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

HUMNABAD TALUK, BIDAR DISTRICT, KARNATAKA

दक्षिण पश्चिमी क्षेत्र, बैंगलोर

South Western Region, Bengaluru

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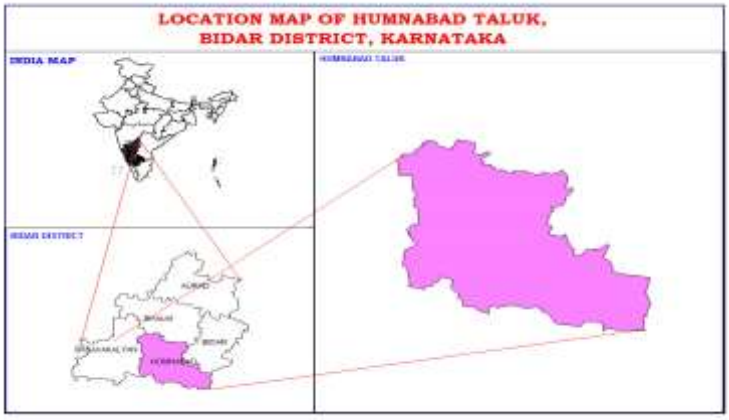
Government of India
Ministry of Jal Shakti
Department of Water Resources, RD & GR
Central Ground Water Board

AQUIFER MANAGEMENT PLAN OF HUMNABAD TALUK, BIDAR DISTRICT, KARNATAKA STATE



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AQUIFER MANAGEMENT PLAN OF HUMNABAD TALUK, BIDAR DISTRICT, KARNATAKA STATE

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AQUIFER MANAGEMENT PLAN OF HUMNABAD TALUK, BIDAR DISTRICT, KARNATAKA STATE

1. SALIENT INFORMATION

Name of the Taluk: **HUMNABAD**

District: Bidar

State: Karnataka

Area: 981 sq.km.

Population: 3,32,362

Annual Normal Rainfall: 812 mm

1.1 Aquifer Management Study area

Aquifer mapping studies was carried out in Humnabad Taluk, Bidar district of Karnataka covering an area of 981 sq.kms under National Aquifer Mapping Project. Humnabad Taluk of Bidar district is located between north latitude 17°35'04" and 17°56'36" and east longitude 77°02'42" and 77°27'25", and is covered in parts of Survey of India Toposheet Nos.56 G/1,56 G/2,56 G/5 and 56 G/6. Humnabad Taluk is bounded by Bhalki & Bidar Taluks on north, Chincholi & Gulbarga Taluk of Kalburgi district on south, Telangana State on east and Basavakalyana Taluk on western side.

Location map of Humnabad Taluk of Bidar district is presented in **Figure 1**.

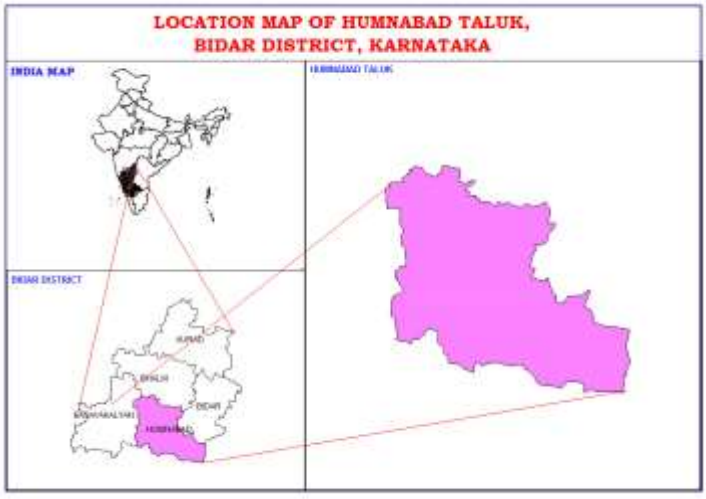


Fig 1: Location Map of Humnabad Taluk, Bidar district

Taluk administration of Humnabad Taluk is divided into 6 Hoblies and Humnabad is only one town, which is also the Taluk head quarter. There are 85 inhabited and 2 uninhabited villages in Humnabad Taluk.

1.2 Population

According to 2011 census, the population in Humnabad Taluk is 3,32,362 in which 262581 constitute the rural population and 69781 is the urban population, which works out to 79 % (rural) and 21 % (urban) of the total population of the Taluk. The study area has an overall population density of 339 persons per sq.km. The decadal variation in population from 2001-2011 is 12.82 % in the Taluk.

1.3 Rainfall

Humnabad Taluk enjoys semi-arid climate. Dryness and hot weather prevail in major part of the year. The area falls under Central Dry agro-climatic zone of Karnataka state and is categorized as drought prone. The normal annual rainfall in Humnabad Taluk for the period 1981 to 2010 is 812 mm. Seasonal rainfall pattern indicates that major amount of rainfall was recorded during South-West Monsoon seasons (620 mm) which contributes about 76% of the annual normal rainfall, followed by North-East Monsoon season (115 mm) constituting 14 % and remaining 10 % in Pre-Monsoon season (73 mm) (**Table-1**).

Computations were carried out for the 30-year blocks of 1981- 2010, the mean monthly rainfall at Humnabad Taluk is ranging between 3 mm during February to 174 mm during September. The coefficient of variation percent for pre-monsoon, monsoon and post monsoon season is 81, 33 & 59 percent respectively. Annual CV at this station works out to be 28 percent (Table-1). It has been observed that the frequency of occurrence of drought is **once in 4 years** at Humnabad Taluk.

Table 1: Statistical Analysis of Rainfall Data of Humnabad Station from 1981 to 2010

STATION		JAN	FEB	MAR	APR	MAY	PRE MONSOON	JUN	JUL	AUG	SEP	SOUTH WEST MONSOON	OCT	NOV	DEC	NORTH EAST MONSOON	ANNUAL RAINFALL
Humnabad	Normal Rainfall (mm)	7	3	13	19	34	77	116	158	172	174	620	92	20	4	115	812
	ST.DEV	15	7	23	20	48	63	67	99	89	112	202	61	29	7	68	224
	CV%	209	229	180	104	141	81	58	62	52	64	33	66	146	177	59	28

Agriculture is the main occupation in Humnabad Taluk. Major Kharif crops are Jowar, Bajra, Maize, Paddy, Sugarcane and Vegetables. Main crops of Rabi season are Tur, Bengal gram, Maize, Horse gram, Groundnut and Soyabean (**Table 2**). Pulses are grown in 44% and Jowar in 13% of total crop area of the Taluk. Oil seeds accounts for of 31% of total crop area.

Table 2: Cropping pattern in Humnabad Taluk during 2015-2016 (Ha)

Year	Paddy	Maize	Bajra	Jowar	Pulses	Fruits	Vegetables	Oil seeds	Sugarcane	Cotton
2015-2016	342	222	553	7963	28107	467	250	19535	5779	0

Source: District at a Glance 2015-16, Govt. of Karnataka

It is observed that net sown area accounts for 57% and area sown more than once is 7 % of total geographical area in Humnabad Taluk (**Table 3**). 100% of net area irrigated is only from bore wells (**Table 4**).

