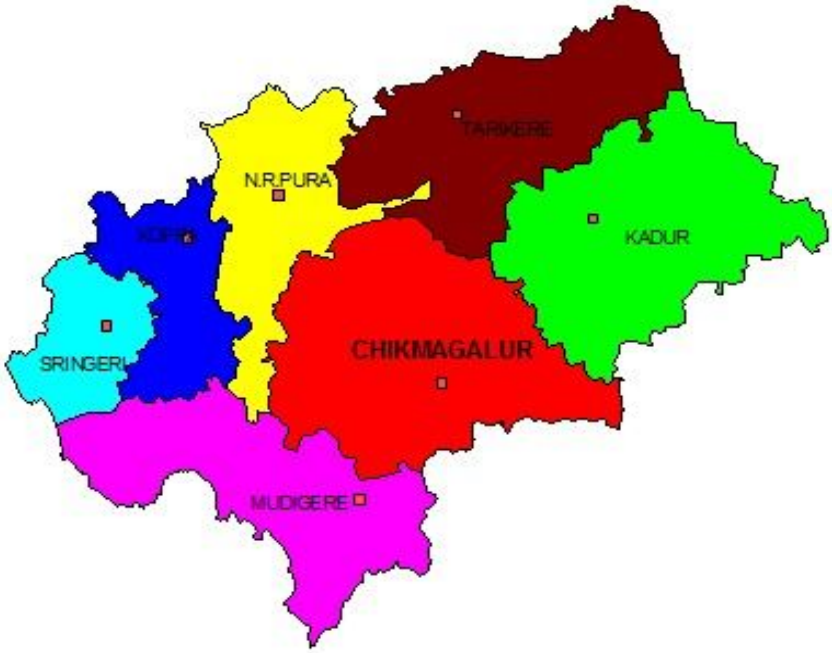
जल वर्ष 2007 Water Year 2007

स्वच्छ सुरक्षित जल – सुन्दर खुशहाल कल

CONSERVE WATER - SAVE LIFE

GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES
CENTRAL GROUND WATER BOARD

GROUND WATER INFORMATION BOOKLET
CHIKMAGALUR DISTRICT, KARNATAKA



SOUTH WESTERN REGION
BANGALORE
FEBRUARY 2013

सुशील गुप्ता
अध्यक्ष
केन्द्रीय भूमि जल बोर्ड,
जल संसाधन मंत्रालय,
भारत सरकार,
भूजल भवन, एन एच. - 4,
फरीदाबाद.

Sushil Gupta
Chairman
Central Ground Water Board,
Ministry of Water Resources,
Government of India,
Bhujal Bhawan, NH-IV,
Faridabad.

FOREWORD

Groundwater is an essential component of the environment and economy. It sustains the flow in our rivers and plays an important role in maintaining the fragile ecosystems. The groundwater dependence of agrarian states like Karnataka is high. Recent studies indicate that 26 percent of the area of Karnataka State is under over exploited category and number of blocks is under critical category. In view of the growing concerns of sustainability of ground water sources, immediate attention is required to augment groundwater resources in stressed areas. Irrigated agriculture in the state is putting additional stress on the groundwater system and needs proper management of the resources.

Central Ground Water Board is providing all technical input for effective management of ground water resources in the state. The groundwater scenario compiled on administrative divisions gives a better perspective for planning various ground water management measures by local administrative bodies. With this objective, Central Ground Water Board is publishing the revised groundwater information booklet for all the districts of the state.

I do appreciate the efforts of Dr. K.Md.Najeeb, Regional Director and his fleet of dedicated Scientists of South Western Region, Bangalore for bringing out this booklet. I am sure these brochures will provide a portrait of the groundwater resources in each district for planning effective management measures by the administrators, planners and the stake holders.

Sushil Gupta
CHAIRMAN

PREFACE

Ground water contributes to about eighty percent of the drinking water requirement in the rural areas, fifty percent of the urban water requirement and more than fifty percent of the irrigation requirement of the nation. Central Ground Water Board has decided to bring out district level ground water information booklets highlighting the ground water scenario, its resource potential, quality aspects, recharge – discharge relationship, etc., for all the districts of the country. As part of this, Central Ground Water Board, South Western Region, Bangalore, has prepared such booklets for all the 30 districts of Karnataka state.

Chikmagalur district Ground Water Information Booklet has been prepared based on the information available and data collected from various state and central government organisations by several hydro-scientists of Central Ground Water Board with utmost care and dedication. This booklet was prepared by Shri S.N.Ramaiah, Scientist-D, and subsequently updated with recent data by Smt. Sandhya Yadav, Scientist 'C', under the guidance of Dr. K. R. Sooryanarayana, Scientist 'D', Central Ground Water Board, South Western Region, Bangalore. I take this opportunity to congratulate them for the diligent and careful compilation and observation in the form of this booklet, which will certainly serve as a guiding document for further work and help the planners, administrators, hydro geologists and engineers to plan water resources management in a better way in the district.

(K. Md. Najeeb)
Regional Director

CHICKMAGALUR DISTRICT AT A GLANCE

Sl. No.	Items	Statistics
1.	**General Information**	
	(i) Geographical area (sq. km.)	7201
	(ii) Administrative Division (as in 2009 - 10)	
	(a) Number of Taluks	7 (Chikmagalur, Kadur, Koppa, Mudigere, N. R. Pura, Sringeri, Tarikere)
	(b) Number of Panchayats/ Villages	226 Panchayats & 1117 Villages
	(iii) Population (as per 2001 Census)	11,40,905
	(iv) Average Annual Rainfall (mm)	1904
2.	**Geomorphology**	
	(i) Major physiographic units	Southern Malnad, Central Semi- Malnad & South eastern maidan area.
	(ii) Major Drainage	Krishna River
3.	**Land Use (sq. km.) (As per A.S.C.R. 2008 – 09)**	
	(i) Forest area (ha)	200485
	(ii) Net area sown (ha)	295920
	(iii) Cultivable area (ha)	319790
4.	**Major soil types**	Red loamy & Red sandy soil (mainly) Hilly area soil & mixed red & black soil (occur in small areas)

5.	**Area under principal crops (As per A.S.C.R. 2008 – 09)**	**Crops**	**Area (ha)**
		Paddy	43,789
		Ragi	58,306
		Jowar	9481
		Maize	4639
		Gram	7663
		Sunflower	13,951
		Groundnut	3769
		Cotton	1202
		Sugarcane	1308
		Coffee	73,919
		Coconut	37,990
		Arecanut	19,751
6.	**Irrigation by different sources (Areas & Numbers of structures) (As per 4th Census of Minor Irrigation Schemes 2006 – 07, published in March 2011)**	Area Irrigated (ha)	Number
	(i) Dug wells	500	426
	(ii) Shallow Tube wells	26046	24212
	(iii) Other sources:		
	(a) Lift Irrigation Schemes	16051	4075
	(b)Surface Flow Irrigation	17991	1943
	(iv) Net irrigated area	2,98,842	
7.	**Number of ground water monitoring wells of Central Ground Water Board (as on 31.03.2012)**		
	(i) Dug wells	39	
	(ii) Piezometers	7	
8.	**Predominant Geological Formations**	Charnokite, gneisses & unclassified crystallines, slates, phyllites & schists.	
9.	**Hydrogeology**		
	(i) Major water bearing formation	Gneiss & Schist (Fractured & weathered)	
	(ii) Pre - monsoon depth to water level during May 2011 (in mbgl)	1.69 to 17.83	

	(iii) Post – monsoon depth to water level during Nov. 2011 (in mbgl)	0.81 to 15.93
	(iv) Long term water level trend in 10 years (2001 – 2010) (a) Pre – monsoon; May 2001 – May 2010 (m/year) (b) Post – monsoon; Nov. 2001 – Nov. 2010 (m/year)	(a) In 27 NHS, depth to water level shows rising trend in the range of 0.012 to 0.084 m/year & in 1 NHS it shows falling trend to the tune of 0.01 m/year. (b) In 29 NHS, depth to water level shows rising trend in the range of 0.019 to 0.023 m/year. & in 3 NHS it shows falling trend in the range of 0.019 to 0.023 m/year
10.	**Ground water Exploration by Central Ground Water Board (up to year 2001 – 02)**	
	(i) Number of wells drilled (EW, OW, PZ, SH, Total)	30 – EW; 11 - OW
	(ii) Depth Range (mbgl)	14.40 – 265.21
	(iii) Discharge (litres per second)	0.77 – 11.16
	(iv) Transmissivity (m^2/day)	0.11 - 108
11.	**Ground water quality**	
	(i) Presence of chemical constituents more than permissible limit	Nitrate (in a major area of Kadur taluk & also in marginal area of Chikmagalur taluk)
12.	**Dynamic Ground Water Resource (2009) (ham)**	
	(i) Annual replenishable ground water resource	57509
	(ii) Net Annual Ground Water Draft	23529
	(iii) Projected demand for domestic & industrial uses upto 2025	4036
	(iv) Stage of ground water development (%)	46

13.	**Awareness & Training activity**	
	(i) Mass awareness programmes organized	
	(a) Date	25.03.99
	(b) Place	Tangli village, Kadur taluk
	(ii) Water management Training Programmes organized	
	(a) Date	29.11.2006
	(b) Place	Zilla Panchayat Meeting Hall, Chikmagalur
14.	**Artificial recharge & rainwater harvesting**	
	(i) Projects completed by CGWB (No. & amount spent)	Nil
	(ii) Projects under technical guidance of CGWB	Nil
15.	**Ground water control & Regulation**	
	(i) Number of OE assessment units	1 (Chikmagalur taluk); 2 (Kadur taluk); 1 (Tarikere taluk).
	(ii) Number of Semi Critical assessment units	1 (Chikmagalur taluk); 1(Kadur taluk)
	(iii) Number of blocks notified	Nil

1.0 Introduction

1.1 Location

Chikmagalur district lies in the south central part of Karnataka, between 12°54'42" – 13°53'53" N latitudes and 75°04'46" – 76°21'50" E longitudes, with a geographical area of 7201 sq. km. The district is bounded by Shimoga & Davangere districts in the north, Chitradurga district in the east, Hassan & Dakshin Kannada district in the south and Udupi district in the west.

