केंद्रीय भूमि जल बोर्ड

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भारत सरकार

Central Ground Water Board

Department of Water Resources, River Development and Ganga Rejuvenation,

Ministry of Jal Shakti

Government of India

AQUIFER MAPPING AND MANAGEMENT OF GROUND WATER RESOURCES

DHUBRI DISTRICT, ASSAM

उत्तर पूर्वी क्षेत्र, गुवाहाटी

North Eastern Region, Guwahati

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Central Ground Water Board

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Ministry Of Water Resources, River Development & Ganga Rejuvenation

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GOVERNMENT OF INDIA

भारतसरकार

AQUIFER MAPPING AND MANAGEMENT PLAN OF DHUBRI DISTRICT, ASSAM

ANNUAL ACTION PLAN, 2019-20

NORTH EASTERN REGION

उत्तरपूर्वीक्षेत्र

GUWAHATI

गुवाहाटी

September, 2021

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ANNUAL ACTION PLAN, 2019-20

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CHAPTER 1.0

INTRODUCTION

1.1 Objectives

The objective of the study is to prepare aquifer map of the area in 1:50,000 scale, identify the groundwater related issues and prepare a groundwater management plan.

1.2 Scope of the study

Dhubri district has vast groundwater and surface water resources. The water resources of the district can be judiciously used for sustainable economic growth. Sustainable management plan of groundwater extraction warrants study on the occurrence of groundwater, its quantity and quality.

1.3. Approach and methodology

The approach is to identify the principal and major aquifers, quantify the resources and prepare a management plan. Finally the scientific knowledge will be disseminated to farmers, state government and stake holders.

The methodology is illustrated below:

Data compilation and data gap analysis: The preliminary works consisted of collection and review of all existing hydrogeological and exploration data of CGWB, State Groundwater Departments. All data were plotted in base map on GIS Platform (MapInfo-11.0 using Projection category longitude/latitude (WGS 84-EPSG 4326). On the basis of available data, Data Gaps were identified.

Data Generation: Efforts were made to fill the data gaps by multiple activities such as exploratory drilling, geophysical techniques, hydro-geochemical analysis, besides detailed hydrogeological surveys.

Aquifer Map Preparation: On the basis of integration of data generated from various studies of hydrogeology and geophysics, aquifers have been delineated and characterized in terms of quality and potential. Various maps have been prepared bringing out characterization of aquifers, which can be termed as aquifer maps providing spatial variation (lateral & vertical) in reference aquifer extremities, quality, water level, potential and vulnerability (quality & quantity).

Aquifer Management Plan Formulation: Based on aquifer map a sustainable development plan of the aquifer is formulated

1.4 Area Details

Dhubri district is covered by Survey of India Toposheet No. 78 F/15, 78 F/12, 78 F/13, 78 F/14, 78 F/15, 78 F/16, 78 G/13, 78 J/3, 78 J/4, 78 J/7, 78 J/8 and 78 K/1 and bounded by 25˚ 27′23” and 26˚ 22’ 16” North Latitudes and 89˚41’19” and 90˚ 29′02” East longitudes covering an area of 2135.14sq km (Fig.1.1).

The district is located 295 kms away from the state capital and is linked by Roadways, Railways and Waterways.

Table 1.1: Administrative set up of the study area

Sl no	State	District	Block	Geographical area
1	Assam	Dhubri	Hatidhura	63.92
2	Assam	Dhubri	Agomoni	167.51
3	Assam	Dhubri	Golakganj	132.31
4	Assam	Dhubri	Rupshi	116.76
5	Assam	Dhubri	Gauripur	178.80
6	Assam	Dhubri	Jamadarhat	77.53
7	Assam	Dhubri	BirsingJarua	381.81
8	Assam	Dhubri	South Salmara	130.77
9	Assam	Dhubri	Debitola	76.66
10	Assam	Dhubri	Mahamaya	113.47
11	Assam	Dhubri	Nayeralga	98.90
12	Assam	Dhubri	Bilasipara	113.00
13	Assam	Dhubri	Chapar-Salkocha	187.14
14	Assam	Dhubri	Fekamari	162.15
15	Assam	Dhubri	Mankachar	109.55

Table 1.2: Number of Towns, Sub Divisions, C.D. Blocks, Zila Parishads, Anchalik Panchayats, Goan Panchayats and Villages:

District / State	Towns (Statutory + Census)	Sub-Division	C.D. Block	Zilla Parishad	Anchalik Panchayats	Gaon Panchayats	No of Villages
Dhubri	9	3	14	1	15	168	1091
Assam	214	56	219	20	189	2202	26395

Table 1.3: Demographic profile of Dhubri district (2011 Census):

District / State	Area(Sq. Km.)	Population	Male	Female	Rural	Urban	Population density per sq km
Dhubri	2176.00	1948632	998346	950286	1746715	201917	1171
Assam	78438.08	31169272	15954927	15214345	26780516	44388756	391

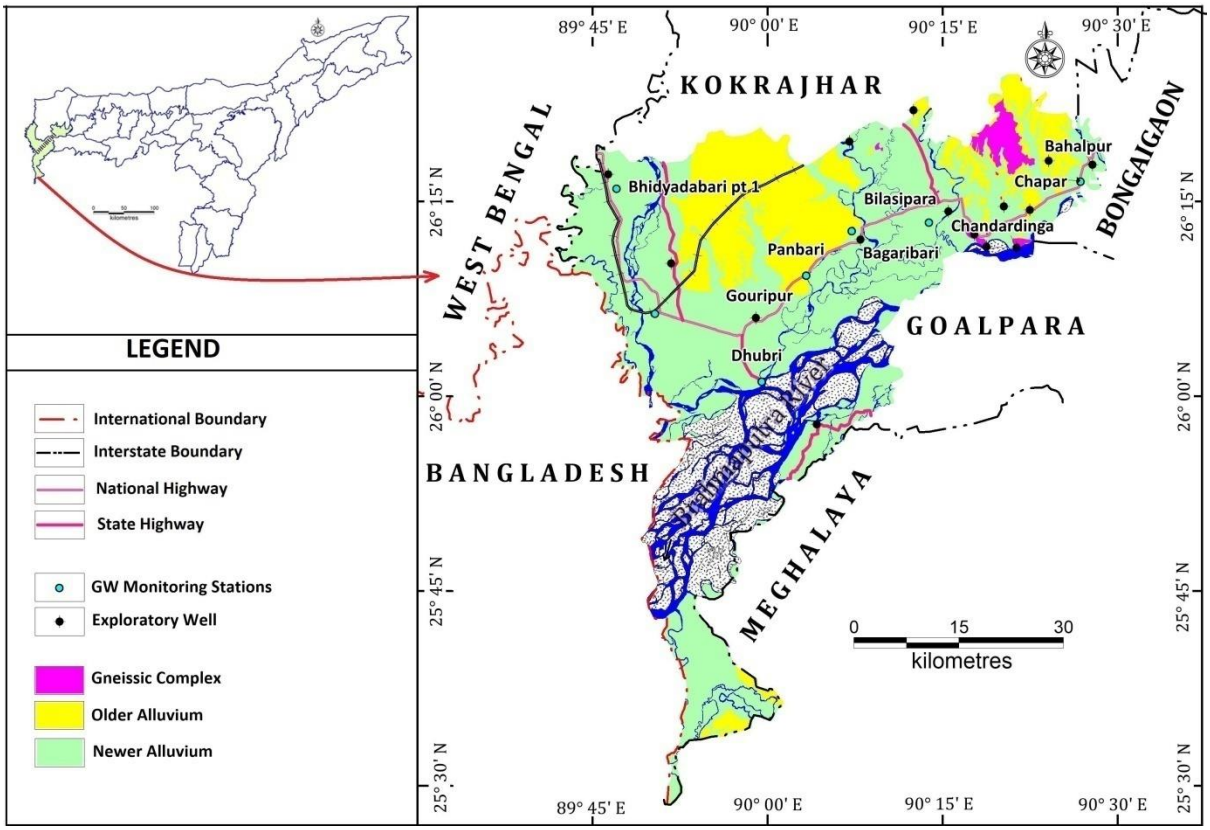

Fig.1.1: Base Map of Dhubri District, Assam

1.5 Data availability, data adequacy, data gap analysis and data generation

One of the important aspect of aquifer mapping programme was the synthesis of the large volume of data already collected during specific studies carried out by Central Ground Water Board and various Government organizations with a new data set generated that broadly describe an aquifer system. The data were assembled, analysed, examined, synthesized and interpreted from available sources. These sources were predominantly non computerized data, which was converted into computer based GIS data sets. On the basis of available data, Data Gaps were identified.

Data Generation: There was also a need for generating additional data to fill the data gaps to achieve the task of aquifer mapping. This was achieved by activities such as exploratory drilling, geophysical study, soil infiltration test, ground water quality analysis besides detailed hydrogeological surveys.

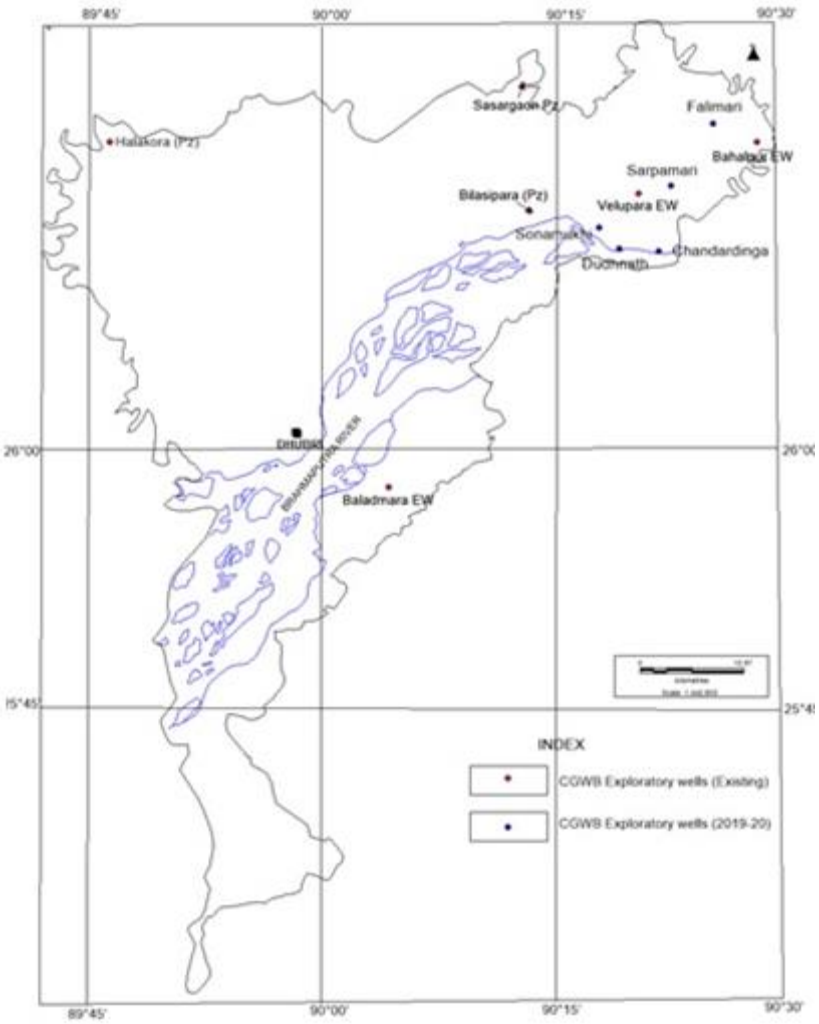

Fig 1.2: Available data and data generation of exploration in Dhubri district

1.4 Rainfall-spatial, temporal and secular distribution

Taking the average, the monthly minimum temperature is observed in January. Similarly the average monthly maximum temperature is observed in May. The average annual rainfall in the district is 2877.9 mm. The rainfall pattern observed is that during November to March (winter) average annual rainfall is low with dry condition while April to October was observed as wet period that received high average annual rainfall. Due to varied distribution of rainfall, the district suffers from heavy flood during wet period and moisture stress in the dry period. Analysis of rainfall data shows that out of 104 average annual rainy days, there are only 10 rainy days during the period of November to March and the remaining 94 rainy days during the period of April to October. Relative humidity was highest during June & July while it was the lowest during February & March.

