



केंद्रीय भूमि जल बोर्ड

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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 DONGARGARH BLOCK, RAJNANDGAON DISTRICT, CHHATTISGARH

उत्तर मध्य छत्तीसगढ़ क्षेत्र, रायपुर

North Central Chhattisgarh Region, Raipur

**AQUIFER MAPS AND GROUND WATER MANAGEMENT PLAN,
DONGARGARH BLOCK, RAJNANDGAON DISTRICT,
CHHATTISGARH**

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BLOCK-WISE AQUIFER MAPS AND MANAGEMENT PLANS DONGARGARH BLOCK, RAJNANDGAON DISTRICT

1. SALIENT INFORMATION

1.1 About the area:

Name of the Block	Dongargarh
Area	1130 Sq. km.
District	Rajnandgaon
State	Chhattisgarh

Administrative Map of Dongargarh Block

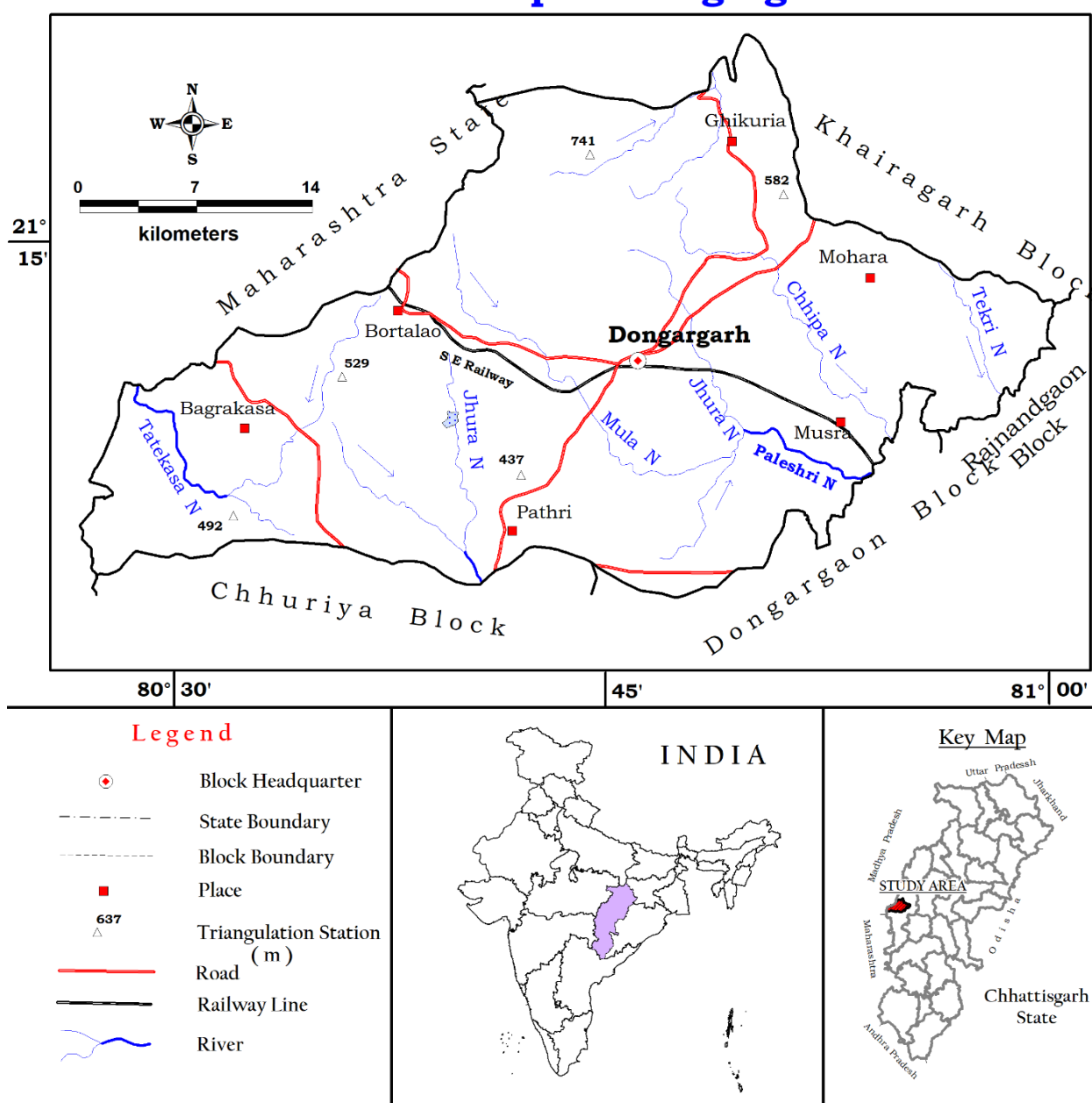


Figure 1 Administrative Map

1.2 Population:

The total population of Dongargarh block as per 2011 Census is 208117. 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
Dongargarh	2,08,117	1,03,321	1,04,796	1,70,745	37,372

Source: CG Census, 2011

1.3 Population Growth rate:

The decadal growth rate of this block is 19.51 as per 2011 census.

1.4 Rainfall:

The study area receives rainfall mainly from south-west monsoon. It sets in third/fourth week of June and continues till mid-August/September with heaviest showers in the months of July and August. The months of July and August are the heaviest rainfall months and nearly 95% of the annual rainfall is received during June to September months. Average annual rainfall in the study area is (Average of the last five years i.e. 2012-13 to 2016-17) 937.68mm

Table 2 Rainfall data in Dongargarh block (in mm)

Year	2012-13	2013-14	2014-15	2015-16	2016-17
Monsoon rainfall	1097.4	1247.9	640.6	850.2	852.3

Source: Statistical Hand Book Rajnandgaon District, 2016-17

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 ponds and other sources. The groundwater abstraction structures are generally Dugwells, Borewells /tubewells. The principal crops in the block are Paddy, Wheat and Gram. In some areas, double cropping is also practiced. The agricultural pattern, cropping pattern and area irrigated data of Dongargarh block is given in Table No. 3 (A, B, C, and D).

Table 3(A) Land use pattern (in ha)

Block	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
Dongargarh	76732	8792	8377	5257	6243	44595	15268	59863

Table 3(B) Cropping pattern (in ha)

Block	Kharif	Rabi	Cereal				Pulses	Tilhan	Fruits Vegetables	Reshe	Mirch Masala	Sugar-cane
			Wheat	Rice	Jowar & Maize	Others						
Dongargarh	43815	59863	2149	38175	29	0	15347	2523	2329	0	16	1

Table 3(C) 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 Talabs	Irrigated area	Irrigated area by other sources	Net Irrigated area	Gross irrigated area	% of irrigated area wrt. Net sown area
43	10374	1834	5363	1327	284	31	197	1071	17289	17289	38.76

Table 3(D) Contribution of Groundwater in Irrigation Pattern (ha)

Block	Area irrigated through Borewell/ Tubewell	Area irrigated through Dugwell	Area irrigated through Groundwater	Net area irrigated through all sources	GW contribution in Irrigation (%)
Dongargarh	5363	284	5647	17289	32.66

1.6 Groundwater Resource Availability:

Based on the resource assessment made, the resource availability in Dongargarh block is given in the Table No. 4.