1.2 Administrative set up

Chikmagalur is the district headquarters. The district comprises of 7 taluks namely, Kadur, Mudigere, Chikmagalur, Koppa, Tarikere, Sringeri and N. R. Pura (**Figure 1**). There are 34 hoblies, 226 Gram Panchayats, 4 Municipalities, 9 Towns/ Urban agglomeration and 1034 inhabited & 83 un-inhabited villages.

1.3 Population

Population of the district (2001 Census) is 11, 40, 905 with an average population density of 158 per km^2.

1.4 Drainage

Chikmagalur district falls in Krishna basin. The district is the birth place of six rivers. They are Thunga, Bhadra, Hemavathi, Vedavathi, Yagachi and Netravathi. Drainage Map of Chikmagalur district is given in **Figure 2**.

1.5 Crops & Irrigation practices

About 41% of the geographical area of the district is under cultivation. Irrigation through dug wells is more prevalent in Koppa, Chikmagalur & Sringeri taluks. Irrigation through shallow tube wells is more prevalent in Kadur, Tarikere & Chikmagalur taluks and also to a greater extent in Koppa taluk. Lift Irrigation Schemes are under implementation to a larger extent in Mudigere taluk followed by N. R. Pura & Koppa taluks..

Crops cultivated in the district are mainly rain fed. Major crops of the district are ragi, paddy, jowar, pulses, sunflower, groundnut, coffee, coconut and arecanut.

Fig.1

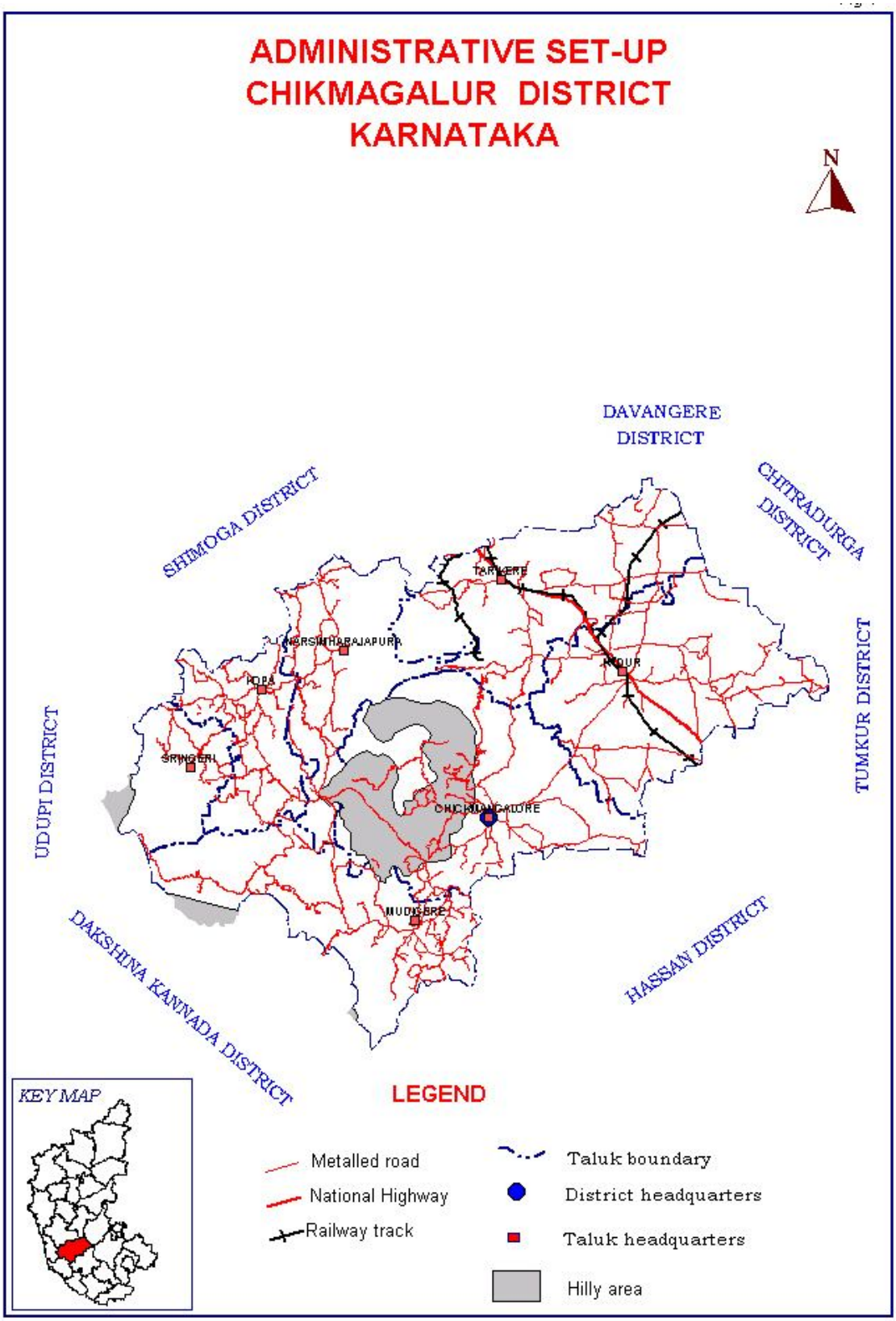
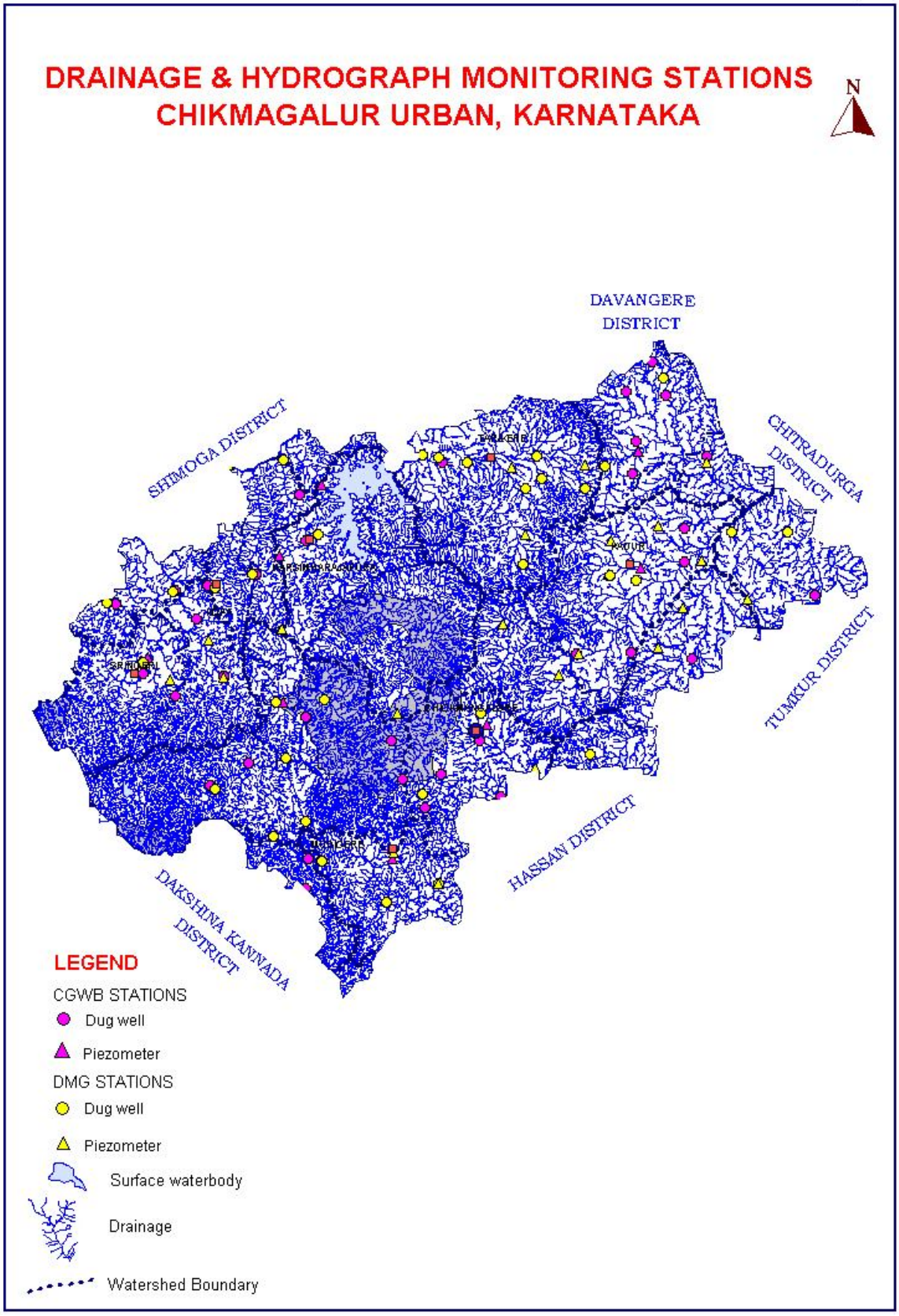

ADMINISTRATIVE SET-UP
CHIKMAGALUR DISTRICT
KARNATAKA
N
DAVANGERE DISTRICT
SHIMOGA DISTRICT
CHITRADURGA DISTRICT
TUMKUR DISTRICT
UDUPI DISTRICT
DAKSHINA KANNADA DISTRICT
HASSAN DISTRICT
TARIKERE
NARSIMHARAJAPURA
KOPA
KADUR
SRINGERI
CHIKMAGALURE
MUDIGERE
KEY MAP
LEGEND
Metalled road
National Highway
Railway track
Taluk boundary
District headquarters
Taluk headquarters
Hilly area

Fig. 2


DRAINAGE & HYDROGRAPH MONITORING STATIONS
CHIKMAGALUR URBAN, KARNATAKA
N
DAVANGERE DISTRICT
SHIMOGA DISTRICT
CHITRADURGA DISTRICT
TUMKUR DISTRICT
HASSAN DISTRICT
DAKSHINA KANNADA DISTRICT
LEGEND
CGWB STATIONS
Dug well
Piezometer
DMG STATIONS
Dug well
Piezometer
Surface waterbody
Drainage
Watershed Boundary

1.6 Activities carried out by Central Ground Water Board (CGWB)

Previous works have been carried out by CGWB, South Western Region (SWR), in different parts of Chikmagalur district under Systematic Hydrogeological Surveys, Reappraisal Hydrogeological Surveys and Exploratory Drilling Programme to study and update various aspects of ground water regime and quality. Phase wise exploratory drilling programme has been undertaken in the district, where altogether 41 nos. of exploratory & observation wells were drilled in Phase I & Phase II, and during the period 1978 – 2002 (**Figure – 3**). Monitoring of spatial and temporal change in ground water level in the district is being done by Central Ground Water Board, South Western Region, through 46 nos. of established monitoring stations, viz. 39 dug wells & 7 piezometers four times annually, viz. May, August, November & January.

