



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 DONGARGAON BLOCK, RAJNANDGAON DISTRICT, CHHATTISGARH

उत्तर मध्य छत्तीसगढ़ क्षेत्र, रायपुर

North Central Chhattisgarh Region, Raipur

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

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ACKNOWLEDGEMENT

The author is grateful to Shri G. C. Pati, Chairman, Central Ground Water Board for giving opportunity for preparation of the National Aquifer Mapping & Management report of Rajnandgaon block, Rajnandgaon district, Chhattisgarh. I express my sincere gratitude to Shri G. L. Meena, Member (WQ & WTT) & Sh. S. Marwaha, Member (Scientific), CGWB for giving valuable guidance, encouragement and suggestions during the preparation of this report. The author is thankful to Dr. S. K. Samanta, Head of the Office, Central Ground Water Board, NCCR, Raipur extending valuable guidance and constant encouragement during the preparation of this report. The author is also thankful to Sh. A. K. Biswal, Sc. D; Sh. A. K. Patre, Sc.D; Sh. J. R. Verma, Sc.D; Sh. Uddeshya Kumar, Sc-B & Sh. R. K. Dewangan, Sc-B and other officers and officials of all the sections of the office for the help rendered & for providing the needful data during the preparation of this report on "AQUIFER MAPPING & MANAGEMENT PLAN IN DONGARGAON BLOCK, RAJNANDGAON DISTRICT, CHHATTISGARH".

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BLOCK-WISE AQUIFER MAPS AND MANAGEMENT PLANS

DONGARGAON BLOCK, RAJNANDGAON DISTRICT

1. SALIENT INFORMATION

1.1 About the area:

Name of the Block	Dongargaon
Area	507 Sq. km.
District	Rajnandgaon
State	Chhattisgarh

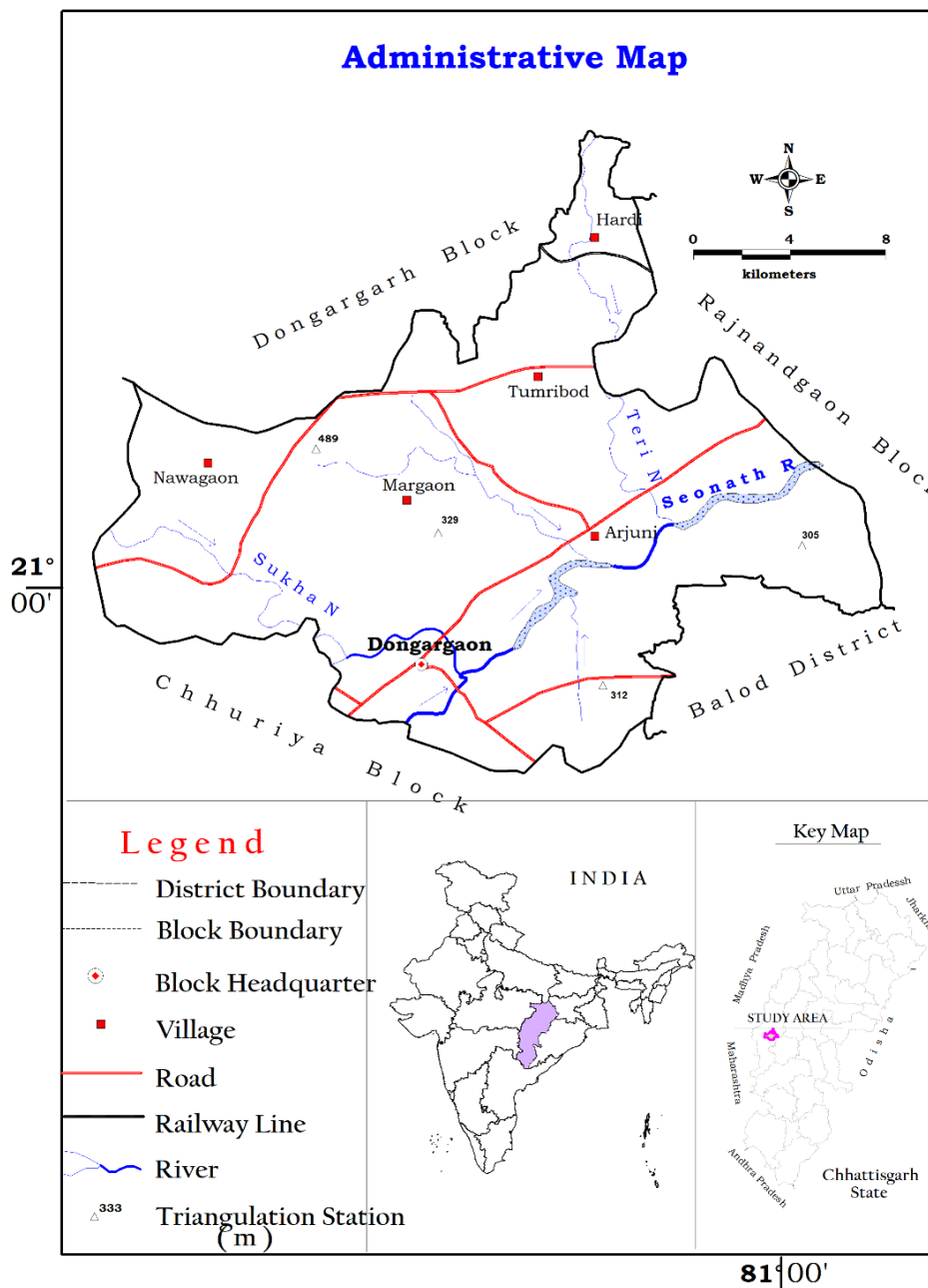


Figure 1 Administrative Map

1.2 Population:

The total population of Dongargaon block as per 2011 Census is 134767. 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
Dongargaon	134767	67103	67664	120074	11517

Source: CG Census, 2011

1.3 Population Growth rate:

The decadal growth rate of this block is 21.75 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) 877.92mm

Table 2 Rainfall data in Dongargaon block (in mm)

Year	2012-13	2013-14	2014-15	2015-16	2016-17
Monsoon rainfall	809	1079.6	631	934	936

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 Dongargaon 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
Dongargaon	41249	608	5506	2676	2742	28535	19580	48115

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						
Dongargaon	28535	19580	655	29711	74	5	8845	789	3277	3	99	0

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
24	2785	2182	7118	698	582	8	146	138	10769	10769	37.73

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 (%)
Dongargaon	7118	582	7700	10769	71.5

