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

KADUR TALUK, CHIKMAGALUR DISTRICT, KARNATAKA

दक्षिण पश्चिमी क्षेत्र, बैंगलोर

South Western Region, Bengaluru

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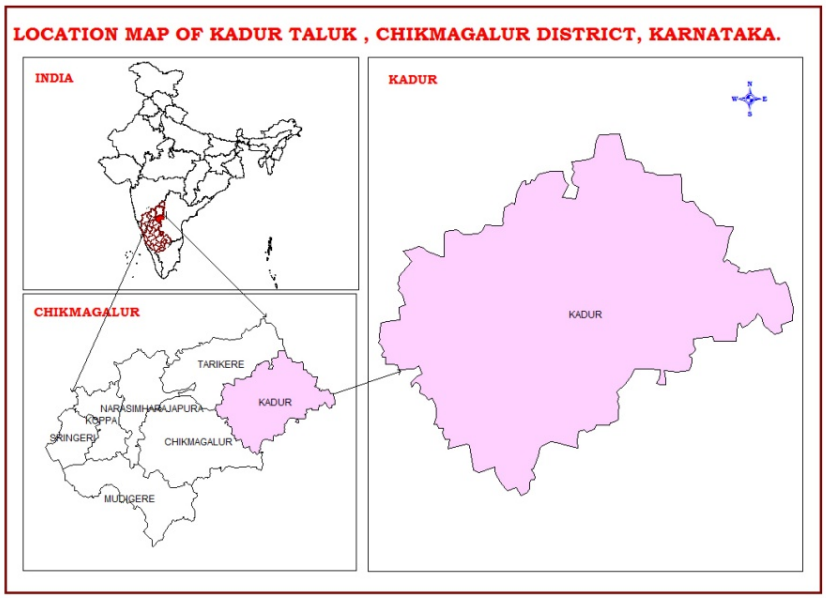
GOVERNMENT OF INDIA
MINISTRY OF JAL SHAKTI
DEPARTMENT OF WATER RESOURCES, RD & GR
CENTRAL GROUND WATER BOARD

AQUIFER MAPS AND MANAGEMENT PLAN OF KADUR TALUK, CHIKMAGALUR DISTRICT, KARNATAKA STATE



By

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AUGUST, 2020

AQUIFER MAPS AND MANAGEMENT PLAN OF KADUR TALUK, CHIKMAGALUR DISTRICT, KARNATAKA STATE

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AQUIFER MAPS AND MANAGEMENT PLAN OF KADUR TALUK, CHIKMAGALUR DISTRICT, KARNATAKA STATE

1.0 Salient information

Taluk name: **KADUR**

District: Chikmagalur

State: Karnataka

Area: 1435 sq.km.

Population: 291668

Normal Annual Rainfall: 648 mm

1.1 Aquifer Management study area

Aquifer mapping studies was carried out in Kadur Taluk, Chikmagalur district of Karnataka, covering an area of 1435 sq.kms under National Aquifer Mapping. Kadur Taluk of Chikmagalur district is located between north latitude 13°18'46.7" and 13°45'39" & east longitude 75°50'6" and 76°21'50.8" and is covered in parts of Survey of India Toposheet Nos. 48O/14 and 15. It is bounded by Tarikere in north, Arsikere and Belur Taluks of Hassan district in south, Hosadurga Taluk of Chitradurga district in east and Chikmagalur Taluk on the western side. Location map of Kadur Taluk of Chikmagalur district is presented in **Fig. 1.**

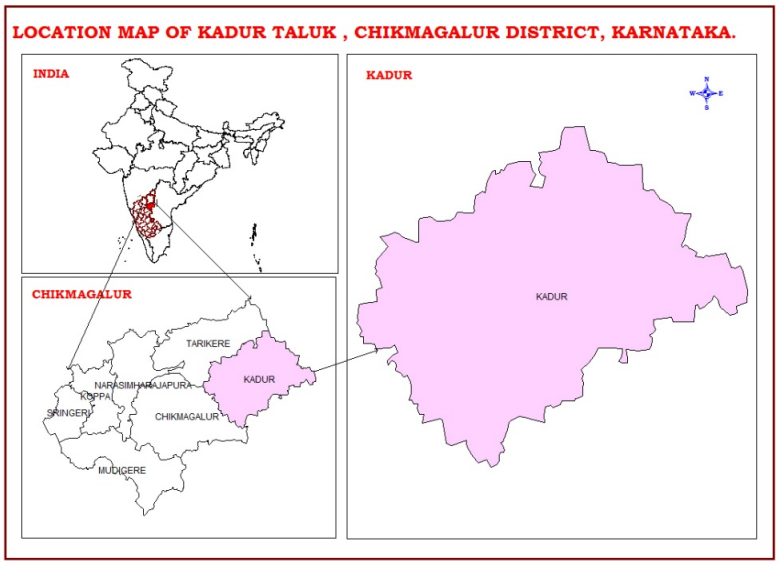


Fig. 1: Location Map of Kadur Taluk, Chikmagalur district

Kadur town is the Taluk headquarter of Kadur Taluk. There are 8 Hoblis and312 villages in Kadur Taluk. It is situated 233 km north- south of Bangalore. It is connected by State Highway Bangalore-Honnavar which passes through it. The Railway broad gauge connecting Bangalore-Pune passes through it. The nearest airport to Kadur is Bajpe airport of Mangalore and the Mysore airport.

