



संरक्षित जल - सुन्दर स्वास्थ्य कल  
CONSERVE WATER - SAVE LIFE



GOVERNMENT OF INDIA  
MINISTRY OF WATER RESOURCES  
CENTRAL GROUND WATER BOARD

GROUND WATER INFORMATION BOOKLET  
UTTARA KANNADA DISTRICT,  
KARNATAKA



SOUTH WESTERN REGION  
BANGALORE  
September 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 Uttara Kannada 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.V. Chinagudi, Scientist-B, Central Ground Water Board, South Western Region, Bangalore. 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 and manage the water resources in a better way in the district.

**(K.Md.Najeeb)**

Regional Director

## UTTARA KANNADA DISTRICT AT A GLANCE

<b>SI No</b>	<b><u>ITEMS</u></b>	<b>STATISTICS</b>
<b>I</b>	<b>GENERAL INFORMATION</b>	
1	Geographical Area :	10222 Sq. Km
2	Administrative Divisions	
	i) No. Of Taluks :	11
	ii) No. Towns :	6
	iii) No. of Villages :	1246
	iv) Average annual rainfall	1166.3 - 3672.5
3	Population (2011 census) :	
	a) Total Population :	14.37lakhs
	b) Rural Population :	9.66 lakhs
	c) Urban Population :	3.88 lakhs
	d) Density of Population :	140 Persons/Sq.km
	e) Literacy percentage :	76.60%
<b>II</b>	<b>GEOMORPHOLOGY</b>	
	Major physiographic divisions	i) coastal plains, ii) Western ghats iii) Eastern table land
	Major Drainages	Kali, Sharavathi, gangavali and Aganashini
<b>III</b>	<b>Land use (2005-2006)</b>	
	a) Area under forests (ha)	813695
	b) Area not available for cultivation(ha)	50600
	c) fallow and other land (ha)	47107
	d) Net area sown(ha)	113277
	e) Area sown more than once (ha)	11473
	f) Gross area under cultivation (ha)	124750
	g) Net irrigated area (ha)	25437
	h) Area irrigated by ground water (ha)	9390
<b>IV</b>	<b>MAJOR SOIL TYPES</b>	Hilly soil, lateritic soil, loamy soil and semi-black cotton soil.
<b>V</b>	<b>AREA UNDER PRINCIPAL CROPS (2002-03) figures in ha</b>	Paddy – 80311 Maize -- 1542 Pulses – 2426 Spices – 15787 Oil seeds- 3452 Fruits -- 6924 Vegetables- 302 Sugarcane- 1008 Cotton – 6197 Coconut-- 7197
<b>VI</b>	<b>IRRIGATION BY DIFFERENT SOURCES</b>	Source Area(ha) Dugwells –7302 Borewells-2090 Lift - 596 Tanks/Ponds-4754

		Canals	- 94
		Other sources	- 10601
		Net irrigated area	-25437
<b>VII</b>	<b>NUMBER OF GROUND WATER MONITORING STATIONS OF CGWB</b>		
	No of Dugwells	34	
	No of piezometers	10	
<b>VIII</b>	<b>PREDOMINANT GEOLOGICAL FORMATIONS</b>		
	Recent	Alluvium	
	Lower Precambrian	Dharwar system	Meta-sedimentary & Metavolcanics
	Archaean Formation	Peninsular gneisses	Gneisses, migmatites and granites
<b>VII</b>	<b>HYDROGEOLOGY</b>		
	Major Water Bearing Formations		
	<b>Shallow aquifers</b> of alluvium along the stream courses, sea coast, creeks, weathered zones of schists, metasedimentaries and metavolcanics occurring between the depths of 3 to 20 mbgl		
	<b>Deeper aquifers</b> of fractured and jointed Schists, gneisses and metavolcanics and meta sedimentaries up to 200 mbgl.		
	Premonsoon Water levels during 2007	1.91 to 29.88 mbgl.	
	(mbgl)		
	Post monsoon Water levels during 2006 (mbgl)	0.36 to 16.85 mbgl.	
	Long term water level trends (1998-2007)m/year	<b>NHS dugwells</b>	<b>NHS Piezometers</b>
	Premonsoon Rising trends (no.)	9	2
	Premonsoon Falling trends (no.)	27	9
	Postmonsoon Rising trends (no.)	30	6
	Post monsoon Falling trends (no.)	7	5
<b>IX</b>	<b>GROUND WATER EXPLORATION BY CGWB</b>	<b>Phase I</b>	<b>Phase II</b>
	<b>No of wells drilled</b>	5 EW, 4OW	33
	<b>Depth range (m)</b>	16-47	89-200
	<b>Discharge (l/sec)</b>	0.05 – 3.75	0-8.5
	<b>Transmissivity (m<sup>2</sup>/day)</b>	7.1 – 446	2.09–24.41
<b>X</b>	<b>GROUND WATER QUALITY</b>		
	Presence of constituents more than permissible limits	Nitrates and Fluoride	
	Type of water		
	The quality of ground water in general is potable and suitable for irrigation purposes,		
<b>XI</b>	<b>DYNAMIC GROUND WATER RESOURCES (As per revised estimation as per 1997 methodology) AS ON 31ST MARCH 2009</b>		
	a) Net annual ground water availability	51060	