Drainage Map

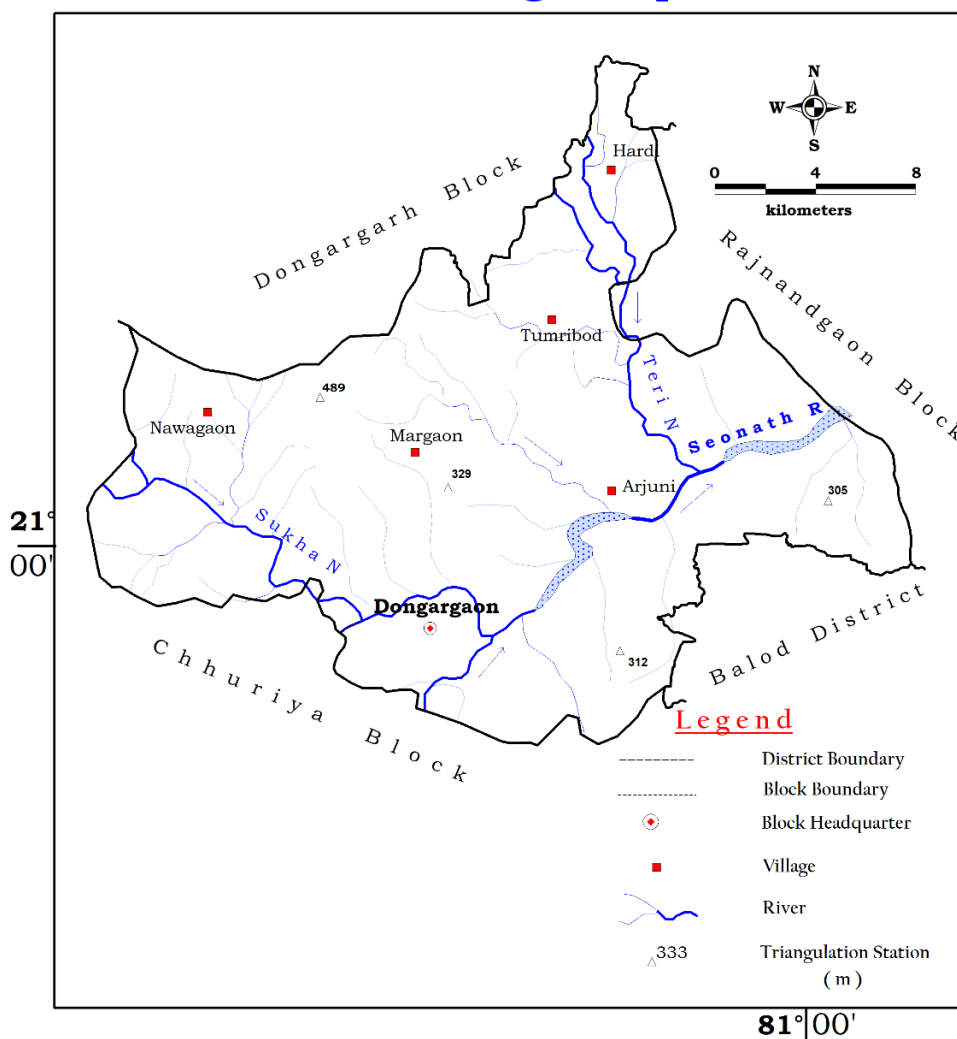


Figure 2 Drainage Map

Geomorphological Map

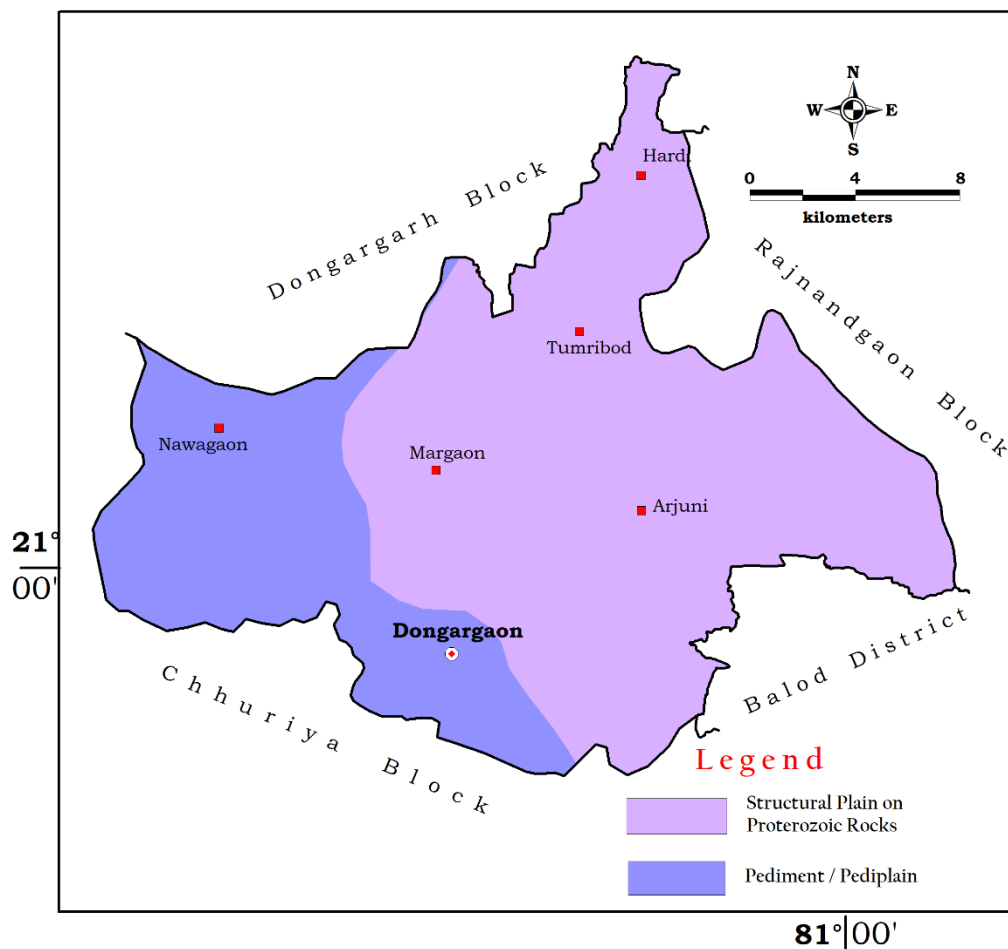


Figure 3 Geomorphological Map

Geomorphology of the Dongargaon block implies that more than 50 % area of the block is covered by structural plain on Proterozoic rock.

1.6 Groundwater Resource Availability and Extraction:

Based on the resource assessment made, the resource availability in aquifer wise in Dongargaon block is given in the table-4.

