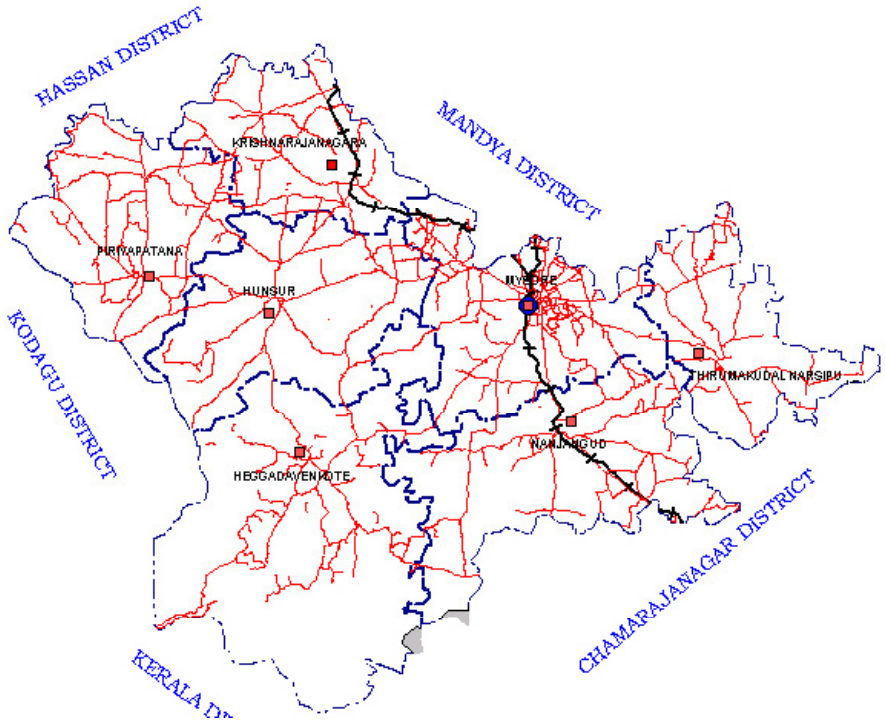
जल वर्ष 2007 Water Year 2007

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
MYSORE DISTRICT, KARNATAKA



SOUTH WESTERN REGION
BANGALORE
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FOREWORD

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, 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 27 districts of Karnataka state, of which six of the districts fall under farmers' distress category.

The **Mysore** 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 M.A.Farooqi, Assistant Hydrogeologist**, under the guidance of Dr. K. Md. Najeeb, Superintending Hydrogeologist, Central Ground Water Board, South Western Region, Bangalore. The figures were prepared by S/Sri. H.P.Jayaprakash, Scientist-C and K.Rajarajan, Assistant Hydrogeologist. 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, hydrogeologists and engineers to plan the water resources management in a better way in the district.

(T.M.HUNSE)
Regional Director

MYSORE DISTRICT AT A GLANCE

Sl. No.	ITEMS	STATISTICS	
1	**GENERAL INFORMATION**		
	i) Geographical area (Sq Km)	6763.82	
	ii) Administrative Divisions		
	Number of Tehsils / taluks	7, H.D.Kote, Hunsur, K.R.Nagar, Mysore, Nanjangud, Periyapatna, T. Narasipur	
	No. of Panchayat /Villages :	235/1216 + 124	
	iii) Population (As on 2001 Census)	26,41,027	
	iv) Average annual rain fall (1901-70)	782 (697 – 904) mm	
2	**GEOMORPHOLOGY**		
	Major Physiographic Units	The district is classified as uplands area. However the south-western parts of the district falls under semi-malnad category with elevation ranging from 2200 to 3150 mamsl, where as the general elevation of uplands is 700-900 m amsl. The malnad region is covered under forest. The Hekkan betta (3732 m amsl) of the Naganpur Reserved Forest, the Shige betta (3724 m amsl) of the Ainurmarigudi Reserved Forest and the Jainbaribetta (3231 m amsl) of the Bedrampadi reserved forest mark the water divide making the southern boundary of H.D. Kote taluk and also of the district.	
	Major Drainages	Drained by 5 perennial rivers namely East flowing Cauvery, Kabini, Nugu, Gundal and Lakshmanthirtha The major drainage in the district is the east flowing Cauvery River. The main Cauvery River flows from west to east in the northern parts of the district till its confluence in the K.R.Sagar reservoir.	
3	**LAND USE (Sq Km)**		
	Forest area	628.51	
	Net area sown	4864.1	
	Cultivable area	-	
4	**MAJOR SOIL TYPES**	Red sandy soils, Red loamy soils And Deep black soils	
5	**AREA UNDER PRINCIPAL CROPS (2004-2005) in ha**	**Crop**	**Area**
		Paddy	118084
		Ragi	79824
		Jowar	19819
		Pulses	119016
		Oilseeds	25551
		Fruits & Vegetable	9572
		Sugar cane	9535

		Tobacco Cotton Others **Total**	59482 71938 69785 **582606**
6	**IRRIGATION BY DIFFERENT SOURCES** Dug wells Bore wells Tanks/ Ponds Canals Lift Other Sources	**Area (Ha)** 10323 5795 17377 87685 375 -	**Number** - - -
	Net Irrigated Area	**121555**	
7	**NUMBER OF GROUND WATER MONITORING STATIONS OF CGWB** (As on 31-03-2007) Number Dug wells Number of Piezometers	 53 12	
8	**PREDOMINANT GEOLOGICAL FORMATIONS**		
	Recent	Alluvium	
	~~ U n c o n	f o r m i t y ~~~~~~~~~~~~~~~~~~~~	
	Pre-Cambrian (Intrusives)	Closepet Granites, Ultra basic / Basic Intrusives	
	Lower Pre-Cambrian	Metavolcanics, Metasediments	
	Archaean	Gneisses and Charnockites	
9	**HYDROGEOLOGY**		
	Major Water Bearing Formations -		
	Shallow aquifers of alluvium along the stream courses and weathered zones of Granites and gneisses occurring between the depths of 8 to 14 m bgl.		
	Deeper aquifers of jointed and fractured Granites, gneisses and Charnockites occurring between the depths of 25 to 200 m bgl.		
	Pre-monsoon Water Levels during 2006		1.66 – 12.75 m bgl
	Post-monsoon Water Levels during 2006		0.40 – 10.82 m bgl
	Long term water level trends (1997-2006) in m/year:	Pre-monsoon	At nineteen National Hydrograph Stations (NHS) water levels have shown rising trend in the range of 0.012 to 1.709 m/year, while at sixteen NH Stations water levels have recorded falling trend in the range of 0.039 to 0.565 m/year.

		Post-monsoon	At twenty NH Stations water levels have shown rising trend in the range of 0.006 to 1.237 m/year, at fifteen NH Stations water levels have shown falling trend in the range of 0.020 to 0.440 m/year.
10	**GROUND WATER EXPLORATION BY C.G.W.B. (As on 31-03-2007)**		
	No of wells drilled		EW: 34, OW: 18,
	Depth range (m)		35.00 – 92.00 m bgl
	Discharge (litres / second)		<1.0 – 8.0 Litres / second.
	Storitivity (S)		
	Transmissivity (m2/day)		20 – 900 m2 / day.
11	**GROUND WATER QUALITY**		
	Presence of chemical constituent more than the permissible limit		Chemical quality of Ground water Suitable for all purposes in Major parts of the district.
12	**DYNAMIC GROUND WATER RESOURCES** (mcm) (2004)		
	Annual replenishable Ground Water Resources		42944.34
	Net annual Ground Water Draft		23822.33
	Projected demand for Domestic and Industrial uses up to 2025		6133.36
	Stage of Ground Water development as on March 2004 (%)		63%
13	**AWARENESS AND TRAINING ACTIVITY**		
	Mass Awareness Programmes Organised		One
	Date Place No of participants		February 2004 Mysore 325
	Water Management Training Programmes organised:		Nil
14	**EFFORTS OF ARTIFICIAL RECHARGE & RAIN WATER HARVESTING:**		Nil
	Projects completed by CGWB (No and amount spent)		Nil
	Projects under technical guidance of C.G.W.B. (numbers)		Nil
15	**GROUND WATER CONTROL AND REGULATION**		
	Number of OE Blocks		1, Mysore (P)

	Number of Critical Blocks Number of Blocks notified	--- Nil
16	**MAJOR GROUND WATER PROBLEMS AND ISSUES**	Groundwater development has reached 63% for the district as a whole. As groundwater level, is declining in some parts, revitalising by cleaning and deepening the dug wells will help in augmenting the yield. Adopting watershed treatment is a good option to control in augmenting the natural recharge.