	(ham)	
	b) Existing gross ground water draft for all uses (ham)	18351
	c) Allocation for domestic and industrial use for next 25 years in (ham)	3363
	d) Net ground water availability for future irrigation development (ham)	32222
	e) Stage of development as on March 2009 (%)	37.5
<b>XII</b>	<b>AWARENESS AND TRAINING ACTIVITIES</b>	
	Mass awareness programme arranged	Nil
	Water Management training programme arranged	Nil
<b>XIII</b>	<b>GROUND WATER CONTROL AND REGULATION</b>	
	Number of OE blocks	2
	Number of Critical blocks	Nil
	Number of blocks notified	Nil

## **1.0 INTRODUCTION**

### **1.1 LOCATION.**

The Uttara Kannada district is located between north latitudes  $13^{\circ} 55' 02''$  to  $15^{\circ} 31' 01''$  and east longitudes  $74^{\circ} 0' 35''$  to  $75^{\circ} 10' 23''$  falling in the survey of India degree sheet Nos –48 I, 48 J, 48 K, 48 M, and 48N. The district is having geographical area of 10222 sq. kms.

### **1.2 ADMINISTRATIVE SETUP.**

The district headquarters is located at Karwar. The district is divided into four subdivisions viz; 1) Bhatkal subdivision, comprising of Bhatkal, Honnavar taluks. 2) Karwar subdivision, comprising of Haliyal, Karwar, Supa taluks. 3) Kumata subdivision, comprising of Kumata, Ankola taluks and 4) Sirsi subdivision comprising of Sirsi, Yellapur, Siddapur and Mundgod taluks.

### **1.3 ACCESSIBILITY.**

The district head quarters Karwar is located about 500 kms from Bangalore city on Panjim – Mangalore National highway No 17. The National highway No 17 enters the district from South and passes through Karwar, Ankola, Kumta, Honnavar, Bhatkal and leaves the district through Northern boundary. The other important roads are state highways connecting Ankola – Hubli – Gadag and Honnavar – Shimoga – Bangalore. The famous Konkan railway connecting all the towns between Panvel (Bombay) and Trivandrum passes through the western most part of the district in almost north-south direction. All the taluk head quarters are well connected to district head quarters by state highways and metalled roads. All villages are connected to taluk head quarters by metalled roads. The administrative map of Uttara Kannada district is given as Figure-1.

