



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

YADGIR DISTRICT, KARNATAKA

दक्षिण पश्चिमी क्षेत्र, बैंगलोर

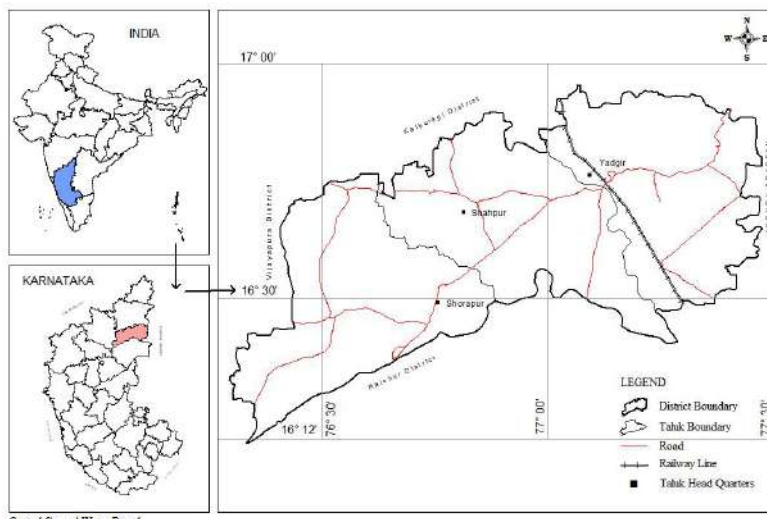
South Western Region, Bengaluru



**GOVERNMENT OF INDIA
MINISTRY OF JAL SHAKTI
DEPT. OF WATER RESOURCES, RD & GR
CENTRAL GROUND WATER BOARD**

NATIONAL AQUIFER MAPPING – DISTRICT REPORT

**AQUIFER MAPPING & MANAGEMENT PLAN
YADGIR DISTRICT, KARNATAKA**



By

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**SOUTH WESTERN REGION
BENGALURU**

JUNE 2021

NATIONAL AQUIFER MAPPING – DISTRICT REPORT
YADGIR DISTRICT, KARNATAKA

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YADGIR DISTRICT AT A GLANCE

Sl. No.	Items	Statistics		
1	General Information			
	(i) Geographical area (Sq.Km)	5235		
	(ii)Administrative Division (as on 2014-2015)			
	(a) Number of Taluks	3 Yadgir, Shorapur & Shahpur		
	(b) Number of Panchayats/Villages	117/519		
	(iii) Population(Projected to 2020 from 2011 Census)	1415385		
	(iv) Average Annual Rainfall (mm)	641.2		
2	Geomorphology			
	(i) Major physiographic units	Table land		
	(ii)Major Drainage	Krishna & Bhima		
3	Land Use in (ha)			
	(i) Forest area	33773		
	(ii)Net area sown	299536		
	(iii)Cultivable waste area	2385		
4	Major soil types	Deep black soil, Medium black soil& Lateritic soil		
5	Area under principal crops (as on 2014- 15)	Crops	Area (ha)	
		Jowar	41584	
		Bajra	16160	
		Paddy	82109	
		Gram	10880	
		Wheat	1080	
		Tur	44909	
		Sunflower	4528	
		Sugarcane	1481	
		Cotton	103866	
		Ground Nut	43358	
6	Irrigation by different sources (Area(ha)&Number of structures) (District at a Glance (2014-15))		Area irrigated	Number
	(i) Dugwells	9011	3013	
	(ii)Tubewells/Borewells	15802	5445	
	(iii)Tanks/Ponds	3525	308	
	(iv)Canals	129354	-	
	(v)Othersources:(a)LiftIrrigationSchemes	(a)2656	2381	
	(b)Others	(b)3954	-	
(vi)Net irrigated area	164302 ha			

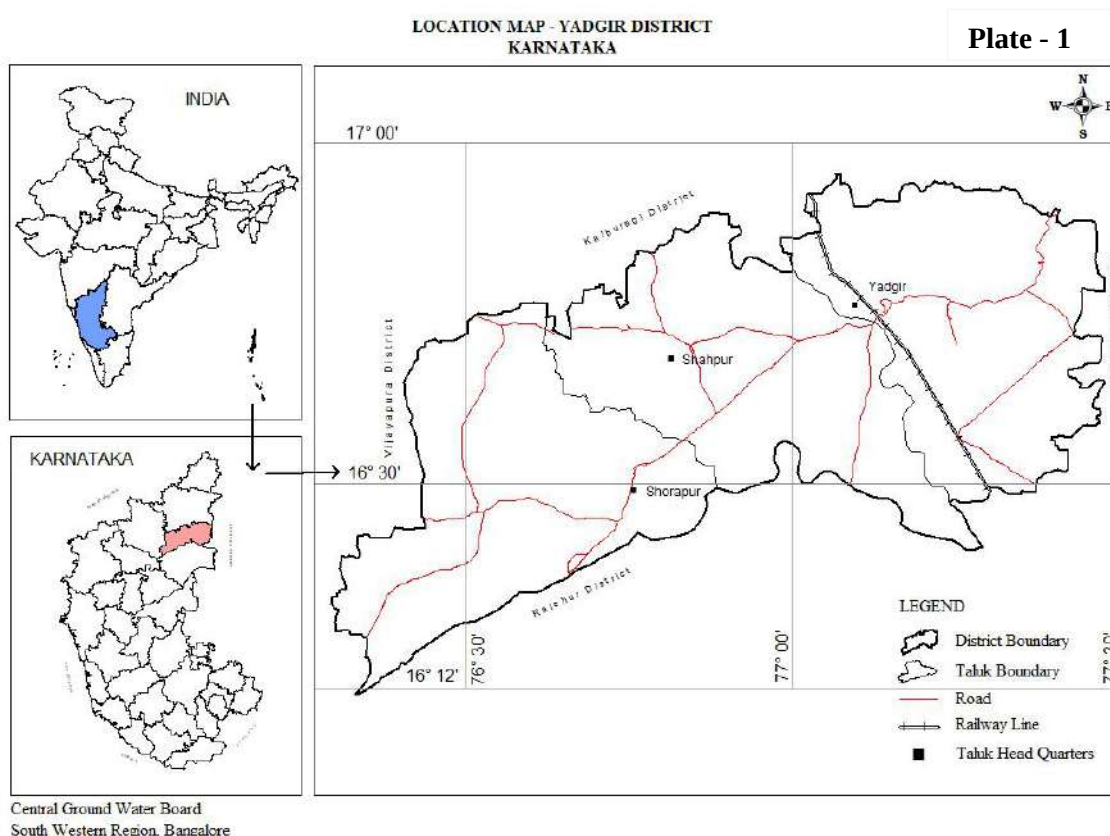
7	Number of groundwater monitoring wells of Central Ground Water Board (as on 2018)	
	(i) Dugwells	30
	(ii) Piezometers	8
8	Predominant Geological Formations	Granite, Gneiss, Basalt, Limestone, Laterites, Schist
9	Hydrogeology	
	(i) Major water bearing formation	Granite, Gneiss, Vesicular Basalt & Limestone
	(ii) Pre-monsoon depth to waterlevel during May 2019 (mbgl)	1.92 to 16.66
	(iii) Post-monsoon depth to waterlevel during November 2019 (mbgl)	0.70 to 20.67
	(iv) Long term water level trend in 10 years (2010-2019) (m/year)	
	At 29 National Hydrograph Stations (NHS), fluctuation in waterlevels show a rise from 0.5 to 5.89 mts, while at one NHS waterlevels have recorded falling trend in the range of -1.68 m/year	
10	Ground water exploration by Central Ground Water Board	
	(i) Number of wells drilled (EW, OW, PZ, SH, Total)	Exploratory wells - 80
	(ii) Depth Range (mbgl)	17.4 to 200
	(iii) Discharge (litres per second)	0.01 to 28.60
	(v) Transmissivity (m ² /day)	0.56 to 330
11	Ground water quality	
	(i) Presence of chemical constituents more than	EC, Fluoride, Nitrate & Arsenic
	(ii) Type of water	Calcium-Magnesium Bicarbonate Type
12	Dynamic ground water resource (2017)	
	(i) Annual Extractable Ground Water	41343
	(ii) Total Annual Ground Water extraction	14029
	(iii) Projected demand for domestic & industrial uses (ham)	2397
	(iv) Average Stage of ground water extraction	34%
13	Groundwater control & Regulation	
	(i) Number of OE blocks	Nil
	(ii) Number of Critical blocks	Nil
	(iii) Number of blocks notified	Nil

14	Major groundwater problems & issues	Yadgir taluk is falling under Semi-critical, Shahpur & Shorapur taluks are falling under Saft category. Fluoride, Nitrate & Arsenic concentration beyond permissible limitis reported in ground water of few areas falling in Shorapur, Shahpur& Yadgir taluks.
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1.0 INTRODUCTION

1.1 Location

Yadgir district lies in the northern part of Karnataka between 16° 11' 00" – 16° 50' 00" N. latitudes and 76° 17' 00" - 77° 28' 00" E. longitudes, with a geographical area of 5234.4 sq.km. The district is bounded by Kalaburgi district in the north, Vijayapura district in west, Raichur district in south and Andhra Pradesh in the east.



(Plate 1). Of the total 117 aspirational districts identified by NITI Aayog based on composite indicators from Health & Nutrition, Education, Agriculture & Water Resources, Financial Inclusion and Skill Development and Basic infrastructure which have an impact on Human Development Index, Yadgir district is one of the aspirational district identified in Karnataka State which is affected by poor socio-economic indicators. These are aspirational in the context, that improvement in these district can lead to the overall improvement in human development.

1.2 Administrative Set Up

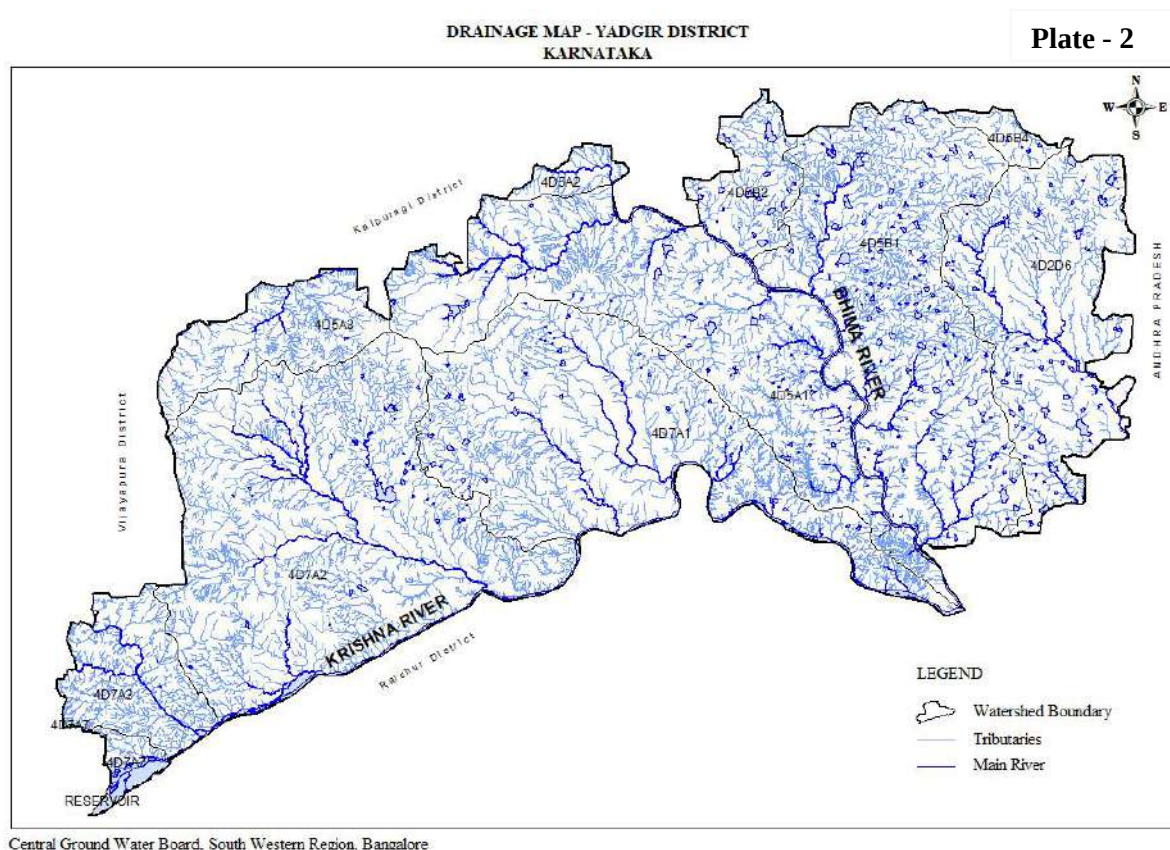
Yadgir is the district headquarters. The district comprises of 3 taluks namely, Shahapur, Yadgiri and Shorapur **(Plate 1)**. There are 16 hoblies, 117 Gram Panchayats, 4 Municipalities, 7 Towns/ Urban agglomeration and 487 inhabited & 32 un-inhabited villages.