1.2 Population

According to 2011 census, the population ofKadurTaluk is 2,91,668. Out of the total population 1,46,483 constitute the male population and 1,45,185is the female population. The urban population is 56,874 and rural one is 2, 34,794. Decadal change in population from 2001-2011 is 0.8% in Kadur Taluk. Decadal change in rural and urban population is 0.5 % and 6.27 % respectively. The total numbers of families in the Taluk are 13,450. The density of population is 205 persons per square km.

1.3 Rainfall

Kadur Taluk has semi-arid climate. Dry and hot weather prevails in major part of the year. All throughout the year, moderate weather prevails. The area falls under Central Dry Agro-climatic Zone of Karnataka state and is categorized as drought prone. The climate of the study area is quite agreeable and free from extremes. The year is usually divided into four seasons namely summer from March to May; rainy season or south-west monsoon season from June to September; post-monsoon season covering the months of October and November and dry or winter Season from December to February. Rainfall generally decreases from west to east. April and May are regarded as the summer monthswith maximum temperature around 30 degree Celsius and minimum temperature is around 19 degree Celsius.

There is one rain gauge station in Kadur Taluk, the rainfall data in respect of this station from the year 1981 to 2010 is analyzed and presented in **Table 1**. The data pertaining to these gauges is of long-term nature and are well maintained. It is presumed that they are representative of the Taluks and the same is used for analysis. Normal annual rainfall in the Taluk for the period 1981 to 2010 is 648 mm.

Table 1: Raingauge and its location in Kadur Taluk

Sl. No	Station	Latitude	Longitude	Altitude
1	Kadur	13.57	76.83	645.7

1.3.1 Statistical analysis

Computations were carried out for the 30 years blocks of 1981- 2010 on Mean, Standard deviation and coefficient of variation (CV) of each month pre -monsoon, monsoon, post monsoon and annual and are shown in **Table 2**.

The mean monthly rainfall at Kadur Taluk is ranging between 1 mm during February to 157 mm during October. The CV percent for pre-monsoon, monsoon and post monsoon season is 55, 29 & 56 percent respectively. Annual CV at this station works out to be 27 percent.

Table 2: Statistical Analysis of Rainfall Data of Kadur Taluk, Chikamagalur District, Karnataka for the Period 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
Kadur	Normal Rainfall (mm)	2	1	14	36	74	127	74	62	55	110	300	157	53	11	221	648
	STDEV	6	5	29	36	45	70	51	38	31	62	88	110	63	18	124	175
	CV%	292	496	208	100	61	55	70	60	57	57	29	70	119	159	56	27

1.3.2 Assessment of Drought

Rainfall data of Kadur Taluk has been analyzed for 46 years using IMD method to assess the drought condition. The results of the classification are listed in the **Table 3**. It is observed that the Kadur Taluk has experienced alternating no drought to acute drought conditions over the years.

Table 3: Classification of drought and its periodicity (IMD, 1971)							
% Deviation (Di)		**>0**	**0 to -25**	**-25 to -50**	**50 to -75**	**<-75**	**Probability of drought occurrences**
Category		No drought	Mild (Normal)	Moderate	Severe	Acute	
		Years					
Taluk	Kadur	8	30	7	1	0	Once in 6 years

The details of the drought assessment are discussed as herein under. Out of 46 years of analysis in Kadur Taluk, "No Drought" condition is experienced in 8 years, "Mild Drought" condition is experienced in 30 years and "Moderate Drought" condition experienced in 7 years. Further it is observed that "Severe Drought" condition is experienced in 1 year i.e., during 1985. Based on occurrence and frequency of past drought events, the probability of occurrence of various intensities of drought at the station has been studied. It has been observed that the frequency of occurrence of drought is **once in 6 years** at Kadur Taluk which may be attributed to scanty rainfall and its erratic distribution in space and time.

1.4 Agriculture & Irrigation

Agriculture is the main occupation in Kadur Taluk, since 80.5% of the total population constitutes the rural population. The amount of rainfall and its distribution throughout the season contributes to the cropping pattern in the area. There are two agricultural seasons namely Kharif (June – October) and Rabi season (Mid October – Mid February). Most of the agriculture is through rain fed and ground water is a major source of irrigation. Major Kharif crops are paddy, maize, ragi, jowar, and vegetables. Main crops of Rabi season are pulses, and oilseeds. Among the commercial crops, sugarcane and cotton are grown. Fruits and vegetables are also grown in the area (**Table 4**).

Table 4: Area wise crops grown in Kadur Taluk

Year	Paddy	Jowar	Maize	Ragi	Pulses	Sugarcane	Oil seeds	Total fruits	Total vegetables	Cotton
	Area under cultivation (in ha)									
2013 - 14	263	3183	10460	27248	14262	321	8810	1236	3949	437

During the year 2014 – 15, percentage of gross sown area of total geographical area is 67 % and net sown area was 77 % in Kadur Taluk (**Table 5 and Fig 2**). Irrigation practices by different sources in the Taluk are presented in **Table 6**.