Table 4 Ground Water Resources of Rajnandgaon block in Ham

Name of Block	Ground Water Recharge (Ham)				Total Annual Ground Water (Ham) Recharge (5=1+2+3+4)	Total Natural Discharge (Ham)	Net Ground Water Availability (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
Dongargaon	2867.23	1639.44	324.34	2082.44	6913.45	691.35	6222.10

1.7 Water Level Behavior:

1.7.1 Pre- monsoon water level (May 2018):

In the pre-monsoon period, it has been observed that in Dongargaon block, water level in Phreatic aquifer vary between 1.52 to 9.27 m bgl with average water level of 5.61m bgl shown in Table No. 5(A). In deeper semi-confined aquifer, water level varies between 8.7 to 26.99 m bgl with average water level of 16.06 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
Dongargaon	1.52	9.27	5.61

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

Block Name	Semi-confined Aquifer		
	Min	Max	Avg
Dongargaon	8.7	29.66	16.06

Depth To Water Level of Phreatic Aquifer (Pre-monsoon 2018)

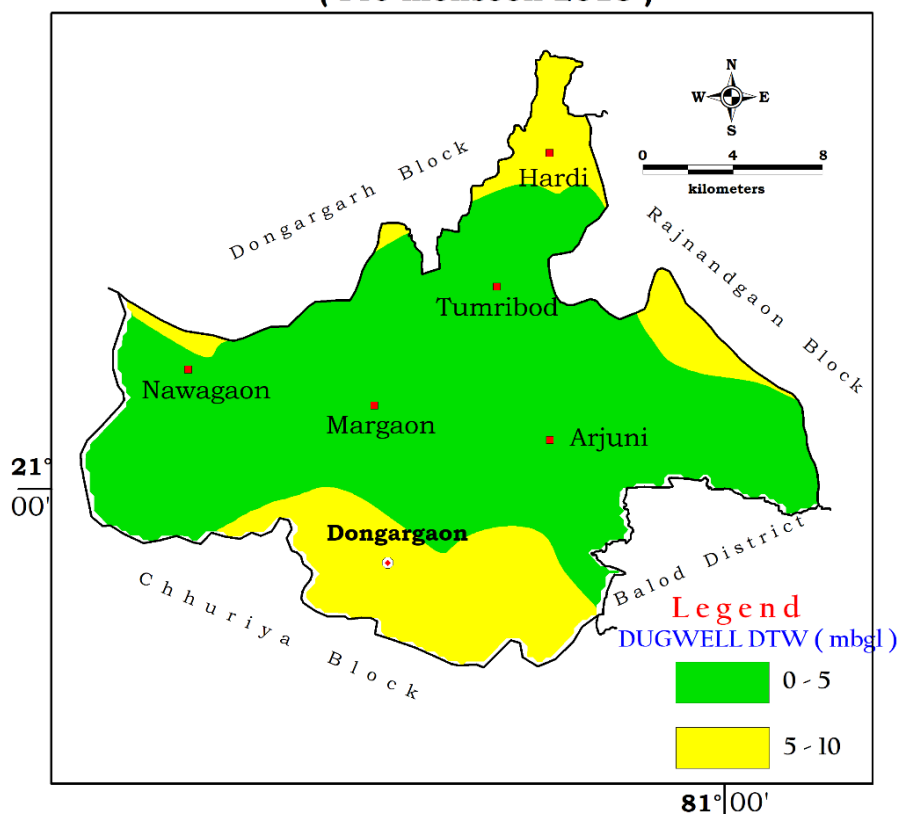


Figure 4 Pre monsoon Depth to water level of Phreatic Aquifer

Depth To Water Level of Semiconfined Aquifer (Pre-monsoon 2018)

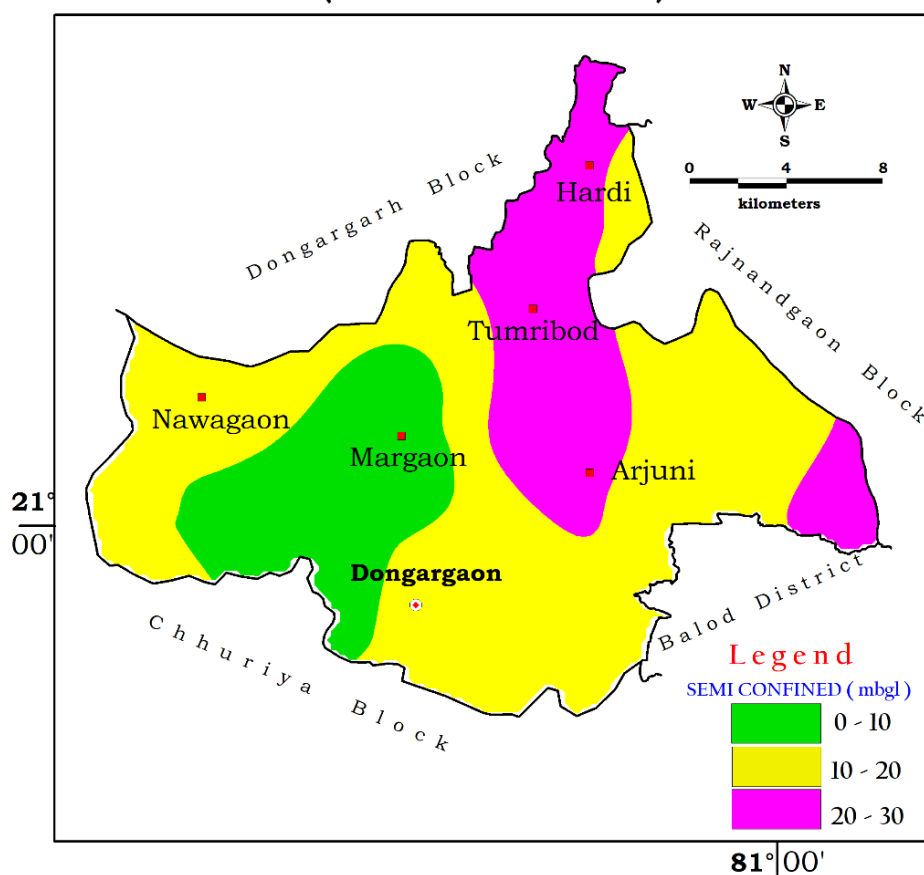


Figure 5 Pre monsoon Depth to water level of Semiconfined Aquifer

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 varies between 1.43 to 6.3 m bgl with average water level of 3.73 m bgl shown in Table No. 5(C). In deeper semi-confined aquifer, water level varies between 5.3 to 22.04 m bgl with average water level of 11.32 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
Dongargaon	1.43	6.3	3.73

