



# केन्द्रीय भूमिजल बोर्ड

जल शक्ति मंत्रालय, जल संसाधन, नदी विकास और गंगा संरक्षण विभाग  
भारत सरकार

## **Central Ground Water Board**

Ministry of Jal Shakti,  
Department of Water Resources, River Development  
and Ganga Rejuvenation  
Government of India

Report on

## **AQUIFER MAPPING AND MANAGEMENT PLAN**

**Hangal Taluk, Haveri District, Karnataka**

दक्षिण पश्चिमी क्षेत्र, बेंगलुरु  
South Western Region, Bengaluru

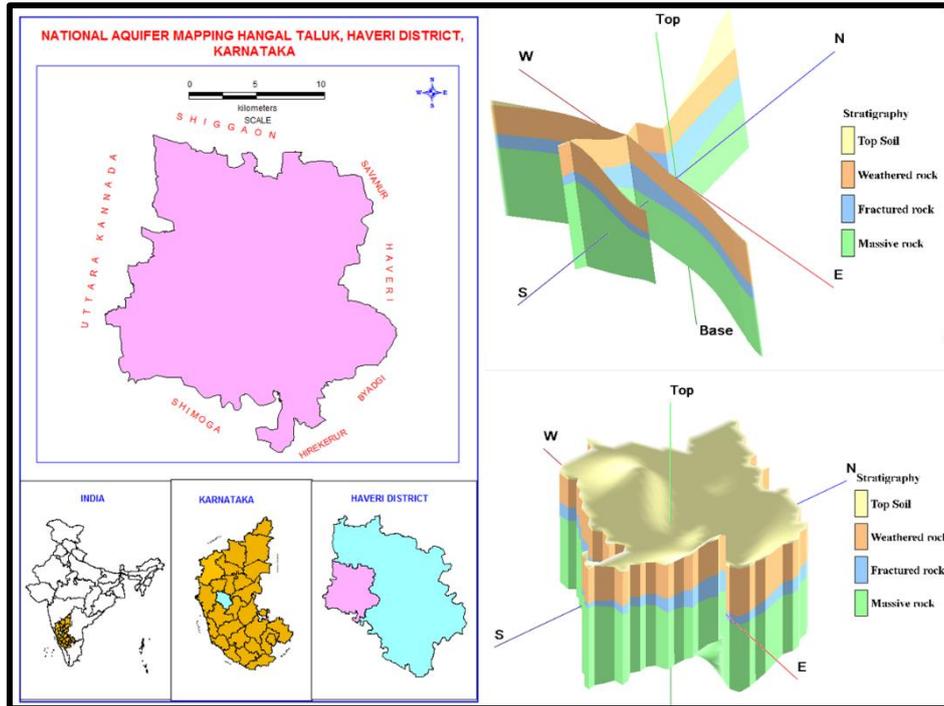
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# AQUIFER MAPS AND MANAGEMENT PLAN, HANGAL TALUK, HAVERI DISTRICT, KARNATAKA STATE

(AAP – 2021-2022)



By

**SUSHANT S. NAVARAT, ASSISTANT HYDROGEOLOGIST, CGWB, SWR, Bengaluru**

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# AQUIFER MAPS AND MANAGEMENT PLAN, HANGAL TALUK, HAVERI DISTRICT, KARNATAKA STATE

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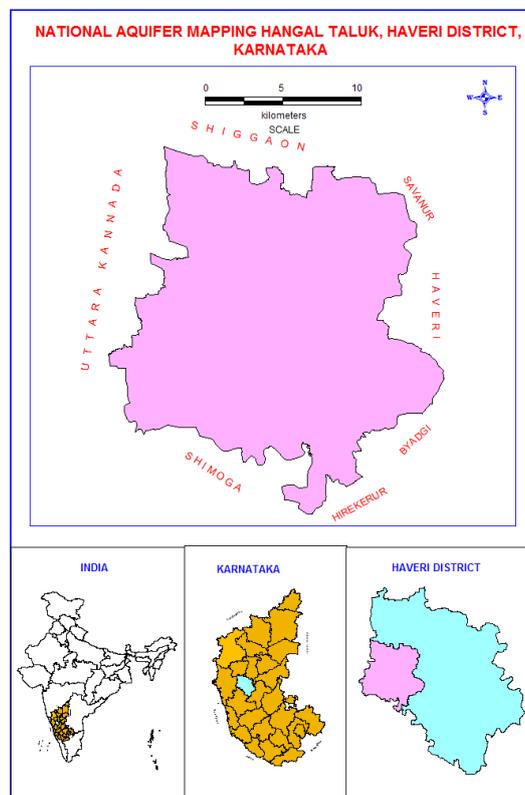
# AQUIFER MAPS AND MANAGEMENT PLAN, HANGALTALUK, HAVERI DISTRICT, KARNATAKA STATE

## 1 SALIENT FEATURES

Name of the taluk	: HANGAL
District	: Haveri
State	: Karnataka
Area	: 770 sq.km
Population	: 2,60,455
Annual Normal Rainfall	: 963 mm (2020)

### 1.1 Study area

Aquifer mapping studies have been carried out in Hangal taluk, Haveri district of Karnataka, covering an area of 770 sq.kms under National Aquifer Mapping Project. The Hangal taluk is located between North Latitudes 14° 34' 00" and 14° 55' 00" and East Longitudes between 75° 01' 00" to 75° 20' 00" and is falling in Survey of India Toposheets No forms parts of 48N/1, 48N/2, 48N/5, 48N/6. The study area is bounded on the East by Haveri Taluk, on the North by Shiggaon Taluk, on the South by Hirekerur & Byadgi Taluks of Haveri District and Shimoga District, on the West by Uttara Kannada District. Location map of Hangal taluk of Haveri district is presented in **Fig-1**. Hangal is taluk head quarter. There are 155 villages in this taluk.



**Fig 1: Location map**

## 1.2 Population

According to 2011 census, the population in Hangal taluk is 2,60,455. Out of which 1,33,171 are males while 1,27,264 are females. The average sex ratio of Hangal taluk is 1046. The Hangal taluk has an overall population density of 338 persons per sq.km. The decadal variation in population from 2001-2011 is 12.87% in Hangal taluk. The population details are given in **Table-1**.

**Table-1: Population details (2011) of Hangal taluk**

<b>Total Population</b>	<b>260455</b>
<b>Number of Male</b>	133171
<b>Number of Female</b>	127284
<b>Share of the district population (%)</b>	16.14
<b>Total Number of Rural populations</b>	232296
<b>Total Number of Urban populations</b>	28159
<b>Decadal change in population (2001-2011) (%)</b>	12.87
<b>Decadal change in rural population (%)</b>	12.91
<b>Decadal change in urban population (%)</b>	12.60

*Source: As Per 2011 Census at District at a glance 2019-20, Govt. of Karnataka*

## 1.3 Rainfall and Climate

Hangal taluk experiences semi-arid, sub-tropical climate. The area falls under Northern transitional agro-climatic zone of Karnataka state. The normal annual rainfall in Hangal taluk for the period 1961 to 2010 is 1044 mm.

