केंद्रीय भूमि जल बोर्ड
जल संसाधन, नदी विकास और गंगा संरक्षण
विभाग, जल शक्ति मंत्रालय
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

KANSABEL BLOCK, JASHPUR DISTRICT, CHHATTISGARH

उत्तर मध्य छत्तीसगढ़ क्षेत्र, रायपुर
North Central Chhattisgarh Region, Raipur

2020

भारत सरकार

Government of India

जल शक्ति मंत्रालय, जल संसाधन, नदी विकास एवं गंगा संरक्षण बिभाग

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केन्द्रीय भूमि जल बोर्ड

Central Groundwater Board

कांसाबेल बिकाशखंड, जशपुर जिला, छत्तीसगढ़ के जलभृत नक्शे एवं भूजल प्रबंधन योजना

Aquifer Maps and Ground Water Management Plan of Kansabel Block, Jashpur District, Chhattisgarh

केन्द्रीय भूमि जल बोर्ड

उत्तर मध्य छत्तीसगढ़ क्षेत्र

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AQUIFER MAPS AND GROUND WATER MANAGEMENT PLAN, KANSABEL BLOCK, JASHPUR DISTRICT, CHHATTISGARH

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AQUIFER MAPPING AND MANAGEMENT PLAN FOR KANSABEL BLOCK (JASHPUR DISTRICT), CHHATTISGARH

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KANSABEL BLOCK

1. SALIENT INFORMATION:

1.1 About the area: Kansabel Block is situated on the southwestern part of Jashpur district of Chhattisgarh and is bounded on the north by Kunkuri and Bagicha Block, in the west by Sarguja district, in the south by Pathalgaon and Pharsabahar block and in the east by Duldula Block. The block area lies between 22.529 and 22.761 N latitudes and 83.627 and 83.967 E longitudes. The geographical extension of the study area is 507.15 sq. km representing around 08 % of the district's geographical area. Administrative map of the block is shown in Figure 1. The major part of the block is comprises of pediment or pediplain on Chotanagpur granitic gneiss. Except the northern part of the block is comprises of denudational hills and plateau. Geomorphological map is shown in Figure 2. The major drainage of the block includes Ghughri Nala, Ib river and Maini river, which are parts of middle Mahanadi basin. Drainage map shown in Figure 3.

1.2 Population: The total population of Kansabel block as per 2011 Census is 76735 out of which rural population is 76735 while there is no population. The population break up i.e. male- female, rural & urban is given below -

Table 1 Population Break Up

Block	Total population	Male	Female	Rural population	Urban population
Kansabel	76735	37840	38895	76735	0

Source: CG Census, 2011

1.3 Growth rate: The decadal growth rate of the block is 10.87 as per 2011 census.

1.4 Rainfall: The study area receives rainfall mainly from south-west monsoon. About 87% of the annual rainfall is received during June to September and July and August are the months of maximum precipitation. The area gets some rainfall during winter season also. Average annual rainfall in the study area is (Average of the last five years i.e. 2013 to 2017) 745.42 mm with 70 to 80 rainy days.

