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जल संसाधन, नदी विकास और गंगा संरक्षण मंत्रालय

भारत सरकार

Central Ground Water Board

Ministry of Water Resources, River Development and Ganga

Rejuvenation

Government of India

Report on

AQUIFER MAPPING AND MANAGEMENT PLAN

Challakaere Taluk, Chitradurga District, Karnataka

दक्षिण पश्चिमी क्षेत्र, बेंगलोर

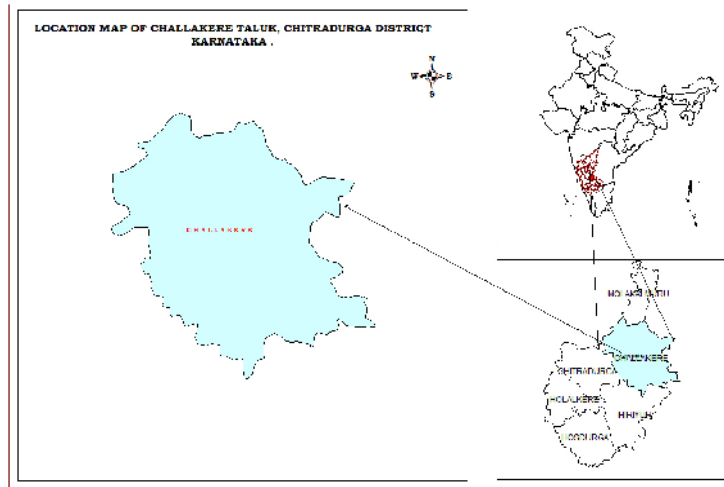
South Western Region, Bengaluru

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Government of India
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& Ganga Rejuvenation
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**CHALLAKAERE TALUK AQUIFER MAPS AND MANAGEMENT
PLANS, CHITRADURGA DISTRICT,
KARNATAKA STATE**



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**CHALLAKERE TALUK AQUIFER MAPS AND MANAGEMENT PLANS,
CHITRADURGA DISTRICT, KARNATAKA STATE**

1. SALIENT INFORMATION

Name of the taluk	: CHALLAKERE
District	: Chitradurga
State	: Karnataka
Area	: 2,086 sq.km.
Population	: 3,65,784
Annual Normal Rainfall	: 516 mm

1.1 Aquifer management study area

Aquifer mapping studies were carried out in **Challakere taluk**, Chitradurga district of Karnataka, covering an area of **2,086 sq.kms** under **National Aquifer Mapping Project**. Challakere taluk of Chitradurga district is located between north latitude $14^{\circ}04'17.8''$ and $14^{\circ}37'26.8''$ & east longitude $76^{\circ}27'15.1''$ and $77^{\circ}01'31.8''$, and is covered in parts of Survey of India Toposheet Nos. 57B/7, 57B/10, 57B/11, 57B/14, 57B/15 and 57B/16. Challakere taluk is bounded by Kudligi and MolkaImuru taluk on north, Hiriyur taluk on south, Chitradurga and Jagalur taluks on west and Andhra Pradesh on eastern side. Location map of Challakere taluk of Chitradurga district is presented in Figure-1.