Table 4 Groundwater Resources of Dongargarh Block

Name of Block	Ground Water Recharge (Ham)				Total Annual Ground Water Recharge (Ham) (5=1+2+3+4)	Total Natural Discharges (Ham)	Annual Extractable Ground Water Recharge (Ham) (7=5-6)
	Monsoon Season		Non-monsoon season				
	Recharge from Rainfall	Recharge from Other Sources	Recharge from Rainfall	Recharge from Other Sources			
	1	2	3	4	5	6	7
Dongargarh	5095.82	1872.37	557.05	2517.62	10042.86	633.40	9409.46

Drainage Map of Dongargarh Block

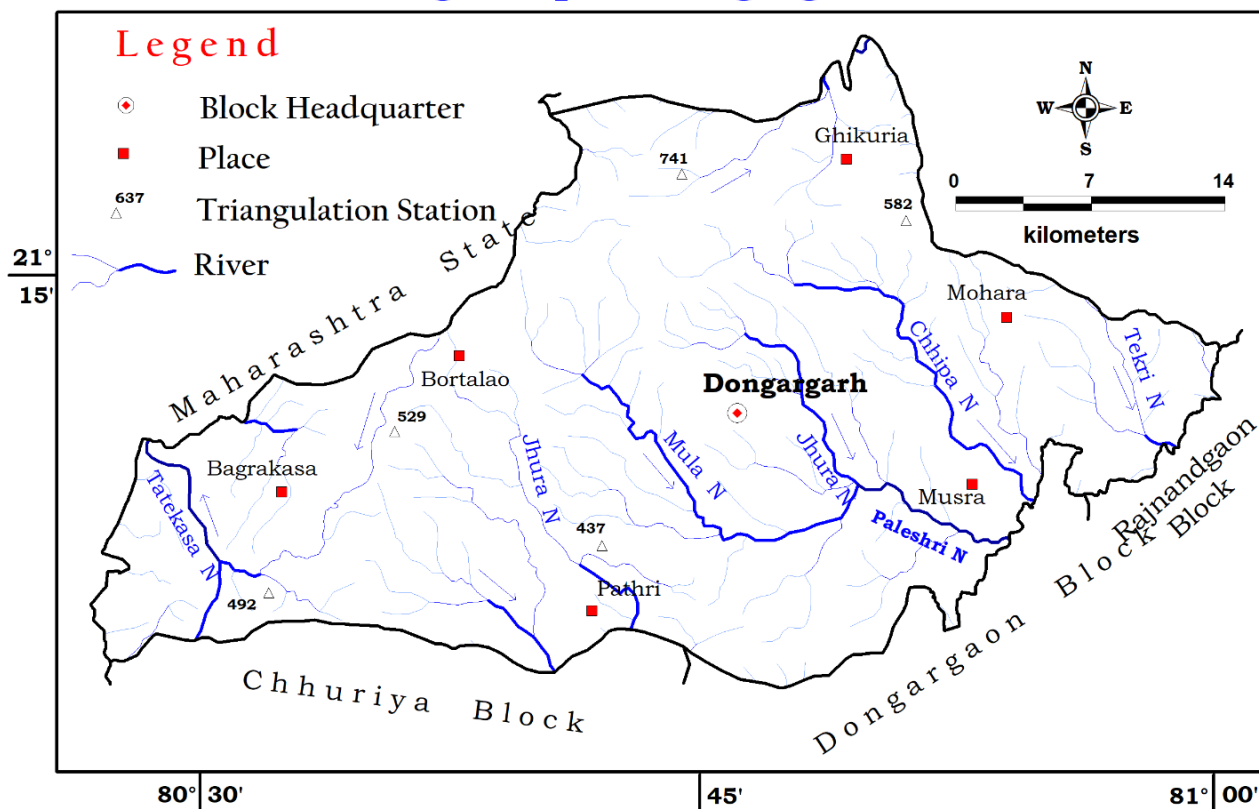


Figure 2 Drainage Map

Geomorphological Map

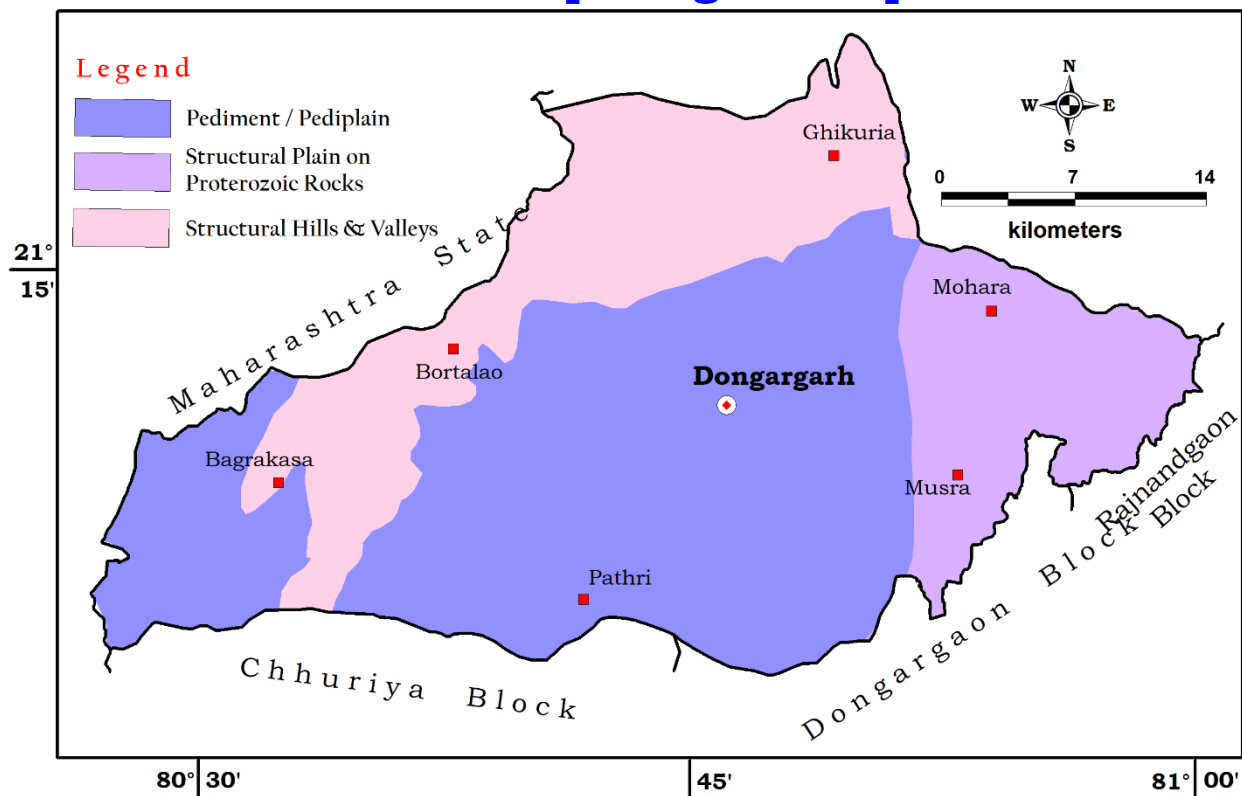


Figure 3 Geomorphological Map

1.7 Water Level Behaviour:

1.7.1 Pre- monsoon water level (May 2018):

In the pre-monsoon period, it has been observed that in Dongargarh block, water level in Phreatic aquifer vary between 3.9 to 13.2 m bgl with average water level of 8.13m bgl shown in Table No. 5(A). In deeper semi-confined aquifer, water level varies between 9.62 to 20.9 m bgl with average water level of 15.48 m bgl shown in Table No. 5(B).