2.0 Rainfall

The average annual rainfall of the district is 1904 mm. Kadur taluk receives the lowest rainfall of 646 mm, whereas Sringeri taluk receives the highest rainfall in the district amounting to 3850 mm. Seasonal and Annual Normal Rainfall for the period 2001 – 2010, of Chikmagalur district is illustrated in **Table - 2**.

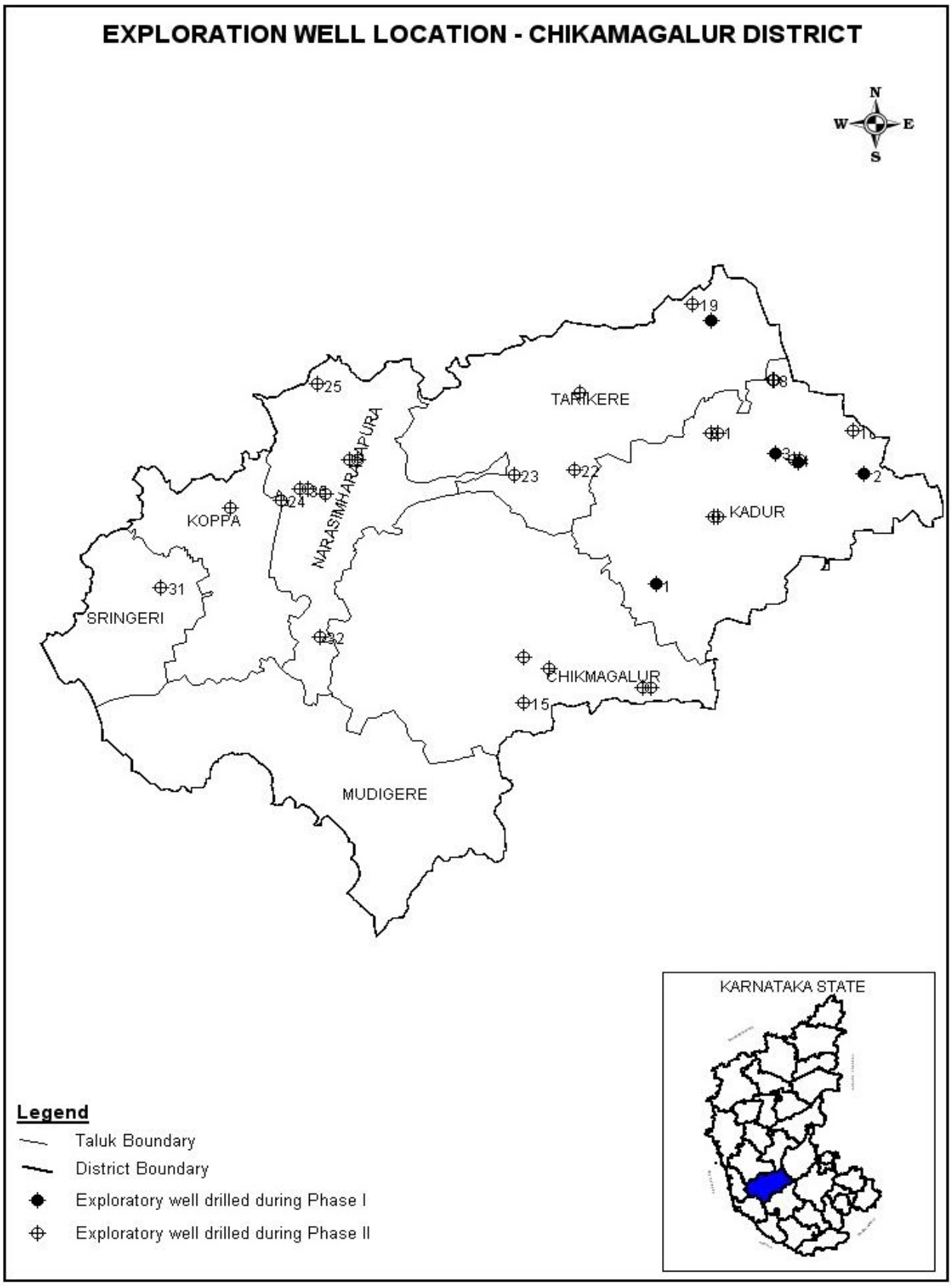
Table 2: Seasonal and Annual Normal Rainfall for the period 2001 – 2010, of Chikmagalur district

Station	Pre- - Monsoon	SW Monsoon	NE Monsoon	Annual
	Rainfall (mm)			
Chikmagalur	212	470	229	911
Kadur	164	302	180	646
Koppa	166	2322	216	2703
Mudigere	300	2132	324	2756
Narasimharajapura	150	1173	183	1506
Sringeri	232	3332	286	3850
Tarikere	146	639	212	997

3.0 Geomorphology & Soil Type

Major soil type in the district comprises of red loamy & sandy soil. However, hilly area soil and mixed red & black soil are also found to occur in small areas in the central and northeastern part respectively.

Fig. 3


EXPLORATION WELL LOCATION - CHIKAMAGALUR DISTRICT
N
W
E
S
19
25
TARIKERE
8
1
1
3
2
23
22
24
KOPPA
NARASIMHARAJAPURA
KADUR
1
31
SRINGERI
32
CHIKMAGALUR
15
MUDIGERE
KARNATAKA STATE
Legend
Taluk Boundary
District Boundary
Exploratory well drilled during Phase I
Exploratory well drilled during Phase II

4.0 Ground Water Scenario

Ground water in the district occurs under water table and semi confined conditions. Weathered, fractured and jointed gneiss and schist serve as potential aquifers in the district. Ground water development in the area is through dug wells and bore wells. Ground water development has increased in large-scale compared to earlier years. This is mainly due to liberal financing by various banks for agricultural development.

4.1 Hydrogeology

4.1.1 Chickmagalur Taluk

Most of the area in Chikmagalur taluk is covered by schist followed by gneissic rock formation in southern part of the taluk. Weathered, fractured and jointed schist and gneiss serve as potential aquifers in the area (**Figure - 4**). Depth of weathered zone ranges from 6.80 to 14.25 m bgl. Pre-monsoon depth to water level during the year 2011 (**Figure - 5**) ranges from 1.83 to 17.83 mbgl. Post-monsoon depth to water level (**Figure - 6**) ranges from 1.91 to 13.85 mbgl and seasonal water level fluctuation ranges from 0.08 to 3.98 mbgl. Based on water level data of the National hydrograph stations (**Figure – 7a & 7b**) located in the taluk (long term water level trend 2001 to 2010), it is observed that hydrograph of Handi is showing rising trend at the rate of 0.27 m/year during pre-monsoon and also rising trend at the rate of 0.72 m/year during post monsoon. No hydrograph located in Chikmagalur taluk shows falling trend during both pre and post monsoon period. Pumping tests on shallow aquifers conducted in the area during hydrogeological surveys shows that specific capacity varies from 8.80 to 398 lpm/mdd.

4.1.2 Kadur taluk

Nearly 80% of the area in Kadur taluk is covered by gneissic rock formation and schist occupies rest of the area. Ground water occurs under water table as well as in semi-confined condition. Weathered, fractured and jointed gneiss and schist serves as potential aquifers in the area (**Figure - 4**). Depth of weathered zone in the area ranges from 5.51 to16.10 m bgl. Pre - monsoon depth to water level during the year 2011 (**Figure - 5**) in the area ranges from 2.69 to 3.96 m bgl, Post monsoon DTW (**Figure - 6**) ranges from 2.7 to 7.35 m bgl, and seasonal water level fluctuation ranging from 0.01 to 3.22 m. Based on water level data of the National hydrograph stations (**Figure – 7a & 7b**) located in the taluk (long term water level trend 2001 to 2010), it is observed that hydrograph of Antargatta shows rising trend during both pre and post-monsoon period at the rate of 0.19 and 0.41 m/year. Pumping tests on shallow