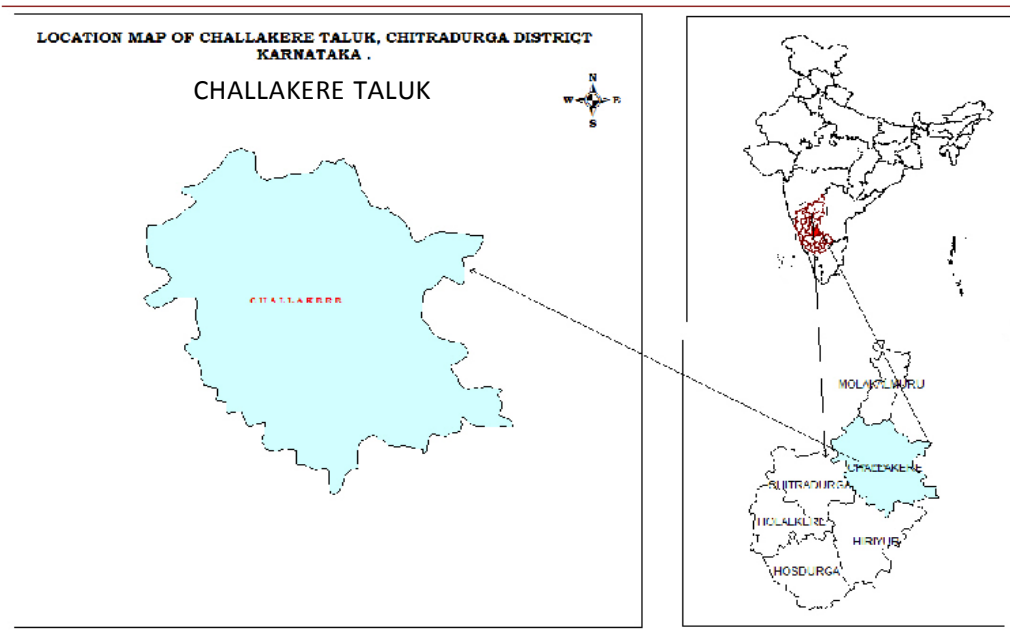


Fig 1: Location Map of Challakere taluk, Chitradurga district, Karnataka

Challakere is the largest taluk of Chitradurga District. Taluk administration of Challakere taluk is divided into 4 Hoblies and 39 Gram Panchayaths. Challakere is the lone town in taluk, which is the taluk headquarter also. There are 185 inhabited and 10 uninhabited villages in the taluk. Challakere town is famously called Oil City with numerous edible oil mills around the city, Challakere is famous for kambali (woven blankets) made by the local Kuruba people. Challakere kambali are sent to various markets across India. Challakere weekly Sunday market has the highest turnover in the state. Of late it is developing as the Science City as several science and research organizations such as IISc, DRDO, BARC and ISRO have set up their establishments here.

1.2 Population

According to 2011 census, the population in Challakere taluk is 3,65,784, of which rural population is 3,10,590 constituting about 85%, and the urban population is 55,194, constituting only about 15% of the total population. The taluk has an overall population density of 175 persons per sq.km and showed a decadal increase of about 10% during 2001-2011.

1.3 Rainfall

Challakere taluk enjoys semi-arid climate. Dryness and hot weather prevails in major part of the year. The area falls under Central Dry agro-climatic zone of Karnataka state and is categorized as drought prone. The normal annual rainfall in Challakere taluk for the period 1981 to 2010 is 516 mm. Seasonal rainfall pattern indicates that, major amount of (272 mm) rainfall is received during South-West Monsoon seasons, which contributes to about 53% of the annual normal rainfall, followed by North-East Monsoon season (140 mm) constituting about 27% and remaining (104 mm) 20% during pre-monsoon season (Table-1).

Computations were carried out for the 30 year blocks of 1981- 2010, the mean monthly rainfall in Challakere taluk is ranging between 3 mm during February to 116 mm during September. The coefficient of variation percent for pre-monsoon, monsoon and post- monsoon season is 63, 50 and 65 percent respectively. Annual CV at this station works out to be 32 percent (Table-1).

Table-1: Statistical Analysis of Rainfall Data of Challakere Taluk, Chitradurga District, Karnataka (1981 to 2010)

Station		JAN	FEB	MAR	APR	MAY	PRE	JUN	JUL	AUG	SEP	SW	OCT	NOV	DEC	NE	Annual
Challakere	NORM	4	3	6	32	59	105	53	33	70	116	272	90	43	6	140	516
	STDEV	10	12	15	31	51	65	43	30	64	77	135	69	66	14	91	164
	CV%	253	351	235	97	87	63	80	90	92	67	50	77	153	219	65	32

1.4 Agriculture and Irrigation

Agriculture is the main occupation in Challakere taluk. Oilseeds are the major crop grown in the taluk accounting for almost 70 percent of the total crop area, followed by vegetables (8%) and pulses covering about 8% and 7% of the total crop area respectively. Maize, Ragi, Jowar and Paddy are some other crops grown in the taluk, basically for self-consumption.

Table 2: Cropping pattern in Challakere taluk 2014-2015 (Ha)

Year	Paddy	Maize	Ragi	Jowar	Pulses	Fruits	Vegetables	Oil seeds	Sugarcane	Cotton
	Area under cultivation (in ha)									
2014-2015	1171	4521	1353	1599	7648	2023	8997	78386	0	1269

It is observed that net sown area accounts for about 46% of total geographical area, while area sown more than once is 11% of total geographical area in the taluk (Table-3). As per the data available, the taluk comprises of 4334 Dug wells and 9847 Borewells. Ground water is the lone source for irrigation in the taluk, and the entire 24,071 hectares Irrigated area is catered through borewells as all the existing Dug wells have dried up. (Table-4).