Actual annual rainfall data of Hangal Taluk from 2011 to 2020 was analyzed (**Table-2**). The data were plotted and derived the rainfall trend line (**Fig-2**) and it was noted that the rainfall had increased slightly in last 10 years. Precipitation for the analyzed decadal ranges from 547 to 1370 mm. The decadal average rainfall at Hangal taluk is 943 mm, The statistical analysis of the rainfall variation among the period 1981-2010 has given in **Table-3**, and it was noted as the normal rainfall is 205, Standard Deviation is 265, and coefficient of variation is 33 %. The annual rainfall of the monthly basis during the period of 2010 to 2019 decadal years were given in **Table-4**.

**Table-2: Actual Annual Rainfall Data of Hangal taluk, Haveri district (2011 to 2020)**

<b>Year</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>Decadal Average</b>
<b>Rainfall in mm</b>	999	834	886	1365	775	547	744	971	1370	963	943

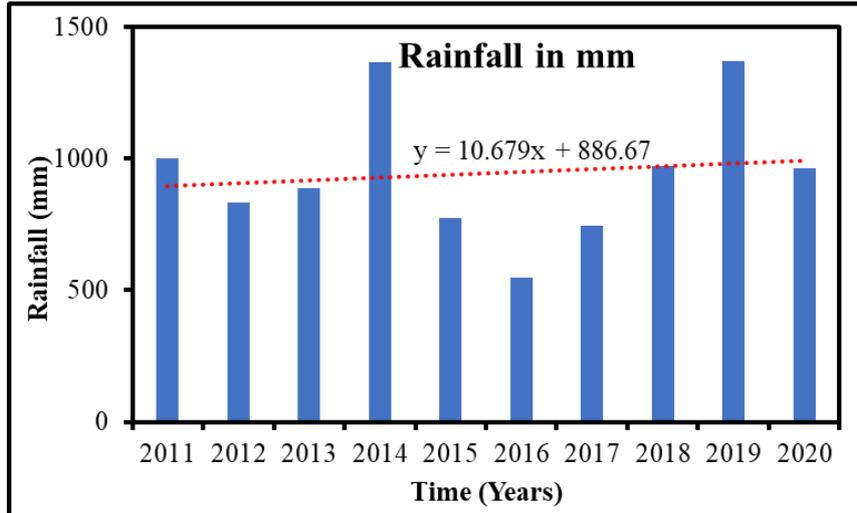


Fig 2: Annual Rainfall trend map of Hangaltaluk of Haveri district

Table-3: Statistical analysis of Normal annual rainfall of Hangal taluk, Haveri District (1981-2010)

Period	Normal	Standard Deviation	Coefficient of Variation (%)
January	2	6	277
February	2	10	487
March	11	18	165
April	37	36	97
May	57	43	75
<b>PRE-MONSOON</b>	110	57	52
June	134	81	60
July	180	126	70
August	124	73	59
September	94	57	60
<b>SOUTH WEST-MONSOON</b>	532	226	42
October	115	85	74
November	40	55	137
December	9	14	169
<b>NORTH EAST-MONSOON</b>	164	105	64
<b>Annual</b>	<b>805</b>	<b>265</b>	<b>33</b>

**Table-4: Annual rainfall of Hangal taluk, Haveri District (2010-2019)**

Year	Jan	Feb	Mar	Apr	May	PRE	Jun	Jul	Aug	Sep	MON	Oct	Nov	Dec	POST	Annual
2010	14	0	0	81	56	151	148	289	182	111	730	153	109	0.0	262	1143
2011	0	0	0	71	47	118	245	212	201	139	797	134	61	0	195	1110
2012	0	0	0	97	107	204	177	91	157	59	484	56	67	0	123	811
2013	15	0	0	44	0	59	177	91	157	59	484	56	67	0	123	666
2014	0	0	3	127	159	289	113	337	254	70	774	105	113	13	231	1294
2015	0	0	39	20	146	205	250	100	123	93	566	94	0	0	94	865
2016	0	0	0	2	55	57	177	156	93	42	468	6	16	0	22	547
2017	0	0	0	124	69	193	102	208	92	151	553	266	17	0	283	1029
2018	0	0	0	17	218	235	280	159	194	73	706	97	23	9	129	1070
2019	0	0	0	37	0	37	103	311	678	194	1286	353	37	1	391	1715

#### 1.4 Agriculture & Irrigation

Agriculture is the main occupation in Hangal taluk. Major Kharif crops are Maize, Paddy, Jowar, Green gram, Fruits and other commercial crops. Main crops of Rabi season are Maize, and Paddy (**Table-5**). Water intensive crops like paddy & sugarcane are grown in 24.25 % of total sown area. Maize is grown in 35.6% and Jowar in 3.3% of total sown area of taluk. Pulses are grown in 4.5% & oil seeds account 4% of total sown area.

**Table-5: Cropping pattern in Hangal taluk 2018-2019 (Ha)**

Crops		Area (ha)	Total area (ha)	Total area (ha)
<b>Cereals</b>	Paddy	15031	<b>43277</b>	<b>70094</b>
	Jowar	2404		
	Bajra	0		
	Maize	25786		
	Ragi	16		
	Wheat	5		
	Other	35		
<b>Pulses</b>	Tur	21	<b>3238</b>	
	Horse gram	826		
	Black gram	131		
	Green gram	1888		
	Avare	19		
	Cow pea	286		
	Bengal gram	65		
	Other	2		
<b>Fruits</b>			<b>5235</b>	
<b>Vegetables</b>			<b>231</b>	
<b>Oil Seeds</b>	Groundnuts	575	<b>2875</b>	
	Sunflower	194		
	Safflower	4		
	Castor	0		
	Sesamum	0		
	Niger Seed	0		
	Soyabean	2082		
	Linseed	4		
	Other	16		
<b>Commercial crops</b>			<b>15238</b>	

Source: As per Annual Season Crop Report 2018-19 in District at a glance 2019-20, Govt. of Karnataka

It is observed that net sown area accounts 73% and area sown more than once is 21% of total geographical area in Hangal taluk (**Table-6**). Area not available for cultivation is 11 % of total geographical area. Whereas, area covered by fallow land is very less. 93 % of net area irrigated is only from bore wells (**Table-7**).