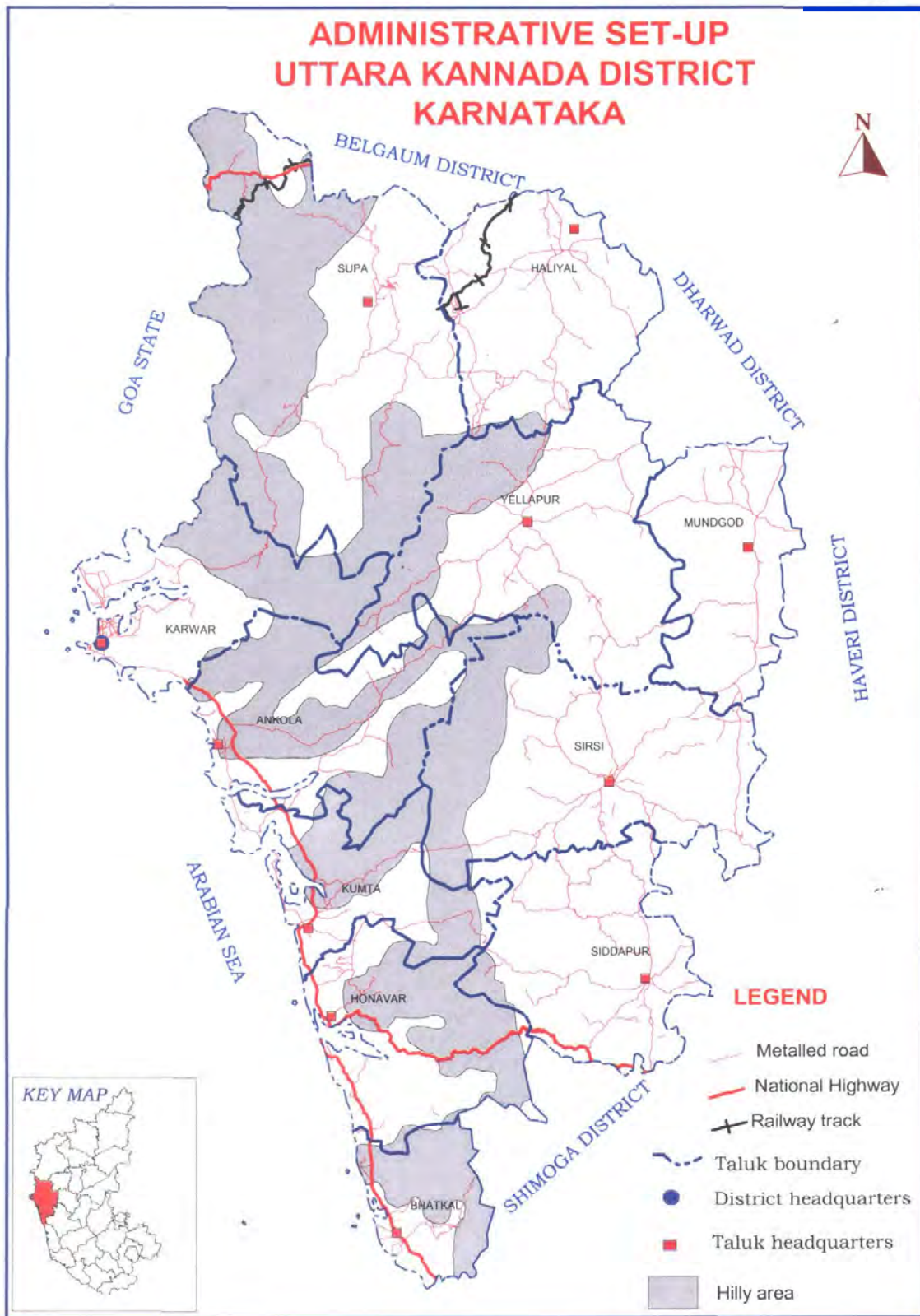
### **1.4 POPULATION.**

The total population in the district is around 14.37 lakhs (as per 2011 census), out of which rural population constitutes 9.66 lakhs. The urban population is 3.88 lakhs and the density of population of the district is 140 persons per square kilometer. The literacy of the population is 76.60%.

### **1.5 DRAINAGE**

The important rivers in the district are Sharavathi, Kali, Aghanashini, and Gangavali. all these rivers flowing in westerly direction to Join Arabian sea. All the rivers in the district together with their tributaries exhibit dendritic drainage pattern (Figure-2).

Fig.1





## **1.6 LAND USE AND CROPPING PATTERN.**

The district has 813695 ha. forest which constitutes 79 % of the total geographical area of the district. The land not available for cultivation is 50600 ha which is about 5 % of the total area. The fallow land in the district is around 16951 ha. The other uncultivated lands are 30156 ha. Net area sown during the year 2005-06 was around 113277 ha. out of which, 11473 ha. land was sown more than once.

## **1.7 CROPS**

The main food crops grown in the district are paddy, Maize, pulses groundnut, and spices. Sugarcane, cotton and arecanut are the main commercial crops grown in the district.

## **1.8 IRRIGATION.**

Out of 113277 ha of cultivated land during 2005-06, 25437 ha was under irrigation (22% of total cultivated area), out of which 94 ha was irrigated under canals, 4754 ha was irrigated under tanks, 7302 ha was irrigated by dugwells, 2090 ha was irrigated by tube/bore wells.