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

Block Name	Semi-confined Aquifer		
	Min	Max	Avg
Dongargaon	5.3	22.04	11.32

**Depth To Water Level of Phreatic Aquifer
(Post-monsoon 2018)**

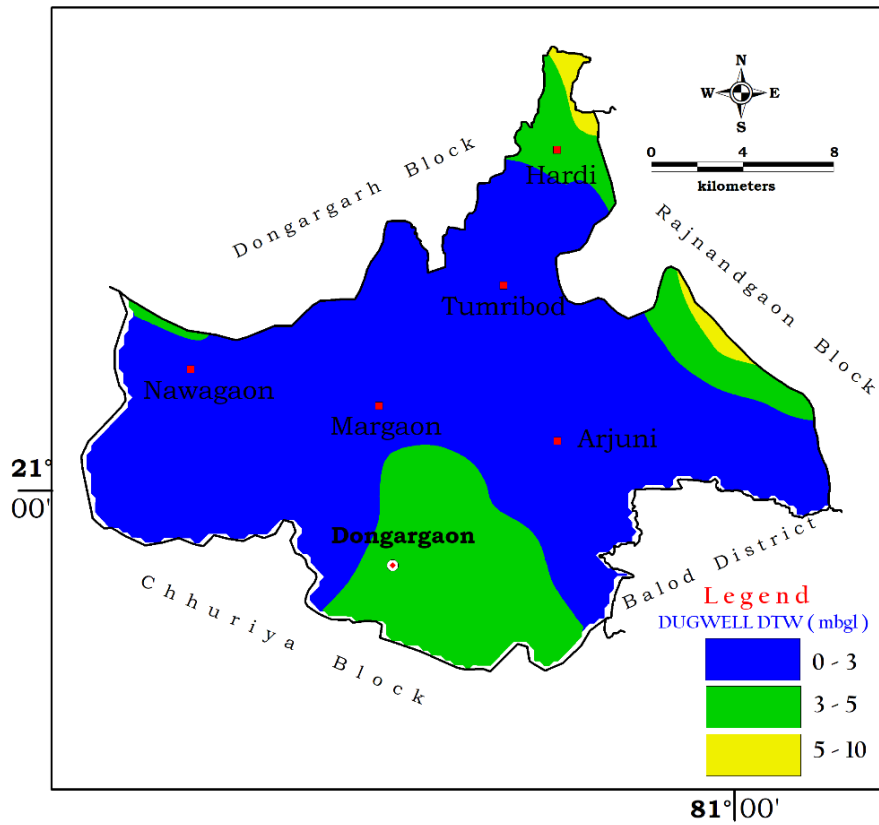


Figure 6 Post monsoon Depth to water level of Phreatic Aquifer

**Depth To Water Level of Semiconfined Aquifer
(Post-monsoon 2018)**

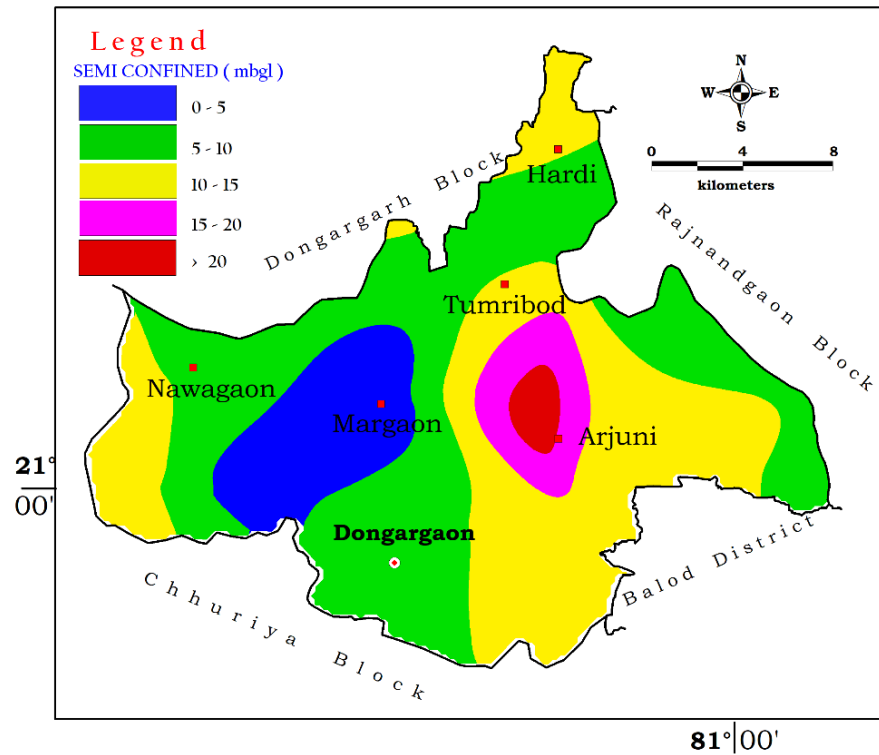


Figure 7 Post monsoon Depth to water level of Semiconfined Aquifer

1.7.3 Seasonal water level fluctuation:

The water level fluctuation data indicates that in Dongargaon block, water level fluctuation in phreatic aquifer varies from 0.09 to 3.6m with an average fluctuation of 1.88 m show in Table No. 5(E). Water level fluctuation in semi-confined aquifer varies from 0.25 to 11.99 m with an average fluctuation of 4.74m 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
Dongargaon	0.09	3.6	1.88