**Table-6: Details of land use in Hangal taluk 2018-2019 (Ha)**

Geographical area	Area under Forest	Area not available for cultivation	Fallow land	Area Sown		
				Net sown area	Area sown more than once	Total sown/ Cropped area
77525	8474	8412	26	56281	15992	72273

Source: As per Annual Season Crop Report 2018-19 in District at a glance 2019-20, Govt. of Karnataka

**Table-7: Irrigation details in Hangal taluk (Ha)**

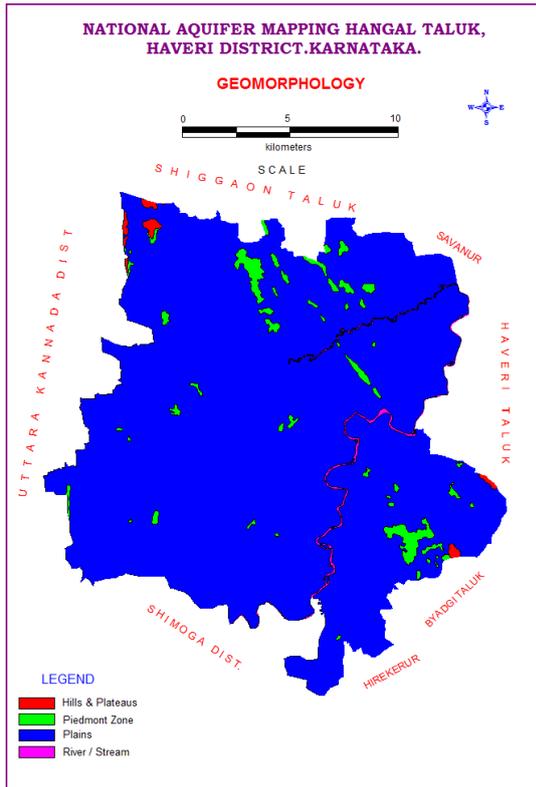
S.No	Source		Number of Structures	Gross area irrigated (ha)	Net area irrigated (ha)
1	Surface water	Canals	47	610	610
		Tanks	728	0	0
		Lift irrigation	2178	0	0
		<b>Total (I)</b>			<b>610</b>
2	Ground water	Dug wells	30	0	0
		Bore wells	15275	35007	28270
		Other Source		1779	1408
		<b>Total (II)</b>			<b>36786</b>
<b>Grand Total (I + II)</b>				<b>37396</b>	<b>30288</b>

Source: As per Annual Season Crop Report 2018-19 in District at a glance 2019-20, Govt. of Karnataka

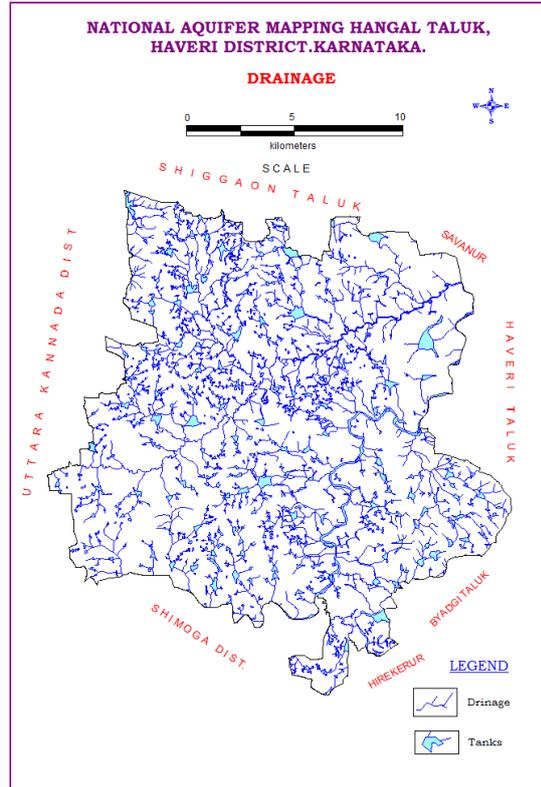
### 1.5 Geomorphology, Physiography & Drainage

Hangal taluk lies in a plateau region formed by schistose rocks, which represents “Dharwar Schists”. The geomorphology of the Hangal taluk was derived in (Fig-3), the prominent features are Plains and pediment zones, patched of Hills and plateaus are present in the northern and southern part of the taluk. The central and southern parts exhibit overall “pedeplain terrain” having sparsely distributed NW-SE trending ridge lineaments and tors. The elevation in the plains varies from 608 m in the North western part to 557 m amsl in the Southern part of the taluk. This has its bearing on the regional slope which is towards south. The differential altitude is significant as it is responsible to cause irregular ground water flow patterns on the micro scale. Topography is dominantly controlled by geological structures.

The entire Hangal taluk is drained by Dharma tributary of Vardha (Varada) river which is contributes to Tungabhadra upper sub-basin which is a part of major Krishna River Basin. The Drainage pattern is dendritic to sub-dendritic (Fig-4).



**Fig-3: Geomorphology Map**



**Fig-4: Drainage Map**

## 1.6 Soil and Landuse

The soils of Hangal taluk are given in (Fig-5), which are broadly be classified into greyish brown to dark reddish-brown soils. These soils are derived from schistose rocks in semi-arid, sub-tropical climate and these vary in depth and texture, depending on the parent rock type, physiographic settings and climatic conditions. Reddish brown clayey soils cover major part of the taluk, followed by the greyish brown sandy soil. These soils have clay loam to sandy (skeletal) clayey texture. The soils are overlapped by alluvial clayey materials along the tributaries.

The landuse pattern of the taluk is derived in (Fig-6), it shows that the agriculture is the major practice in most part of the region and part of the region is covered by forest.

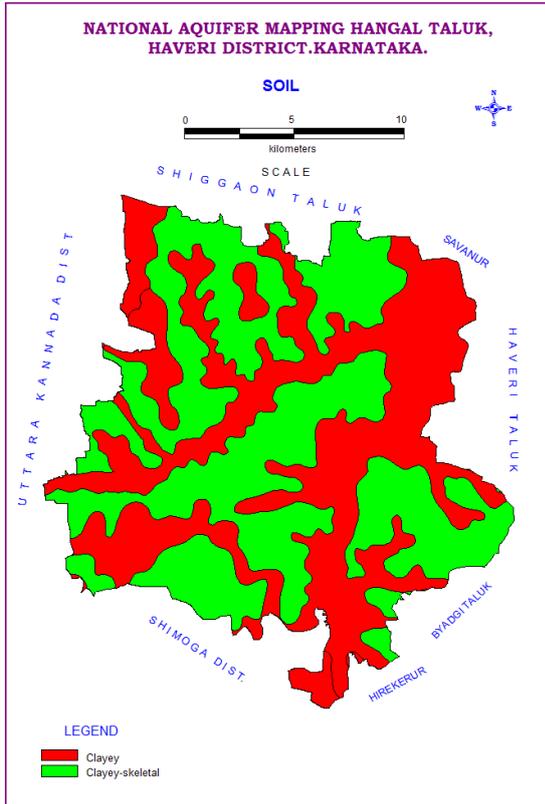


Fig-5: Soil Map

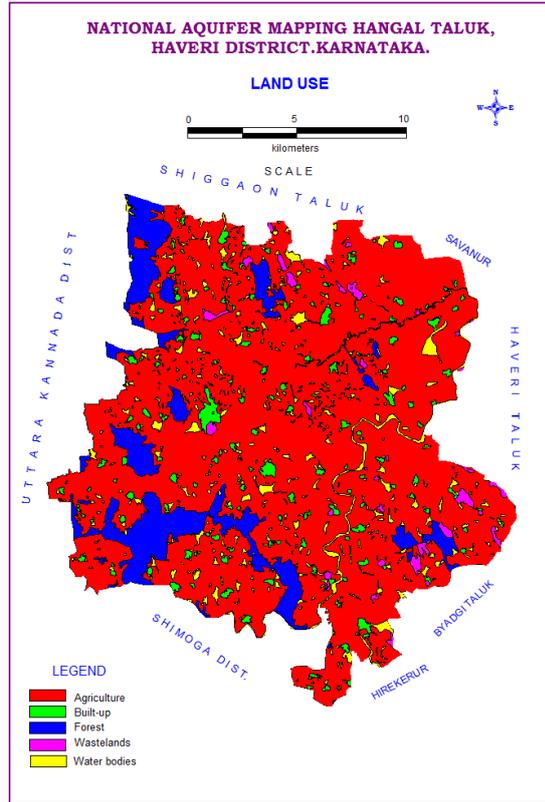


Fig-6: Landuse Map

### 1.7 Ground Water Resource Availability and Extraction

Aquifer wise total ground water resources up to 200 m depth is given (Table-8) as per 2020 estimations. The details of dynamic (phreatic) ground water resources of 2017 is shown in (Table-9).