Table 5(A) Aquifer wise Depth to Water Level (Pre-monsoon)

Block Name	Phreatic Aquifer		
	Min	Max	Avg
Dongargarh	3.9	13.2	8.13

Table 5(B) Aquifer wise Depth to Water Level (Pre-monsoon)

Block Name	Semi-confined Aquifer		
	Min	Max	Avg
Dongargarh	9.62	20.9	15.48

Depth To Water Level (Pre-monsoon 2018)

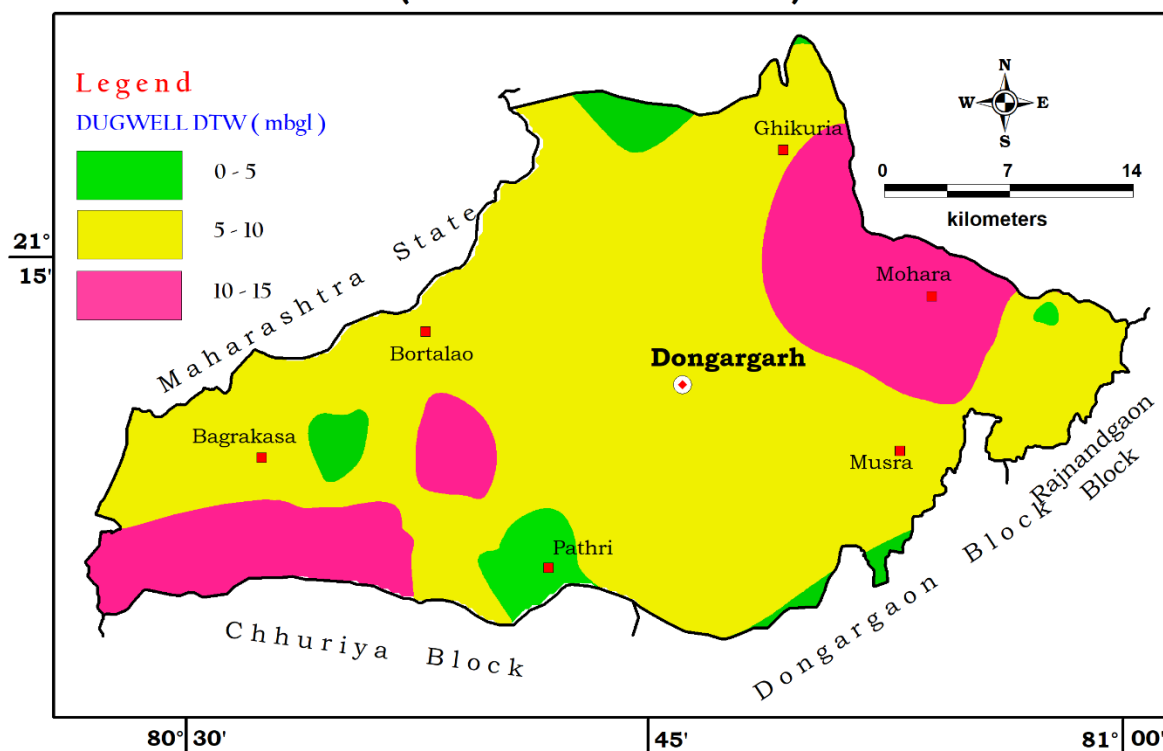


Figure 4 Pre monsoon Depth to water level of Phreatic Aquifer

Depth To Water Level (Pre-monsoon 2018)

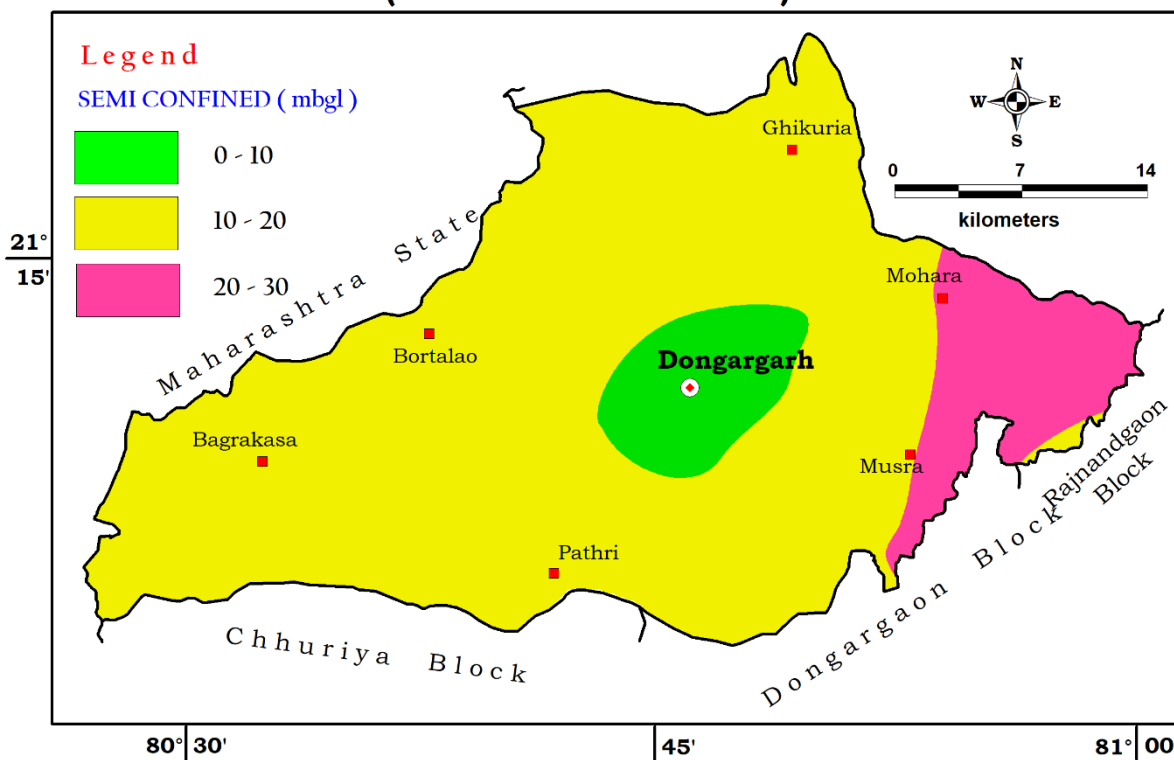


Figure 5 Pre monsoon Depth to water level of Semiconfined Aquifer

1.7.2 Post- monsoon water level (Nov 2018):

In the post-monsoon period, it has been observed that in Dongargarh block, water level in Phreatic aquifer vary between 1.6 to 10.7 m bgl with average water level of 5.32 m bgl shown in Table No. 5(C). In deeper semi-confined aquifer, water level varies between 8 to 15.2 m bgl with average water level of 11.06 m bgl shown in Table No. 5(D).

Table 5(C) Aquifer wise Depth to Water Level (Post-monsoon)

Block Name	Phreatic Aquifer		
	Min	Max	Avg
Dongargarh	1.6	10.07	5.32

Table (D) Aquifer wise Depth to Water Level (Post-monsoon)

Block Name	Semi-confined Aquifer		
	Min	Max	Avg
Dongargarh	8	15.2	11.06

Depth To Water Level (Post-monsoon 2018)