Table 3: Details of land use in Challakere taluk 2014-2015 (Ha)

Taluk	Total Geographical Area	Area under Forest	Area not available for cultivation	Fallow land	Net sown area	Area sown more than once
Challakere	1,94,380	6,987	22,263	37,638	89,100	21,755

Source: District at a glance 2014-15, Govt. of Karnataka

Table 4: Irrigation details in Challakere taluk (Ha)

Source of Irrigation	Net area irrigated (Ha)	% of area
Canals	0	0
Tanks	0	0
Wells	0	0
Bore wells	7,423	100%
Lift Irrigation	0	0
Other Sources	0	0
Total	7,423	

Source: District at a Glance 2014-15, Government of Karnataka

1.5 Geomorphology, Physiography and Drainage

The geomorphology of the taluk is characterized by vast stretches of undulated plains interspersed with sporadic ranges or isolated clusters of low ranges of rocky hills. Challakere taluk falls in the plain region. The Challakere taluk, Chitradurga district falls under Krishna River basin. The important rivers of the taluk is Vedavati, which is a tributary of Tungabhadra. Drainage pattern in the taluk is dendritic to sub-dendritic (Fig.-3).

1.6 Soil

The taluk is having predominantly fertile black soil with varying clayey and sandy mixtures. Red loamy soil cover is also seen in some parts of the taluk.

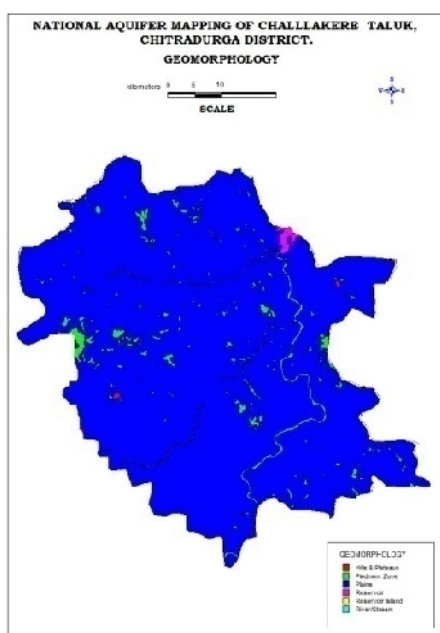


Fig 2: Geomorphology Map

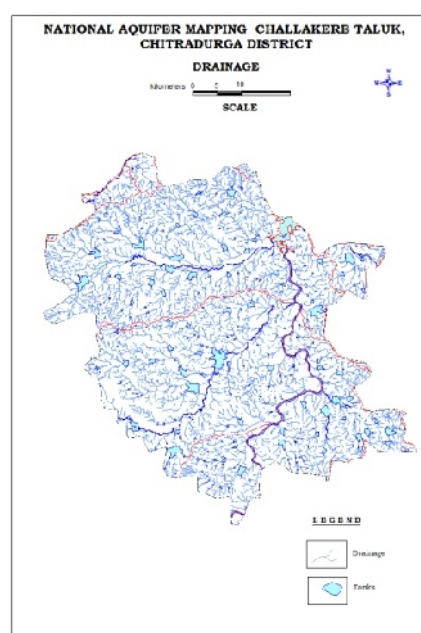


Fig 3: Drainage Map

1.7 Ground water resource availability and extraction

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

Table 5: Total GW Resources (2013) (Ham)

Taluk	Annual Replenishable GW resources	Fresh In-storage GW resources		Total availability of fresh GW resources
		Phreatic	Fractured (down to 200 m)	Dynamic + Phreatic in-storage + fractured
Challakere	8,904	00	5,345	14,250

1.8 Existing and future water demands (as per GEC-2013)

Net ground water availability for future irrigation development : 4.69 MCM

Domestic and Industrial sector demand for next 25 years : 9.52 MCM

1.9 Water level behaviour

(a) Depth to water level

Aquifer - I

This aquifer-I is totally de-saturated due to over-exploitation and has become totally dry. However, isolated patches in topographical lows are seen yielding for very short durations.