Table 2 Rainfall data in Kansabel block in mm

Year	2013	2014	2015	2016	2017
Annual rainfall	713.2	795.2	479.7	814	925

Source: IMD

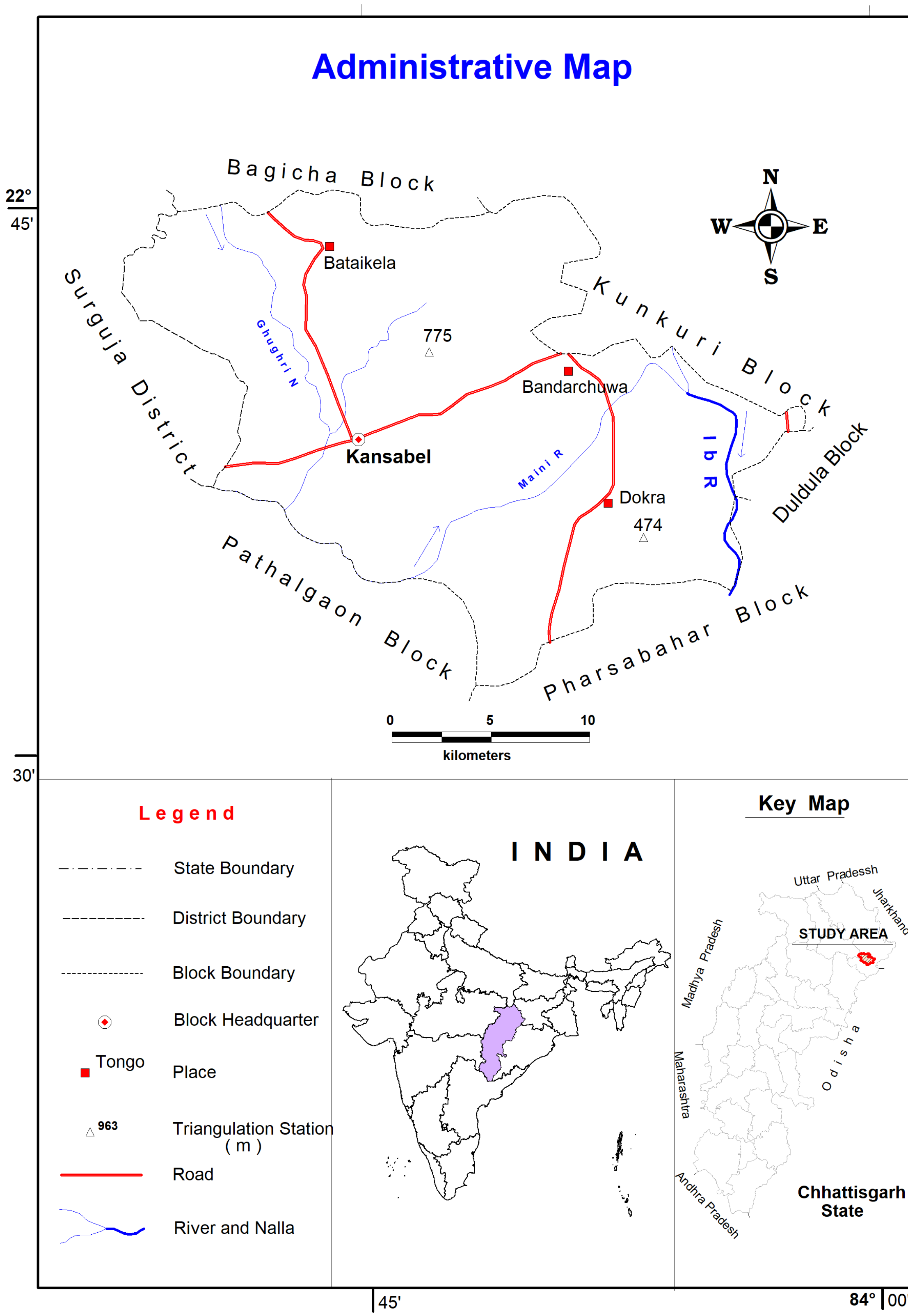

Figure 1 Administrative Map of the Block

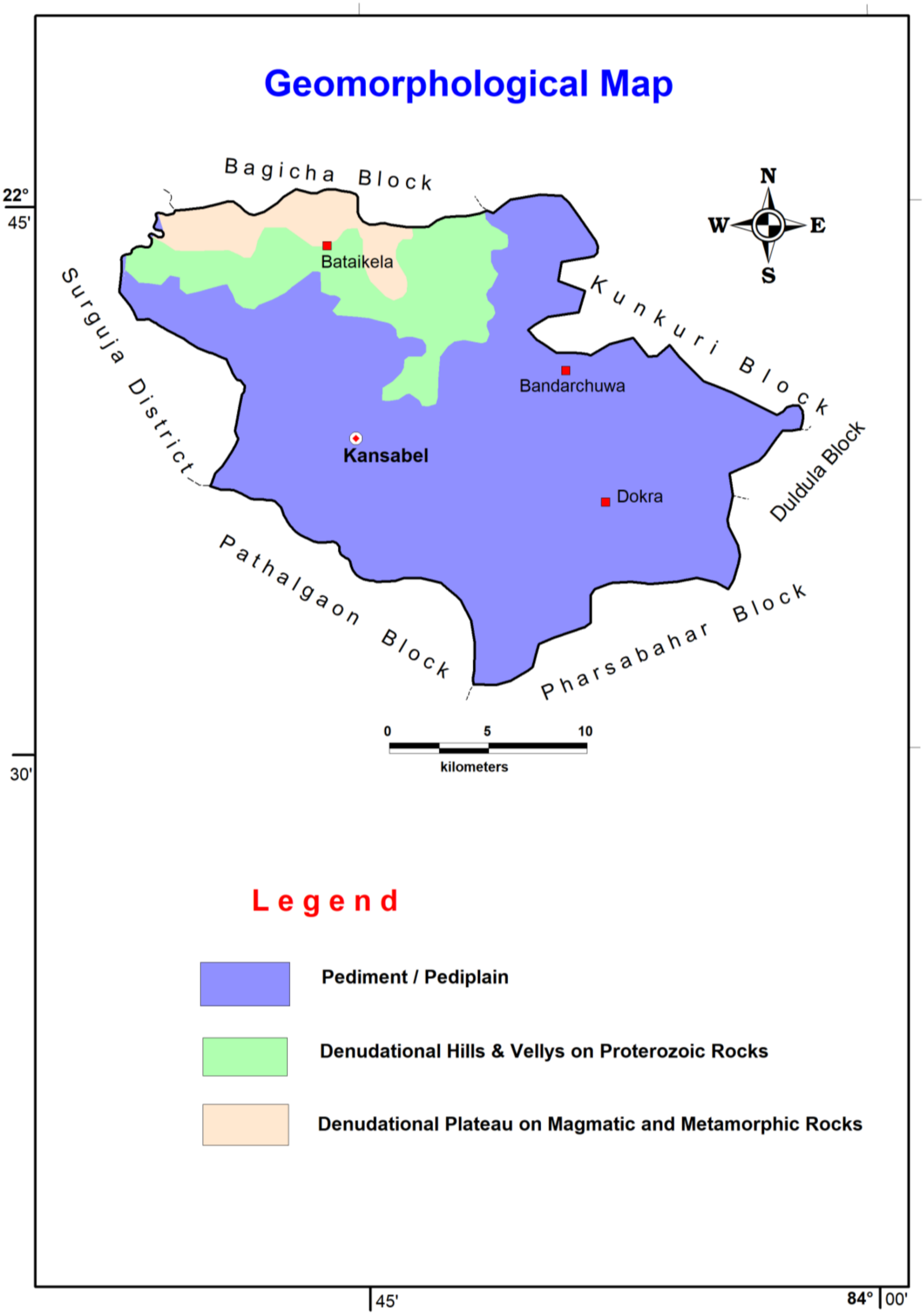

Figure 2 Geomorphological Map of the Block

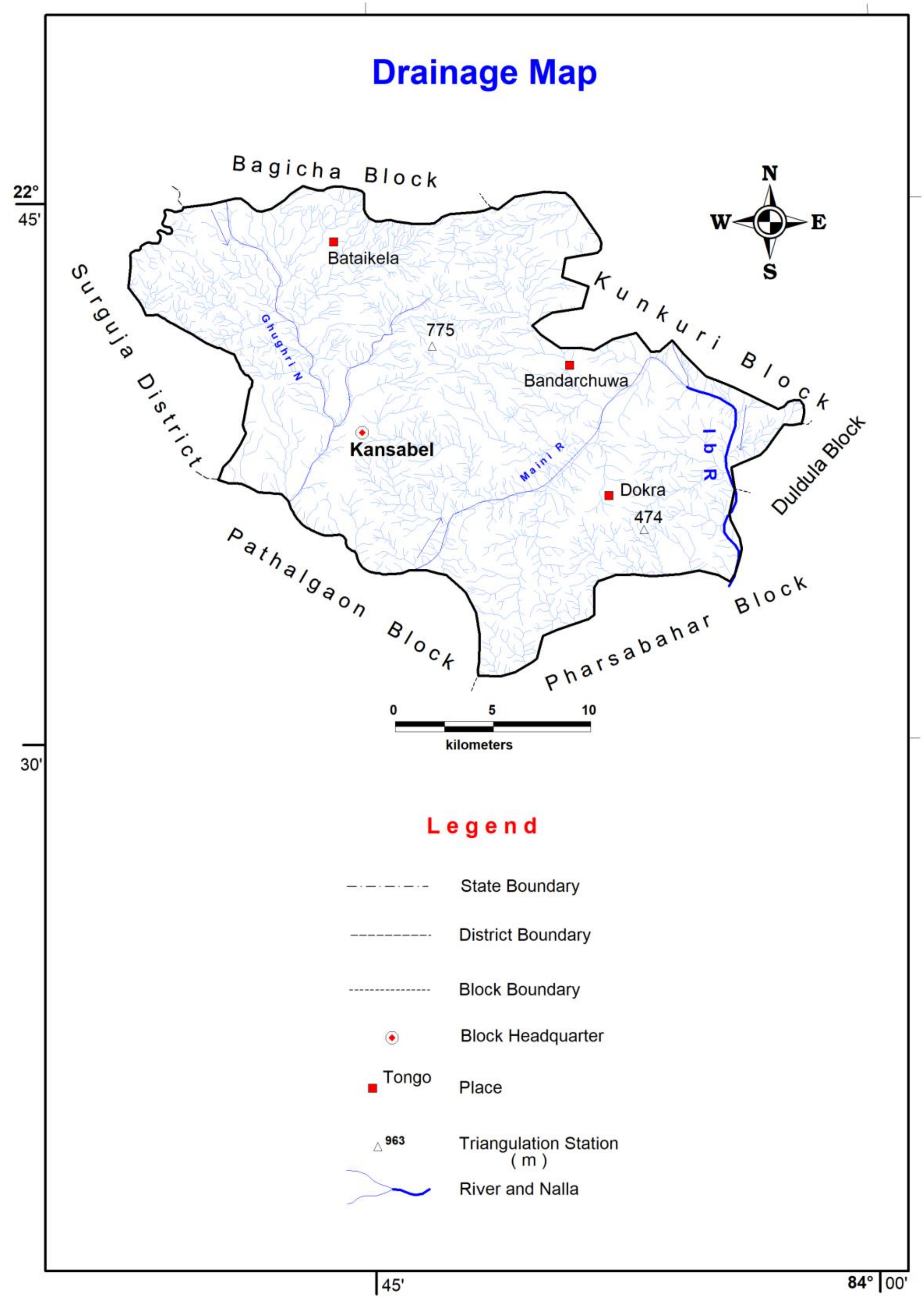

Figure 3 Drainage Map of the Block

1.5 Agriculture and Irrigation: Agriculture is practiced in the area during Kharif and Rabi season every year. During the Kharif, cultivation is done through rainfall while during the Rabi season; it is done through ground water as well as partly through surface water like canals and other sources. The groundwater abstraction structures are generally Dugwells, Borewells /tubewells. The principal crops in the block are Paddy, Wheat, Vegetables and pulses. In some areas, double cropping is also practiced. The agricultural pattern, cropping pattern and area irrigated data of Kansabel block is given in Table 3, 4, 5 & 6

Table 3 Land use and Agricultural pattern (in ha)

Total geographical area	Revenue forest area	Area not available for cultivation	Non-agricultural & Fallow land	Agricultural Fallow land	Net sown area	Double cropped area	Gross cropped area
42192	4848	6134	3284	447	24396	844	25240

Table 4 Cropping pattern (in ha)

Kharif	Rabi	Cereal				Pulses	Tilhan	Fruits and Vegetables	Mirch Masala	Sugarcane
		Paddy	Wheat	Jowar & Maize	Others					
24342	898	18766	14	186	0	3111	2464	604	69	2

Table 5 Area irrigated by various sources (in ha)

No. of canals (private and Govt.)	Irrigated area	No. of bore wells/ Tube wells	Irrigated area	No. of dug wells	Irrigated area	No. of Ponds	Irrigated area	Irrigated area by other sources	Net Irrigated area	Gross irrigated area	% of irrigated area wrt. Net sown area
3	123	87	19	1651	181	183	3	251	577	593	2.43

Table 6 Statistics showing Irrigation by Ground water

Net Irrigated Area	Net Irrigated Area by ground water	Percentage of Area Irrigated by ground water
577	200	35

1.6 Groundwater Resource Availability and Extraction: Based on the resource assessment made, the resource availability in aquifer wise in Kansabel block is given in the table-4.