Table 5: Land use pattern of Kadur Taluk

Year	Total Geographical Area (ha)	Area under Forest (ha)	Area not available for cultivation (ha)	Other uncultivated land (ha)	Total fallow land (ha)	Net sown area (ha)	Area sown more than once (ha)
2014-15	141101	8984	16806	16487	3970	94854	13432

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

Table 6: Irrigation practice in Kadur Taluk

Source of irrigation	No. of irrigation source	Net area irrigated (ha)	Gross area irrigated (ha)
Tanks	136	2390	2390
Wells	3	30	30
Tube/ Bore wells	12807	8515	8982
Lift Irrigation	15	0	0
Other Sources	Nil	0	0
Total	**12961**	**10935**	**11402**

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

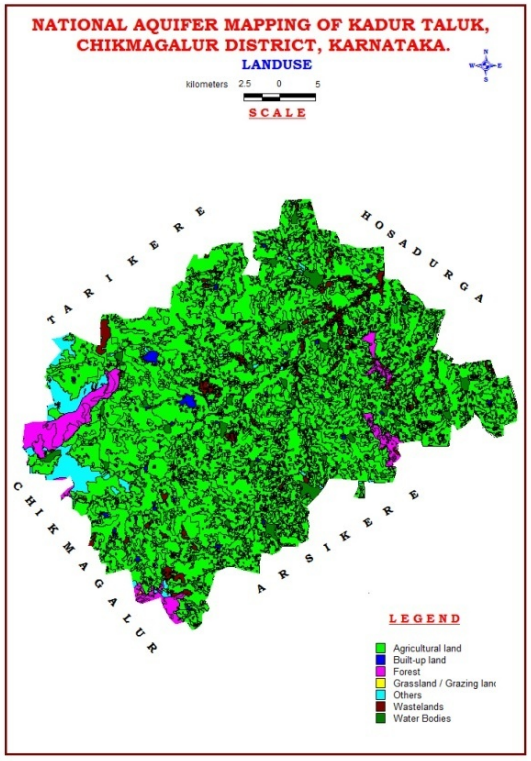
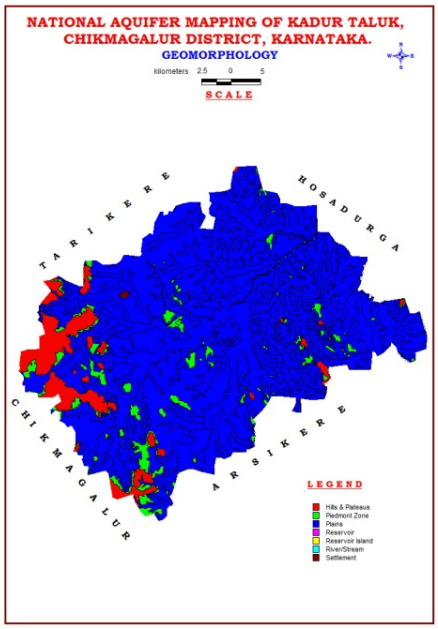


Fig. 2: Land use map

1.5 Geomorphology, Physiography & Drainage

Geomorphologically, Kadur Taluk belongs to Southern Maidan regionwhich is characterized by plain area with gentle rolling topography. The hills are mostly in the western and southern part of the Taluk with a general slope in the easterly direction. There are piedmont zones in between which are scattered unevenly. (**Fig. 3**.)

The Taluk lies in Vedavati river sub basin, which is a tributary to the Tungabhadra river. River Tunga and River Bhadra together form River Tungabhadra which is a tributary of Krishna river. They exhibit dendritic to sub-dendritic drainage pattern.(**Fig. 4**.) Both river Veda and Avathi rises in the eastern part of the Sahyadri hill range in Bababudan mountain ranges. The Veda which flows for about 64 km in the Taluk unites with Avati near Pura and forms the joint stream referred as Vedavati. It is generally perennial in nature but goes dry downstream from anicuts and become effluent again further downstream. A tank is constructed across Tayihalla stream, a tributary of Vedavadi river and in Ayyanakere, a tank is formed by embanking Gourihalla stream. The surface water availability is calculated out to be 4.421 MCM



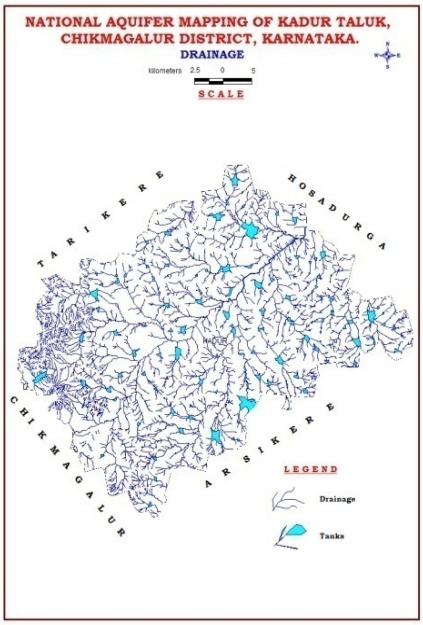


Fig. 3: Geomorphology mapFig. 4: Drainage map

1.6 Soil

The Taluk is mainly covered by clayey soil and varieties of clayey soil like mixed and skeletal variety **(Fig. 5).** In few areas, red soil occurs. The infiltration rate is moderately good. In Dogehalli village, red loamy soil type is found to be present. The initial infiltration capacity of the soil varies from 8.85 cm/hr to a final infiltration of 5 cm/hr with constant k value of 0.04. Similarily in Bukkasagara village grey clayey variety of soil is found with initial infiltration of 5.05 cm/hr to a final infiltration of 1.4 cm/hr. The value of constant k is 0.04.