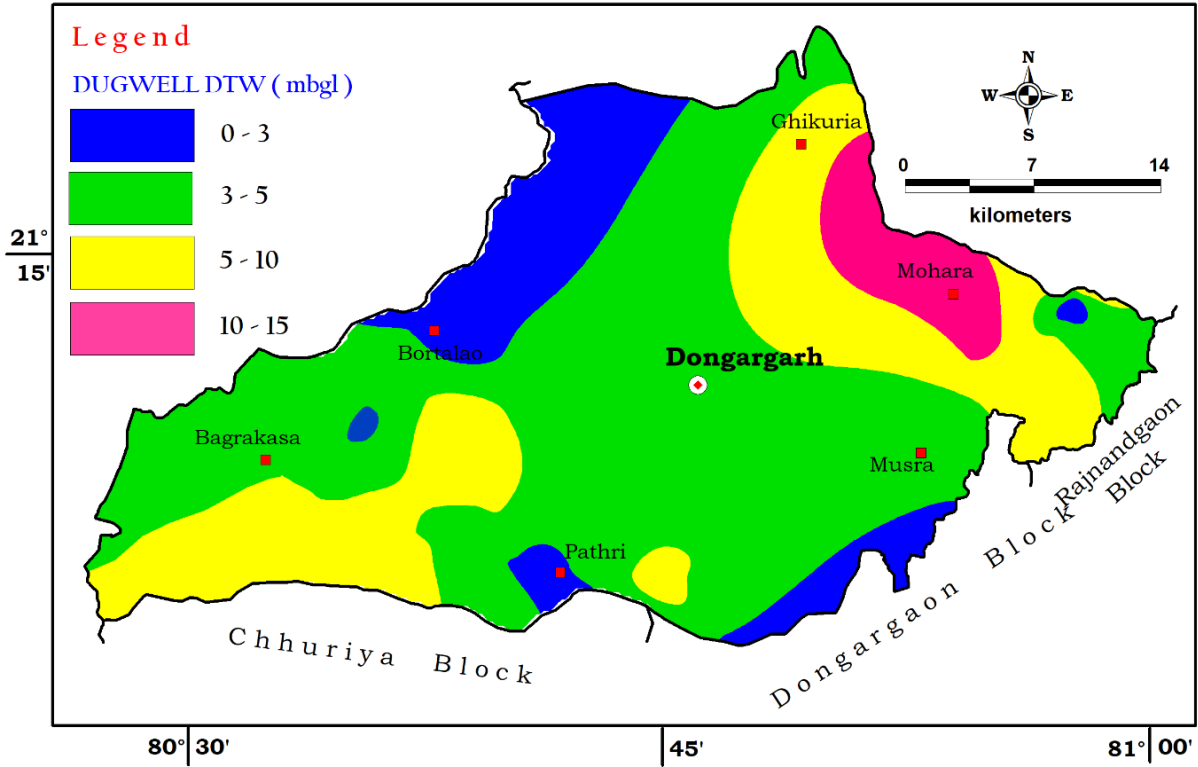


Figure 6 Post monsoon Depth to water level of Phreatic Aquifer

Depth To Water Level (Post-monsoon 2018)

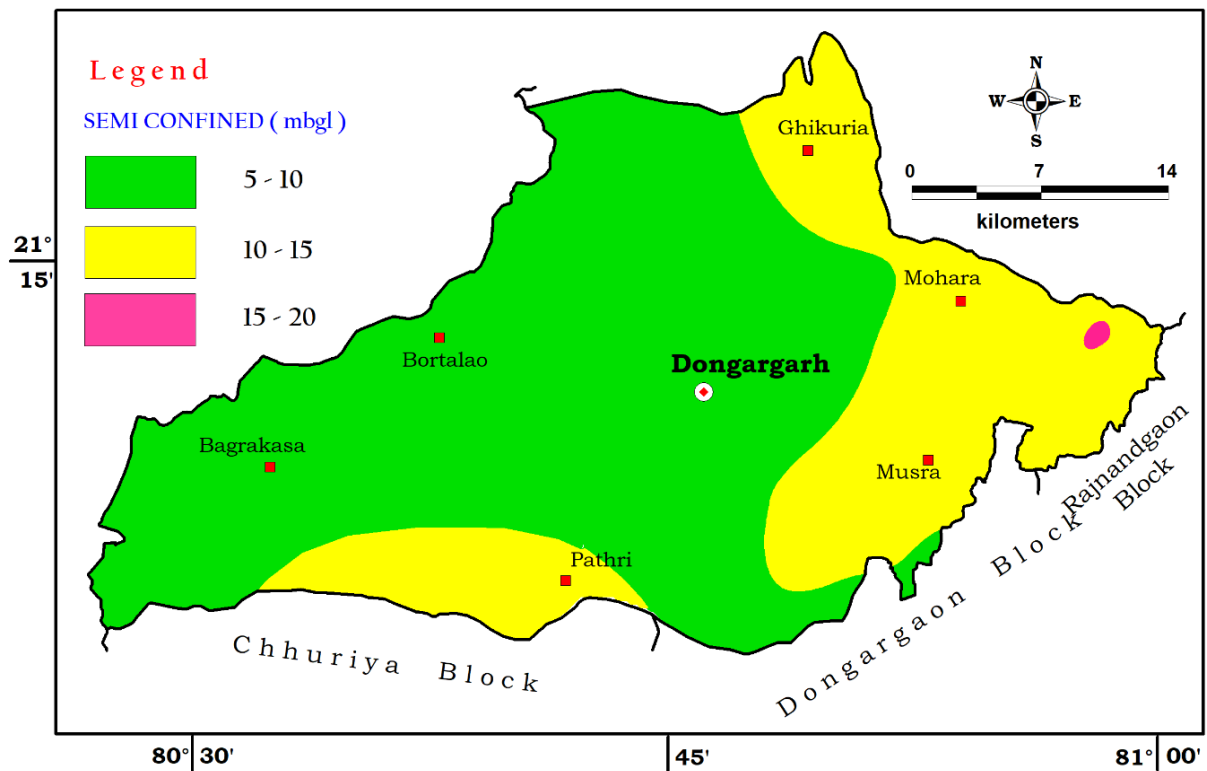


Figure 7 Post monsoon Depth to water level of Semiconfined Aquifer

1.7.3 Seasonal water level fluctuation:

The water level fluctuation data indicates that in Dongargarh block, water level fluctuation in phreatic aquifer varies from 0.49 to 6.8m with an average fluctuation of 2.8 m show in Table No. 5(E). Water level fluctuation in semi-confined aquifer varies from 1.39 to 5.7 m with an average fluctuation of 4.41m shown in Table No. 5(F).

Table 5(E) Aquifer wise Depth to Water Level Fluctuation (Phreatic aquifer)

Block Name	Phreatic Aquifer		
	Min	Max	Avg
Dongargarh	0.49	6.8	2.8

Table 5(F) Aquifer wise Depth to Water Level Fluctuation (Semi-confined aquifer)

Block Name	Semi-confined Aquifer		
	Min	Max	Avg
Dongargarh	1.39	5.7	4.41

Ground Water Level Fluctuation (Post-monsoon Vs Pre-monsoon 2018)

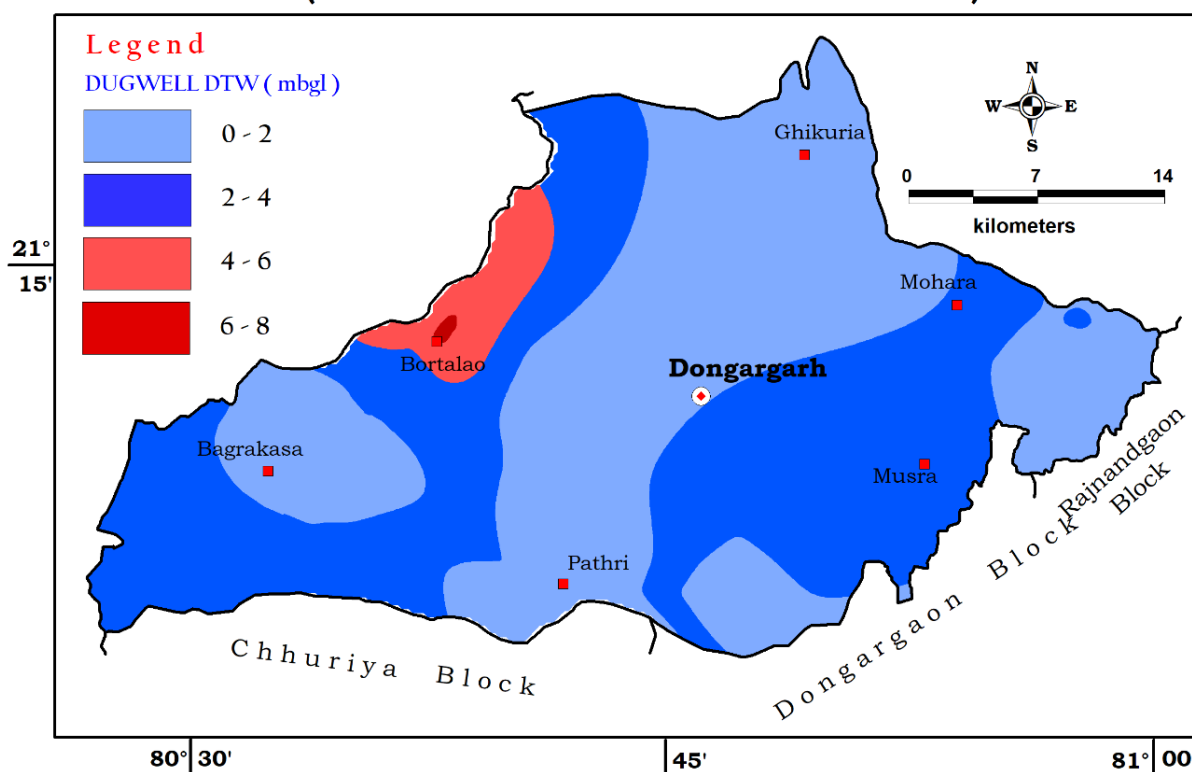


Figure 8 Ground water level fluctuation of Phreatic Aquifer

Ground Water Level Fluctuation (Post-monsoon Vs Pre-monsoon 2018)