Aquifer - II

Pre-monsoon: 20.97 - 35.22 mbgl (Fig.-4)

Post-monsoon: 22.30 - 49.30 mbgl (Fig.-5)

(b) Water level fluctuation

Aquifer-II (Fig.-6)

Seasonal Fluctuation: Fall in the range of 1.33 - 14.08 m (Fig.-6)

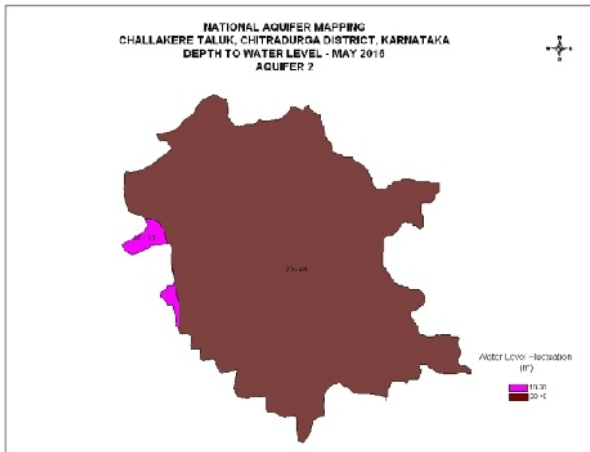


Fig.4: Pre-monsoon Depth to Water Level (Aq-II)

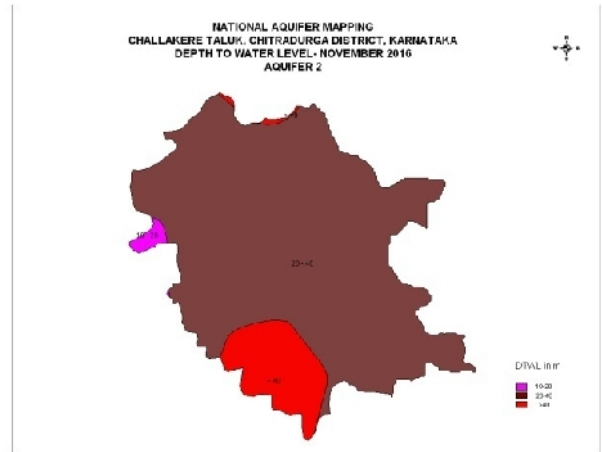


Fig.5: Post-monsoon Depth to Water Level (Aq-II)

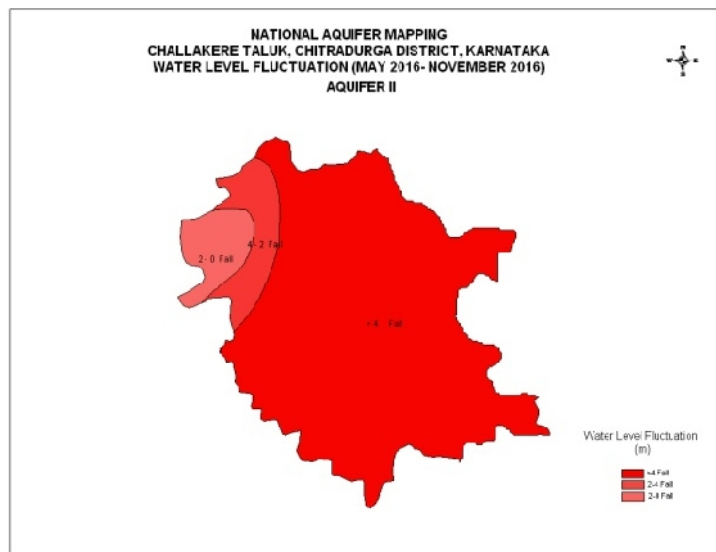


Fig.6: Water Level Fluctuation (Aq-II)

2. AQUIFER DISPOSITION

2.1 Number of aquifers: In Challakere taluk, there are mainly two types of aquifer systems;

- i. **Aquifer-I (Phreatic aquifer)** comprising Weathered Granite Gneiss
 - ii. **Aquifer-II (Fractured aquifer)** comprising Fractured Granite Gneiss / Schist
- In Challakere taluk, fractured granitic-gneiss, gneisses and hornblende-schist are the main water bearing formations (Figure-7). Ground water occurs within the jointed and

fractured granitic-gneisses under semi-confined to confined conditions. In Challakere taluk bore wells were drilled from a minimum depth of 132 mbgl to a maximum of 200 mbgl (Table-6). Depth of weathered zone (Aquifer-I) ranges from 13.3 mbgl to 25.0 mbgl. This aquifer-I or Phreatic Aquifer is totally de-saturated due to over-exploitation and has become totally dry. However, isolated patches in topographical lows are seen yielding seasonally, that too for very short durations. Ground water exploration reveals that aquifer-II fractured formation was encountered between the depth of 25 to 200 m bgl. Yield ranges from 1.5 to 4.0 lps. Transmissivity ranges from 5.27 to 42.16 m²/day. Specific capacity ranges from 4.54 to 29.6 lpm/m draw down. The basic characteristics of each aquifer are summarized in Table-7.