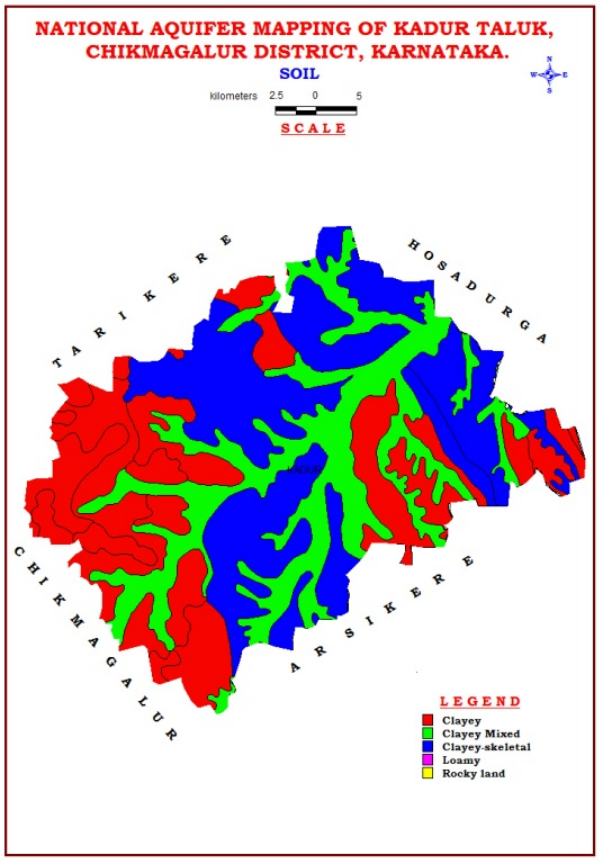


Fig. 5: Soil map

1.7 Ground water resource availability and extraction

(Aquifer wise up to 200 m depth)

Table 7: Total Ground water Resource available in Aquifer -I & Aquifer-II (March 2017)

Taluk	Annual replenishable GE resources (in ham)	Fresh In-storage GW resources		Total availability of fresh GW resources
		Phreatic (in ham)	Fractured (Down to 260m) (in ham)	Dynamic + phreatic in-storage + fractured (in ham)
Kadur	9933	30146	4824	44903

1.8 Existing and future water demands based on ground water resource estimation of March 2013 and 2017

Year	Existing Gross GW extraction for Irrigation (ham)	Existing Gross GW extraction for domestic and industrial water supply (ham)	Allocation for domestic and industrial use for the next 25 years (ham)	Net GW availability for future Irrigation development (ham)
2013	9858	406	425	729
2017	10867	519	541	89

1.9 Water level behavior

(a) Depth to water level

Aquifer – I

- Pre-monsoon: 1.19 – 3.77mbgl (**Fig 6**)
- Post-monsoon: 1.71 – 4.62 mbgl (**Fig 7**)

Aquifer – II

There is paucity of data is the taluk.

(b) Seasonal water level fluctuation

Aquifer – I

Fall range from 0.52 m bgl to 0.85 mbgl

Aquifer – II

There is paucity of data is the taluk.

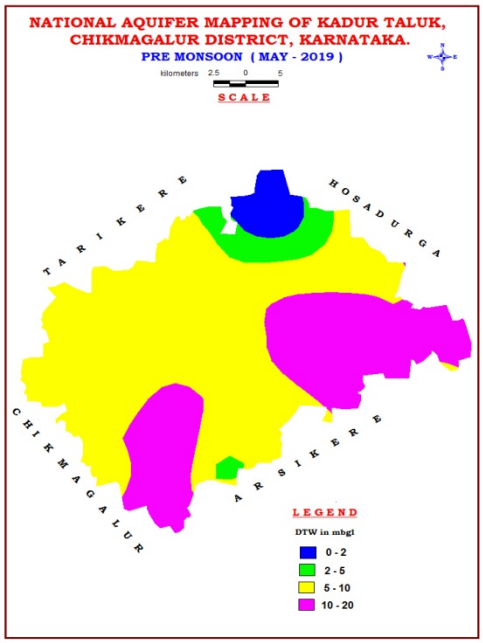


Fig 6: Pre monsoon water level map

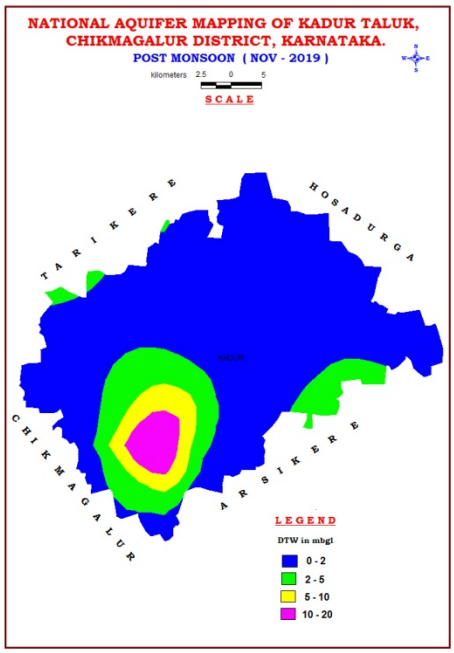


Figure 7: Post monsoon water level map

2.0 Aquifer disposition

Granite occupy nearly 80%of the eastern part whereas Dharwarian schist occurs in the rest 20% in the western part of the Taluk (**Fig 8**). The gneisses comprise of migmatites associated with biotites and hornblendes. The granites are grey in colour and are fine to coarse grain in nature. Alluvium occurs in localized areas as very thin veneer adjacent to the river and along stream course in Vishnusamudra tank downstream upto Sananahalli village limit. It is having a width of 300 m with reported thickness from 6 to 12 m bgl. Ground water occurs under water table to semi confined condition depending upon disposition of aquifer which is mainly granite and schist. Ground water occur under water table to semi confined condition in granite whereas in schist groundwater occur in weathered, jointed and fractured zone under water table condition.

