable for development through construction of bore wells.

In the alluvial plain, groundwater occurs in regionally extensive aquifers down to the depth of 305 m. It has a very good yield prospect. The aquifers are consisting of sands of various grades with gravel and are suitable for construction of both shallow and deep tube wells. Groundwater occurs under unconfined to semi-confined condition occupying an area of about 200 sq. km. in and around Haihata – Dumunichowki which is under artesian condition. In other parts also, the water level rests at shallow depth and in major part, it rests between 2 – 5 m bgl during pre-monsoon period. The study of long term water level trend shows no significant change in rise/fall in water level in the last 10 years.

The shallow tube wells tapping aquifers within 50 m depth are capable of yielding about 10 lps in major places, deep tube wells constructed within 95 m depth tapping about 30 m granular zones are yielding 10 – 20 lpm. The transmissivity of the aquifer ranges from 41 to 6162 m^2/day and the permeability varies from 10 to 59 m/day. In hard rock, the yield of bore well constructed in greater Guwahati area ranges from 4 to 300 lpm. The dispositions of aquifers in Kamrup district, Assam are shown in (Plate-IIIa-IIIc). The summarized results of the exploration conducted by C.G.W.B. in the district are given in Table 1.

4.2 Ground Water Resources

Dynamic ground water resources of Kamrup district are estimated based on the methodology adopted as per GEC 1997, following water level fluctuation and rainfall infiltration factor methodology.

The annual dynamic ground water resources as on 2009 are estimated to be 1847.29 MCM while the net annual ground water draft is 715.97 MCM. The stage of ground water development is 43%. The projected demand for domestic and industrial uses up to 2025 is estimated to be about 105.16 MCM. The district is still under ‘Safe’ category and sufficient resources are still available for future development.

4.3 Ground Water Quality

The water samples collected from the monitoring stations and the exploratory wells drilled in different parts of the district were analyzed in the Chemical Laboratory of C.G.W.B., NER, Guwahati. The results of the chemical analysis of ground water samples reveal that ground water is fresh, potable and suitable for both domestic

and irrigation purposes. However, due to slightly higher content of iron in some sporadic patches of the area and fluoride content exceeding permissible limit in some pockets in and around Guwahati City, water needs to be treated before being used for drinking purpose.

4.4 Status of Ground Water Development

Ground water development is at low key at present and estimated to be 644 MCM only against the vast annual dynamic resources of 1482 MCM. After allocation for domestic and industrial requirement of 105 MCM for a population estimated in 2025, the net annual dynamic resources of 790 MCM are still available for development.

At present, groundwater draft is mainly for domestic and irrigation purposes and a negligible amount is for industry. The water supply schemes for drinking purpose are executed by Assam Public Health Engineering Department through groundwater structures like dug well, hand pump and deep tube well. The groundwater draft for irrigation is mainly from shallow tube well implemented by Agriculture Department through the farmers. The existing draft for irrigation is estimated to be 586 MCM.

4.5 Water Laws

The Guwahati Water Bodies (Preservation and Conservation) Act 2008 (Assam Act No. XX of 2008) of the Assam Legislative Assembly received the assent of the Governor on 05.08.2008 and its notification came on effect on 07.08.2008 to provide for preservation, protection, conservation, regulation and maintenance of water bodies into natural water reservoir and convert into eco-tourism recreation centre to suit the ecological balance within the jurisdiction of Guwahati Metropolitan Development Authority and to protect the water bodies from the encroachers and damages and the matters connected therewith or incidental thereto. The area of land specified in the Schedules I, II, III and IV of this Act are declared as Water Bodies namely Sarusala Beel, Borsola Beel, Silsako Beel and Deepor Beel which are shown in Plate-IV.

5.0 GROUND WATER MANAGEMENT STRATEGY

Thick and extensive alluvial deposit with rich aquifer system covering major part of the district is suitable for ground water development through open wells,

shallow tube wells and deep tube wells. To meet the drinking and other requirements of limited quantities of individual households, open wells and filter point wells are feasible almost in all parts of the district, except the areas occupied by hills. Ring wells of 0.80 to 1.20 m diameter to depth of 5 to 10 m bgl are likely to hold sufficient quantity of water to meet the requirement. Filter point wells to the depth of about 20 to 25 m bgl by providing galvanized iron/PVC pipes with slotted pipes against the granular zones are suitable for extraction of groundwater for domestic use.