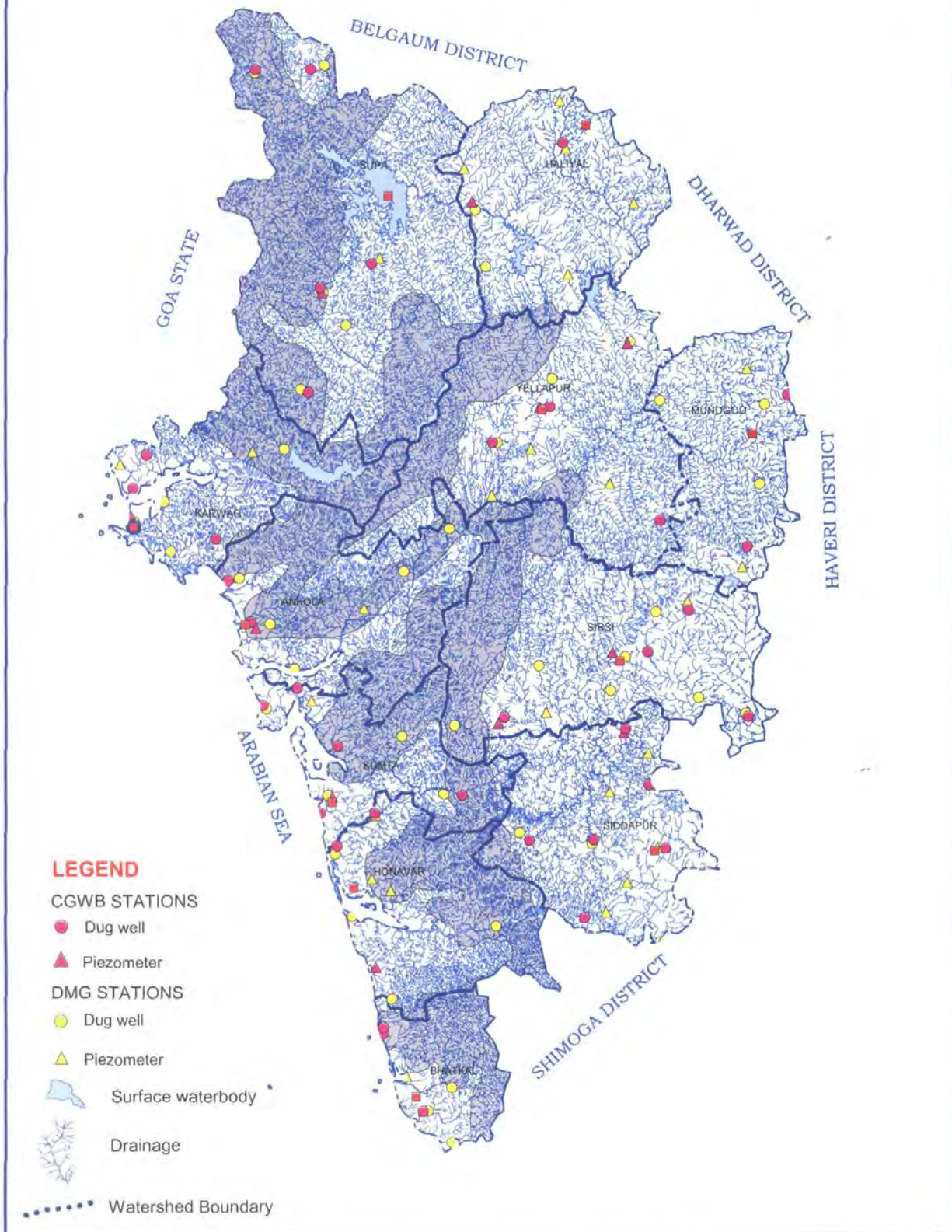
## **1.9 INDUSTRIES**

In the district there are two big, two medium and 7736 small scale industries. The important minerals available in the district are Iron and Manganese ores, Lime shell and moulding sand.

## **1.12 STUDIES CARRIED OUT BY CGWB**

Systematic hydrogeological surveys have been carried out by Shri. P. Nandakumaran, Scientist-B, Central Ground Water Board, SWR, Bangalore covering Halyal, Ankola, Kumta, Bhatkal, Honnavartaluku of Uttara Kannada district during the years 1984-87. Systematic hydrogeological surveys have been carried out by Shri. S.S.Hegde, Asstt. Hydrogeologist, Central Ground Water Board, SWR, Bangalore covering Sirsi and Yellapur taluks of Uttara Kannada district during the years 1986-87. Hydrogeological surveys were carried out by Shri. V.Saivasan, Asstt. Hydrogeologist, covering Siddapura and parts of Bhatkal taluks of Uttara Kannada district during the years 1985-86. Hydrogeological surveys were carried out by Shri.U.Joshi Asstt. Hydrogeologist, covering Mundgod taluk of Uttara Kannada district during the years 1985-86. Hydrogeological surveys were carried out by Shri. V.S.Prakash, Scientist-B, covering Karwar taluk of Uttara Kannada district during the years 1987-88. Hydrogeological surveys were carried out by Shri. K.Keerthiseelan, Scientist-C, covering Supa taluk of Uttara Kannada district during the years 1987-88. Another report was compiled by Shri. K. Keerthiseelan, Scientist-C, on "Hydrogeology and Ground Water Potential in Uttara Kannada district, Karnataka State" during the year 1990-91.

# DRAINAGE & HYDROGRAPH MONITORING STATIONS UTTARA KANNADA DISTRICT, KARNATAKA



## 2.0. RAINFALL AND CLIMATE

The Uttara Kannada District experiences tropical monsoon climate. Generally the weather is hot and humid on the coastal areas throughout the year. The district falls under the Hilly agro climatic zone except for western parts of Karwar, Ankola, Kumta, Honnavar and Bhatkal taluks which fall under coastal agro climatic zone. The temperatures start rising from January to peak in May, around 30 degrees is common. The highest day time temperatures rise some time up to 38°C. Thereafter it decline during the monsoons. As can be expected, the humidity is lowest during the dry season and highest during the monsoons. The winds are predominantly south westerly during the summer monsoon and northeasterly during the winter monsoon. The year may broadly be classified into four seasons. The dry season is from January to February with clear and bright weather. It is followed by hot weather from March to May. During this season thunderstorms are common in the month of May. The monsoon season is from June to September. This season yields around 75% (Haliyal taluk) to 90% (Karwar taluk) of the annual rainfall. The period from October to December may be termed as the post monsoon season. On an average the district receives annually around 2750 mm rainfall from nearly 103 rainy days. The rainfall decreases from over 3230 mm in west to less than 1207 mm in east. The coefficient of variability of premonsoon season rainfall is high indicating erratic rainfall. The same is the case during the post monsoon season. The variability is 30 to 40 % during the monsoon season, which is normal. July is the wettest month with normal monthly rainfall in all stations in excess of 300mm. The seasonal and normal rainfall for the period 2001-10 is given in table.1 and the taluk wise rainfall is given in annexure1

<b>Table : 1. Seasonal &amp; Annual Normal Rainfall for the period 2001-2010 Uttara Kannada District, Karanataka</b>				
<b>Station</b>	<b>Pre-Monsoon</b>	<b>SW Monsoon</b>	<b>NE Monsoon</b>	<b>Annual</b>
	<b>Rainfall (mm)</b>			
Ankola	195	3121	286	3602
Bhatkal	327	4055	334	4716
Haliyal	122	907	99	1129
Honnavar	209	3246	304	3759
Karwar	210	2841	301	3352
Kumta	204	3116	294	3614
Mundgod	143	865	117	1125
Siddapur	172	2562	180	2914
Sirsi	105	2054	201	2360
Supa	145	2005	149	2300
Yellapur	111	2171	157	2440

## **3.0. GEOMORPHOLOGY AND SOIL TYPES**

### **3.1 PHYSIOGRAPHY.**

The major part of the district is covered by hilly areas belonging to Sahyadri hill ranges, except for the narrow coastal strip on western side and plain table land areas on eastern most parts of the district occupying parts of Mundgod and Halyal taluks. The land mass of the district is situated between the elevations of 0 to 800 m above msl. The highest peak in the district is Darshangudda located 915 m.amsl near the border to Goa state. The District is having coast line of 122 kms.