Table 7 Ground Water Budget of Kansabel block in Ham

Ground Water Recharge (Ham)				Total Annual Ground Water (Ham) Recharge	Total Natural Discharges (Ham)
Monsoon Season		Non-monsoon season			
Recharge from Rainfall	Recharge from Other Sources	Recharge from Rainfall	Recharge from Other Sources		
2748.44	179.85	422.87	387.01	3738.17	373.82

Table 8 Ground Water Dynamic Resource (Unconfined Aquifer) of Kansabel block in Ham

Annual Extractable Ground Water Recharge (Ham)	Current Annual Ground Water Extraction (Ham)				Annual GW Allocation for Domestic Use as on 2025	Net Ground Water Availability for future use	Stage of Ground Water Extraction (%)	Categorization (OE/Critical/Semicritical/Safe)
	Irrigation Use	Industrial Use	Domestic Use	Total Extraction				
3364.35	1294.50	179.01	16.00	1489.51	193.63	1860.22	44.27	Safe

Table 9 Ground Water Static Resource (Unconfined Aquifer) and Dynamic Resource (Confined Aquifer) of Kansabel block in Ham

Static Resources Area (Ha)	Difference Piezometric Head (Pre-post) m	Storativity (S)	Dynamic Ground Water Resource of Confined Aquifer (Ham)	Bottom level of the top confining layer (m)	In storage Ground Water Resource of Unconfined Aquifer (Ham)	Sum of Dynamic GW (Confined Aquifer) and In storage GW (Unconfined Aquifer) resource (Ham)
50715	5.2	0.00025	57.49	200.00	2338.51	2395.99

Table 10 Total Resourses in Kansabel Block (in MCM)

Block	**Dynamic Resources (MCM)**		**Insitu Resources (MCM)**		**Total Resources (MCM)**
	Aquifer I	**Aquifer II**	**Aquifer I**	**Aquifer II**	
Kansabel	33.64	0.57	23.39	92.41	150.02

1.7 Existing and Future Water Demand (2025): The existing draft for irrigation in the area is 1294.50 Ham while the total extraction for all uses is 1489.51 Ham. At present scenario to meet the future demand for water, a total quantity of 1860.22 ham of ground water is available for future use.

1.8 Water Level Behavior:

(i) Pre-monsoon water level: In the pre-monsoon period, it has been observed that in Kansabel block, water level in dugwells (phreatic aquifer) varies between 3.43 to 10.95 mbgl with average water level of 6.6 mbgl. Water level in semiconfined aquifer, varies between 7.22 to 21.33 mbgl with average water level is 13.63 mbgl.

Table 11 Phreatic aquifer Depth to Water Level in mbgl (Pre-monsoon)

Block Name	Phreatic Aquifer		
	Min	Max	Avg
Kansabel	3.43	10.95	6.6

Table 12 Semiconfined Aquifer Depth to Water Level in mbgl (Pre-monsoon)

Block Name	Semiconfined Aquifer		
	Min	Max	Avg
Kansabel	7.22	21.33	13.63

(ii) Post-monsoon water level**:** In the post-monsoon period, it has been observed that the water level varies from 1.1 to 6.03 mbgl with an average of 3.55 mbgl in phreatic aquifer. In semiconfined/fractured formation, the post monsoon water level variation range is 4.34 to 12.45 mbgl with average of 8.43 mbgl.

Table 13 Phreatic Aquifer Depth to Water Level in mbgl (Post-monsoon)

Block Name	Phreatic Aquifer		
	Min	Max	Avg
Kansabel	1.1	6.03	3.55

Table 14 Semiconfined Aquifer Depth to Water Level in mbgl (Post-monsoon)

Block Name	Semiconfined Aquifer		
	Min	Max	Avg
Kansabel	4.34	12.45	8.43

(iii) Seasonal water level fluctuation: The water level fluctuation data indicates that in Kansabel block, water level fluctuation in phreatic aquifer varies from 1.22 to 8.25 mbgl with an average fluctuation of 3.48 mbgl. Water level fluctuation in semiconfined Aquifer varies from 2.86 to 8.88 mbgl with an average fluctuation of 5.20 mbgl.