For agricultural purpose, shallow tube wells can be constructed in areas occupied by flood plain and younger alluvial formation. A number of shallow tube wells constructed by State Agriculture Department and the study of the performance of the tube wells shows that tube wells constructed within 30m depth, tapping over about 9 m granular zone giving discharge of about 600 lpm. As such, based on the nature of sub-surface geology, a shallow tube well of 30 to 50 m depth tapping about 15 m granular zones expected to yield 30 to 50 m^3/hr in alluvial area. A well assembly of 100 mm diameter GI or PVC pipe can be lowered in a 150 mm diameter borehole. Considering the shallow water level, a centrifugal pump can be used to irrigate about 3 ha of land with an average annual draft of 0.03 MCM.

6.0 RECOMMENDATIONS

Detailed hydrogeological surveys aided by exploratory drilling carried out by Central Ground Water Board have revealed the existence of rich aquifer system down to the depth of 300 m. The geological formation constituting the district comprises of Recent to Sub-recent unconsolidated alluvial formation and Pre-Cambrian consolidated rocks in the form of hills and inselberg.

The hydrogeological set up and availability of huge dynamic ground water resources indicates that there is much scope for the development of ground water through construction of different ground water abstraction structures in a planned way. Keeping in view of the copious rainfall received in the district, rainwater harvesting through various means should be popularized in the district. In sloping terrain; rainwater may be harvested in the ponds coated with impervious polythene sheets etc. for utilizing the water for various purposes.

Table 1 Summarized results of the exploration conducted by C.G.W.B. in Kamrup district

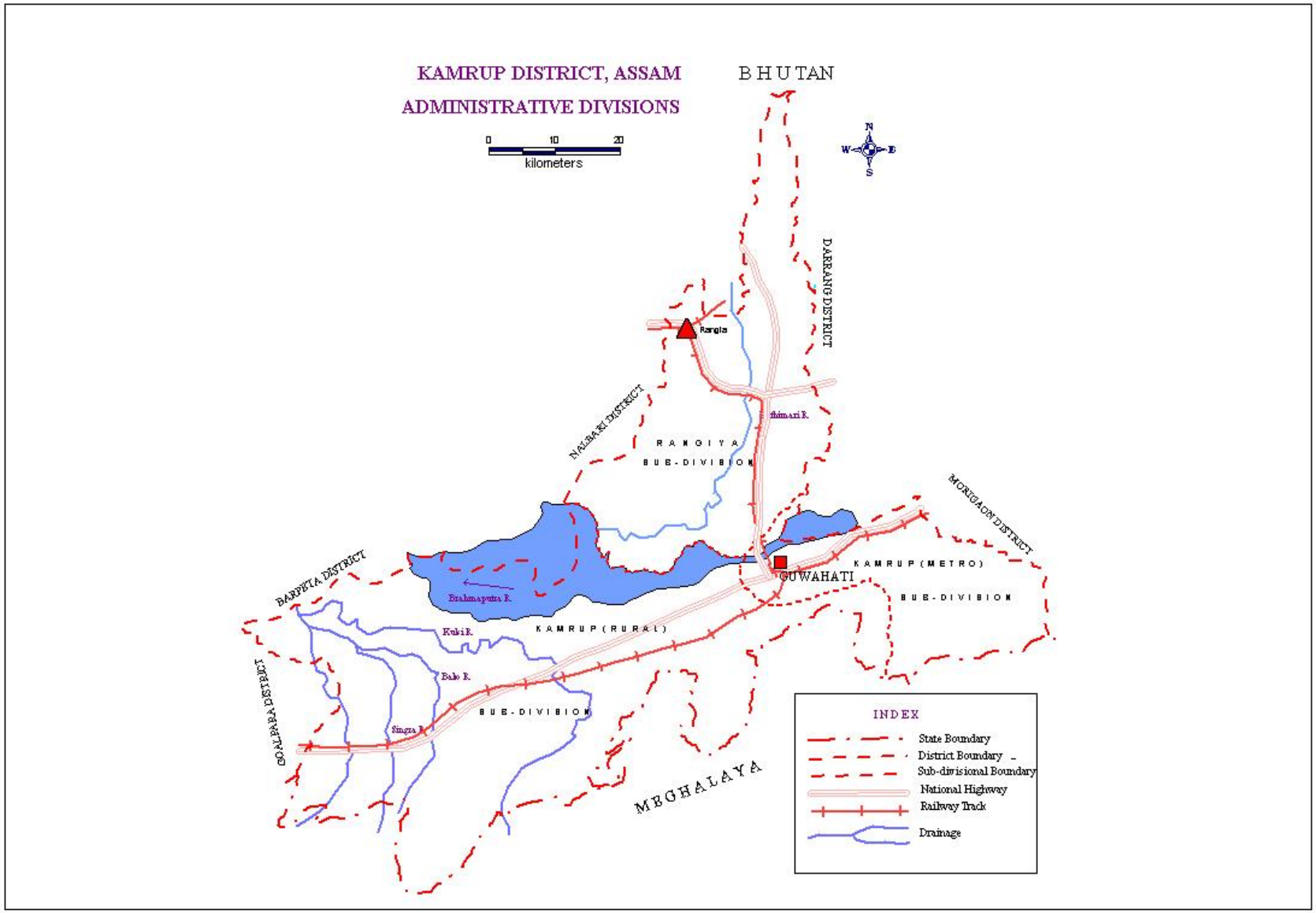
Sl. No.	Location	Depth (m)		Zones encountered (m)	Zones tapped (m)	SWL (mbgl)	Yield (lpm)	DD (m)	T (m^2/d)	P (m/d)	S	Remarks
		Drilled	Const.									
1	Sakhati E.W. 25°57′15″ 91° 04′ 00″	181.5	143.0	19-21 44-48 57-59 69-77 80-88 108-116 119-127 132-181.50	30m	5.92	120	2.76	41	0.54	-	
2	Chalkata E.W 25°56′10″ 91° 06′ 30″	101.9	98.0	8-10 17-21 25-30 39-53 60-68 75-86 88-97	33 m	7.03	394	11.54	41	0.97	-	Bed rock Fresh granite encountered
3	Jogipara E.W. 26° 02′ 00″ , 91° 05′ 15″	189.1	93.0	6-9 27-40 43-52 67-92 183-189	27 m	4.15	749	2	21	46	$8.6X10^{-4}$	Do
4	Borgaon E.W. (Singra) 25°57′09″ , 91° 09′ 58″	120.7	100.0	23-26 41-47 45-57 61-64 69-79 85-88 95-98	17 m	4.5	492					Do
5	Rani E.W. 26° 02′ 42″ 91° 34′ 30″	200.25	200.0	13-90 93-98 148-160 170-187 194-200	39 m	4.75						
6	Chaygaon E.W. 26°04′00″ , 91° 24′ 08″	201.3	158.0	0-18 64-82 85-92 97-102 105-112 116-120 123-126 132-146 151-156	49 m	2.12	225	2.23	866	14		