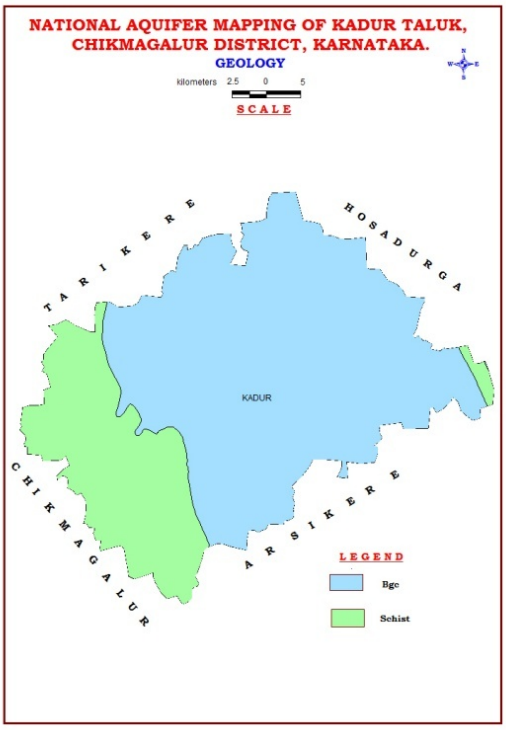


Fig 8: Geology Map

Ground water exploration programme of CGWB was carried out in two phases in the district. Only two wells have been drilled in Kadur Taluk (**Table 8**) which reveals that the weathered, jointed and fractured granite is the potential aquifer system. (**Fig 9)**

Table 8: Drilling details ofGround Water Exploration Programme in Kadur Taluk

Location	Depth drilled (mbgl)	Casing (m)	Lithology	Static water level (mbgl)	Discharge (lps)	Drawdown (m)	Specific Capacity (lpm/m)	Transmissivity (m2/day)
Vakkalageri 13°39'29" 76°13'26"	257.57	6.10	Granitic Gneiss with amphibolite	4.13	0.75	---	---	15
Devanur 13°25'40" 76°04'56"	171.99	11.80	Granitic Gneiss	9.85	4.25	3.09	119	58

Majority of the dug well in granitic gneiss ranges in depth from 10.3m to 21.2m having a weathered zone from 3m to 18m. Water level lies in the range of 2.67m to 18.44m. Whereas in the schist formation, the open dug well is in the depth range of 5.1m to 15.7m, with weathered zone in the range of 3m to11m. The static water level ranges between 2.1m to 12.9m.

Pumping test of 500 minutes conducted on open well in Kadur have revealed that the discharge ranges between 5 to 6 lps with a drawdown of 2.7m and unit area specific capacity of 2.1 lpm/m/m^2

2.1 Number of aquifers: In Kadur Taluk, there are mainly two types of aquifer systems; (**Fig 7**)

i. Aquifer-I (Phreatic aquifer, weathered zone) comprising of Granitic Gneiss

ii. Aquifer-II, (Fractured zone) comprising of FracturedGraniticgneiss

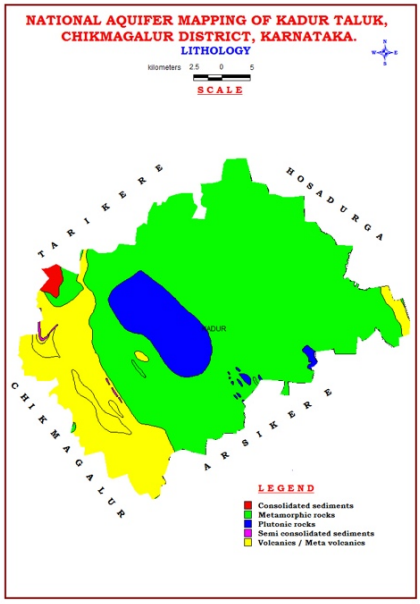


Fig 9: Lithology Map

2.2 3 D aquifer disposition and basic characteristics of each aquifer

Aquifer disposition – The drilling data obtained from other departments is utilised for generating aquifer disposition maps through Rock works software. The 2D and 3D outputs thus obtained is presented in Fig-10A to 10 D.