Fig. 4

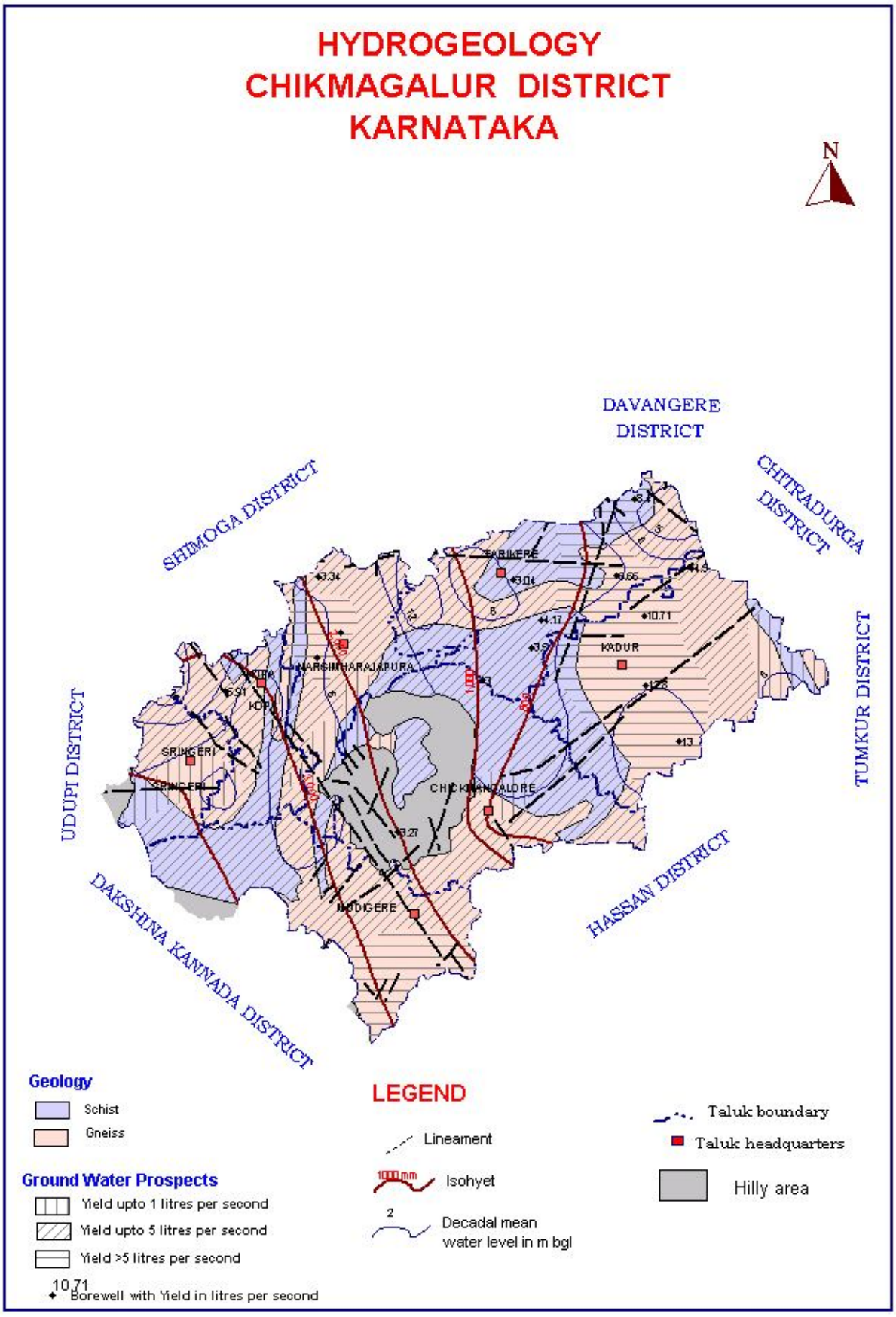

HYDROGEOLOGY
CHIKMAGALUR DISTRICT
KARNATAKA
N
DAVANGERE DISTRICT
SHIMOGA DISTRICT
CHITRADURGA DISTRICT
TUMKUR DISTRICT
UDUPI DISTRICT
DAKSHINA KANNADA DISTRICT
HASSAN DISTRICT
TARIKERE
KADUR
NARASIMHARAJAPURA
SRINGERI
CHICKMANGALORE
MUDIGERE
Geology
Schist
Gneiss
Ground Water Prospects
Yield upto 1 litres per second
Yield upto 5 litres per second
Yield >5 litres per second
10.71 Borewell with Yield in litres per second
LEGEND
Lineament
1000mm Isohyet
2 Decadal mean water level in m bgl
Taluk boundary
Taluk headquarters
Hilly area

Fig. 5

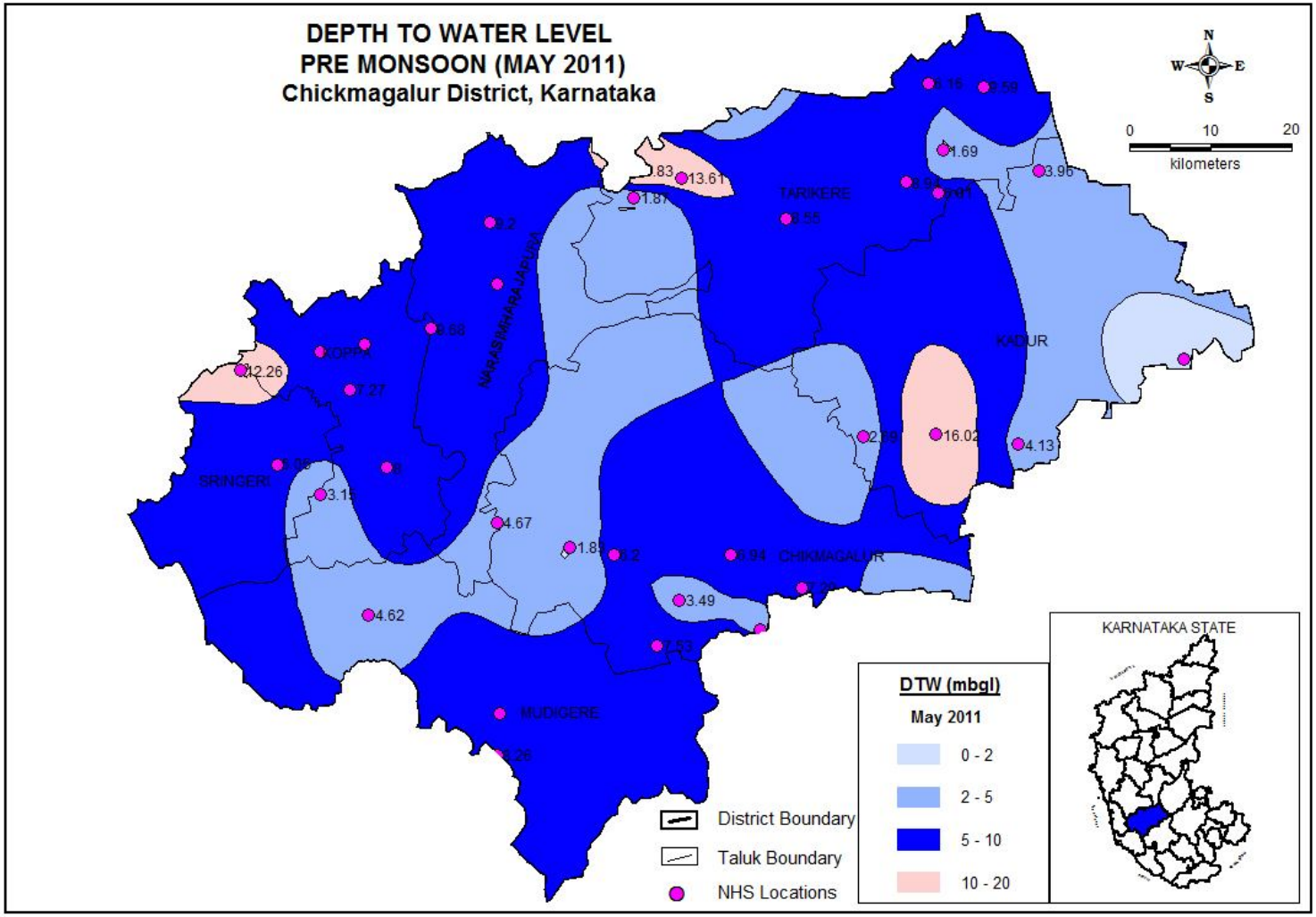

DEPTH TO WATER LEVEL
PRE MONSOON (MAY 2011)
Chickmagalur District, Karnataka
N
W
E
S
0
10
20
kilometers
TARIKERE
KADUR
CHIKMAGALUR
SRINGERI
MUDIGERE
NARASIMHARAJAPURA
KOPPA
12.26
7.27
3.68
13.61
1.87
1.69
3.96
16.02
4.13
3.15
4.67
4.62
3.49
DTW (mbgl)
May 2011
0 - 2
2 - 5
5 - 10
10 - 20
District Boundary
Taluk Boundary
NHS Locations
KARNATAKA STATE

