



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
CHICKBALLAPUR DISTRICT, KARNATAKA**



**SOUTH WESTERN REGION
BANGALORE
AUGUST 2012**

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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.

Dr. S. C. Dhiman

PREFACE

Ground water contributes to about eighty percent of the drinking water requirements in the rural areas, fifty percent of the urban water requirements and more than fifty percent of the irrigation requirements 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, vulnerability area etc., for all the districts of the country. As part of this, Central Ground Water Board, South Western Region, Bangalore, is preparing such booklets for all the 30 districts of Karnataka state, incorporating the data up to the period 2011-12.

The Chickballapur 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 has been prepared by Shri. B. K. Kallapur, Scientist-D. The figures were prepared by Sri. J. Sivaramakrishnan, Assistant Hydrogeologist and the rainfall data provided by Shri H.P.Jayaprakash Scientist-C. The efforts of Report processing section in finalising and bringing out the report in this format are commendable.

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, academicians, hydrogeologists and engineers to plan the water resources management in a better way in the district.

(Dr. K.Md.Najeeb)
Regional Director

CHICKBALLAPUR DISTRICT AT A GLANCE

SL NO	ITEM	STATISTICS
I	GENERAL INFORMATION	
	i) Geographical Area	4208 Sq. Km
	ii) Administrative Divisions (March 07)	1, Chickballpur
	No. Of Taluks :	6
	No of Panchayats/villages	151 /1321
	iii) Population (as on 2001 census)	12.54 lakhs Density 298 persons/sq.km
	iv) Average annual Rainfall	756 mm
2	GEOMORPHOLOGY	
	Major physiographic units	2
	Major Drainages	3
3	LAND USE	
	a) Forest Area (sq.km)	497.04
	b) Net Area Sown (sq.km)	1694.74
4	MAJOR SOIL TYPES	
		1. Red Loamy 2. Red Sandy 3. Mixed Red
5	AREA UNDER PRINCIPAL CROPS (2009-10)in ha.	
	Ragi	45980
	Paddy	3359
	Maize	39139
	Oil seeds	24904
	Pulses	18236
	Fruits	7957
	Vegetables	5841
6	IRRIGATION BY DIFFERENT SOURCES (in ha)(2009-10)	
	Dug wells	00
	Bore wells	41311
	Tanks	00
	Canals	00
	Other Sources	0.0
	Lift Irrigation	00
	Net Area Irrigated	41311
7	NO .OF GROUND WATER STRUCTURES	
	Domestic BW	5069
	Piped water supply	865
8	NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on 31.03.2011)	
	Dug wells	32.
	Piezometers	13.

9	PREDOMINANT GEOLOGICAL FORMATIONS	Peninsular Gneissic complex (Granites, Gneisses and Chickballapur schist(Horn blende schist and Amphibolite schist)
10	HYDROGEOLOGY	
	Major water bearing formations	Weathered and fractured Granite Gneisses and schists,
	Premonsoon Depth to water level (2011)	1.80 to 11.35 mbgl (NHS OB Dugwells) 8.00 to 26.36 mbgl (pz)
	Postmonsoon Depth to water level (2011)	0.87 to 11.35 mbgl (NHS OB Dugwells) 7.76 to 26.99 mbgl (pz)
	Long term water level trend (2002-2011) in m per year	100% stations show rising premonsoon trend –ranging between 0.054 m to 0.351 m 80 % stations show rising postmonsoon trend ranging between 0.163 m to 0.715 m.
11	GROUND WATER EXPLORATION BY CGWB AS ON MARCH 2012	
	EW (Depth Range /Discharge range) 44	Depth –20.00 –501 mts Discharge –0.078- 14 lps
	OW(Depth Range /Discharge range) 11	Depth - 50.00- 400.5 mts Discharge – negl-6.73 lps
	Total	
	Transmissivity (m ² /day)	4 to 50.
12	GROUND WATER QUALITY	
	Presence of chemical constituents more than permissible limits	Fluoride,
	Type of water	Potable in general
13	DYNAMIC GROUND WATER RESOURCES (as on March 2009) IN HAM	
	Net annual ground water availability	28426
	Existing ground water draft for all uses	40060
	Projected demand for Domestic and Industrial use up to 2025	2387
	Stage of ground water Development (%)	141 %
14	WATER MANAGEMENT TRAINING PROGRAMMES ORGANISED	12.9.06 &13.9.06- Chickballapur No of participants-40
15	EFFORTS OF ARTIFICIAL RECHARGE AND RAINWATER HEAVING	Centrally sponsored scheme in Gauribidinur taluk Demonstrative artificial recharge project.

16	GROUND WATER CONTROL AND REGULATION No of OE Blocks No of safe blocks	NOT NOTIFIED 5 1
17	MAJOR GROUND WATER PROBLEMS AND ISSUES	Water level depletion and yield dwindling in major parts of 5 taluks, over exploited with overall 140 % ground water development. High concentration of fluoride in Bagepally taluk.

CHICKBALLAPUR DISTRICT

1.0 INTRODUCTION :

Chickballapur district is the eastern gateway to Karnataka. It formed by bifurcating old Kolar district in to Chickballapur and Kolar districts. It is land locked district and hard rock terrain of Karnataka in the maiden (plain) region and covers an area of 4208 sq.km. The district lies almost in the central part of peninsular India, which has immense bearing on its geoclimatic conditions. This district experiences tropical climate throughout the year. Chickballapur district owes its prosperity and development to the existence of ancient tanks. There are as many as 1243 tanks located in the district. The main occupation of people is agriculture. In the absence of surface water irrigation system ground water is the main source of irrigation.

1.1 Location:

Chickballapur district lies between North latitude 13° 13' 04" to 13° 58'29" and East Longitude 77° 21' 52" to 78° 12' 31". It is bounded by Bangalore and Tumkur districts on the west, Ananthpur district of Andhra Pradesh on the north, Chittoor district on the east and by Kolar district on the south. Administratively the district is divided into 6 taluks, 26 hoblies, 151 gram- panchayats and 1321 villages. The population as per the 2011 census is 12.54 lakhs and the density of population is 298 per sq.km.

1.2: Administrative setup & Approachability:

Total geographical area of the district is 4208 sq.km .The district is divided into 6 taluks. The Chickballapur district consists of Chickballapur, Chintamani, Siddalghatta, Bagepalley, Gauribidinur and Gudibanda taliuks. The district is well connected by highways and rail. The NH-7 from Bangalore to Hyderabad passes through this district via Chickballapur and Bagepalli towns. The south central railway connecting Bangalore to Hyderabad passes through the district in the western parts of the district. The administrative setup of the district is shown in **Fig -1**

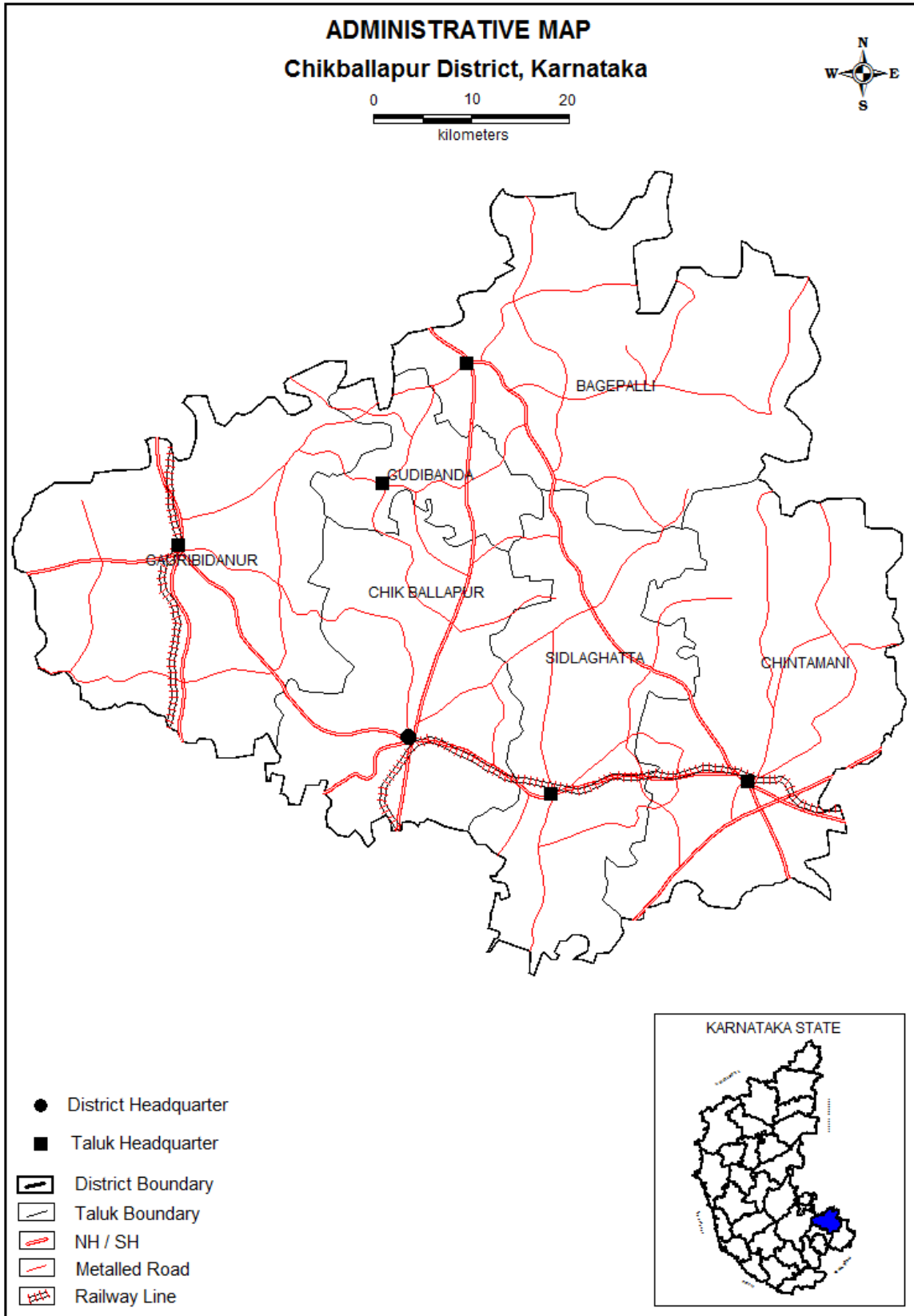
1.3 Demographic features:

The total population in the district is around 12.54 lakhs (as per 2011 census) with poplation density of 298 persons/sq. km. The rural population constitute 9.27 lakhs and urban population constitutes 2.21 lakhs (census 2001) .The schedule cast population constitute 2.47 lakhs and the scheduled tribe population constitutes 1.25 lakhs . The sex ratio in the district is 964 females for every 1000 males.

1.4 Basin and Drainage:

There are no perennial rivers in Chickballapur district .The district is drained by three river basins namely Palar, Ponnaiyar, and Pennar. All these rivers and their tributaries are small and carry water only during rainy season. Palar originates at Ambajidurga hillocks in Chintamani taluk and flows NW-SE direction .The drainage is highly dendritic in nature. The Pennar river originates in Doddapallapura taluk of Bangalore district and flows towards north covering parts of Sidlaghatta, Gowribidinur, Bagepalley and Gudibanda taluks, river Papagni enters in Sidlaghatta taluk and flows towards NE covering parts of Chintamani, Bagepalley, and Sidlaghatta, taluks. North Pinakani originates from nandihills in Chickballpur taluk and flows in Chickballapur and Gowribidanur taluks for about 55 kms and enters

Fig: 1



Anathapura district in Andhra Pradesh state. South Pinakani originates from Nandi hills and flows in Chickballapur and Sidlaghatta taluks for about 110 kms and enters Tamilnadu state. Apart from these river Arkavathi a tributary of Cauvery also originates in Nandi hills and flows only 2.8 kms in the district and enters Bangalore district . The drainage map of the district is given in **Fig -2**

1.5 Land use pattern

11% of the total area of the district is covered by forest and 68 % by cultivable land. 28 % of the area is uncultivated (08-09). Area sown in the district forms 40% of the total area of the district.

1.6 Agriculture and Irrigation practices :

The predominant crops grown are finger millet, groundnut and pulses. Finger millet occupies about 27 % of the total cultivated area. The important irrigated crops are paddy, mulberry, sugarcane, potato and other vegetables. The important commercial fruit crops grown are mango and grapes. The area irrigated by wells constitutes 99% of the total irrigated area. Dug well irrigation practice is largely replaced by bore-well irrigation. Irrigation is being practiced both in the valley as well as in upland areas.

1.7 Studies carried out by CGWB :

Systematic and Reappraisal hydrogeological surveys were carried out in Chickballapur district during different field season programmes from 1984 to 2006. phase-I of Exploratory drilling was carried out during 1988-1990 of maximum depth of 250 mts and phase- II of deep exploratory drilling was carried out between 2009-2012 with 500 m rig capacity for the first time in hard rock terrain.

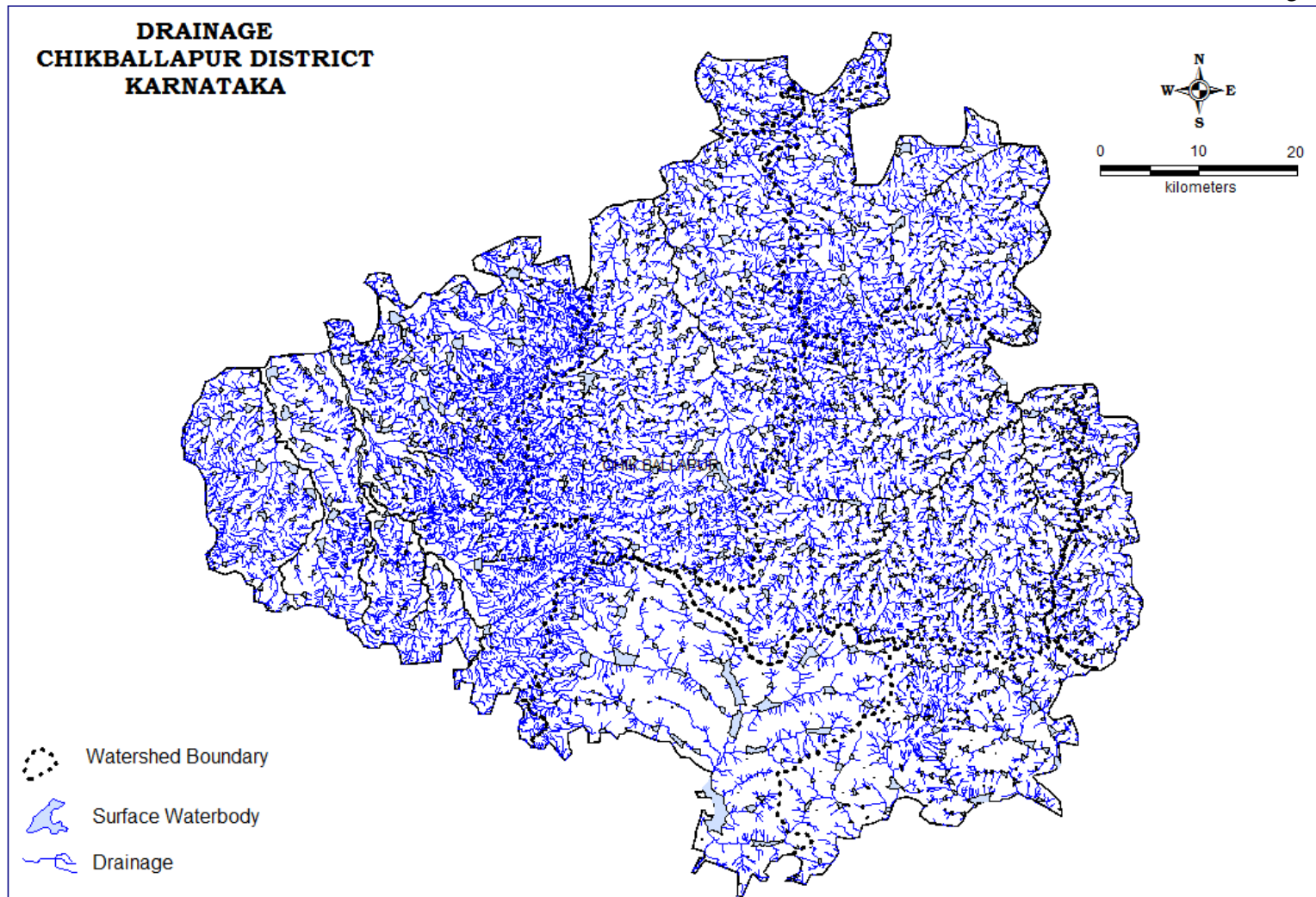
2.0 RAINFALL AND CLIMATE:

Chickballapur district falls in the Eastern dry agro climatic Zone. It experiences a semi-arid climate, characterized by typical monsoon tropical weather with hot summers and mild winters. The year is normally divided into four seasons. They are; a) dry season during Jan-Feb, b) Premonsoon season during Mar-May, c) Southwest Monsoon season during Jun-Sep and d) Post or Northeast monsoon season during Oct-Dec.