1.3 Population

Population of the district projected for 2020 from 2011 Census is 1415385 with an average population density of 270 per km².

1.4 Drainage

Krishna and Bhima rivers drain the district. They constitute the two major river basins of the district. Kagna and Amarja are the two sub - basins of Bhima River, which occur within the geographical area of the district (**Plate 2**).



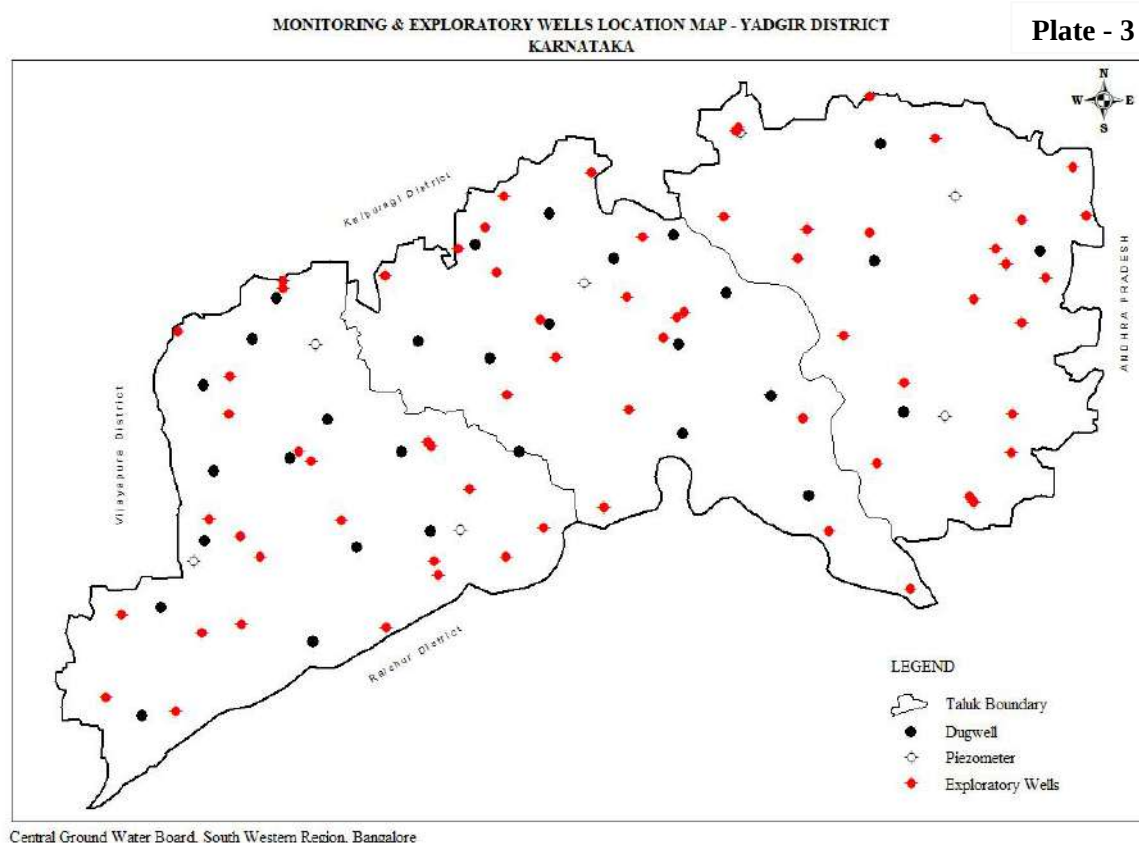
1.5 Crops & Irrigation Practices

About 75% of the geographical area of the district is under cultivation. Irrigation through dug wells is more prevalent in Yadgir taluk, whereas, irrigation in Shorapur and Shahpur taluks is through canal of Upper Krishna Project. Lift Irrigation Schemes are under implementation along Bhima River. The crops cultivated in the district are mainly rain fed. The major crops of the district are jowar, bajra, gram, tur, groundnut, sunflower and sugarcane. The irrigated crops are rice, wheat and sugarcane.

1.6 Activities Carried out by Central Ground Water Board

Previous works have been carried out by Central Ground Water Board (CGWB), South Western Region (SWR), in different parts of Yadgir district under Systematic Hydrogeological Surveys (1976-77, 1986-87), Reappraisal Hydrogeological Surveys

(1991-92, 1993-94, 1997-98 & 1998-99) and Exploratory Drilling Programme through inhouse and outsourcing to study and update the various aspects of ground water regime and quality during 2018 to 2020. Monitoring of spatial and temporal change in ground water level in the district is being done by CGWB, SWR, through established monitoring stations viz. dug wells & piezometers, four times annually, viz. May, August, November and January **(Plate 3)**.



2.0 RAINFALL & CLIMATE

The southwest monsoon sets in the middle of June and extends till the end of September. Bulk of the annual rainfall occurs during this season, which constitutes over 77% of the annual rainfall. Significant rainfall occurs during the winter monsoon owing to north eastern monsoon, which constitutes 7% of the annual rainfall. Average actual annual rainfall for the year 2019 for the district is 641.2 mm.

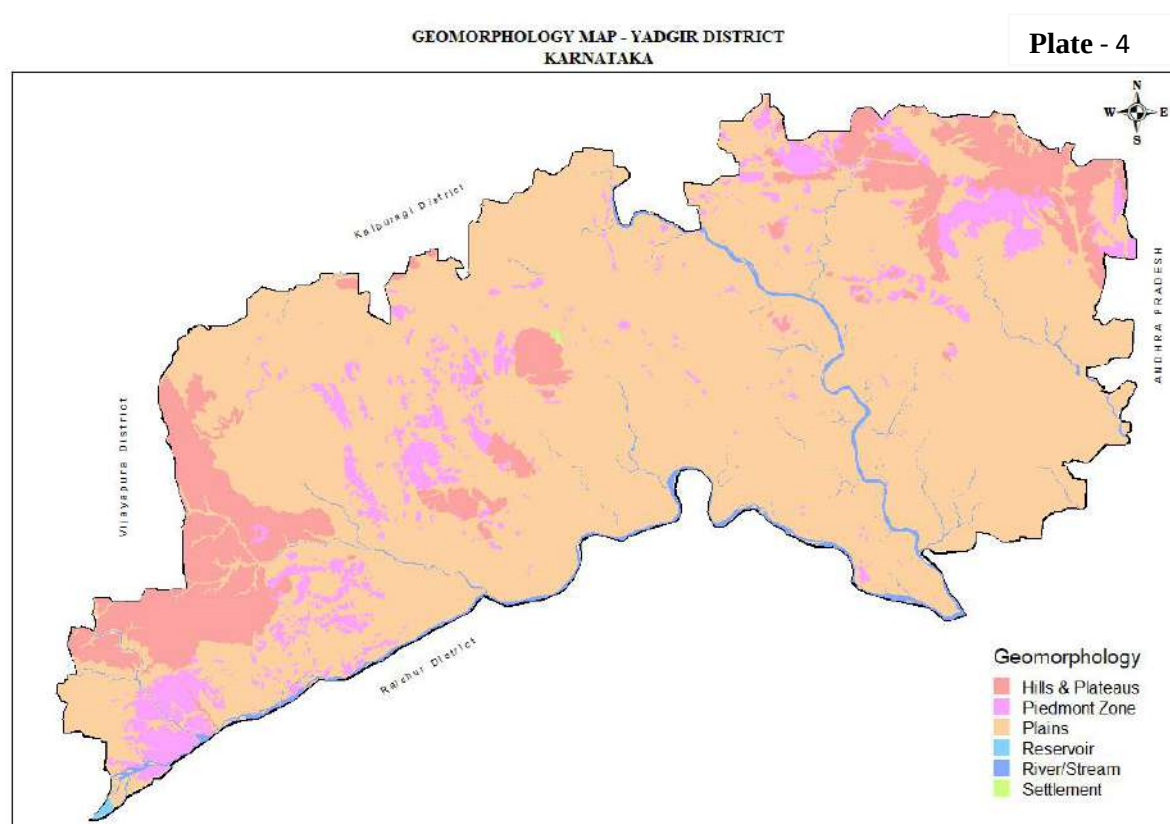
Yadgir district lies in the northern plains of Karnataka and has semi - arid type of climate. Dry climate prevails for most part of the year. December is the coldest month with mean daily maximum and minimum temperatures being 29.5°C & 15°C to 10°C respectively. During peak summer, temperature shoots up to 45°C. Relative humidity varies from 26% in summer to 62% in winter.

3.0 GEOMORPHOLOGY & SOIL TYPES

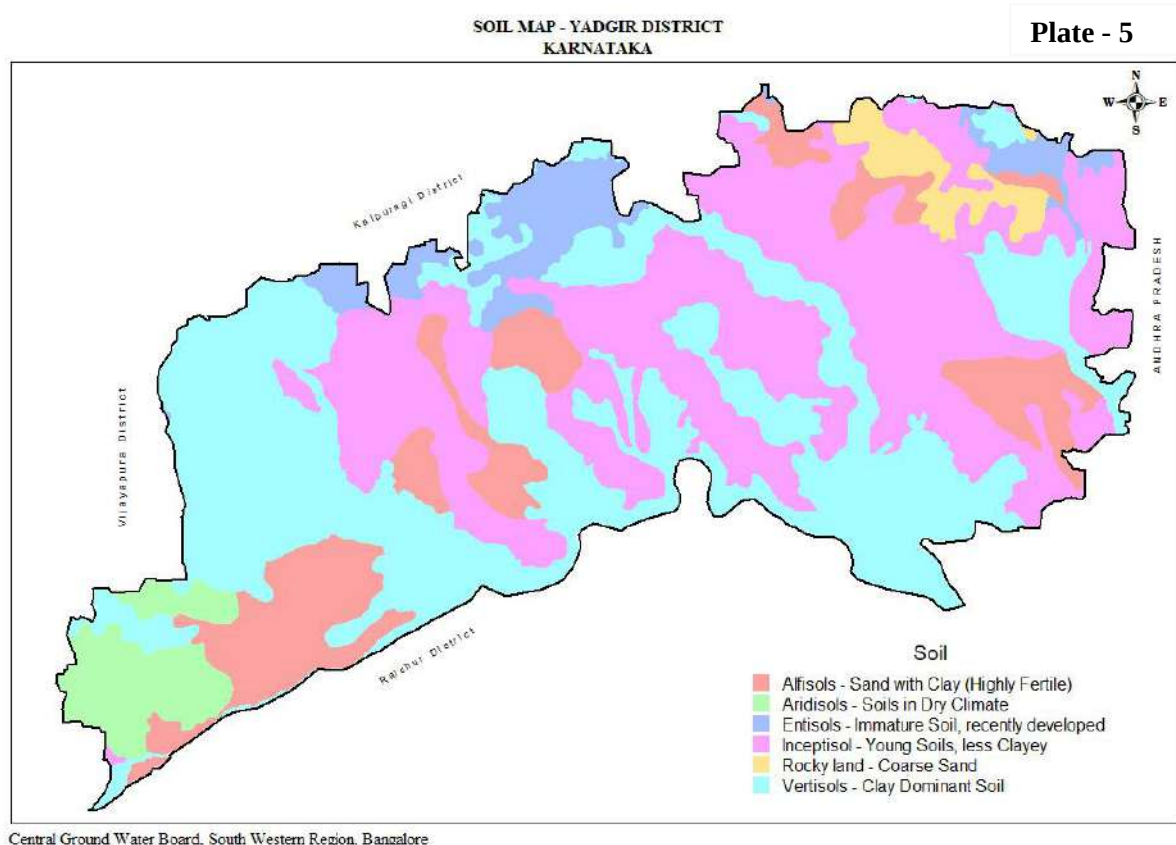
The northern part of the district represents a plateau, typical of Deccan Trap terrain and is deeply indented with ravines. The southern part represents undulating terrain with sparsely distributed knolls & tors. The prominent hill ranges in the district at Shorapur and Shahpur have an altitude of 567 & 604 m amsl respectively (**Plate 4**). The ground elevation varies significantly from 340 m amsl in southeast to 620 m amsl in the north. The regional slope is towards south and southeast.

The soil types in the district are deep black, medium black soil, shallow soil and lateritic soil (**Plate 5**). The deep & medium black soil covers practically the entire district area, except a small portion towards the northern part of the district. Black soil has been derived from basaltic rocks and varies in colour from medium to deep black. Its thickness varies from 0.5 to 3.6 m. Infiltration rate of shallow, medium and deep black soil is moderate to poor. Infiltration rate of medium black soil recorded in the district is 2.5 cm/hr.

Lateritic soil occurs in small extent towards the northern part of the district and its thickness varies from 1.0 to 5.0 m. It has moderate to good infiltration characteristics.