Fig. 6

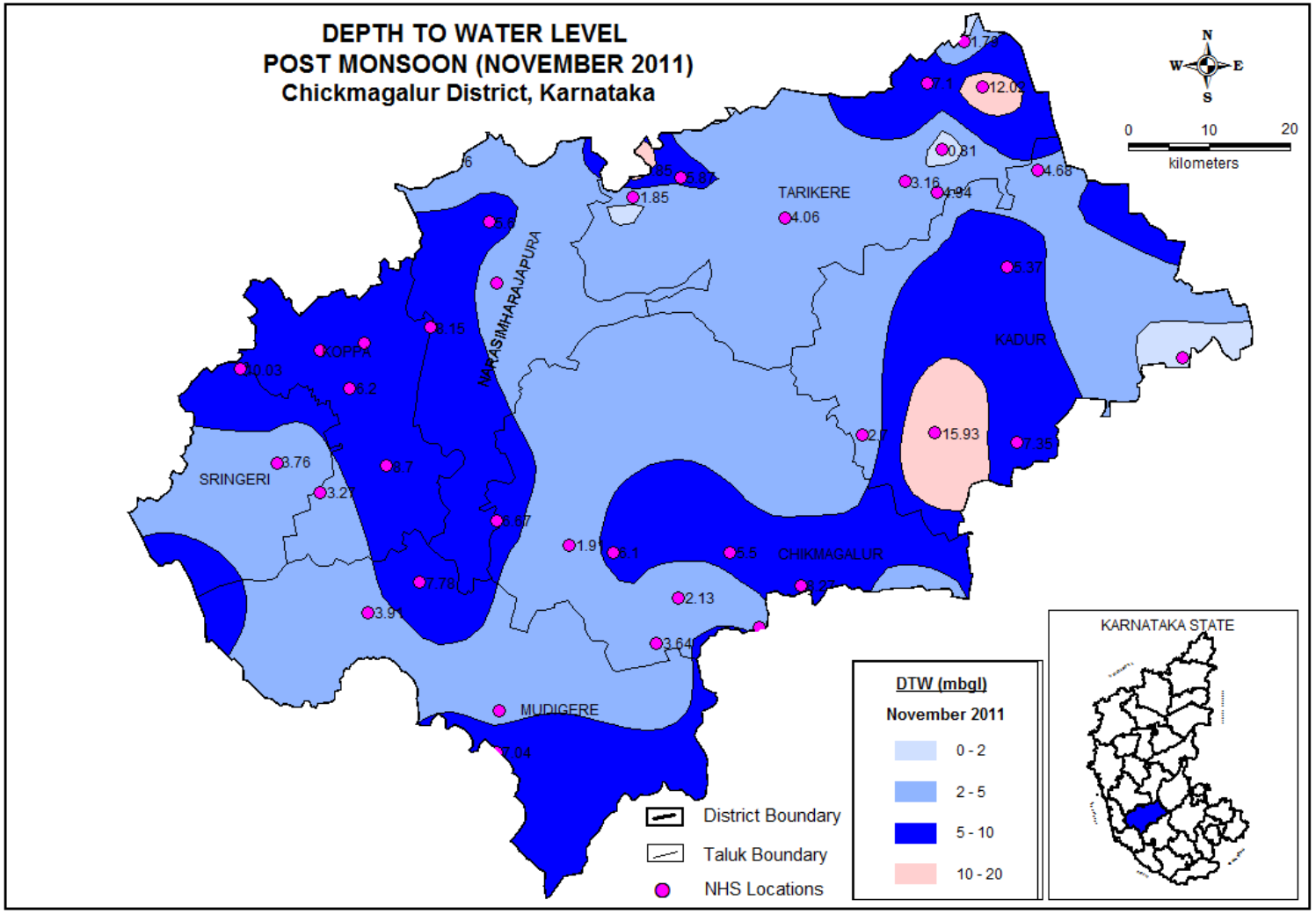

DEPTH TO WATER LEVEL
POST MONSOON (NOVEMBER 2011)
Chickmagalur District, Karnataka
N
W
E
S
0
10
20
kilometers
TARIKERE
4.06
KADUR
15.93
CHIKMAGALUR
NARASIMHARAJAPURA
KOPPA
SRINGERI
MUDIGERE
10.03
3.76
3.91
2.13
3.64
1.85
4.68
5.37
7.35
DTW (mbgl)
November 2011
0 - 2
2 - 5
5 - 10
10 - 20
District Boundary
Taluk Boundary
NHS Locations
KARNATAKA STATE

Fig. 7a

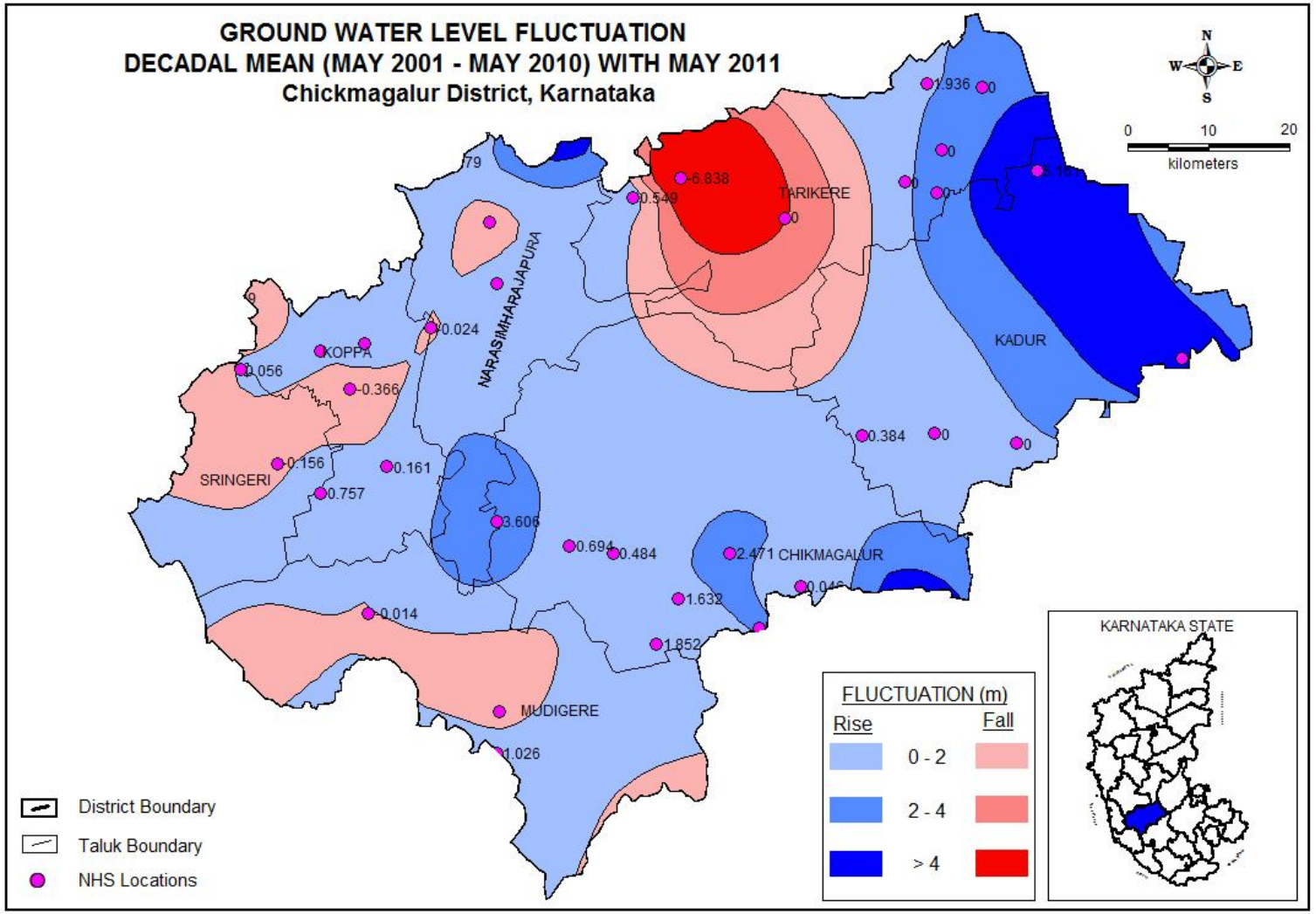
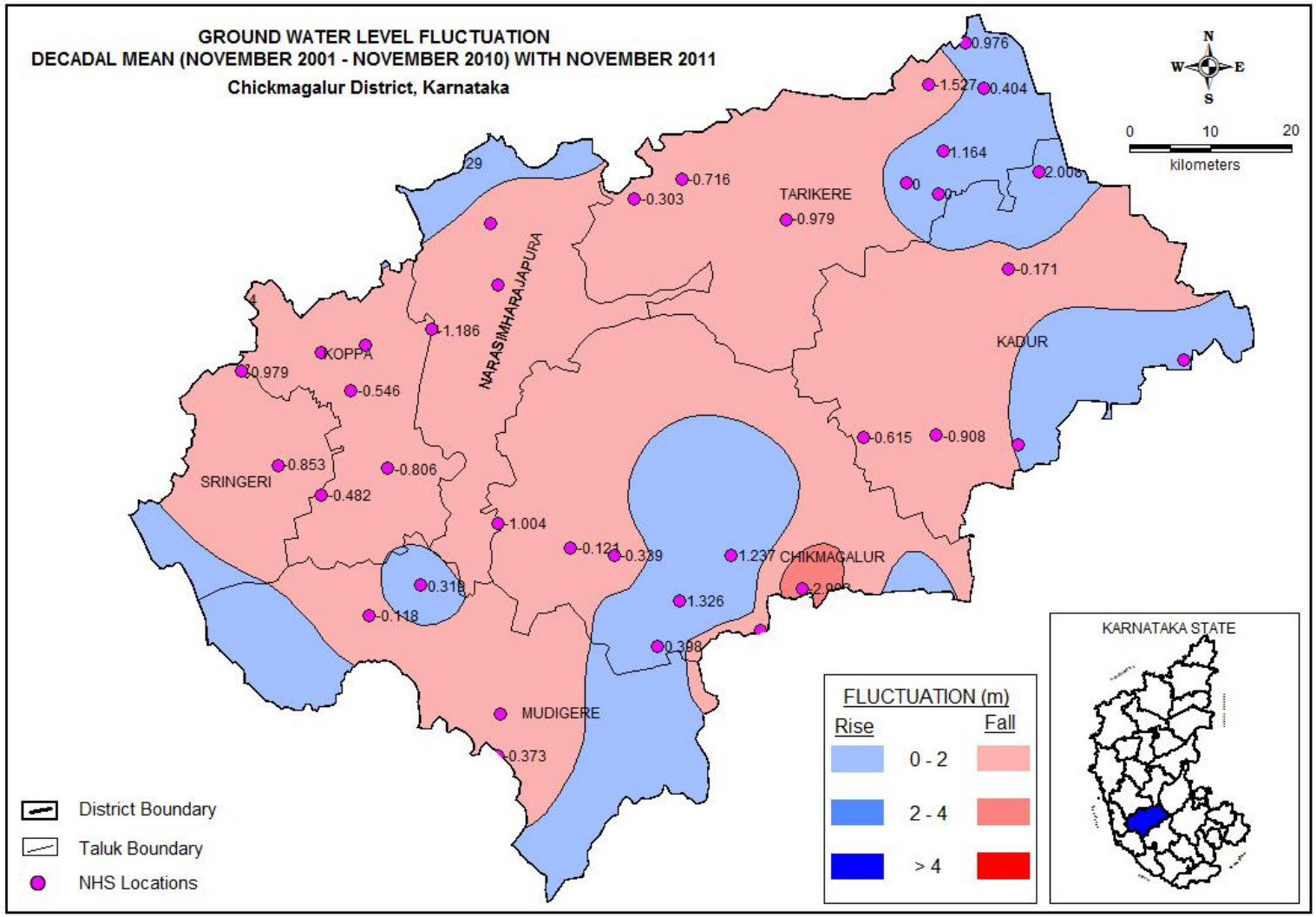

GROUND WATER LEVEL FLUCTUATION
DECADAL MEAN (MAY 2001 - MAY 2010) WITH MAY 2011
Chickmagalur District, Karnataka
N
W
E
S
0
10
20
kilometers
-6.838
0.549
TARIKERE
0
1.936
0
0
0
0
0.024
NARASIMHARAJAPURA
KOPPA
0.056
0.366
KADUR
0.384
0
0
SRINGERI
0.156
0.161
0.757
3.606
0.694
0.484
2.471
CHIKMAGALUR
1.632
0.014
1.852
MUDIGERE
1.026
FLUCTUATION (m)
Rise
Fall
0 - 2
2 - 4
> 4
KARNATAKA STATE
District Boundary
Taluk Boundary
NHS Locations

Fig. 7b


GROUND WATER LEVEL FLUCTUATION
DECADAL MEAN (NOVEMBER 2001 - NOVEMBER 2010) WITH NOVEMBER 2011
Chickmagalur District, Karnataka
N
W
E
S
0
10
20
kilometers
0.976
1.527
0.404
1.164
2.008
0.716
0.303
TARIKERE
0.979
0.171
KADUR
NARASIMHARAJAPURA
1.186
KOPPA
0.979
0.546
0.615
0.908
0.853
0.806
SRINGERI
0.482
1.004
0.121
0.339
1.237
CHIKMAGALUR
0.318
1.326
0.118
0.398
MUDIGERE
0.373
District Boundary
Taluk Boundary
NHS Locations
FLUCTUATION (m)
Rise
Fall
0 - 2
2 - 4
> 4
KARNATAKA STATE

aquifers conducted in the area during hydrogeological surveys shows that specific capacity varies from 7.3 to 71 lpm/mdd.