There are 6 rain gauge stations in the district, one in each of the 6 taluks. Data from these stations for the period from 1971 to 2000 is analysed. Normal annual rainfall ranges from around 848 mm at Chintamani in west to around 651 mm at Bagepalli in the east averaging 756 mm in the district and for 2011, 676 mm rainfall is recorded

The southwest monsoon contributes around 55 percent of the annual rainfall. The other monsoon (NE) yields around 30 percent. The balance of around 15 percent results from the premonsoon. September and October are the wettest months with over 100mm monthly rainfall. Thunderstorms are common during the month of May. The post monsoon season often gets copious rains due to passing depressions.

Fig 2



There is one meteorological observatory at KGF, which has long term records. The one at Chickballapur is of recent origin. Normally April and May are hottest months with temperatures as high as 40° C. They are generally lowest during December being as low as 10°C. Potential evapotranspiration is around 1550mm annually ranging from 170mm in Apr-May period to less than 100mm during Nov–Dec period.

3.0 GEOMORPHOLOGY AND SOILS:

The topography of the district is undulating to plain. The central and eastern parts of the district forming the valley of Palar Basin, are well cultivated. The northern part of the district forms a depression forming the valley of the North Pinakini River towards Gauribidanur. The general elevation varies from 249 to 911 m above mean sea level

The soils of Chickballapur district occur on different landforms such as hills, ridges, pediments, plains and valleys. The types of soils distributed range from red loamy soil to red sandy soil and lateritic soil. Of the total area, about 73% is suitable for agriculture and horticulture; about 3% for forestry, pasture and the remaining area is suitable for quarrying, mining and as habitat for wildlife.

4.0 GROUND WATER SCENARIO:

4.1 Hydrogeology :

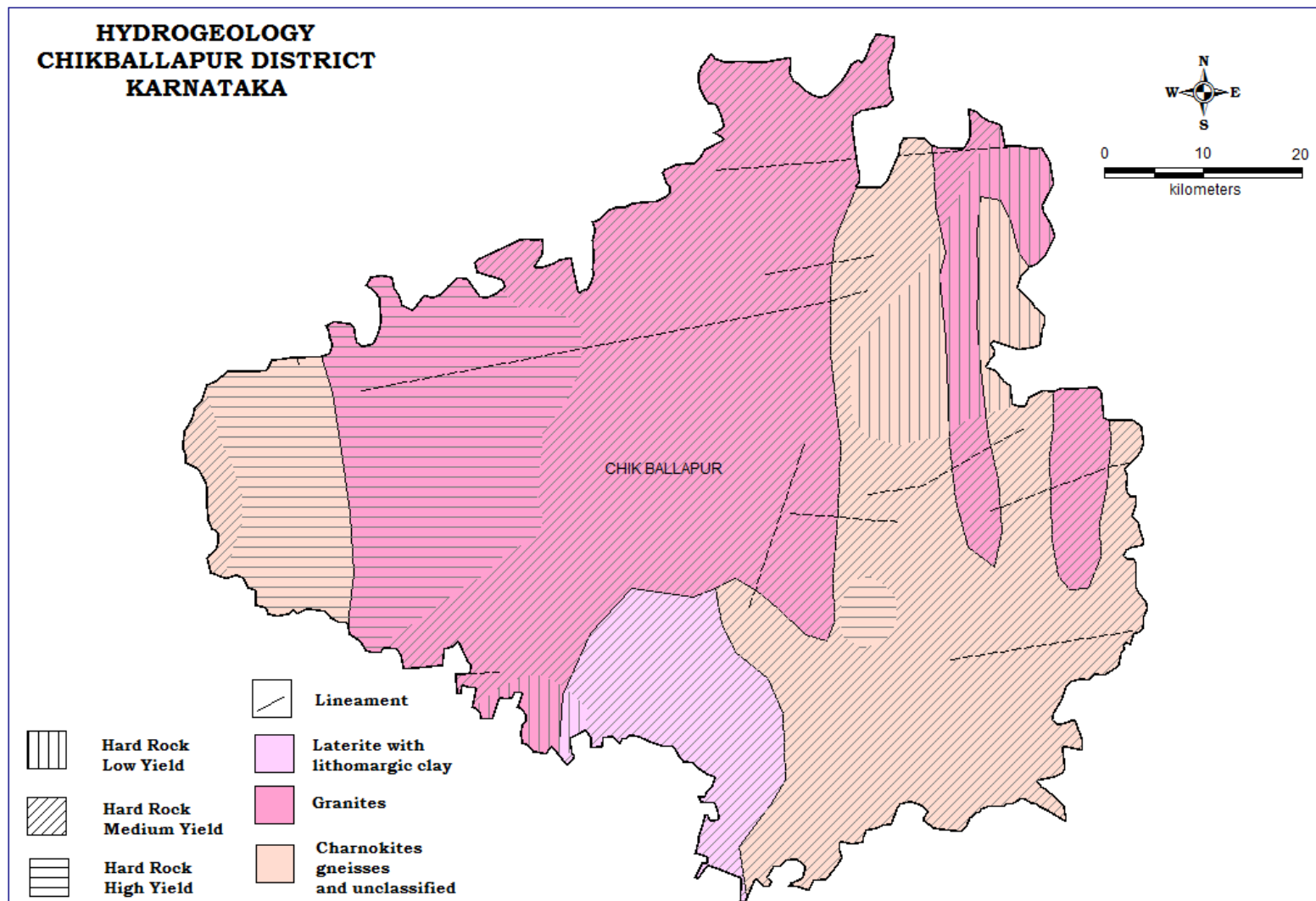
Granites, gneisses, schists, laterites and alluvium underlie the district. Basic dykes intrude the above formations at places. Granites and gneisses occupy major portion of the district. Schists are mostly confined to the northwestern part of Gauribidanur taluk. Laterites occupy small portions in Chickballapur, and Sidlaghatta taluks. Alluvium is confined to river courses. Fractures or lineaments occupy well-defined structural valleys and majority of them trend NE-SW.

The occurrence and movement of ground water is controlled by weathered zone and fractures and fissures that exist in hard rocks. In the district, ground water occurs in phreatic and semi-confined to confined conditions. It also occurs in alluvium under water table conditions. The weathered thickness varies from 6 to 18 m in the majority of the area, except in parts of Sidlaghatta and Chikballapura taluks where it ranges from 40 to 60 m. The depth of water level in piezometer generally ranges from 12 to 49 mbgl. The ground water levels are essentially controlled by physiographic features and rainfall distribution. The hydrogeology map of the Chickballapur district is given in **Fig - 3**

Mode of ground water extraction is through borewells. Among the abstraction structures, borewells are predominant. The yield of borewells in hard rock varies generally from 15 to 200 m³/day. The depth of irrigation borewells range in depth from 100 to 300 mbgl and the yield of borewells ranges from 0.5 to 20 m³/hour.

Semi-confined to confined aquifer is formed due to fractures in hard formations. This aquifer system is developed by bore wells ranging in depth up to 300m. Its yield ranges up to 1200m³/day. and specific capacity ranges from 2 to 173 lpm/m

Fig:3



Premonsoon Water Level (2011)

Out of 32 NHS wells, the water level data is available for only 10 stations. The May 2011 premonsoon depth to water level varies from 1.80 mts (Thondebhav, Gouribidnur taluk) to 11.35 mts (southern part of Chickballapur taluk). A generalised water level map of premonsoon is given as **Fig- 4**. In general, major part of the district comes under 2-10 m bgl depth to water level. The water level recorded in Piezometer stations which represent semi confined aquifer, depth to water levels range between 8-26 m.

Post monsoon Depth to Water Level (2011):

Post monsoon Depth to water level in NHS dug wells ranges from 0.87 mts (Thondebhav, Gouribidnur taluk) to 13.35 mts (Irgampalli, Chintamai taluk). A generalized water level map of postmonsoon is given as **Fig - 5**. In general major part of the district comes under 0-10 m range and small parts in Chintamani taluk show Depth to water level between 10-20 m.

Decadal Water Level Fluctuation [(mean of 2001-2010) compared to 2011]

The mean water level of 2001 to 2010 when compared with water levels of 2011 the fluctuation was mostly in the range of 0-2 m in major parts of the area for premonsoon period (**Fig-6**) and it is in 0-4 m range for most part of the district for post monsoon period (**Fig-7**).

Long term water level trend (2002-2011)

Out of 32 observations wells the long-term trend for premonsoon period is available for nine stations and all are showing rising trend in the range of 0.054 to 0.686 m/year. The postmonsoon long term water level trend is available for 10 stations, out of which eight stations show rising trends in the range of 0.163 to 0.715 m/year and remaining two stations show falling trend in the range of 0.209 and 0.399 m/year.