Central Ground Water Board, South Western Region, Bangalore



4.0 GROUND WATER SCENARIO

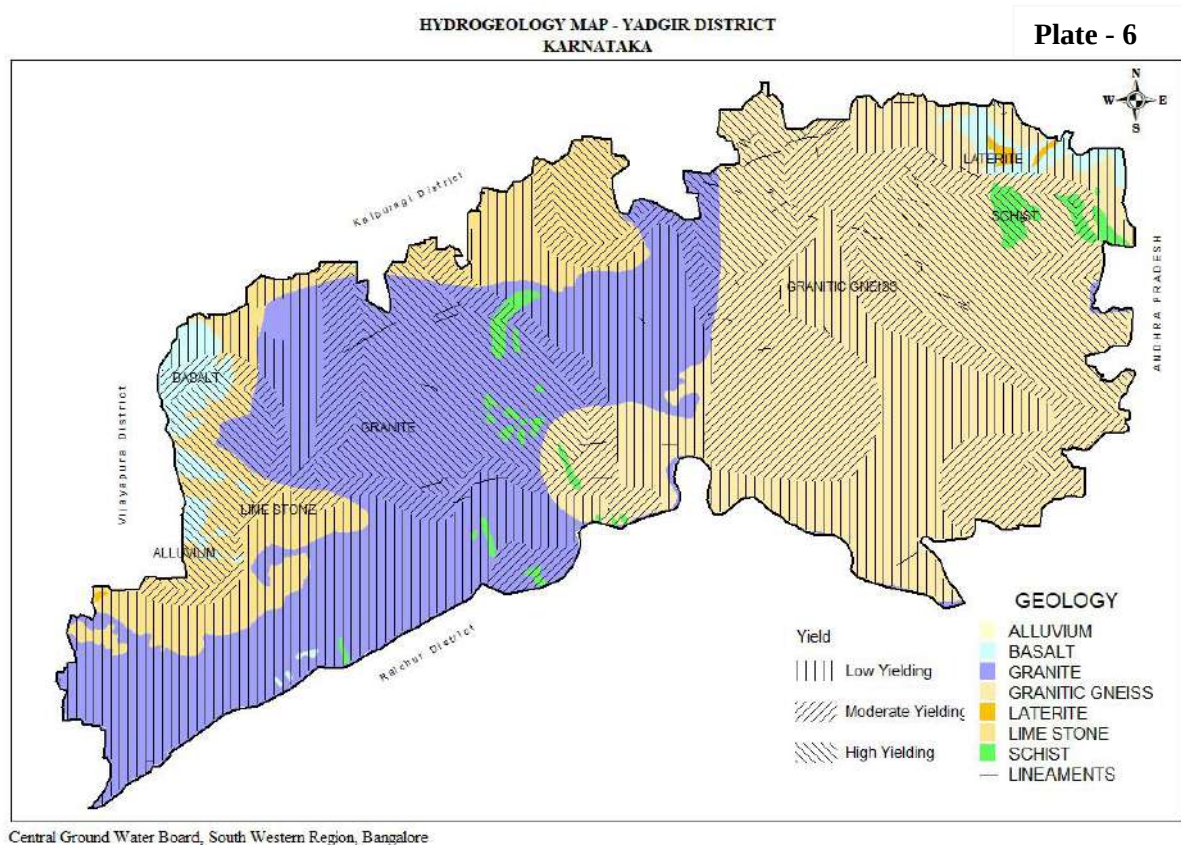
4.1 Hydrogeology

The southern part of the district comprises the Peninsular Gneiss and granites. Central, northeastern and southwestern part comprises of sedimentary formations viz., sandstone, quartzite, shale, slate, limestone and dolomite (**Plate 6**). Deccan Trap basalts cover eastern parts.

4.1.1 Occurrence of Ground Water

Major ground water bearing formations are granite, gneiss, limestone and vesicular basalt. Ground water occurs in weathered, fractured & jointed zones of these formations. In weathered zones ground water occurs in phreatic condition, whereas in the fractured & jointed formation it occurs in semi- confined to confined condition. The main source of recharge to ground water is precipitation, followed by seepage from canals and return flow from irrigation.

A small portion of Deccan Trap basalts, which comprise different flows, fractures & interstitial pore spaces of vesicular zone, are good repositories of ground water. In limestone, solution cavities are considered to be more potential than weathered and fractured zones. Laterite have primary porosity and are considered to be moderately good aquifer.



4.1.2 Depth to Water Level

Out of 30 National Hydrograph Station (NHS) dug wells located in Yadgir district, the depth to water levels recorded during pre – monsoon (May 2019) and post – monsoon (November 2019) periods were in the range of 1.92 to 16.66 mbgl and 0.70 to 20.67 mbgl respectively. The map of the Pre-monsoon depicts that a major part of the district has shallow to moderate depth to water levels up to 5 mbgl and only in Yadgir taluk major portion deeper water level of more than 10 mbgl is observed.

Depth to water level in 8 NHS piezometers in the district during pre – monsoon (May 2019) (**Plate 7**) and post – monsoon (November 2019) periods (**Plate 8**) were in the range of 4.54 to 31.10 mbgl and 0.49 to 9.57 mbgl respectively.

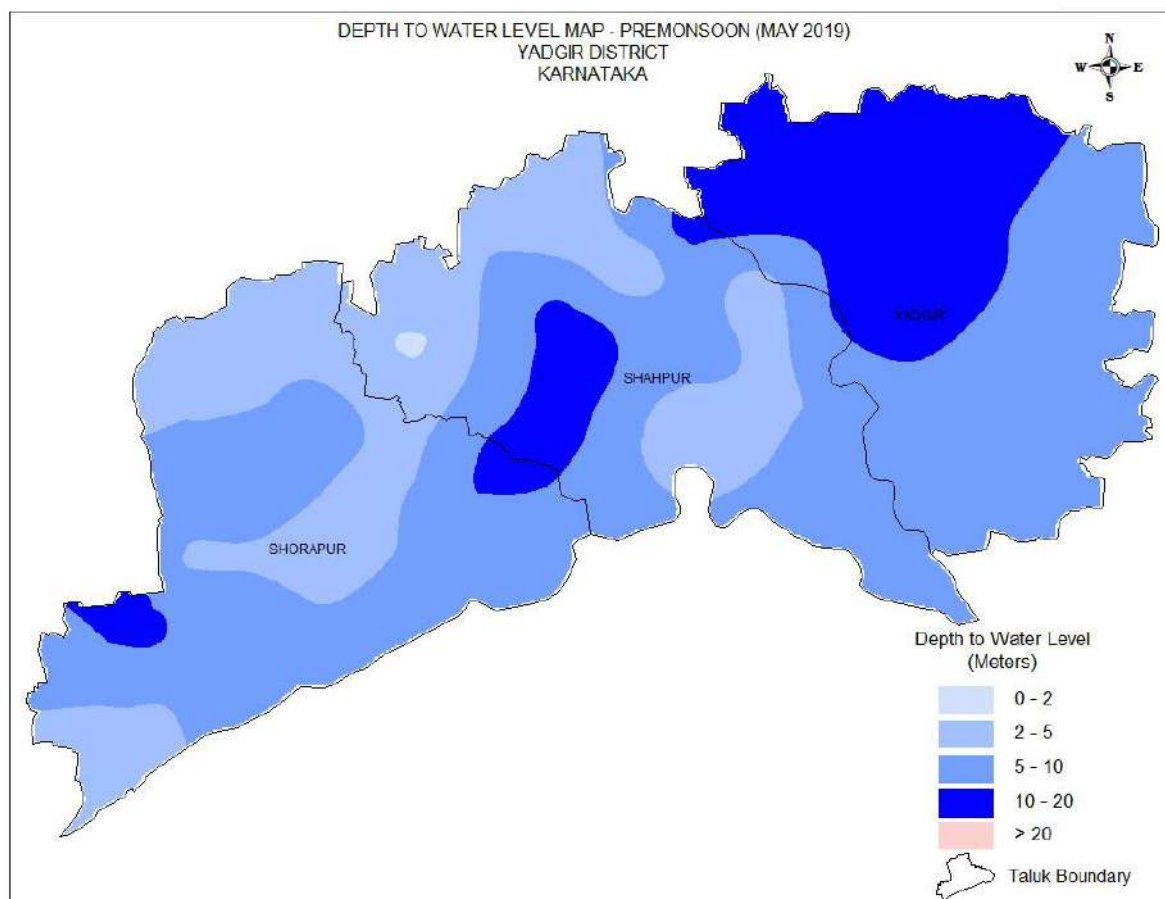
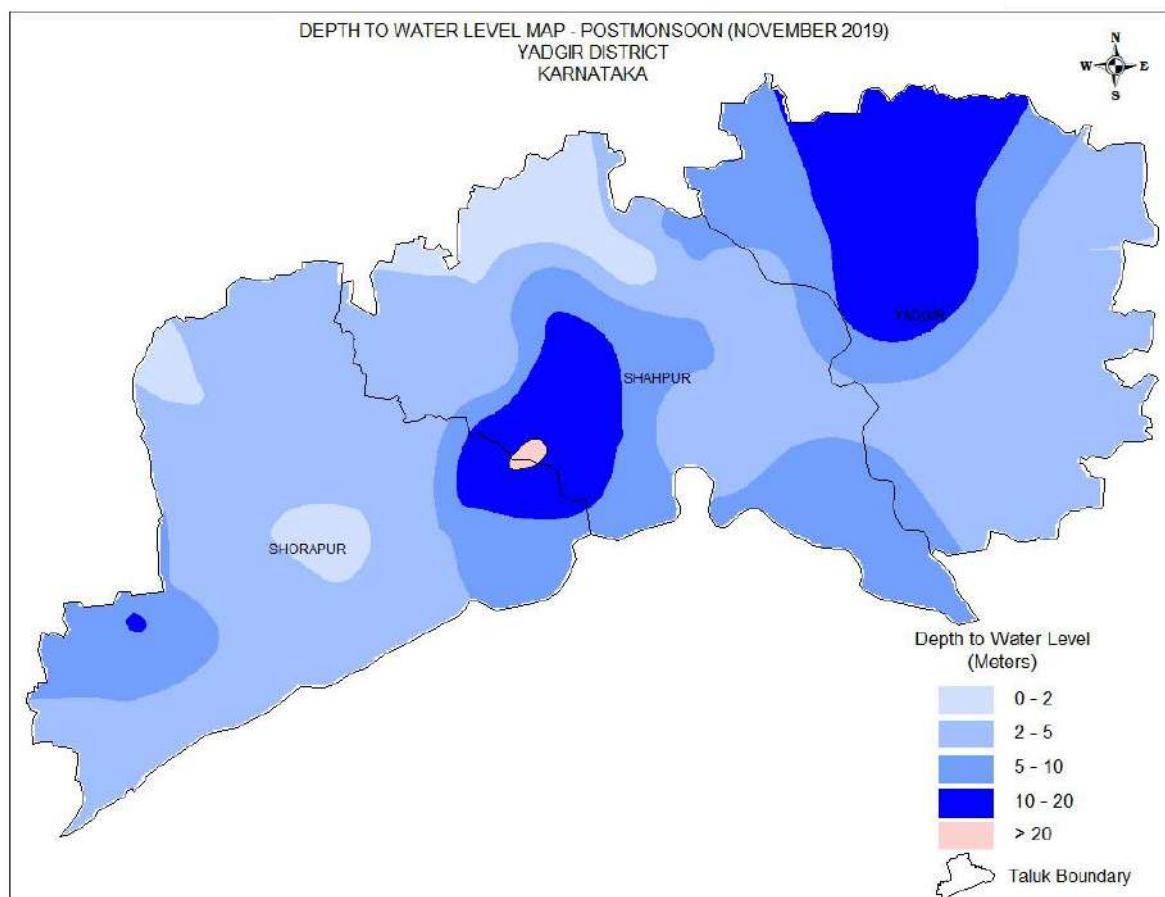