1.0 INTRODUCTION

1.1 General:

Mysore city was the capital of the former princely state of Mysore. On independence it became part of Madras presidency. On the linguistic reorganisation of the state in 1956 a new state named Mysore State was formed with its headquarters at Bangalore in which Mysore was a district. Later, on the first of November 1973 the state was renamed as Karnataka. The then Mysore district comprised of 3 sub-division viz. Mysore, Hunsur and Nanjangud sub divided into 11 taluks with a total area of 11954 sq.km. The district was bifurcated with the creation of a new district viz. Chamarajanagar, with its headquarters at Chamrajanagar by taking out the taluks of Chamarajanagar, Gundlupet, Kollegal, and Yellandur. Thus the district at present consists of 7 taluks with a total area of 6269 Sq.km.

1.2 Location:

Mysore district falls in the survey of India degree sheet Nos. 48P, 57D, 57H and 58A. The district is bounded by north latitudes $11^0$45' - $12^0$40' and east longitudes $75^0$59' -$77^0$05' covering an area of 6269 Sq. km. The district is one of the southern most districts of the state and is bordered by Kodagu district in the west, Cannanore district of Kerala state in the south west, Chamarajanagar district in the south and south east, Mandya district in the north and Hassan district in the north west.

1.3 Administrative Set up:

Mysore district is divided into 7 taluks namely H.D.Kote, Hunsur, K.R.Nagar, Mysore, Nanjangud, Periyapatna, T. Narasipur for administrative purposes. The district comprises of 1203 inhabited villages with 236 grama panchayats and nine townships/ municipalities. In addition to this there are 129 uninhabited villages as per 2001 census. A map showing administrative set-up of the district is given as Fig-1

1.4 Communications:

The district is well connected by all weather roads. The state highway connects the district headquarters with the state capital and other important cities of the district. The broad gauge railway line passes through Mysore and the taluk headquarters of KR Nagar. All the other taluk headquarters and other towns are connected with all weather roads thus making all parts of the district accessible through out the year.

1.5 Drainage:

The major drainage in the district is the east flowing Cauvery River. The Kabini River one of the major tributaries of Cauvery flows diagonally from the SW of the district to the NE before joining the Cauvery River at T. Narasipur in the NE part of the district. The main Cauvery River flows from west to east in the northern parts of the district till its confluence in the K.R.Sagar reservoir. The reservoir makes the northern boundary of the district. Kabini river, a tributary of Cauvery enters the district from its southern part, flows in the easterly direction and receives Nugu and Gundal rivers. Lakshmanthirtha river, another tributary of Cauvery enters the district in Hunsur taluk near Chikka Hejjur. It flows in NE direction through Hunsur and K.R.

Nagar before joining Cauvery. It is a perennial system of rivers. The Drainage map of the district is presented in Fig 2.

1.6 Crops and Irrigation Practices:

The net sown area comprises 72% of the total geographical area, of which about 20% is sown more than once. Paddy is the major crop in the district and is grown in favourable areas totalling about 1107 km^2, followed by pulses and Ragi which are cultivated in 913 and 722 km^2 respectively. Other major crops grown in the district are Cotton, Sugarcane, Jowar Tobacco and Oilseeds. About 17% of the total geographical area is under irrigation in the district, comprising of the command area of K.R.Sagar and Kabini Projects. The right bank high level canal of K.R.Sagar known as the Varuna canal passes through Mysore, T. Narsipur, Nanjangud, & H.D.Kote taluks. Out of the total area of 1180 km^2 under irrigation about, 11% is irrigated from ground water by dug wells and bore wells. While canals account for 81% of the total area under irrigation, tanks account for approximately 7% of the total area irrigated.

1.7 Activities carried out by CGWB:

Central Ground Water Board has carried out Systematic Hydrogeological surveys, Reappraisal Hydrogeological surveys and Groundwater Exploration in the district. The hydrogeological investigations and groundwater exploration during the first phase have revealed the existence of potential zones within 100 meters depth in granitic and gneissic formations. The report on Hydrogeological Conditions in Mysore district was prepared in the year 1992. The report contained the details of old Mysore district inclusive of present Chamarajanagar district.

2.0 RAINFALL AND CLIMATE

Mysore district receives an average rainfall of 776.7 mm. There are 53 rainy days in the district on an average about 50% of annual rainfall occurs during the southwest monsoon period (table 2.1). The rainfall generally decreases from west to east. The coefficient of variation is around 30% in the west to above 35% in the east, indicative of consistent rainfall in the west as compared to the east. The pre-monsoon rainfall is more consistent than the post-monsoon rainfall. The southwest monsoon had been normal from 1994 onwards till 1999, excessive during 2000 and deficient thereafter. The northwest monsoon is much better comparatively being excessive to normal during the recent past. Over all on an annual basis, there are more normal to excessive rainfall years than deficient ones. While during 1997, 1999, 2000 and 2005, the district received Excess rainfall, 1998, 2001, 2002, 2003 and 2004, it was Normal and only during 2006, the district received Deficient rainfall.

The average minimum and maximum temperatures vary from 34 to 21.4 ^{o}C in April to 16.4 to 28.5 ^{o}C in January. Relative humidity ranges from 21 to 84%. Wind speed ranges from 7.9 in October to 14.1 kmph in July. Annual potential evapo-transpiration is 1533.5 mm. The PET less than the monthly mean rainfall during the months of July, September and October in different taluks, thereby indicating availability of water surplus for recharge to ground water.

Table-2.1 Taluk-wise Rainfall data of Mysore district

Sl. No.	Taluk	Number of Rain gauge Stations	Normal Rainfall mm (1901-70)	Actual Rainfall mm 2005	Rainy days	
					Normal (1901-70)	Actual (2005)
1	H.D. Kote	6	904	1171.1	59	85
2	Hunsur	7	761	1003.2	55	90
3	K.R. Nagar	7	741	923.5	48	59
4	Mysore	6	798	882.7	55	60
5	Nanjangud	5	697	1118.4	49	72
6	Periya Patna	5	858	1215.8	62	77
7	T. Narasipura	6	718	1091.4	45	67
Total/Average		42	782	1058.1	53	73

Source: District at a glance- 2005-06

3.0 GEOMORPHOLOGY AND SOIL TYPES

Geomorphologically, the district is classified as denudational uplands with about 85 to 90% of the district falling in this category. The next important geomarphological unit is older flood plains mainly in the H.D Kote taluk and parts of Mysore taluk. Ridges and valleys form the third important unit and is mainly restricted to the Nanjangud and H.D Kote taluk and north western part of Mysore taluk. Flat valleys are not very common except for isolated appearances. The general elevation in the district ranges from 700-800 m amsl except for the denudational hills and ridges. However the H.D Kote taluk in the southern parts of the district has higher elevation ranging from 2200-3150 m amsl. The Mullur betta with an elevation of 3150 m amsl falls in the area. The Hekkan betta (3732 m amsl) of the Naganpur Reserved Forest, the Shigebetta (3724 m amsl) of the Ainurmarigudi Reserved Forest and the Jainbaribetta (3231m amsl) of the Bedrampadi reserved forest mark the water divide making the southern boundary of H.D. Kote taluk and also of the district.

The soil type of district is grouped in to three types viz., the red sandy soils, red loamy soils and deep black soils. Almost entire district is covered by red sandy soil except a small parts of T. Narapur taluk. The soils are having high permeability and neutral with a pH of 7. The thickness of the soil varies from less than a meter to 6 m. North-eastern part of T. Narasipur taluk comprises of red loamy soil. It is characterized by clayey content mixed with sand. It is less permeable compare to sandy soil. It is having good moisture holding capacity and is fertile. The thickness varies from less than a meter to 16 m. Deep Black soils occur in south-western part of T. Narasipur taluk in a small area. These soils are dark brown, dark greyish brown to very dark grey or black in colour. The texture is usually clayey throughout the profile. These soils are fertile and generally produce good yields. Adequate soil and water management practices and drainage facilities are essential to obtain sustainable yields; otherwise salinity and water logging conditions may develop. These soils need to be drained once in 3-5 years with good quality water.