Table-8: Total Ground Water Resources (2020) (Ham)

Taluk	Annual replenishable GW resources	Fresh In-storage GW resources		Total availability of fresh GW resources
		Phreatic	Fractured(Down to 200m)	Dynamic +phreatic in-storage + fractured
Hangal	21544	31602	2576	55722

Table.9: Dynamic Ground Water Resource, Hangal taluk - 2017(Ham)

Net Annual Ground Water Availability	20518.130
Existing Gross Ground Water Draft for Irrigation	6516.509
Existing Gross GW Draft For Domestic And Industrial Water Supply	471.340
Existing Gross Ground Water Draft For All Uses	6987.849
Allocation For Domestic And Industrial Use For Next 25 Years	870.295
Net Ground Water Availability For Future Irrigation Development	13131.326
Existing Stage of Ground Water Development	34.057 %
<b>Category</b>	<b>Safe</b>

## 1.8 Existing and Future Water Demands (as per GWRA-2017 &2020)

As per the GWRA 2017, the net ground water availability was 205138.130ham and the total ground water draft for all uses is 6987.849 Ham with stage of development at 34.057% and the taluk falls in Safe category. Thus there is further scope for future irrigation development 13131.326 Ham. The domestic (Industrial sector) demand for next 25 years is estimated at 870.295 Ham.

The details of dynamic (Phreatic) ground water resources for Hangal taluk as on March 2020 is shown in **Table-10**. It is observed that the stage of ground water extraction is remains same in the taluk from 34.057 % to 34.96 % from 2017 to 2020 with an increase in the net ground water availability during 2020 with a figure of 21544.35 Ham.

**Table.10: Dynamic Ground Water Resource, Hangal taluk – 2020 (Ham)**

Net Annual Ground Water Availability	21544.35
Existing Gross Ground Water Draft for Irrigation	6731.85
Existing Gross GW Draft For Domestic And Industrial Water Supply	0.00
Existing Gross Ground Water Draft For All Uses	7531.32
Allocation For Domestic And Industrial Use For Next 25 Years	861.91
Net Ground Water Availability For Future Irrigation Development	13950.59
Existing Stage of Ground Water Development	34.96 %
<b>Category</b>	<b>Safe</b>

## 1.9 Water level behaviour

The ground water level data have been monitored from the representative wells for pre and Post-monsoon seasons for the years 2012 to 2021 has given in (**Table-11 and Table-12**) respectively. The Water level fluctuations to the pre and post monsoon of the 2019 year has given in (**Table-13**), it has found that the water level fluctuates between 0.5 to 9.1 mbgl in Aquifer-1, whereas in Aquifer-2 it fluctuates between 0.8 to 1.8 mbgl. The ground water level maps prepared to the Hangal taluk Pre and post monsoon are given in **Fig 7** and **Fig 8** respectively.

**Table 11: Depth to water level of Pre Monsoon – State Groundwater Department**

S.No	Village	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
1	Maharajapet	0.00	23.90	0.00	0.00	0.00	0.00	23.95	23.98	22.70	19.60
2	Makaravalli	24.10	31.20	26.10	27.00	28.00	30.05	30.58	30.80	28.85	28.65
3	Adur	13.00	20.40	17.10	12.00	22.70	0.00	0.00	23.70	-	12.52
4	Akki Alur	13.20	24.90	20.30	13.00	23.00	32.60	25.20	25.30	18.95	16.90
5	Hangal	3.25	5.50	3.00	1.50	4.20	4.55	3.20	4.05	3.30	3.05
6	Hanumanakoppa	18.80	18.50	16.30	14.20	19.10	21.25	16.15	17.76	14.34	14.12
7	Akki Alur	13.20	0.00	0.00	0.00	0.00	0.00	14.20	-	12.35	12.60
8	Bommanahalli	16.40	0.00	15.25	0.00	0.00	0.00	0.00	-	Dry	Dry
9	Hanumankoppa	12.15	15.50	0.00	0.00	0.00	0.00	11.30	12.80	12.40	12.00
10	Sammasagi	12.55	0.00	13.60	0.00	0.00	12.80	15.00	16.30	12.80	13.60

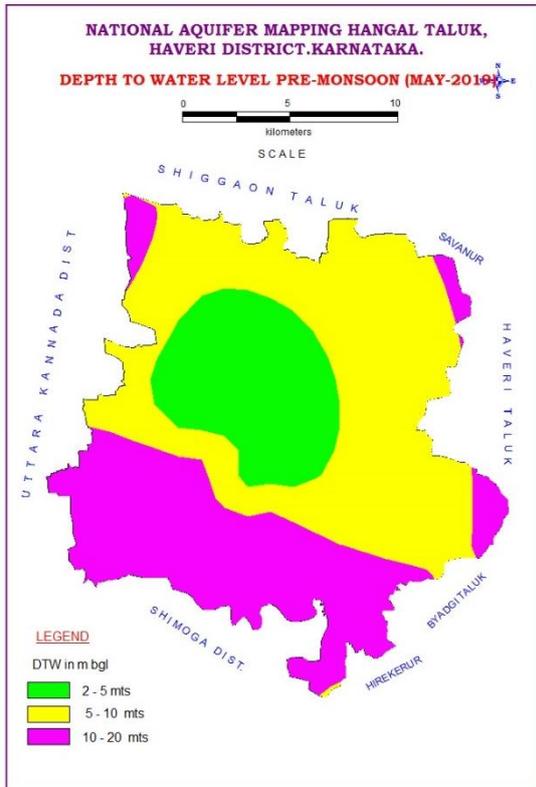
**Table 12: Depth to water level of Post Monsoon – State Groundwater Department**