Main surface water resources are harnessed for generating electricity by Kalinadi hydroelectric project and Kadra hydroelectric project. There are no major or medium irrigation projects in the district. There are about 1048 minor irrigation tanks irrigating around 23984 ha.

### **3.2 SOIL TYPES**

Along the coast on the western most part of the district the coastal alluvial soil is occurring. The most rugged hilly parts of the district are covered by hilly type soil and surrounded by the areas covered by lateritic soil. On eastern parts, the lateritic soils change to red loamy soils. Some area on eastern most parts of Mundgod taluk are covered by semi-black cotton soils.

## **4.0 GROUND WATER SCENARIO**

### **4.1.1 Occurrence of Ground Water**

Uttara Kannada district consists of rock formations of Archaean complex characterised by a system of ridges and a plateau on the west. Laterites occur overlying the schist and granites, and alluvium along the rivers and lagoons of the coast.

Main aquifers in the study area are the weathered and fractured zones of metavolcanics, meta-sedimentaries, granites, gneisses and laterites. The alluvial patches are found along the major stream courses.

Since, the hard rocks in the area do not possess primary porosity, the secondary structures like joints, fissures and faults present in this formation act as porous media. It generally constitutes about 3% of the volume of formation to facilitate storage of ground water. The phreatic zone generally occurs within the depth range of 3.00 to 30.00 mbgl. The fracture zones occur at various depth zones within the depth of 185.00mbgl. It is found that the water bearing characteristics of schistose rocks are more or less similar to that of gneisses and granites. But the weathered zones of schists may not yield as granites and gneisses because of their compact and fine grained nature.

Alluvium occurs along the river banks in a few to 14.00 metres thickness, holds the bank storage and along the sea coast and creeks occurs as narrow strip of sand bed having a depth up to 50m.

Ground water in the above aquifer system generally occurs under unconfined, semi-confined and confined conditions. In the shallower zones it exists under

phreatic condition and in the deeper zones it exists under semi-confined to confined conditions. The ground water is generally being exploited from the depth range of 3.00 to 31.00mbgl through dug wells and from 30.00 to 200.00mbgl through dug-cum-bore wells and Bore wells. The hydrogeological map depicting the hydrogeological details of the area is presented as Figure-3. The hilly tracks have thin weathered covers and the valley portions have thicker weathered zones.

#### **4.1.2 Ground water levels**

37 dug well National Hydrograph Stations (NHS) monitored in Uttara Kannada district during May 2011 shows water level in the range of 1.76 to 12.81mbgl (Appendix-I). During November 2011, the general depth to water levels in the national hydrograph stations (dug wells) were in the range of 0.56 to 17.06mbgl (Appendix-I). The water levels in 4 piezometers ranges from 1.77 to 14.10 m.bgl during May 2007 and 1.91 to 9.16 mbgl during November 2007.

A premonsoon water level map was prepared using May 2011 water levels available from the 30 national hydrograph network monitoring stations (Figure-4). The major part of the Uttara Kannada district is having the premonsoon water levels between 5 to 10 mbgl during 2011. Water levels between 2 and 5 m bgl were observed around Karwar town, in northern part of Supa, northern and north western part of Siddapur taluk, along the coast between Kumta and Ankola, also on southern parts of Ankola. The water levels between 10-20 mbgl are observed in northern parts of Supa and Halyal taluks, on south eastern part of Yellapur taluk, Eastern parts of Mundgod, Sirsi and Siddapur taluks. Remaining parts of the district is having water levels between 5-10 mbgl.

A post-monsoon depth to water level map has been prepared using NHS data (Figure-5). The major part of Uttara Kannada district is having the post monsoon water levels between 2 to 5 mbgl during 2011. In southern part of the district around Honavar town the depth to water levels are more than 10 m bgl and between 5 to 10 mbgl. In major parts of Sirsi and Siddapur taluks, and small parts of ankola, Yellapur, and Mundgod taluks the depth to water levels are between 5 to 10 m bgl. In Sirsi taluk around Sirsi town and east of it the depth to water levels are between 10 to 20mbgl. The area having water levels less than 2 mbgl during November 2011 is observed around Karwar town.

#### **4.1.3 Water Level Fluctuation**

The fluctuation of the water level is observed with a rise in the middle part of the district & fall in the northern & southern parts of the district. Ground water level fluctuation with respect to decade mean (2001- 2010) for the months of May and November 2011 is given in figures 6 and 7.