4.0 GROUND WATER SCENARIO

4.1 Hydrogeology:

Hydrogeologically, the area forms a part of hard rock terrain comprising of granites, gneisses, charnockites amphibolites. Pegmatite veins and dolerite dykes are commons intrusives in the area. The flat and low-lying areas are covered by a thick mantle of fertile soil, while, the elevated portions and hills are capped by laterite. The occurrence and movement of ground water depends on the secondary porosities like weathering, fracturing, faulting and other lineaments. This has a bearing on the tectonic history of the area as well. Prominent lineaments seen in the district are oriented in a NNE –SSW direction N-S as well as in NW-SE direction. The foliation in the granitic gneiss is trending NE–SW to NNW-SSE with a generally easterly dip of 40° to 80°. Faults are observed trending E-W to NW- SE, especially in the southern part of the district. There are alluvial aquifers of limited aerial extent and thickness having primary porosity occurring along river courses. The river sections contain sand, silt and gravel in varying proportions. Hard rocks do not posses primary porosity, the ground water occurs under phreatic conditions in weathered zones of granites and gneiss, and under semi-confined to confined conditions in joints and fractures of these rocks at deeper level in the district. In granites and gneisses, weathering has given rise to thick sandy residuum down to the depth of 2.0 and 20.0 m. bgl and it forms an important phreatic aquifer in the district. These aquifers are developed by dug wells, dug-cum-bore wells and shallow tube wells. The depth of dug wells in the district range from 5.28 to 17.59 mbgl. Cross sectional area of dug wells varies from 5.39 to 115.31 m^2. The specific capacities of these wells range from 23 to 966 lpm/m and the discharges range from 4.5 to105.6 m^3/hour. The draw-downs range between 0.65 and 4.44 m. The specific capacities in alluvial areas are higher ranging from 131 to 884 lpm/m. Fractured granites and gneisses form prolific deeper aquifers in some parts of the district. In charnockites, specific capacities are in the range of 23 to 115 lpm/m while the major rock type viz granites gneiss have recorded specific capacities of 42 to 966 lpm /m. The transmissivities range between 21 and 912 m^2/d. The yield wise distribution of aquifers is given in fig 6.1. It is observed that the aquifers falling in about 90% of the district yield up to 5 lps. There are small patches of areas where yield is less than one lps. There are small areas having high yielding up to 30 lps. Hydrogeological map of the district is presented in Fig 3.

4.1.1 Occurrence of ground water

Ground water in the district generally occurs under unconfined to semi-confined conditions. In the shallower zones it is under phreatic conditions and in deeper zones it is under semi-confined conditions. The ground water is being exploited from within the depth range of 10.00 to 20.00 m bgl through dug wells and 30.00 to 92.00 m bgl through dug-cum-bore wells and bore wells. Exploration has proved the presence of prolific aquifers till the explored depth.

4.1.2 Depth to Water Level

The water levels at National Hydrograph Stations are monitored by the Central Ground Water Board regularly to keep a constant watch on ground water regime. While preparing this report, water level data of these NH Stations for the

past ten years were analysed. The depth to water levels in the national hydrograph stations of H.D. Kote taluk were in the range of 4.58 m bgl to 12.62 m bgl during pre-monsoon (May 2006) and from 2.47 m bgl to 10.82 m bgl during post-monsoon season (Nov 2006). In Hunsur taluk the water level ranges from 3.05 m bgl to 8.80 m bgl during pre-monsoon (May 2006) and from 0.96 m bgl to 3.20 m bgl during post-monsoon season (Nov 2006). In K.R. Nagar taluk these water level ranged between 3.18 m bgl and 17.52 m bgl during pre-monsoon (May 2006) and between 1.72 m bgl and 6.16 m bgl during post-monsoon season (Nov 2006). In Mysore taluk these water level ranged between 3.39 m bgl and 12.75 m bgl during pre-monsoon (May 2006) and between 1.82 m bgl and 2.84 m bgl during post-monsoon season (Nov 2006). In Nanjangud taluk these water level ranged between 1.66 m bgl and 6.30 m bgl during pre-monsoon (May 2006) and between 2.08 m bgl and 4.32 m bgl during post-monsoon season (Nov 2006). In Periya Patna taluk these water level ranged between 5.16 m bgl and 6.35 m bgl during pre-monsoon (May 2006) and between 1.90 m bgl and 5.17 m bgl during post-monsoon season (Nov 2006). In T. Narasipura taluk these water levels ranged between 3.88 m bgl and 6.48 m bgl during pre-monsoon (May 2006) and between 0.40 m bgl and 4.17 m bgl during post-monsoon season (Nov 2006).

Pre-monsoon (May 2006) water levels recorded from these stations show that, the shallower water levels of 2–5 metres bgl are recorded in the north and southern parts of Periya Patna taluk, north-western parts and in a small patch in central part of K.R. Nagar taluk, north-western and south-eastern parts of Hunsur taluk, south and south-eastern parts of Nanjangud taluk, northern parts of Mysore, T.Narasipura and H.D. Kote taluks. Remaining part of the district is having water levels in the range of 5–20 metres bgl. While deeper water levels of 10–20 metres bgl are found to occur as small isolated patches in southern parts of Mysore, central parts of Hunsur taluk and western parts of Periya Patna taluk. The pre-monsoon and post-monsoon depths to water levels are depicted in Fig 4 and Fig 5.

From the map it can be observed that major parts of the district has moderate to moderately deep water levels between 5 to 10 m during pre-monsoon period.

4.1.3 Seasonal water level fluctuation

Consequent upon seasonal rainfall, the water levels record a rise, indicating the build up of storage in ground water reservoir. During the non-monsoon period, this gets depleted due to exploitation. Therefore, the water levels, in general show, a receding trend from December to May. As far as Seasonal fluctuation is concerned, rise in water levels is observed throughout the district (except for a lone well in Nanjangud taluk) and it is in the range of 0.53 m to 10.65 m. The extent of seasonal fluctuation in the district indicates that good recharge of the phreatic aquifer is taking place under prevailing conditions.

4.1.4 Long-term water level trend

For long-term water level trends, analysis of Water levels data of National Hydrograph Stations for the period from1997 to 2006 in Mysore district was carried out. Analysis of this water level data of National Hydrograph Stations in Mysore district for the period from1997 to 2006 suggests - the pre-monsoon water levels have shown that, at nineteen National Hydrograph Stations (NHS) water levels have shown rising trend in the range of 0.012 to 1.709 m/year, while at sixteen NH Stations water levels have recorded falling trend in the range of 0.039 to 0.565 m/year. For during the post-monsoon period at twenty NH Stations water levels have shown rising trend in the range of 0.006 to 1.237 m/year, at fifteen NH Stations water levels have shown falling trend in the range of 0.020 to 0.440 m/year.

4.1.5 Aquifer systems encountered in the area

The study of aquifer geometry and parameters have been attempted by Central Ground Water Board, South western Region, Bangalore, under its ground water exploration programme through drilling exploratory bore wells at selected places. Ground water occurs under phreatic conditions in the weathered rocks, top-soils and in river alluvium. Occurrence and movement of ground water is controlled by degree of weathering and fracturing in the weathered zone. These aquifers are developed by dug wells, dug-cum-bore wells and shallow tube wells. The depth of dug wells in the district range from 5.28 to 17.59 m bgl. Cross sectional area of dug wells vary in the range of 5.39 to 115.31 m^2. The specific capacity of these wells in the area ranges from 23 to 966 lpm/m and the discharge ranges from 4.5 to 105.6 m^3/hr. The draw down varies from 0.65 to 4.44 m. The specific capacity in alluvial area is higher ranging from 131 to 884 lpm/m. In charnockites it is in the range of 23 to 115 lpm/m, while the major rock type viz. granites gneiss has recorded a specific capacities in the range of 42 to 966 lpm /m. The transmissivity is found to be in the range of 21 to 912 m^2 /day.

Ground water occurs under semi-confined to confined conditions in fractures and joints below the zone of weathering. The occurrence and movement of ground water is controlled by intensity of fracturing and their inter connection. This zone is developed by bore wells. Depth of aquifer in this zone ranges from ranges from 25 to 90 m. Discharge ranges from less than one to 8 lps. Drawdown ranges from 0.5 to 23 m for pumping duration of 100 minutes. The transmissivity ranges from 0.5 – 819 m^2/day/m. It is observed that the aquifers falling in about 90% of the district yield up to 5 litres/second. There are small patches of areas where yield is less than one litres/second and also localised high yielding patches of up to 30 litres/second.

4.2 Ground water Resources:

Net annual ground water availability in the district is 41143.06 ham, total annual ground water draft is 23822.33 ham, available resource for future development is 17761.65 ham, which can create ground water irrigation potential of 19577.35 ha. The ground water development in the district is 63%. When considered talukwise, the ground water development is highest about 88% in Mysore taluk, followed by Nanjangud (73%), T. Narasipura (71%), Hunsur (57%), Periyapatna in taluk (42%), K.R. Nagar (39%) and the least, about 37% in H.D. Kote taluk. The taluk-wise groundwater resource (as on March 2004) is given in the table-4.1.