7	Garigaon E.W. 26°09′00″, 91° 39′ 30″	201.3	192.0	25-35 45-49 60-66 83-86 119-123 174-179 186-189	31 m	5.15	435	2.01	564	16		
8	Sonapur E.W. 26°07′00″ 91° 58′ 02″	73.6	69.0	13-16 23-26 52-66 66-71	12 m	2.55	50	8.06	68	1.4	$8 X10^{-4}$	Bed rock encountered
9	Khetri E.W. 26°07′30″ , 92° 07′ 00″	93.5	82.0	0-6 44-52 58-63 68-81	18m	1.95	1336	16.39	89.31	3.44		
10	Khanapara E.W. 20°08′24″ , 91° 49′ 24″	72.0	71.0	5.5-18 27.5-36.5 55-72	15 m	3.6	140	-	-	-		A.C.
11	Rangamati E.W. 26°05′08″ , 91° 31′ 04″	180.45	98.0	39-51 69-97 143-146	28 m	4.33	197	0.34	2023	51	$1.8 X10^{-4}$	
12	Fakirtola E.W. (Hajo) 26°13′00″ , 91° 31′ 27″	94.00	81.0	13-59 59-64	24 m	1.14	490	-	-	-		A.C.
13	Sualkuchi E.W. 26°09′55″, 91° 34′ 10″	62.50	62.0	50-62.50	6 m		25					
14	Dumuni-chowki E.W. 26°20′30″, 91° 49′ 00″	219.45	168.0		54 m	0.6	3239	8.95	742.8		$2.17 X 10^{-3}$	
15	Rangia E.W. 26°27′ 45″ , 91° 36′ 45″	306.39	156.0	6-44 52-58 63-96 101-130 133-154 158-198 207216 230-240 256-298	54 m	0.92	1876	4.28	4947	41		
16	Muktapur E.W.	195.90	167.0	31-37 71-101 126-150 159-165	51 m	0.36	904	2.84	6162	59	$3.38 X 10^{-4}$	
17	Circuit House, Guwahati E.W. 26°11′31″ , 91° 45′ 06″	68.75	57.0	21-27 30-47 50-56	22 m	10.06	674	1.66	1637	44		
18	Adagodam	305.41	Casin	Treatment at		10	140	-	-	-	-	Hard