4.1.3 Koppa Taluk

Western part of the area in Koppa taluk is covered by gneiss and central and northern part of the taluk occupied by schist formation. Fractured and jointed gneiss and schist serves as potential aquifers in the area (Figure - 4). Depth of weathered zone ranges from 7.15 to 11.05 m bgl. Pre-monsoon depth to water level during the year 2011 (Figure - 5) ranges from 6.0 to 9.68 mbgl and post-monsoon depth to water level (Figure - 6) ranges from 5.46 to 8.15 mbgl and seasonal water level fluctuation ranges from 0.53 to 1.07 m. Based on water level data of the National hydrograph stations located (Figure – 7a & 7b) in the taluk (long term water level trend 2001 to 2010), it is observed that hydrograph of Koppa shows rising trend during pre-monsoon and post-monsoon period at the rate of 0.115 and 0.116 m/year respectively. Hydrograph located at Narve show fallinf trend at the rate of 0.02 m/year during post – monsoon period. Pumping tests on shallow aquifers conducted in the area during hydrogeological surveys shows that specific capacity varies from 9.10 to 65 lpm/mdd.

4.1.4 Mudigere Taluk

Nearly 60% of the area in Mudigere talk is covered by gneiss and rest of the area is occupied by schist formation. Weathered fractured and jointed gneiss and schist serves as potential aquifers in the area (Figure - 4). Depth of weathered zone ranges from 7.95 to 12.20 m bgl. Pre-monsoon depth to water level during the year 2011 (Figure - 5) ranges from 4.62 to 13.61 mbgl. Post-monsoon depth to water level (Figure - 6) ranges from 3.63 to 7.78 mbgl and seasonal water level fluctuation ranges from 0.10 to 7.74 m. Based on water level data of the National hydrograph stations located (Figure – 7a & 7b) in the taluk (long term water level trend 2001 to 2010), it is observed that all hydrographs of Mudigere taluk show rising trend during pre – monsoon, the maximum rise in depth to water level recorded at Halemudigere as 0.31 m/year. During post - monsoon period also all hydrographs show rising trend & maximum rise is recorded at Bhavikere as 0.29 m/year. Pumping tests on shallow aquifers conducted in the area during hydrogeological surveys shows that specific capacity varies from 8.5 to 398 lpm/mdd.

4.1.5 N.R.Pura Taluk

Nearly 90% of the area in N.R.Pura taluk is covered by gneiss and rest of the area is occupied by schist formation. Weathered fractured and jointed gneiss and schist serves as potential aquifers in the area (Figure - 4). Depth of weathered zone ranges from 10.68 to 13.41m bgl. Pre-monsoon depth to water level during the year 2011 (Figure - 5) ranges from 4.67 to 9.20 mbgl. Post-monsoon depth to water level (Figure - 6) ranges from 3.75 to 6.67 mbgl and seasonal water level fluctuation ranges from 2.0 to 3.6 m. Based on water level data of the National hydrograph stations (Figure 7a – 7b) located in the taluk (long term water level trend 1996 to 2005), it is observed that the hydrograph of N.R.pura shows maximum rising trend during pre – monsoon to the tune of 0.32 m/year and during post - monsoon period hydrograph of Shettikoppa shows maximum rising trend of 0.35 m/year.

4.1.6 Sringeri taluk

Nearly 70% of the area in Sringeri taluk is covered by gneiss and rest of the area is occupied by schist formation. Weathered, fractured and jointed gneiss and schist serves as potential aquifers in the area (Figure - 4). Depth of weathered zone ranges from 7.17 to 15.20 m bgl. Pre - monsoon depth to water level during the year 2011 (Figure - 5) ranges from 3.15 to 12.26 mbgl. Post-monsoon DTW (Figure - 6) ranges from 3.27 to 10.03 mbgl and seasonal water level fluctuation ranges from 0.12 to 2.29 m. Based on water level data of the National hydrograph stations (Figure 7a & 7b) located in the taluk (long term water level trend 2001 to 2010), it is observed that the hydrograph of Begaru shows maximum rising trend to the tune of 0.22 m/year during pre – monsoon period and hydrograph of Jayapura shows falling trend to the tune of 0.011 m/year during pre – monsoon period. During post – monsoon period, hydrograph at Begaru & Samse show rising trend to the tune of 0.196 & 0.021 m/year respectively. However, hydrographs at Jayapura & Sringeri show falling trend to the tune of 0.02 & 0.019 m/year respectively during post – monsoon period.

4.1.7 Tarikere taluk

Nearly 50% of the area in Tarikere taluk is covered by gneiss and rest of the area is occupied by schist formation. Weathered, fractured and jointed gneiss and schist serves as potential aquifers in the area (Figure - 4). Depth of weathered zone ranges from 6.85 to 20.7 m bgl. Pre-monsoon depth to water level during the year 2011 (Figure - 5) ranges from 1.69 to 16.02 mbgl. Post-monsoon depth to water level

(Figure - 6) ranges from 0.81 to 15.93 mbgl and seasonal water level fluctuation ranges from 0.02 to 5.78 m. Based on water level data of the National hydrograph stations (Figure 7a & 7b) located in the taluk (long term water level trend 2001 to 2010), it is observed that all the hydrographs show rising trend during both pre and post monsoon period at the rate of 0.02 to 0.84 & 0.04 to 1.80 m/year respectively. The hydrograph of Agrahara show maximum rising trent to the tune of 0.84 m/year during pre – monsoon and at Shivane R. S show maximum rising trend to the tune of 1.80 m/year during post – monsoon.

4.2 Ground Water Resources

The resource estimation and categorization is carried out as per the recommendations of "Ground Water Estimation Methodology – 97" (GEM – 97) considering water shed as a unit. Water shed and hydrological boundaries do not match with the administrative boundaries. As a result, different parts of taluk fall in different watersheds having different stages of ground water development and categorization. However, for administrative convenience taluk wise data is preferred. Hence, taluk wise resource and average stage of development is computed on prorata basis from watershed data and presented in Table 2.

Data illustrated in Table - 2, indicates that net annual ground water availability for the district is 51097 ham, gross ground water draft is 23529 ham and ground water balance available for further ground water development is 27622 ham.

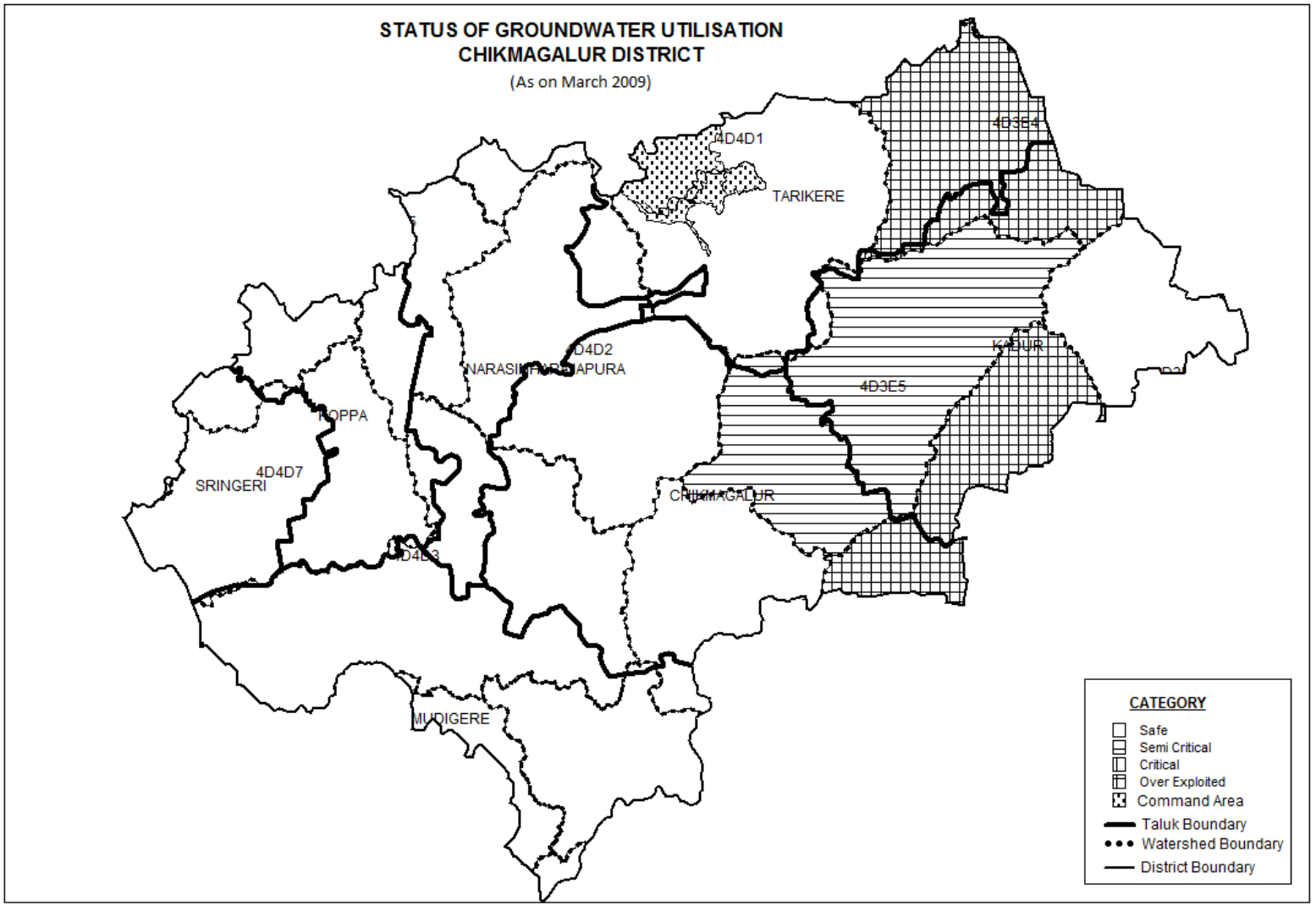
Entire area of Koppa, Mudigere, N.R. Pura and Sringeri taluks are SAFE for ground water development. More than 50% of the area of Chikmagalur taluk is SAFE and only a small portion towards eastern part of Kadur taluk is SAFE. < 50% of Kadur taluk falls in OVER EXPLOITED category and the remaining portion is SEMI - CRITICAL. Chikmagalur taluk is partly SEMI – CRITICAL & OVER EXPLOITED (Figure – 8). A moderate portion in northeastern & eastern part of Tarikere taluk is OVER EXPLOITED.