Plate - 8

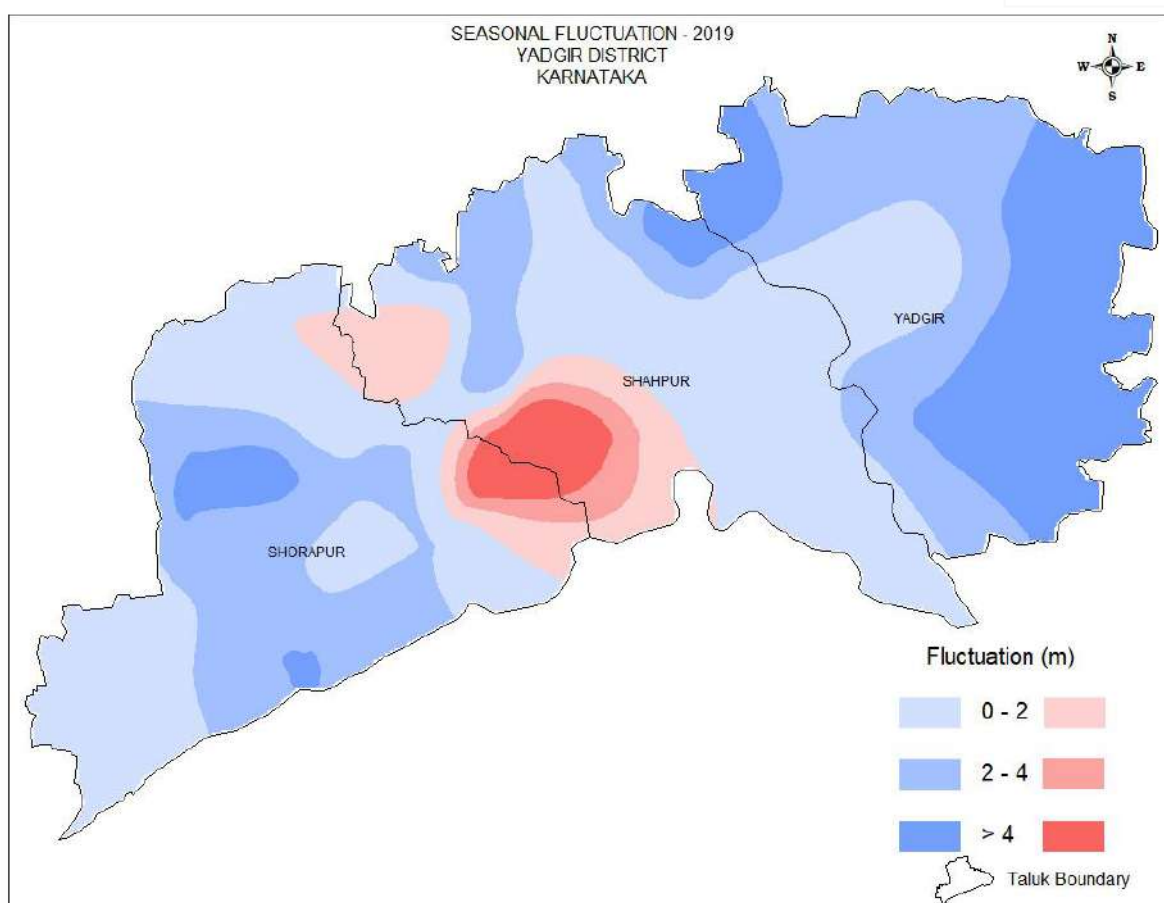


4.1.3 Seasonal ground water level fluctuation

Subsequent to seasonal rainfall, ground water level records a rise, indicating recharge to ground water. During pre-monsoon period there is depletion of ground water level due to exploitation, natural discharge and no recharge. This is manifested as fall in ground water level during pre-monsoon period. Therefore, ground water level in general shows a receding trend from December to May.

Seasonal water level fluctuation (May & November 2019) as observed in 28 NHS dug wells indicate there is rise in ground water level in the range of 0.5 to 3.7 m and 2 NHS dug well indicating fall of in the range of -1.28 to -4.01 m (**Plate 9**).

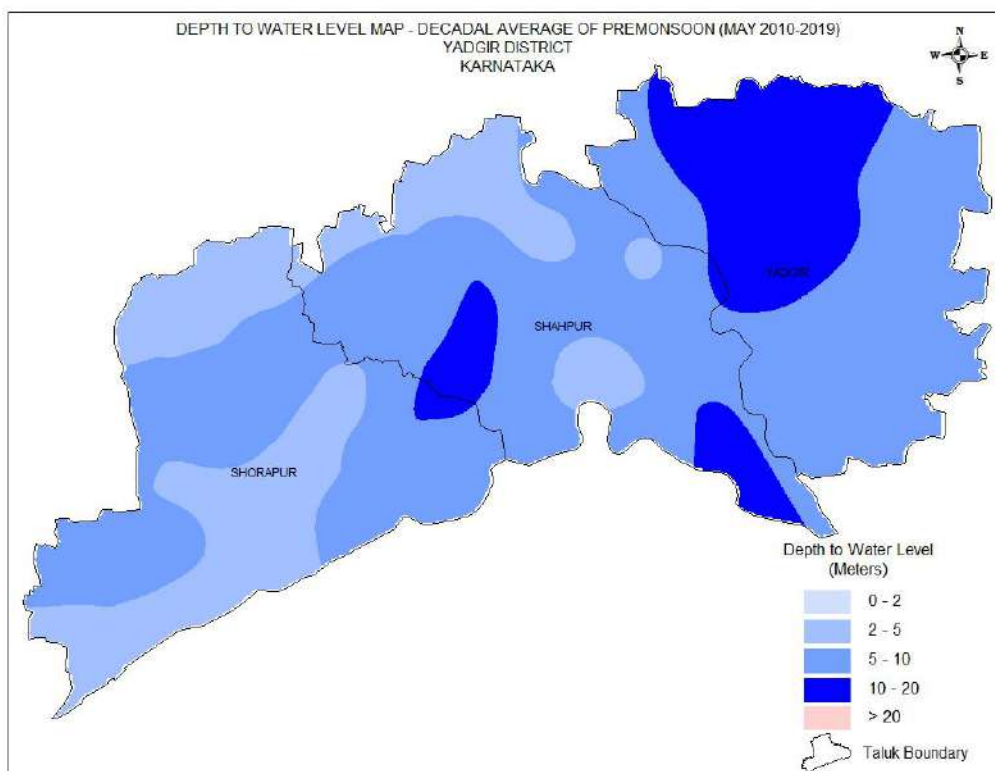
Plate - 9



4.1.4 Decadal Average Water Level of May (2010 – 2019)

Mean Ground Water level for the period of May 2010 to May 2019 is analysed, it is observed that like Pre-monsoon water level data of May 2019, the decadal average water level also follows the same trend which depicts that a major part of the district has shallow to moderate depth to water levels up to 5 mbgl and only in Yadgir taluk major portion deeper water level of more than 10 mbgl is observed (**Plate 10**).

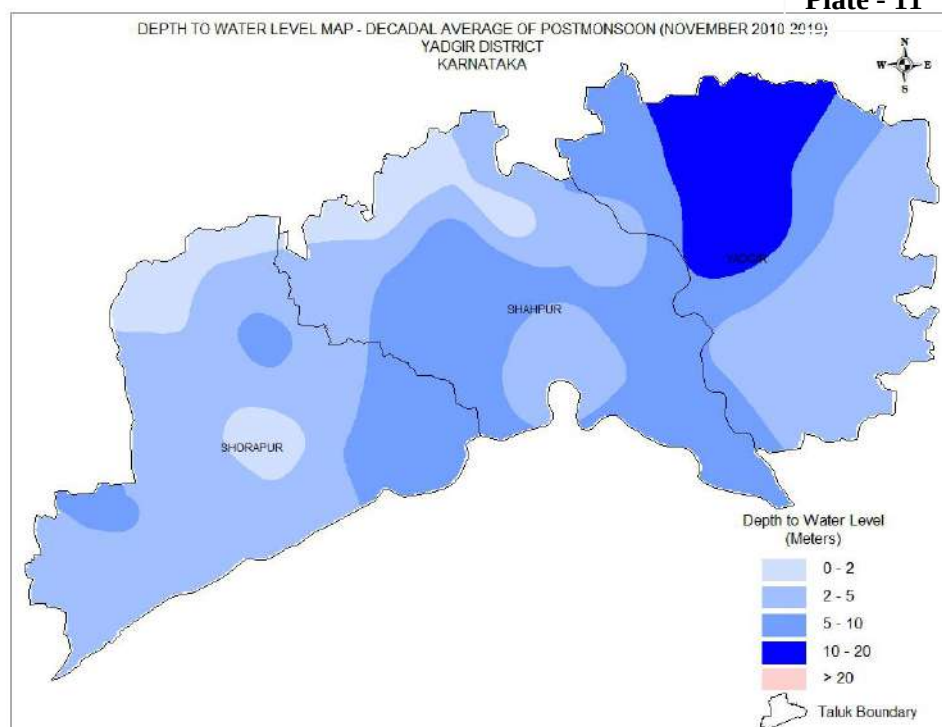
Plate - 10



4.1.5 Decadal Average Water Level of November (2010 – 2019)

Mean Ground Water level for the period of November 2010 to November 2019 is analysed (**Plate 11**), it is observed that like Post-monsoon water level data of November 2019, the decadal average water level also follows the same trend which depicts that a major part of the district has shallow to moderate depth to water levels up to 5 mbgl and only in Yadgir taluk major portion deeper water level of more than 10 mbgl is observed.

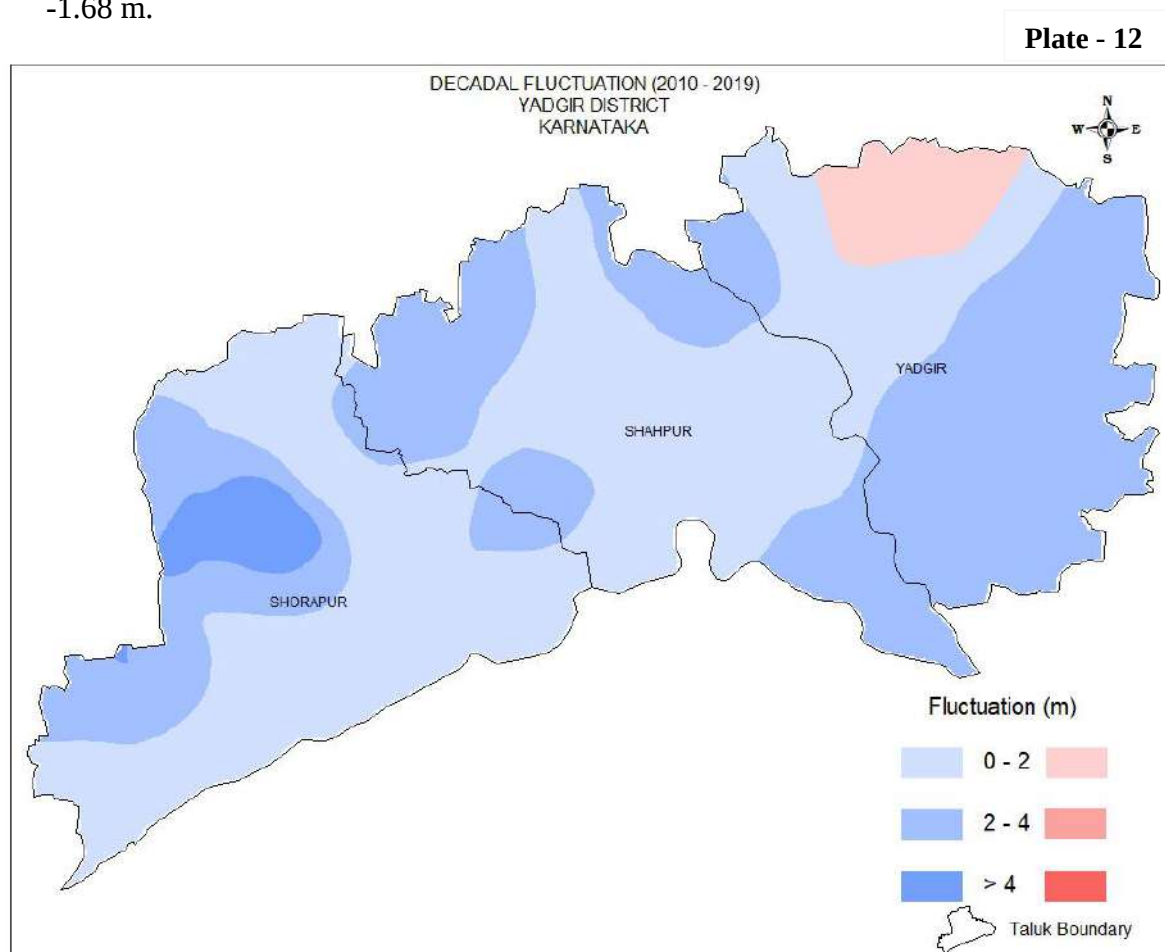
Plate - 11



4.1.6 Decadal Fluctuation

Subsequent to seasonal rainfall, ground water level records a rise, indicating recharge to ground water. During pre-monsoon period there is depletion of ground water level due to exploitation, natural discharge and no recharge. This is manifested as fall in ground water level during pre-monsoon period. Therefore, ground water level in general shows a receding trend from December to May.

Decadal water level fluctuation of Mean May (2010 to 2019) & Mean November 2010 to 2019) as observed in 29 NHS dug wells (**Plate 12**) indicate there is rise in ground water level in the range of 0.5 to 5.89 m and in one NHS dug well indicating fall of -1.68 m.