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

Block Name	Semi-confined Aquifer		
	Min	Max	Avg
Dongargaon	0.25	11.99	4.74

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

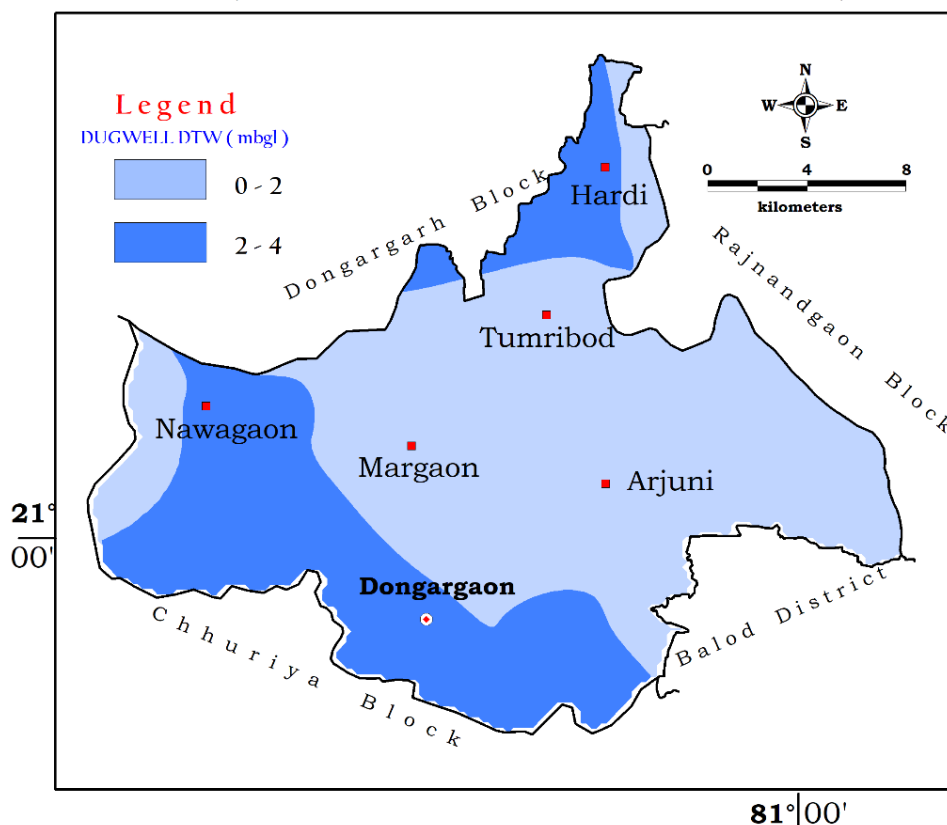


Figure 8 Ground water level fluctuation of Phreatic Aquifer

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

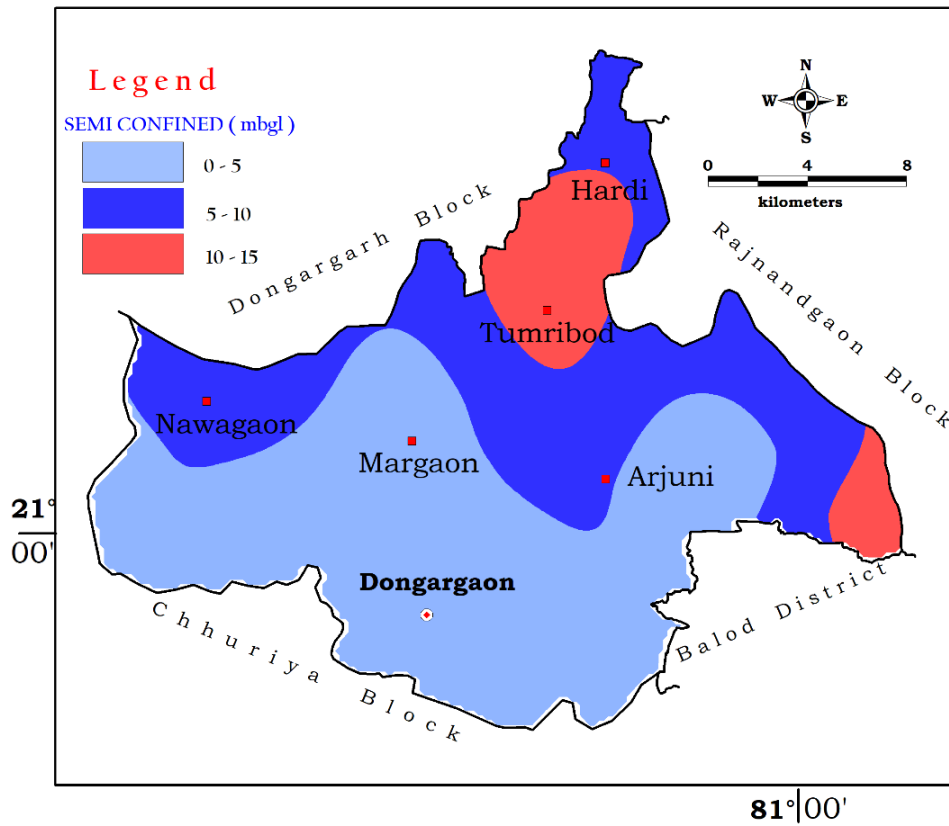
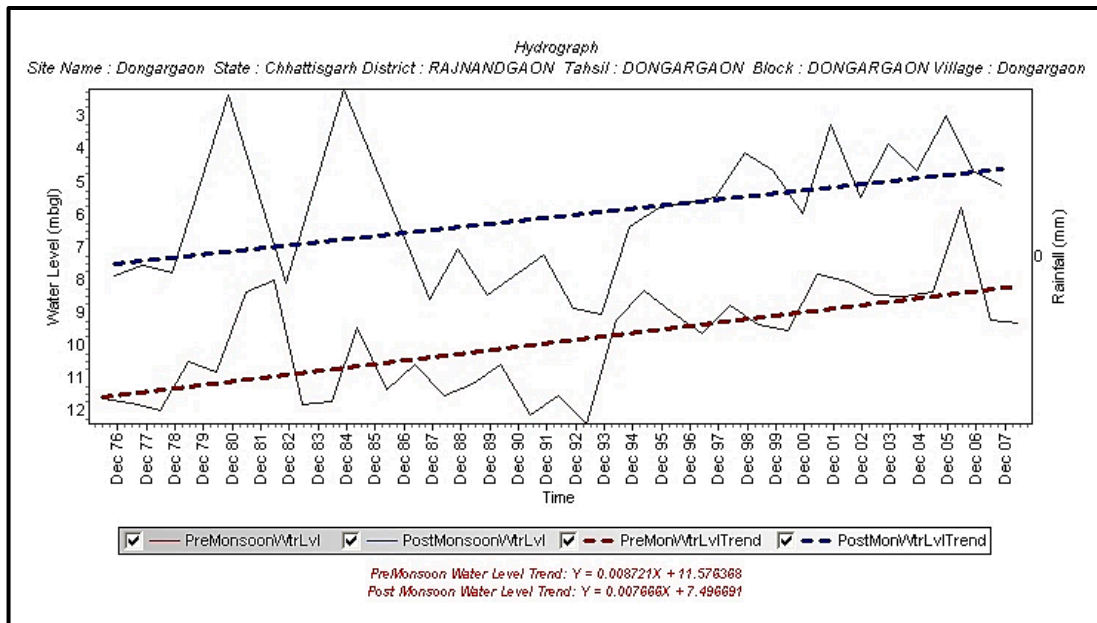
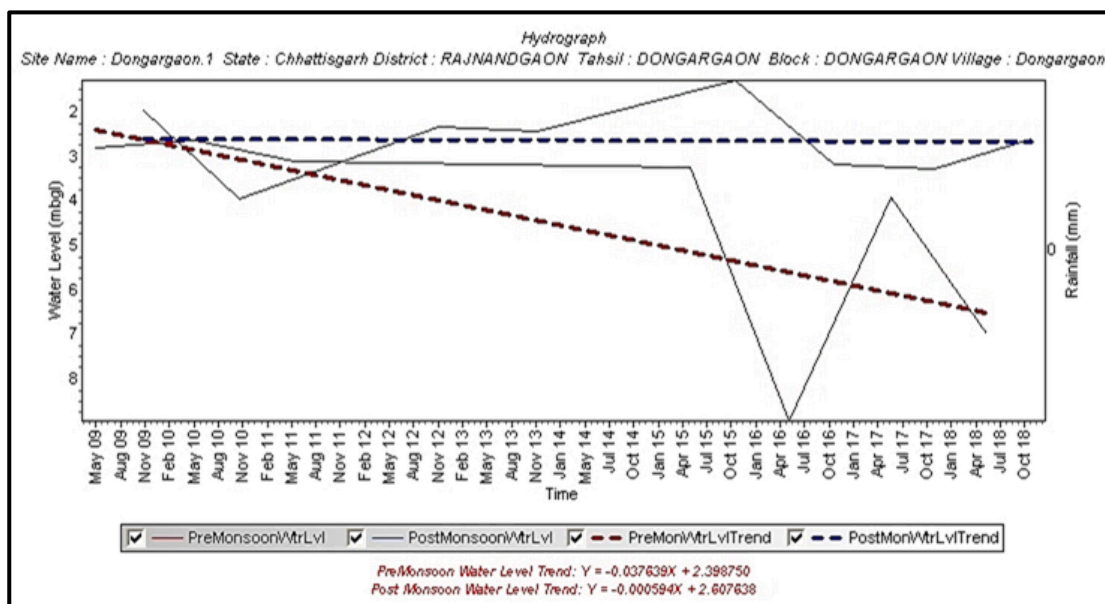