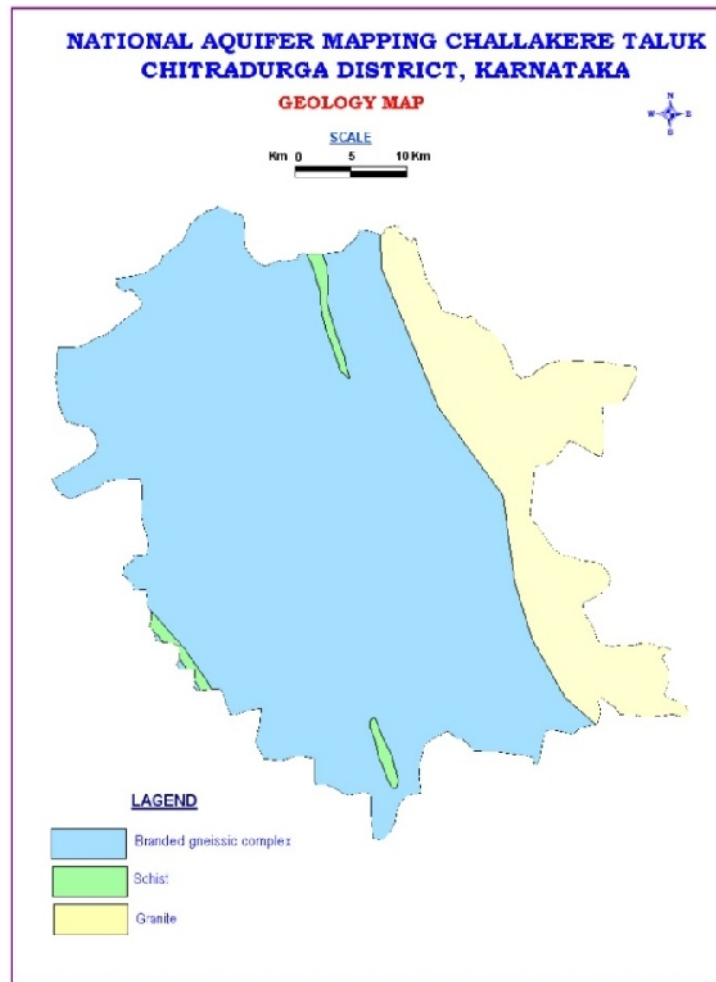


Fig 7: Geology Map

Table 6: Details of Ground water Exploration

Sl. No.	Location	Latitude	Longitude	Depth Drilled (m bgl)	Casing Depth (m bgl)	Fracture Zones (mbgl)	SWL (mbgl)	Q (lps)	DD (m)
1.	Brindavanahalli	14°18'40"	76°49'09"	50.00	11.80	12.60 - 20.00	5.00	1.20	
2.	Deverahalli	14°27'26"	76°36'56"	32.60	15.00	9.88, 15.0-19.0, 21.0-23.0	8.55	7.78	
3.	Hotteppanahalli	14°27'09"	76°36'48"	57.00	2.65	1.00 - 48.00	10.44	3.7	
4.	Guruvanahalli	14°36'45"	76°36'01"	76.20	4.20	7.0-18.0, 35.0-36.0, 49.0-50.0	11.86	0.37	
5.	Dodda Biranahalli	14°10'25"	76°49'45"	200.00	11.94	Nil			
6.	Hotteppanahalli	14°14'25"	76°39'05"	200.00	5.77	31.99, 182.90	23.02	0.86	49.98
7.	Neralagunte	14°24'15"	76°35'25"	200.00	5.67	27.42, 155.38, 169.09	12.72	1.17	28.35
8.	Allapura	14°16'50"	76°50'50"	200.00	5.32	114.25	22.33	0.97	44.93
9.	Parasurampura	14°15'35"	76°54'00"	200.00	11.74	91.40	6.06	0.88	66.12
10.	Parasurampura (Supply to Huralikatte)	14°15'40"	76°54'05"	200.00	17.86	22.85	5.64	0.92	64.63
11.	Jajur	14°23'05"	76°52'00"	187.47	14.61	15.40, 36.56, 91.40	8.5	4.22	4.16
12.	Jajur (Supply to Kamasamudra)	14°23'05"	76°51'55"	118.82	17.61		8.5	4.0	19.0
13.	Bommasandra	14°19'05"	76°42'35"	151.00	15.67	31.99, 118.00	24.35	6.40	18.34
14.	Kodihalli	14°27'45"	76°39'40"	200.00	20.94	119.00, 135.00	29.94	0.65	57.06
15.	Nayakanahatti (Supply to Mallurahatti)	14°28'25"	76°32'05"	27.43	21.35	22.00	16.33	4.00	5.46
16.	Nayakanahatti	14°28'35"	76°32'15"	200.00	20.64	21.0-24.0, 98.00	4.82		
17.	Ullarti (Supply to Durgavara)	14°23'25"	76°43'50"	200.00	11.80	90.00, 118.82-123.29	0.21		
18.	Obayyanahatti	14°29'20"	76°36'15"	159.95	5.97	59.41	2.44		