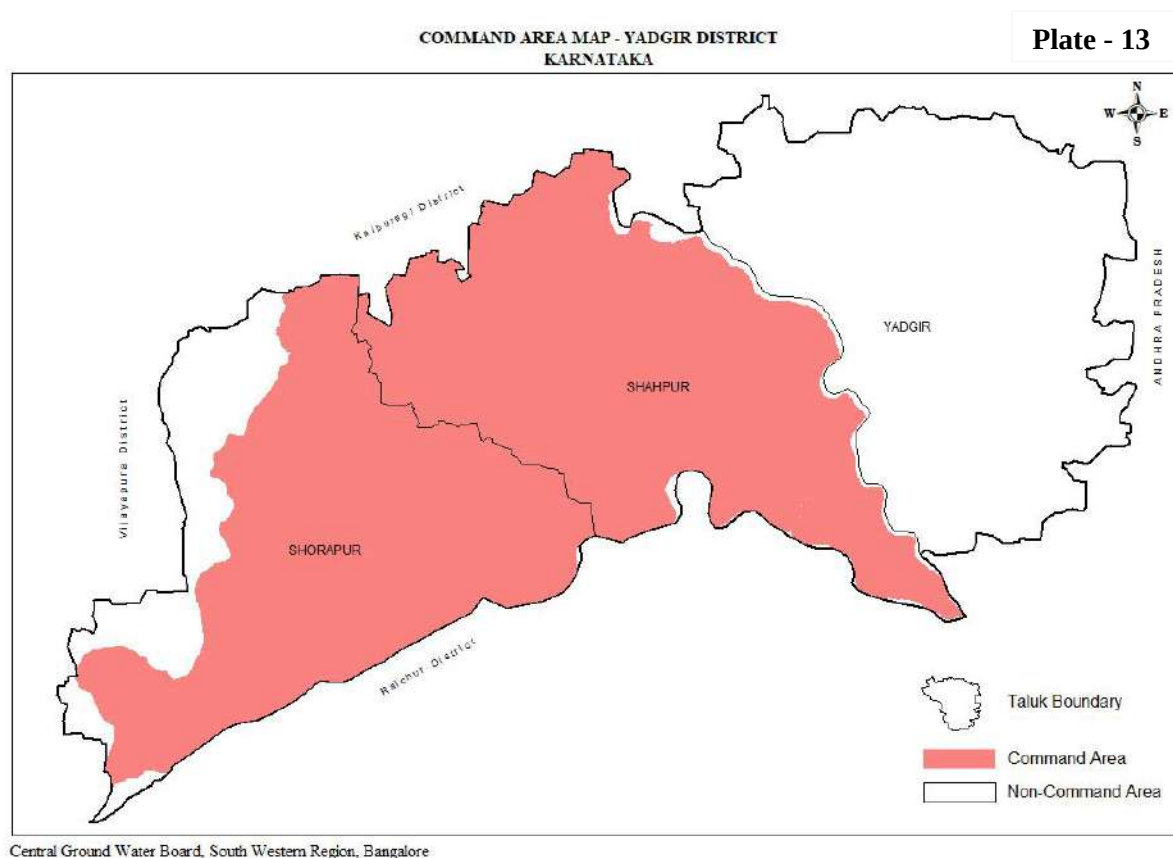


4.1.7 Command Area

Over an area of 3108 sq.km is demarcated as command area in the district which is 59% of the total area of the district, remaining area 2181 sq.km fall in non-command area which is 31% (**Plate 13**). Entire Shahpur taluk and parts of Shorapur taluk is covered under Command area, whereas entire Yadgir taluk falls in non-command area.

Most of the deeper water levels (>10 mts) in pre & post monsoon period in the district is observed in the non-command part of the district, except in Shahpur taluk where in

south-western part show deeper water levels and falling trend in ground water level on analysis of the seasonal fluctuation.



4.1.8 Water Logging

An area of 546 sq.km in Shorapur taluk and 178 sq.km in Shahpur taluk is prone for water logging as the water level is less than 5 m. These areas need to be taken special care in managing the ground water resources so that both the taluks can be prevented for becoming water logged. A detailed management plan is given in chapter 6.1.2.

4.1.9 Ground Water Exploration

Under, ground water exploration programme & National Aquifer Mapping Programme of CGWB, in the district, attempt has been made to study aquifer geometry & parameters through drilling exploratory bore wells through in house and outsourcing work. The selection of sites of all such bore wells was done based on detailed hydrogeological investigation and geophysical surveys.

The aquifer zones in the area have been found to occur under phreatic condition at shallow depth primarily in the weathered formation, followed by semi – confined to confined condition in fractured & jointed formation at greater depth. Geological formations occurring in the district are Granites, Granitic Gneiss which covers majority of the district, a small portion of Schist & Laterites in the north-eastern part and a small portion of Lime stone and Basalt on the western side.

In Granites, exploratory bore wells have been drilled to depth ranging from 45 to 200 mbgl. The thickness of weathered zone encountered ranges from 2 to 27 m. Water bearing fractures occur within the depth range of 7.5 to 172 mbgl. Drill time discharge ranges from <1 to 8.2 lps.

The depth of exploratory bore wells drilled in the sedimentaries of Bhima Formation range from 36 to 200 mbgl. The thickness of weathered zone encountered range from 2 to 45 m. Water bearing fractures occur within the depth range of 12 to 190 mbgl. Drill time discharge ranges from 0.01 to 9.87 lps.

The depth of exploratory bore wells drilled in Granitic gneisses ranges from 17 to 200 mbgl. The thickness of weathered zone encountered range from 1.7 to 36.75 m. Water bearing fractures occur within the depth range of 7.5 to 159 mbgl. Drill time discharge ranges from 0.02 to 8.2 lps.

Based on the Ground Water Exploration and NAQUIM studies (**Table - 1**), the districts has been broadly classified as Low, Moderate & High Yielding areas where < 1 lps classified as low yielding, between 1 – 3 lps as moderate yielding and > 3 lps as high yielding areas on ground water point of view.

Fracture analysis was carried out on the exploratory wells drilled in the district, it is found that water yielding prominent fractures, yielding discharge upto 8 lps occurs between a depth of 50 to 150 mbgl. Further, deeper fractures are also recorded upto a depth of 190 mbgl in some of the wells which is less productive. On analysing the fracture and its yield aquifer wise, it is observed that Granitic Gneiss formation is more productive followed by Limestone, Granites and Basalts are less productive. Based on the analysis it is suggested that borewells can be recommended upto a depth of 150 mts in the district. Based on the exploratory drilling activities carried out in the district, the expected yield from the borewells drilled in Granitic Gneiss is upto 8 lps, Limestone is 5 to 8 lps, Granites upto 4 lps and Basalts upto 1.5 lps.

4.1.9.1 3-Dimension view of the Aquifer in Yadgir district

Based on the various studies carried out in the district and data thus generated, various 2-D & 3-Dimensional output generated from the Rockworks are presented below (**Plate 14 to 18**).

Plate - 14

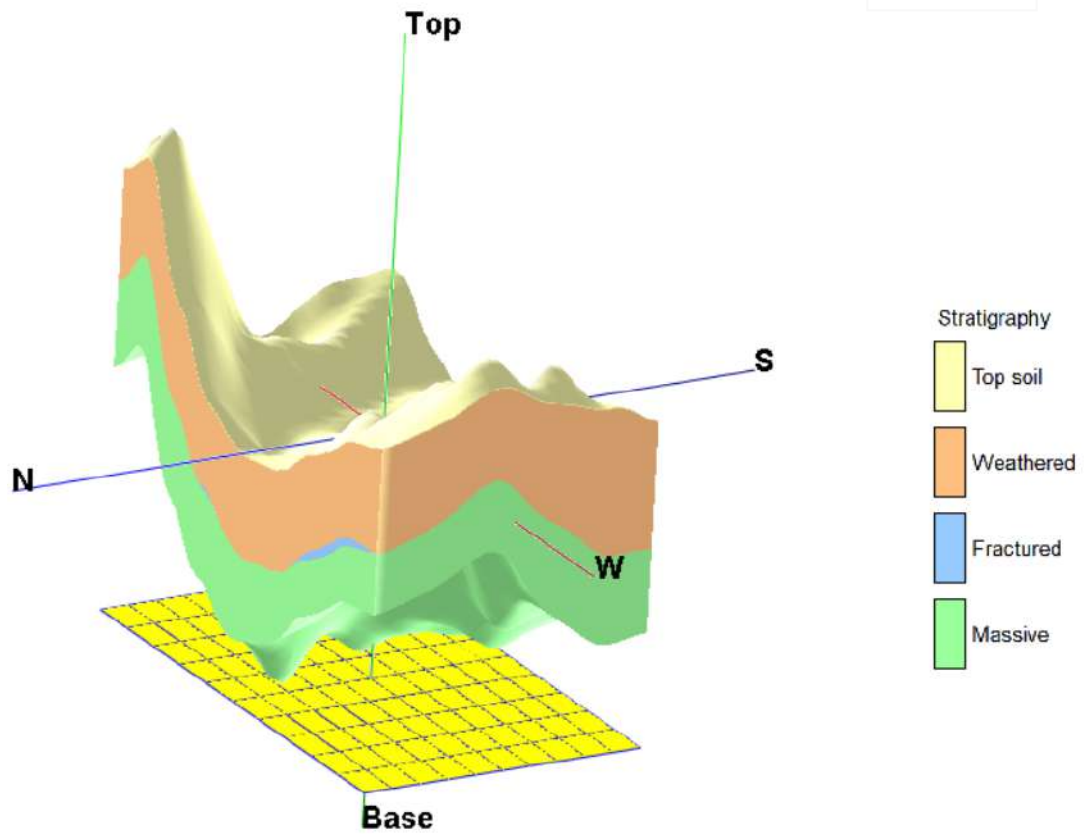
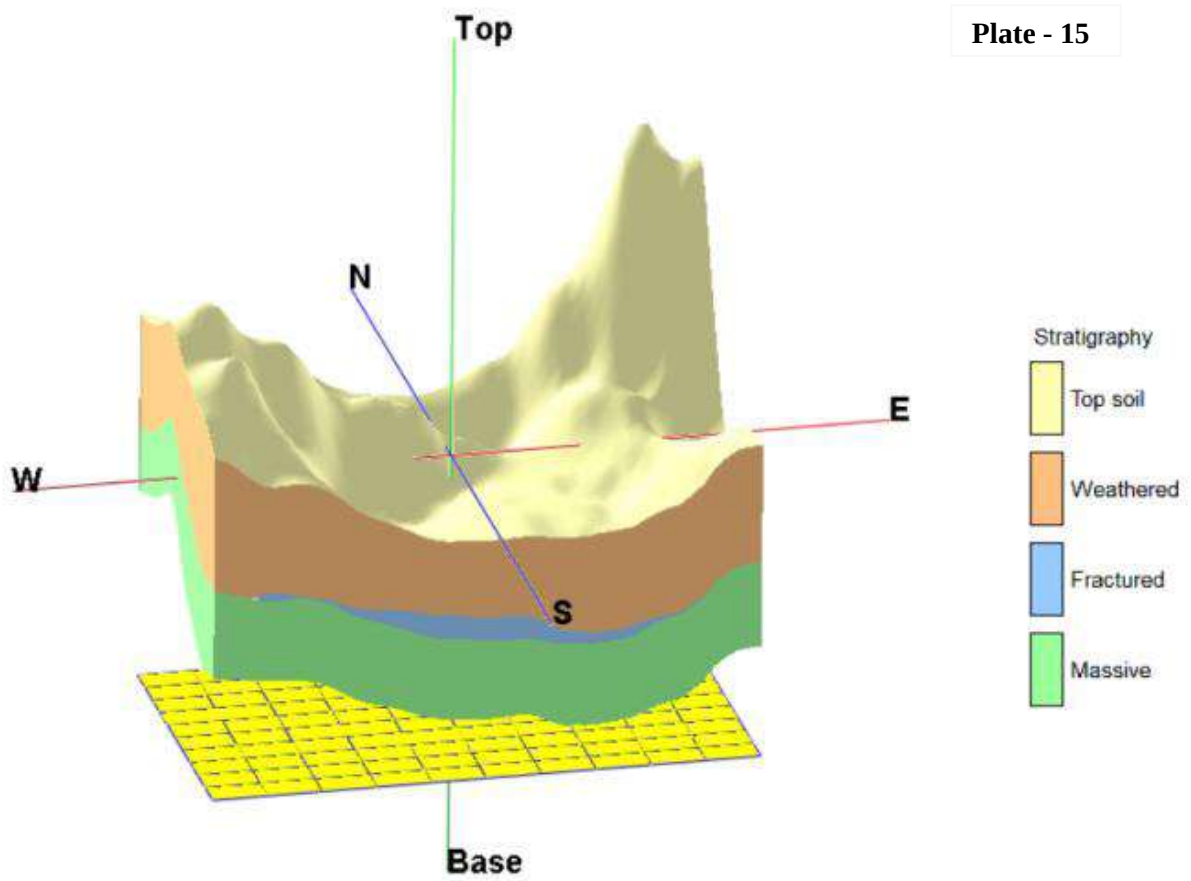
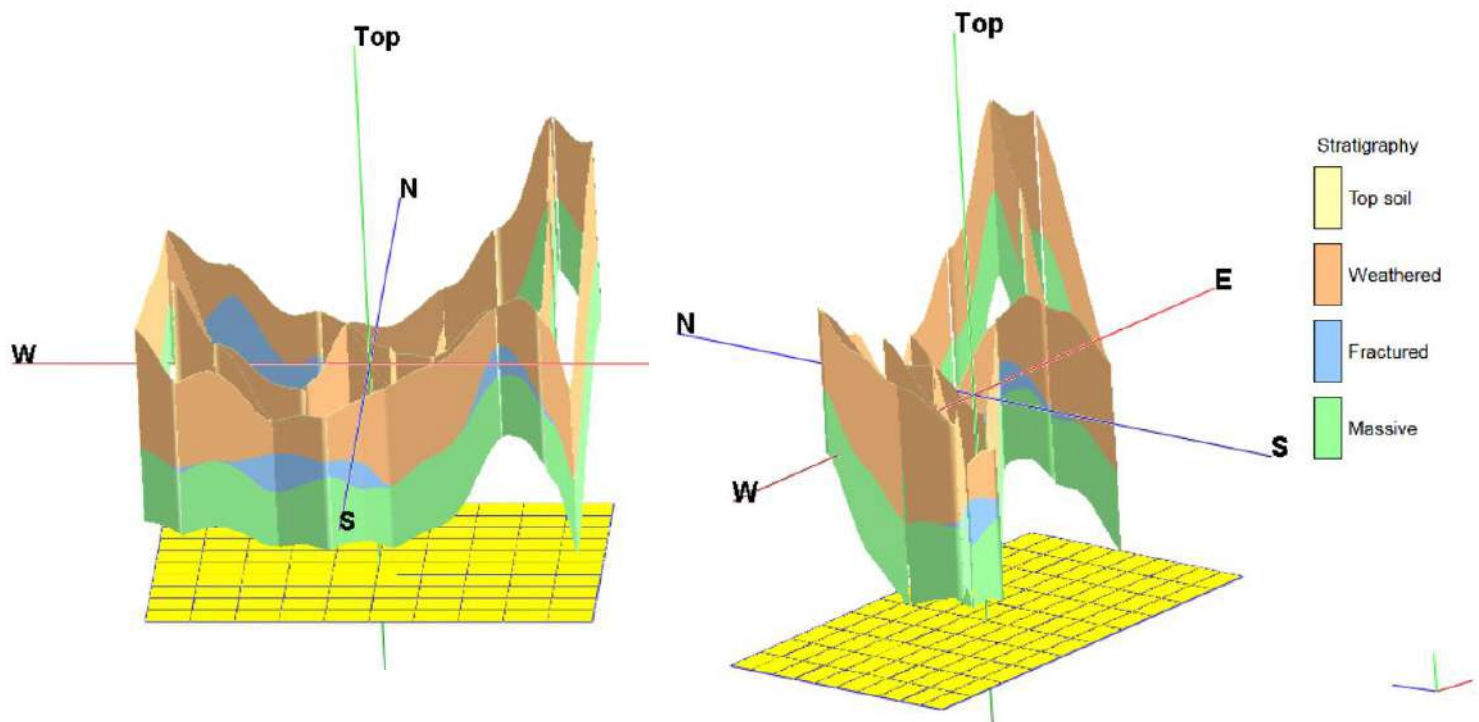
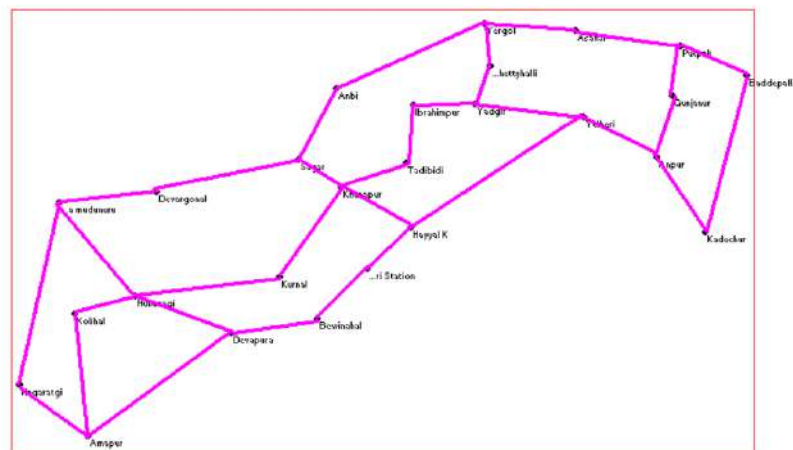