The salient features of the taluk-wise groundwater recharge to the aquifer system in the district are depicted in table-3. The perusal of this table indicates that, the annual ground water recharge for year 2004 for the whole district is 42944.34 ham. The maximum being 9963 ham in H.D. Kote taluk and the least 3357.35 ham in T. Narasipura taluk.

The annual draft for domestic and industrial uses in Mysore district, is 3915.16 ham and the draft for irrigation purposes is 19922.70 ham. It is further observed that the total ground water draft during the year 2004 was 23822.33 ham. It is also observed that highest draft is recorded in Mysore taluk (5962.30) and the least in K.R. Nagar taluk (1259.23 ham). The taluk-wise stage of ground water development details computed for the district in the ground water estimation studies for the year 2004 is given in table-4.1 and stage of ground water development is presented as Fig 6.

TABLE 4.1: TALUK WISE GROUND WATER RESOURCES AND CATAGORISATION OF MYSORE DISTRICT, KARNATAKA AS ON 31ST MARCH 2004

SL NO	TALUK	TOTAL ANNUAL GROUND WATER RECHARGE	NET ANNUAL GROUND WATER AVAILABILITY	EXISTING GROSS GROUND WATER DRAFT FOR IRRIGATION	EXISTING GROSS GROUND WATER DRAFT FOR DOMESTIC AND INDUSTRIAL WATER SUPPLY	EXISTING GROSS GROUND WATER DRAFT FOR ALL USES	ALLOCATION FOR DOMESTIC AND INDUSTRIAL USE FOR NEXT 25 YEARS	NET GROUND WATER AVAILABILITY FOR FUTURE IRRIGATION DEVELOPMENT	EXISTING STAGE OF GROUND WATER DEVELOPMENT	BALANCE GROUND WATER IRRIGATION POTENTIAL AVAILABLE	CATAGORISATION AS ON MARCH 2004			
											SAFE AREA (%)	SEMICRITICAL AREA (%)	CRITICAL AREA (%)	OVER-EXPLOITED AREA (%)
		HAM	HAM	HAM	HAM	HAM	HAM	HAM	(%)	HA				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	16
1	**H.D. KOTE**	9963.00	9518.08	3189.25	365.59	3554.44	569.19	5841.93	39	6352.89	69	19		12
2	**HUNSUR**	5896.39	5639.75	2753.20	487.03	3238.51	718.97	2263.12	62	2363.84	73			27
3	**K.R. NAGAR**	3408.40	3259.43	981.85	278.82	1259.23	411.73	1907.83	43	1934.44	97			3
4	**MYSORE**	7039.24	6774.49	4481.62	1489.04	5962.30	2477.58	1504.85	103	1582.99	27			73
5	**NANJANGUD**	7432.50	7127.87	4609.86	579.06	5187.94	907.94	2036.04	77	2111.57		80		20
6	**PERIYAPATNA**	5847.45	5613.61	1937.34	414.43	2349.99	604.83	3072.26	45	4003.86	SAFE			
7	**T. NARSIPURA**	3357.35	3209.83	1969.58	301.19	2269.92	443.11	1135.61	75	1227.76	57	3	8	32
	TOTAL	**42944.34**	**41143.06**	**19922.70**	**3915.16**	**23822.33**	**6133.36**	**17761.65**	**63**	**19577.35**				

4.3 Ground Water Quality:

Quality of groundwater in the district, in general, is good and potable. Central ground Water Board monitors quality of ground water in phreatic aquifers in the district from a network of NH Stations every year. It is observed that ground water quality in the district in general is very good. However inland salinity is reported from isolated patches as in Saligram, Begur and Madhur where the EC is above permissible limits. North-eastern part of Piriya Patna, north-western part of K.R. Nagar, north-western part of Mysore, south-western part of T. Narsipur, eastern part of Nanjangud and central part of H.D. Kote have nitrate concentration above permissible limits. Nitrate is above permissible limits around Elivala, Bilikere, Hangod, Bettadapura, Hosur, Saligrama, Kalyanapuram, Palaya, Madhur, Muguru area also. Samples from exploratory bore wells represent water quality of deeper aquifer in the district. Analysis results of samples from these bore wells indicate that in general quality of ground water from semi-confined and confined aquifers in the district is good and potable. pH ranges from 7.38 to 8.81. EC ranges from 360 to 3268 µs/cm at 25^0C (Hebbalguppe). In major part of the district nitrate is within permissible limits except at Mugur, Thirakanur, Yelgundi, Gundip and Hebbalaguppe. Chloride is in permissible limits in the entire district. Except a small pocket in the southern part of Mysore taluk fluoride distribution is with in permissible limits. Ground Water quality of the district is depicted in Fig -7.

4.4 Status of Ground Water Development:

In most parts of the district, ground water is major source for domestic and drinking purposes. Ground water is the main source of domestic supplies and irrigation in major parts of the district. Out of the total area of 1180 km^2 under irrigation, about 11% is irrigated using ground water through dug wells and bore wells. Farmers with small land holdings depend mainly on the rainwater and water available in the shallow wells. There are 4501 dug wells and 16478 bore wells in the

district as per third MI census. Out of these 87 dug wells and 349 bore wells are not in use due to various reasons including drying up of the wells. Taluk-wise break up of these wells is presented in table –4.2.

Table-4.2 : Distribution of Wells according to status as per MI Census 2000-01

Sl No	Taluk	Wells in Use		Wells not in use	
		Dug Wells	Bore Wells	Dug Wells	BW
1	**H.D. Kote**	261	2506	21	47
2	**Hunsur**	853	2381	3	57
3	**K.R. Nagar**	621	823	11	22
4	**Mysore**	222	3155	9	50
5	**Nanjangud**	604	3077	17	81
6	**Periyapatna**	187	2033	13	78
7	**T. Narasipura**	1753	2503	13	14
Total		**4501**	**16478**	**87**	**349**

4.4.1 Water Lifting Devices

Water lifting devices used in the district are Electric motor, Diesel Pump, Wind Mill and manual / animal operated. Electric pump is the most common water-lifting device, being used in more than 90% of the wells as given in table 4.3.

Table-4.3 : Distribution of wells according to water lifting device as per MI Census 2000-01.

Lifting Device	Dug Well	Bore Well	Total
Electric Pump	4209	15188	19397
Diesel	263	535	798
Wind Mill	13	331	344
Solar	0	0	0
Manual / Animal Operated	3	10	13
Others	100	763	863
Total	**4588**	**16827**	**21415**

4.4.2 Water Lifting Devices

Capacity of pumps used in the area to draw ground water ranges from less than 2HP to >10HP. While more than 85% of the wells are fitted with 4 to 6 HP motor, a very small number around 0.03% are fitted with more than 10HP motor. Distribution of wells according to Horse Power is given in table-4.4.

Table-4.4 : Distribution of Wells according to Horse Power

	Horse Power						
Type of well	**0 - 2**	**2 - 4**	**4 - 6**	**6 - 8**	**8 - 10**	**> 10**	**Not Specified**
Dug Well	37	229	3862	251	89	4	116
Bore Well	268	612	14461	311	68	3	1104
Total	305	841	18323	562	157	7	1220
Percentage	1.42	3.93	85.6	2.62	0.7	0.03	5.7

4.4.3 Drinking water Wells

As per the records, as on 31.3.2006, the domestic water requirement is catered through 994 numbers of Mini-water supply schemes, 1,489 numbers of piped water supply schemes through borewells along with 10,411 bore wells installed with

hand pumps. In most parts of the district, ground water is major source for domestic and drinking purposes.

5. GROUND WATER MANAGEMENT STRATEGY

5.1 Ground water development:

The average stage of ground water development in the district is 63% indicating that that there are areas where there is scope for further development. A hydrogeological map showing water-bearing formations, yield potential, decadal mean water level and isohyets is shown in fig 3. Sustainability of ground water resource and its judicious use should be given prime importance while making development strategy. In critical and over-exploited areas, artificial recharge and rainwater harvesting measures are recommended to augment to ground water system. About 17761.65 ham of ground water resource is available in the district for further development. The development is recommended only in area categorised as safe and semi-critical (Fig- 6). In such areas, potential aquifers can be located by hydrogeological surveys aided by geophysical methods. Dug wells and filter-points are recommended only in river and valley banks where sufficient thickness of valley-fill is available, which gets saturated during rainy seasons. Ground water development in other feasible areas should be done by bore wells. Spacing norm of 200 m may be strictly adhered to avoid interference. Aquifer should be pumped as per crop water requirement.