Out of 13 piezometer network stations, the long term trends for premonsoon period is available for 10 stations. Five stations are showing declining trend in the range of 0.011 to 6.257 m/year and remaining 5 stations show rising trend in the range of 0.042 to 1.131 m/year. The long term trend for post monsoon period is also available for 10 piezometer network stations and five are showing declining trends in the range of 0.004 to 2.87 m/year. The remaining 5 stations are showing rising trends in the range of 0.36 to 2.63 m/year.

Aquifer parameters/well parameters of unconfined aquifer:

Specific capacity of dugwells ranges from 0.22 to 1.69 m³/min/m with unit area sp.capacity ranging from 0.357 to 47 l/m/m/m².

Aquifer parameters of confined aquifers :

Central Ground Water Board, South western Region, Bangalore has carried out drilling in two phases. Under first phase During 1988-1990, 30 no E.W and 3 OW s were drilled. The depth range of these wells were in the range of 20 to 260m and yield range was between 0.5 to 7.46 lps.

Fig-4

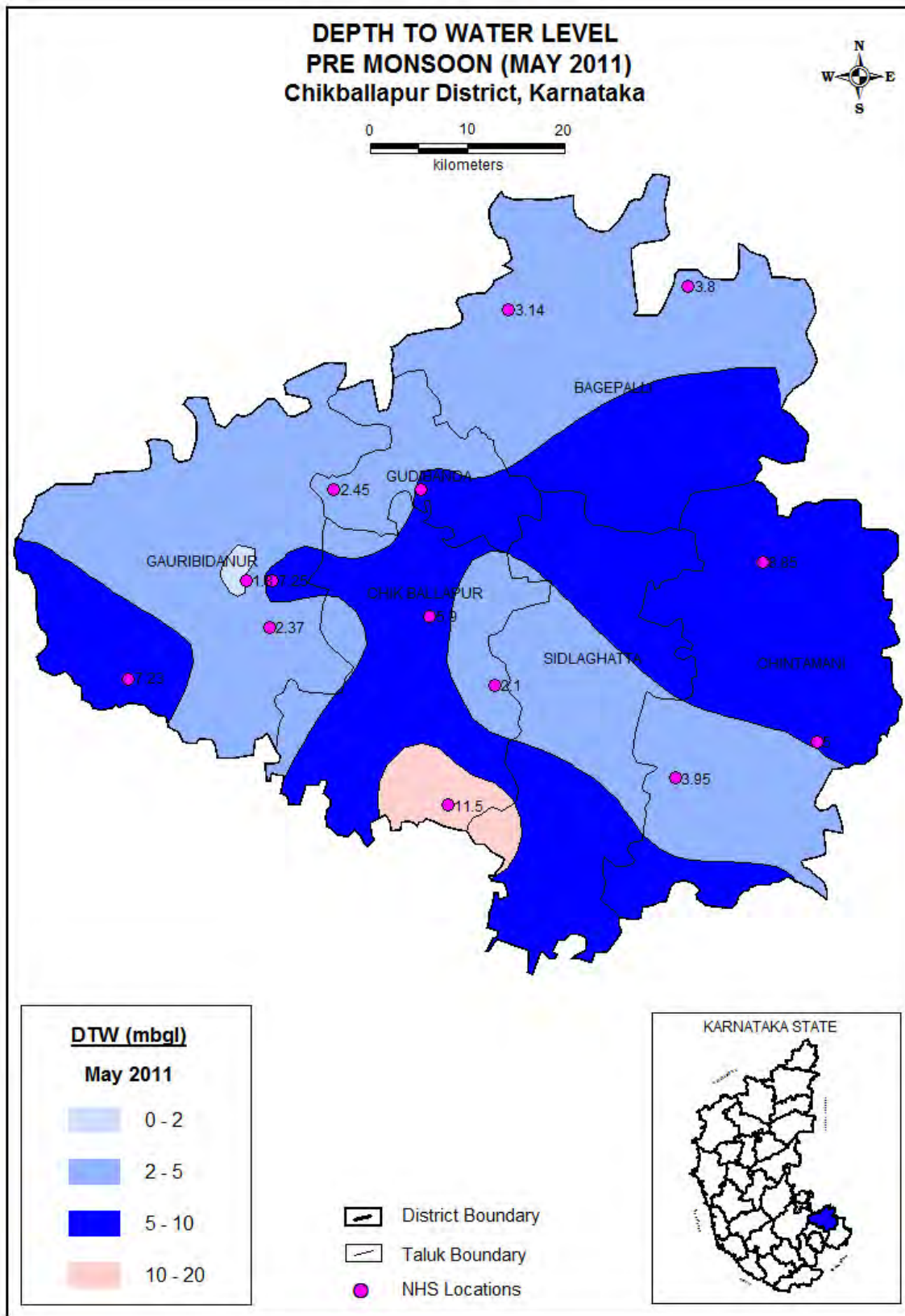


Fig-5

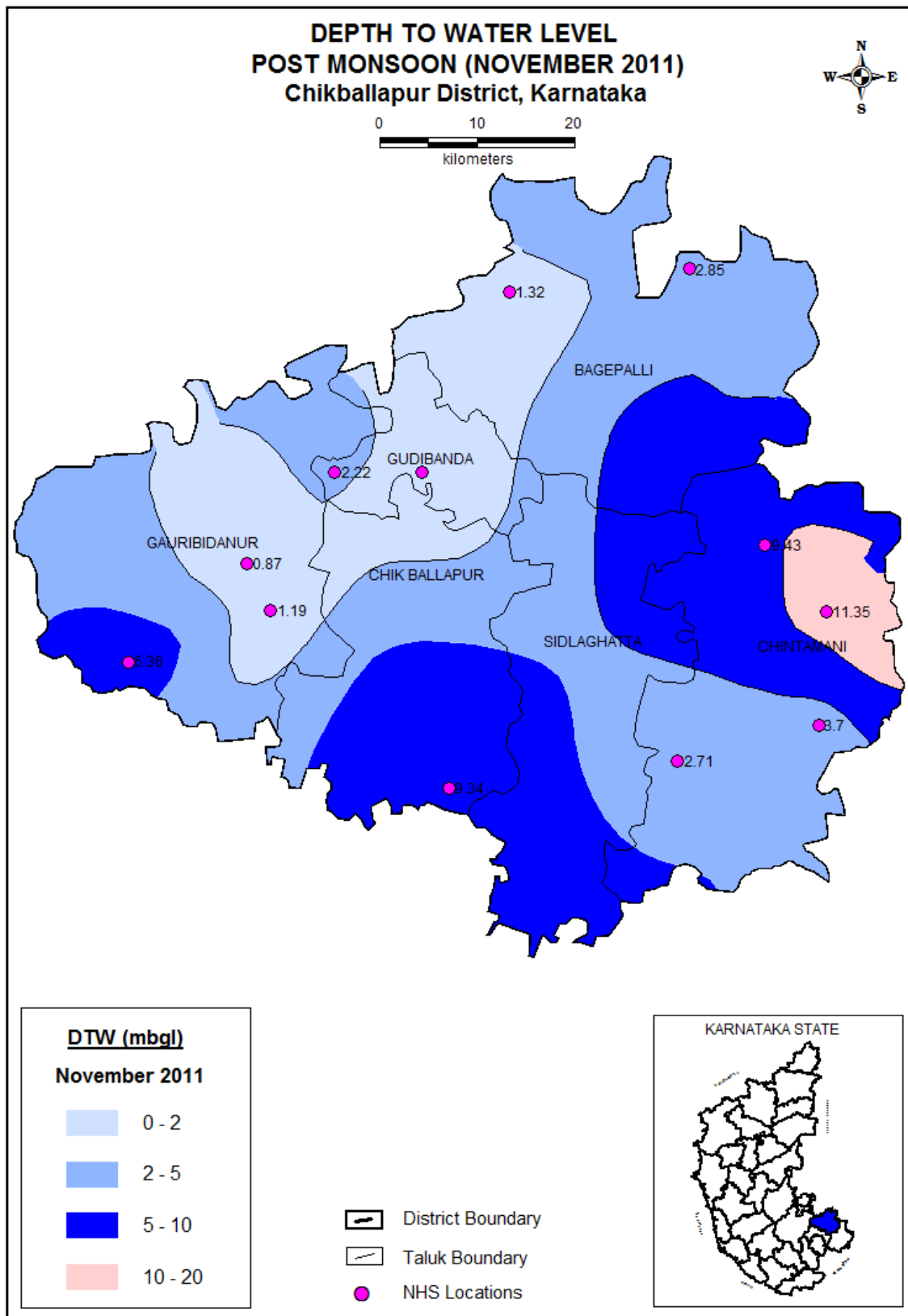


Fig-6

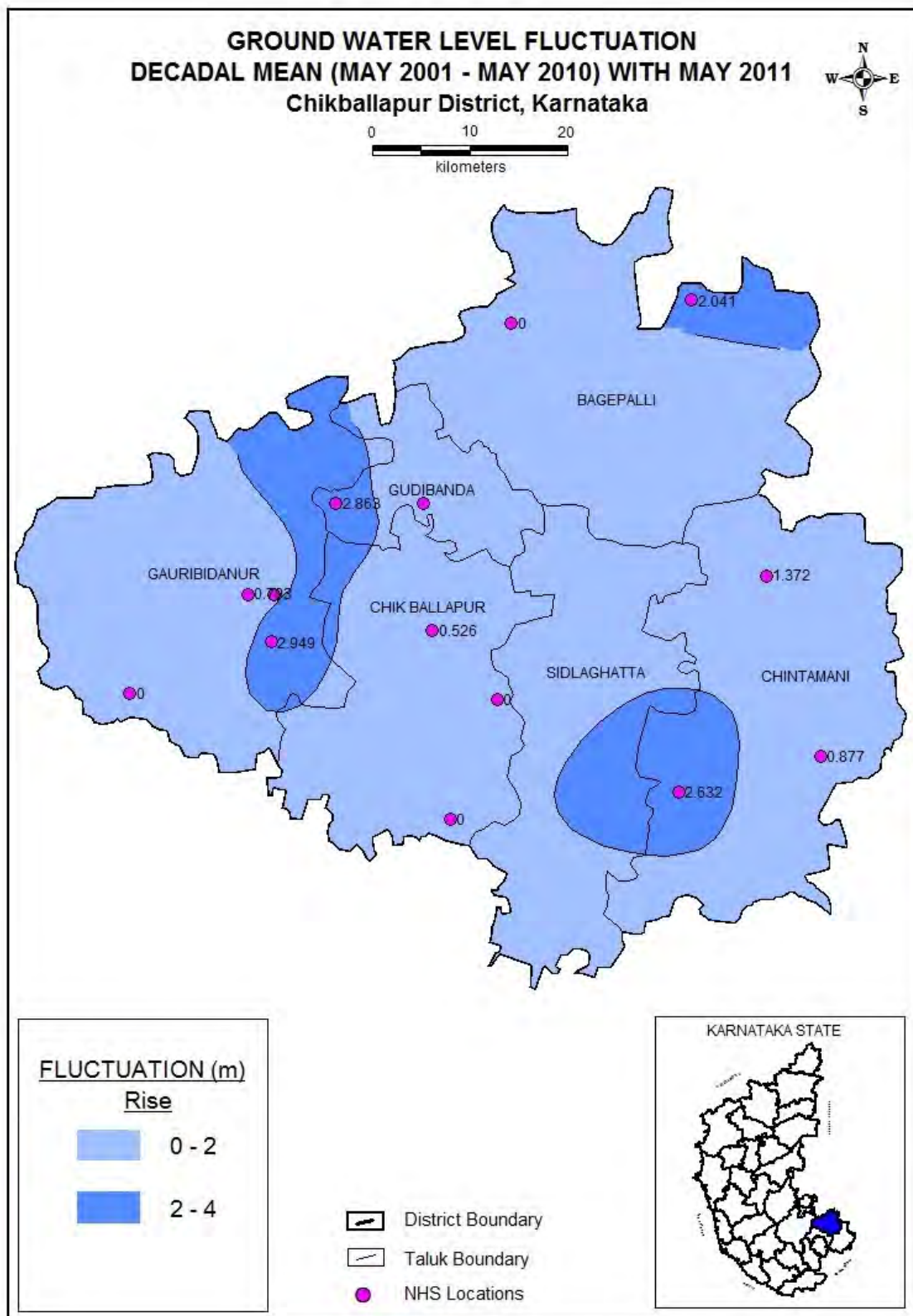
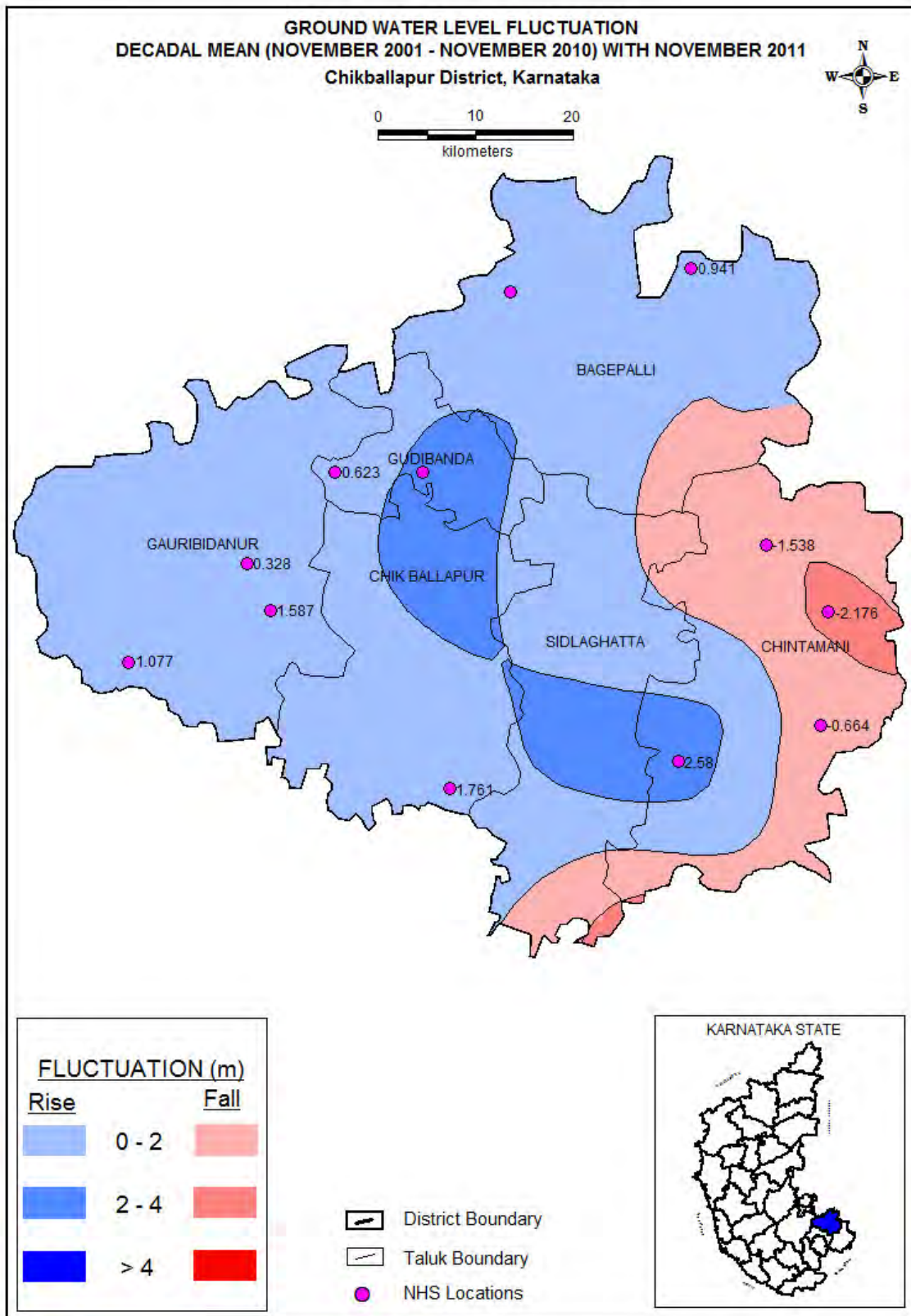


Fig-7



During second phase between 2008-2012 , 14 E.W and and 11 OWs were drilled with 500m capacity rig. The depth range of the wells ranging between 103.1 to 5001 m and discharges recorded were between 0.5 to 12.76 lps. The T values ranging between 4 to 50 m² /day. The location of exploration wells is given in **Fig-8**.

The average annual unit draft of bore-wells for the district is 1.1 Ha.m. As per well census 2005-06 data the well density for the different taluks ranges from 4.47 (Bagepalli) to 7.96 wells/sq.km. (Shidlaghatta). The average well density for the district works out to be 6.65 wells/sq.km.

4.2 Ground water Resources:

Taluk-wise ground water resources, drafts, balance resources available and the category as on March 2009 are given table –1.