Plate - 15



Stratigraphic Model of subsurface in Yadgir district

Plate - 18



Fence Diagram of Subsurface in Yadgir District

Table - 1

Details of the Exploration wells drilled In Yadgir District										
S.No	Taluk	Location	Longitude	Latitude	Depth of the Well (mbgl)	Casing Depth (m bgl)	Fracture Zone (m bgl)	Static Water Level (mbgl)	Discharge (lps)	Major formation
1	Shahpur	Gugi	76.74794	16.77736	200	11.58	Dry	Dry	0.02	LIME STONE
2	Shahpur	Sagar	76.80319	16.62433	140.2	20.21	24,24.5135,136	31.3	8.2	GRANITE
3	Shahpur	Madarki	76.77950	16.80078	200	11.59	Dry	Dry	0.02	LIME STONE
4	Shahpur	Ibrahimpur	76.95661	16.79006	200	17.61	131,131.5152,152.5	8.07	0.21	GRANITE
5	Shahpur	Tadibidi	76.97956	16.68478	200	8.32	97.28,97.8,139.84,140.5	7.3	0.21	GRANITE
6	Shahpur	Khanapur	76.99472	16.70556	200	17.62	108108.5	1.79	0.01	GRANITE
7	Shahpur	Anbi	76.89836	16.85819	140	11.69	96,97	1.32	8.2	LIME STONE
8	Shahpur	Gundluru	77.25753	16.42156	200	13.82	Dry	Dry	0.02	GRANITIC GNEISS
9	Shahpur	Hayyal K	76.94108	16.60864	200	17.88	99100	4.71	0.43	GRANITIC GNEISS
10	Shahpur	Bendebemli	77.16700	16.48214	200	20.69	Dry	Dry	0.02	GRANITIC GNEISS
11	Shahpur	Shahapur	76.84078	16.70328	200	11.72	Dry	Dry	0.02	GRANITE
12	Shahpur	DORNAHALLI	76.93889	16.72778	90	2.00	14, 21, 38	4.105	0.05	GRANITE
13	Shahpur	HULKAL	76.79167	16.75278	73	0.00	Dry	7.525	0.01	LIME STONE
14	Shahpur	M.KOLLUR	76.91250	16.50694	76.2	5.25	Dry	8.209	1.54	GRANITIC GNEISS
15	Shahpur	M. KOLLUR	76.91250	16.50694	80	8.20	Dry	8.239	0.61	GRANITIC GNEISS
16	Shahpur	MUDBEL	76.80000	16.83333	90	2.70	6, 7	0.38	0.11	LIME STONE
17	Shahpur	UKINAL	76.66667	16.75000	45	5.10	25, 34	4.712	6.67	GRANITE
18	Shahpur	UKINAL	76.66667	16.75000	45	0.00	9.6	Dry	1.28	GRANITE
19	Shahpur	VIBHUTHIHALI	76.85833	16.66389	64	0.00	Dry	2.273	1.1	GRANITE
20	Shahpur	KHANAPUR	77.00306	16.71111	80	10.50	7.5, 23, 36, 65	3.246	1.26	GRANITE
21	Shahpur	WADGERA	77.13750	16.60000	80	8.20	7.5, 17, 20.4, 38, 43	5.173	2.7	GRANITIC GNEISS
22	Shahpur	WADGERA	77.13750	16.60000	60	0.00	8, 13, 20, 50	4.736	2.19	GRANITIC GNEISS
23	Shorapur	Tintani	76.66706	16.38056	200	5.85	Dry	Dry	0.02	GRANITE
24	Shorapur	Balasettihalli	76.50376	16.38344	200	11.70	Dry	Dry	0.02	LIME STONE
25	Shorapur	Devapura	76.72603	16.43578	200	13.37	23,24	6.96	0.21	GRANITE
26	Shorapur	Rajan kollur	76.45978	16.37550	200	5.60	Dry	Dry	0.02	LIME STONE
27	Shorapur	Hunusagi	76.52533	16.45489	200	5.42	88.16,89	5.43	0.43	GRANITE
28	Shorapur	Amapur	76.42992	16.29275	200	6.45	71.5,72	4.64	0.21	GRANITE
29	Shorapur	Kolihali	76.46811	16.49419	193	5.74	173,174,190,190.5,	63.87	9.87	LIME STONE
30	Shorapur	Hagaratgi	76.36869	16.39433	200	44.75	157.5,158,	17.13	0.01	LIME STONE
31	Shorapur	Bechipal	76.56833	16.56568	200	24.72	Dry	Dry	0.02	GRANITE
32	Shorapur	Gundlagera	76.48508	16.06122	200	27.13	Dry	Dry	0.02	GRANITE
33	Shorapur	chikka mudunuru	76.49036	16.60486	136	11.59	88.16,89,94.24,95.5,	18.11	11.73	LIME STONE
34	Shorapur	Chincholi	76.43214	16.69114	200	23.69	Dry	Dry	0.02	BASALT
35	Shorapur	Shorapur	76.76083	16.52586	200	5.54	Dry	Dry	0.02	GRANITE
36	Shorapur	Kurnal	76.84431	16.48567	200	20.15	36,37	6.82	0.08	GRANITE
37	Shorapur	Devargonal	76.71796	16.57102	180	11.18	19,20,115.52,116.52,172.5,173	13.15	6.7	GRANITE
38	Shorapur	Bewinahali	76.80267	16.45483	200	25.60	38.5,39	4.42	1.19	GRANITE
39	Shorapur	Malla B	76.55167	16.73581	200	11.58	Dry	Dry	0.02	LIME STONE
40	Shorapur	HUNSAGI	76.50278	16.47667	70	2.00	Dry	Abandoned	0.02	LIME STONE
41	Shorapur	KEMBHAVI	76.49167	16.64444	90	0.00	Dry	13.26	1.8	LIME STONE
42	Shorapur	BYCHAPAL	76.58333	16.55556	90	18.40	16, 27, 90	3.78	4	GRANITE
43	Shorapur	DEVARGONAL	76.71389	16.57500	58.5	6.20	16.3, 23.4	2.953	5	GRANITE
44	Shorapur	DEVALAPUR	76.72083	16.45000	90	18.00	13.5, 9.0	6.051	0.33	GRANITE
45	Shorapur	DEVARGONAL	76.71389	16.57500	58.5	0.00	Dry	2.953	5	GRANITE
46	Shorapur	HADNUR	76.55139	16.74444	90	4.00	Dry	5.36	0.25	LIME STONE
47	Shorapur	HEBBAL (K) EW	76.61667	16.49306	36	12.30	12, 27, 36	5.953	0.02	LIME STONE
48	Yadgir	Yergol EW	77.06450	16.90550	200	25.40	58,58.7,103,104.7,	30.1	4.25	GRANITIC GNEISS
49	Yadgir	Bommashettyhalli EW	77.04770	16.81210	200	23.70	69,69.779.5,80.7,117,118.5	23.55	8.19	GRANITIC GNEISS
50	Yadgir	Chandraki	77.44100	16.86290	200	12.20	Dry	Dry	0.02	GRANITIC GNEISS
51	Yadgir	Gunjanur	77.35430	16.77810	200	12.15	82.3,82.8,119,120.2,	15.55	8.2	GRANITIC GNEISS
52	Yadgir	Asanal EW	77.21200	16.79530	200	18.10	88.4,88.9,131.1,132.1,	10.85	5.4	GRANITIC GNEISS
53	Yadgir	Lingeri Station	77.18320	16.68620	200	19.40	50,50.8	6.37	0.78	GRANITIC GNEISS
54	Yadgir	Gajarakot	77.28630	16.89430	200	18.25	Dry	Dry	0.02	GRANITIC GNEISS
55	Yadgir	Yelheri	77.33010	16.72490	200	17.90	20,20.8,35,35.3,	5.87	5.39	GRANITIC GNEISS
56	Yadgir	Wankasambar	77.37300	16.60480	200	36.75	Dry	Dry	0.02	GRANITIC GNEISS
57	Yadgir	Baddepalli EW	77.37210	16.56380	200	24.40	121.7,122.2,182,183,	23.67	3.17	GRANITIC GNEISS
58	Yadgir	Kadachur EW	77.32530	16.51820	200	12.20	102.7,103.2,158.6,159.6,	29.92	2.83	GRANITIC GNEISS
59	Yadgir	Putpak	77.45700	16.81240	200	14.40	78,78.5,125,125.6,	24.01	0.02	GRANITIC GNEISS
60	Yadgir	Belagundi	77.22020	16.55310	200	12.15	Dry	Dry	0.02	GRANITIC GNEISS
61	Yadgir	Anpur EW	77.41050	16.74710	200	32.20	85.4,86.6	14.38	2.83	GRANITIC GNEISS
62	Yadgir	Yadgir	77.13160	16.76740	200	12.20	115.9,116.4	8.07	0.07	GRANITIC GNEISS
63	Yadgir	YARGOL	77.06250	16.90139	30	3.25	30	4.729	2.8	GRANITIC GNEISS
64	Yadgir	MOTTANHALI EW	77.21250	16.93750	90	6.10	Dry	Abandoned	0.02	GRANITIC GNEISS
65	Yadgir	BANDEHALLI	77.14167	16.79861	80	14.50	80	4.799	2.33	GRANITIC GNEISS
66	Yadgir	BANDEHALLI	77.14167	16.79861	17.4	8.50	17.4	4.492	0.02	GRANITIC GNEISS
67	Yadgir	BANDEHALLI	77.14167	16.79861	20.4	17.50	20.4	4.492	0.02	GRANITIC GNEISS
68	Yadgir	KADACHUR	77.32917	16.51250	80	13.40	80	4.39	1.63	GRANITIC GNEISS
69	Yadgir	KADACHUR	77.32917	16.51250	50	8.50	50	4.02	2	GRANITIC GNEISS
70	Yadgir	KILLANKERA EW	77.25139	16.63750	80	18.00	8, 28	4.933	0.02	GRANITIC GNEISS
71	Yadgir	NANDEPALLI EW	77.38333	16.70000	58	6.00	9.5, 15, 27.2	7.424	1.75	GRANITIC GNEISS
72	Yadgir	NANDEPALLI	77.38333	16.70000	32.8	4.70	10, 15	7.038	28.6	GRANITIC GNEISS
73	Yadgir	YARGOL	77.06250	16.90139	72	12.00	20, 25, 49, 72	4.623	2.8	GRANITIC GNEISS
74	Yadgir	YARGOL	77.06250	16.90139	50	3.50	50	4.729	2.8	GRANITIC GNEISS
75	Yadgir	DHARAMPUR	77.38333	16.80833	71.65	6.25	15, 38.1, 54.33	2.596	4.2	GRANITIC GNEISS
76	Yadgir	GUNJUNUR	77.36667	16.76250	62.2	12.20	11, 26, 42, 59	4.34	2.33	GRANITIC GNEISS
77	Yadgir	GUNJUNUR	77.36667	16.76250	57.6	9.50	11, 39, 49	4.82	1.67	GRANITIC GNEISS
78	Yadgir	GUNJUNUR	77.36667	16.76250	30	16.80	14, 22.5	4.82	1.67	GRANITIC GNEISS
79	Yadgir	GUNJUNUR	77.36667	16.76250	30	8.50	14, 30	4.82	1.67	GRANITIC GNEISS
80	Yadgir	YARGOL	77.06250	16.90139	30	1.70	30	4.729	2.8	GRANITIC GNEISS