Table 3: Details of land use in Humnabad Taluk during 2015-2016 (Ha)

Total Geographical Area	Area under Forest	Area not available for cultivation	Fallow land	Net sown area	Area sown more than once
99243	11014	12115	9881	56818	7416

Source: District at a Glance 2015-16, Govt. of Karnataka

Table 4: Irrigation details in Humnabad Taluk

Source of Irrigation	Net area irrigated (Ha.)	% of area
Canals	0	0
Tanks	0	0
Wells	2881	40
Bore wells	4342	60
Lift Irrigation	0	0
Other Sources	0	0
Total	7223	

Source: District at a Glance 2015-16, Govt. of Karnataka

1.5 Geomorphology, Physiography & Drainage

Physiographically, the Taluk falls in southern high land is popularly known as Bidar plateau, which is made up of laterite. Bidar plateau has an elevation range from 640 to 684 m above mean sea level. The ground surface is flat, gently sloping forming broad valleys and flat-topped hills. The flat-topped hills with step like sides exhibit the terraced landscape. (**Figure 2**). The Taluk is covered under both Godavari and Bhima river basins. The river Karanja tributary to Godavari flows in northern part of Taluk and the river Mullamari takes its origin in Basavakalyana Taluk, flows from west to east direction, then flows into Gulbarga district before joining the river Kagna. The Kagna River is one of the major tributaries of Bhima River. Besides these, there are several streams, which are of ephemeral in nature. The drainage pattern in the Taluk varies from sub-dendritic to dendritic and some streams have a sub parallel drainage to the main river. The drainage map of the district is presented in **Figure 3.**

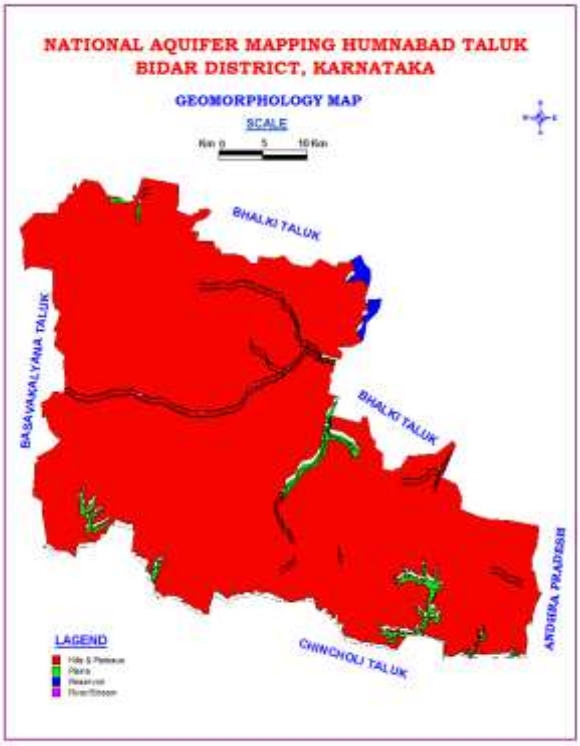


Figure 2: Geomorphology Map

Figure 3: Drainage Map

1.6 Soil

Major parts of the Taluk are comprised of black soils and are derived from Deccan traps. These are deep black in colour and their texture varies from loam to clay (**Figure 4**). Lime concentration in this soil is high resulting in poor infiltration capacities. Their infiltration characteristics are poor to moderate. This type of soil is found mainly in areas lying below 610 m contour and along the valley portions. Lateritic soil is confined to the central portion of the Taluk. Lateritic soils are pale to bright red in colour and clay to clayey loam in nature. This soil has moderate to good infiltration characteristics. This type of soil is found mainly in areas lying above 610 m contour.

Figure 4: Soil Map

1.7 Ground water resource availability and extraction

Aquifer wise total ground water resources up to 200 m depth are given in **Table 5** below.

Table 5: Total GW Resources (As per GEC 2017 in Ham)

Taluk	Annual replenishable GW resourc	Fresh In-storage GW resources		Total availability of fresh GW resources
		Phreatic	Fractured (Down to 200m)	Dynamic +phreatic in-storage + fractured
Humnaba	2786	2621	1305	6712

1.8 Existing and future water demands (As per GEC- 2017)

Net ground water availability for future irrigation development: 22.05 MCM

Domestic and Industrial sector demand for next 25 years:1.67 MCM

1.9 Water level behavior

(a) Depth to water level

Aquifer - I

Pre-monsoon: 4.98 to 16.50 mbgl (**Figure 4**)

Post-monsoon: 3.70 to 16.90 mbgl (**Figure 5**)

Aquifer - II

Pre-monsoon: 16.50-18.24 mbgl

Post-monsoon: 16.65 – 18.20 mbgl

(b) Water level fluctuation

Aquifer-I

Seasonal Fluctuation: Rise ranges upto 1.30 m;
Fall ranges upto 2.67 m

Aquifer-II

Seasonal Fluctuation: fall of 1.70 to Rise shows upto 1.59 m

Figure 4: Pre-monsoon Depth to Water Level of Aquifer I

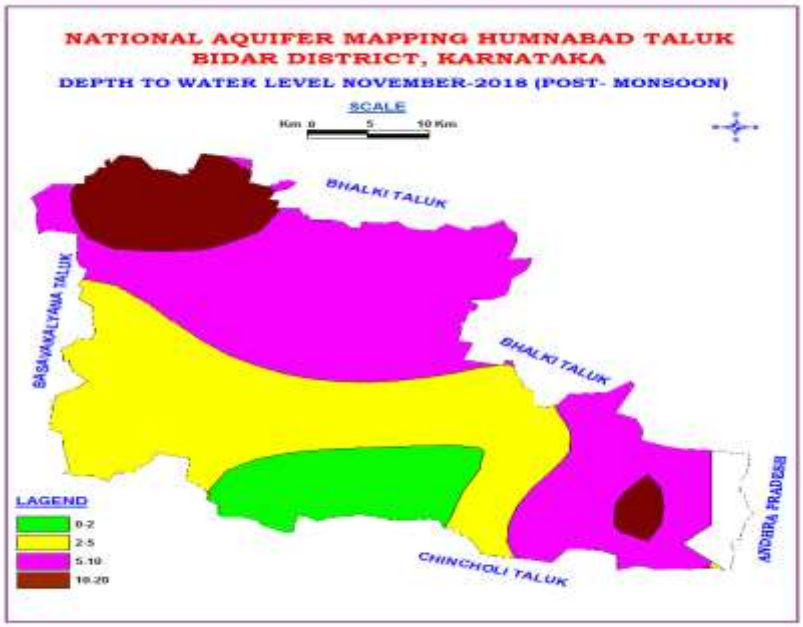


Figure 5: Post-monsoon Depth to Water Level of Aquifer II

2.0 AQUIFER DISPOSITION

2.1 Number of aquifers: In Humnabad Taluk, there are mainly two types of aquifer systems;

i. **Aquifer-I (Phreatic aquifer)** comprising Weathered Basalt / Schist
ii. **Aquifer-II (Fractured aquifer)** comprising Fractured Basalt / Schist

In Humnabad Taluk, Basalt and schist are the main water bearing formations (**Figure 6**). Ground water occurs within the weathered and fractured Basalt and schist under water table condition and semi-confined condition. In Humnabad Taluk, bore wells were drilled from a minimum depth of 47.95 mbgl to a maximum of 198.00 mbgl (**Table-6**). Depth of weathered zone (Aquifer-I) ranges from 3 mbgl to 45 mbgl. Ground water exploration reveals that aquifer-II fractured formation was encountered between the depth of 38 to 166 mbgl. Yield ranges from 0.2 to 16.5 lps. The basic characteristics of each aquifer are summarized in **Table 7**.