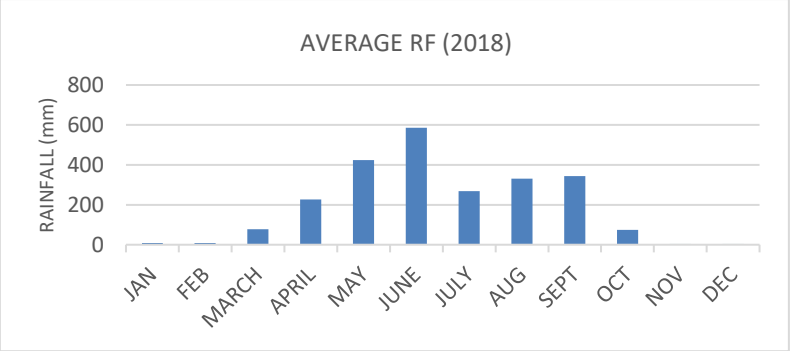

Fig 1.3: Average monthly rainfall and monthly rainfall (2018)

1.5 Physiography and Geology

Dhubri district occupies an area of 2,17600 hectares out of which only an area 4086 hectares has slope of more than 20%. It falls in the Brahmaputra valley and has a plain topography with patches of small hillocks like Tokorabandha, Dudhnath, Chandardinga, Boukuamari, Boropahar, Chakrasila, etc. these hillocks are situated in the north eastern part of the district. The mighty river Brahmaputra bisects the district, on Northern side with Dhubri and Bilasipara Sub-Division and Southern side with Southa Salmara-Mankachar Sub-Division. Slope map of Dhubri is shown in figure 1.4

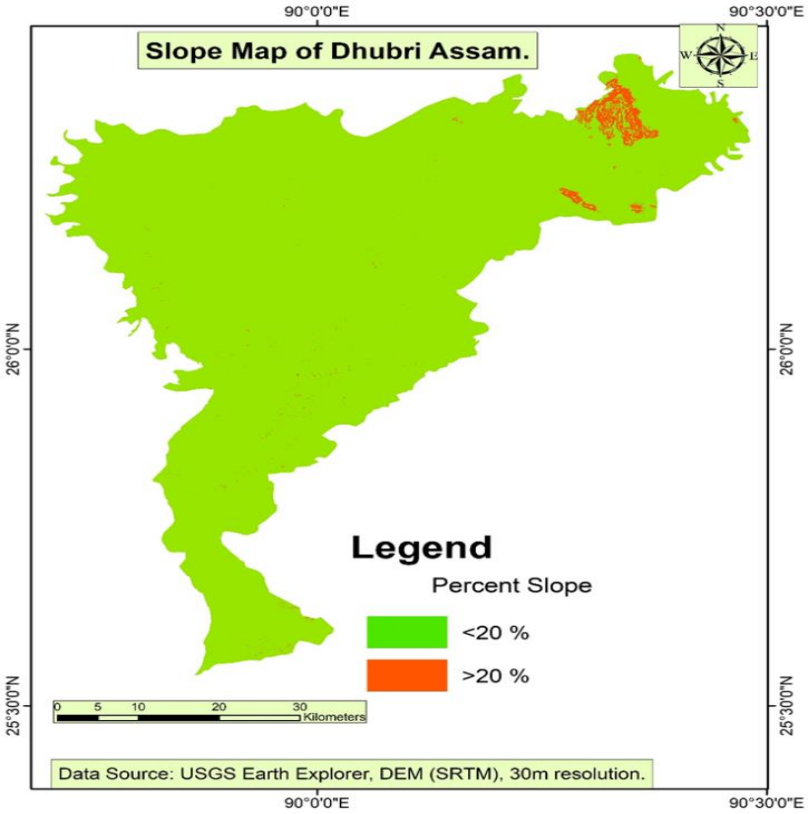

Fig1.4: Slope map of Dhubri

The district constitutes the vast alluvial plains of Brahmaputra River system. The monotony of the flat alluvial tract is interrupted by the presence of Archaean inliers in the form of disconnected hillocks referred to as inselbergs and these occur specially in the eastern and southern parts of the district. These hillocks are joined by the offshoots of Shillong

plateau and are found on the north bank near Diplebeel, Sitdangabeel and east of Bilasipara and on the south bank of the foothill portion of Garo Hills along the district boundary. The level difference between the valley and the peaks of the inselbergs ranges from 25 to 455 m. These hillocks are covered by a thick lateritic mante and are occupied by evergreen mixed forest. Terraced alluvial deposits occupy 80% of the district with conspicuous occurrence of buried channels, back swamps, etc. Soils in greater part of the district are sandy and silty loam, or clayey loam. It is found to be highly acidic to slightly alkaline in nature and is moderately permeable and characterised by the presence of low organic carbon and low soluble salts. Soils restricted to inselberg areas are more clayey, lateritic and less permeable and are highly acidic in nature. From agriculture point of view, the soils in major part of the area are suitable for all sorts of crops cultivation.

Pre-Cambrian gneiss-schist complex projecting abruptly above the vast stretch of alluvium as isolated hills forms the consolidated formation in the district. These rock formations had been subjected to faulting and fracturing at several places. The unconsolidated formation is represented by the alluvial deposits of the recent age. This formation is found spreading on either side of the River Brahmaputra and comprises medium to coarse grained sand, gravel, pebbles, cobbles, etc., with intercalation of silt and clay. It is characterised by the presence of hard compact lateritic clay (Chapar formation) followed by coarse sand with pebbles and cobbles.

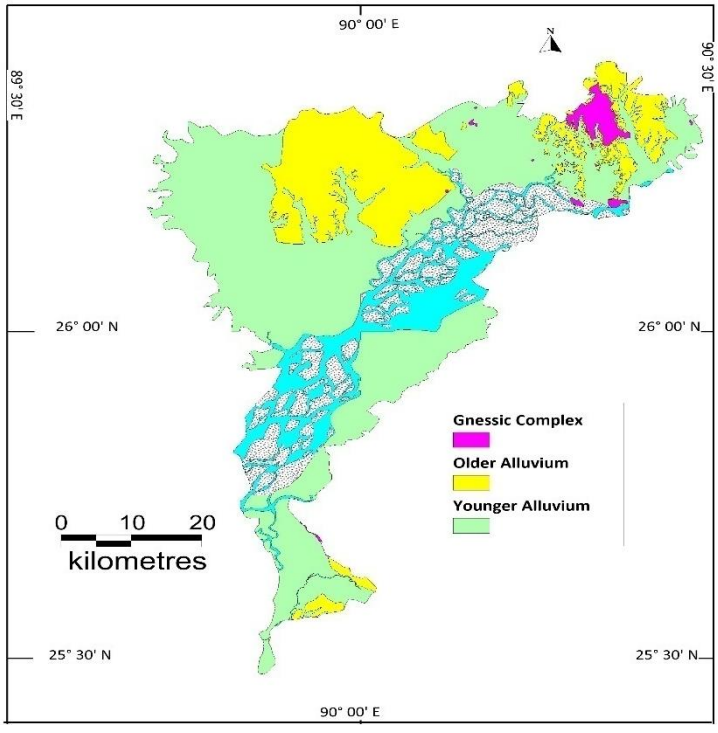

Fig 1.5. Geological Map of Dhubri, Assam

1.6 Drainage

Mighty river Brahmaputra is flowing through this district from east to west with its tributaries like Champabati, Gourang, Gadadhar, Gangadhar, Tipkai, Sankosh, Silai, Jinjiram, etc. The rivers act as drainage and during rainy season the river-beds rise to an optimum level

causing stagnancy in low-lying areas for months together. With the coming down of water in rivers the stagnant water is swept away by the rivers.

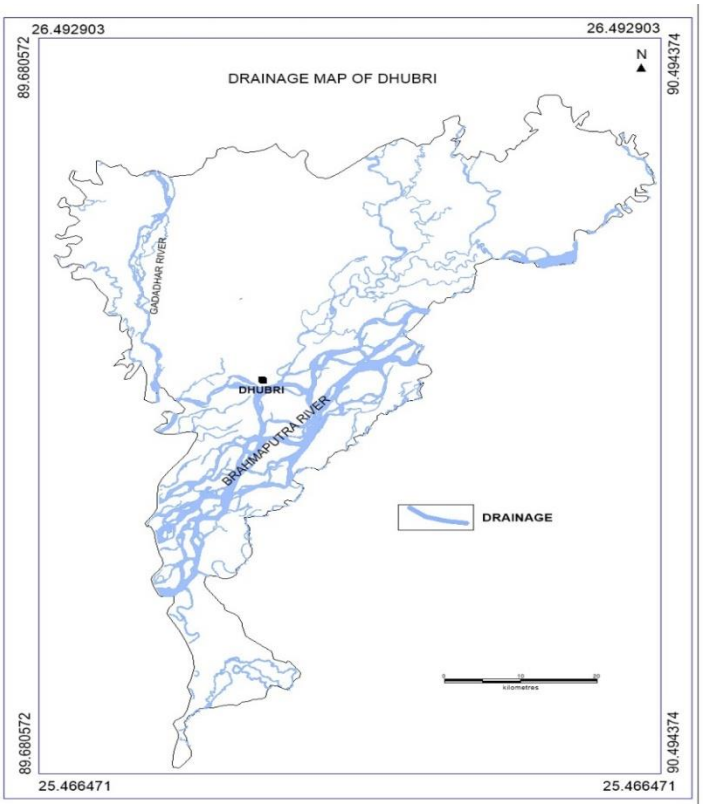

Fig 1.6: Drainage Map of Dhubri, Assam

1.7Land use Pattern

Land use pattern of the villages in different blocks are given in the following table (Table: 1.4).

Table 1.5: Land use pattern of Dhubri district, Assam

District	Total Geographical area (HA)	Area under agriculture			
		Gross cropped Area	Net sown area	Area sown more than once	Cropping intensity
Dhubri	217600	230511.8	135112.5	93246.51	170

(Source: District Irrigation Plan, Dhubri District, 2016-20, Assam)

1.8 Soil

The soil of the district has been found to exhibit heterogeneous characteristics. In the district majority of the places particularly reverine tracts loamy to sandy loam soil are predominant. In some pockets clay to heavy clay soil are also in existence. Soil reaction is acidic. Flood & Erosion: Flood is a regular phenomenon for the District which causes extensive damage almost every year. The South Salmara - Mankachar Sub-Division is worst affected by floods. The entire South Salmara revenue Circle 15 and Sukchar areas under Mankachar revenue Circle are very badly affected and major portion of South Salmara Circle has already been washed away by errosion. Golokganj Town and PubKanuri village are

affected by flood and erosion of river Gangadhar. Bilasipara Sub-Division is mostly affected by flash floods of River Gaurang.

1.9 Agriculture

The District is favoured by desirable soil and climatic condition grows a wide range of crops. It is primarily dependent on agriculture and forest products. Paddy is the main crop and source of income with surplus production than its requirement and is grown mainly as summer and winter paddy. The other major crops are Mustard, Jute, Potato, Wheat, Lentil, Black gram and different vegetables like Brinjal, Cabbage, Cauliflower, Ladys finger, Radish, Tomato, Cucumber, Carrot and Guards. Onion, Garlic, Chilly, Zinger and Turmeric are also grown in small areas in all the Dev. Blocks. Some other minor crops are pea, sesamumNiger , Cucurbits, Pineapple, Tapioca etc. Important plantation crops are Banana, Coconut, arecanut, guava, mango, lemon, bamboo etc. From forest mainly timber and bamboo add to the income though boulder and sand. Fish, milk, meat and egg have small contribution to the economy.

Gross irrigated area in the district is **57761** ha and net irrigated area is **44689.69** ha. Block wise distribution of irrigated lands are shown in Table 1.3.

Table 1.6: Distribution of irrigated land (Source: Agriculture Dept., Dhubri in District Irrigation Plan, 2016-20, DhubriDistrict, Assam)

District	Area (in Hectares)			
	Gross Irrigated Area	Net Irrigated area	Partially Irrigated/ Protective Irrigation	Un-irrigated or Totally Rainfed
Dhubri	57761	44689.69	511.77	90509

Surface and ground water resources are used in the district for irrigation purposes. Two state government agencies are engaged for implementation of irrigation schemes in the district. The irrigation department is the nodal agencies in creation of major, medium and minor irrigation schemes while agriculture department is providing irrigation facilities to farmers through construction shallow tube wells. Block wise share of surface and groundwater irrigation is shown in Table 1.7.

Table 1.7: Share of surface and groundwater irrigation

	Surface Irrigation (BCM)				Groundwater based irrigation (BCM)		
District	Canal (major & medium)	Minor Irrigation Scheme (FIS)	Lift Irrigation	Various water bodies including rain water harvesting	Open Well	STW	BW
Dhubri	4078	0.01573	0.0018	0.00171		0.103041	0.00243
Total Surface Water Irrigation				0.034714	25%		
Total Ground Water Irrigation				0.105471	75%		
Total Irrigated Water				0.140185			

1.10 Industry

Agro based industry is the main industry in the district. Other industry includes textiles, brick etc. The existing water demand of various industries were worked out by NABARD in the District Irrigation Plan of Dhubri District for 2016-20 as per Table 1.9.