4.2 Ground Water Resources

Taluk wise ground water resource potential estimated as per the Ground Water Estimation Methodology (GEM) 2015 as on March 2017 is given in the **Table -2**. As illustrated in Table - 2 and **Plate 19** below, out of 3 taluks of the district, Shahapur and Shorapur is suitable for ground water development. Remaining Yadgir taluk is falling in semi critical category. Net ground water availability in the district is 41343 ham. Existing ground water draft for all uses is 14030 ham. Availability of ground water resource for future irrigation development is 26579 ham and average stage of ground water development of the district is 34%. Hence there is enough scope for ground water development in the district. However, development may be taken up as per the advice of experienced hydrogeologist and it should be restricted to areas falling in safe category. Intense monitoring of water level is recommended to keep an eye on water level trend in the district. Data on total ground water resources is presented in **Table-3**.

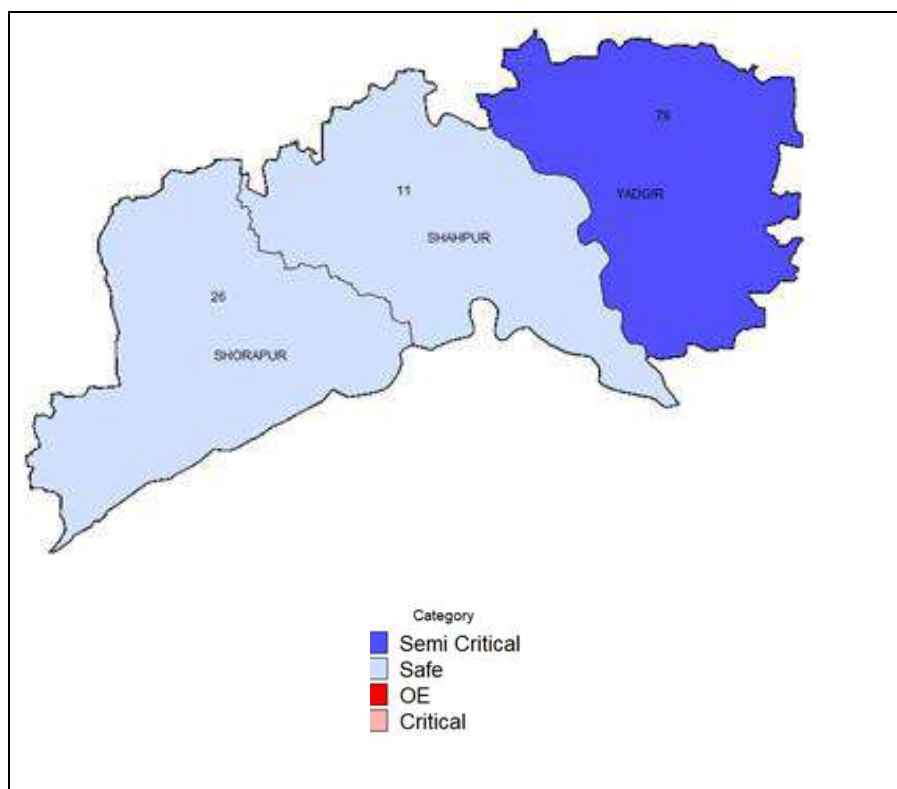
Table.2: Talukwise Ground Water Resources of Yadgir District as on March 2017

Sl.No.	DISTRICT	TALUK	NET ANNUAL GROUND WATER AVAILABILITY (Ham)	EXISTING GROSS GROUND WATER DRAFT FOR IRRIGATION (Ham)	EXISTING GROSS GROUND WATER DRAFT FOR DOMESTIC AND INDUSTRIAL WATER SUPPLY (Ham)	EXISTING GROSS GROUND WATER DRAFT FOR ALL USES (Ham)	ALLOCATION FOR DOMESTIC AND INDUSTRIAL USE FOR NEXT 25 YEARS (Ham)	NET GROUND WATER AVAILABILITY FOR FUTURE IRRIGATION DEVELOPMENT	EXISTING STAGE OF GROUND WATER DEVELOPMENT (%)	CATEGORY
1	Yadgir	Shahpur	19318	1965	241	2206	522	16831	11	SAFE
2	Yadgir	Shorapur	10393	2164	519	2683	889	7340	26	SAFE
3	Yadgir	Yadgir	11633	8238	904	9141	987	2408	79	SEMICRITICAL

Table.3: Present Total Ground Water Resource (in ham)

Taluk	Annual replenishable GW resources (in ham)	Fresh In-storage GW resources (in ham)		Total availability of GW resource (in ham)
		Phreatic	Fractured	Dynamic + phreatic in-storage + fractured in-storage
Shahpur	19318	4493	3677	27488
Shorapur	10393	4096	3596	18085
Yadgir	11633	698	3440	15771

Categorisation of Assessment Unit in Yadgir district (as on March 2017)



4.3 Status of Groundwater Development

Dug wells are mainly the ground water abstraction structure in use for irrigation purposes in all the taluks, followed by shallow & medium borewells. In Yadgiri district shallow & medium borewells are extensively used, whereas, deep bore wells are rarely drilled in the district. Lift irrigation schemes are also being executed to a large extent in Shahapur and Shorapur taluks respectively. There are in total 4461 types of lift irrigation schemes in the district of which, on river there are 679 schemes, on stream there are 2546 schemes, on drain/canal there are 14 schemes, on tanks/ponds/reservoirs/check dams there are 1117 schemes and other types of minor surface lift schemes there are 105 numbers. The details of ground water abstraction structures constructed under various minor irrigation schemes in Yadgir district are mentioned in the **Table - 4**.

Table.4: District wise ground water abstraction structures constructed under various minor irrigation schemes in Yadgir district

District	Dugwells		Shallow Borewells		Medium Borewells	
	Total Numbers	Defunct	Total Numbers	Defunct	Total Numbers	Defunct
Yadgir	1988	312	6754	190	5927	84

Source: Vth Census of Minor Irrigation Schemes 2013-14

4.4 Unit Area Annual Ground Water Recharge

Sustainability of ground water resource depends mainly on two factors viz., Annual ground water recharge and annual ground water draft. The annual ground water recharge depends on the quantity and intensity of rainfall, the infiltration characteristics of the soil, the depth to ground water level, the slope of the area and the geomorphology. The ground water recharge is assessed separately for the monsoon and non-monsoon period due to rainfall as well as due to other sources which includes return seepage from irrigated area, seepage from canals, water bodies, influent rivers etc. The total ground water recharge is expressed in meters which can be arrived at by dividing the total annual ground water recharge by the area. In Karnataka state, the unit area recharge is grouped into four categories viz., 0.025 - 0.10m, 0.10 - 0.15m, 0.15 - 0.25, and 0.25 - 0.5m.

In Yadgir district, the unit area annual recharge is in the range of 0.06 m to 0.13 m and the taluk wise details are given in **Table - 5**.

Table.5: Unit area Annual Ground Water Recharge – Yadgir District

Taluk	Total Area(HA)	Total Annual Recharge (HAM)	Unit Annual Replenishable Ground Water Resource (m)
Shahpur	161919	20765	0.13
Shorapur	186189	11409	0.06
Yadgir	171230	12430	0.07

5. GROUND WATER QUALITY

Quality of ground water in the district, in general is good and potable. It is suitable for domestic and irrigation purposes. Water samples collected from NHS (dug wells) during May 2018 monitoring were analysed to decipher the quality of shallow aquifer. All important parameters viz., pH & TDS, EC, Nitrate and Fluoride concentration beyond permissible limit is noticed in parts of Yadgir, Shorapur & Shahpur taluks. Specific conductance ranges from 700 to 7100 micro-Siemens per cm at 25°C, Nitrate ranges from 2 to 826 mg/l and Fluoride concentration ranges from 0.26 to 4.0 mg/l. The map showing the location of fluoride, nitrate and arsenic constituents more than permissible limits is given below in **Plate 20** and details of analysis carried is listed in **Table - 6**.

CGWB, SWR, BENGALURU
REGIONAL CHEMICAL LABORATORY

TABLE.6: ANALYTICAL RESULTS OF SAMPLES COLLECTED UNDER NHS IN YADGIR DISTRICT (2018-19)

Sl.No	Location	Latitude	Longitude	Type of Well	DOC	pH	EC μS/cm	Cl mg/l	NO3 mg/l	F mg/l
1	Bijaspur	16.5667	76.8167	Dugwell	23/5/2018	7.824	1540	256	153	1.2
2	Bolashettihal	16.3906	76.5072	Dugwell	23/5/2018	7.980	1870	185	102	1.2
3	Chigerahalli	16.8861	76.7611	Dugwell	23/5/2018	8.172	850	163	2	0.78
4	Devapur A	16.4333	76.7333	Dugwell	23/5/2018	7.960	1360	156	151	1.5
5	Devatkall	16.4667	76.6333	Dugwell	23/5/2018	7.820	1940	355	111	0.44
6	Doranahalli	16.7417	76.8500	Dugwell	30/5/2018	8.006	800	107	161	0.63
7	Googi	16.3836	76.6392	Dugwell	23/5/2018	8.116	830	21	99	1.3
8	Gurmitkal	16.8708	77.3889	Dugwell	29/5/2018	8.137	1650	227	81	2.1
9	Hebbal B	16.4819	76.5978	Dugwell	23/5/2018	7.711	2600	554	176	0.45
10	Kakkeri	16.3667	76.5833	Dugwell	23/5/2018	7.792	1090	121	94	1.3
11	Kembhavi	16.6528	76.5361	Dugwell	28/5/2018	7.710	940	121	100	1.30
12	Khanapur(Gulburga)	15.5583	74.6417	Dugwell	29/5/2018	7.973	3800	490	548	0.72
13	Kumbarpet	16.5075	76.7536	Dugwell	23/5/2018	8.005	950	28	9	0.76
14	Kurkunde A	16.5833	77.1000	Dugwell	30/5/2018	7.818	2800	227	252	1.30
15	Madarki	16.7833	76.7667	Dugwell	23/5/2018	8.024	700	36	55	0.55
16	Malla(K)	16.7417	76.5500	Dugwell	23/5/2018	8.371	2900	192	247	4.00
17	Mallabad	17.2333	76.4167	Dugwell	23/5/2018	7.881	6000	667	100	2.00
18	Mallabad(Yadgiri)	17.2333	76.4167	Dugwell	24/5/2018	7.746	3300	533	224	0.90
19	Managanal	16.7169	77.0372	Dugwell	30/5/2018	7.903	800	71	238	1.20
20	Mudbal	16.8000	76.7933	Dugwell	23/5/2018	7.985	970	43	550	1.30
21	Naikal	16.7333	77.0500	Dugwell	30/5/2018	7.659	1030	57	110	1.00
22	Shivpur Tanda	16.8022	76.6303	Dugwell	23/5/2018	7.979	1080	92	318	1
23	Shorapur A	16.5314	76.7833	Dugwell	23/5/2018	7.697	1030	426	197	0.51
24	Ukinal	16.7583	76.6333	Dugwell	23/5/2018	7.906	2300	156	2	1.6
25	Halkal	16.7542	76.7875	Dugwell	23/5/2018	8.335	970	178	236	1.9
26	Vajjal	16.4767	76.5472	Dugwell	23/5/2018	7.724	1800	156	68	1.4
27	Wandgera(Alternative)	16.5875	77.1000	Dugwell	30/5/2018	7.993	7100	1569	826	0.26

6.0 GROUND WATER RELATED ISSUES & PROBLEMS

In the Yadgir district, variable stages ground water development are noticed as per the March 2017 estimations. Shahpur & Shorapur taluks have an existing stage of ground water extraction of 11 & 26 % respectively and there is ample scope of ground water development in these taluks. Whereas, in Yadgir taluk the stage of ground water extraction is 79 %, where in it requires suitable management plan to arrest further deterioration of the ground water.