In areas, which are categorized as critical and over-exploited, growing crops like paddy, sugarcane etc, having high water requirement may be avoided. Advance irrigation methods like drip and sprinkler irrigation may be practiced.

In the command areas conjunctive use of surface and ground water may be practiced to avoid long-term hazards like water logging and ground water as well as soil salinity problems.

5.2 Water conservation and Artificial Recharge:

Large parts of Mysore and T. Narasipura taluks and parts of Hunsur, Nanjangud and H.D. Kote taluks fall in over-exploited category. Water level in most parts of these areas are showing downward trend. Under the situation there is a need to augment ground water recharge by opting for rainwater harvesting and artificial recharge structures to harvest non-committed surface runoff.

In the western part of the district where the topography is hilly and rugged artificial recharge structures like nalla and gully plugs contour bunds and contour trenches and nalla bunds may be constructed and in comparatively plain areas percolation tanks and point recharge structures like recharge shafts recharge pits and recharging through existing dug/bore wells may be practiced. In semi-urban areas in the district, lot of roof area is available for rooftop rainwater 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.

6. GROUND WATER RELATED ISSUES & PROBLEMS

There is over exploitation of ground water resource in 73% area of Mysore, 32% area of T. Narasipura, 27% of Hunsur and 20% area of Nanjangud taluks. This over-exploitation has resulted in depletion of water levels. Artificial recharge measures are required to be taken up in these areas on priority basis. Mysore, the

district headquarters is the only urban centre in the district. Presently the Ground water here is not under threat as the city is provided with piped water supply from surface water sources. Studies on the pollution aspects related to the urbanization didn't reveal any significant adverse effect in water quality. Nitrate concentration of more than permissible limit exists in many parts of the district. This may be due to indiscriminate use of fertilizer and biological contamination from decaying vegetation. Judicious use of fertilizer and proper care in disposing the biological waste coupled with artificial recharge (in favourable areas) can address this problem.

7. AWARENESS AND TRAINING ACTIVITY

7.1 Mass Awareness Programmes (MAP):

Central Ground Water Board, South Western Region organized a Mass Awareness Pragramme on "Protection and Conservation of Ground Water" conducted at J.S.S.P.P.H Auditorium, S.J.C.E. Campus, Manasa Gangothri, Mysore. The programme was inaugurated by Sri K.R.Niranjan, I.A.S., Chief Executive Officer, Zilla Panchayat, Mysore. Prof. B.S. Basavarajaiah, Special Officer, S.J.College of Engineering presided over the function. Prof.B.G.Sangameshwara, Principal, S.J.College of Engineering, and Prof. A. Balasubramanian, Chairman, Department of Studies in Geology, University of Mysore were the Guests of Honour during the programme. Regional Director, Central Ground Water Board, Bangalore, while addressing the gathering, enlightened the audience by explaining about the aims and objectives of organizing Mass Awareness Pragramme. "Protection and Conservation of Ground Water" He also emphasized on the need for judicious utilization of ground water coupled with effective conservation methods. The participants included students, senior citizens, progressive farmers, advocates and representatives from NGOs. During the programme technical presentations on the theme of the programme were given by Scientists of Central Ground Water Board, South Western Region, Bangalore. An exhibition depicting various aspects of protection and conservation of water including various rainwater harvesting and artificial recharge techniques was also organized on the occasion.

7.2 Participation in Exhibition, Mela, fair etc:

CGWB has not participated in any Exhibition, Mela, Fair, etc. but organised Exhibition on its own as part of Mass Awareness Programme conducted at Mysore during February 2004.

8.0 AREAS NOTIFIED BY CGWA/SGWA

No area in the district is notified so far.

9.0 RECOMMENDATIONS

As already discussed the average stage of ground water development in the district is 63% indicating that there are areas where there is scope for further development. Categorisation of the areas is shown in Fig 6 . It may be noted that all command areas are under safe category. Categorization as shown in the fig is only for non-command areas. While K. R. Nagar and Periyapatna taluks are safe for ground water development, whereas in Nanjangud no area is safe except canal command. Rest of the taluks are partly safe and partly over-exploited. But all the command areas falling in the district are safe for further development. The dugwells, which penetrate partially the weathered, fractured zones of the aquifers, may be deepened further for

the better productivity. Construction of check dams and sub surface dykes at appropriate places across the nallahs and streams in the water-table depleting areas of Mysore, T. Narasipura, Hunsur, H.D. Kote and Nanjangud taluks may be envisaged. A comprehensive programme has to 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 will arrest the sub-surface flows and augment the groundwater resources. Ground water usage should be encouraged in topographic lows and valley areas of low water level fluctuations with adequate soil conservation measures to prevent the soil erosions. Constant monitoring of ground water quality should be carried out in the Canal command areas to prevent the pollution and related problems. Determination of trace elements and organic compound should be done to help in categorizing the quality of water. Ground water in canal command area is found under-developed therefore, it is strongly recommended to prepare an action plan to bring more area under conjunctive use of ground water and surface water irrigation. Conjunctive use of both Surface and Ground water practiced in the canal command area would improve the quality of ground water, prevent the water logging conditions and availability of canal water to the tail end areas. The ground water development should be allowed only areas, which are categorised as safe and semi-critical with caution. Mass awareness programmes should be conducted for public awareness about the limited availability of ground water resource. For domestic purposes dug wells are ideal structures in denudational uplands and older flood plains while in the rest of the area the wate level is expected to be deep and may dry up in summer. For domestic purposes 2.5 m dia dug well down to 8-14 m will be ideal where as for irrigational purposes deeper dug wells with depth ranging from 14-18 m bgl with a dia of 5-6 m is recommended. The locations for bore wells are site specific and have to be pinpointed based on scientific investigations. In general the lineaments trending NE-SW and E-W are expected to be have higher yield. Sites for bore wells and dug wells should selected with the technical advice from technical qualified persons. The bore well may be constructed down to 200 m with a dia of 152 to 165 mm. Since potential fracture zones are encountered with in a depth zone of 100 m, small capacity DTH Rig is sufficient for drilling borewells for domestic purposes of 152 mm diameter. For irrigation bore wells a depth of 200 m with a diameter of 152 to 165 mm is recommended. The thickness of weathered formation hardly exceeds 22 m and hence there is no problem for lowering the casing pipes. However, at places loose boulders are encountered just above the bedrock thereby creating problems for proper sitting of casing pipe. In cases where boulder problems are encountered reaming of the borehole with mud circulation before lowering the casing is recommended. Cement sealing provided in the annular space ensures longer life of the well. Farmers should be educated to grow less water intensive crops and adopt micro irrigation system. Government should provide subsidy such irrigation systems. Artificial recharge structures should be constructed in feasible areas for augmenting ground water resource and to improve ground water quality.