Table-1 Summary of the ground water estimation as on March 2009 for Chickballapur district

Sl No	Taluk	Net Annual Ground water Availability (HAM)	Existing Ground water Draft for all uses (HAM)	Net Ground water Availability for future Irrigation Development (HAM)	Catagorisation based on Stage of Ground water Development (% area)			
					Safe	Semi-critical	Critical	Over Exploited
1	Bagepalli	6483	5442	1671	55	-	-	45
2	Chikballapur	4319	6921	0	-	-	-	100
3	Chintamani	5286	7908	28	-	-	-	100
4	Gauri-bidanur	3973	7540	0	-	-	-	100
5	Gudibanda	2375	3803	0	-	-	-	100
6	Sidlaghatta	5990	8446	0	-	-	-	100
7	Total	28426	40060	1699	-	-	-	-

The net annual ground water availability of the district is 28426 Ham , draft for all uses is 40060 ham and available resources for future irrigation development is 1699 ham . Out of 6 taluks 5 are over exploited and in Bagepally taluk about 55% of the area is safe. Average stage of development is 140 %. There is over draft of 11634 ham annually in the district .The map showing unit area annual ground water recharge potential is given as **Fig –9**. The unit area annual recharge values are ranging from 0.025 to 0.10 m for the district. Taluk wise resources and categorization are given in table-1 and as **Fig- 10**.

4.3 Ground Water Quality:

In general, the ground water is of acceptable quality for irrigation and domestic use. The pH value of ground water ranges from 7 to 8.67 indicating that the water is alkaline in nature. In major part of the district the specific conductance values are within 2000 us/cm at 25° C. Fluoride concentration of more than 1.5 mg/l. is reported from Bagepalli taluk. However, some of the exploratory borewells also have recorded fluoride concentration of 2mg/l and above. Nitrate concentration of more than 45 ppm is reported from parts of Mulbagal, Bangarpet and Malur taluks. A ground water vulnerability map is presented as **Fig –11**, showing distribution of Fluoride , Nitrate in ground water and areas with fertiliser and pesticide contaminated ground waters in the district.

Fig-8

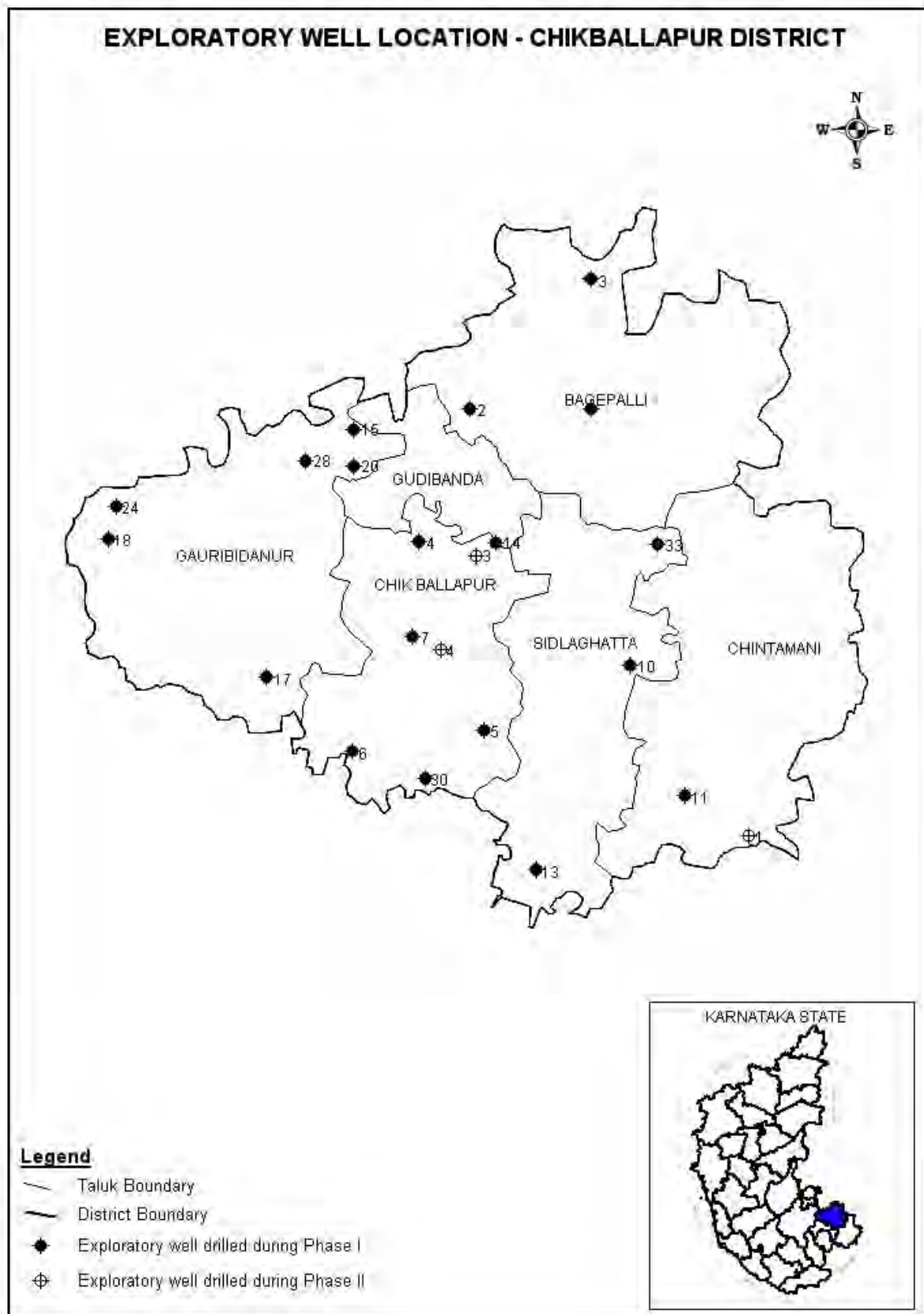
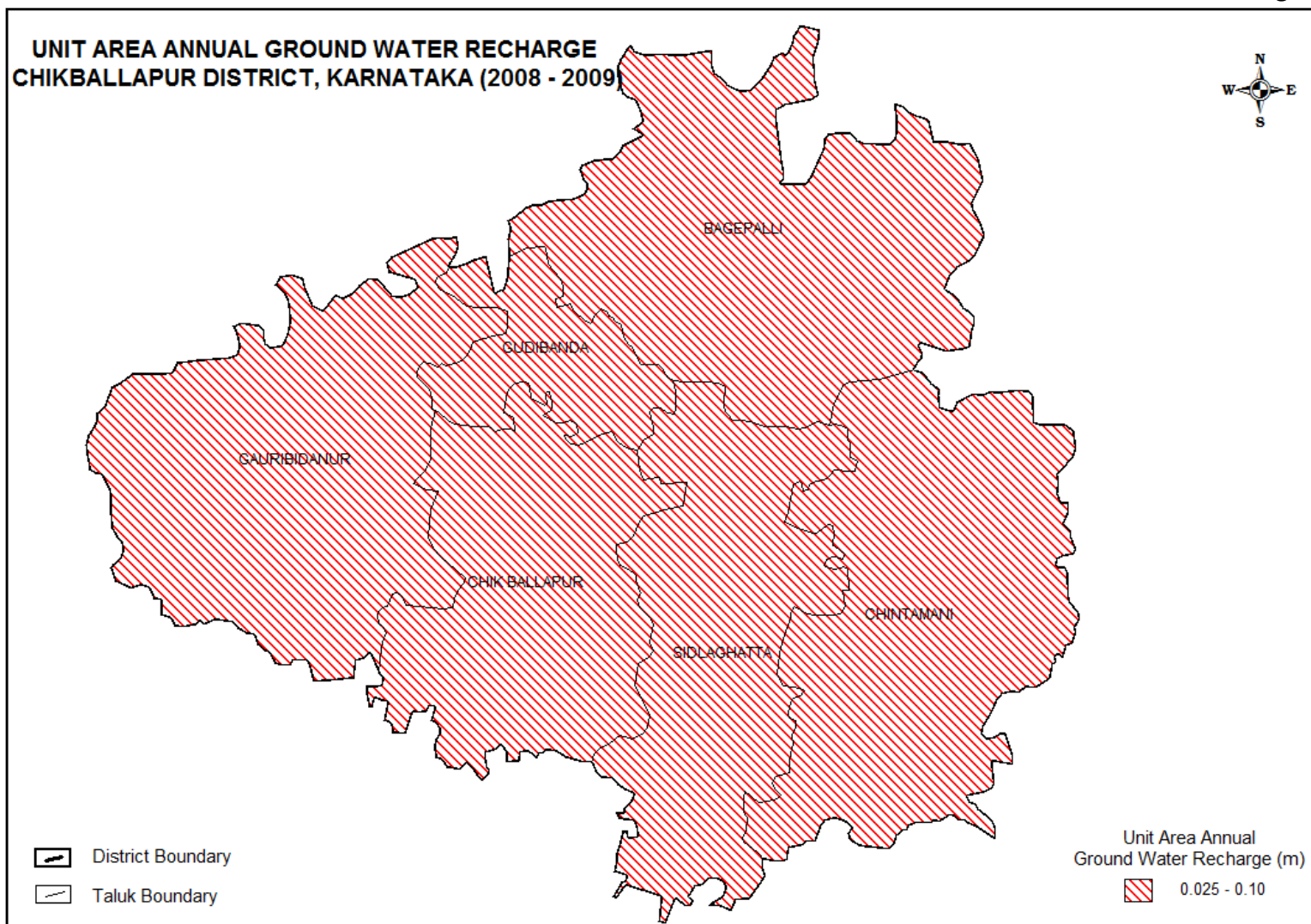


Fig: 9



4.4 Status of groundwater development :

Wells are the major source of irrigation in the district. There are about 683 dug wells and 29016 bore wells in the district as per 4rd MI census. 345 dug wells and 930 bore wells have gone dry in the district due to lowering of water level. Talukwise breakup of the wells is given in table 2.