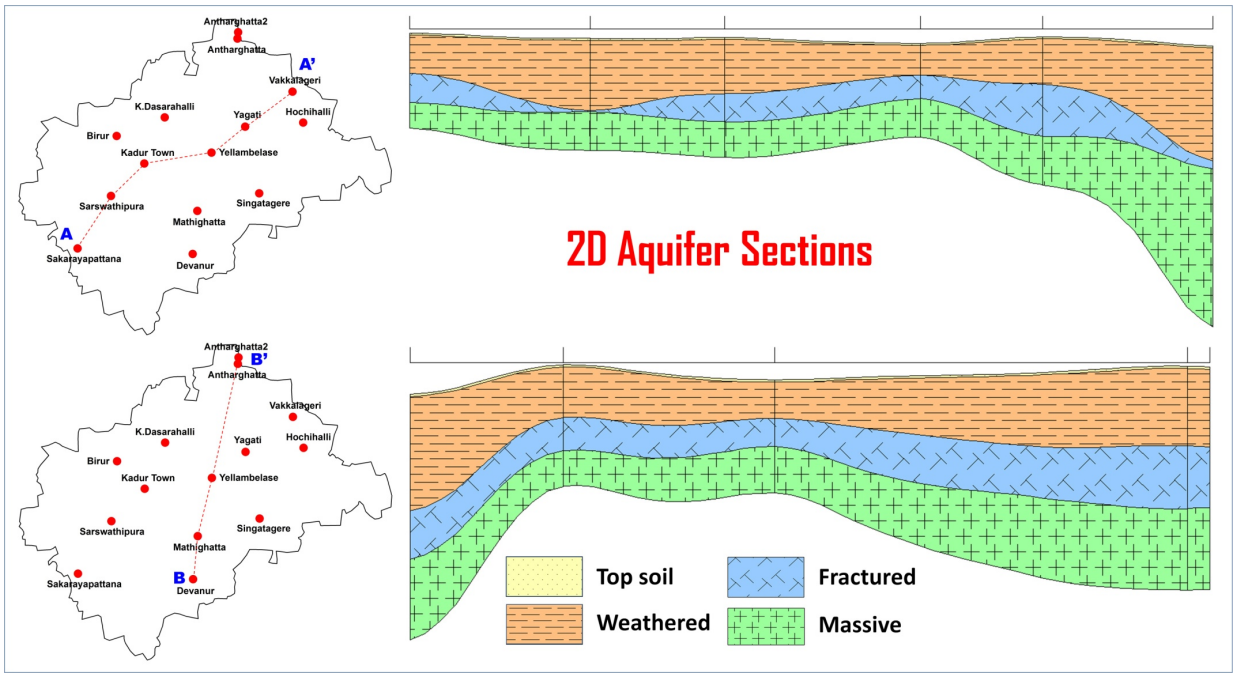
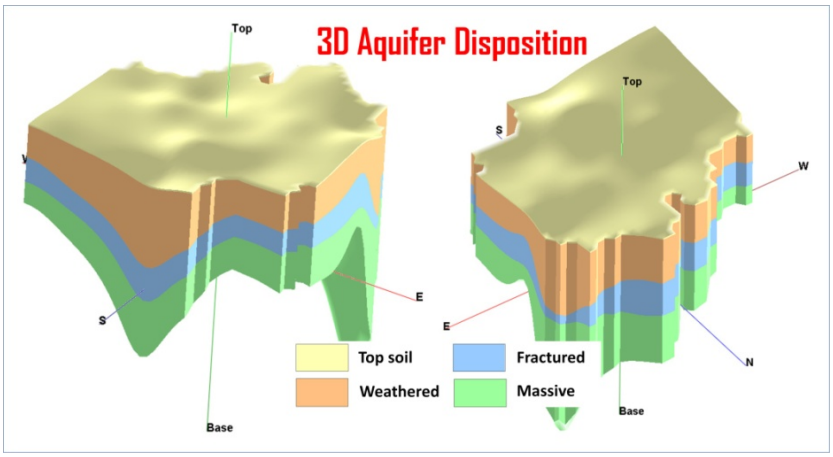
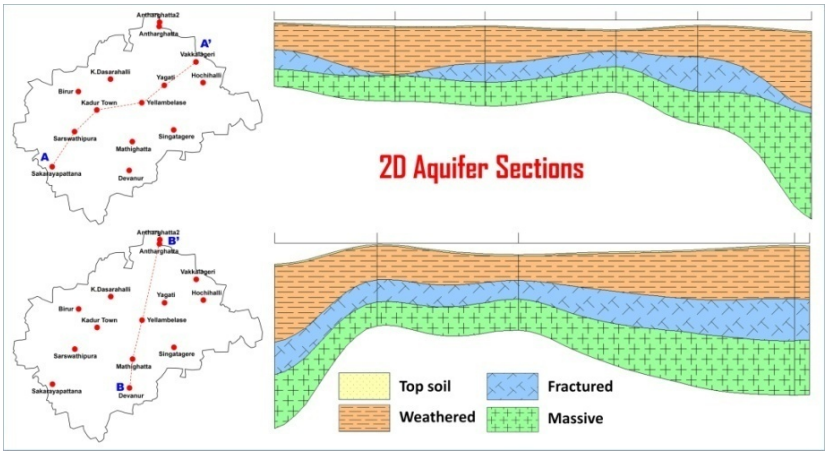