S.No	Village	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
1	Maharajapet	15.10	12.10	1.00	0.00	0.00	0.00	21.65	9.70	9.17	8.23
2	Makaravalli	24.20	20.90	8.90	22.50	28.90	24.85	22.90	15.15	17.22	17.98
3	Adur	12.60	7.90	0.00	13.00	20.30	22.00	16.65	6.61	7.35	6.42
4	Akki Alur	8.20	9.00	18.50	11.30	21.80	20.80	11.08	8.40	10.44	8.55
5	Hangal	1.60	1.50	6.90	2.00	2.90	2.20	2.10	0.50	1.20	1.35
6	Hanumanakoppa	12.10	9.90	7.30	12.50	14.70	12.00	11.14	9.54	8.96	8.94
7	Akki Alur	8.20	7.30	3.60	11.50	0.00	11.20	7.20	5.80	7.02	6.40
8	Bommanahalli	7.50	6.10	8.30	0.00	11.90	0.00	12.70	7.23	Dry	Dry
9	Hanumankoppa	11.20	9.80	0.00	14.30	14.30	12.10	10.00	7.70	7.80	7.95
10	Sammasagi	11.1	10.40	8.00	12.90	0.00	13.50	12.50	9.80	9.85	9.90

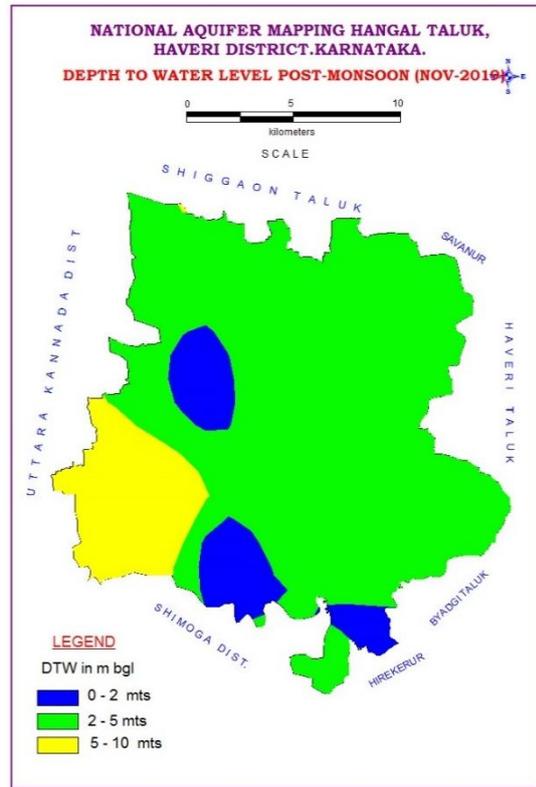
The long-term data of Depth to Water level is analysed to interpret the behaviour of groundwater over period of time (**Table-11 & Table-12**). The groundwater level is observed to show an increasing trend. This directly means that, the availability of groundwater is enhanced over the last decade. The pre-monsoon period as well as post-monsoon period shows the increasing trend of groundwater level.

**Table 13: Depth to water level of Pre and Post-Monsoon (2019), CGWB-SWR**

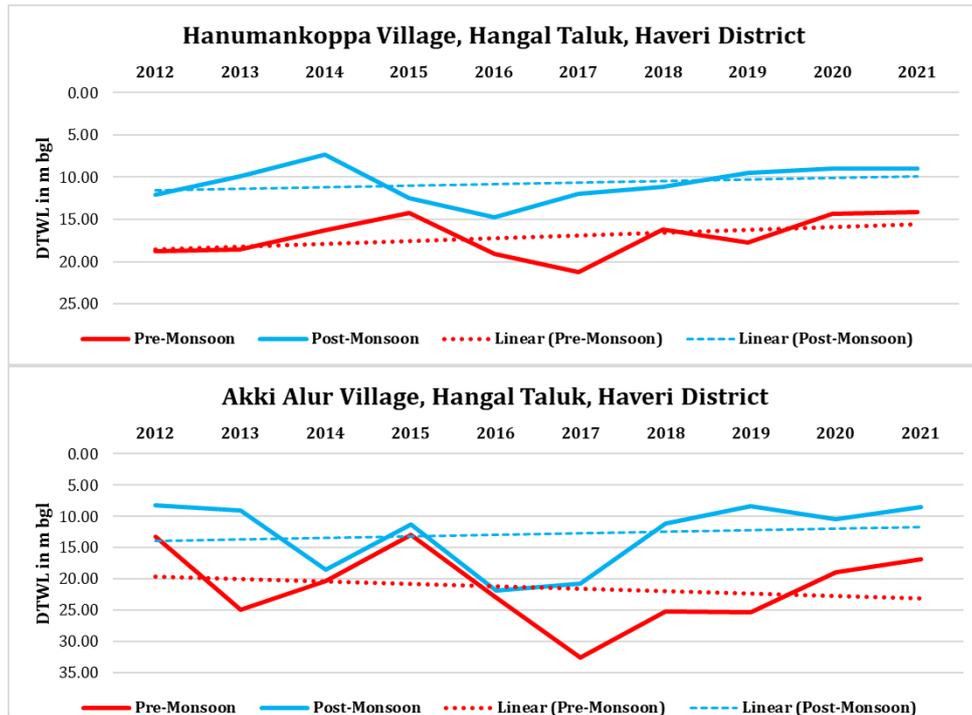
S. No	Village	Source	Pre-monsoon Depth to water May-2019 (mbgl)	Post-monsoon Depth to water Nov-2019 (mbgl)	Water level Fluctuation
<b>Aquifer-I</b>					
1	Maharajapet	Dug Well	13.8	12.3	1.5
2	Makaravalli	Dug Well	27.2	20.5	6.7
3	Adur	Dug Well	11.5	11.0	0.5
4	Akki Alur	Dug Well	21.7	12.6	9.1
5	Hangal	Dug Well	4.9	2.5	2.4
6	Hanumanakoppa	Dug Well	14.1	9.8	4.3
<b>Aquifer-II</b>					
7	Akki Alur	Borewell	8.6	7.8	0.8
8	Bommanahalli	Borewell	5.8	7.7	1.8
9	Hanumankoppa	Borewell	11.0	9.6	1.4
10	Sammasagi	Borewell	12.0	11.2	0.8



**Fig-7: Pre-monsoon Depth to Water Level**



**Fig-8: Post-monsoon Depth to Water Level**



**Fig-9: Groundwater level Fluctuation in the villages of Hangal taluk**

## 2 AQUIFER DISPOSITION

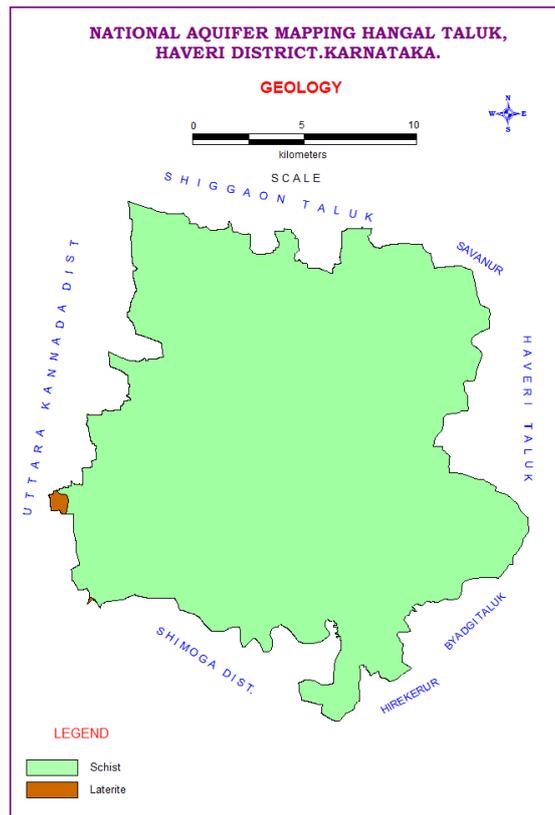
The occurrence and movement of water in the subsurface is broadly governed by geological frameworks i.e., nature of rock formations including their porosity (primary and secondary) and permeability. The principal aquifers in the area is Schist and patch of Laterite, the occurrence and movement of ground water in these rocks are controlled by various factors and it primarily depends on the degree of interconnection of secondary pores/voids developed by fracturing and weathering in the hard rock.