Figure 9 Ground water level fluctuation of Semiconfined Aquifer

1.7.4 The long-term water level trend:



From 1976 to 2007 it is showing rising trend for both Pre-monsoon and Post-monsoon water level which indicate more recharge with less extraction during these decades.



But in last decades from 2009 to 2018 there was significant fall in pre-monsoon water level trend which implies the extraction of ground water was increased.

2. AQUIFER DISPOSITION:

2.1 Number of Aquifers:

There are four 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 Dongargaon Block

Geological Formation	Aquifer	Area Covered (Sq. k. m.)
Gunderdehi Formation	Shale <i>Aquifer-I (Phreatic Aquifer)</i> <i>Aquifer-II (Fractured aquifer)</i>	60.42
Charmuria Formation	Limestone <i>Aquifer-I (Phreatic Aquifer)</i> <i>Aquifer-II (Fractured aquifer)</i>	120.4
Chandrapur Group	Sandstone <i>Aquifer-I (Phreatic Aquifer)</i> <i>Aquifer-II (Fractured aquifer)</i>	51.4
Bijili Rhyolite and Dongargarh Granite	Acidic Rock <i>Aquifer-I (Phreatic Aquifer)</i> <i>Aquifer-II (Fractured aquifer)</i>	176

Aquifer Map of Dongargaon Block

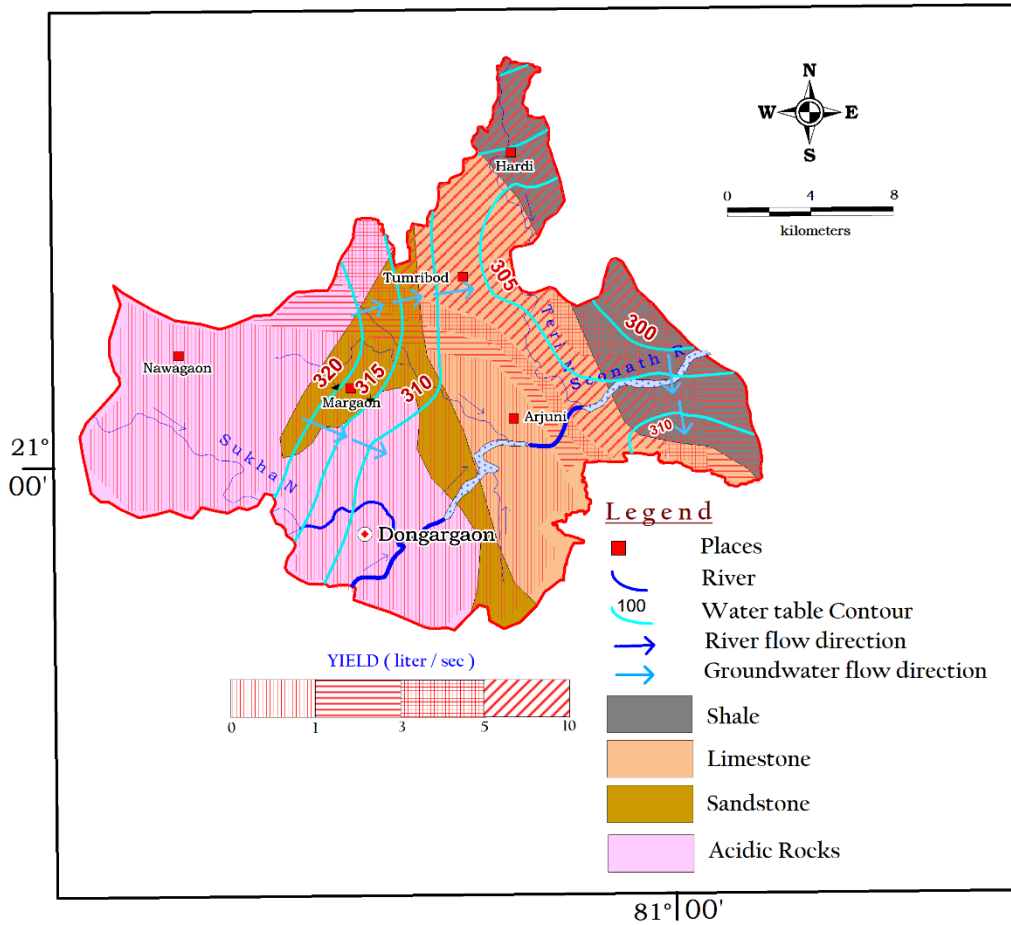
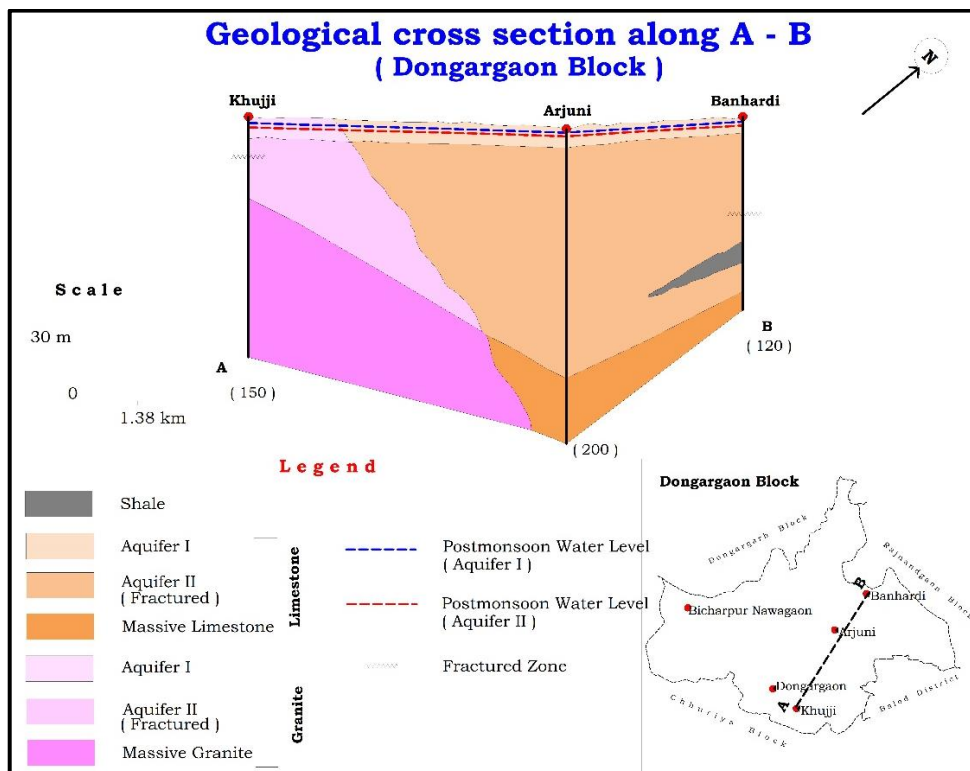