Fig 10 A: 2D output aquifer model





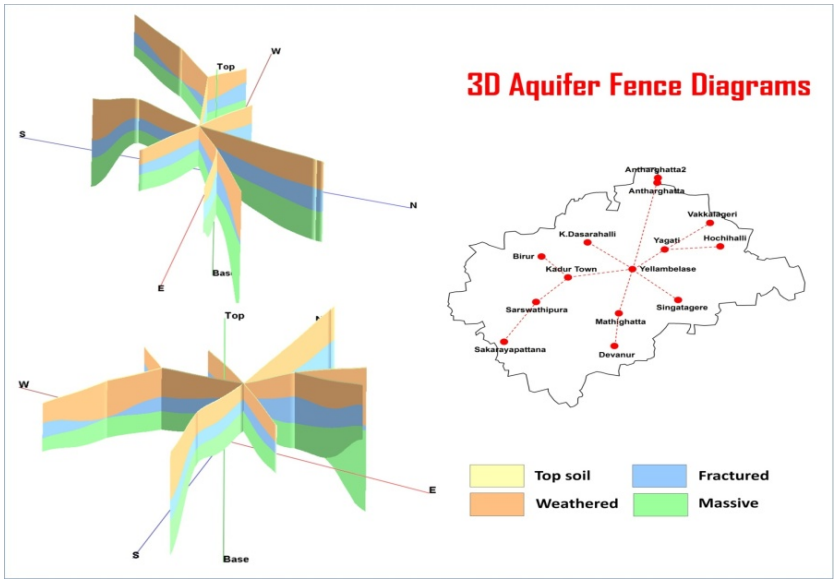


Fig-10B to 10D: 3D aquifer model

3.0 Ground water resource, extraction, contamination and other issues

3.1 Aquifer wise resource availability and extraction (GEC, 2017)

Taluk	Annual Extract GW resource (ham)	Existing Gross GW extraction for Irrigation (ham)	Existing Gross GW extraction for domestic and industrial water supply (ham)	Existing Gross GW extraction for all uses (ham)	Allocation for domestic and industrial use for the next 25 years (ham)	Net GW availability for future Irrigation development (ham)	Stage of GW development (%)	Category
Kadur	9933	10867	519	11386	541	89	115	OE

Table 9: Present total Ground Water Resource (Dynamic+phreatic-in-storage fractured-in-storage)

Taluk	Annual Replenishable GW resources (in ham)	Fresh In-storage GW resources (in ham)		Total availability of GW resource (in ham)
		Phreatic Aquifer-I	Fractured Aquifer-II	Dynamic +phreatic in-storage + fractured in-storage
Kadur	9933	30146	4824	44903

Table 10: Present ground water availability and draft scenario (2017) in Kadur Taluk and expected improvement in Stage of Ground Water Development in future, on implementation of artificial recharge & irrigation development schemes.

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 Project	Expected Improvement in Overall Stage of Ground Water Development
	HAM	HAM	%	HAM	HAM	HAM	%	%
Kadur	9933	11386	115	483	Nil	10416	109	6

Table 11: Comparison of ground water availability and draft scenario in Kadur Taluk (2011 to 2017)

Taluk	2011			2013			2017		
	GW Availability for Non command area	GW Draft for Non command area	Stage of GW withdrawal	GW Availability	GW Draft	Stage of GW withdrawal	GW Availability	GW Draft	Stage of GW withdrawal
Kadur	10096.67	10203.80	101	10138	10263	101	9933	11386	115

3.2 Chemical quality of ground water and contamination

Representative water samples have been collected from National Hydrograph Stations (NHS) during pre-monsoon and analyzed at Chemical Laboratory, C.G.W.B, S.W.R, Bangalore is presented in **Table 12**.

Table 12: Chemical analysis results of Ground water in Kadur Taluk

Sample No.	LOCATION	Type of Well	Date of Collection	pH	Specific Conduct. in µS/cm at 25°C	Cl^-	$N0_3$	F^-
1	Anthragatta	BW	11.06.2018	8.60	1830	256	76.1	0.98
2	Hirenallur	DW	11.06.2018	8.93	300	241	18.3	0.19
3	Kadur	BW	11.06.2018	8.36	2900	568	17.7	0.70
4	Macheri	DW	11.06.2018	8.96	4600	809	122	0.65
5	Mallidevihalli	DW	11.06.2018	8.27	2100	288	28.8	1.17
6	Gujjenahalli	BW	11.06.2018	8.15	590	32	ND	ND
7	Sakkerapatna	HP	11.06.2018	8.66	1160	110	7.5	0.89
8	Agrahara	BW	11.06.2018	8.26	2400	348	40.1	0.36
9	Vakkalegeri	EW	1999	8.50	1050	39	29	1.29

(a) Aquifer – I: 3 samples were collected from NHS dug wells representing Aquifer – I in Kadur Taluk and chemical analysis result indicate that the

- **E.C**: EC value is in the ranges of 300 to 4600 m/mhos/cm at 25ºC. Highest value is observed in Macheri village.
- **pH**: The value of pH ranges from 8.27 to 8.96.
- **Cl**: Cl ranges from 241 mg/l to 809 mg/l.

- **NO_3:** The value of NO_3 ranges from 18.3 to 122 mg/l. Highest value of 122 mg/l is found in Macheri which is above the permissible limit as per BIS, 2012 drinking water standards.
- **F:** All the samples show fluoride within desirable limit as per BIS, 2012.

(b) Aquifer -II: 5 samples were collected from borewells and Hand pump which represented the aquifer II in Kadur Taluk.

- **E.C**: EC value in groundwater is in the ranges of 590 to 2900 m/mhos/cm at 25^{o}C. Highest value is observed in Kadur.
- **pH**: The value of pH ranges from 8.15 to 8.66.
- **Cl**: Cl ranges from 32mg/l to 568 mg/l.
- **NO_3:** The value of NO_3 ranges from 0 to 76.1 mg/l. Highest value is observed in Anthraghatta which is above the permissible limit as per BIS, 2012 drinking water standards.
- **F:** All the samples show fluoride value within desirable limit as per BIS, 2012 standards

In general, ground water quality in Kadur Taluk is good and potable except in some localized areas where nitrate and salinity content are found to be greater than permissible limit. Ground water samples have been found suitable for agriculture & irrigation purposes.