Table 1.8: Industrial water extraction in Dhubri District, Assam

SN	Block	Name of the industry	Extraction (BCM)
1	Hatidhura	Rice mill, chakki, Cane & bamboo, Tailoring, Jute craft	0.03061
2	Agomoni	Rice mill, Atta chakki, Tailoring, Jute Craft, Steel furniture, D.T.P	0.05069
3	Golakganj	Rice Mill, Atta Chakki, Tailoring, Steel fabrication & furniture, D.T.P, Coaltar industry, Cane & bamboo, Weaving, Jute craft	0.04165
4	Rupshi	Rice mill, Tailoring, Steel furniture, DTP, Jute craft, Flour mill, Brick Manufacturing, Atta Chakki, Cement Factory	0.04039
5	Gauripur	Rice mill, Atta chakki, Tailoring, Ice Factory, Chow chow manufacturing, Steel Fabrication, D.T.P , Agarbatti manufacturing, Papad making, Concrete Block, Coaltar Industry, Press Offset, Mustard Oil mill, Bakery, Beauty Parlour, Package drinking water	0.08121
6	Jamadarhat	Rice mill, Atta chakki, Tailoring, Weaving, Dry fish, Agarbatti Manufacturing, Jute Craft	0.03076
7	BirsingJarua	Jute Craft, Rice mill, Tailoring	0.04081
8	South Salmara	Rice mill, Tailoring, Chicken supari, Dry fish, Jute craft	0.03031
9	Debitola	Rice Mill, Jute Craft, Atta chakki, Tailoring, Brick Industry, Steel Furniture, D.T.P, Terracotta, RCC Products	0.06097
10	Mahamaya	Rice mill, Atta chakki, Tailoring, Dry Fish, D.T.P, Steel Furniture, G.I. bucket & truck manufacturing, Cement factory, Press offset	0.05081
11	Nayeralga	Rice mill, Tailoring, Steel fabrication and furniture, Chicken supari, Dry fish	0.04021
12	Bilasipara	Tailoring, Brick Manufacturing, Jute Craft, Mustard oil mill, Steel furniture, D.T.P, Atta chakki, Rice Mill, Steel Fabrication & furniture, Press offset, Baakery	0.07046
13	Chapar-Salkocha	Rice mill, Tailoring, Atta chaki, Mustard Oil Mill, Jute craft, Brick Manufacturing, Steel Fabrication, Stone Crusher, D.T.P	0.06071
14	Fekamari	Rice mill, Atta chakki, Tailoring, Dry Fish	0.08091
15	Mankachar	Crusher nut, Rice mill, Atta chakki, Tailoring, Dry Fish, D.T.P, Steel Furniture, G.I. bucket and truck manufacturing, Cement factory, Press offset	0.06029
		Total	0.77079

CHAPTER 2.0

Data Collection and Generation

2.1 Data collection

2.1.1 Hydrogeological data

Water level data: The entire study area is covered by regular monitoring of 07nos. of GWMS and another 21nos. of key wells have been established. All these wells are under monitoring after establishment.

Table 2.1: Key wells location details

SN	Name of Village/Site	Latitude (N)	Longitude (E))	NHNS/Key well	RL (mamsl)	Total depth of Pz/Dw (m)	Type (DW/Pz/ Spring)	Aquifer group	Measurement point (magl)
1	Bagaribari	26°12'49.1"	90°07'12.3"	NHNS Well	33	30	DW	Unconsolidated (1st aquifer)	0.95
2	Bilasipara	26°13'28.4"	90°13'49.2"	NHNS Well	29	8	DW		0.90
3	Chapar	26°16'36.8"	90°26'48.7"	NHNS Well	39	6.70	DW		0.72
4	Dakhin Tokesara Part IV	26°06'27.5"	89°50'21.2"	NHNS Well	23	7	DW		1.02
5	Dhubri Town	26°01'12.9"	89°59'28.7"	NHNS Well	45	12	DW		1.00
6	Panbari	26°09'23.3"	90°03'17.6"	NHNS Well	49	19.86	DW		0.85
7	Shapamari Beat	26°14'18.4"	90°22'30.2"	NHNS Well	48	25	DW		0.86
8	Shernagar	26°11'38.54"	89°34'49.7"	NHNS Well	26	6.86	DW		0.96
9	Bhidyadabaript 1	26°16'4.51"	89°47'2.541"	NHNS Well	20	5.15	DW		0.80
10	Dighaltari	26°14'42.90"	89°46'51.56825"	Key well	33	6.32	DW		0.75
11	Bisondaipt 1	26°8'29.11"	89°50'12.59975"	Key well	30	6.6	DW		0.85
12	Harihat Bazar	26°10'47.43"	89°50'6.09888"	Key well	13	7.14	DW		0.97
13	Rangamari College	26°8'28.10"	90°2'33.44515"	Key well	32	13.86	DW		0.85
14	Khoraghat	26°12'59.55"	90°8'7.61926"	Key well	15	6.70	DW		0.88
15	Chirakuta	26°13'51.1"	90°16'56.92056"	Key well	27	7.9	DW		0.96
16	Mohisbattan	26°12'34.32"	90°19'4.67122"	Key well	35	5.9	TW		0.83
17	Falimari	26°18'14.78"	90°24'34.93286"	Key well	34	8..70	DW		0.89
18	Chandardinga	26°11'25.08"	90°21'23.8609"	Key well	32	9.30	DW		0.76
19	Madhusaulmari	26°4'43. 92"	89°57'14.83"	Key well	25	-	Hp		0.88
20	Raipur part I	26°6'56. 50"	89°50'25.29"	Key well	37	7.94	DW		1.18
21	Boramari	26°11'50. 01"	89°46'7.8105"	Key well	34	6.8	DW		0.54
22	Dudhnath	26°11'41. 28"	90°18'36.767"	Key well	26	7.2	DW		0.80
23	Sonamukhi	26°12'16. 67"	90°17'33.25"	Key well	37	8	DW		0.86
24	Modhargula	26°2'56. 46"	89°57'51.791"	Key well	33	-	Hp		0.89
25	ChaurangiMor	26°4'48. 68"	89°57'35.45"	Key well		-	Hp		1.16
26	AtaniRajbari	26°11'58. 66"	90°8'33.4432"	Key well	40	6.38	DW		0.87
27	Salbanda (Borkanda sub centre)	26°13'27. 65"	90°9'31.624"	Key well	33	11.38	DW		0.77
28	Sonamukhi	26°2'56. 46"	89°57'51.791"	Key well	37	7.55	DW		1.03
29	Satguri	26°4'48. 68"	89°57'35.45"	Key well	32	7.9	DW		0.82
30	Didharpara	26°11'58. 66"	90°8'33.4432"	Key well	23	15.3	DW		0.98
31	Dafarpur	26°13'27. 65"	90°9'31.624"	Key well	30	5.66	DW		0.97

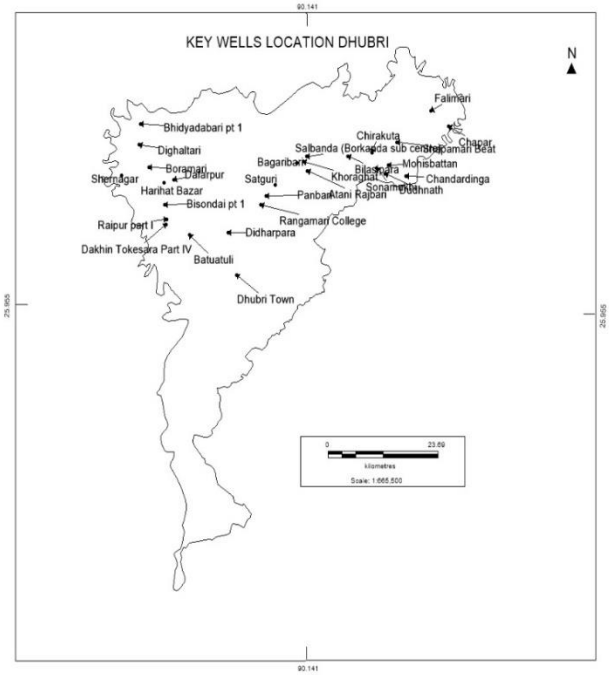

Fig 2.1: Key wells location, Dhubri

Table 2.2: Water level measurement of key wells

S.N.	Location	Month & depth-to-water level (mbgl)	
		Nov-19	Mar-20
1	Bagaribari	12.95	14.71
2	Bilasipara	2.7	3.45
3	Chapar	3.45	4.74
4	Dakhin Tokesara Part IV	2.63	3.95
5	Dhubri Town	1.74	2.00
6	Panbari	17.46	18.28
7	Shapamari Beat	14.45	17.09
8	Shernagar	1.39	1.86
9	Bhidyadabaript 1	2.4	3.61
10	Dighaltari	0.53	1.
11	Bisondaipt 1	1.95	4.23
12	Harihat Bazar	2.49	4.85
13	Rangamari College	11.18	12.18
14	Khoraghat	3	3.64
15	Chirakuta	3.38	3.77
16	Mohisbattan	2.78	4.09
17	Falimari	5.69	6.75
18	Chandardinga	5.6	6.40
19	Raipur part I	2.78	3.53
20	Boramari	3.05	3.77
21	Dudhnath	4.34	4.50
22	Sonamukhi	3.9	4.50
23	AtaniRajbari	3.31	3.99
24	Salbanda (Borkanda sub centre)	0.7	5.25
25	Sonamukhi	1.35	2.38
26	Satguri	3.73	4.80
27	Didharpara	2.58	3.09
28	Dafarpur	2.01	3.71

2.1.2 Soil Infiltration Test

Salient features of the test sites are provided in Table 2.3&2.4. A perusal of the table shows that the tests have been conducted only in barren land and the soil types encountered in the sites are sand admixtures.

Table 2.3: Salient features of the test sites

Site	Location	Land use	Soil type	Latitude	Longitude
Balajan	Balajan, Rupshi	Barren Land	Clay loam	N26˚5′46.49″	E89˚53′0.53909″
AtaniKhanabari	AtananiKhanabari	Barren Land	Clay loam	N26˚11′38.17142″	E90˚8′34.75″

Table 2.4: Summary of Infiltration Test

Site	Land use	Soil type	Infiltration rate (mm/hr)	Duration of test (min)	Total Quantum of water added in m	IF = (4)/ (6) *100)
Balajan	Barren Land	Clay loam	9	140	208	0.043269
Atani Khanabari	Barren Land	Clay loam	0	90	210	0

2.1.3 Water Quality

To understand the chemical quality of groundwater in the study area and its suitability for domestic, drinking and agricultural utilisation, and existing quality data of CGWB (Figure.13) were collected. Water samples were collected from monitoring wells for detailed, iron, heavy metals and arsenic.

2.1.4 Geophysical survey

No geophysical survey was carried out in the district before and during NAQUIM study.

2.1.5 Exploratory Drilling

Central Ground Water Board, North Eastern Region, Guwahati has drilled a total of 16 exploratory wells till 2010.During AAP 2019-20 exploration activity initiated in the district. In total 5 exploratory wells and 5 observation wells were constructed in the district. Also under PMKSY a total of 100 wells has been drilled by Irrigation Department, Govt. of Assam, details of which has been given in table 2.6, 2.7 and 2.8.

Table 2.5: Details of exploratory wells in Dhubri District, Assam

SN	Village/ Location	Latitude (N)	Longitube (E)	Type of well (DW/BW/TW)	Depth (m)	Discharge m3/hr	Source/ Agency
1	Baldamara	25°57'48"	90°04'13"	TW	101.00		CGWB
2	Jugipara (Bahalpur)	26°17'48"	90°27'50"	TW	27.00	22	CGWB
3	Velupara	26°14'35"	90°20'15"	TW	152.00	62	CGWB
4	Bilasipara	26°14'12"	90°15'30"	TW	33.50	22	CGWB
5	Sasargaon	26°22'00"	90°12'30"	TW	29.50	22	CGWB
6	Halakura	26°17'03"	89°46'20"	TW	25.40	28	CGWB
7	Hatsingrimari	NA	NA	TW	183.52	-	DGM
8	Jangal	NA	NA	TW	78.05	-	DGM
9	Matiabag (Gouripur)	$26^0$06’ 00	$89^0$59’00	TW	46	30	CGWB

10	Bagaribari (Kathalbari)	$26^0$12’03	$90^0$07’58	TW	54	30	CGWB
11	Civil Hospital	26 10 12	89 51 44	TW	101.50	-	CGWB
SN	Village/ Location	Latitude (N)	Longitube (E)	Type of well (DW/BW/TW)	Depth (m)	Discharge m3/hr	Source/ Agency
12	Sapatgram	90° 7' 12"	26° 19' 35"	TW	51.10	36	CGWB
13	Falimari	26^0 18’ 6”	90^0 24’ 51.92”	TW	66.74	22.135	CGWB
14	Sarpamari	26^0 14’ 20”	90^0 22’ 29.36”	TW	103.05	16.53	CGWB
15	Chandardinga	26^0 11’ 26”	90^0 21’ 22”	BW	118.85	28.75	CGWB
16	Sonamukhi	26^0 12’ 26”	90^0 17’ 45”	BW	203.59	16.53	CGWB
17	Dudhnath	26^0 11’30”	90^0 18’47”	BW	172.89	22.14	CGWB

Table 2.6: Details of implemented schemes under pmksy (hkkp) gw in Dhubri district (Electrical powered tube wells)