### 2.1 Aquifer Types

In Hangal taluk, there are mainly two types of aquifer systems have encountered

- **Aquifer-I (Phreatic aquifer)** comprising Schist
- **Aquifer-II (Fractured aquifer)** comprising Schist

In Hangal taluk, Schist are the main water bearing formations (**Fig-10**). Ground water occurs within the weathered and fractured Schist unconfined condition and semi-confined condition. In Hangal taluk bore wells were drilled from a minimum depth of 130.9 mbgl to a maximum of 182.5 mbgl. The details of groundwater exploration carried out in the Hangal taluk is given in **Table-14**. Depth of weathered zone ranges from 17 mbgl to 30.5 mbgl. Ground water exploration reveals that aquifer-II fractured formation was encountered between the depth of 25 to 73.6 mbgl. Yield ranges from 0.31 to 5.60 lps. The basic characteristics of each aquifer are summarized in **Table-15**.



**Fig-10: Geology of the Hangal taluk**

**Table-14: Details of Groundwater exploration in Hangal taluk**

S.No	Location	Depth (mbgl)	Casing (m)	Lithology	SWL (mbgl)	Q (lps)	DD (m)	T (m <sup>2</sup> /day)
1	Bomanahalli EW	179.0	18.65	Schist	12.63	4.3	-	-
2	Hangal EW	175.7	17	Schist	14.5	4	-	-
3	Sammalagi EW	182.5	30.5	Schist	6.244	0.31	-	-
4	Adur EW	130.9	29.1	Schist	14.41	5.6	-	-

**Table-15: Basic characteristics of each aquifer**

Aquifers	Weathered Zone (Aq.-I)	Fractured Zone (Aq.-II)
Major Lithology	Weathered Schist	Fractured / Jointed Schist
Thickness range (mbgl)	30.5	Fractures upto 73.6 mbgl
Depth range of occurrence of fractures (mbgl)	17 to 30.5	25-73.6
Range of yield potential (lps)	Poor yield	0.31-5.60
Specific Yield (%)	2%	0.2%
Transmissivity (m <sup>2</sup> /day)	-	-
Quality Suitability for Domestic & Irrigation	Suitable	Suitable