Table 15 Phreatic Aquifer Depth to Water Level Fluctuation in mbgl

Block Name	Semiconfined Aquifer		
	Min	Max	Avg
Kansabel	1.22	8.25	3.48

Table 16 Semiconfined Aquifer Depth to Water Level Fluctuation in mbgl

Block Name	Semiconfined Aquifer		
	Min	Max	Avg
Kansabel	2.86	8.88	5.20

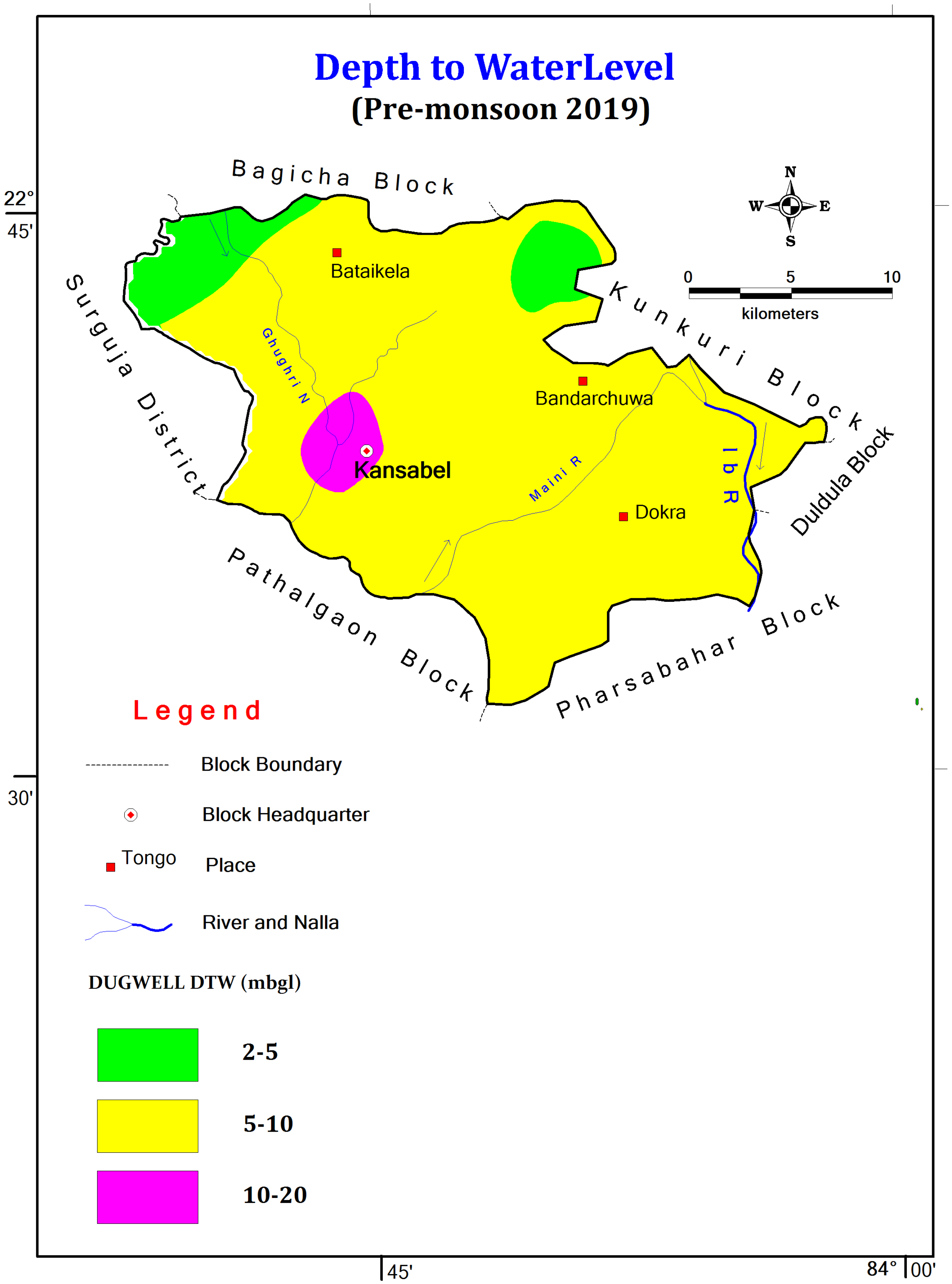

Figure 4 Pre-monsoon depth to waterlevel of Phreatic Aquifer

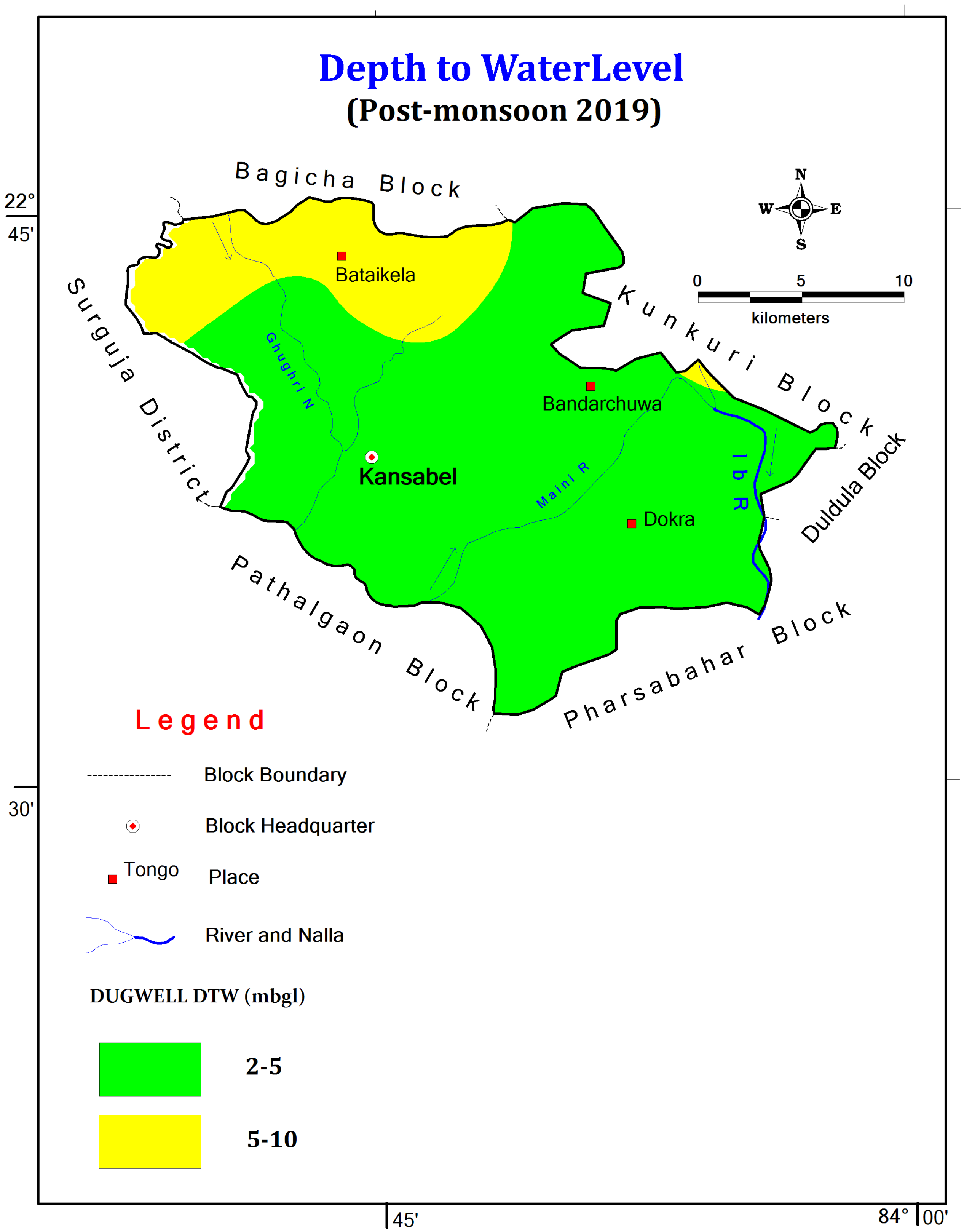

Figure 5 Post-monsoon depth to waterlevel of Phreatic Aquifer

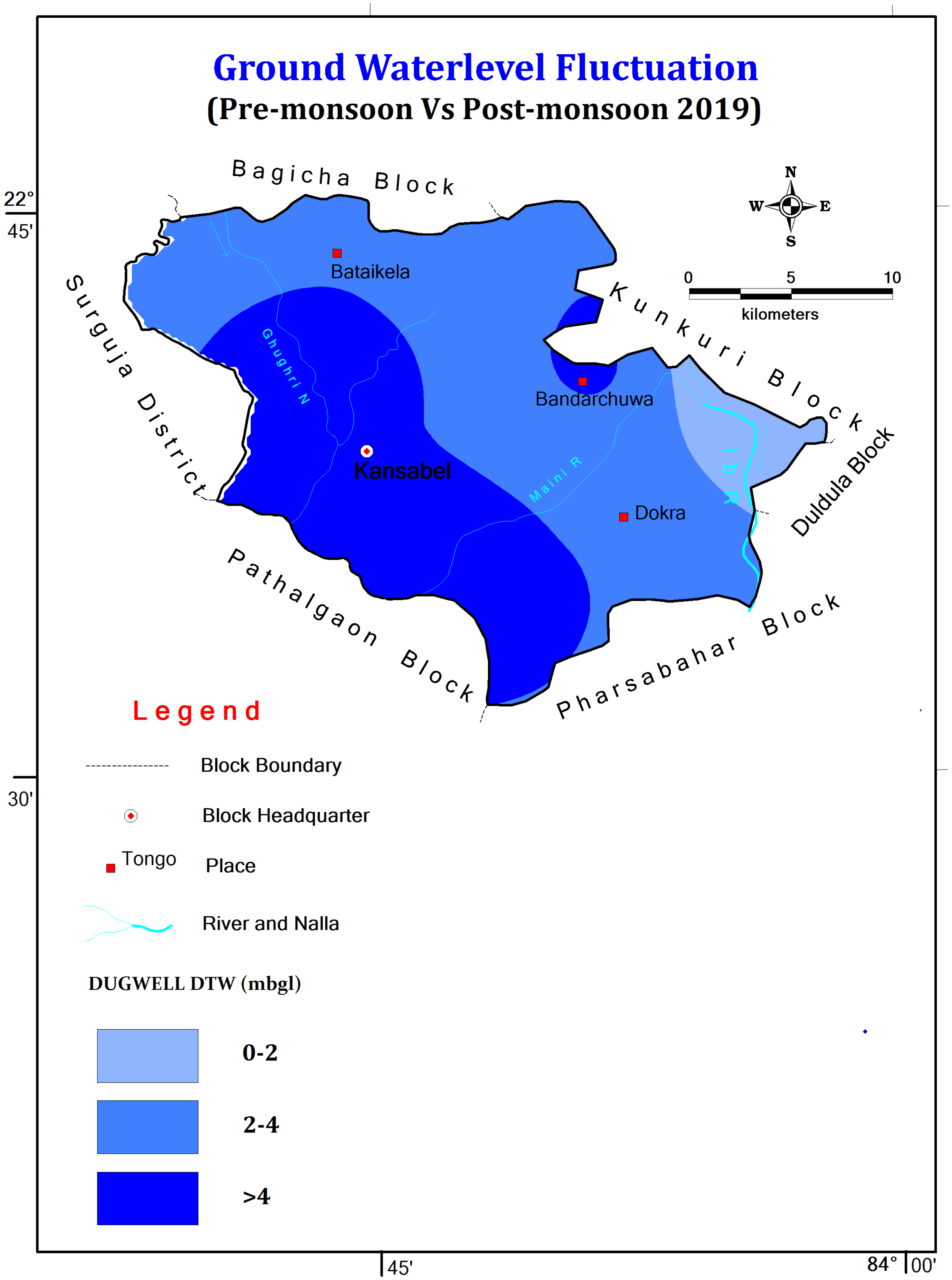

Figure 6 Seasonal waterlevel fluctuation of Phreatic Aquifer

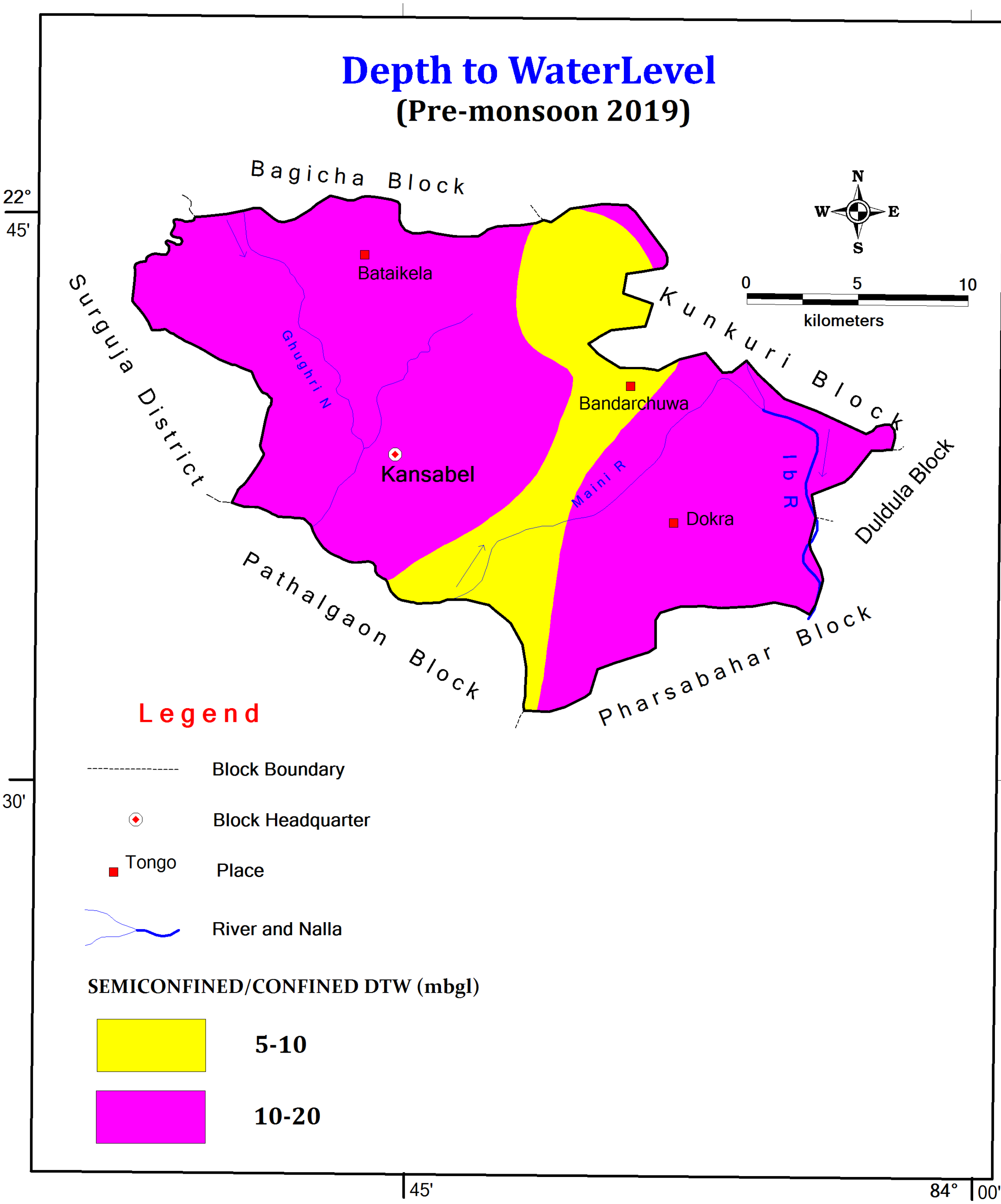

Figure 7 Pre-monsoon depth to waterlevel of Confined/Semiconfined Aquifer