	E.W. 26°08′50″, 91° 44′ 38″		g 14.55	depth 159m 165m 177.5-180.5m								Rock
19	Goreswar E.W. 26°31′ 00″, 91° 43′ 00″	159.90	-	-		-	-	-	-	-	-	S.H.
20	Boko E.W. 26°00′00″, 91° 14′ 00″	106.70	31.80	-	9 m	3.17	603	1.75	1355	89	-	Deposit Well
21	Chang-sari E.W. 26°19′45″ , 91° 40′ 09″	192.98	187.0	-	36 m	0.54	40	18.33	4.20		-	Abandoned
22	RBI Colony, Geetanagar	53.80	53.50	-	21 m	0.92	44	9.50	0.60	-	-	Deposit Well
23	Science Museum Khanapara	55.55	54.50	12.70-28 31-34 46-55	12 m	3.38	143	11.32	16.24	0.67		Do
24	Jambari (EW)	89.55	64.0	-	15 m	1.60	492	-	-	-	-	
25	Jambari (OW)	64.60	62.0	-	39 – 43 59 – 61	1.60	492	-	-	-	-	
26	Bamuni-gaon (EW)	87.85	81.0	-	32 – 44 53-57 73-77	1.64	492	-	-	-	-	
27	Bamuni-gaon (OW)	80.50	77.0	-	38 – 42 54 – 55.5 74 - 75.5	-	-	-	-	-	-	
28	Dhupguri (EW)	92.70	89.0	-	46 – 49 67 -76	8.0	383	-	-	-	-	
29	Dhupguri (OW)	88.40	86.0	-	47 - 48 70 - 74	-	-	-	-	-	-	
30	Gohalkona (EW)	53.10	53.0	-	32 – 41 44 - 50	2.10	383	-	-	-	-	
31	Gohalkona (OW)	51.66	50.0	-	35 – 38 45 - 48	2.0	492					
32	Raipara (EW)	80.15	80.0	-	47 – 53 65 - 77	_						
33	Sakhadari (EW)	92.35	81.0	-	33 - 37 52 - 58 72 - 78	12	433					
34	Sakhadari (OW)	80.5	79.0	-	34.5 – 36 55 - 57 75 - 77	-						