Figure 6: Geology Map

Table 6: Details of Ground water Exploration

Sl. No	Location	Latitude	Longitude	Depth Drilled (mbgl)	Casing Depth (m)	Fracture Zones (mbgl)	SWL (mbgl)	Q (lps)	DD (m)
1	Bimalkheda	17°40'00"	77°25'45"	174.20	45	165-166	44.92	0.2	
2	Udbal	17°40'30"	77°'15'30"	198.00	30	80.6-81.6	33.88	0.75	
3	Mannekhalli	17°46'10"	77°'30'45'	178.15	20	38-39	46.92	--.	
4	Maniknagar EW	17°46'40"	77°06'25"	115.05	9.45	65-68,93-95	2.67	7.33	10.38
5	Maniknagar OW	17°46'40"	77°06'25"	92.85	6.10	62-64,85-87	2.5	7.33	1.82
6	Hallikhed.K EW	17°46'10"	77°30'45"	58.05	3.0	55-58.05	0	14.6	1.32
7	Hallikhed.K OW 1	17°46'40"	77°30'45"	90.65	12.6	55-58,79-81	5.789	12.9	2.82
8	Hallikhed.K OW 2	17°46'10"	77°30'45"	47.95	5.5	45-47.95	0.23	8.8	0.9
9	Dubalgundi EW	17°51'30"	77°12'00"	88.65	17.7	52-55	5.74	16.5	6.46
10	Dubalgundi OW	17°51'30"	77°12'00"	67.25	17.89	54-56	5.167	6.67	4.78

Table 7: Basic characteristics of each aquifer

Aquifers	Weathered Zone (Aq.-I)	Fractured Zone (Aq.-II)
Prominent Lithology	Basalt/Schists	Fractured / Jointed Basalt, Schists
Thickness range (mbgl)	45	Fractures upto 166 mbgl
Depth range of occurrence of fractures (mbgl)	-	38 – 166 80% between 50 -
Range of yield potential (lps)	Poor yield	0.2-16.5
Specific Yield	2%	0.
T (m^2/day)	-	-
Quality Suitability for Irrigation	Suitable	Suita ble
Suitability for Domestic purposes	Suitable	Suita
Remarks	Over exploited	Ground water potential fractures, 1 to 2 sets likely up to the depth of 150 m bgl.

2.2 3 D aquifer disposition and Cross-Sections

(A) Aquifer disposition – Rockworks output (**Figure 7 & Figure 8**)