Figure 10 Aquifer Map of Dongargaon block

2.2 3-D Aquifer Disposition and Basic Characteristics of each Aquifer:



Disposition of Aquifer in Dongargaon Block

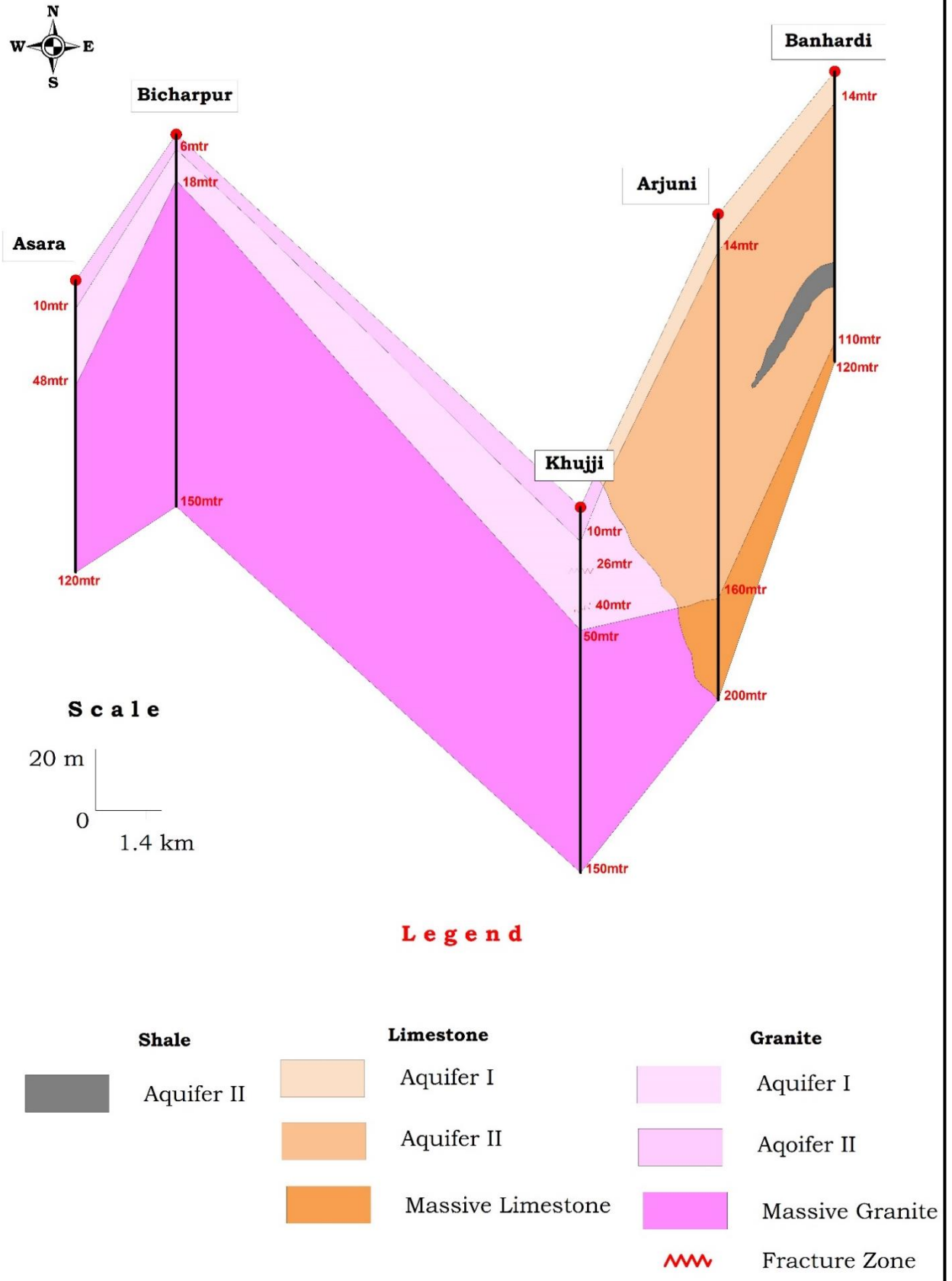


Figure 11 Cross section and Fence diagram of Dongargaon Block

Table 7 Aquifer Characteristics of Dongargaon Block

Places		Bicharpur	Arjuni	Banhardi
Major Formation		Granite	Limestone	Limestone, Shale
Thickness (in m)	Aquifer-I	17	10.5	9
No of potential zone	Aquifer-II	-	1 (158m to 160m)	2 (57m to 60m and 115m to 118m)
Yield (lps)		Dry	0.078	1.2
Transmissivity (m ² /day)		-	0.23	-
Drawdown (m)		-	-	-

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 Dongargaon block is 6222.10 ham. The extraction details and the future scenario (2025) along with the categorisation is depicted in the table no 8.