Table 7: Basic characteristics of each aquifer

Aquifers	Weathered Zone (Aq.-I)	Fractured Zone (Aq.-II)
Prominent Lithology	Weathered Gneiss / Granite	Jointed /Fractured Granite, Gneiss
Thickness range (m bgl)	25.00	Fractures down to 200 mbgl depth
Depth range of occurrence of fractures (mbgl)	12.00 - 25.00	25 - 200 80% between 25.00 - 135.00
Range of yield potential (lps)	De-saturated, almost Dry now	0.65 - 4.0
Specific Yield	-	0.2%
T (m ² /day)	-	2 - 100
Quality, Suitability for Irrigation	-	Suitable
Suitability for Domestic purposes	-	Suitable
Remarks	Over-Exploited	Ground water potential fractures, 1 to 3 sets likely up to the depth of 200 m bgl.

2.2. 3 D Aquifer Disposition and Cross-sections

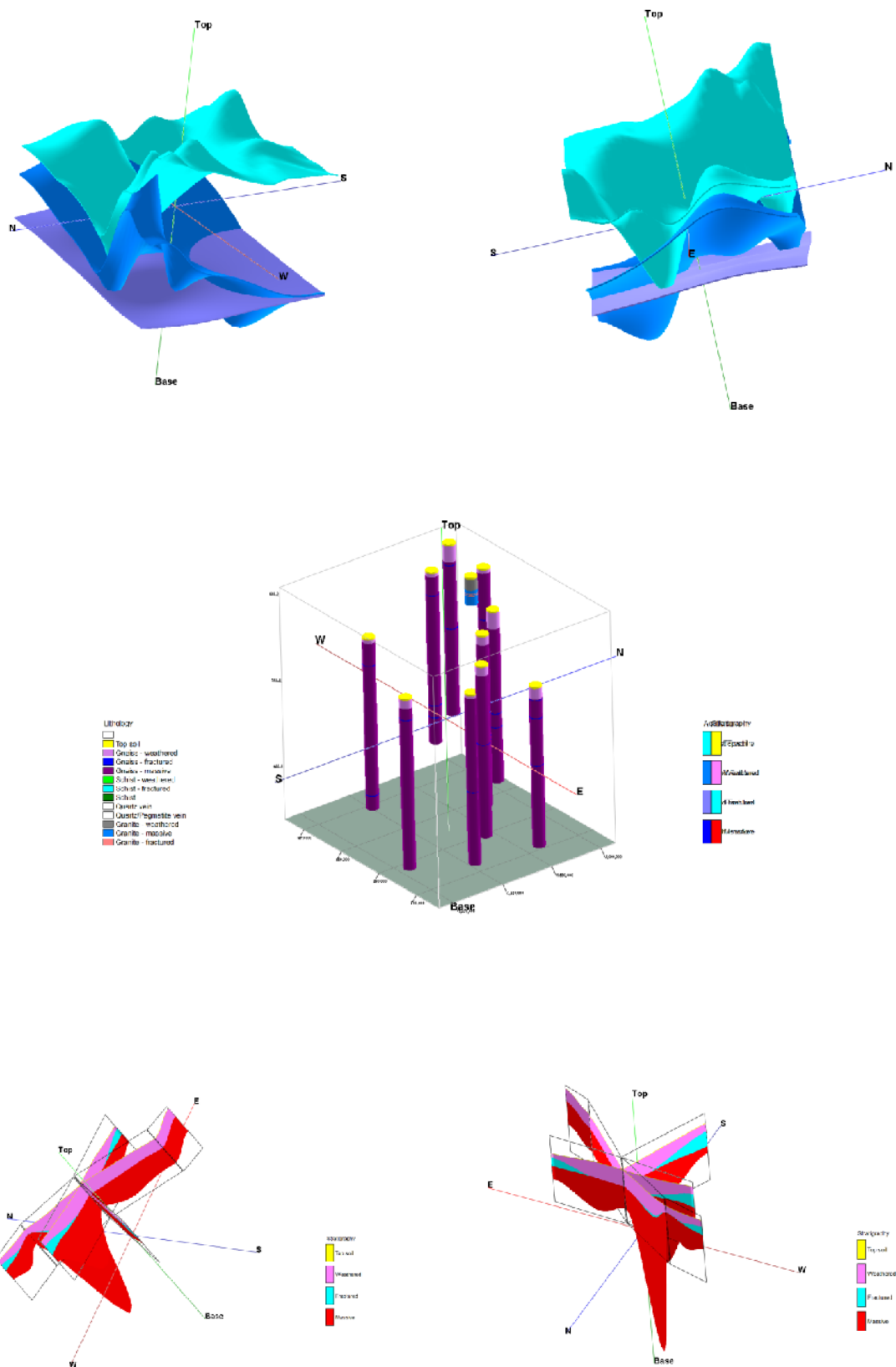


Fig 8: Aquifer Disposition and Cross-sections

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

a. Aquifer wise resource availability and extraction

(a) Present Dynamic Ground Water Resource (2013)