## 2D AQUIFER DISPOSITION

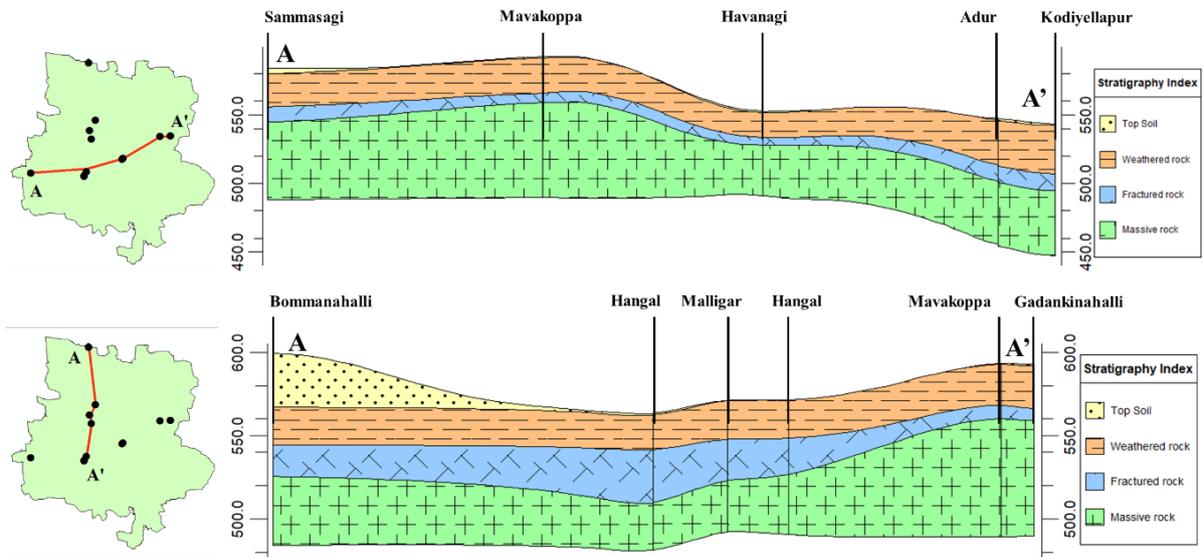


Fig.11: 2-D Cross Sections of Hangal Taluk

## 3D AQUIFER DISPOSITION

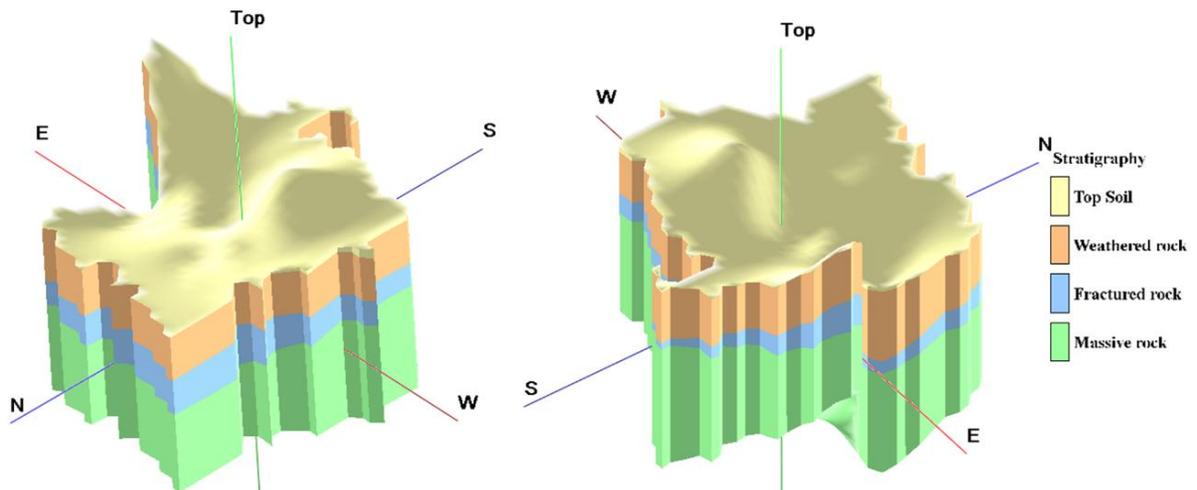


Fig.12: 3-D Aquifer Disposition model of Hangal Taluk

### 3D FENCE DIAGRAM

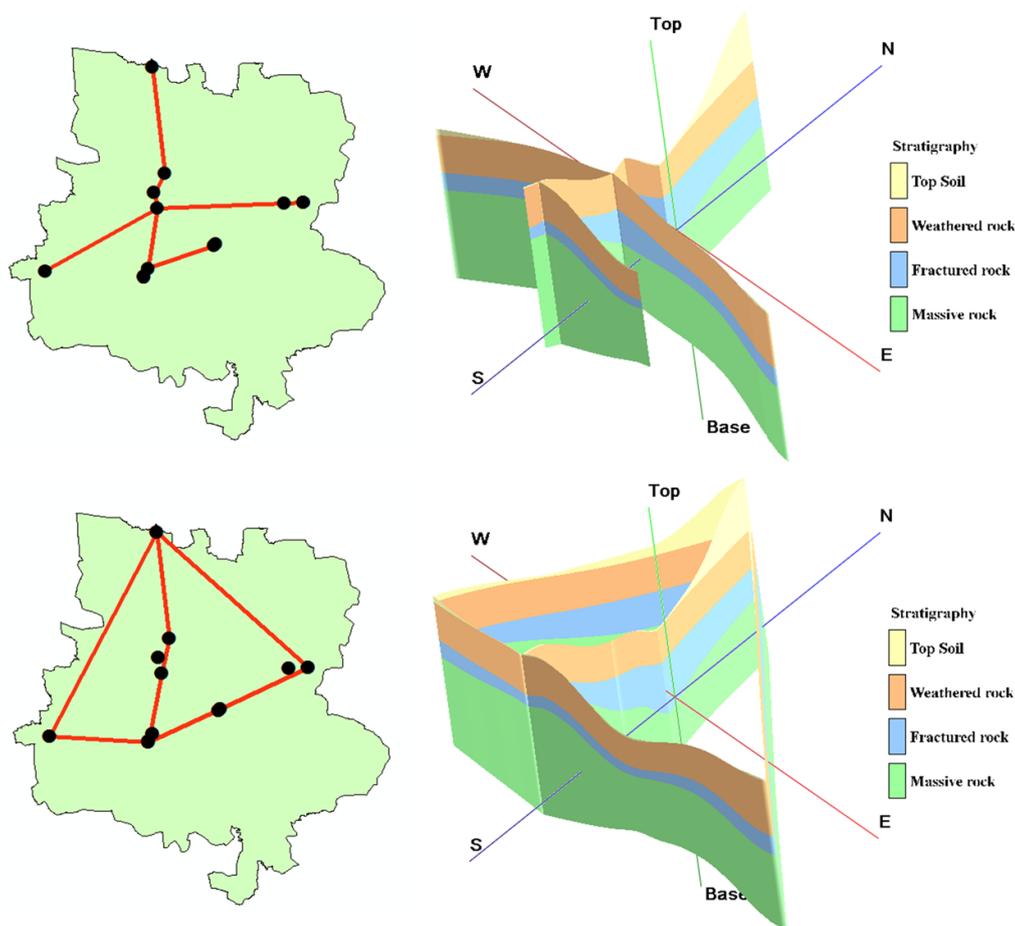


Fig.13: 3D Fence Diagram of Hangal Taluk

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

The main ground water issues are Limited Ground Water Potential / Limited Aquifer Thickness / Sustainability, declining water level trend are the major issues in the Hangal taluk.

### 3.1 Comparison of Ground Water Resource and Extraction

The Dynamic Ground Water Resource 2013, 2017 and as on 2020 has given in **Table 16**. It is observed that the ground water availability has developed during these years 2013, 2017, and 2020. However, it is attributable to the improvement in the irrigation practice, influence of command area and also due to the water conservation / recharge activities carried out in the taluk by various state government and other agencies.

**Table-16: Comparison of ground water availability and draft scenario in Hangal taluk**

Taluk	GW availability (in ham)	GW draft (in ham)	Stage of GW development	GW availability (in ham)	GW draft (in ham)	Stage of GW development	GW availability (in ham)	GW draft (in ham)	Stage of GW development
	2013			2017			2020		
HANGAL	19139	9830	51	20518	6988	34	21544	7531	35

It is seen that the stage of ground water extraction developed in the taluk in comparison with 2013 and 2017 estimations and the stage of ground water development & the taluk is categorized as “Safe”.

### 3.2 Chemical Quality of Ground Water and Contamination

Interpretation from Chemical Analysis results in Hangal taluk is mentioned below. The groundwater quality data monitored by CGWB-SWR were attached in the **Table-17** and the water quality data monitored by State groundwater department, Karnataka were given in **Table-18**.