Sl. No.	Location	Block	Geo-cordinate		Drilled Depth	Construction Depth	Water Level
			Latitude (N)	Longitude (E)	(m)	(m)	(mbgl)
1	SagolcharaPt-I	Gauripur	26.03	89.93	42.00	42.00	3.50
2	Adabaript-I	Gauripur	26.02	89.94	42.00	42.00	3.50
3	Sagolchara Pt-II	Gauripur	26.02	89.94	33.00	33.00	3.50
4	khoderchar	Gauripur	26.03	89.94	39.00	39.00	4.00
5	Sagolcharapt-i	Gauripur	26.03	89.93	39.00	39.00	3.50
6	Kalapakani Pt-II	Gauripur	25.96	89.92			
7	KismatHasdaha Pt-III	Gauripur	26.01	89.9	36.00	36.00	4.00
8	Motirchar Pt-I	Gauripur	26.02	89.93	42.00	42.00	3.50
9	Dharmashala Pt-IV	Gauripur	26.03	89.89	39.00	39.00	4.00
10	Borbila Pt-I	Gauripur	26.02	89.92	42.00	42.00	4.00
11	Madhusoulmari Pt-I (Jay Chand Village)	Gauripur	26.08	89.94	36.00	36.00	4.00
12	Kachuarkhas Pt-III	Gauripur	26.01	89.89	39.00	39.00	4.00
13	Dubair Char	Gauripur	26.03	89.98	39.00	39.00	3.50
14	KismatHasdaha Pt-IV	Gauripur	26.05	89.91	42.00	42.00mtr	4.00
15	KismatHasdaha Pt-III	Gauripur	26.06	89.9	42.00	42.00	4.00
16	Dharmashala Pt-IV	Gauripur	26.04	89.9	36.00	36.00	4.00
17	Kachuarkhas Pt-II	Gauripur	26.04	89.91	36.00	36.00	4.00
18	Kachuarkhas Pt-I	Gauripur	26.03	89.9	39.00	39.00	4.00
19	Falimari Pt-I (KuntirChar Pt-I)	Gauripur	26.06	89.99	39.00	39.00	4.00
20	Saulmari Pt-II	Gauripur	26.06	89.85	36.00	36.00	3.50
21	Kismat Hasdaha Pt-I	Gauripur	26.05	89.87	-	-	-
22	Sagolchara Pt-II	Gauripur	26.03	89.94	42.00	42.00	4.00
23	Binnachara Pt-IV	Gauripur	25.99	89.83	36.00	36.00	3.00
24	Binnachara Pt-I	Gauripur	26.99	89.82	36.00r	36.00	3.50
25	Falimari Pt-II	Gauripur	26.06	89.99	42.00	42.00	4.00
26	Singimari Pt-II	Gauripur	26.04	89.87	-	-	-
27	Uttar Raipur Pt-I	Rupshi	26.11	89.85	39.00	39.00	4.50
28	Geramari Pt-I	Debitola	26.12	90	33.00	33.00	4.00
29	Dhorarghat Pt.-II	Rupshi	26.11	89.9	30.00	30.00 .	4.50
30	Baniamari	Rupshi	26.1	89.88	45.00.	45.00	4.50
31	Dumordoha Pt.-III	Rupshi	26.11	89.92	39.00	39.00	4.20
32	Beguntoli	Debitola	26.08	89.98	39.00	39.00	4.00

33	Beguntoli	Debitola	26.08	89.98	45.00	45.00	4.00
34	Dangir Char	Debitola	26.07	90	30.00	30.00	4.00
35	Boraibari Pt.-III	Debitola	26.1	90.64	36.00	36.00	4.20
36	Nalia Pt.-I	Rupshi	-	-	30.00	30.00	4.00
37	Hariarkuti	Debitola	26.12	89.95	36.00	36.00	4.80
38	DebottarHasdoha Pt.-VI	Rupshi	26.08	89.89	39.00	39.00	4.50
39	Madhushoulmari Pt.-Ii(baruarvita)	Rupshi	26.07	89.95	45.00	45.00	4.50
40	Lalmohaner Alga	Debitola	26.09	90.01	36.00	36.00	4.00
41	Chapgarh Pt.-I	Rupshi	26.11	89.95	33.00	33.00	3.80
42	Asharikandi Pt.-II	Debitola	26.09	90	30.00	30.00	3.50
43	South Geramari	Debitola	26.07	89.99	30.00	30.00	4.00
44	South Geramari	Debitola	26.04	89.59	30.00	30.00	4.00
45	South Geramari	Debitola	26.06	89.99	30.00	30.00	4.00
46	Uchita	Rupshi	26.11	89.85	36.00	36.00	4.50
47	Uttar Raipur Pt-I	Rupshi	26.12	89.85	36.00	36.00	4.50
48	Uchita	Rupshi	26.12	89.85	36.00	36.00	4.50
49	Dumordoha Pt.-III	Rupshi	26.1	89.92	39.00	39.00	4.00
50	Khagrabari (Dhorarghat)	Rupshi	26.12	89.89	-	-	-
51	Shyamcharankuti Pt.-III	Debitola	26.13	89.98	-	-	-
52	Chapgarh Pt.-II	Rupshi	26.13	89.95	-	-	-

Table 2.7: Details of implemented schemes under pmksy (hkkp) gw in Dhubri district (Solar powered tube wells)

S.N	**Location**	**Block**	**Geo-cordinate**		**Drilled Depth**	**Construction Depth**	**Water Level**
			Latitude (N)	**Longitude (E)**	(m)	(m)	(mbgl)
1	Shyamcharankuti Pt.-III	Debitola	-	-	30.00	30.00	3.50
2	Shyamcharankuti Pt.-III	Debitola	26.126548	89.998006	36.00	36.00	3.50
3	Shyamcharankuti Pt.-III	Debitola	26.7358	89.5955	39.00	39.00	3.50
4	Shyamcharankuti Pt.-III	Debitola	26.125162	89.994254	30.00	30.00	3.50
5	Geramari Pt.-I	Debitola	26.111877	89.98283	36.00	36.00	3.50
6	ChaparBalajan	Rupshi	26.1187	89.86733	36.00	36.00	4.00
7	ChaparBalajan	Rupshi	26.12519	89.86689	33.00	33.00	4.00
8	Uchita	Rupshi	26.119145	89.858895	30.00	30.00	4.00
9	Dumordoha Pt.-III	Rupshi	26.088251	89.924627	29.10	29.10	4.00
10	Geramari Pt.-VI	Debitola	26.071224	89.990066	39.00	39.00	3.50
11	Beguntoli	Debitola	26.087576	89.976785	36.00	36.00	4.00
12	Sater Alga	Debitola			36.00	36.00	3.50
13	Dolshinger Alga Pt.-I	Debitola	26.082129	90.017515	33.00	33.00	3.50
14	SajuarKuti	Debitola	-	-	36.00	36.00	4.00
15	MatiabogChakjogipara	Debitola	-	-	33.00	33.00	4.00
16	Chapgarh	Rupshi	26.112700	89.953700	39.00	39.00	4.00
17	SajuarKuti	Debitola	-	-	33.00	33.00	4.00
18	SajuarKuti	Debitola	-	-	30.00	30.00	4.00
19	Alomganj Pt.-VI	Debitola	-	-	36.00	36.00	4.00
20	Jhaler Alga Pt.-I	Debitola	26.075484	90.008527	30.00	30.00	4.00
21	Fulkumari	Rupshi	26.108650	89.955988	30.00	30.00	4.00
22	South Geramari	Debitola	26.076995	89.990845	30.00	30.00	4.00

23	Alomganj Pt.-II	Debitola	26.129009	90.027827	-	-	-
24	Baghmara	Debitola	26.068858	90.011988	-	-	-
25	Tistarpar	Gauripur	26.020487	89.855989	36.00	36.00	3.2
26	Velakoba	Gauripur	26.03853	89.860047	36.00	36.00	3.00
27	Kalapakani	Gauripur	25.965769	89.922554	36.00	36.00	3.50
28	Adabari	Gauripur	26.030342	89.940718	33.00	33.00	3.50
29	Rowa	Gauripur	26.04559	89.935429	33.00	33.00	3.00
30	KismatHasdaha	Gauripur	26.057008	89.907755	42.00	42.00	4.00
31	Dubair Char	Gauripur	25.998666	89.852342	33.00	33.00	3.50
32	Dharmasala	Gauripur	26.02852	89.87836	39.00	39.00	3.50
33	Gaspara	Gauripur	26.001489	89.881843	33.00	33.00	3.00
34	RowaPt-II	Gauripur	26.043631	89.934933	42.00	42.00	3.00
35	JhagraparPt-II	Gauripur	26.046299	89.757464	33.00	33.00	3.50
36	Dharmashala	Gauripur	26.012639	89.880536	36.00	36.00	3.50
37	BinnacharaPt-II	Gauripur	26.019469	89.820863	36.00	36.00	3.50
38	BinnacharaPt-II	Gauripur	26.018308	89.821165	36.00	36.00	3.50
39	Adabari	Gauripur	26.026164	89.937478	36.00	36.00	3.50
40	JangliyaPt-II	Gauripur	26.007343	89.90396	36.00	36.00	3.50
41	JangliyaPt-II	Gauripur	26.013401	89.911294	36.00mtr	36.00mtr	3.50
42	Singimari	Gauripur	26.03551	89.865374	36.00mtr	36.00mtr	3.00
43	AdabariPt-I	Gauripur	26.04114	89.925584	39.00mtr	39.00mtr	3.00
44	Eilshamari	Gauripur	25.946133	89.898552	36.00mtr	36.00mtr	3.00
45	Kalapakani	Gauripur	25.958304	89.924386	36.00mtr	36.00mtr	3.00
46	D-Hasdaha	Gauripur	26.074834	89.871086	36.00mtr	36.00mtr	3.50
47	AdabariPt-II	Gauripur	26.047655	89.923208	36.00mtr	36.00mtr	3.00
48	Soulmari	Gauripur	26.064793	89.849108	32.50mtr	32.50mtr	3.00

CHAPTER 3.0

Data Interpretation, Integration and Aquifer Mapping

3.1 Data Interpretation

The subsurface geology of Dhubri District is interpreted based on exploration data of CGWB and exploration data of Directorate of Geology & Mining, Govt. of Assam. The drilled depth of CGWB's exploratory well ranges from 25.40 to 203.59mbgl whereas DGM's exploratory well depth ranges from 78.05 to 183.52 mbgl.

Table 3.1: Distribution of EW based on drilled depth

Village	Depth (m)	SWL (mbgl)	Draw down (m)	Zones	Saturated thickness (m)	Transmissivity (m2/day)	Discharge (m3/hr)
Falimari	66.74	6	0.88	33-48	15	1308.92	22.135
Sarpamari	103.05	15	1.49	64-70, 73-79, 82-88, 91-97	24	-	16.53
Chandardinga	118.85	8	0.52	44-50, 90-93, 114-118	13	28.75	28.75
Sonamukhi	203.59	4.3	-	62-66, 191-195	8	3.48	16.53
Dudhnath	172.89	8	-	31-35, 50-54, 68-72, 93-97, 136-140	20	-	22.14

Table 3.2: Aquifer wise characteristics

Major Aquifer	Depth Range (m)	Zones	Transmissivity (m2/day)	Discharge (m3/hr)
Younger Alluvium	0-110	33-48, 64-70, 73-79, 82-88, 91-97	1308.92	22.135
Undifferentiated Gneiss	23-162	44-50, 62-66, 90-93, 114-118, 191-195	3.48-28.75	16.53- 28.75
Granite	12-173	31-35, 50-54, 68-72, 93-97, 136-140	-	22.14

CGWB has previously carried out drilling with exploratory wells to a depth range of 25 to 182 m. The exploration reveals presence of unconsolidated alluvial aquifer down to the explored depth of 182 m bgl.

During the AAP 2019-20 CGWB has drilled a total of 5 exploratory wells and 5 observation wells were drilled. From exploration and available data it has been deciphered that three principal aquifers systems can be identified in the district, viz., Alluvium of unconsolidated nature belonging to Quaternary age and Undifferentiated Gneiss and Granite of Pre Cambrian age.

Unconsolidated formation: It is represented by the alluvial deposits of the recent age. This formation is found spreading on either side of the River Brahmaputra and comprises medium to coarse grained sand, gravel, pebbles, cobbles, etc., with intercalation of silt and clay. It is characterised by the presence of hard compact lateritic clay (Chapar formation) followed by coarse sand with pebbles and cobbles. Ground water occurs under water table and semi-confined conditions.The aquifer is characterized by coarse grained materials ranging in size from gravel to boulder down to a depth of 182 m.

The eastern side of the district is dominated by gravely formation. Towards the southern part of the district the aquifers are arenaceous in nature. Generally, the size of the aquifer materials decreases towards the south. Ground water occurs under unconfined to confined conditions.