Table 2: Groundwater Resource and Stage of Development of Chikmagalur District, Karnataka State as on March 2009

TALUK	Recharge from rainfall during monsoon season (HAM)	Recharge from other sources during monsoon season (HAM)	Recharge from rainfall during non-monsoon season (HAM)	Recharge from other sources during non-monsoon season (HAM)	Annual replenishable GW Resource(HAM)	Natural discharge during non-monsoon season(HAM)	Net Ground water Availability (HAM)	Irrigation draft (HAM)	Domestic and industrial draft (HAM)	Total annual ground water draft for all uses (HAM)	Projected domestic and industrial draft 2025 (HAM)	Net Ground water availability for future irrigation development (HAM)	Stage of development (%)	Categorization
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CHIKMAGALUR	1955	1463	2220	424	6061	433	5628	2042	409	2451	490	3099	44	SAFE(P)
KADUR	3767	2016	3722	1447	10951	1095	9856	8610	557	9167	615	1316	93	Semicritical(P)
KOPPA	3920	1192	775	128	6015	501	5513	501	162	663	184	4828	12	SAFE
MUDIGERE	3495	700	1725	148	6069	894	5175	784	1085	1868	1265	3126	36	SAFE
N.R. PURA	4529	1026	1622	113	7291	511	6780	490	146	637	173	6116	9	SAFE
SRINGERI	5757	1368	1018	504	8648	2012	6636	2410	548	2958	655	3571	45	SAFE
TARIKERE	2688	4611	1779	3395	12474	964	11509	5383	402	5785	654	5566	50	SAFE(P)
TOTAL	**26111**	**12376**	**12861**	**6159**	**57509**	**6410**	**51097**	**20220**	**3955**	**23529**	**4036**	**27622**	**46**	

Criteria for categorization of taluks: (i) Full- Entire taluk falling under a particular category; (ii) Partial (P): >50% of the area of the taluk falling under a category; (iii) Partial (P-I): where non of the category is having more than 50% area (**As per Figure 8**).

Fig. 8


STATUS OF GROUNDWATER UTILISATION
CHIKMAGALUR DISTRICT
(As on March 2009)
4D4D1
TARIKERE
4D3E4
4D4D2
NARASIMHARAJAPURA
KOPPA
4D4D7
SRINGERI
4D3E5
KADUR
CHIKMAGALUR
MUDIGERE
CATEGORY
Safe
Semi Critical
Critical
Over Exploited
Command Area
Taluk Boundary
Watershed Boundary
District Boundary

4.3 Ground Water Quality

Ground water quality in the wells tapping weathered and fractured crystalline formations is generally good and suitable for drinking as well as for irrigation purposes. The electrical conductivity (EC) of ground water varies from 100 to 3000 micro mhos/cm at 25ºC. EC of more than 2000 μs /cm occurs along Kadur-Tarikere border and in the southeastern parts of Kadur taluk. Fluoride concentration in ground water in the district is less than 1 mg/l. However, Nitrate concentration of more than permissible limit occurs in > 50% area of Kadur taluk and also in a minor portion towards eastern part of Chikmagalur taluk, as depicted in Figure – 9.

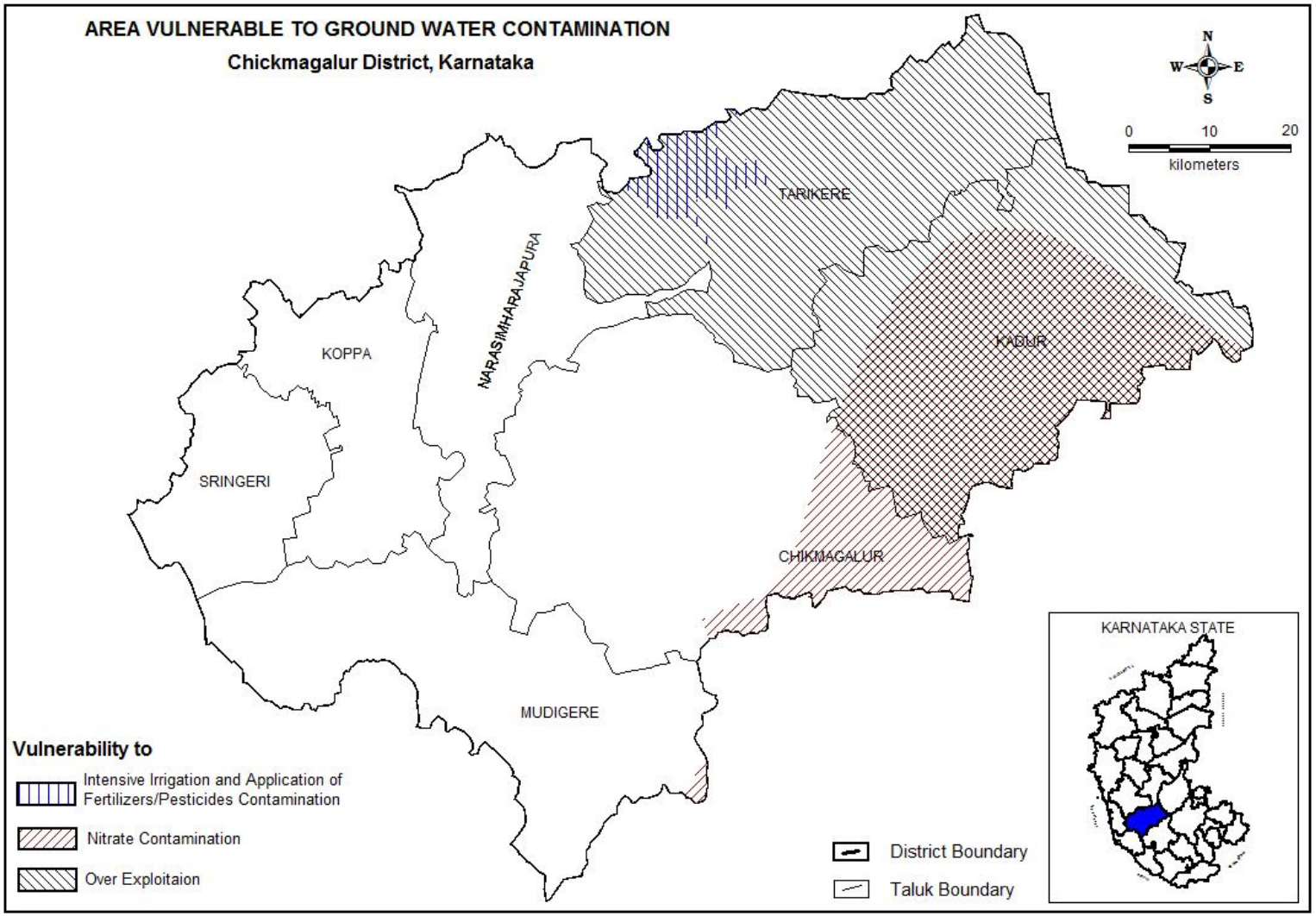
4.4 Status of Ground Water Development

Owing to hilly and undulating terrain condition, uneven distribution of aquifers, financial constraints of marginal farmers and non-availability of cultivable land, ground water development is in low pace in the district. The farmers with small acreage of land depend mainly on rainwater and water available in shallow wells. The abstraction structures, dug-wells and bore wells constructed/existing are mainly tapping aquifers within depth range 5.55 to 20.70 mbgl and 75 to 200 mbgl respectively. Major ground water developmental activities are concentrated in the valley regions, along the banks of rivers/streams and a moderate development is observed in undulating land/plateau. Yield of wells recorded in the district varies from negligible to maximum of 65 m^3/day. Ground water extraction for irrigation is practiced through shallow abstraction structures (dug well) and bore wells, found all over the area in the district. Owing to the steep and undulating terrain with large subsurface flow condition, irrigation is practiced only in the valley region. Out of the net sown area of 298842 ha (4^{th} Census of Minor Irrigation Schemes) and net irrigated area of 49075 ha, only 26546 ha (4^{th} Census of Minor Irrigation Schemes) of land comes under irrigation through ground water. Keeping in view of the available cultivable wasteland and unused annual utilizable ground water resource availability and marginal growth rate in agricultural sector, there is a need to develop the wastelands to bring ground water irrigation in practice specially in Koppa, Mudigere, N.R.Pura and Sringeri taluks. A marginal area taken up for ground water developments in the upstream areas would improve the agricultural production.