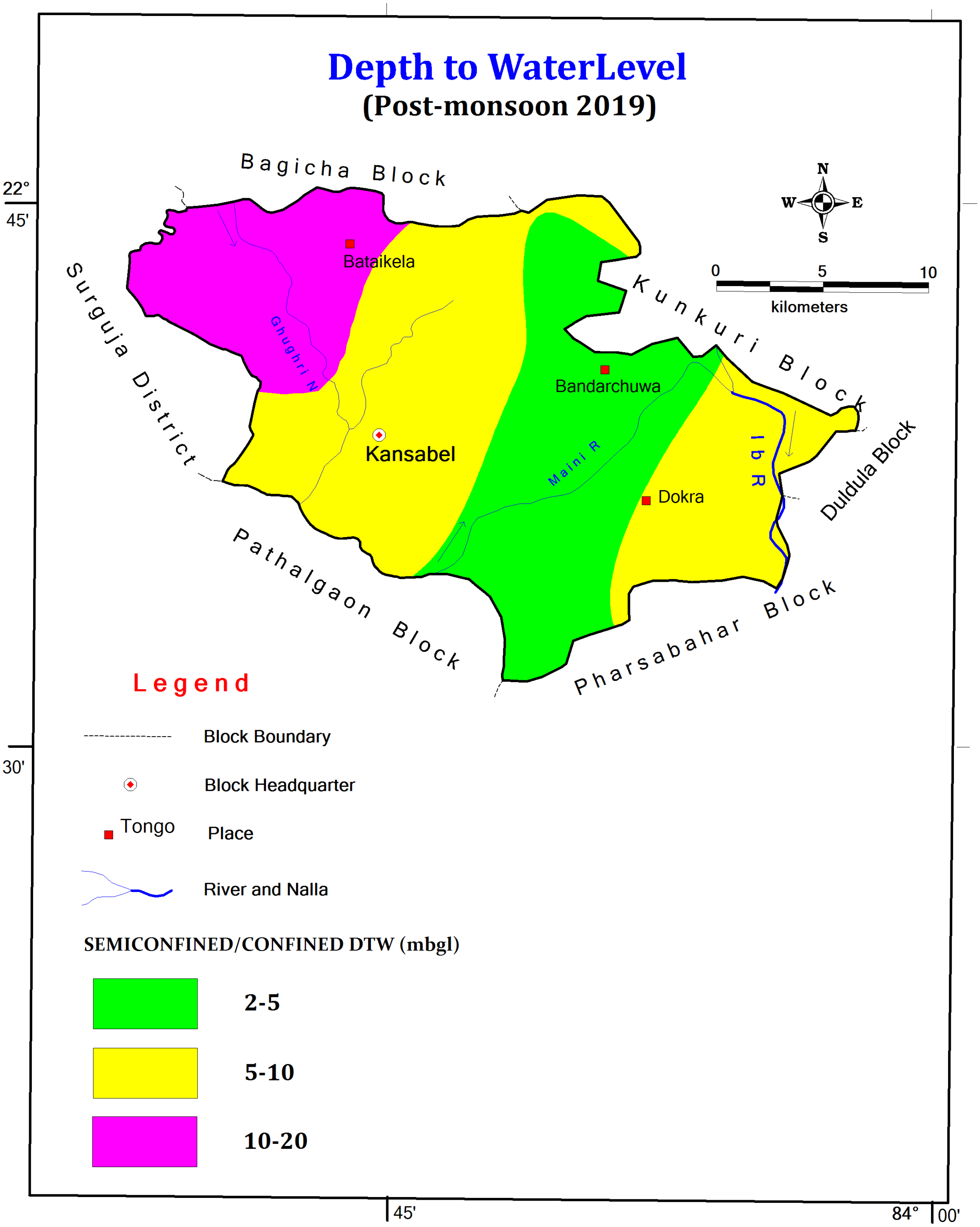

Figure 8 Post-monsoon depth to waterlevel of Confined/Semiconfined Aquifer

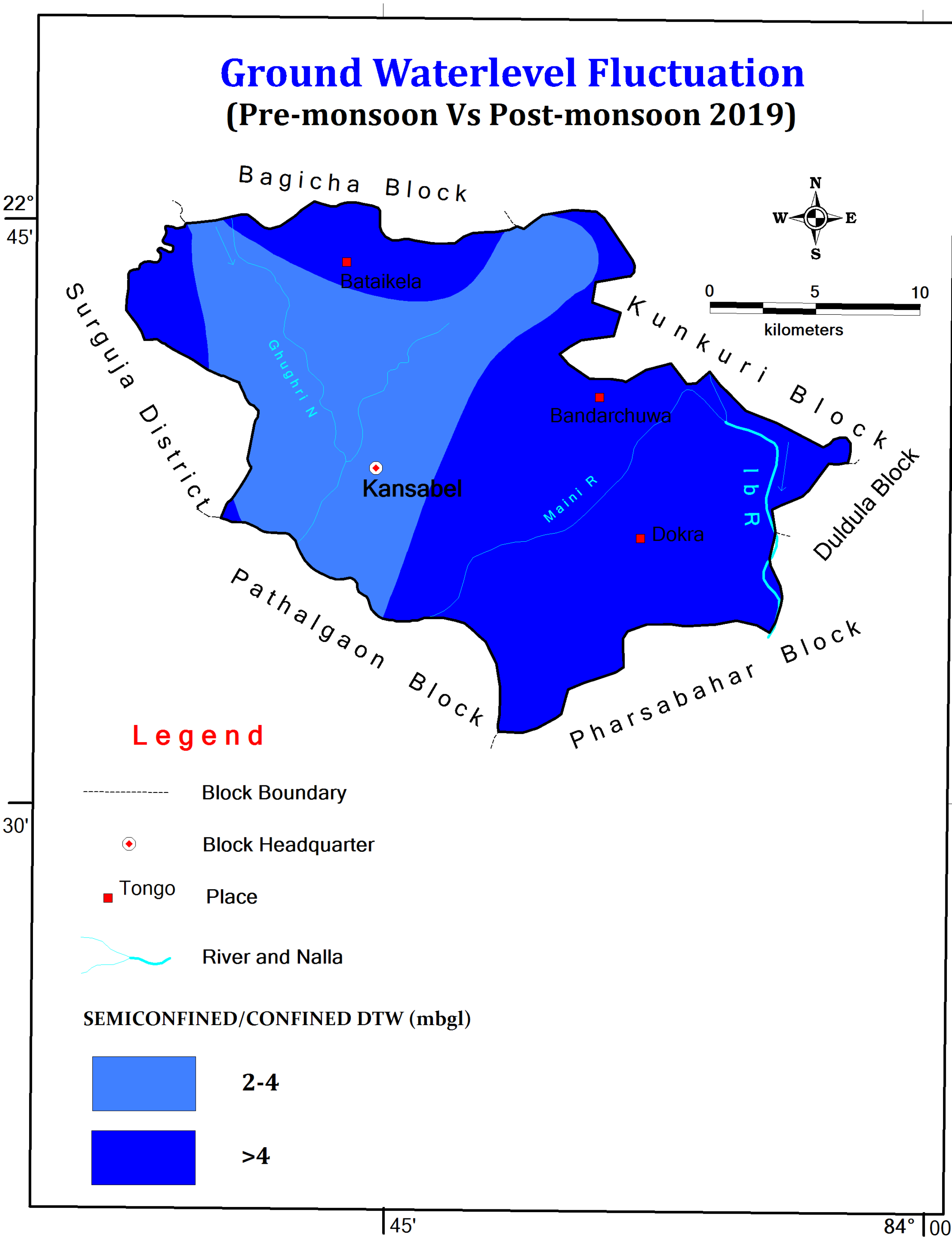

Figure 9 Seasonal waterlevel fluctuation of Confined/Semiconfined Aquifer

(iv) The long-term water level trend: There is a significant declination in water level in premonsoon as well as significant inclination in water level trend in post monsoon.

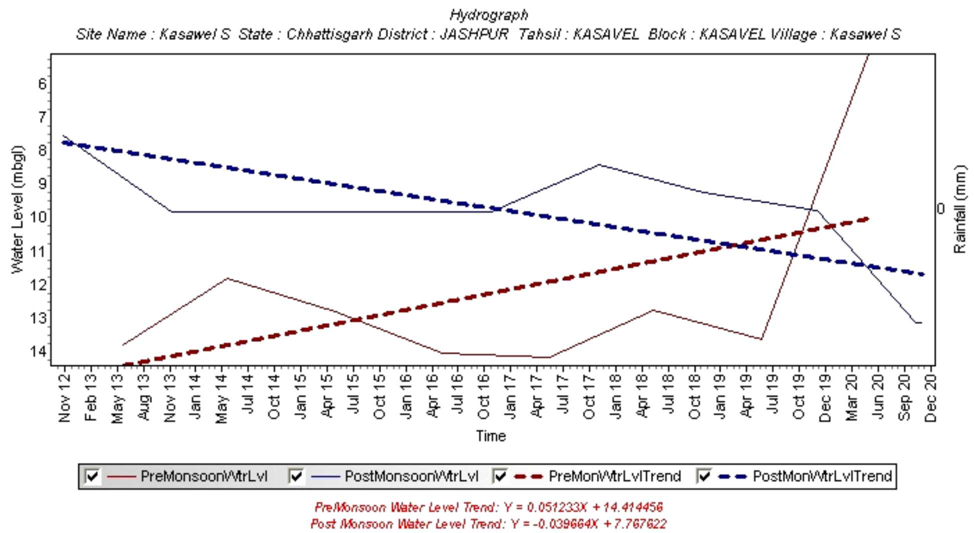

Figure 10 Hydrograph of Kansabel town, Kansabel block

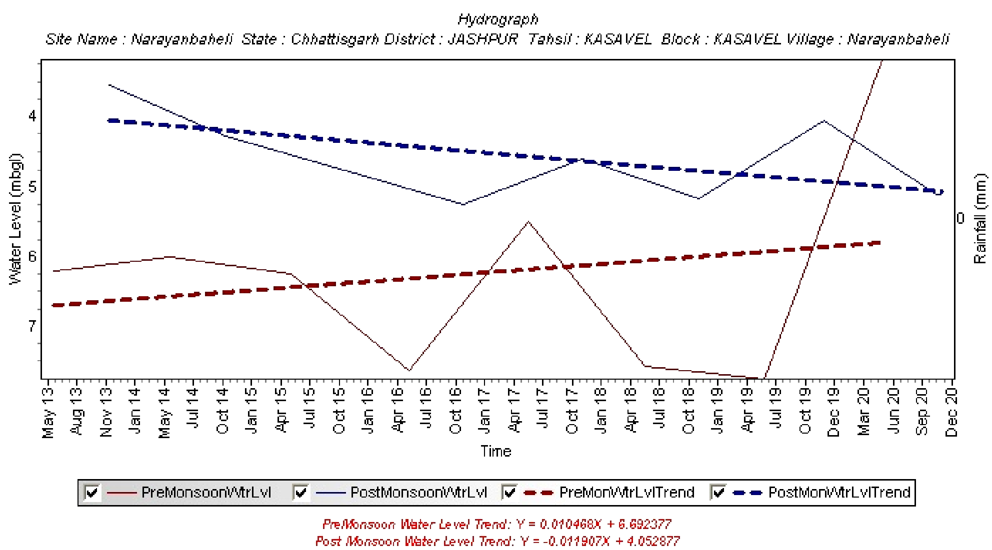

Figure 11 Hydrograph of Narayanbaheli Village, Kansabel block

2. AQUIFER DISPOSITION:

2.1 Number of Aquifers: There is only one major aquifer system viz. Granite Aquifer system. The aquifer system has the shallow aquifer and deeper aquifer which occurs in phreatic and semiconfined condition respectively.

Granite Aquifer System:

Groundwater occurrence is largely limited to secondary permeability, such as weathered zones, joints, fractures or faults. The potential of weathered zones depends on the degree and depth of weathering and associated fracturing, and the saturated thickness. The aquifers are generally discontinuous, and often confined. Higher yields are obtained where thick weathered zones are associated with bedrock fracturing. DTH drilling technique is preferred in Granite aquifer where well construction is required depending upon the thickness of weathered zone.