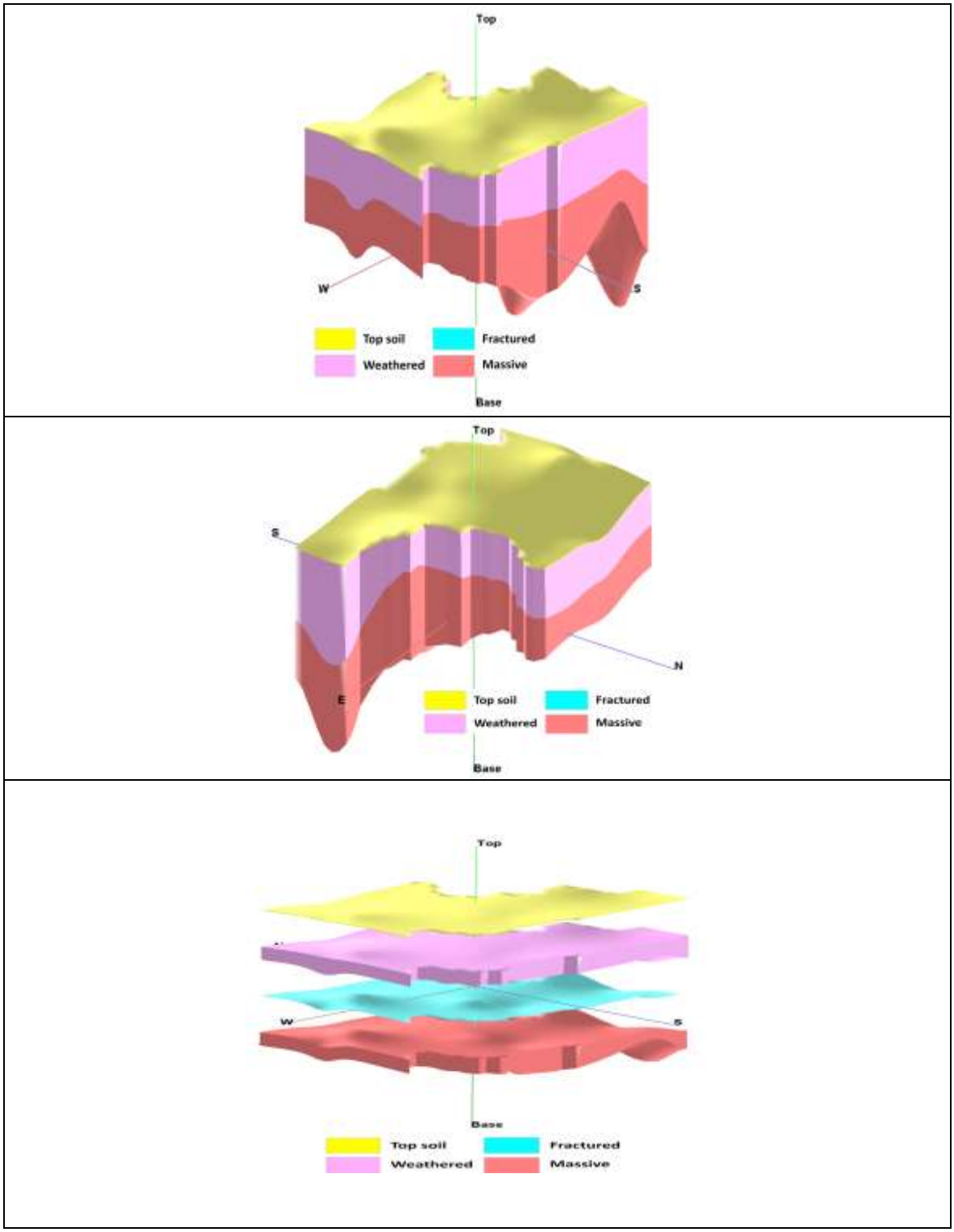
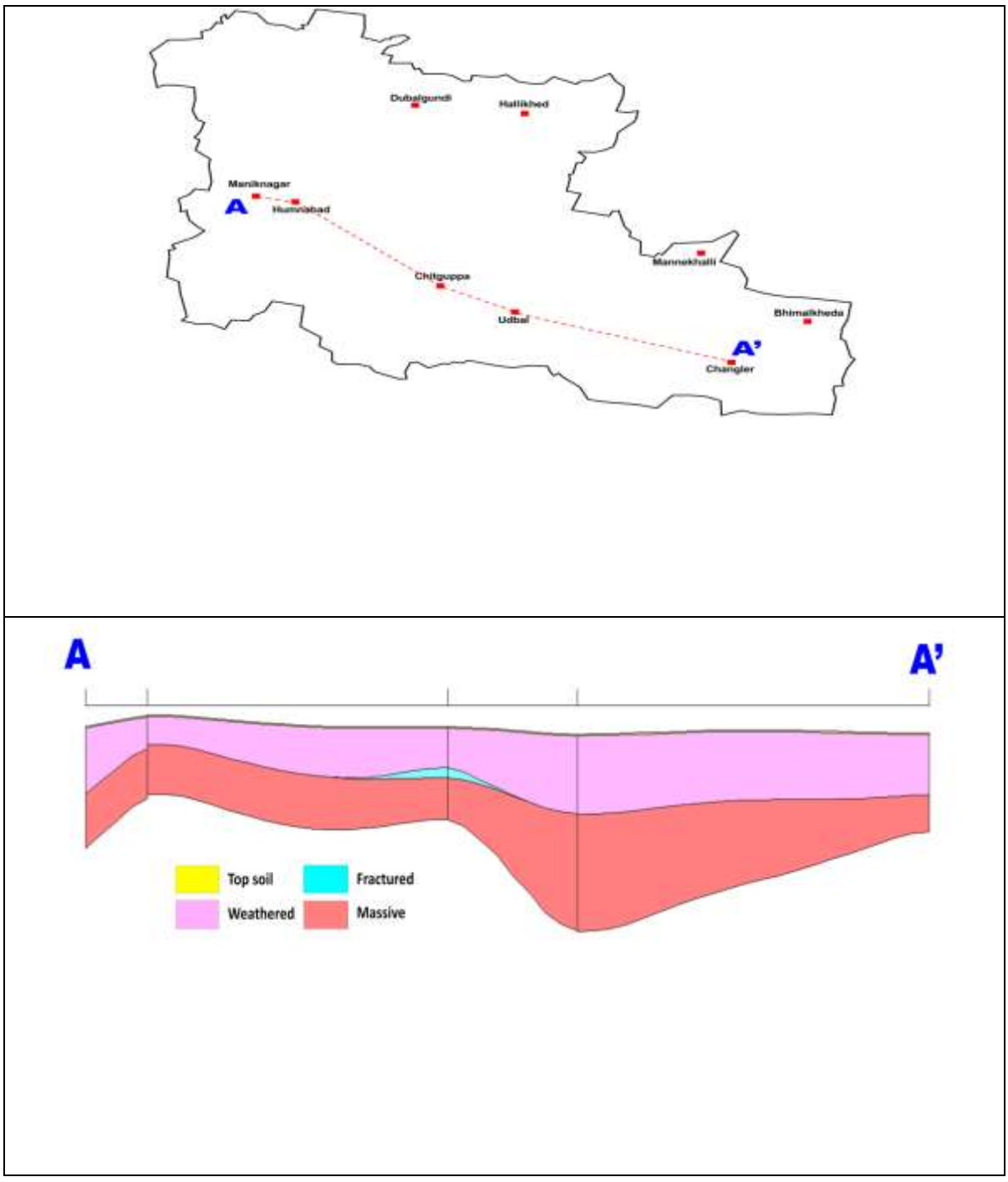