Table 8 Ground Water Resources of Dongargaon block in Ham

Total Ground Water Availability of Unconfined Aquifer (Ham)	13923.3
Existing Gross Ground Water Draft for All uses (Ham)	5073.70
Stage of Ground Water Development %	81.54
Category	Semi-Critical

Name of Block	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 (13=7-8-9-12)
		Irrigation Use	Industrial Use	Domestic Use	Total Extraction (11=8+9+10)		
	7	8	9	10	11	12	13
Dongargaon	6222.10	4727.98	5.99	339.73	5073.70	447.48	1040.65

4. GROUND WATER RESOURCE ENHANCEMENT:

4.1 Space available for recharge and proposed interventions:

Table 9 Aquifer wise space availability

Block	Area Identified for Artificial Recharge (Sq.Km)	Average Depth to Postmonsoon water level (mbgl)-3			Sy	Sub surface storage potential (mcm)	Surface Water Requirement (mcm)
		3 to 5	5 to 10	10 to 15			
Dongargaon	92.11	1	-	-	0.016	1.09	1.45

5. ISSUES:

- i. During summer, Dugwells in villages are dry except in few locations Several hand pumps also stop yielding water. Drying Dugwells and depletion of ground water level during premonsoon in Dongargaon blocks is due to excessive ground water withdrawal.
- ii. In Dongargaon block Ground Water Draft for Irrigation is 4727.98 ham which is 93% of Gross draft i.e. 5073.7
- iii. The aquifer itself is a low yielding one in Dongargaon block (i.e. Charmuria formation)
- iv. It has been observed during fieldwork in pre-monsoon period, there is colossal wastage of groundwater through public water supply system.
- v. Poor stage of groundwater development.

6. MANAGEMENT PLAN:

6.1 Supply side interventions:

- i. 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.

- 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.

Artificial Recharge Structure in Dongargaon Block

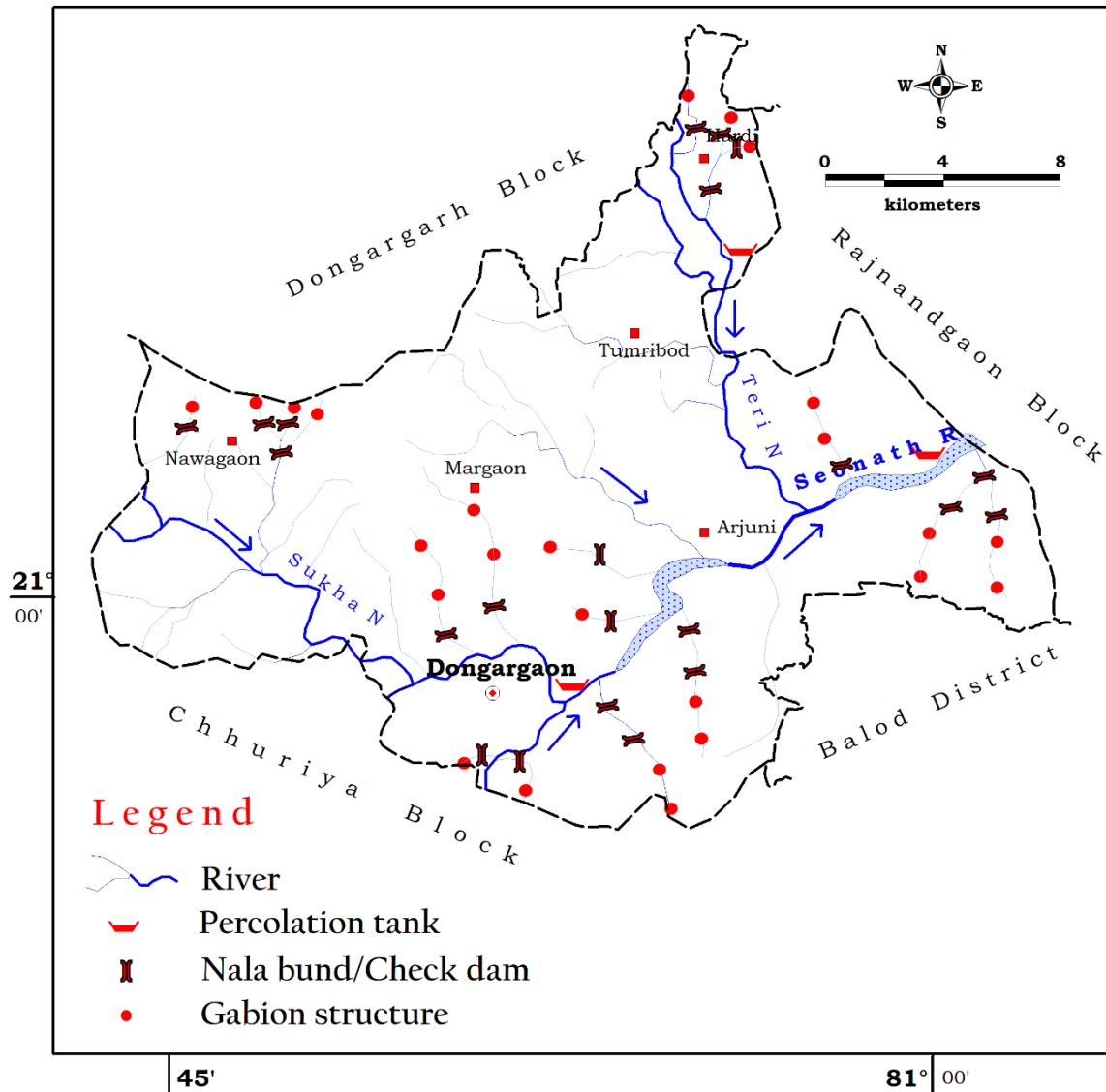


Figure 12 Management plan of Dongargaon Block

- iii. 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

- iv. Recharge should be practice in dried up bore well and Dug well.
- v. 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
Dongargaon	92.11	1.45	3	22	25
	Recharge Capacity		0.6	0.66	0.125
	Estimated cost (Appx. 8.45 million rupees)		6	2.2	0.25

6.1 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 507 sq.km of Dongargaon block of Rajnandgaon district has been considered for Aquifer Mapping and Management Plans. The total g.w resource is 13923.3 Ham with stage of g.w development 81.54 % and categorized as "Semi Critical". 71.5 % of the irrigated area is uses groundwater for irrigation. The major aquifer groups are Gunderdehi Shale, Charmuria Limestone, Chandrapur Sandstone, Dongargarh Granite and Bijili Rhyolite. 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, by constructing artificial recharge structure 1.45 MCM

water can be recharged and constructing of tubewell at suitable locations, drinking water needs may be fulfilled.