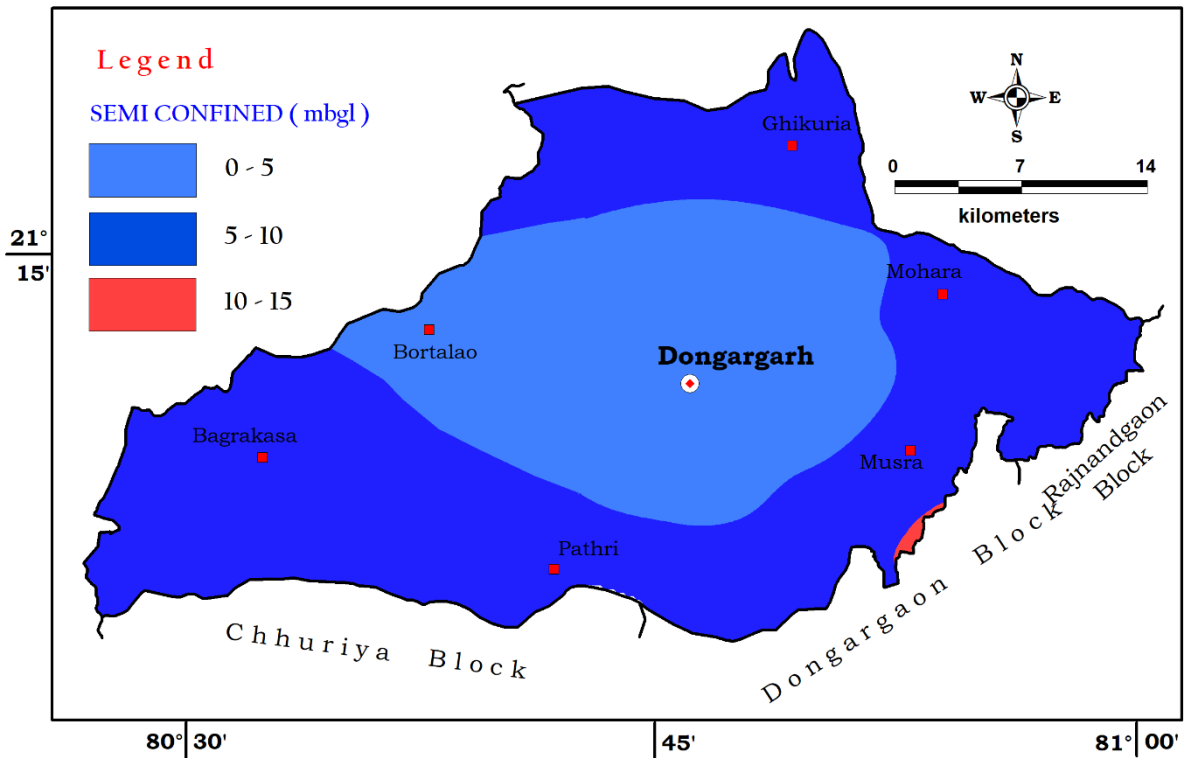
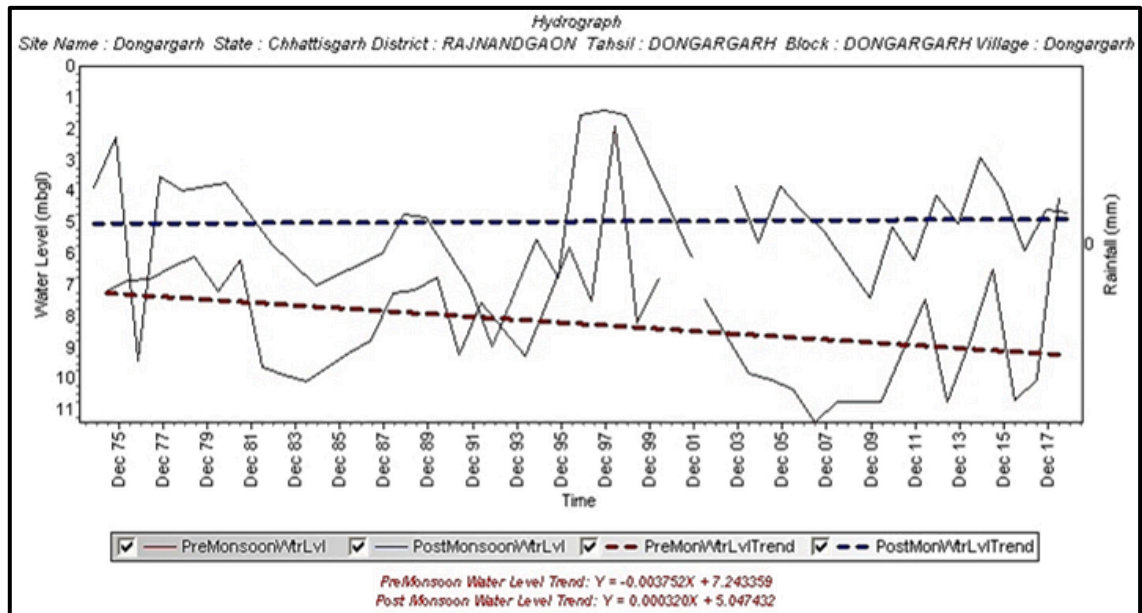


Figure 9 Ground water level fluctuation of Semiconfined Aquifer

1.7.4 The long-term water level trend:



Considering the last 40 years from 1975 to 2017 there was fall in pre-monsoon but have a constant post-monsoon water level trend which implies the extraction of ground water was increased.

2. AQUIFER DISPOSITION:

2.1 Number of Aquifers:

There are two major aquifers present in this block. As the aquifers are Consolidated in nature, so further those aquifers are divided in to two sub aquifers in Z-direction. One is Aquifer-I, which represents the Phreatic Aquifer or Weathered zone and another one is Aquifer-II, which represents Fractured Aquifer or Semi-confined aquifer as the fractures are connected to the weathered zone.