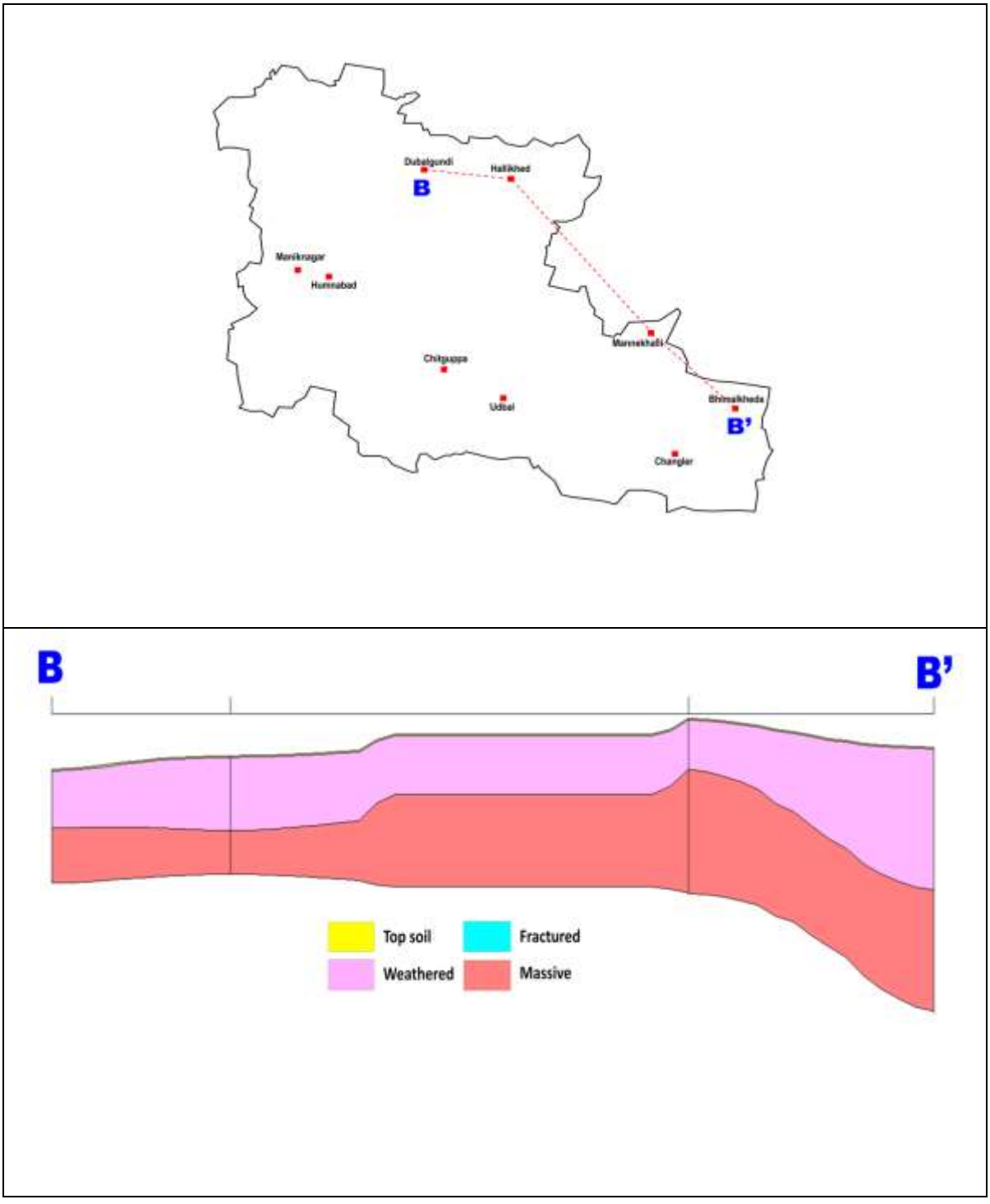
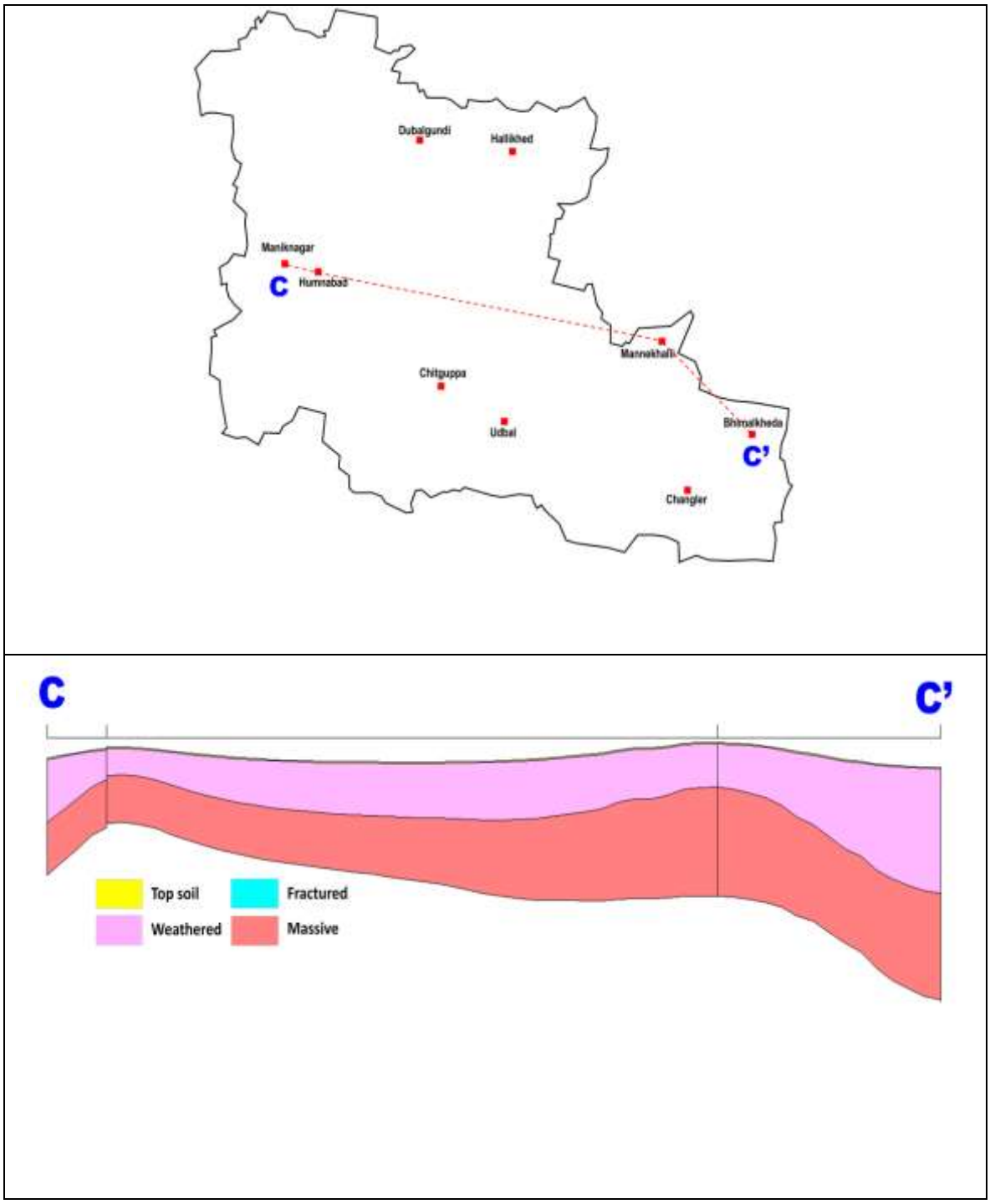