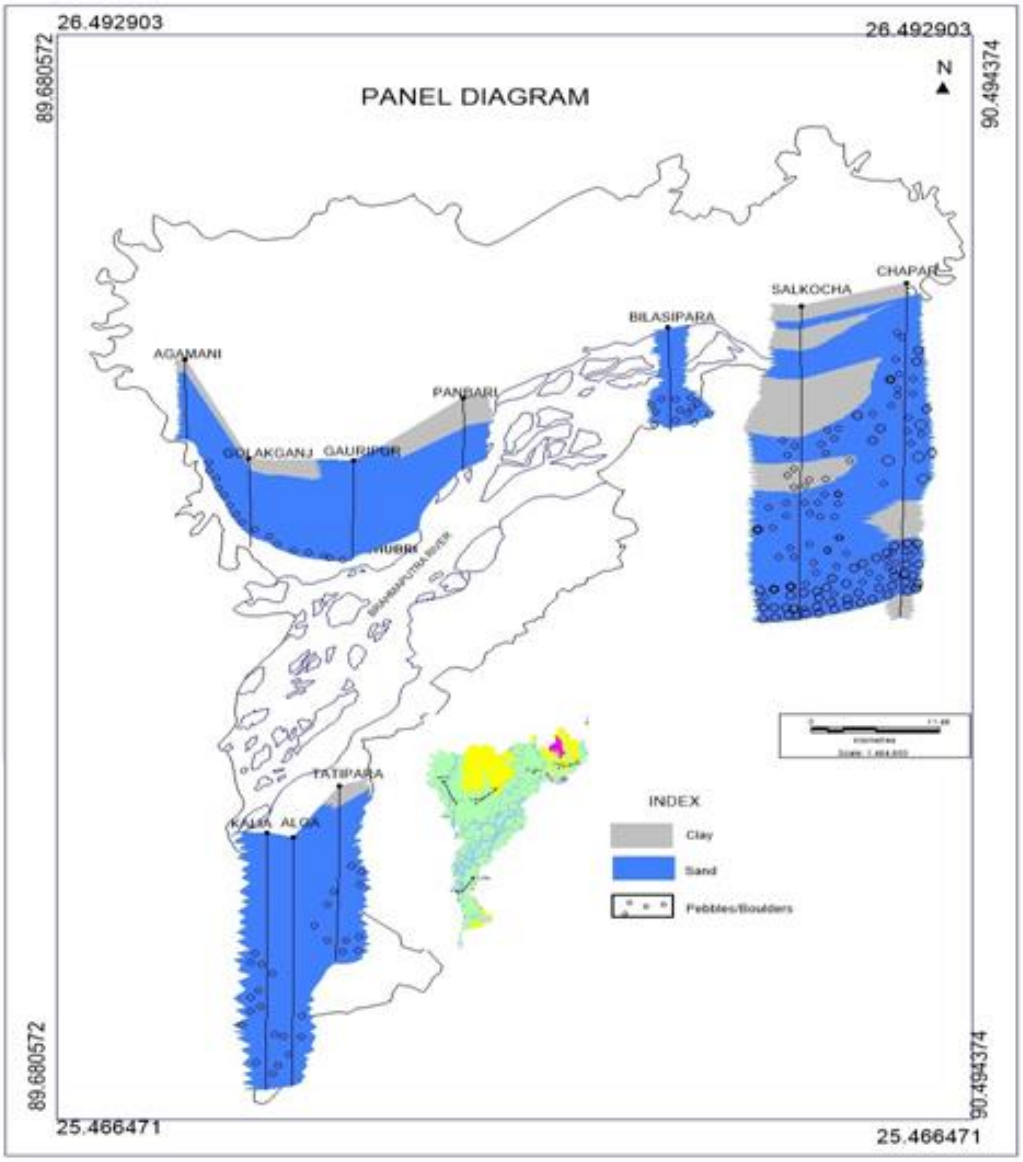

Fig 3.1: Aquifer disposition in Dhubri district

Preliminary pumping test was carried out in the exploratory well at Falimari and after analysis it was found out that the transmissivityis 1308.92 m2/day. The discharge of the bore

well is 22.135 lps and static water level of the borewell is 6 mbgl. The formation at Falimari is characterized by gravelly formation with intercalations of silt and clay.

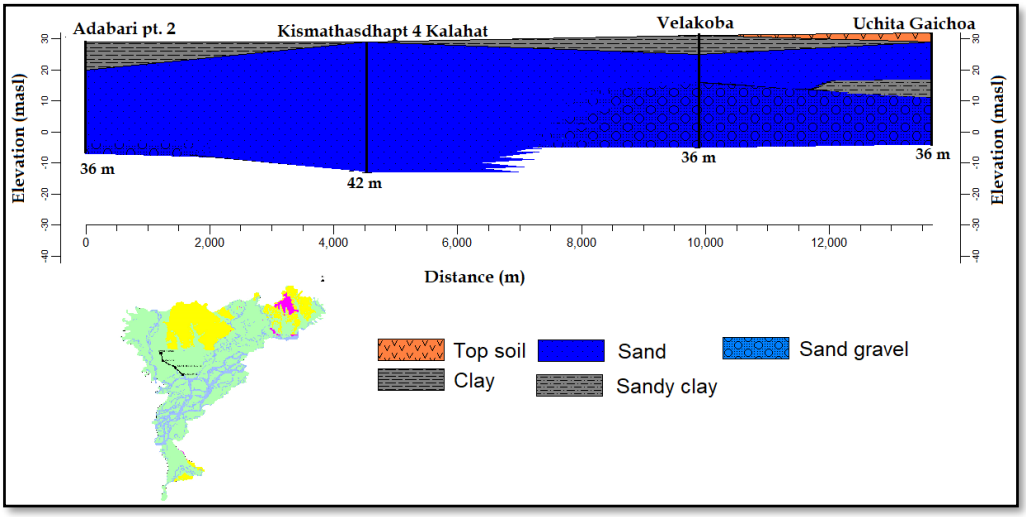

Fig 3.2: Aquifer disposition along AdabariPt 2-Kismathasdapt 4 Kalahat-Velakoba- Uchita Gaichoa

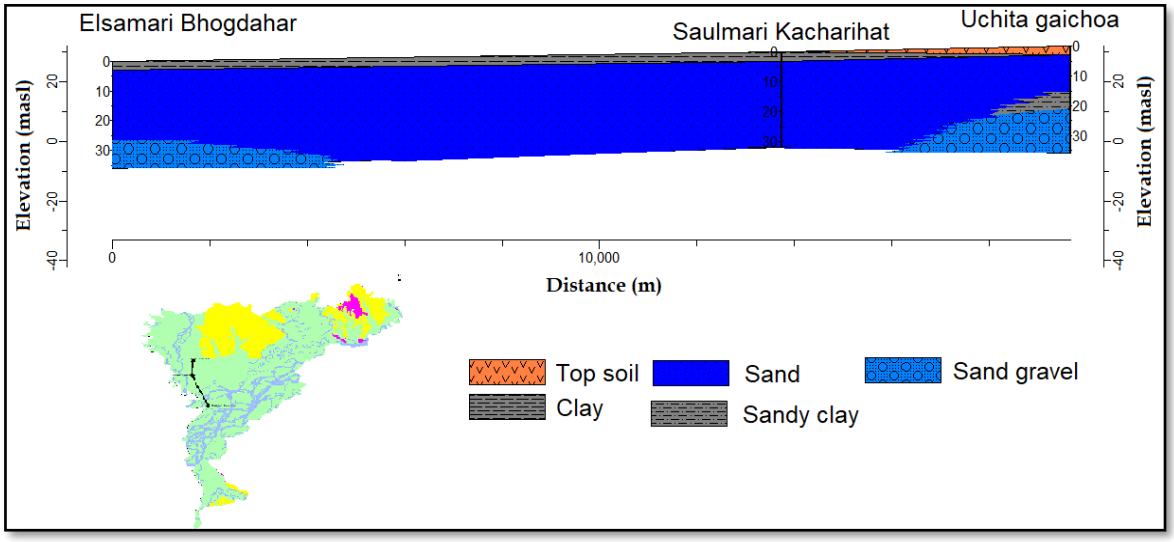

Fig 3.3: Aquifer disposition along Elsamari Bhogdahar-Saulmari Kacharihat-Uchita Gaichoa

Consolidated formation: It projects abruptly above the vast stretch of alluvium as isolated hills in the district. These rock formations had been subjected to faulting and fracturing at several places through which water percolates to facilitate weathering. Weathered zone forms as such are restricted to about 10 m thickness and is often lateritic in character. Occurrence of ground water is limited in these formations and is confined to topographic lows and weathered residuum. The movement of ground water is controlled by the presence of fractures and fissures. Extraction of ground water in these zones is possible through large diameter dug wells and bore wells in hydrogeologically suitable areas. Ground water occurs under water table conditions in the weathered zone.

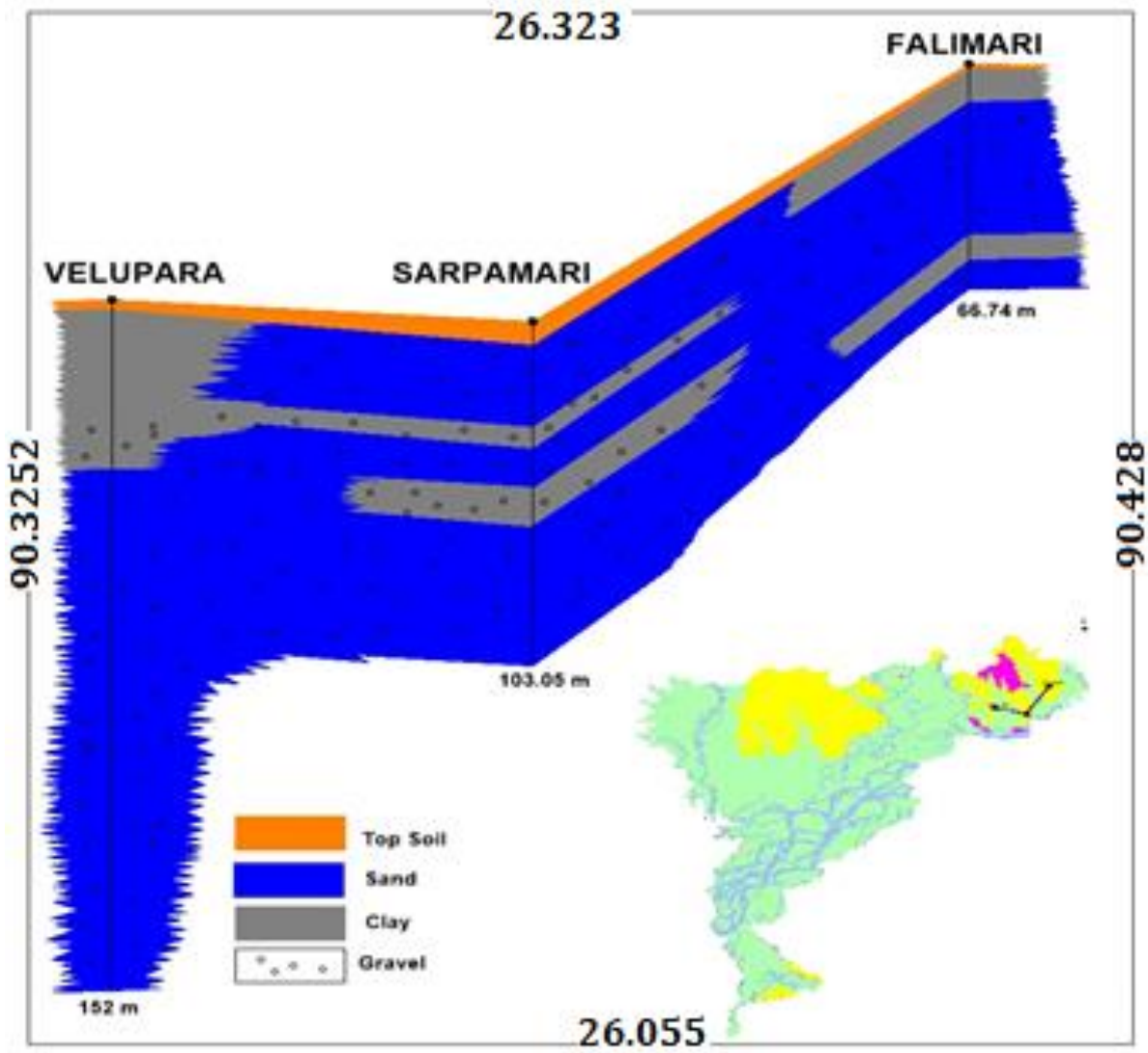

Fig 3.4: Aquifer disposition along Velupara-Sarpamari-Falimari

Preliminary pumping tests were carried out on the exploratory wells at Chandardinga and Sonamukhi. After analysis it was found out that at Chandardinga the transmissivity is 28.75 m^2/day and at Sonamukhi is 3.48 m^2/day. The details are given in Table 3.1.The formations encountered at Sonamukhi and Chandardinga were composed of Ultramafic rocks upto a depth of 203 mbgl. The overburden is upto a depth of 24 mbgl. At Dudhnath Granite is encountered from a depth of 13 mbglupto a depth of 173 mbgl.