2.2 Aquifer wise Characteristics:

Table 17 Aquifer Characteristics of Kansabel block

CHARACTERISTICS	AQUIFER SYSTEM	
	Fractured Granite	**Weathered Granite**
Major Geological Formation	Chotanagpur Granite Geneiss	Chotanagpur Granite Geneiss.
Major Rock type	Granite Geneiss	Granite Geneiss
Avg Weathered Thickness (m)	-	17.85
Transmissivity (m^2/day)	3.5 to 32.72	-
Average Drawdown (m)	38	23
Discharge	Negligible to 4.5 lps	10 to 100 m3/day
No. of Potential Zone	1 to 2set < 50 m 1 to 2set: 50m to 100m 1 set: 100m to 200m (Most potential zone- 50 to 100m)	-

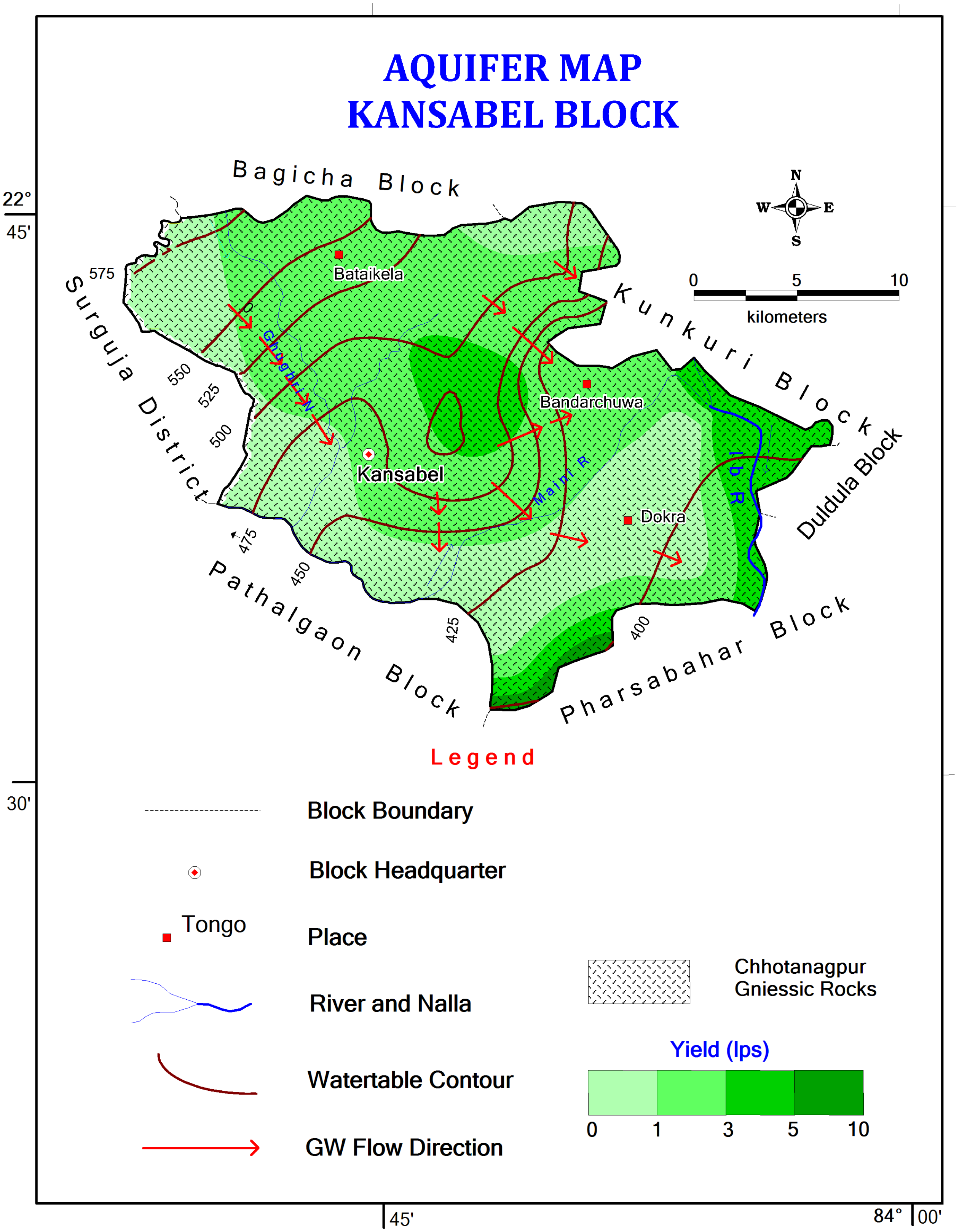

Figure 12 Aquifer map of Kansabel block

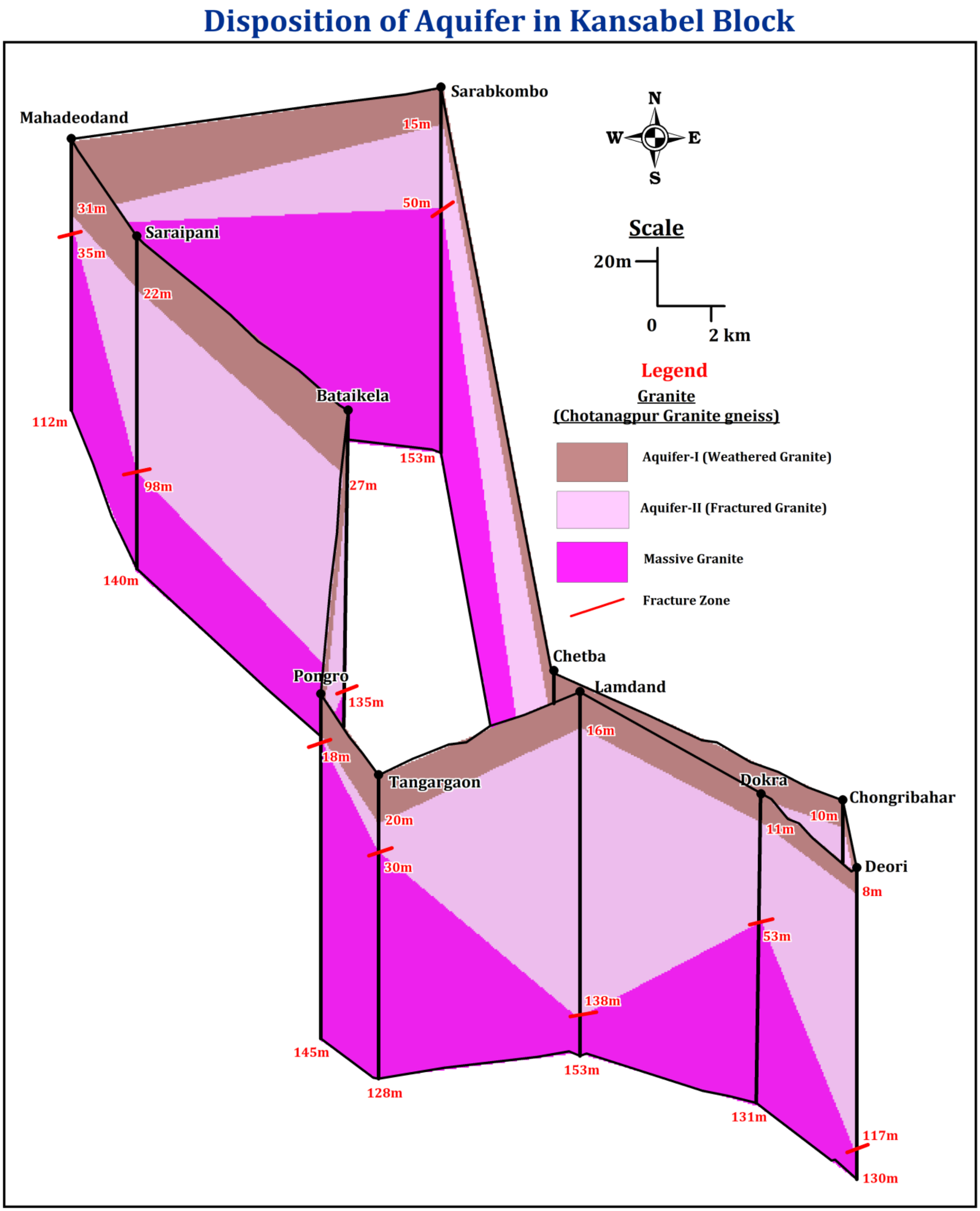

Figure 13 Fence diagram of Kansabel block

3. GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES:

3.1 Aquifer wise resource availability and extraction: Resource availability of Kansabel block is given in the Table 8 where net ground water availability for future use is 193.63 ham. The extraction details and the future scenario (2025) along with the categorisation are also depicted in the Table 8.

Table 18 Categorization of Assessment Unit

District	Block	Stage of Ground water development (%)	Categorisation
Jashpur	Kansabel	44.27	Safe

3.2 Categorisation: Kansabel block falls in safe category. The stage of Ground water development is 44.27 %. The Net Ground water availability is 1860.22 ham. The Ground water draft for all uses is 1489.51 Ham. The Ground water resource for future uses for Kansabel Block is 193.63 Ham.

3.3 Chemical Quality of Ground water and Contamination: Throughout the study area, the water samples from both dugwell and handpumps were collected and chemical analysis has been completed. Villages like Bataikela and Kuthera have more Iron and Manganese concentration also village like Bewrapali and Saraitola have Magnesium concentration more than its permissible limit. Overall ground water of the study area is suitable for the drinking, agriculture and industrial purpose.