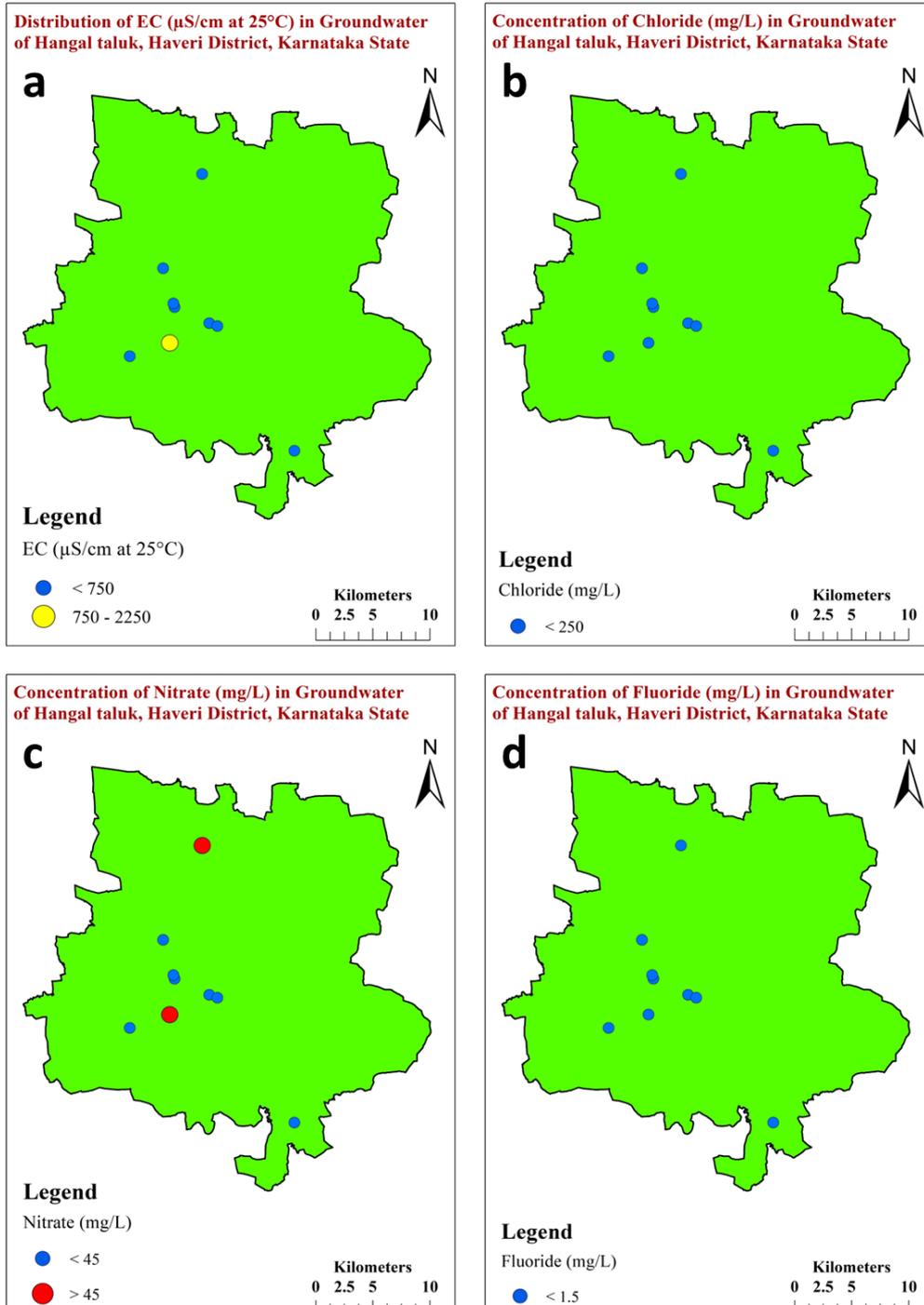
- **ELECTRICAL CONDUCTIVITY:** In general, EC values range from 150 to 1730  $\mu\text{mhos/cm}$  in the aquifer-I and from 550 to 1900  $\mu\text{mhos/cm}$  for aquifer-II at 25°C (**Fig-14a**).
- **CHLORIDE:** Chloride concentration in ground water ranges between 14 and 355 mg/l in the aquifer-I and from 39 to 163 mg/l for aquifer-II (**Fig-14b**).
- **NITRATE:** Nitrate concentration in ground water ranges from 2 and 20 mg/l in the aquifer –I and from 1 and 503 mg/l in the aquifer –II (**Fig-14c**).
- **FLUORIDE:** Fluoride concentration in ground water ranges between 0.02 and 0.15 mg/l in the aquifer-I and between 0.05 and 0.42 mg/l in the aquifer-II (**Fig-14d**).

**Table-17: Ground water quality of Dug & Bore wells of Hangal taluk, CGWB-SWR**

S.No	Village	Well Type	PH	EC	CI	NO3	F
1	Hangal	DW	7.80	660	89	2	0.13
2	Girisinakoppa	DW	7.14	960	188	20	0.09
3	Hanumankoppa	DW	7.39	650	89	20	0.04
4	Akki Alur	DW	6.99	150	14	2	0.02
5	Satenahalli	DW	7.56	1730	355	8	0.15
6	Nitiginalkoppa	BW	7.41	750	96	61	0.42
7	Girisinakoppa	BW	7.59	930	163	2	0.22
8	Akki Alur	BW	7.58	600	124	5	0.06
9	Satenahalli	BW	7.19	680	82	1	0.05
10	Gudde Mallapura	BW	7.48	550	39	63	0.11
11	Tilavali	BW	7.14	800	89	21	0.10
12	Gadankinahalli	BW	7.55	1900	135	503	0.13

**Table-18: Ground water quality of Dug & Bore wells of Hangal taluk – State Groundwater Dept**

Monsoon	Village	Well Type	pH	NO3	CI	F
Pre-Monsoon	Maharajpet	BW	7.58	29.77	119.11	1
	Hanumankoppa	BW	7.56	6.9	208.44	1.21
	Makarvalli	BW	7.66	16.36	59.55	0.85
	Adur	BW	7.92	15	152.86	1.1
	Akki Alur	BW	7.82	6.68	216.38	0.9
	Hangal	BW	7.34	3.06	105.21	1.04
	Bommanahalli	DW	7.92	24.86	69.48	0.95
	Sammasagi	DW	7.42	16.1	206.46	0.653
Post-Monsoon	Hanumankoppa	BW	7.8	1.509	622.84	0.513
	Akki Alur	BW	7.86	34.93	234.55	0.504



**Fig.14 a-d: Ground water quality of the Hangal taluk**

In general, ground water quality in Hangal taluk is good for drinking purpose as depicted in above illustrated maps, and data as per “Indian Standard Drinking Water Specification 2009”. Ground water samples have also been tested and found suitable for agriculture & irrigation purposes.

## 4 GROUND WATER RESOURCE ENHANCEMENT AND PROPOSED MANGEMENT STRATEGY

### 4.1 Resource Enhancement by Supply Side Interventions

The overall stage of ground water development is at moderate levels of 34.057 % as per GEC 2017 and 34.96 % as on 2020. However, the pre-monsoon long term ground water trend shows the declining trend. During post monsoon, most part of the taluk show rise in water level in greater values.

Recharge dry phreatic aquifer (Aq-I) in the taluk, through construction of artificial recharge structures, viz; check dams, percolation tanks & Sub surface dyke (**Table-19**). 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.

**Table-19: Quantity of non-committed surface runoff & Proposed AR structures in Hangal taluk**

S.No	Artificial recharge structures proposed	
1	Non committed monsoon runoff available in (MCM)	81
2	Number of Existing Artificial Recharge Structure	337
3	Number of Check Dams	311
4	Number of Percolation tanks	75
5	Number of Sub Surface Dyke	2
6	Tentative total cost of the project (Rs in lakhs)	3644
7	Expected Recharge in (MCM)	61

### 4.2 Other interventions proposed

- Periodical maintenance of artificial recharge structures should also be incorporated in the Recharge Plan.
- Excess nitrate & fluoride concentration is found in ground water samples require remedial measures viz.
  - Dilution of nitrate rich ground water through artificial recharge & water conservation.
  - Roof top rain water harvesting.

## 5 SUMMARY AND RECOMMENDATIONS

The main ground water issues are Low Ground Water Development, Limited Ground Water Potential / Limited Aquifer Thickness / Sustainability, of major part of the area. The summary of ground water management plan of Hangal taluk is given in **Table-20**

**Table 20: Summary of Management plan (GWRA-2020) of Hangal taluk**

Present stage of GW Development (2020)	35%
Hangal Taluk Category	Safe
Net Annual Ground Water Availability (MCM)	215.44
Existing Gross Ground Water Draft for all uses	75.31
Total GW Resources (Dynamic & Static upto the depth of 200 mbgl) (MCM)	557.22
Expected additional recharge from monsoon surplus runoff (MCM)	61
Change in Stage of GW development, %	35 to 27.4
Excess nitrate & fluoride concentration	<ul style="list-style-type: none"> <li>• Dilution of nitrate rich ground water through artificial recharge &amp; water conservation.</li> <li>• Roof top rain water harvesting.</li> </ul>