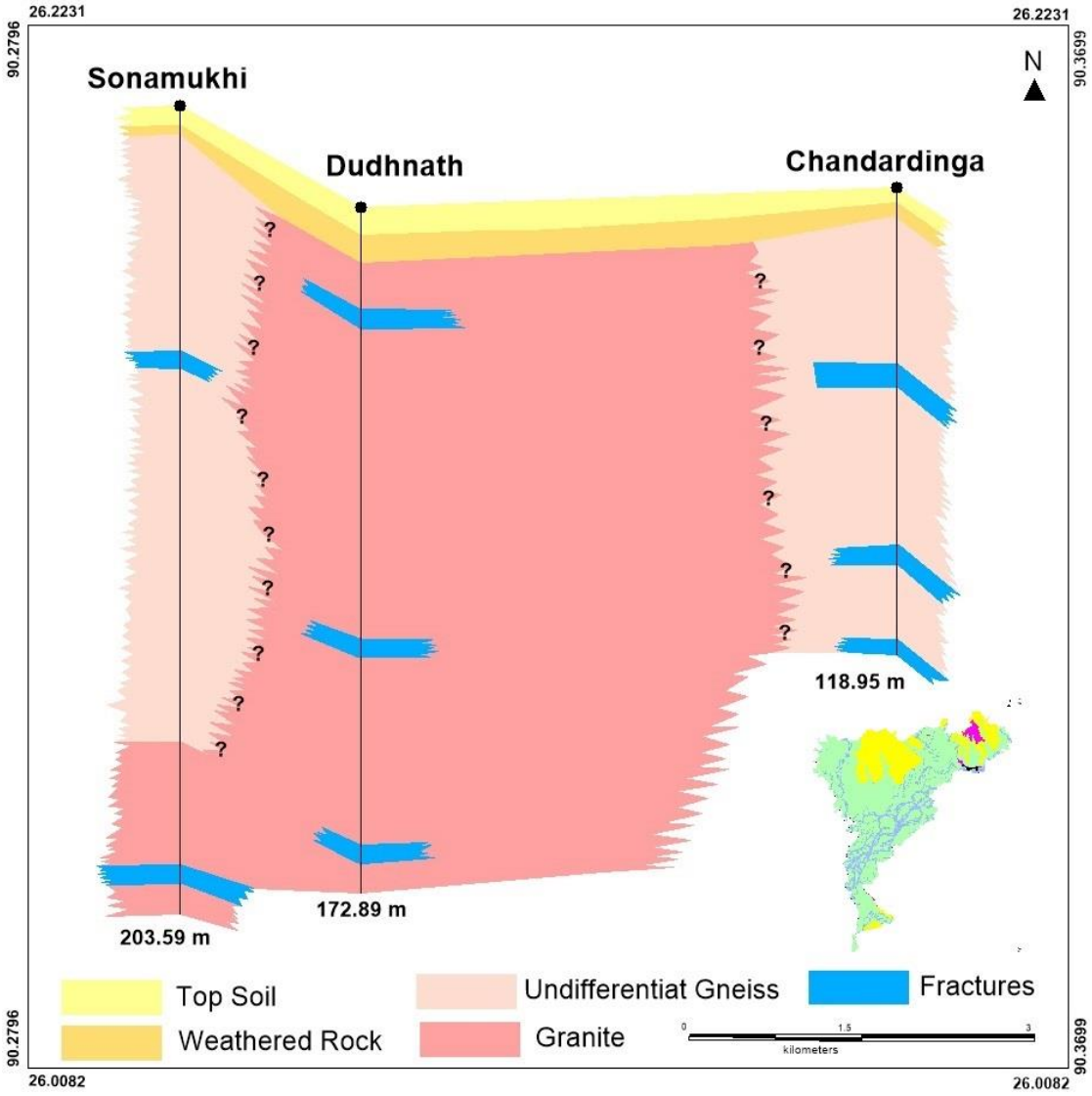

Fig 3.5: Aquifer disposition along Sonamukhi-Dudnath-Chandardinga

3.2: Depth to Water level

In the dug wells water level ranges from 1.86 to 18.28 m bgl during pre-monsoon and from 0.53 to 17.46 m bgl during post-monsoon period. The Pre and post monsoon depth to water level is shown in figures3.4 and figure 3.5 respectively.

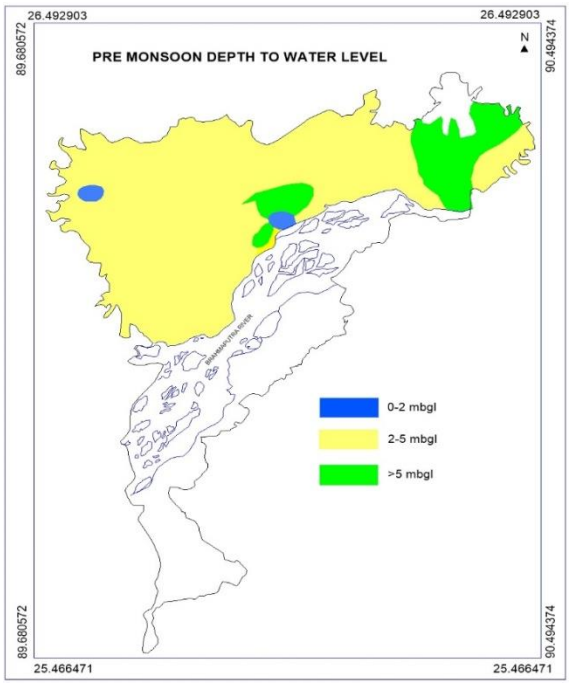

Fig 3.6: Pre monsoon depth to water level

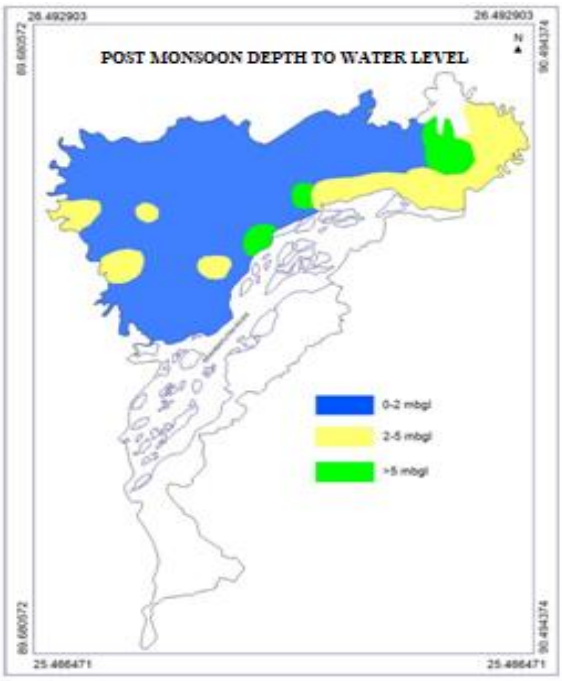

Fig 3.7: Post monsoon depth to water level

3.3 Ground water quality

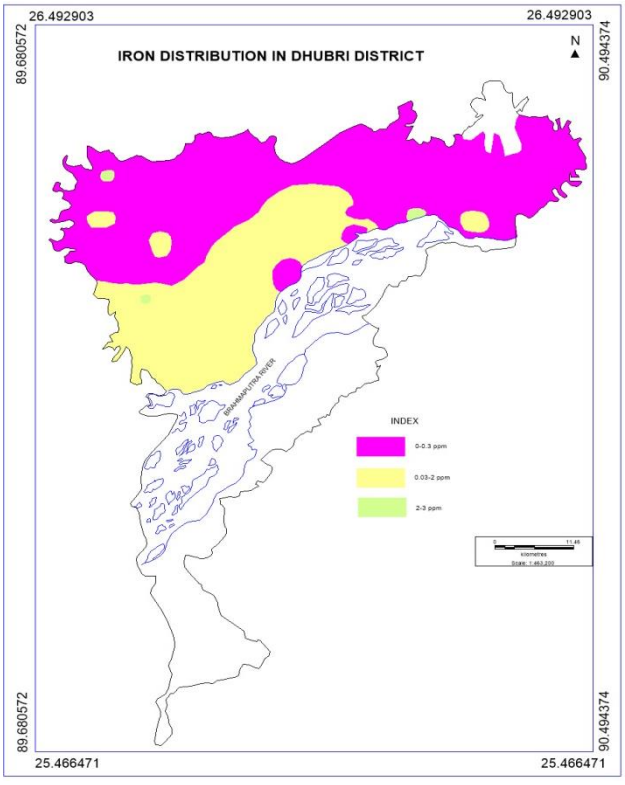

Fig 3.8: Pre monsoon iron distribution

Chemical analysis of ground water samples are carried out by NABL accredited regional chemical laboratory of Central Ground Water Board, North Eastern Region, Guwahati.

Pre-monsoon pH value ranges from 7.29 to 8.90 and in the post-monsoon pH value ranges from 6.03 to 8.41. Pre-monsoon water sample mostly acidic while post-monsoon samples are mostly alkaline in nature. Pre-monsoon iron concentration range in the district is from 0.01mg/l to 2.46 mg/l. Post-monsoon iron concentration is found to be reduced in all the blocks. It is observed that in both pre- and post-monsoon groundwater samples concentration of Ca, Mg, Cl, SO_4, TDS and hardness as $CaCO_3$ are within desirable limit. Location wise concentration range of different chemical elements in groundwater during pre- and post- monsoon in Dhubri district is shown in Table 3.2 and 3.3.

Table 3.2: Pre monsoon water Quality

SN	Location	pH	EC (µs/cm) 25^0C	Turbidity (NTU)	TDS	CO3-2	HCO3-1	TA (as CaCO3)	Cl-	SO4-2	NO3-1	F-	Ca+2	Mg+2	TH (as CaCO3)	Na	K	Fe
					Mg/l													
1	Chapar	7.67	213.00	BDL	105.00	BDL	79.36	79.36	21.27	59.24	0.13	0.18	24.96	6.06	70.00	20.22	8.62	0.19
2	Dakin Tokesara Pt IV	8.52	379.10	0.40	188.40	6.00	128.20	134.20	46.09	102.06	9.94	0.29	89.95	21.83	155.00	2.35	1.86	2.17
3	Dhubri Town	8.90	816.60	BDL	411.40	33.00	360.19	393.19	88.63	34.36	3.79	0.76	64.80	15.73	315.00	88.83	35.80	1.02
4	Shapamari Beat	7.98	121.20	BDL	54.85	BDL	36.63	36.63	10.64	8.09	BDL	0.18	9.99	2.42	25.00	7.76	2.47	0.10
5	Bilasipara	8.17	377.20	0.10	188.30	BDL	115.99	115.99	56.72	69.80	BDL	0.26	54.96	13.34	105.00	26.63	7.53	2.46
6	Shernagar	8.71	295.70	0.10	140.30	9.00	164.83	173.83	10.63	18.55	BDL	0.67	54.95	13.34	120.00	4.41	1.64	0.42
7	Bhidyadabaript 1	7.54	203.40	BDL	101.20	BDL	67.15	67.15	28.36	43.50	BDL	0.21	39.97	9.70	75.00	4.63	1.09	2.41
8	Dighaltari	7.79	133.30	0.30	66.85	BDL	79.36	79.36	10.64	22.95	BDL	0.27	29.98	7.28	55.00	3.95	1.10	0.10
9	Bisondaipt 1	8.55	342.10	BDL	171.60	12.00	152.62	164.62	35.45	70.23	BDL	0.10	39.96	9.70	85.00	36.99	19.84	0.18
10	Harihat Bazar	7.66	445.60	0.60	223.60	BDL	140.41	140.41	60.27	44.18	BDL	0.27	54.92	13.33	160.00	18.74	8.97	0.17
11	Rangamari College	7.52	89.85	BDL	44.54	BDL	97.68	97.68	7.09	8.87	BDL	0.22	19.99	4.85	30.00	7.48	3.95	0.09
12	Khoraghat	8.10	138.80	BDL	69.51	BDL	61.05	61.05	14.18	32.36	BDL	0.09	19.98	4.85	45.00	6.47	6.07	1.63
13	Chirakuta	8.02	259.70	0.40	130.10	BDL	36.63	36.63	60.27	16.64	5.05	0.16	29.98	7.28	60.00	17.65	3.17	0.15
14	Mohisbattan	8.56	303.80	BDL	152.30	6.00	134.31	140.31	24.82	54.97	BDL	0.29	29.93	7.27	115.00	36.91	4.40	1.99
15	Falimari	8.17	90.96	0.30	45.63	BDL	42.73	42.73	10.64	26.23	BDL	0.17	19.99	4.85	30.00	5.91	1.78	0.01
16	Chandardinga	7.55	122.20	0.10	62.37	BDL	73.26	73.26	10.64	41.90	BDL	0.21	34.98	8.49	65.00	2.55	2.15	0.10
17	Madhusaulmari	7.93	383.30	BDL	197.70	BDL	109.89	109.89	56.72	80.15	2.50	0.24	74.94	18.19	145.00	7.33	0.90	1.82
18	Raipur Part I	8.33	1178.00	BDL	606.60	15.00	280.82	295.82	173.71	98.79	0.31	0.30	184.87	44.87	345.00	5.73	4.94	0.62
19	Boramari	8.80	721.70	BDL	361.90	18.00	219.78	237.78	95.72	71.98	BDL	0.41	89.92	21.82	195.00	47.44	3.98	0.40
20	Dudhnath	8.19	104.50	0.10	50.42	BDL	24.42	24.42	10.63	20.10	BDL	0.21	9.99	2.43	20.00	8.03	0.33	0.31
21	Sonamukhi	8.85	1050.00	0.10	530.50	15.00	238.09	253.09	120.53	118.65	BDL	0.20	214.94	52.17	295.00	62.07	48.54	0.39
22	Modhargula	8.13	219.70	BDL	102.90	BDL	91.57	91.57	10.63	49.57	BDL	0.51	39.97	9.70	75.00	5.52	1.92	1.87
23	ChaurangiMor	8.07	309.60	BDL	156.40	BDL	122.10	122.10	35.45	53.82	1.16	0.33	44.94	10.91	115.00	14.98	1.34	0.59
24	AtaniRajbari	7.96	180.70	BDL	90.79	BDL	91.57	91.57	14.18	30.89	BDL	0.23	34.95	8.48	95.00	3.20	1.60	0.29