Table 6 Details of Aquifer in Dongargarh Block

Geological Formation	Aquifer	Area Covered (Sq. k. m.)
Khairagarh Group	Basic volcanics <i>Aquifer-I (Phreatic Aquifer)</i> <i>Aquifer-II (Fractured aquifer)</i>	266
Dongargarh Granite	Granite <i>Aquifer-I (Phreatic Aquifer)</i> <i>Aquifer-II (Fractured aquifer)</i>	697

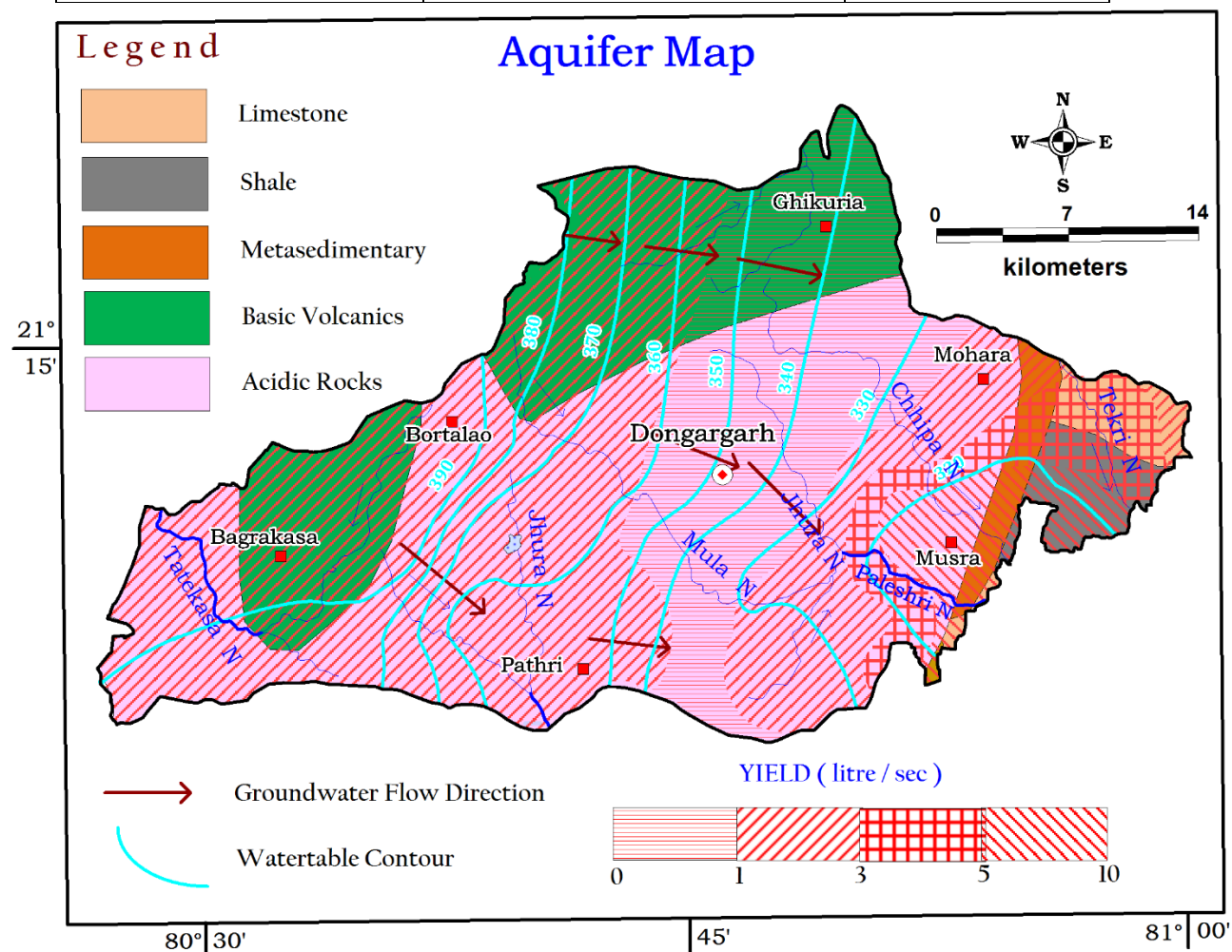
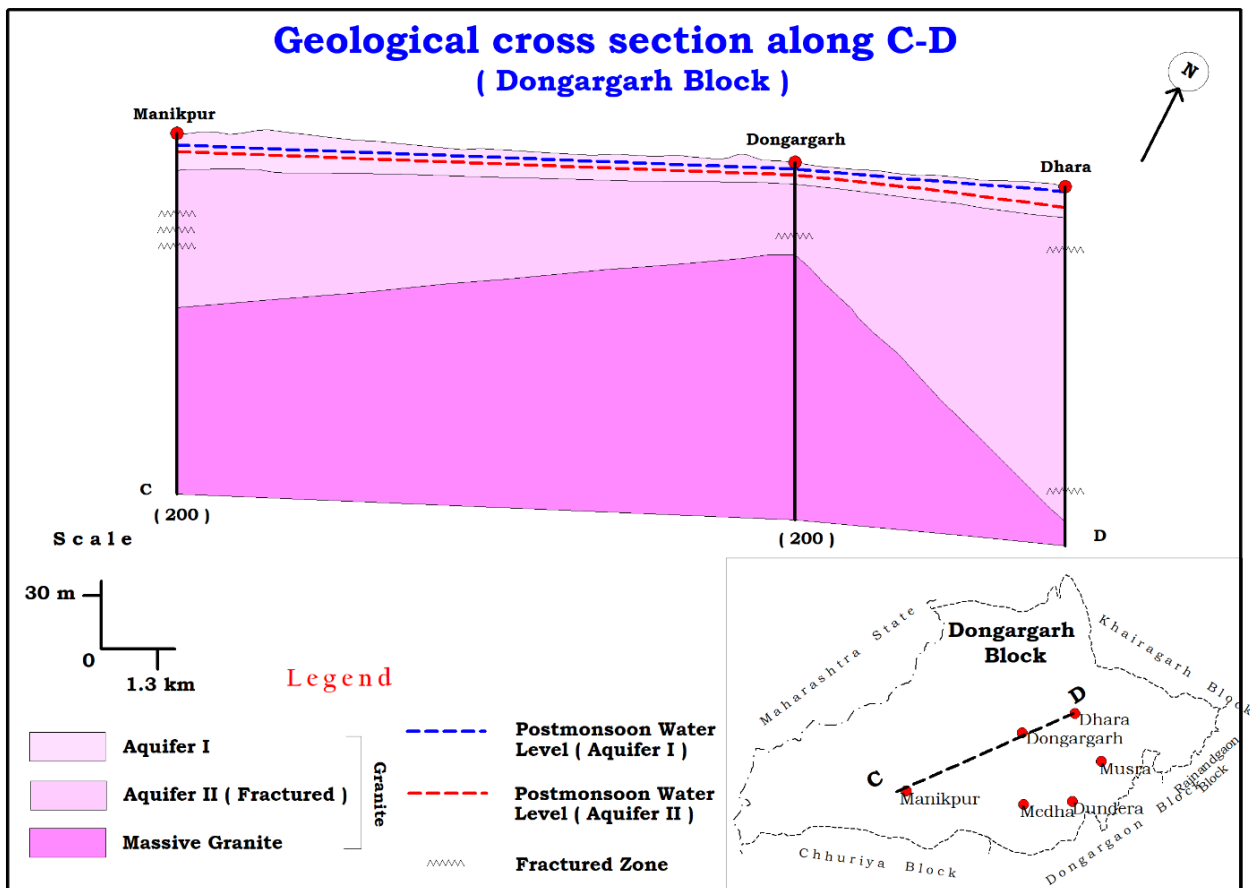
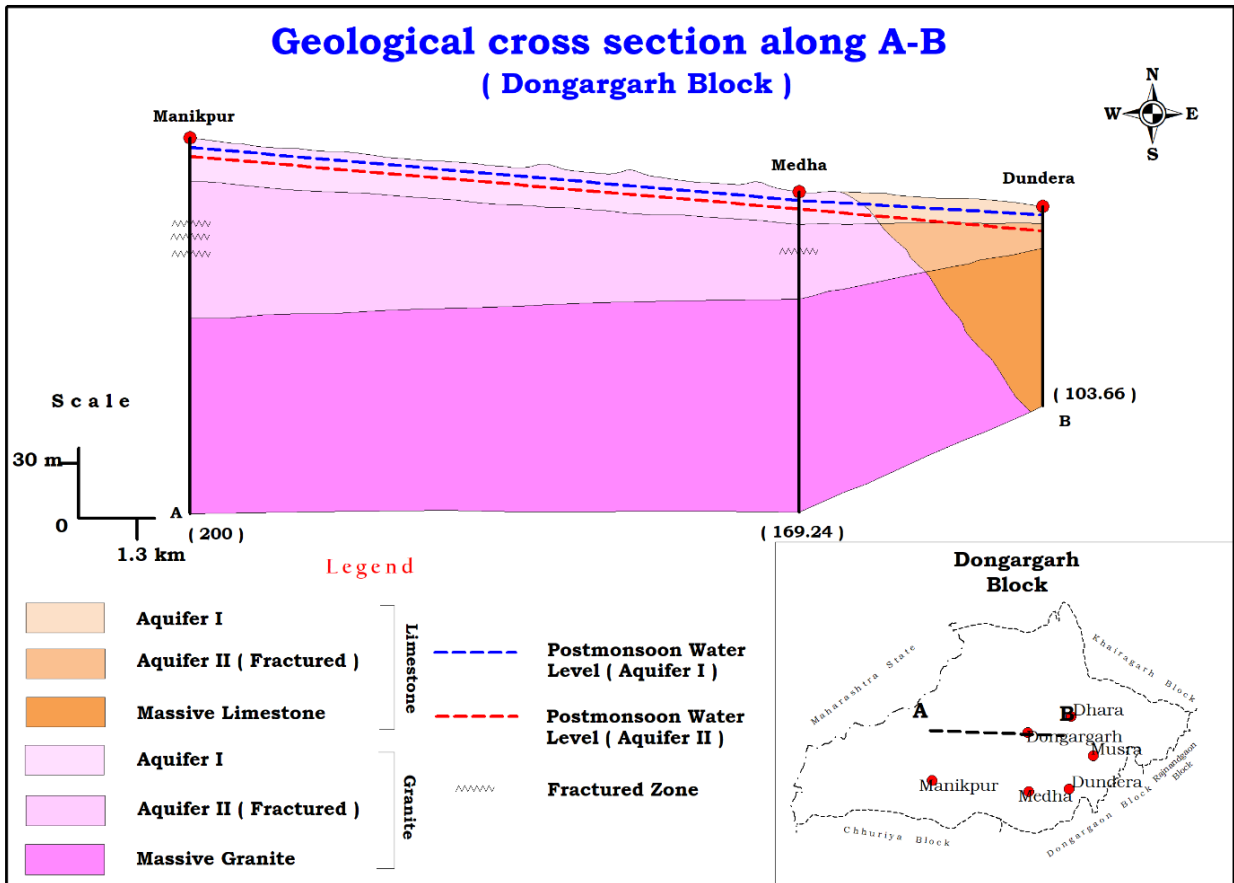