Fig 7: 2D Aquifer Disposition


Dubalgundi
Halilkhed
Maniknagar
A
Humnabad
Chitguppa
Udbal
Mannekhalli
Bhimalkheda
A'
Changler
A
A'
Top soil
Fractured
Weathered
Massive


Dubalgundi
Halikhed
B
Maniknagar
Hunnabad
Mannekhalli
Chitgoppa
Udbal
Bhimalkheda
B'
Changler
B
B'
Top soil
Fractured
Weathered
Massive


Dubalgundi
Hallikhed
Manknagar
C
Hunnabad
Mannakhalli
Chitguppa
Udbal
Bhimakheda
C'
Changler
C
C'
Top soil
Fractured
Weathered
Massive

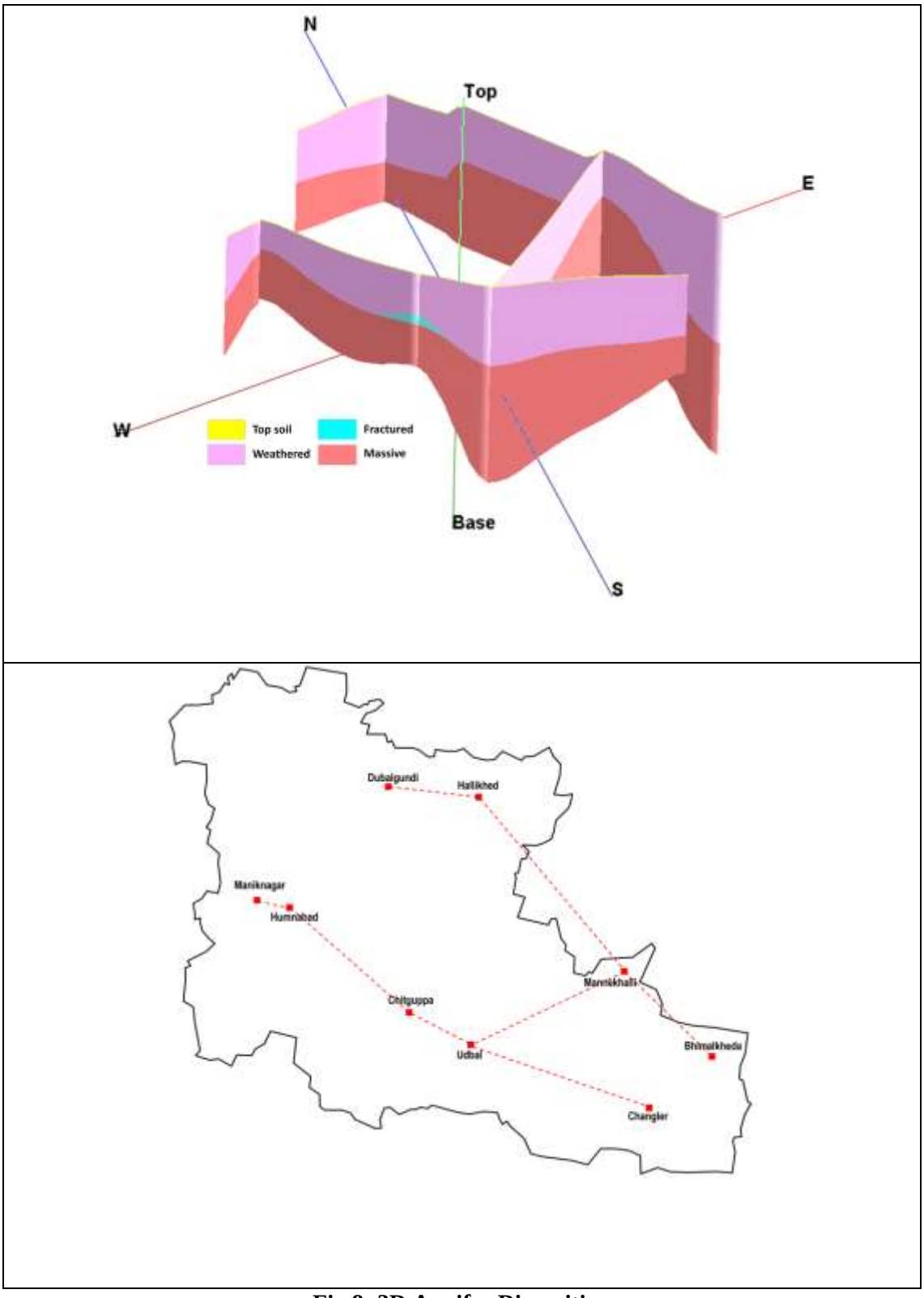
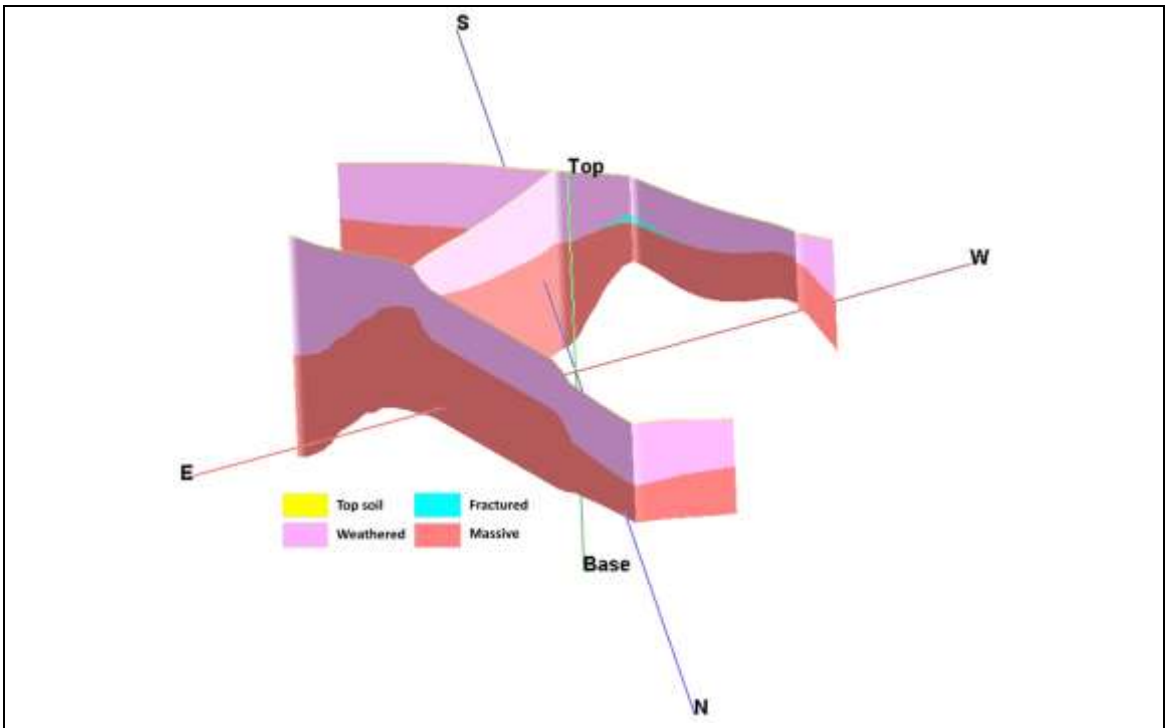
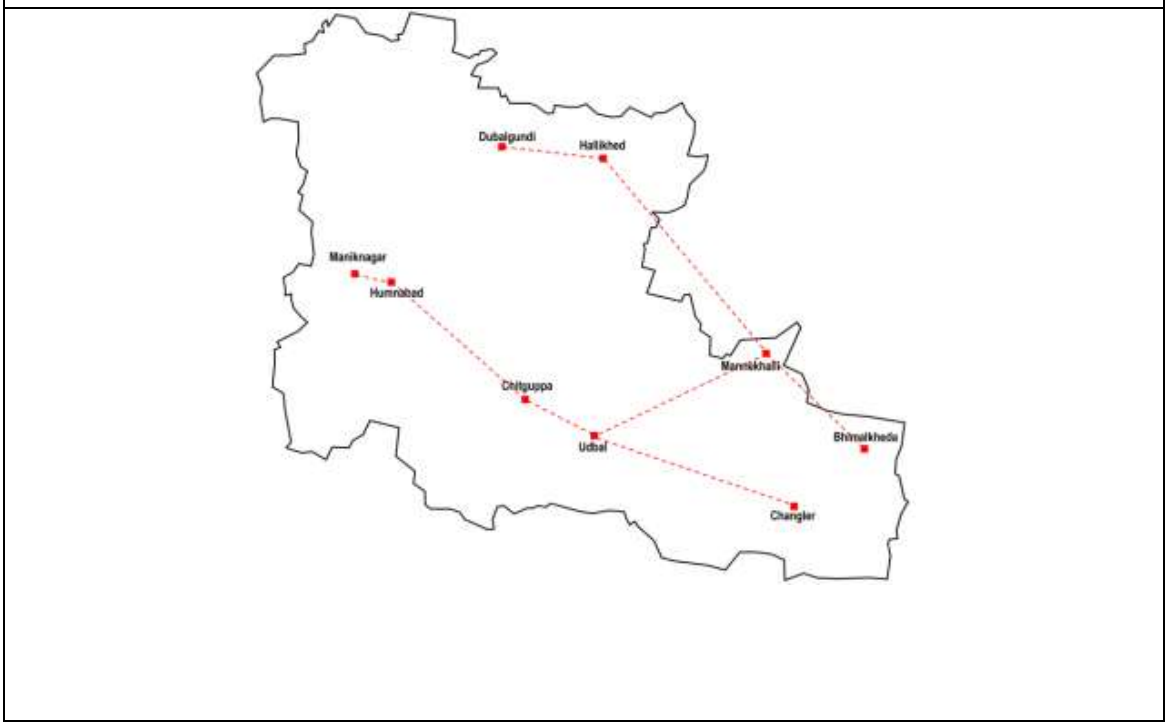