Quality of ground water in the district in general is good and potable. However, EC and fluoride, nitrate & Arsenic concentration beyond permissible limit has been found to occur in a few samples collected from all the three taluks (Refer Water Quality Map).

6.1 Management Aspects

6.1.1 Aquifer wise space available for recharge and proposed Interventions in Yadgir Taluk of Yadgir District

As the taluk is semi-critical, it is the need of the hour to arrest the declining ground water level and drying up of phreatic aquifer by recharging the dry phreatic aquifer (Aq-I) in the taluk, through construction of artificial recharge structures, viz; check dams, percolation tanks & point recharge structures (**Table-7**). 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. The expected improvement in the overall groundwater condition in the taluk is presented in **Table-8**. The area feasible for the artificial recharge structures in the taluk is presented in **Plate 21**.

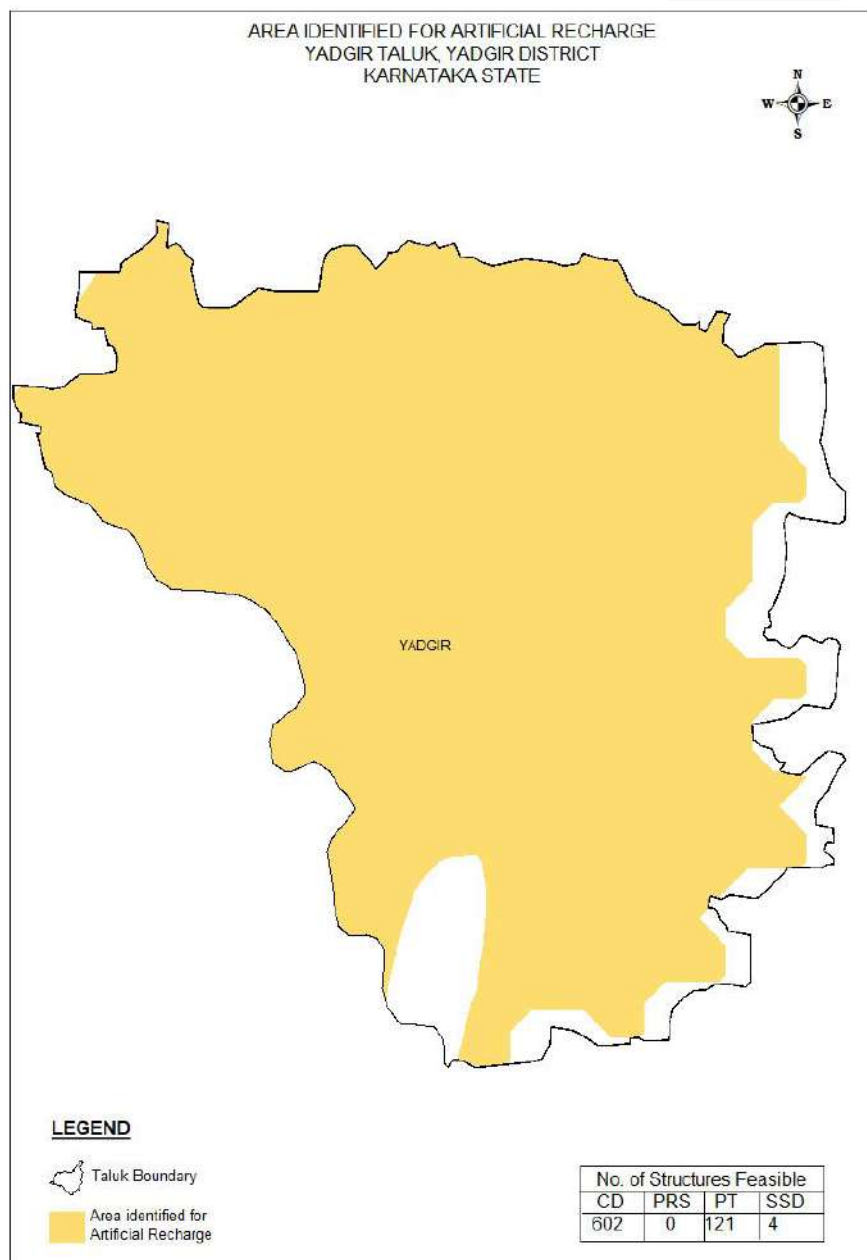
Table.7: Quantity of non-committed surface runoff & expected recharge through AR structures

Artificial Recharge Structures Proposed	Yadgir taluk
Non committed monsoon runoff available (MCM)	133.972
Number of Check Dams (CD)	602
Number of Percolation Tanks (PT)	121
Tentative total cost of the project (Rs. in lakhs)	8440
Excepted recharge (MCM)	100.5
Expected rise in water level (m)	0.6
Cost Benefit Ratio (Rupees/ cu.m. of water harvested) – CD	6.73
Cost Benefit Ratio (Rupees/ cu.m. of water harvested) – PT	2.02

Table.8: Improvement in GW availability due to Recharge, Yadgir taluk

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	Cumulative annual ground water availability	Expected improvement in stage of ground water development after the implementation of the project	Expected improvement in overall stage of ground water development
Yadgir	HAM	HAM	%	HAM	HAM	%	%
	11633	9141	79	10050	21683	42	37

Plate - 21



6.1.2 Ground Water Development in Water Logged areas of Yadgir District

In some parts of Shorapur & Shahpur taluks water logging is predominant. Since these areas are falling in the canal command areas, people have stopped using bore wells and rely heavily on surface water. As a result, water logging has become a common phenomenon in the taluks. Hence, it is recommended to drill additional borewells in these two taluks and the ground water should be pumped out in order to drain the ground water below the 5 meters. Table showing recommended development of ground water through dugwell and borewell is given in **Table-9** & its estimated cost and additional area to be brought under irrigation is given in **Table-10**.

Table.9: showing Development of Ground Water through additional Borewells

S.No	Assessment Unit	Annual Extractable Ground Water Resources (ham)	Existing Ground Water Extraction for all uses (ham)	Stage of Ground Water Extraction (%)	Ground Water resources available for future development (%)	60% of the Annual Extractable Ground water Resource (ham)	Ground Water Resource available for development (ham)	GW Resource to be developed through Dugwell	GW Resource to be developed through Borewell	No. of Dugwells proposed to be constructed	No. of Borewells proposed to be constructed
1	Shahpur	19318	2205	11	49	11591	9386	6570	2816	15643	15643
2	Shorapur	10393	2683	26	34	6236	3553	2487	1066	5921	5921
Total								9057	3882	21564	21564

Table.10: Proposed Ground Water Development in the Water Logging Prone Area						
Details of Structures	Number of Structures Proposed		Estimated Cost (Rs. In Crore)		Area proposed for Irrigation (Ha)	
Taluk	Dug Well	Bore Well	Dug Well	Bore Well	Dug Well	Bore Well
Shahpur	6570	2816	427.05	88.48	9855	2816
Shorapur	2487	1066	161.66	31.98	3730	1066
Total	9057	3882	588.71	120.46	13585	3882

7.0 CONCLUSIONS & RECOMMENDATIONS:

- Yadgir district is one of the aspirational districts identified in Karnataka State which is affected by poor socio-economic indicators. Scientific development in all fronts including water sector in the district can lead to the overall improvement in the socio-economic conditions in the district.
- Yadgir has been blessed by the incessant flowing of two main rivers Krishna and Bhima. In addition to these two rivers, a few tributaries also drain in this region. The district is principally an agricultural district.
- The district comes under north eastern dry agricultural zone and is drought-prone. In general, the area receives consistent rainfall as per historical rainfall data. Bulk of the annual rainfall occurs during south-west monsoon, which constitutes over 77% of the annual rainfall. Significant rainfall occurs during the winter monsoon owing to north eastern monsoon, which constitutes 7% of the annual rainfall. About 75% of the geographical area of the district is under cultivation. Irrigation through dug wells is more prevalent in Yadgir taluk, whereas, irrigation in Shorapur and Shahpur taluks is through canal of Upper Krishna Project. Lift Irrigation Schemes are under implementation along Bhima River.
- The soil types in the district are deep black, medium black soil, shallow soil and lateritic soil. The deep & medium black soil covers practically the entire district area, except a small portion towards the northern part of the district.
- Major ground water bearing formations are granite, gneiss, limestone and vesicular basalt. Ground water occurs in weathered, fractured & jointed zones of these formations. In weathered zones ground water occurs in phreatic condition, whereas in the fractured and jointed formation it occurs in semi- confined to confined

condition. Major part of the district has shallow to moderate depth to water levels up to 5 mbgl. The decadal average water level also depicts that the major part of the district has shallow to moderate depth to water levels up to 5 mbgl and only in the major part of Yadgir taluk, deeper water level of more than 10 mbgl is observed.

- An area of 546 sq.km in Shorapur taluk and 178 sq.km in Shahpur taluk is prone for water logging as the water level is less than 5 m. Special care is needed in this area in managing the ground water resources so that both the taluks can be prevented for becoming water logged. Water logging conditions can be improved by drilling of additional bore wells and farmers in these water logging areas can be encouraged for using ground water. Tentatively, 9000 dug wells and 3800 bore wells may be constructed in the water logged and area prone for water logging.
- Based on the Ground Water Exploration and NAQUIM studies, the districts has been broadly classified as Low, Moderate and high yielding areas where < 1 lps classified as low yielding, between 1 – 3 lps as moderate yielding and > 3 lps as high yielding areas on ground water point of view. On analysing the fracture and its yield aquifer wise, it is observed that Granitic Gneiss formation is more productive followed by Limestone, Granites and Basalts. Further, it is recommended bore wells may be drilled up to a depth of 150 m in the district. The expected yield from the bore wells drilled in Granitic Gneiss is up to 8 lps, Limestone is 5 to 8 lps, Granites up to 4 lps and in Basalts up to 1.5 lps.
- Quality of ground water in the district, in general is good and potable. It is suitable for domestic and irrigation purposes. However, Electrical Conductivity, Nitrate and Fluoride concentration beyond permissible limit are noticed in some parts of Yadgir, Shorapur & Shahpur taluks. Nitrate ranges from 2 to 826 mg/l and Fluoride concentration ranges from 0.26 to 4.0 mg/l.
- Fluoride concentration beyond permissible limit in ground water of some areas of Shorapur taluk may be of geogenic origin. The remedy could be use of surface water resource for drinking purpose. Nitrate content beyond permissible limit in ground water samples of some areas in Shorapur, Shahpur and Yadgir taluks may be attributed to excessive use of fertilizer for agriculture. Thus, leaching of nitrate in the phreatic zone occurs, which the dug wells normally tap. In such areas water from deep bore wells may be used for drinking purpose. Drinking water supply from surface water source needs to be explored.
- The net ground water availability in the district is 41343 ham. Existing ground water draft for all uses is 14030 ham. Availability of ground water resource for future irrigation development is 26579 ham and average stage of ground water development of the district is 34%. Hence there is enough scope for ground water development in the district. However, development is recommended as per the advice of experienced hydro-geologist and it should be restricted to areas falling in safe category/pockets.
- As the Yadgir taluk is semi-critical, recharging the dry phreatic aquifer through artificial recharge structures, like check dams, percolation tanks etc. are recommended. As per the master plan about 600 check dams and about 120 percolation tanks are feasible in the taluk. 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. Rejuvenation of existing tanks by desilting will

help in recharging the phreatic zone. Dug well recharge can also help in rejuvenating dry dug wells.

- Increase in agricultural activity, excessive ground water withdrawal, depletion of ground water levels, reduction in yield etc. in non-command area and ground water quality related issues suggests the need for scientific ground water management, enhancement of storage capacity of the aquifers and protection of ground water quality. Water Use Efficiency (WUE) practices like drip and sprinkler irrigation are comparatively less practiced in comparison with other mode of irrigation which needs to be expanded to save irrigation water by way of precision farming mechanism. This ultimately enhances the area under irrigation potential.
- Encourage community irrigation through registered user groups. Yadgir district comes under “Aspirational district” status as mentioned earlier. Awareness programmes and practice of participatory approach needs to be strengthened with the involvement of all the stake holders for sustainable management.
- The mandatory guidelines like rainwater harvesting and artificial recharge issued by Karnataka Ground Water Authority needs to be strictly implemented in the district as an effort to aim for sustainable ground water development.

8.0 ACKNOWLEDGMENTS

The author is thankful to the guidance and support rendered by Sh. V. Kunhambu, Regional Director, CGWB, SWR, Bangalore and thanks are also due for Technical Section & RODC Section for providing the required data for compilation of the report.

9.0 REFERENCES

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