Fig-1

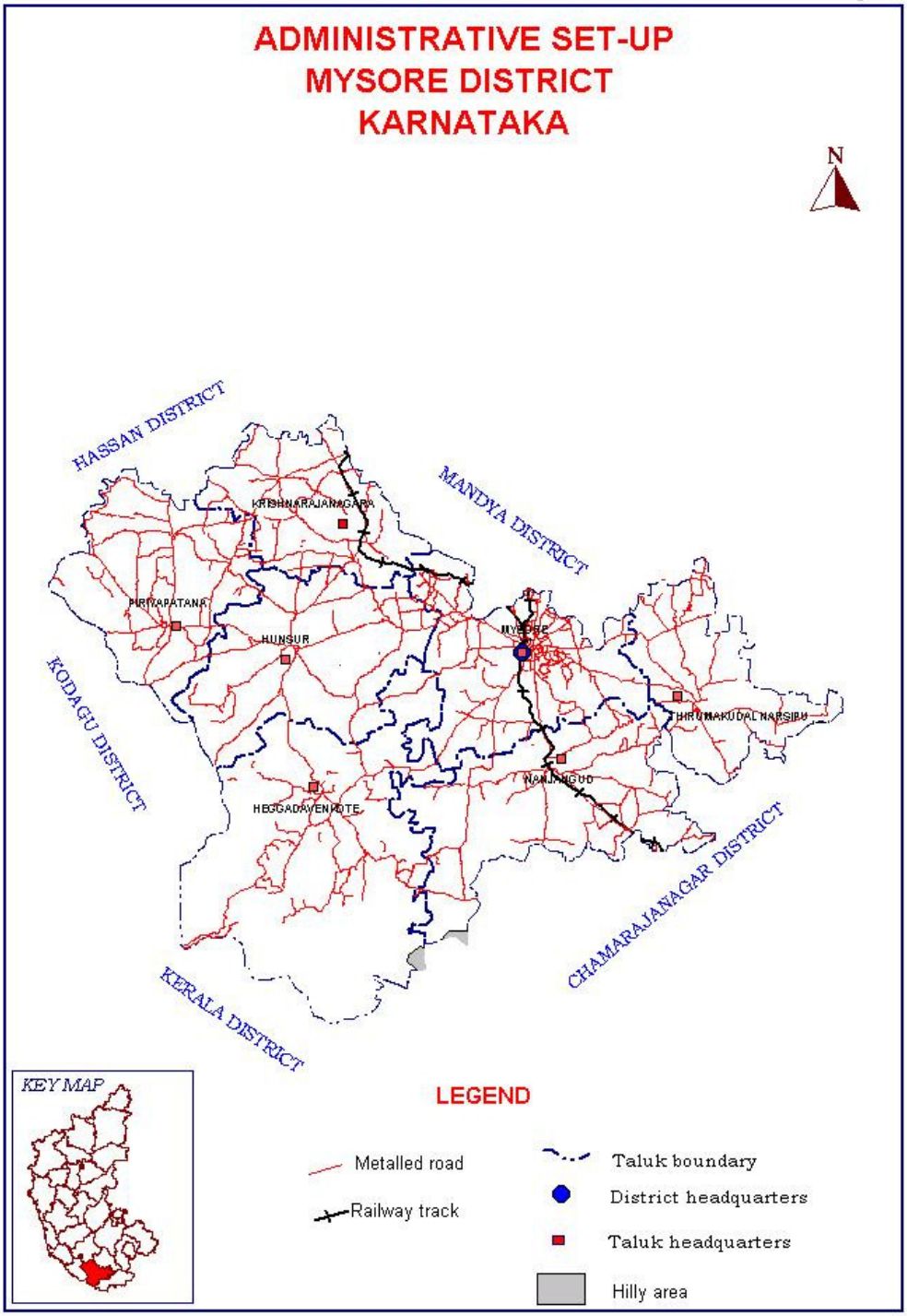

ADMINISTRATIVE SET-UP
MYSORE DISTRICT
KARNATAKA
N
HASSAN DISTRICT
MANDYA DISTRICT
KODAGU DISTRICT
KERALA DISTRICT
CHAMARAJANAGAR DISTRICT
KRISHNARAJANAGARA
PIRIYAPATANA
HUNSUR
MYSORE
THIRUMAKUDALNARSIPU
NANJANGUD
HEGGADAVENKOTE
KEY MAP
LEGEND
Metalled road
Railway track
Taluk boundary
District headquarters
Taluk headquarters
Hilly area

Fig- 2

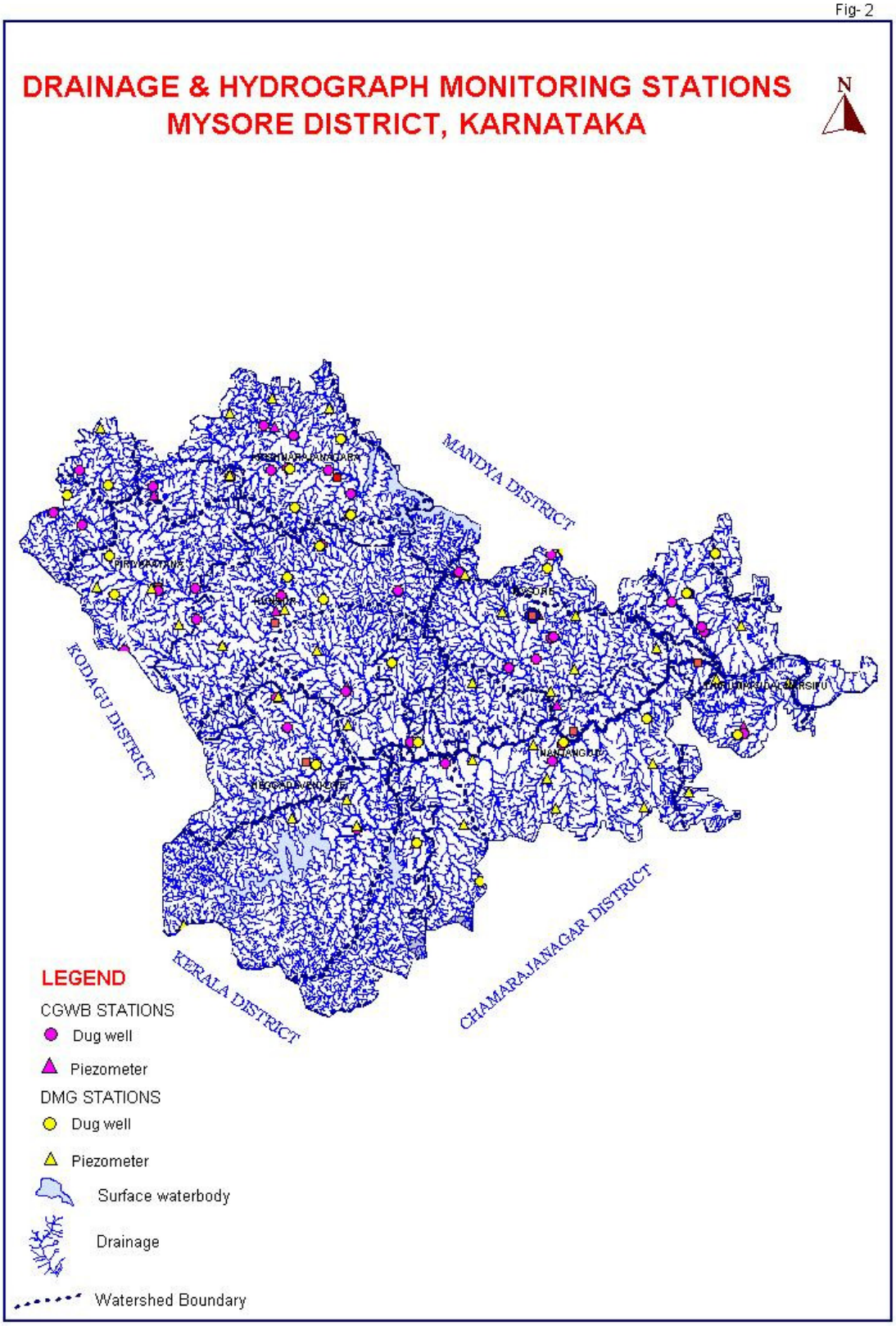

DRAINAGE & HYDROGRAPH MONITORING STATIONS
MYSORE DISTRICT, KARNATAKA
N
MANDYA DISTRICT
KODAGU DISTRICT
KERALA DISTRICT
CHAMARAJANAGAR DISTRICT
LEGEND
CGWB STATIONS
Dug well
Piezometer
DMG STATIONS
Dug well
Piezometer
Surface waterbody
Drainage
Watershed Boundary