Fig. 3

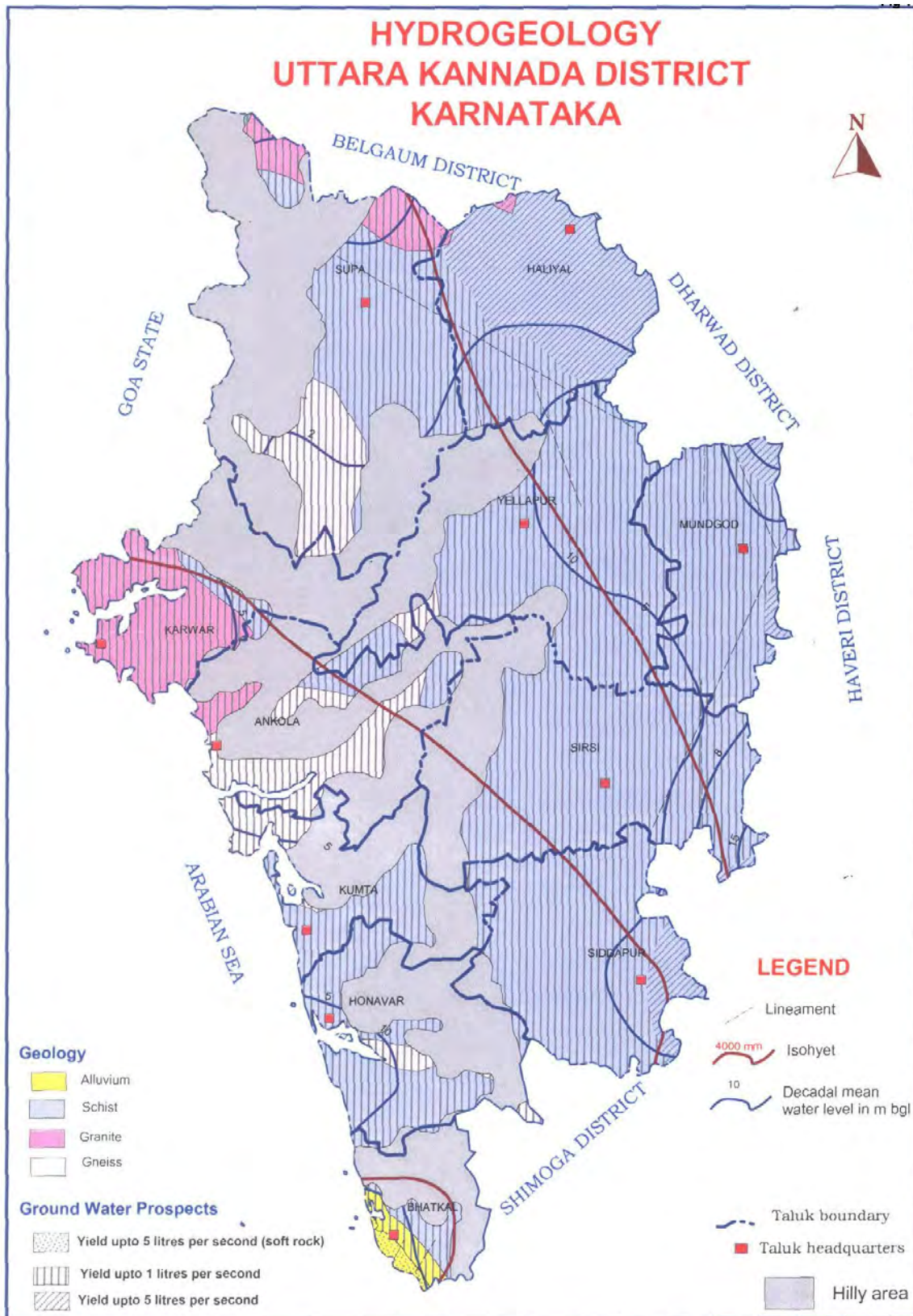


Fig 4