25	Salbanda (Borkanda sub centre)	7.29	230.00	BDL	116.00	BDL	73.26	73.26	31.91	22.97	2.61	0.41	24.97	6.06	65.00	13.73	3.42	0.15
26	Sonamukhi	7.86	229.70	BDL	115.70	BDL	158.73	158.73	7.09	58.48	BDL	0.14	59.95	14.55	120.00	4.91	0.59	0.47
27	Satguri	7.55	73.22	BDL	36.44	BDL	48.84	48.84	7.09	40.24	BDL	0.28	24.99	6.07	35.00	5.05	0.84	1.10
28	Didharpara	8.51	855.90	0.30	430.50	21.00	195.36	216.36	155.98	72.66	0.31	0.33	124.91	30.32	240.00	44.32	3.52	1.39
29	Dafarpur	8.65	439.10	BDL	222.60	9.00	158.73	167.73	42.54	13.33	4.50	0.38	44.94	10.91	120.00	16.54	19.86	0.75
30	Sarpamari	8.15	167.20	0.20	83.33	BDL	97.68	97.68	10.64	21.49	BDL	0.44	29.98	7.28	55.00	8.64	2.97	BDL
31	Chandardinga	8.62	254.90	0.10	128.50	12.00	170.94	182.94	7.09	7.87	BDL	0.42	34.96	8.48	90.00	18.31	0.55	1.91
32	Dudhnath	7.89	259.30	BDL	130.20	BDL	158.73	158.73	10.64	21.00	BDL	2.40	49.95	12.12	110.00	5.09	1.36	2.20

Table 3.3: Post monsoon water quality

SN	Location	pH*	EC* µS/cm at 25°C	Turbidity (NTU)	TDS	CO_3	HCO_3	TA as $CaCO_3$*	Cl*	SO_4	NO_3	F^-	Ca*	Mg*	TH (as CaCO3)	Na*	K*	Fe
					Mg/l													
1	Chapar	7.31	637.60	BDL	373.80	BDL	235.19	235.19	159.53	17.11	BDL	0.45	22.02	42.47	230.00	56.18	34.11	0.39
2	DakhinTokesara Part IV	7.33	650.40	BDL	380.40	BDL	235.19	235.19	116.99	18.53	1.69	0.67	28.02	53.38	290.00	24.91	3.19	0.21
3	Dhubri Town	6.09	38.75	BDL	22.91	BDL	35.03	35.03	28.36	3.68	BDL	0.03	8.01	2.42	30.00	21.65	2.16	0.03
4	Shapamari Beat	6.78	202.50	BDL	118.20	BDL	105.08	105.08	24.82	2.57	BDL	0.61	16.01	19.41	120.00	4.44	0.79	4.44
5	Shernagar	6.96	305.80	BDL	178.60	BDL	120.10	120.10	53.18	18.97	BDL	0.18	18.01	16.98	115.00	20.59	12.18	0.37
6	Bhidyadabaript 1	6.25	58.69	0.20	34.33	BDL	45.04	45.04	17.73	5.19	BDL	0.06	8.01	4.85	40.00	8.74	2.46	0.10
7	Dighaltari	8.41	293.20	BDL	172.40	30.00	85.09	115.09	63.81	19.48	BDL	0.11	20.02	6.06	75.00	49.79	20.57	0.08
8	Bisondaipt 1	8.32	632.70	BDL	372.10	60.00	140.16	200.16	159.53	20.33	1.41	0.29	22.02	40.04	220.00	34.20	16.99	0.33
9	Harihat Bazar	6.16	86.63	BDL	50.63	BDL	60.05	60.05	21.27	9.39	BDL	0.09	10.01	9.70	65.00	1.88	1.95	9.50
10	Batuatuli	6.25	38.31	BDL	22.51	BDL	25.02	25.02	21.27	3.08	BDL	0.05	2.00	6.07	30.00	11.24	3.91	BDL
11	Rangamari College	6.43	106.50	BDL	63.55	BDL	50.04	50.04	17.73	10.65	BDL	0.23	4.00	13.35	65.00	7.11	3.40	0.19
12	Khoraghat	5.70	210.10	BDL	124.40	BDL	25.02	25.02	102.81	7.68	1.24	0.05	10.01	10.92	70.00	42.89	6.19	0.07
13	Chirakuta	7.30	302.30	BDL	179.70	BDL	165.13	165.13	39.00	23.19	BDL	0.36	56.04	10.90	185.00	15.00	10.51	0.47
14	Mohisbattan	6.03	63.47	BDL	37.80	BDL	20.02	20.02	35.45	6.18	BDL	0.03	4.00	4.85	30.00	16.89	9.51	0.10
15	Falimari	8.34	182.70	BDL	109.80	20.00	120.11	140.11	39.00	6.80	BDL	-	20.02	20.62	135.00	19.26	2.79	0.62
16	Panbari BSF	6.84	141.20	BDL	83.98	BDL	85.07	85.07	24.82	15.53	BDL	0.34	22.02	13.34	110.00	4.52	1.16	0.14

CHAPTER 4.0

Ground water Resources

Out of the total geographical area of the unit, hilly areas wherever slope is greater than 20% are to be identified and subtracted as these areas have more runoff than infiltration. The hilly areas wherever slope is more than 20% may be demarcated using DEM data and geomorphological maps.

The rechargeable area is found to be 166400 ha. As block boundary is not available, it was not possible to carry out block wise resource calculation. Here district wise resource calculation is presented. Ground water resources assessment of the state was done based on the recommendations of Ground Water Estimation Committee – 2015 (GEC'15).

Data and assumptions used in the assessment: Following data and assumptions are used in the assessment:

1) Rainfall recharge has been computed by both RIF and WLF methods. Rainfall infiltration factor of 22% for valley fill as per norms is taken for calculation. In WLF method, specific yield has been taken as 0.16 for valley fill deposit following the norms recommended by GEC'2015. The rainfall of Dhubri district is 1963.5mm.
2) Water level data has been considered for 2018-19. Water level fluctuation based on data of March (Pre monsoon) and November (post monsoon) has been considered. The average pre- and post-monsoon water level of Dhubri district is 9.29mbgl and 7.91mbgl respectively. The average water level fluctuation is 0.35m
3) The population figures were collected from Census, 2011and projected to 2020. The per capita domestic requirement is considered as 60 lpcd.

Recharge: The aquifers of the study area are recharged by rainfall. The area experiences south-east monsoon(June, July, August, September).

The monsoon recharge of the 213541 ha of recharge worthy area is 77328.96ham while non-monsoon recharge is 24230.59ham. Recharge from other sources is 8948.01ham. Total ground water recharge is 95041.77ham.

Extraction: Total groundwater extraction for irrigation purpose is 234570.40 ham. Total domestic extraction is 5042.92ham.Total groundwater extraction of Dhubri district is 28613.34ham.

Allocation of resources up to 2025: The net ground water resource is allocated for domestic use 5640.95ham. Net available resource for future use is 56326.25ham.

Groundwater is mainly utilized for domestic purposes. The stage of groundwater extraction in the district is 33.45%.

Table 4.1: Net groundwater availability, existing draft and stage of development for 2020

Recharge worthy area Ha	Total annual GW recharge Ham	Environmental flow Ham	Annual extractable GW resource Ham (2-3)	Existing gross GW draft for all uses Ham	Stage of GW extraction [(5/4)*100%]
1	2	3	4	5	6
213541	95041.77	8503	85537.60	28613.34	33.45%

Static resource: Here also the administrative district has been considered as the assessment unit due to paucity of block-wise data. Hilly areas having slope more than 20% are deleted from the total area to get the area suitable for recharge. The average thickness of saturated unconfined aquifer below ground level as obtained from dug wells / bore wells in the district has been considered.

The Pre-monsoon (month of March) Water Level from Monitoring Wells of CGWB in D district has been considered as the maximum depth below ground level up to which the zone of Dhubriwater level fluctuation occurs. Since the north eastern states receives pre-monsoon showers, which commences from the first week of April, resulting in rise in water levels in the phreatic zones, the deepest water levels are recorded during the month of March. Specific yield value of 0.12 is considered for the district.

(e) Finally the Static Ground Water Resource is computed from the data as obtained:

$$Y = A^* (Z_1 - Z_2)^* Sy$$

Where, Y = Static ground water resources,

A = Area of ground water assessment unit

Z_1 = Thickness of saturated unconfined aquifer below ground level

Z_2 = Pre-monsoon water level

Sy = Specific yield of the unconfined aquifer

Table 4.3: Salient information of static resource of Dhubri district, Assam

Type of rock formation	Total Geographical Area Ha	Assessment Area Ha	Bottom of the unconfined aquifer (m)	Average Pre-monsoon Water Level (m)	Thickness of the saturated zone of the un-confined aquifer below WLF zone (m) [(5)-(6)]	Volume of Saturated zone of the unconfined aquifer below WLF zone (ham)
2	3	4	5	6	7	8
Alluvium	217600	213154	23.31	8.31	31.69	6754850.26

Static/In-storage Ground Water Resources (ham): Volume of saturated zone X specific yield

=6754850.26X0.12= 810582.0312ham

CHAPTER 5.0

Groundwater Related Issues

5.1 Identification of issues

The main groundwater issues identified in the district are-low stage of groundwater extraction, water logging and high iron concentration and Flouride detection.

Water logging: Water logged areas are observed in four blocks. The post monsoon depth-to-water level varies from 0.53 to 17.56 mbgl. The pre-monsoon depth-to water level varies from 1.86 to 18.28 mbgl.

Water logged areas are found in the alluvial plain, flood plain and gently sloping piedmont zone. In the water logged areas high iron concentration is observed.

High iron contamination: Iron content in ground water, above acceptable limit is found in some areas.

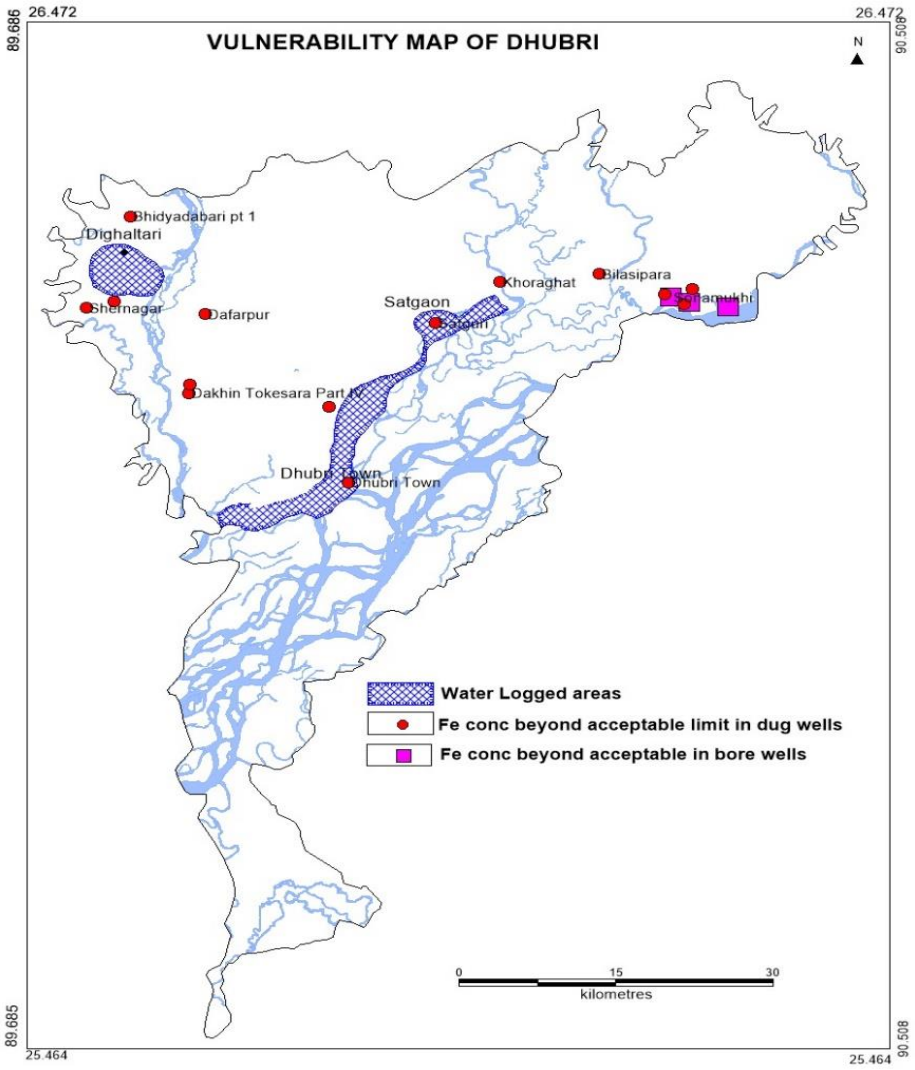

Fig. 5.1: Vulnerability map of Dhubri district, Assam

5.5 Future demand

Future demand of ground water is analyzed for domestic and for irrigation purpose

Domestic purpose: The domestic requirement is worked out for projected block population and requirement is considered as 60litre per person per day.