5.0 Ground Water Management Strategy

Proper groundwater resource management strategy is essential to make most economical, efficient and judicious use of ground water and to achieve a sustainable ground water resources development. Inculcating awareness in water users on the ground water potentialities in

Fig. 9


AREA VULNERABLE TO GROUND WATER CONTAMINATION
Chickmagalur District, Karnataka
N
W
E
S
0
10
20
kilometers
TARIKERE
NARASIMHARAJAPURA
KOPPA
KADUR
SRINGERI
CHIKMAGALUR
MUDIGERE
KARNATAKA STATE
Vulnerability to
Intensive Irrigation and Application of Fertilizers/Pesticides Contamination
Nitrate Contamination
Over Exploitaion
District Boundary
Taluk Boundary

different terrain conditions and its judicious use is essential. Conjunctive use of ground water and surface water can improve unfavourable scenario. In view of ever-growing population and subsequent demand for groundwater for various developmental activities, it is suggested to adopt unconventional means to artificially recharge the ground water in the water level depleting areas specially in eastern part of Chickmagalur taluk, major part of Kadur taluk and eatern part of Tarikere taluk, where the areas fall in semi critical to over exploited category to facilitate the increased ground water availability to the downstream areas. Since, water management is an integral part of environmental management and ecological stability it should be looked holistically. Development of water supply model should be resource based and the whole problem should be tackled in its totality, particularly from the point of view of total supply and ever growing demand for the precious natural resource.

5.1 Ground Water Development

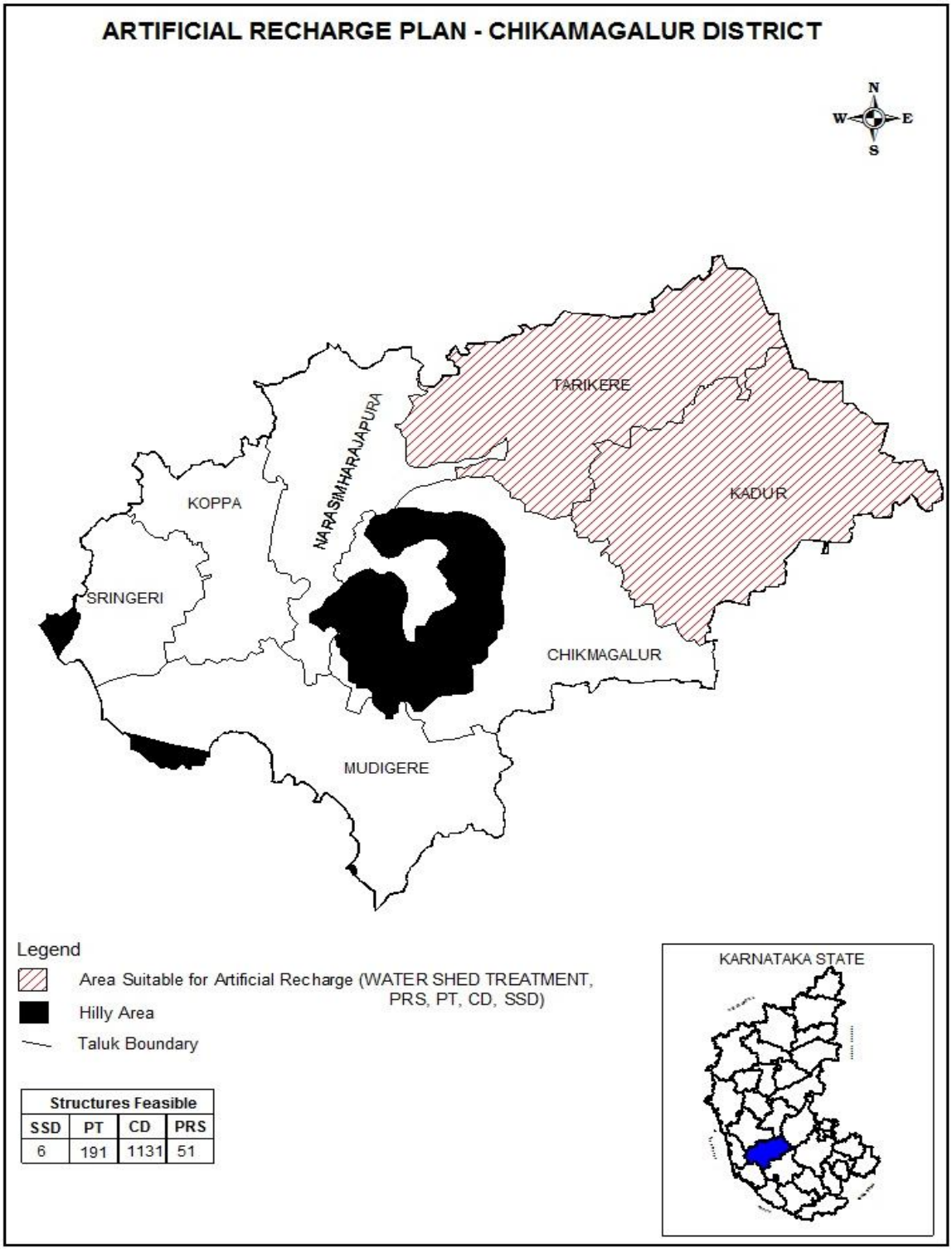
Ground water development is on large scale in eastern part of Chickmagalur, Kadur and Tarikere taluks through structures like dug wells and bore wells. This is mainly due to the liberal financing by various banks for agricultural development. In other four taluks namely Koppa, Mudigere, N.R.Pura and Sringeri taluks, there is vast scope for further ground water development as the entire area in these taluks falls in safe category (Table-2, Fig-8). Ground water can be developed by sinking bore wells in hydrogelogically favorable areas. The sites for drilling bore wells should be selected on sound scientific principles (based on hydrogeological and geophysical surveys).

5.2 Water Conservation and Artificial Recharge

Because of deforestation and bringing more and more grass covered areas for other activities during recent times, the natural way of recharging dynamic reserves of ground water has reduced considerably. Most of the rains falling on the surface of the land flow out of the area immediately as surface run off, causing floods and soil erosion. By constructing suitable structures the contact time of this flowing water with the land is increased or the flow is arrested for some time.

By studying the nature of geological formations, slope of the land, depth of weathering, depth to water level and availability of land and water source for the artificial recharge structures, different types of artificial structures are recommended and shown in the map (Figure – 10). The plain lands on eastern parts of the district covering the areas in Chickmagalur , Kadur and

Fig. 10


ARTIFICIAL RECHARGE PLAN - CHIKAMAGALUR DISTRICT
N
W
E
S
TARIKERE
NARASIMHARAJAPURA
KADUR
KOPPA
SRINGERI
CHIKMAGALUR
MUDIGERE
Legend
Area Suitable for Artificial Recharge (WATER SHED TREATMENT, PRS, PT, CD, SSD)
Hilly Area
Taluk Boundary
Structures Feasible
SSD PT CD PRS
6 191 1131 51
KARNATAKA STATE

Tarikere taluks, suitable artificial recharge structures (Figure - 10) like Check dams, Nalabunds, Sub-surface dykes, Percolation tanks, and point recharge structures like recharging through existing borewells/ dugwells and recharge pits can be done. The areas in other four taluks namely Koppa, Mudigere, N.R.Pura and Sringeri taluks, artificial recharge structures are not feasible because this area receives high annual rainfall to the tune of 1500 to 3000 mm, more over the area in all these four taluks falls in SAFE CATEGORY. The base flow available in the streams and rivers during non-monsoon season (December to April) in these taluks may be arrested through construction of vented dams (Kholhapur type veirs) at suitable sites. This water can be used for either water supply to town and villages in the area or for lift irrigation.

6.0 Awareness & Training activity

Mass Awareness Programme (under AAP 98-99) was conducted at Tangli village in Kadur taluk, Chikmagalur district on 25.03.99 in the premises of primary health unit, Tangli village, to educate people on the utilization of ground water, conservation and prevention of pollution. The meeting was well attended by the local state Govt. authorities and local farmers. Pamphlets giving the details and objectives of 'Ground Water Authority' in Kannada and English were distributed. In general, activities of CGWB, importance of ground water, its qualities, general measures of conserving it, role of farmers in achieving these objectives and activities of CGWB under exploration programme in Kadur taluk were discussed during the awareness programme.

Training Programme on Ground Water Management was organized during 28.11.2006 to 29.11.2006 at Zilla Panchayat Meeting Hall, Chikmagalur. The training programme was organized as a nationwide programme for officers of different departments attached to Zilla Panchayat, NGOs', representatives of farmers and Education Institutions etc. The curriculum of the training programme included water management, ground water conservation, artificial recharge techniques, water quality and its effects on human health, geophysical studies, role of women in water management etc. A Field visit was also planned under the programme covering the area where artificial recharge structures have been constructed. Various scientific aspects of ground water, detailed studies of rainfall pattern and documentaries were presented in the training programme. Certificates were distributed to the trainees after completion of the programme.

7.0 Recommendations

Considering the prevailing scenario of the groundwater resources and development the following recommendations are made for the optimum drawl with sustainable development ground water resources in the district.

1. There is vast scope for further ground water development in Koppa, Mudigere, N.R.Pura and Sringeri taluks, as the area in all these taluks falls in SAFE CATEGORY. Ground water can be developed through construction of additional ground water structures like bore wells.

2. Northern & north-eastern part of Chikmagalur taluk, northern, central, western & south-western part of Kadur taluk falls under SEMI CRITICAL CATEGORY. Eastern part of Tarikere taluk, eastern & south-eastern part of Kadur taluk, small portion in the eastern part of Chikmagalur taluk fall in OVER EXPLOITED CATEGORY. In these areas ground water withdrawal is to be regulated and ground water management strategy should be adopted to minimise abstraction. Farmers should adopt micro irrigation system like sprinkler & drip irrigation system, so that more area can be brought under ground water irrigation with the same draft and crop yield will be more. Artificial recharge structures like Check dams, Nala bunds, Sub- surface dykes, percolation tanks, contour trenches and contour bunds are to be constructed at suitable sites for ground water recharge.

3. All most all areas in Koppa, Mudigere, N.R.Pura and Sringeri are hilly and the rain fall is also high (1500to 3000 mm). There is no scope for construction of artificial recharge structures because unsaturated aquifers get recharged during South-West monsoon rains.

4. Lot of base flow is available in the streams and rivers of these four taluks during non-monsoon period (December to April), this base flow can be harvested by construction of vented dams at suitable places.

5. The water retained in these vented dams can be utilised for domestic water supply to villages and towns located in the area as the villages and towns located in the area faces acute shortage of drinking water during April and May. The water retained in vented dams can also be utilised for lift irrigation.