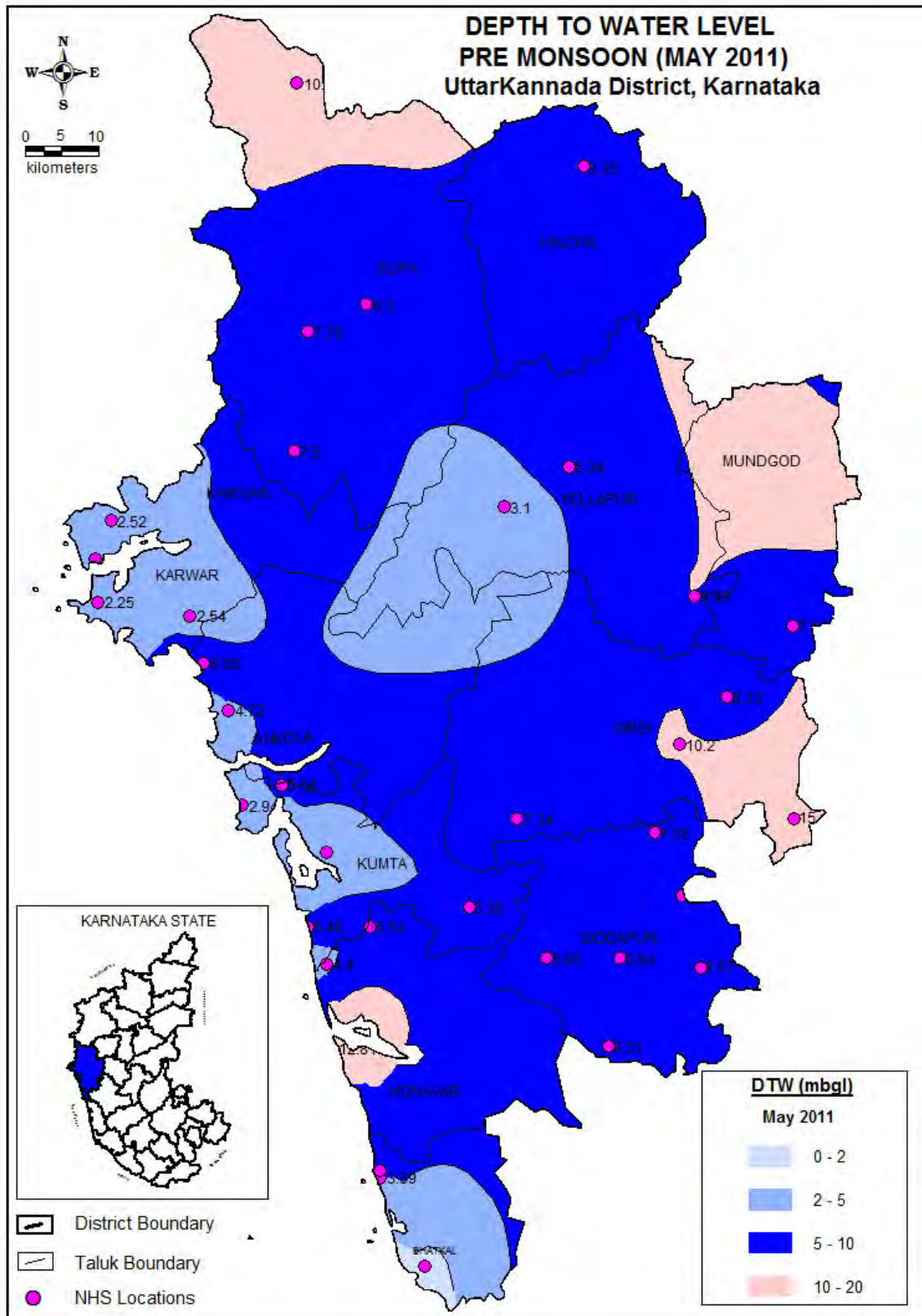


Fig. 5

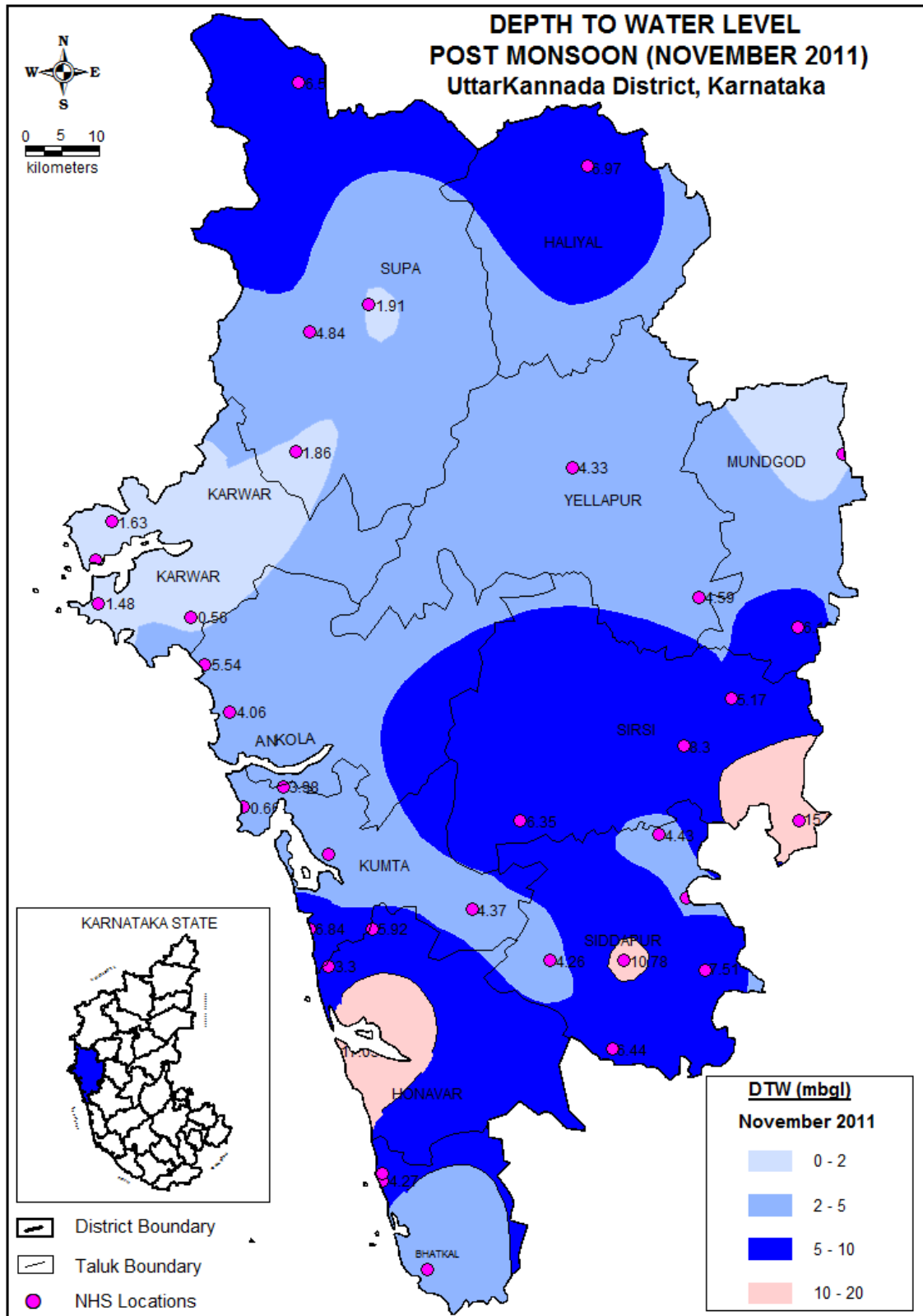