Fig-3

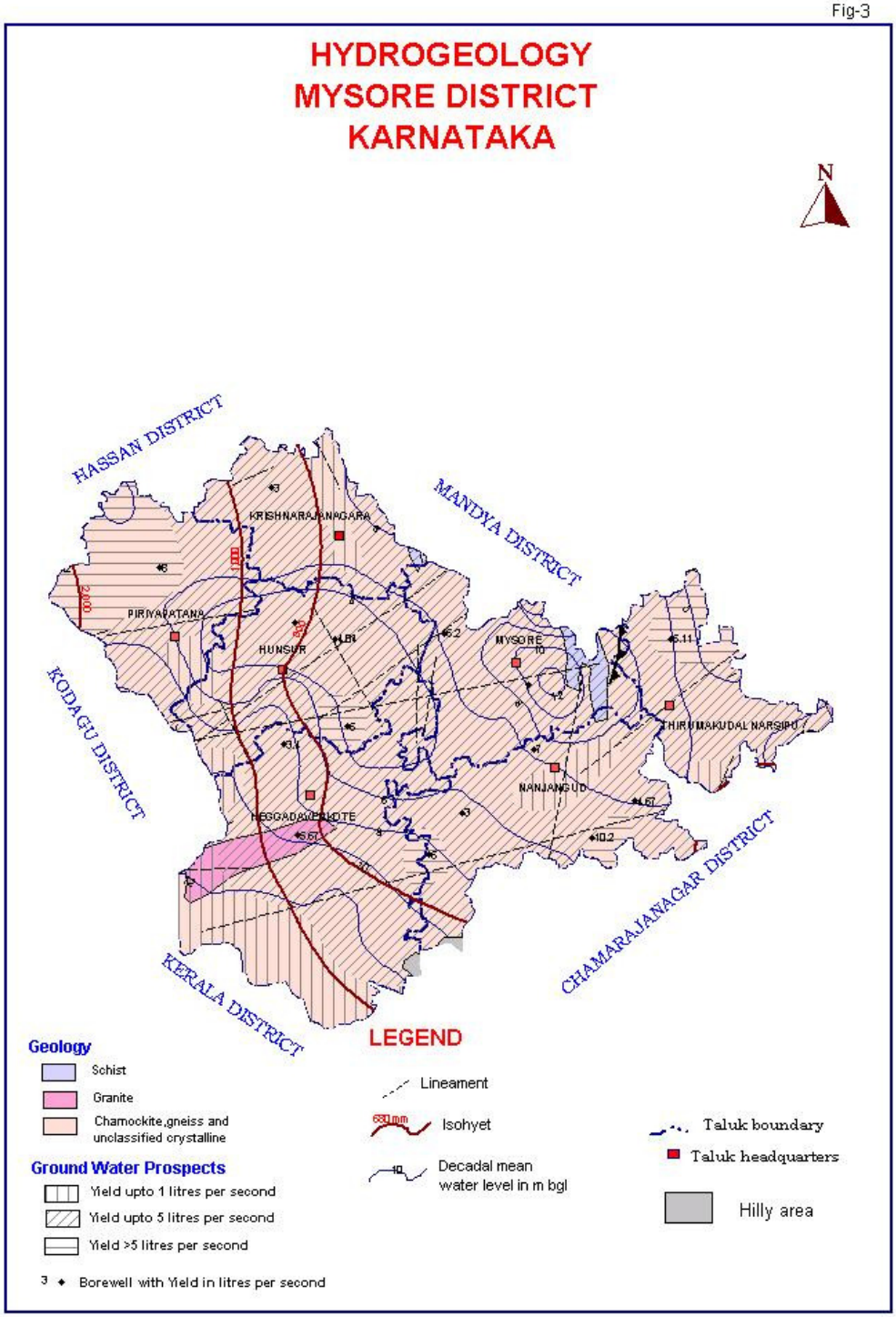

HYDROGEOLOGY
MYSORE DISTRICT
KARNATAKA
N
HASSAN DISTRICT
MANDYA DISTRICT
KODAGU DISTRICT
KERALA DISTRICT
CHAMARAJANAGAR DISTRICT
KRISHNARAJANAGARA
PIRIYAPATANA
HUNSUR
MYSORE
THIRUMAKUDAL NARSIPU
NANJANGUD
HEGGADADEVANKOTE
LEGEND
Geology
Schist
Granite
Charnockite,gneiss and unclassified crystalline
Ground Water Prospects
Yield upto 1 litres per second
Yield upto 5 litres per second
Yield >5 litres per second
Borewell with Yield in litres per second
Lineament
Isohyet
Decadal mean water level in m bgl
Taluk boundary
Taluk headquarters
Hilly area

Fig-4

DEPTH TO WATER LEVEL PRE-MONSOON (MAY-2006)
MYSORE DISTRICT, KARNATAKA

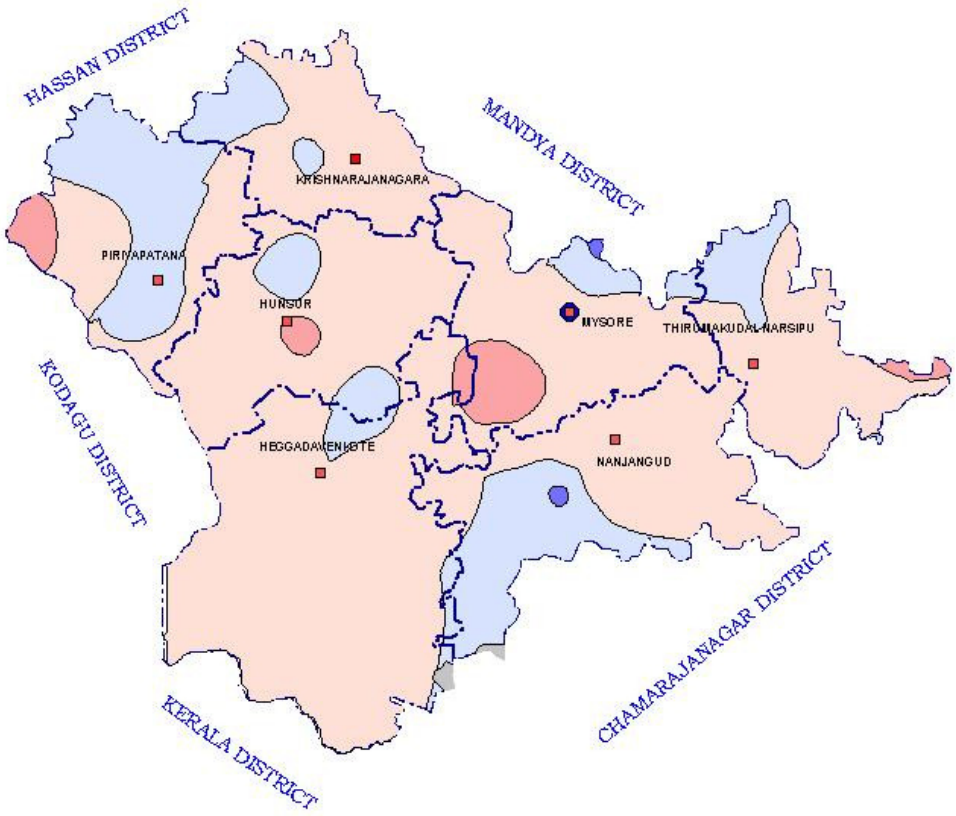


Fig-5

DEPTH TO WATER LEVEL POST-MONSOON (NOVEMBER-2006)