Table 2: Distribution of wells according to status as per MI Census 2005-06

SI No	Taluk	Wells in Use		Wells dried up	
		Dug Wells	Shallow BW	Dug Wells	BW
1	Bagepally	380	4345	193	225
2	Chickballapur	248	5884	143	618
3	Chintamani	17	5955	0	1
4	Gauribidanur	21	6226	0	26
5	Gudibanda	50	1302	9	48
6	Siddlaghatta	17	5304	0	12
	Total	683	29016	345	930

5.0 GROUND WATER MANAGEMENT STRATEGY :

5.1 Ground Water Development

Ground water is developed both for the domestic and irrigation purposes. Almost the entire domestic water requirement for 12.54 lakh population and the live stock is met by ground water. Well irrigation constitutes about 99% of total irrigation. 29016 tube wells/ borewells are in use in the district. As on 2005-06 there are altogether 5069 domestic borewells and 865 piped water supply in Chickballapur district which are wholly dependent on ground water. Even though Chickballapur district is having vast number of irrigation tanks (1243 tanks), their dependability for irrigation again depends upon rainfall conditions. Hence, ground water has a special significance for the all-round development of this water-starved district and plays a vital role in the development of this drought-prone area.

As per the ground water resource estimation, all taluks, except Bagepalli come under the over-exploited category as shown in **Fig-10**. There is almost no resource for further development in these taluks.

5.2 Water conversation and Artificial Recharge :

CGWB has carried out experimental artificial recharge studies under Central Sector Scheme in Gauribidanur taluk during 1994-95 to 1998-99. Under this, gravity recharge experiments in two wellfields at Belchikkanahalli and Hussainpura, Gauribidanur taluk, and roof-top rain harvesting structure and point recharge studies at five locations in Hosur (2 Nos.) Baktharahalli & Sonaganahalli in Gauribidanur taluk were experimented. The above studies have shown favourable results in building up storage in the area to the tune of 3 to 7 m. and resulted in an improvement in the productivity of irrigation borewells.

Fig-10

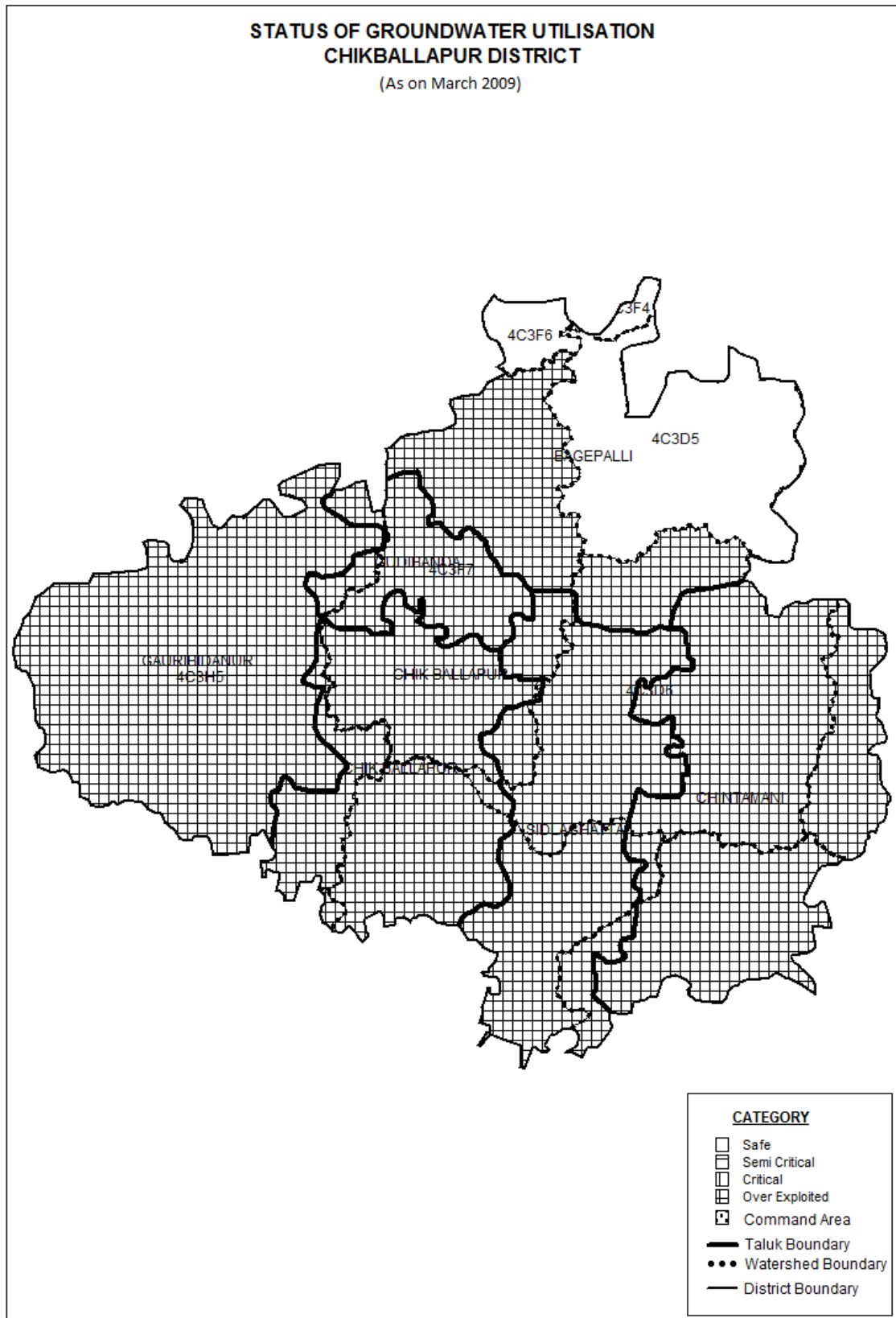
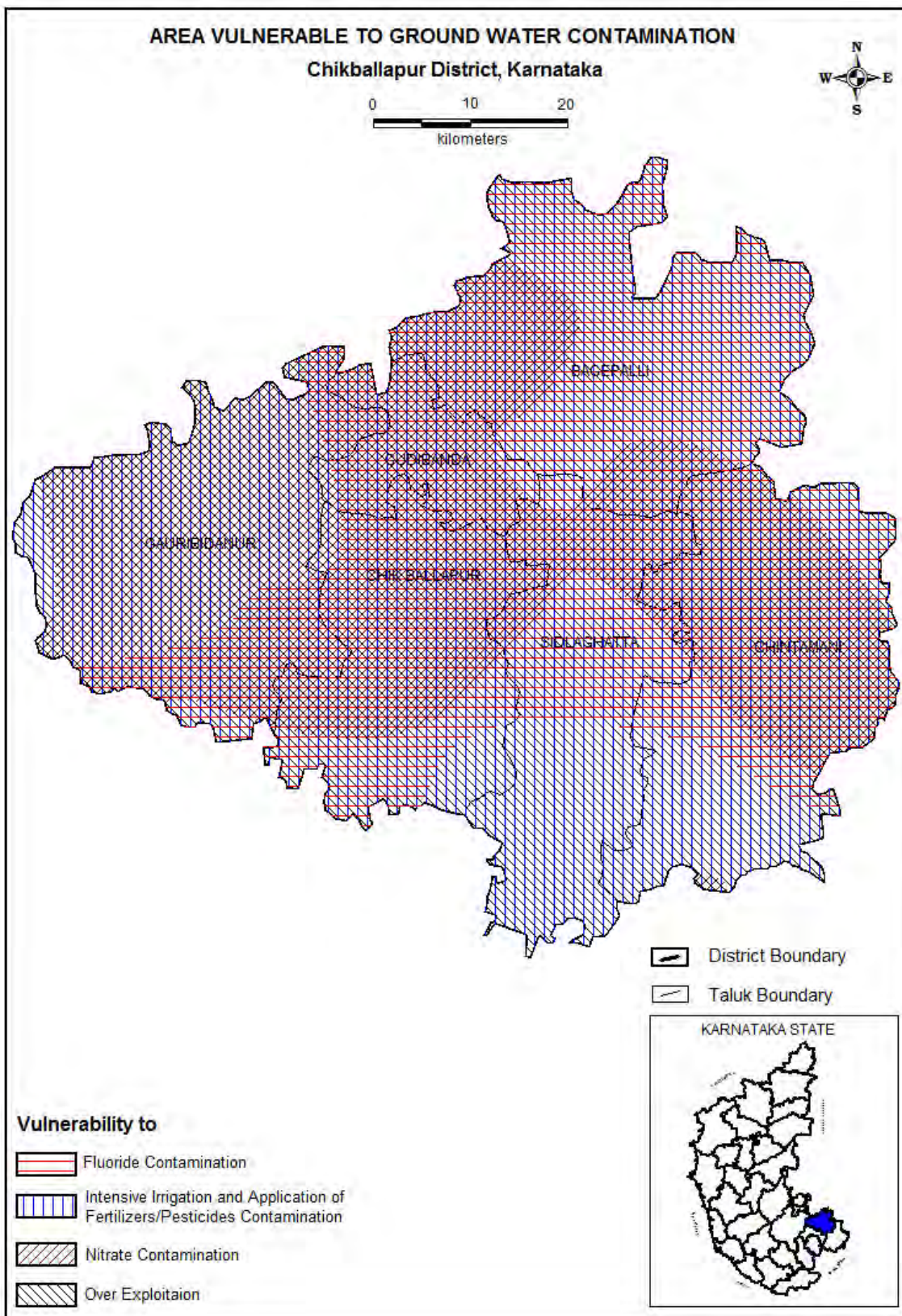