Figure 10 Aquifer Map of Dongargarh block

2.2 3-d aquifer disposition and basic characteristics of each aquifer:



Disposition of Aquifer in Dongargarh Block

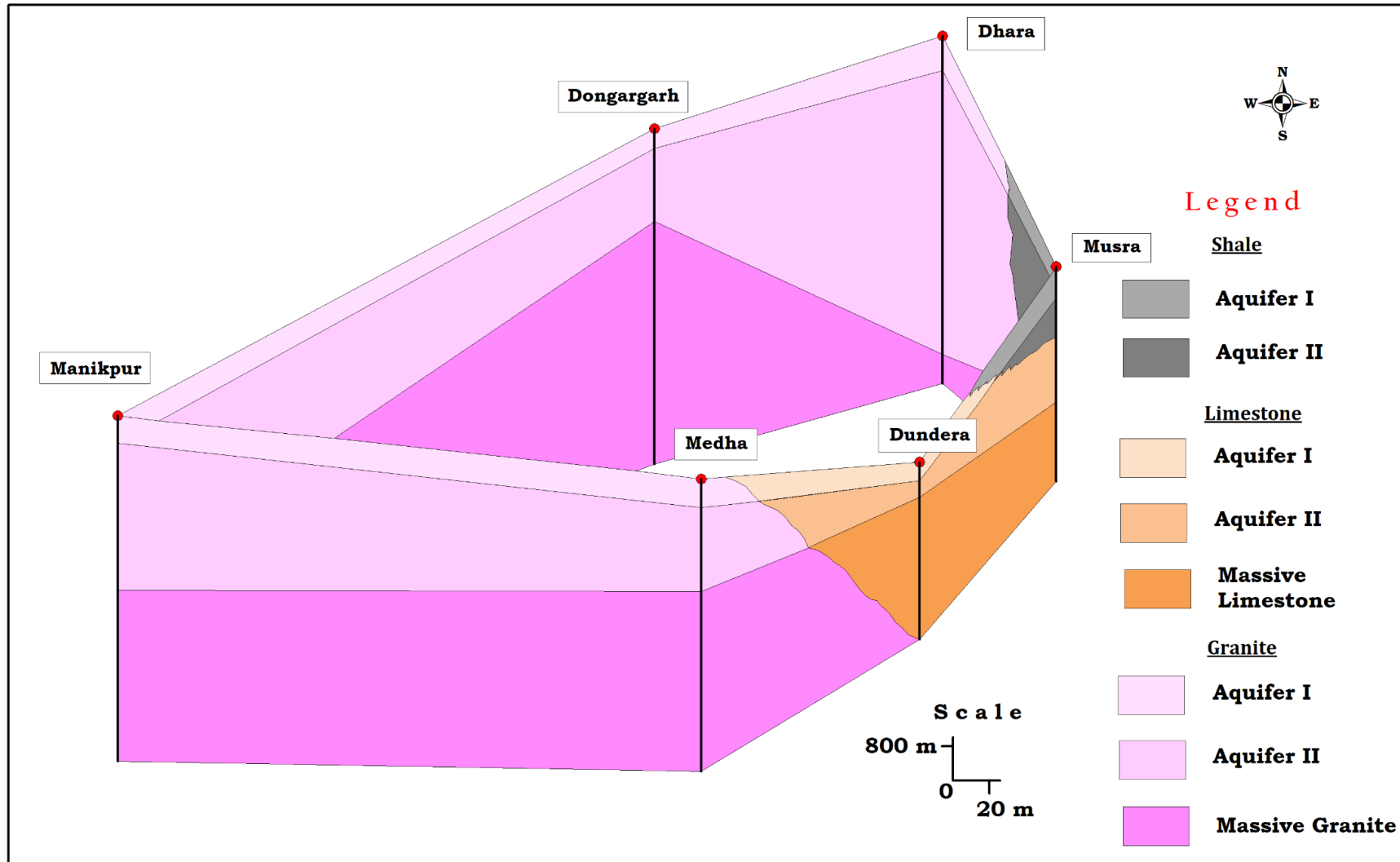


Figure 11 Cross section and Fence diagram of Dongargaon Block

Table 7 Aquifer Characteristics of Dongargarh Block

Places		Musra	Dundera	Medha	Dhara	Manikpur
Major Formation		Granite	Limestone	Granite	Granite	Granite
Thickness (in m)	Aquifer-I	11.5	10	9	20	9.22
No of potential zone	Aquifer-II	3 (32.08-35.08, 57.94-65.56, 70.18-73.18)	1 (9.22-12.22)	3 (27.46-3.08, 50.32-54.94, 62.56-65.56)	4 (12.22-16.84, 32.08-35.08, 164.62-169.24, 179.86-184.84)	3 (42.7-50.32, 57.94-62.56, 93.04-96.04)
Yield (lps)		16.44	1.48	4.92	1.3	5.9
Transmissivity (m ² /day)		4.398	15.71	12.32	11.586	20.8
Drawdown (m)		2	6	19	6.5	41.6

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

Aquifer wise resource availability is given in the following table where the total resource available in Dongargarh block is 3467.61 ham. The extraction details and the future scenario (2025) along with the categorization is depicted in the table