Fig 8: 3D Aquifer Disposition


S
Top
W
E
Top soil
Fractured
Weathered
Massive
Base
N


Dubalgundi
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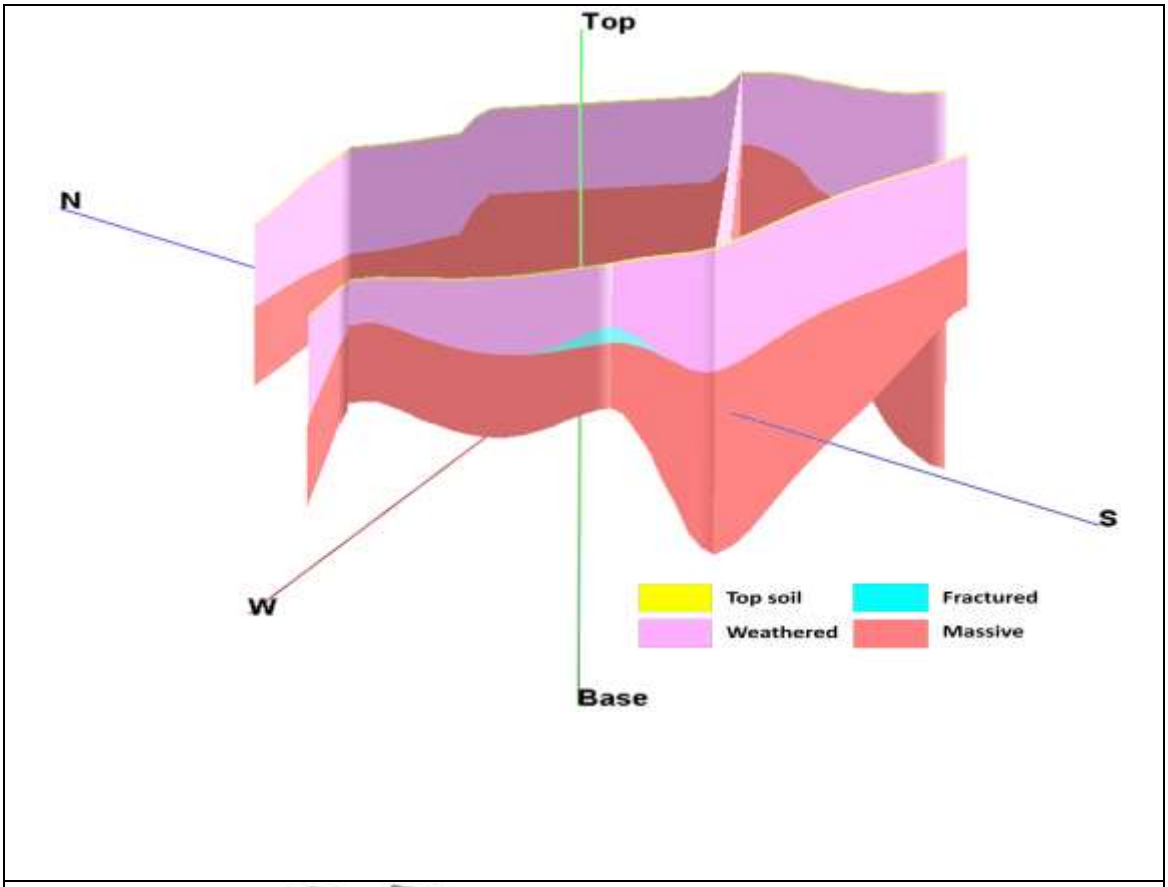
Top
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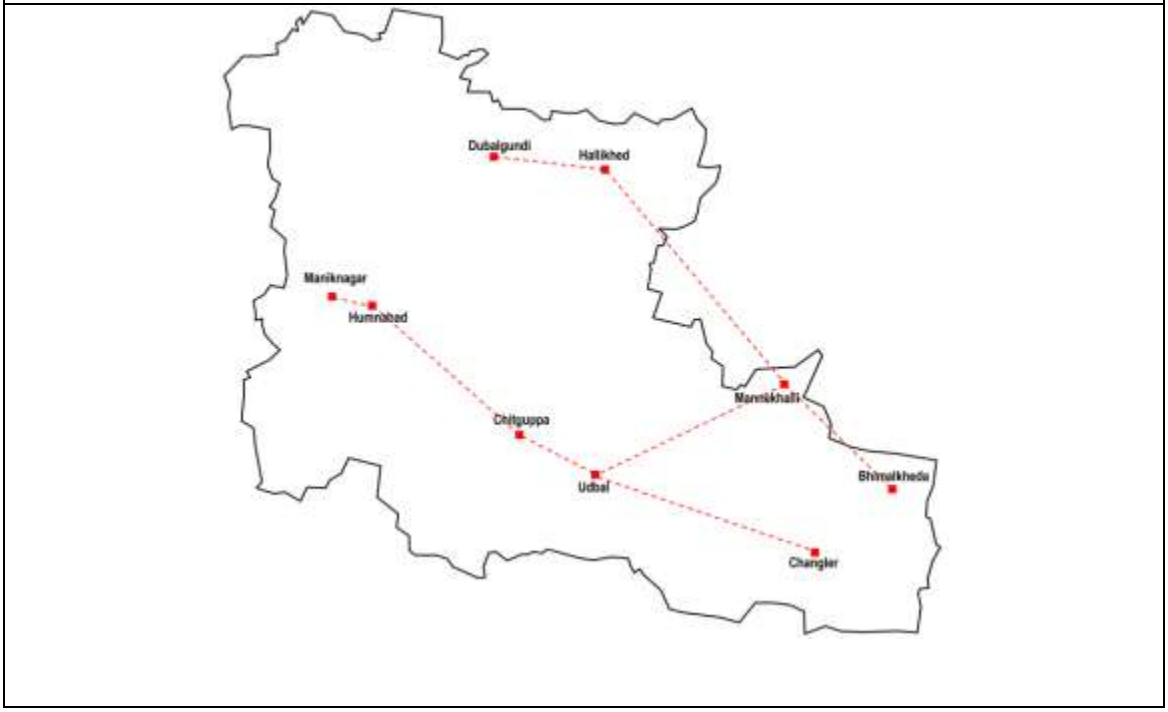
Base
Top soil
Weathered
Fractured
Massive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Halikhed
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Udbal
Bhimalkheda
Changler

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

3.1 Aquifer wise resource availability and extraction

(a) Present Dynamic Ground Water Resource (As per GEC, 2017)