4.0 Other issues

4.1 Ground water resource enhancement

Increase in agricultural activity and excessive ground water withdrawal has resulted in depletion of ground water table, reduction in yield of bore wells and deterioration of ground water quality. Kadur Taluk is drought prone, since rainfall analysis result indicate drought like situation every 6 years. Thus, there is need for ground water management, enhancement of storage capacity of aquifers, protection of ground water quality and proper utilization of ground water.

4.2 Aquifer wise space available for recharge and proposed interventions

Table 13: Quantity of water proposed to be made available through non-committed surface runoff

Non committed monsoon runoff available (MCM)	4.831
Artificial Recharge Structures Proposed	
Area feasible for artificial recharge structures (sq. km)	1009
Number of Check Dams feasible	0
Number of Percolation Tanks feasible	0
Number of Point Recharge structures feasible	0
Tentative total cost of the project (Rs. in lakhs)	2.576
Recharge capacity of sub surface dyke (MCM)	0.725
Recharge capacity of percolation tank (MCM)	2.415
Recharge capacity of Check dam (MCM)	1.208
Recharge capacity of filter bed (MCM)	0.483
Excepted recharge (MCM)	4.831

4.3 Table 14: Improvement in GW availability due to Recharge and water use (WUE) efficiency Demand side interventions method in Kadur Taluk.

Taluk	GW availability (ham)	Stage of GW development %	Expected Additional Recharge from non- committed monsoon runoff (Ham)	Expected Increase in GW Availability (Ham)	Expected Stage of GW Development after recharge (%)	Expected GW availability due to recharge and WUE	Expected Stage of GW Development after WUE
Kadur	9933	115	483	10416	109	26.7	105

5.0 Demand side Interventions

5.1Advanced irrigation practices

- Tube / Bore well is the prevalent source for irrigation in Taluk. Thus, by adopting below mentioned techniques will contribute in ground water resource enhancement in the long run.
- Efficient irrigation techniques will contribute in saving ground water and thus will reduce the irrigation draft. Drip and sprinkler irrigation practices may be popularized.
- Existing stage of ground water development in the Taluk is 115 % and categorized as **over exploited**. Hence, there may be strict regulation for development of ground water. By adopting water use efficiency methods and artificial recharge, the stage of development may be improved by 10%.

5.2 Change in cropping pattern

Change in cropping pattern is necessary since cultivation of water intensive crops like sugarcane is prevalent in the Taluk. Though only 321 hectares is covered under sugarcane, however it should be discouraged owing to consistent increase in stage of ground water development in the Taluk from 101% in 2013 to 115% in 2017.

As the Taluk belongs to central dry zone and is drought prone, farmers may be encouraged to grow drought resistant crops like pearl millet, cowpea, groundnut etc. The concept of inter-cropping, multi-cropping may be popularized among the farming community, so that the farmers have another crop to fall back on when one fails because of deficient rainfall.

5.3 Alternate water sources

As the Taluk is over dependent on ground water for meeting the need of irrigation, hence there should be restriction on indiscriminate digging of borewell. As a total of 4.421 MCM is the surface water component available. An average inflow of 2.43 MCM and average outflow of 2.35 has been calculated from surface water monitoring. The Kere or lakes of Kadur taluk like Madagada, Ayyanakere, Andenahalli, Chikkanagala, Bukkasagara, Tangali, Kukkasamudra, M.Kodihallikere which are considered as the lifeline should be regularly monitored by the concerned state government departments. These lakes may be de-silted and cleaned on periodic interval and people should avoid polluting the sources of water.

Conjunctive use of ground water and surface water is also recommended. Drying of Vedavati river may be avoided by implementing large scale afforestation along the banks of river thus preventing soil erosion.

5.4 Regulation and Control

- Kadur Taluk is categorized as **over exploited**, since the stage of ground water development has reached **115%** (GEC March 2017). The stage of development was 101% as per GEC 2013. Hence strict regulations need to be enforced for development of ground water in the Taluk.
- Ground water recharge component needs to be made mandatory in State Govt. Project, concerned with further development of ground water, viz; Irrigation Projects or Public Water Supply Projects.

- Optimal dependence on ground water for irrigation is recommended. Efficient irrigation techniques need to be implemented which will contribute in saving ground water and thus will reduce the irrigation draft.

5.5 Other interventions proposed:

- Phreatic aquifer (Aquifer-I): Pre -monsoon depth to water level in Kadur taluk ranges between 1.05 to 6.15mbgl; and in post monsoon from 0.48 to 5.97mbgl. This indicates that water levels are considerably shallow and can be replenished through construction of artificial recharge structures.
- Groundwater resource enhancement is proposed through construction of artificial recharge structures and an area of 1009 square km has been considered feasible for such construction. The choice of recharge structure should be site specific and such structures needs to be constructed at feasible sites.
- A total number of 237 percolation tank, 252 point recharge structure and 90 check or multi-arch check dam have been constructed so far by various agencies in the Taluk. Periodical maintenance of these artificial recharge structures should be incorporated inthe Recharge Plan.
- Wherever sufficient roof top area is available in government building, educational institution, or private houses, roof top rainwater harvesting may be implemented. As per CGWB master plan, 3.623 MCM volume of water is likely to be harvested which will create an additional irrigation potential of 0.004 MCM.
- Use of Grey water can improve the groundwater scenario, where a quantum of 3.43 MCM of water is available after incorporating the reuse of domestic waste water in the taluk.
- Community participation and People's participatory approach towards sustainable development and management of Groundwater may be encouraged.

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