Table 8 Ground Water Resources of Dongargarh block in Ham

Name of Block	Annual Extractable Ground Water Recharge (Ham) (7=5-6)	Current Annual Ground Water Extraction (Ham)				Annual GW Allocation for Domestic Use as on 2025	Net Ground Water Availability for future use (13=7-8-9-12)
		Irrigation Use	Industrial Use	Domestic Use	Total Extraction (11=8+9+10)		
Dongargarh	7	8	9	10	11	12	13
	9409.46	5267.50	0.12	524.38	5792.00	674.23	3467.61

Net Annual Ground Water Availability (Ham)	23565.8
Provision for domestic requirement supply to 2025(Ham)	674.23
Stage of Ground Water Development %	61.56
Category	Safe

4. GROUND WATER RESOURCE ENHANCEMENT:

4.1 Aquifer wise space available for recharge and proposed interventions:

Table 9 Aquifer wise space availability

Block	Area Identified for Artificial Recharge* Sq.Km	Average Depth to Post monsoon water level (mbgl)- 3			Sy	Sub surface storage potential (mcm)	Surface Water Requirement (mcm)
		3 to 5	5 to 10	10 to 15			
Dongargarh	751.54	1	4.5	9.5	0.016	29.8	39.6

5. ISSUES:

- i. The aquifer itself is a low yielding one due to which during summer, dugwells in almost all villages are dry except a few locations. Several handpumps also stop yielding water.
- ii. It has been observed during fieldwork in pre-monsoon period, there is colossal wastage of groundwater through public water supply system.
- iii. Uneven distribution of yield potential in consolidated Dongargarh granite
- iv. Good potential zone confined in structurally low laying areas whereas in higher elevation, it is poorly yielding
- v. There is further scope of groundwater development.

6. MANAGEMENT PLAN:

6.1 Supply side interventions:

- i. Sanctuary wells may be constructed for drinking needs as a step towards crisis management.
- ii. It has been observed during fieldwork in pre-monsoon period, there is colossal wastage of groundwater through public water supply system. In this state, the Government has undertaken "Nal Jal Yojana" to provide water to villages. Under this scheme, the government has dug borewells of about 150-200feet depth,

lowered a pump in the well to draw out water and constructed a small tank to hold water. Unfortunately, people do not switch off the pump once the tank is full. Also, the pipes are not fitted with taps to control the flow of water. So, Information, education and Communication (IEC) activities to be organized to sensitize people on the issues of depleting groundwater resource. Massive awareness campaigns are essential to aware people about the importance community participation in saving water.

- iii. 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.

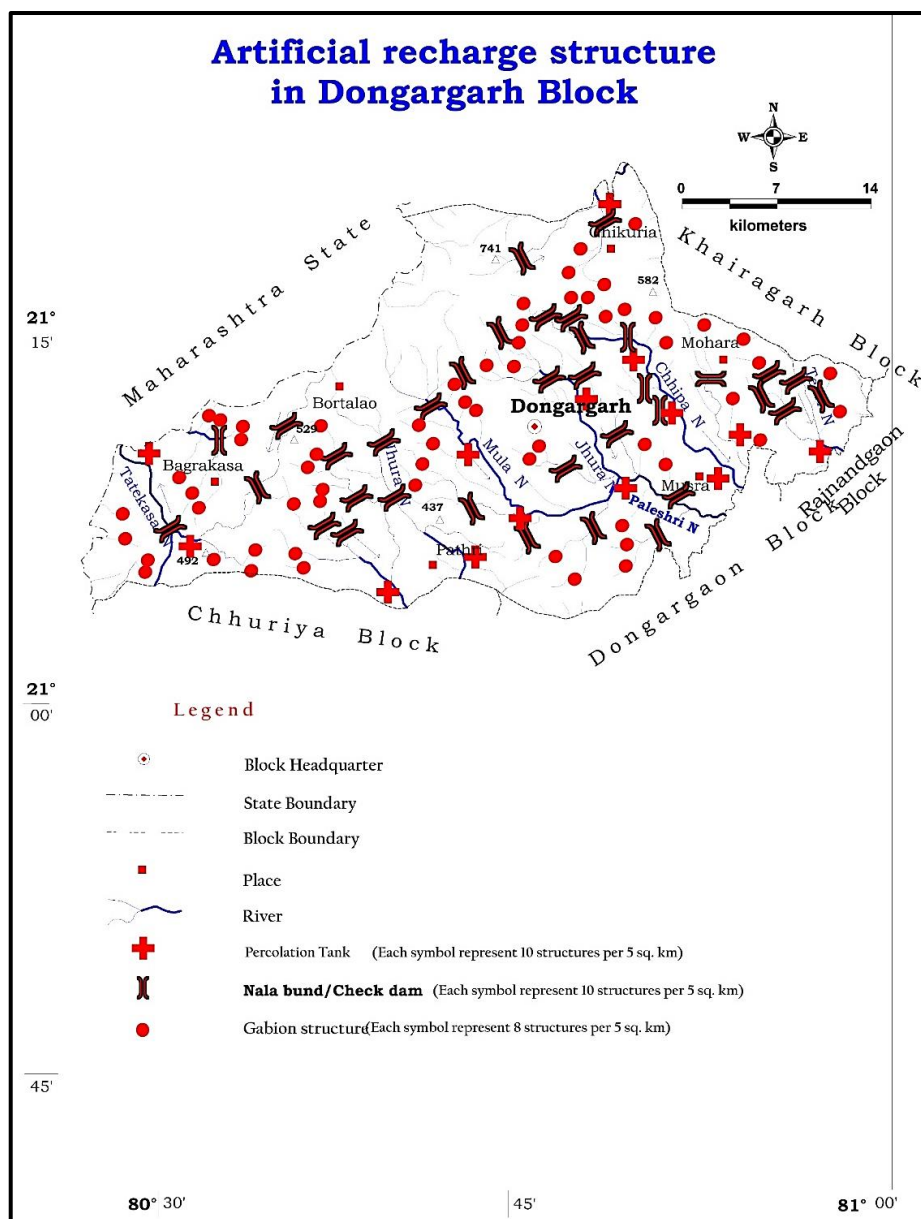


Figure 12 Management plan of Dongargarh Block

- iv. It has been observed that the demand of ground water is increasing for irrigation, industrial and domestic uses. At location near urban areas water level is declining, so 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
- v. Recharge should be practice in dried up bore well and Dug well.
- vi. Govt. may set up network of grids to purchase electricity generated from solar panels. This will encourage the farmers not to waste electricity by extracting groundwater unnecessarily and also provide alternative income.

Table 10 Types of Artificial Recharge structures feasible

Name of Block	Area Feasible for recharge (sq.km)	Sub surface storage potential (mcm)	Types of Structures Feasible and their Numbers		
			P	NB & CD	G
Dongargarh	751.54	39.6	140	300	400
	Recharge Capacity		28	9	2
	Estimated cost (Appx. 314 million rupees)		280	30	4

6.2 Demand side interventions:

- i. Change in Irrigation practices- Water can be Saved using micro irrigation methods such as sprinklers, drip irrigation etc.
- ii. Change in cropping pattern- Water can be Saved by change crops from paddy to Maize.
- iii. Control on wasting water through Public water Supply- Unfortunately, people do not switch off the pump once the tank is full. Also, the pipes are not fitted with taps to control the flow of water.
- iv. Sapling should be planted in Barren land

7. CONCLUSION:

An area of 1130 sq.km of Dongargarh block of Rajnandgaon district has been considered for Aquifer Mapping and Management Plans. The total g.w resource is 23565.8 Ham with stage of g.w development 61.56 % and categorized as "Safe". 32.66 % of the irrigated area is uses groundwater for irrigation. The major aquifer groups are Dongargarh granite and Khairagarh group (Basic volcanics). In terms of Demand side management, by change in cropping and irrigation pattern (micro irrigation methods) water can be saved respectively. In terms of Supply side management, Percolation Tank (140), Nala bund or Check dam (300) and Gabion structures (400) can be constructed to recharge 39.6 MCM water to underground. and constructing of tubewell at suitable locations, drinking water needs may be fulfilled.