TALUK	NET ANNUAL GROUND WATER AVAILABILITY	EXISTING GROSS GROUND WATER DRAFT FOR IRRIGATION	EXISTING GROSS GROUND WATER DRAFT FOR DOMESTIC AND INDUSTRIAL WATER SUPPLY	EXISTING GROSS GROUND WATER DRAFT FOR ALL USES	ALLOCATION FOR DOMESTIC AND INDUSTRIAL USE FOR NEXT 25 YEARS	NET GROUND WATER AVAILABILITY FOR FUTURE IRRIGATION	EXISTING STAGE OF GROUND WATER	CATEGORY
Humnabad	2786	414	150	564	167	2205	20	SAFE

(b) Present total Ground Water Resource

Taluk	Annual replenishable GW resources (Ham)	Fresh In-storage GW resources (Ham)		Total availability of GW resource (Ham)
		Phreatic	Fractured	Dynamic + phreatic in-storage + fractured in-storage
Humnabad	2786	2621	1305	6712

(c) Comparison of Ground Water availability and draft scenario

Taluk	GW availability (Ham)	GW draft (Ham)	Stage of GW development (%)	GW availability (Ham)	GW draft (Ham)	Stage of GW Development (%)	GW availability (Ham)	GW draft (Ham)	Stage of GW Development (%)
	2011			2013			2017		
Humnabad	2498	828	33	2327	809	35	2786	564	20

3.2. Chemical quality of Ground Water and contamination

Interpretation from Chemical Analysis results in Humnabad Taluk is mentioned as under:

Electrical Conductivity: In general, EC vary from 501 to 1685 values which are within the permissible limit as per IS 10500:2012 Standard Drinking Water Specification in both the aquifers.

Fluoride: Fluoride concentration varies from 0.119 to 1.107 mg/l in ground water all values are also within the permissible limit of 1.5 mg/l.

Nitrate: In general, nitrate value varies from 24 to 159 mg/l exceeding the permissible limit of 45 mg/l in few locations. Nitrate contamination is due to extensive use of fertilizers, hence is it anthropogenic in origin.

In general, ground water quality in Humnabad Taluk is good for drinking purpose except in some areas where nitrate is found to be greater than the permissible limit as per IS 10500:2012. Ground water samples are also found suitable for agriculture & irrigation purposes.

4. GROUND WATER RESOURCE ENHANCEMENT

a. Aquifer wise space available for recharge and proposed interventions

Dry phreatic aquifer (Aq-I) in the Taluk, can be recharged through construction of artificial recharge structures, viz; check dams, percolation tanks & point recharge structures (**Table-8**). The choice of recharge structures should be site specific and such structures need to be constructed in areas already identified as feasible for artificial recharge. And the improvement in the ground water recharge is presented in **Table 9.**

Table 8: Quantity of non-committed surface runoff & expected recharge through AR structures.

Artificial Recharge Structures Proposed	Humnabad Taluk
Non committed monsoon runoff available (Ham)	216.202
Number of Check Dams	973
Number of Percolation Tanks	195
Sub-surface dykes	6
Tentative total cost of the project (Rs. in lakhs)	13737.71
Excepted recharge (MCM)	162.151
Additional Irrigation Potential (Lakh Hectares)	0.195
Cost Benefit Ratio (Rupees/ cu.m. of water harvested)	8.47

Table 9: Improvement in GW availability due to Recharge, Humnabad Taluk.

Net annual ground water availability	Existing gross ground water draft for all uses	Existing stage of ground water development	Expected recharge from proposed artificial recharge structures	Additional potential from proposed irrigation development schemes through inter-basin transfer	Cumulative annual ground water availability	Expected improvement in stage of ground water development after the implementation of the	Expected improvement in overall stage of ground water development
Ham	Ham	%	Ham	Ham	Ham	%	%
2786	564	20	16215	Nil	19001	18	2

b. A l t e r n a t e water sources

Karanja project is located near Byalahalli village in Bhalki Taluk of Bidar district across River Karanja. It is proposed to irrigate 29227 ha of Bhalki, Bidar and Humnabad Taluks. As such no data available for the contribution to Groundwater from this surface water irrigation. Upper Mullamari project dam is constructed across Mullamari River. Outlet potential of 3279 Ha has been created in Humnabad, Basavakalyana of Bidar district and Kalburgi taluk of Kalburgi districts. Similarly, no data is available on exact contribution to Groundwater from this project

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5.0. DEMAND SIDE INTERVENTIONS

a. Advanced irrigation practices

It is observed that tube wells and dug wells are the main source for irrigation in the Taluk. Irrigation draft is 414 Ham. Efficient irrigation practices like Drip irrigation & sprinkler needs to be adopted by the farmers in the existing 7223 Ha of gross irrigated area by tube well & wells which will definitely contribute in saving ground water to improve the stage of ground water development in the Taluk.

b. Change in cropping pattern

Water intensive crops like paddy & sugarcane are growing in the Humnabad Taluk. Hence, change in cropping pattern has to be adopted. Taluk shows the stage of Groundwater development is only 20%. So, more area can be brought under groundwater irrigation by developing suitable structure depending up on local conditions.

c. Water Logging and additional area of irrigation

Though the marginally large area of the Taluk Aquifer-1 showing groundwater level between 2-5 meter during post-monsoon period, Aquifer II Groundwater level showing more than 15 meters. Also, as such water logging has not been noticed or recorded in any state agriculture department reports. So, no scope for decline the water table by adopting more area for irrigation.

d. Regulation and Control

Basavakalyana Taluk has been categorized as Safe since the Stage of ground water development is 20**%** (GEC March 2017). Hence, no restriction is required to control further ground water exploitation in the Taluk**.** Ground water recharge component needs to be made mandatory in the non- command area of the Taluk for further development of ground water.

e. Other interventions proposed

Periodical maintenance of artificial recharge structures should also be incorporated in the Recharge Plan. Excess nitrate concentration is found in ground water samples require the remedial measures viz.

- Dilution of nitrate rich ground water through artificial recharge & water conservation.
- Roof top rain water harvesting.
- Micro irrigation.

6. CONCLUSIONS AND RECOMMENDATIONS

NAQUIM studies over an area of 981 sq. kms in Humnabad Taluk, Bidar district is taken up which is underlain by Basalts and Schists. It receives an annual rainfall of 812 mm with occurrence of drought once in 4 years. The net sown area is 56818 Ha against the total cropped area of 64234 Ha. The principle crops grown are Jowar and Bajra, which are rain fed crops. It is observed that no advance groundwater management practices like sprinkler/drip irrigation or water use efficiency like mulching is being practiced in the Taluk.

The depth to water level during pre-monsoon varies from 4.98 to 18.24 m bgl and in post- monsoon it ranges from 3.70 to 18.20 m bgl with ground water fluctuation varying from -2.67 to +1.30 m.

The total annual Dynamic ground water resource as per GEC, 2017 is 2786 Ham with annual ground water draft for all use is 564 Ham. The stage of groundwater development is 20% and categorized as **'Safe'**. Additional resource enhancement of 16215 Ham is proposed by available water sources like non committed surface runoff and Water Use Efficiency practice.

The nitrate contents in ground water exceed the permissible limit for drinking purpose as per IS 10500:2012 which can be tackled through Defluoridation plants and rain water harvesting methods.

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