MYSORE DISTRICT, KARNATAKA

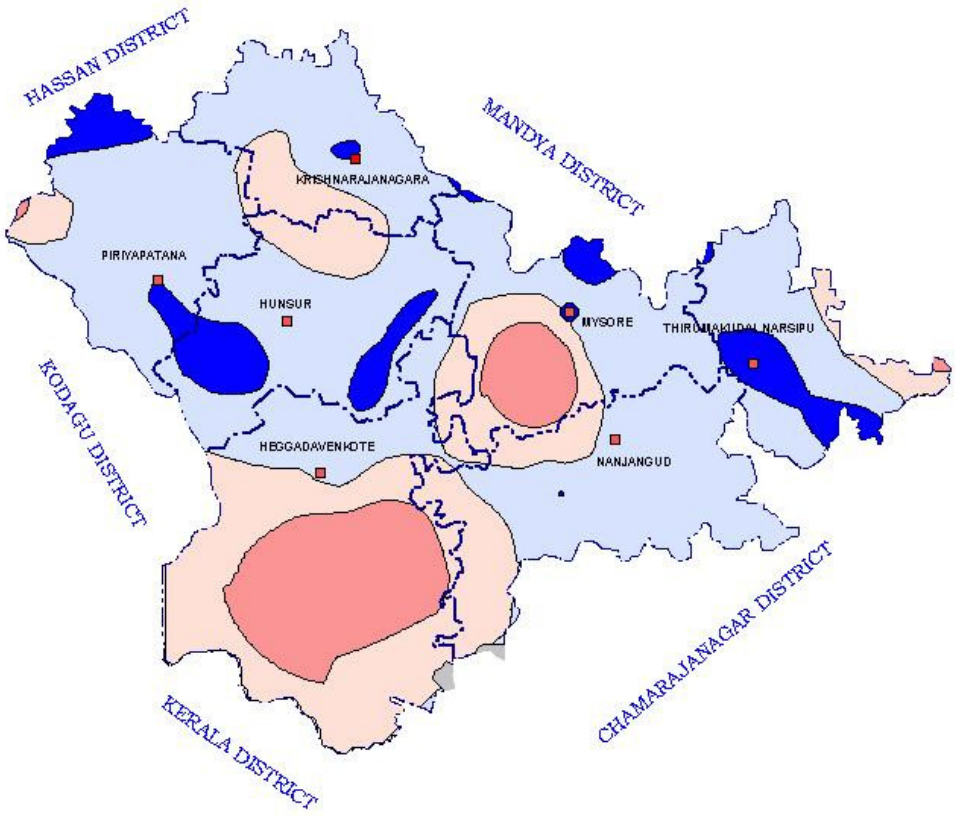


Fig-6

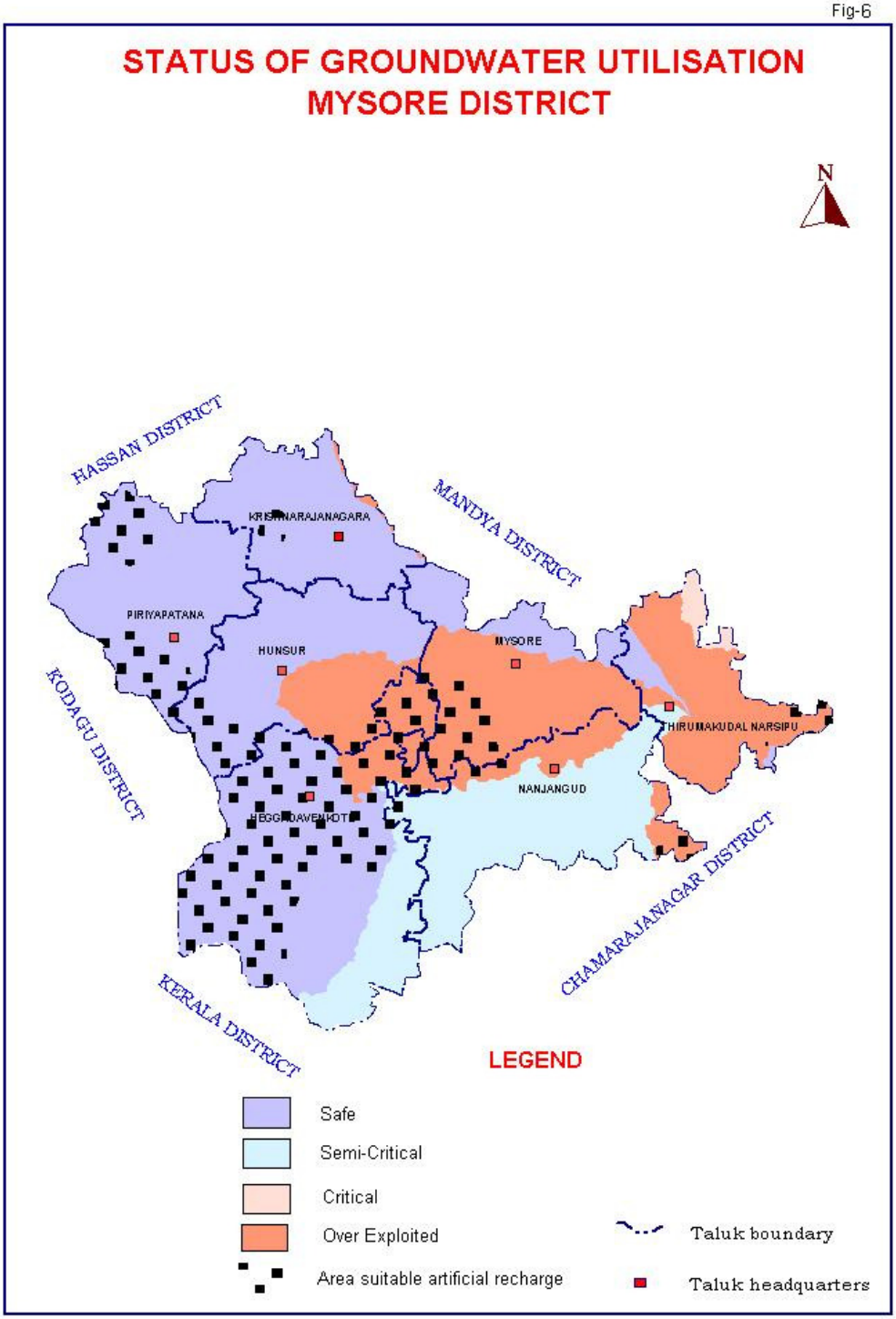
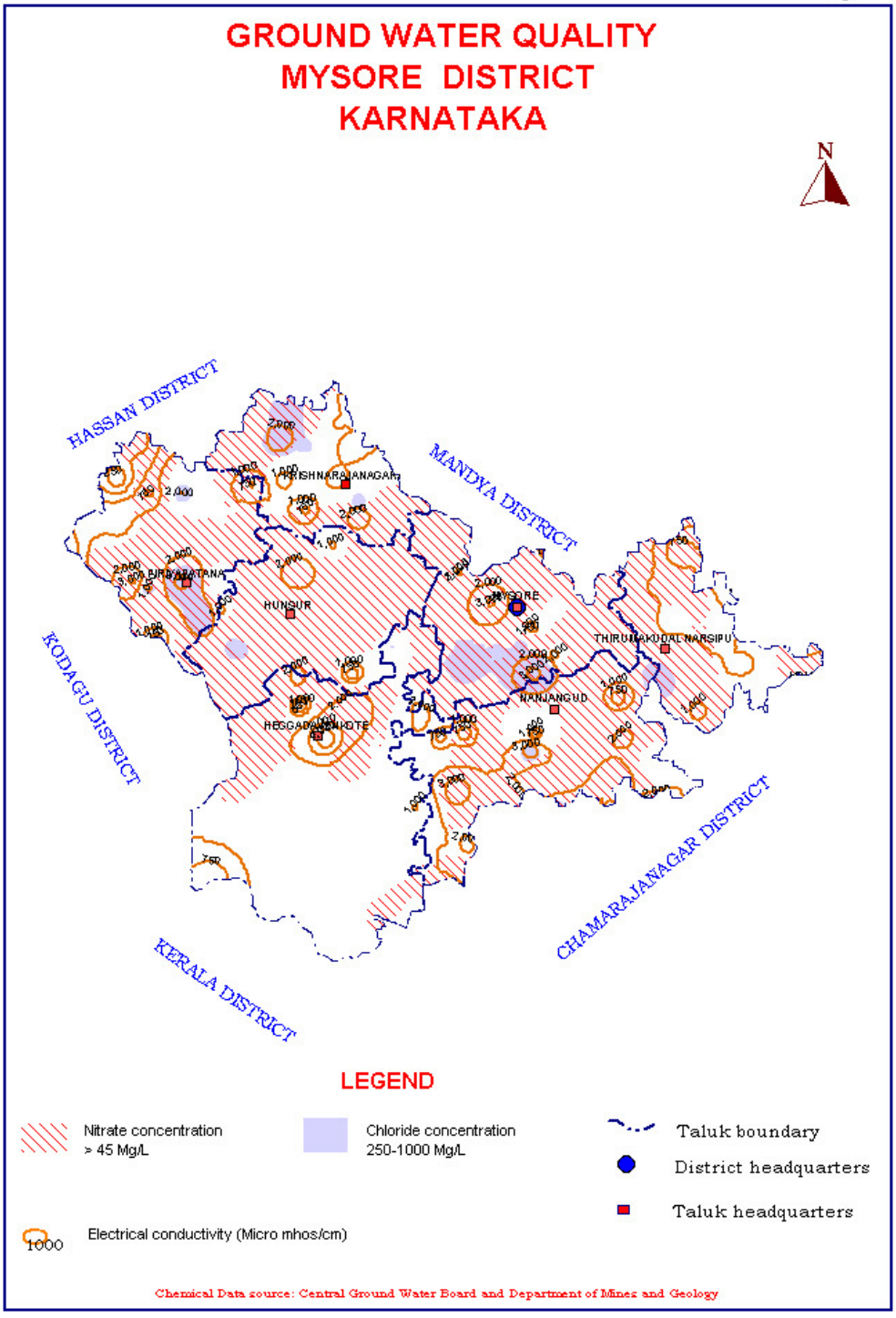

STATUS OF GROUNDWATER UTILISATION
MYSORE DISTRICT
N
HASSAN DISTRICT
MANDYA DISTRICT
KODAGU DISTRICT
KERALA DISTRICT
CHAMARAJANAGAR DISTRICT
KRISHNARAJANAGARA
PIRIYAPATANA
HUNSUR
MYSORE
HIRUMAKUDAL NARSIPU
NANJANGUD
HEGGADAVENKOTE
LEGEND
Safe
Semi-Critical
Critical
Over Exploited
Area suitable artificial recharge
Taluk boundary
Taluk headquarters

Fig-7


GROUND WATER QUALITY
MYSORE DISTRICT
KARNATAKA
N
HASSAN DISTRICT
MANDYA DISTRICT
KODAGU DISTRICT
KERALA DISTRICT
CHAMARAJANAGAR DISTRICT
KRISHNARAJANAGAR
BILIGERE
HUNSUR
MYSORE
NANJANGUD
THIRUMAKUDALNARSIPU
HEGGADADEVANKOTE
LEGEND
Nitrate concentration
> 45 Mg/L
Chloride concentration
250-1000 Mg/L
Taluk boundary
District headquarters
Taluk headquarters
1000
Electrical conductivity (Micro mhos/cm)
Chemical Data source: Central Ground Water Board and Department of Mines and Geology