Plate

Plate-I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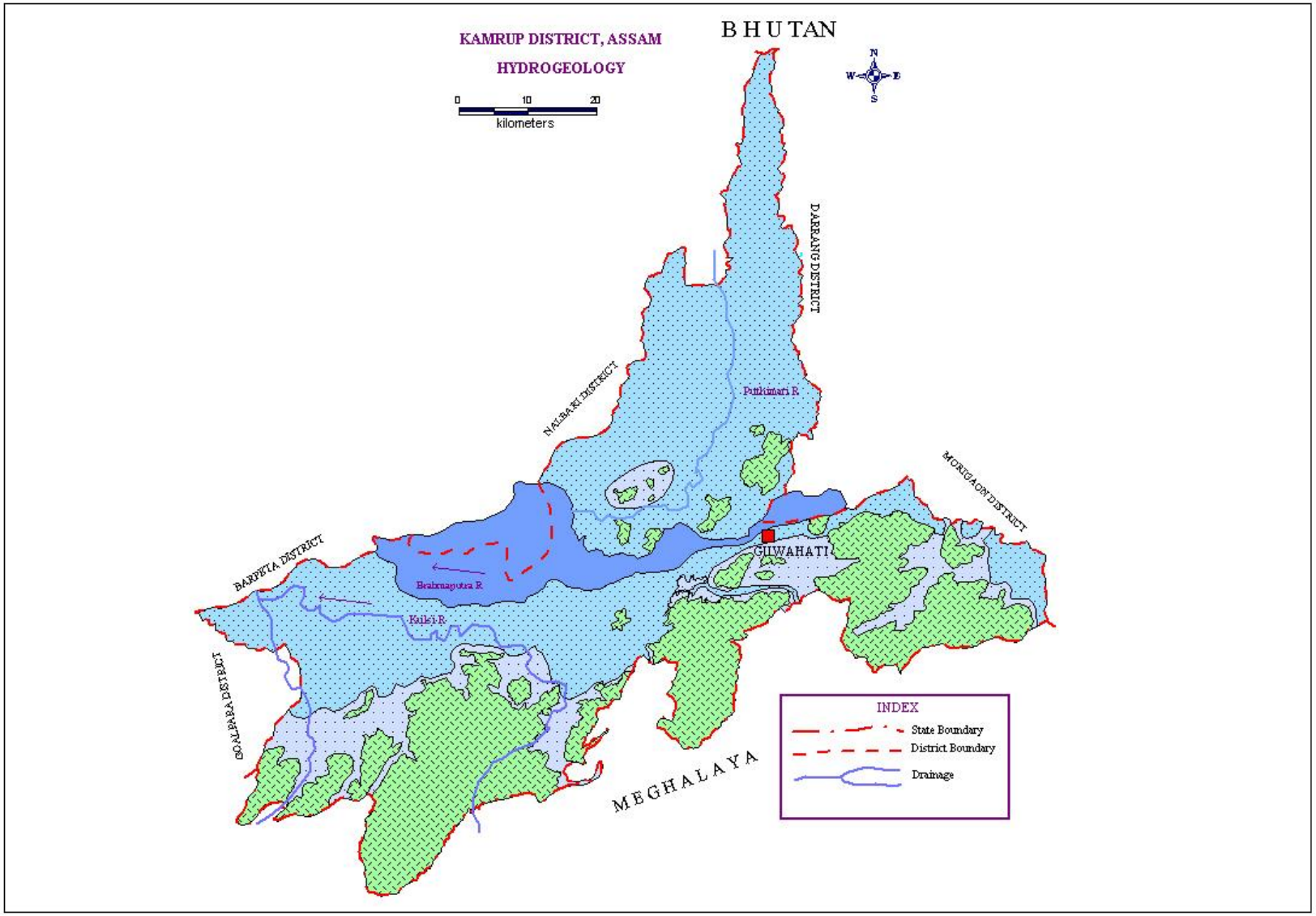
SUB-DIVISION
BARPETA DISTRICT
Brahmaputra R.
Kulsi R.
KAMRUP (RURAL)
Beki R.
Singra R.
SUB-DIVISION
GOALPARA DISTRICT
MEGHALAYA
INDEX
State Boundary
District Boundary
Sub-divisional Boundary
National Highway
Railway Track
Drainage

PlateII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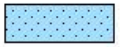
Puthimari R.
MORIGAON DISTRICT
BARPETA DISTRICT
GUWAHATI
Brahmaputra R.
Kulsi R.
GOALPARA DISTRICT
MEGHALAYA
INDEX
State Boundary
District Boundary
Drainage

KAMRUP DISTRICT, ASSAM

HYDROGEOLOGY

L E G E N D

MAP UNIT	FORMATION	LITHOLOGY/GEOMORPHIC FEATURES	AQUIFER DISPOSITION	GROUND WATER PROSPECT
	Recent Alluvium	Sand, gravel, boulders with clay partings/Flood Plain zones and Younger alluvial plain	Aquifer thickness, 30-70m within 150-300m depth	Highly potential. Suitable for shallow tubewells with yield 30-50m3/hr and deep tube wells of 150-200m depthwith yield 50-150m3/hr.
	Older Alluvium	Sand, gravel,clay, boulders/Older Alluvial Plain, Valley fill, Piedmont Plain	Aquifer thickness, 10-50m within 50-100m depth.	Suitable for shallow tube wells with yield 10-20m3/hr.and deep tube well upto 100m depth with yield 30-50m3/hr. Dug wells feasible at the foothills
	Shillong Group	Granite gneiss and weathered materials/ Denudational hill and inselberg	Weathered zones, joints and fractures. Thickness in weathered zones, 5-15m.	Poor potential. Dug wells are feasible in weathered zones.Boreholes at fracture zones at selected points.