4. GROUND WATER RESOURCE ENHANCEMENT:

4.1 Aquifer wise space available for recharge and proposed interventions:

Table 19 Summarised detail of Volume of porous space available for recharge

Major Aquifer	Area Identified for Artificial Recharge (Sq. Km)	Sp. Yield for the formation	Volume of vadose zone available for recharge(mcm)	Sub surface storage potential (mcm)
Granite	191.28	0.008	287	3.056

5. ISSUES:

(i) During summer, dugwells in villages becomes dry at many locations. Several handpumps also stop yielding water. The aquifer itself is a low yielding one.

(ii) In Granite aquifer system potential zone for ground water is related with occurrence of fracture, so drilling a high yield well is always a challenge. Proper scientific study coupled with geophysical investigation may minimize the failure of well.

(iii) High value of Fluoride and Iron has been reported from several locations.

6. MANAGEMENT PLAN:

(i) It has been observed during fieldwork, there is colossal wastage of groundwater through private well and public water supply system. So, Information, Education and Communication (IEC) activities need to be organized to sensitize people on the issues of depleting groundwater resource. Massive awareness campaigns are essential to aware people about the importance of community participation in saving water.

(ii) Desiltation of existing Tanks and Talabs to be carried out for efficient storage of rainwater. Also Rain water harvesting structures may be constructed in villages to reduce stress on groundwater.

(iii) It has been observed that the demand of ground water is increasing for irrigation, industrial and domestic uses. At locations where water level is declining, we have to go for artificial recharge on a long-term sustainability basis. Artificial Recharge structures may be constructed at suitable locations especially in the areas where the water level remains more than 3m in the post-monsoon period in this block to arrest the huge non-committed run-off and augment the ground water storage in the area. The different types of artificial structures feasible in the block are described in Table 20

Table 20 Types of Artificial Recharge structures feasible

Name of Block	Area Feasible for recharge (sq.km)	Volume of Sub Surface Potential for Artificial recharge (MCM)	Types of Structures Feasible and their Numbers			
			Percolation tank	Nalas bunding cement plug/ check dam	Gravity head /Dug well/ tube well/Recharge shaft	Gully plugs Gabion structures
Kansabel	191.28	3.056	7	23	57	42
	Recharge Capacity (MCM)/structure		0.2192	0.0326	0.00816	0.0073

(iv) Fluoride and Iron filter plant may be installed in the villages having higher value of contaminants.

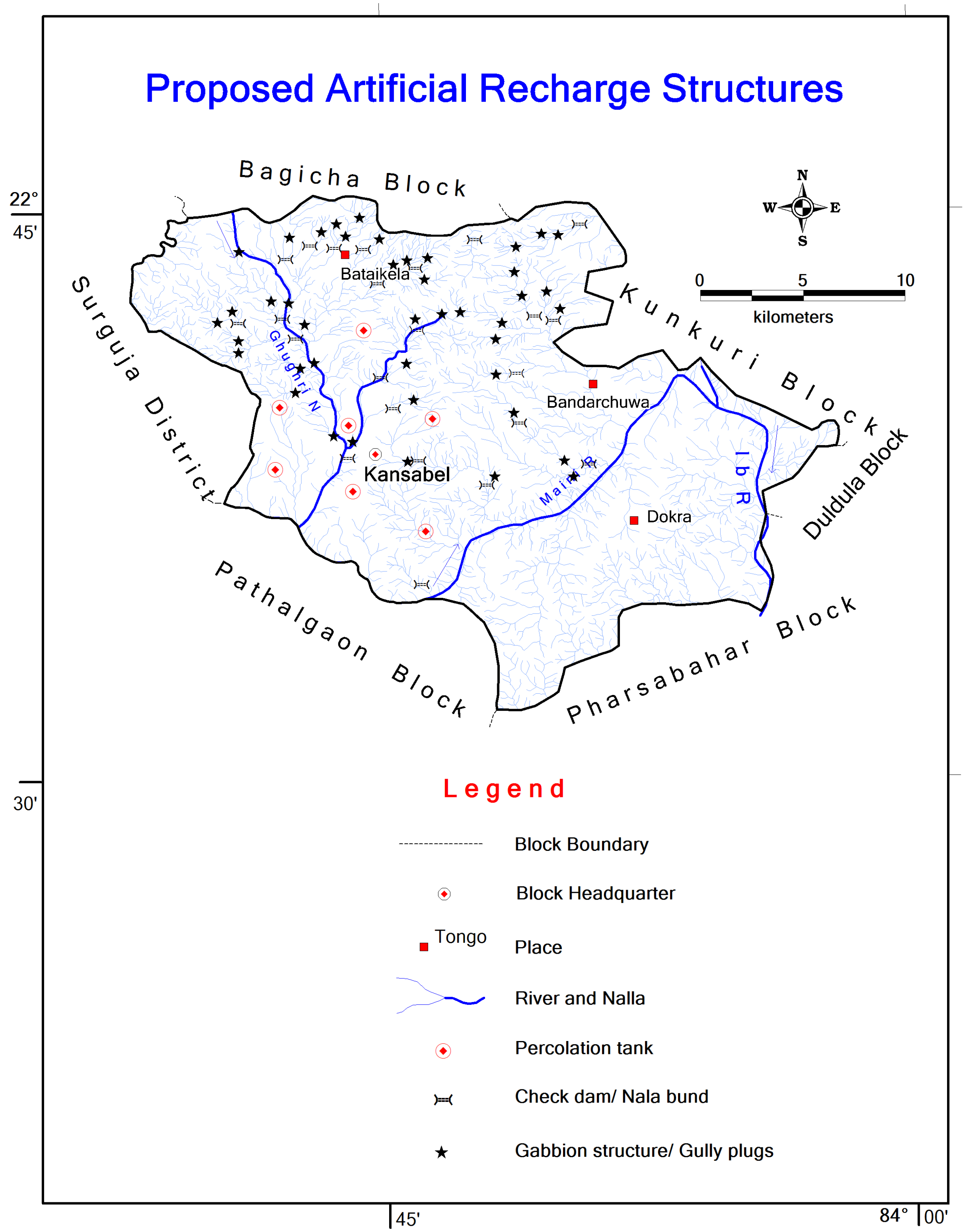

Figure 14 Location of proposed Artificial Recharge Structure

(v) In urban areas STP may be installed for the treatment of sewage water in proper numbers to avoid contamination of ground water. Treatment of sewage water in village through soak pit for the individual houses and Seechewal model or similar model for community level may be adopted to avoid contamination of ground water. Treated water may also be reused for irrigation and other industrial purposes.

(vi) Since the stage of development in the block is 44.27 %. There is scope of utilizing more ground water for future irrigation purpose. Additional number of Ground water abstraction structure may be developed for the effective utilization of ground water resources in the block. The ground water is presently developed through dug wells and tube wells. Yield potential for the block has been shown in Aquifer map (Figure 12). Sites for wells need to be selected only after proper scientific investigation. The ground water quality also needs to be ascertained and the wells used for water supply should be first checked for Iron, Fluoride and other pollutants.

Table 21 Potential of Additional GW abstraction structure creation

Net GW availability (ham)	Stage of GW Development (%)	Present GW draft (Ham)	GW draft at 70% stage of developm ent (ham)	Surplus GW at present Stage of Development (ham)	Number of TW Recommended in each block (Assuming unit draft as 1.6 ham/structure/year)	Number of DW Recommended in each block (Assuming unit draft as 0.72 ham/structure/year)
3364.35	44.27	1489.51	2355.05	865.54	325	481

7. CONCLUSION:

For effective utilization of Ground water existing draft for irrigation may be coupled with micro irrigation system. Change in irrigation pattern, optimum use of available resource, use of ground water potential created after artificial recharge can lead to groundwater savings and increase in gross cropped area of the block (Table: 22).

Table 22 Detail of groundwater saved through change in cropping pattern and other interventions

Block	Existing Gross Ground Water Draft for Irrigation in Ham	Additional Saving of GW after using Micro Irrigation methods in Ham (Assuming 30 % saving)	GW Potential created after Artificial recharge structure in Ham	Development by new GW abstraction structure	Additional GW irrigation Potential created in Ham	Additional Irrigation potential creation for Maize/ wheat in winter season in Ha (Assuming 500 mm water requirement)	Percent increase in Crop area compare to Gross cropped area
Kansabel	1294.5	388.35	305.59	865.54	1559.48	3118.95	12.36%