Taluk	Net Annual Ground Water Availability (Ha m)	Existing Gross Ground Water Draft for Irrigation (Ha m)	Existing Gross Ground Water Draft For Domestic and Industrial Water Supply (Ha m)	Existing Gross Ground Water Draft for all Uses (Ha m)	Allocation For Domestic and Industrial Use for Next 25 Years (Ha m)	Net Ground Water Availability for Future Irrigation Development (Ha m)	Existing Stage Of Ground Water Development (%)	Category
Challakere	8904	8230	798	9028	952	469	101	OE

(b) Present total Ground Water Resource (in ham)

Taluk	Annual Replenishable GW Resources	Fresh In-storage GW Resources		Total availability of GW Resource
		Phreatic	Fractured	Dynamic + phreatic in-storage + fractured in-storage
Challakere	8904	0	5345	14250

(c) Comparison of Ground Water Availability and Draft Scenario in Challakere taluk

Taluk	GW Availability (Ham)	GW Draft (Ham)	Stage of GW Development	GW Availability (Ham)	GW Draft (Ham)	Stage of GW Development	GW Availability (Ham)	GW Draft (Ham)	Stage of GW Development
	2009			2011			2013		
Challakere	8777	8401	96	8872	8839	100	8904	9028	101

b. Chemical Quality of Ground Water and Contamination

In general, ground water quality in Challakere taluk is good for drinking purpose as per "Indian Standard Drinking Water Specification 2009".