Table 5.1: Projected population and water demand for domestic purpose of the area

Census 2011 Population	Decadal growth	Projected Population		Projected water demand (ham)	
		2020	2025	2020	2025
1949258	24.44	237 8017	2668611	5042.94	5640.95
Total		237 8017	2668611	5042.94	5640.95

5.6 Future demand for agriculture

Future Water demand of the district for agricultural sector is assessed by projecting cropping intensity to 200% through assured irrigation in agricultural field. As per District Irrigation Plan, 2016-20, Dhubri, the net sown area of the district is **135112.5** ha and area sown more than once is **93246.51**ha. The gross cropped area of the district is **230511.8** ha and the cropping intensity is nearly 170%. The rainfed or un-irrigated area of the district is **90509** ha and net irrigated area is **44689.69**ha.

The crop water requirement for unirrigated area of the district is estimated based on soil condition, flooding and geomorphic classification using FAO's Cropwat 8.0 software following guidance of Assam Agriculture University.

5.7. Stress Aspects of aquifer

The stress aspects of aquifer is worked out after finding water requirement in various sector and comparing the requirement with allocation of dynamic groundwater in various sector up to 2025.

Table. 5.2: Water requirement for the district

Drinking water requirement up to 2025 Ham	Water requirement to increase the cropping intensity to 200% Ham	Water allocated for domestic purposes up to 2025 Ham	Water allocated for future use up to 2025 Ham
5640.95	31679.47	5640.95	56326.25

5.2.3 Supply and demand gap

It is observed that drinking water allocation is sufficient to meet the future demand and it will not give additional stress in the aquifer. Irrigation water demand can suitably be met from future allocation of resources. Details of supply gap analysis for drinking water and for irrigation are given in Table. 5.2 & 5.3 respectively.

Table 5.3: Supply and demand gap in irrigation

Total irrigation demand Ham	Water allocated for future use Ham	Gap between supply and demand Ham
31679.47	56326.25	24646.78

CHAPTER 6.0

MANAGEMENT STRATEGIES

6.1 MANAGEMENT STRATEGIES

Dhubri district has extractable ground water resource of 85537.60ham and its stage of ground water development is 33.45%. The district has a balance of 56326.25hamground water availability for future use. From the available resource (planned for future development) 9428 nos. of tube wells (considering a unit draft of 3.36 ham/year) can be constructed. Therefore, there is enough scope for future development of ground water in the study area to bring more area under irrigation practice.

Present minor irrigation schemes are using surface water sources only and irrigation from ground water sources is almost nil. Hence, there is ample scope for ground water development for irrigation purpose which will bring prosperity to the society and help the district in achieving self-reliance on food grain. To use the groundwater for irrigation purposes a cropping plan has been designed for the district by using CROPWAT model developed by FAO. A suitable cropping plan for the district was prepared in consultation with Water Management Division of ICAR. Cropping pattern data for the district is presented inTable 6.1.

Net sown area in the district is 135112.5(Source: District Agriculture contingency plan), ha and cropping intensity is 170%. The net sown area included field crops as well as horticulture and plantation crops cultivated on hills and their slopes. Main source of income is paddy with surplus production than its requirement. Jute and mustard seed occupy the major share of cash crops. From forest mainly timber and bamboo add to the income though boulder and sand. Fish, milk, meat and egg have small contribution to the economy. During kharif season, paddy is cultivated in 46,400 ha. After Kharif crops are over major portion of this area remains fallow during Rabi season. The purpose of this plan is to utilize the fallow land about 46,400 ha under assured irrigation during Rabi season which will help to increase gross cropped area to 92800 ha and thereby increase cropping intensity up to 200%. In rice fallowwheat, oilseeds, summer vegetable, winter vegetables, pulses, potato and and summer paddy can be grown with the support of irrigation. Present cropping pattern, proposed cropping pattern, targeted increase in cropping intensity were shown in Table 6.1. & 6.2

Crop-wise and month-wise precipitation deficit has been estimated using CROPWAT after giving necessary meteorological, soil, crop plan inputs given in Table 6.3. Crop-wise andmonth-wise Irrigation water deficit and requirement in ham has been further calculated in Table 6.4.

Table 6.1. Cropping pattern, proposed cropping pattern, intended cropping intensity

Cropping pattern (s)				
Rice based cropping pattern				
Winter paddy	Present Cultivated area (**ha**)	Area to be cultivated (**ha**)	Area to be cultivated (**%**)	Irrigation requirement (**ha m**)
	1	2	3(= % of 1)	4
Winter Paddy (main crop)	46400	46400	100	7247.68
Summer paddy	0	13920	30	5606.28
Wheat	0	4640	10	3354.488
Pulses	0	4640	10	788.8
Summer vegetable	0	6960	15	1048.3152
Winter vegetable	0	6960	15	1116.848
Oilseed	0	2320	5	1382.256
Potato	0	6960	15	1630.96
Net cultivated area	46400			
Gross cultivated area (winter paddy +summer paddy/+wheat/+ pulses/+ summerVeg /+winter Veg/+ oilseed/+potato)		**92800**		
Total irrigation requirement				**22175.65**
Cropping intensity	**100% (Present)**	**200% (Intended)**		
Total (Dhubri district)			Considering irrigation efficiency as 70 %	**31679.47**

Table 6.2. Proposed cropping pattern with water deficit months and IWR, Dhubri district

Rice based cropping pattern			
Crop	**Growing period (Months)**	**Periods/months of water deficit**	**Irrigation requirement (ha m)**
Winter paddy	5	4	7247.68
Summer paddy	4	6	5606.28
Wheat	4	4	3354.488
Pulses	4	5	788.8
Summer vegetable	4	4	1048.3152
Winter vegetable	4	5	1116.848
Oilseed	4	6	1382.256
Potato	5	6	1630.96
		Total	**22175.65**
		Considering irrigation efficiency as 70 %	**31679.47**

The total area of winter paddy cultivation is comprised of (46400 ha) 50 % of the targeted cultivated area of 92800 ha. During kharif season, winter paddy is cultivated from June to mid-July. Since this huge area cannot be cultivated in a single day (one planting date), so it is considered/ planned to cultivate rice in six stages (one covering 10%, two stages covering 15% each and another three stages covering 20% each) during this period.

Potato and oilseed cultivation are done in the month of November-December to March-April, pulses are cultivated during October to November. Vegetables are cultivated from September to December and again from February to April.

The plan is to utilize Winter paddy fallow of 46,400 ha for the cultivation of summer paddy, wheat, potato, oilseeds, pulses and vegetables. It is contemplated to cultivate summer paddy in an area of 13920 ha,wheat and pulses in an area of 4640 ha each, oilseed in an area of 2320 ha summer vegetables, winter vegetables and potato in an area covering 4,840 ha each and Potatoes and vegetables in an area of 6960 ha each.

The peak water requirement for irrigation of winter paddy is during the month of June and for summer paddy is October. For potato it is in the month of February, for wheat and pulses during the month of January, oilseed during March and forsummer vegetables and winter vegetables during the month of March and December.

Table 6.3: Precipitation deficiency (mm)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Winter paddy	0	0	0	0	147	51.1	0	0	0	6.1	0	0
Winter paddy	0	0	0	0	49	98	0	0	0	5.9	0	0
Winter paddy	0	0	0	0	48.4	97.5	0	0	0	0	0	0
Winter paddy	0	0	0	0	0	147.1	0	0	0	5.5	0	0
Winter paddy	0	0	0	0	0.5	146.5	0	0	0	0	0	0
Winter paddy	0	0	0	0	0	48.9	98	0	0	2.6	8.8	0
Summer Paddy	61.9	14.3	0	0	0	0	0	0	48.9	104.3	70.7	70.7
Summer Paddy	64.8	70.4	0	0	0	0	0	0	0.4	202.3	68.9	70.2
Summer Paddy	64.9	77.9	24.7	0	0	0	0	0	0	54.4	217.8	69.4
Wheat	61.9	47.5	0	0	0	0	0	0	0	0	14.4	53.3
Pulses	61.7	23.5	0	0	0	0	0	0	0	2.4	21.9	60.5
Oilseed	49.6	62.8	74	28.4	0	0	0	0	0	0	5.2	35.8
Summer Vegetables	3.2	47.9	79.1	41	0	0	0	0	0	0	0	0
Summer Vegetables	0	23.4	61.3	42.4	0	0	0	0	0	0	0	0
Winter Vegetables	26.7	0	0	0	0	0	0	0	0	0	47.6	62
Winter Vegetables	56.1	27.1	0	0	0	0	0	0	0	0	34.2	53.1
Winter Vegetables	55.6	54.4	0	0	0	0	0	0	0	0	17.3	47.3
Potato	61	43.8	0	0	0	0	0	0	0	0	35	66.9
Potato	52	78	84.4	0.9	0	0	0	0	0	0	1.2	30.3
Potato	51	78	85.7	4.8	0	0	0	0	0	0	0	30

Table 6.4: Irrigation water requirement (ham) of Dhubri district

Crop	Area (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total IWR (Ham)
Winter paddy	10	0	0	0	0	682.08	237.104	0	0	0	28.304	0	0	947.488
Winter paddy	15	0	0	0	0	341.04	682.08	0	0	0	41.064	0	0	1064.184
Winter paddy	20	0	0	0	0	449.152	904.8	0	0	0	0	0	0	1353.952
Winter paddy	20	0	0	0	0	0	1365.088	0	0	0	51.04	0	0	1416.128
Winter paddy	20	0	0	0	0	4.64	1359.52	0		0	0	0	0	1364.16
Winter paddy	15	0	0	0	0	0	340.344	682.08		0	18.096	61.248	0	1101.768
Summer Paddy	10	143.608	33.176	0	0	0	0	0	0	113.448	241.976	164.024	164.024	860.256
Summer Paddy	10	300.672	326.656	0	0	0	0	0	0	1.856	938.672	319.696	325.728	2213.28
Summer Paddy	10	451.704	542.184	171.912	0	0	0	0	0	0	378.624	505.296	483.024	2532.744
Wheat	10	287.216	220.4	0	0	0	0	0	0	0	0	66.816	247.312	821.744
Pulses	10	286.288	109.04	0	0	0	0	0	0	0	11.136	101.616	280.72	788.8
Oilseed	5	115.072	145.696	171.68	65.888	0	0	0	0	0	0	12.064	83.056	593.456
Summer Vegetables	7	11.8784	177.8048	293.6192	152.192	0	0	0	0	0	0	0	0	635.4944
Summer Vegetables	8	0	76.0032	199.1024	137.7152	0	0	0	0	0	0	0	0	412.8208
Winter Vegetables	5	61.944	0	0	0	0	0	0	0	0	0	110.432	143.84	316.216
Winter Vegetables	5	130.152	62.872	0	0	0	0	0	0	0	0	79.344	123.192	395.56
Winter Vegetables	5	128.992	126.208	0	0	0	0	0	0	0	0	40.136	109.736	405.072
Potato	5	141.52	101.616	0	0	0	0	0	0	0	0	81.2	155.208	479.544
Potato	5	120.64	180.96	195.808	2.088	0	0	0	0	0	0	2.784	70.296	572.576
Potato	5	118.32	180.96	198.824	11.136	0	0	0	0	0	0	0	69.6	578.84
IWR (HAM)		**2298.006**	**2283.576**	**1230.946**	**369.0192**	**1476.912**	**4888.936**	**682.08**		**115.304**	**1708.912**	**1544.656**	**2255.736**	**18854.08**

Based on available groundwater resource and exploration data, the approximate numbers of tube wells that can be constructed in the district are worked out.It is deciphered that the aquifer in most parts the district is having low to moderate potentiality, having an average discharge of about 20 m^3/hr and can be sustainably developed and used for irrigation purposes.

A tube well in the area is expected to yield 20 m^3/hr. If such a tube well runs for 8 hrs/day for 120 days, then it will create a draft of 1.92 ham. Tube wells can be designed within a depth of 40 m.

In the considered net sown area of 46400 ha, 16,499 nos. of tube wells can be constructed. It is recommended to keep at least 200 m safe distance between any two tube well.

Annual irrigation water requirement is 31679.47. The annual extractable resource available for future use is 85537.60 ham which is enough to provide irrigation for the area under consideration as per the proposed cropping plan.

Under PMKSY 100 nos of shallow tube wells have been constructed by irrigation dept. As such no of tube wells to be constructed to bring 46400 ha of rice fallow land under assured irrigation is 16399 (16,499-100=16399).

Conjunctive use of surface and ground water is highly recommended. Groundwater development may be regulated by permitting development only in the areas where water supply from surface water source is not sufficient. Further, rainwater harvesting techniques should be encouraged and brought to practice.