Fig-11



A map showing artificial recharge plan for the district is presented as **Fig-12**. The whole district is feasible for artificial recharge practices. With the available resources as many as 16 subsurface dykes, 542 percolation tanks, 3213 check dams and as many as 145 point recharge structures can be constructed in the district

6.0 GROUND WATER ISSUES AND PROBLEMS:

Ground water plays an important role in the economy of the farmers of the Chickballapur district. This district is popularly known as land of Silk and Milk. Agriculture was mainly dependent on irrigation facility by numerable widely distributed tanks during earlier days. Due to drought situations farmers are now mainly depending upon borewells for their irrigation needs. There are about 29016 bore wells in the district, which reflects on the dependency of farmers on ground water

Taluk-wise ground water resources, drafts, balance resources available and the category as on March 2009 are given in table-1. The figures indicates a limited scope for further exploitation of ground water in parts of Bagepalli taluk only. All the other taluks are over exploited. On an average over draft of 11634 ham per year is occurring in the district which results in continuous lowering of water table.

Fluoride concentration of more than 1.5 mg/l. is reported from Bagepalli taluk and other parts. However, some of the exploratory borewells also have recorded fluoride concentration of 2mg/l. and above. Nitrate concentration of more than 45 ppm is reported from many parts of the district.

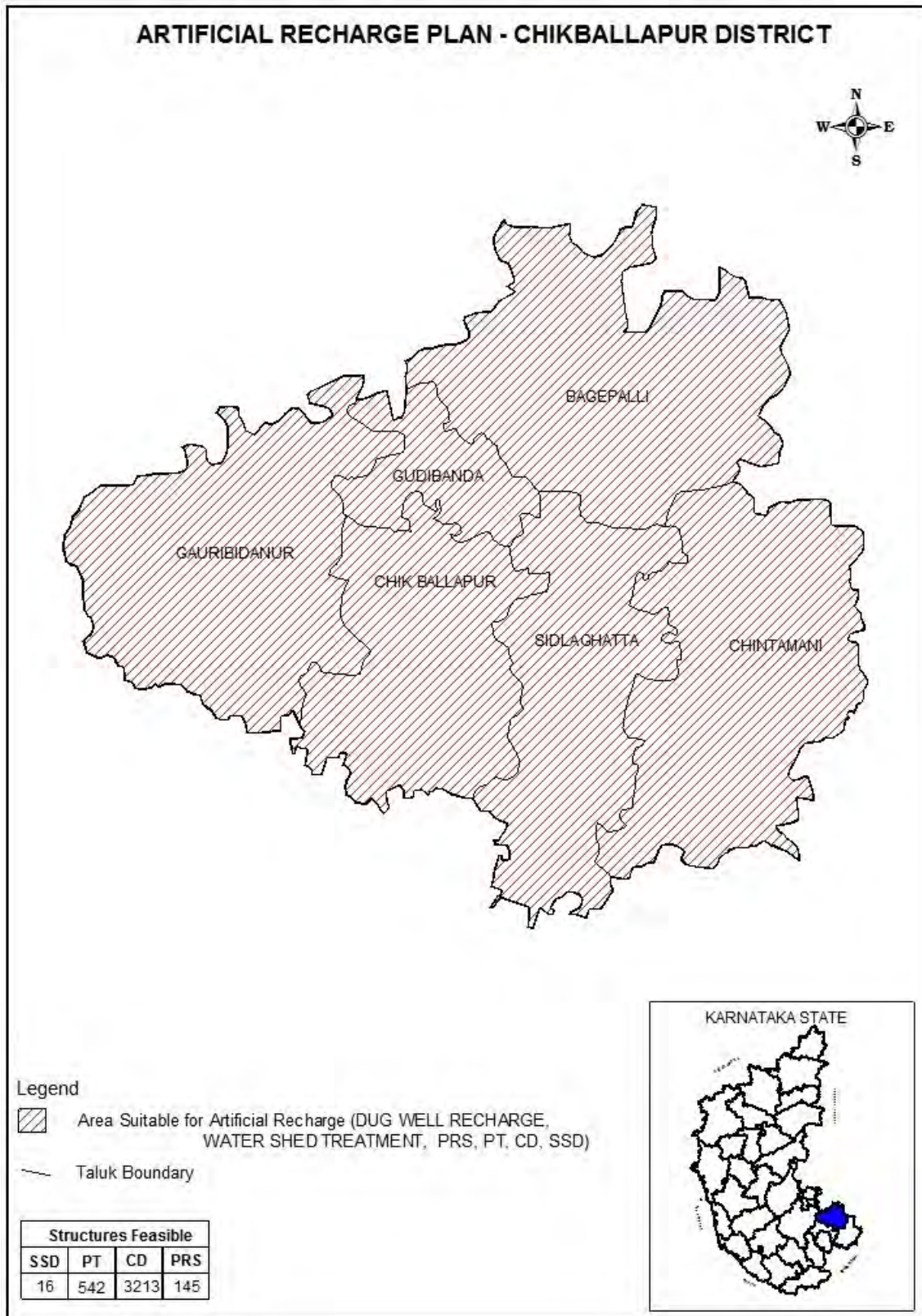
7.0 AWARENESS TRAINING ACTIVITY:

7.1 Mass awareness and Water Management Training programmes :

Water Management Training programme on artificial recharge techniques was conducted between 12/09/06 and on 13/09/2006 at Chickballapur and participated by around 40 trainees from various state government departments, NGOs and progressive farmers of the district.

8.0. Areas notified by CGWA/SGWA – Nil

Fig-12



9.0 . Recommendations :

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

1. Construction of check dams and sub surface dykes at appropriate places across the nallahs and streams in the water table depleting areas, over exploited, critical areas of the district and the areas where water quality problem exists may be taken on priority basis.
2. Considering the fresh water scarcity in the district, a comprehensive programme should be formulated to harvest the rain water through roof top, check dams, surface tanks, bunds and subsurface dykes to use the resources directly from the structures, which in turn to arrest the sub surface flows and augment the groundwater resources.
3. The ground water worthy areas such as topographic lows, valley portions low fluctuations zones should be developed with an adequate soil conservation measures to prevent the soil erosions during rainy seasons.
4. Constant monitoring of ground water quality should be carried out in the fluoride-contaminated areas to prevent further deterioration and related problems. The determination of trace elements and organic compound be done to help in categorizing the quality of water.
5. A detailed geophysical study with the help of the state of the art technology should be conducted to demarcate the extent of potential aquifers and its geometry, especially in central plain region.
6. Except part of Bagepally taluk all other areas come under over exploited categories. In these taluks Ground water legislation should be implemented to avoid further adverse effects of ground water system of the area
7. In semi-urban areas like Chickballapur town and other taluk Head quarters a lot of roof area is available for rooftop rain water harvesting. So in these semi-urban areas rooftop rainwater harvesting practices may be encouraged. This will help in reducing the load on urban water supply systems.