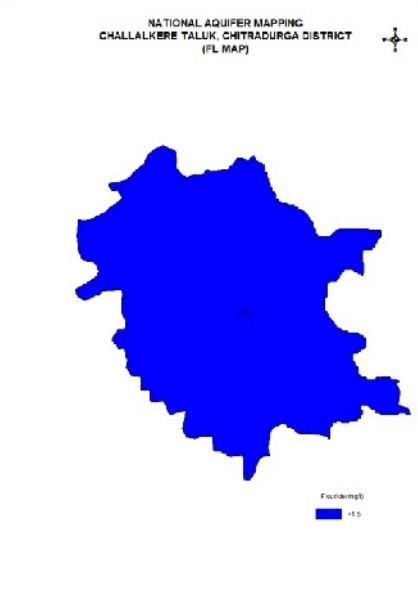


Fig 9: Fluoride Map

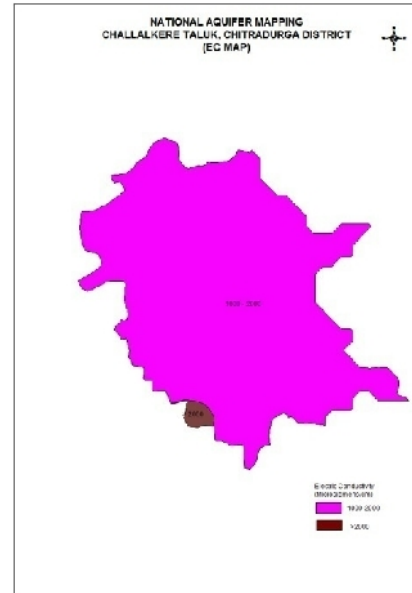


Fig 10: Electrical Conductivity Map

4. GROUND WATER RESOURCE ENHANCEMENT

4.1 Aquifer wise space available for recharge and proposed interventions

Recharge dry phreatic aquifer (Aq-I) in the taluk, through construction of artificial recharge structures, viz., check dams, percolation tanks & point recharge structures (Table-8). The choice of recharge structures should be site specific and such structures need to be constructed in areas already identified as feasible for artificial recharge.

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

Artificial Recharge Structures Proposed	Challakere Taluk
Non committed monsoon runoff available (Ham)	980
Number of Check Dams	60
Number of Percolation Tanks	04
Number of Point Recharge structures	07
Tentative total cost of the project (Rs. in lakhs)	236.00
Excepted recharge (MCM)	5.546
Expected rise in water level (m)	0.135
Cost Benefit Ratio (Rupees / cu.m. of water harvested)	4.26

4.2 Improvement in GW availability due to Recharge, Challakere 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	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		%
Challakere	8904	9028	101	555	-	9459	06	95

After implementation of Artificial Recharge structures for GW recharge, the annual ground water availability will increase from 8904 to 9459 ham and the expected improvement in stage of development is 6% from 101% to 95%

5. DEMAND SIDE INTERVENTIONS

5.1 Advanced irrigation practices

It is observed that presently, ground water through borewells is the lone source for irrigation in the taluk. Water use efficiency measures are need of the hour. Adopting these measures will contribute in ground water resource enhancement in the long run.

Efficient irrigation practices like Drip irrigation and sprinkler need to be adopted by the farmers in the existing 2,4071 ha of gross irrigated area. Presently, draft through irrigation is 8643 ham. Efficient irrigation techniques will contribute in saving ground water by 2593 ham and thus, will improve stage of development by 20% from 95% to 75% (Table-9).

5.2 Change in cropping pattern

In Challakere taluk, only one Water intensive crop i.e., paddy is being grown, that too, in a small area of 1171 hectares, which is basically for self-consumption, and hence, it may not be possible to change it. Hence, change in cropping pattern has not been suggested.

Table-9: Improvement in GW availability due to saving by adopting water use efficiency

Taluk	Cumulative annual ground water availability after implementing AR structures & irrigation development schemes	Existing gross ground water draft for all uses	Stage of ground water development after implementing AR structures & Yettinahole project	Saving due to adopting WUE measures	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		%
Challakere	9459	9028	95	2593	12052	75	26

5.3 Additional area of irrigation

After adopting various water use efficiency techniques and recharge measures and its resultant savings, the stage of development is expected to be 75% in the taluk, which will bring the taluk to the semi-critical category. Hence bringing additional area under irrigation may not be practical with a long-term resource management point of view.

5.4 Regulation and Control

Challakere taluk has been categorized as **Over-Exploited**, since the Stage of ground water development has reached **101%** (GE March 2013). Hence, stringent action has to be taken up through Karnataka Ground Water Authority to control ground water exploitation in the taluk.

Ground water recharge component needs to be made mandatory in the taluk to save the situation from deteriorating further.

5.5 Other interventions proposed:

Periodical maintenance of artificial recharge structures should also be incorporated in the Recharge Plan.

5.6 Summary

The summary of Management plan of Challakere taluk is given in Table-10.

Table-10: Summary of Management plan of Challakere taluk

Challakere taluk is 'Over-Exploited' and present stage of GW Development (2013)	101%
Net Annual Ground Water Availability (MCM)	89.04
Existing Gross Ground Water Draft for all uses (MCM)	90.28
Groundwater development feasibility	4.69
Total GW Resources (Dynamic & Static up to the depth of 200 m bgl) (MCM)	243.60
Expected additional recharge from monsoon surplus runoff (MCM)	5.55
Change in Stage of GW development, %	101 to 95
Expected Saving due to adopting WUE measures (MCM)	25.93
Change in Stage of GW development, %	95 to 75