Fig. 6

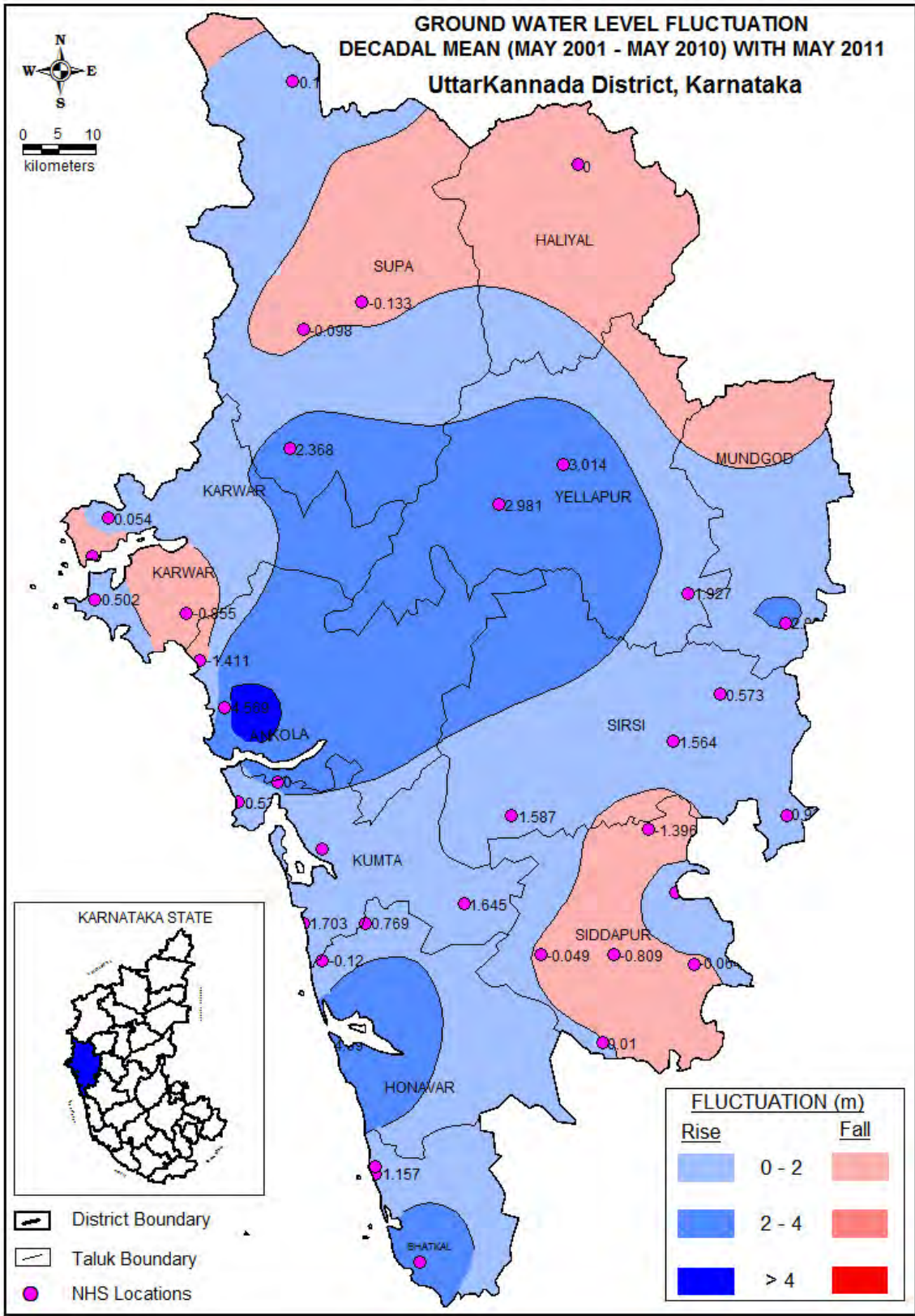
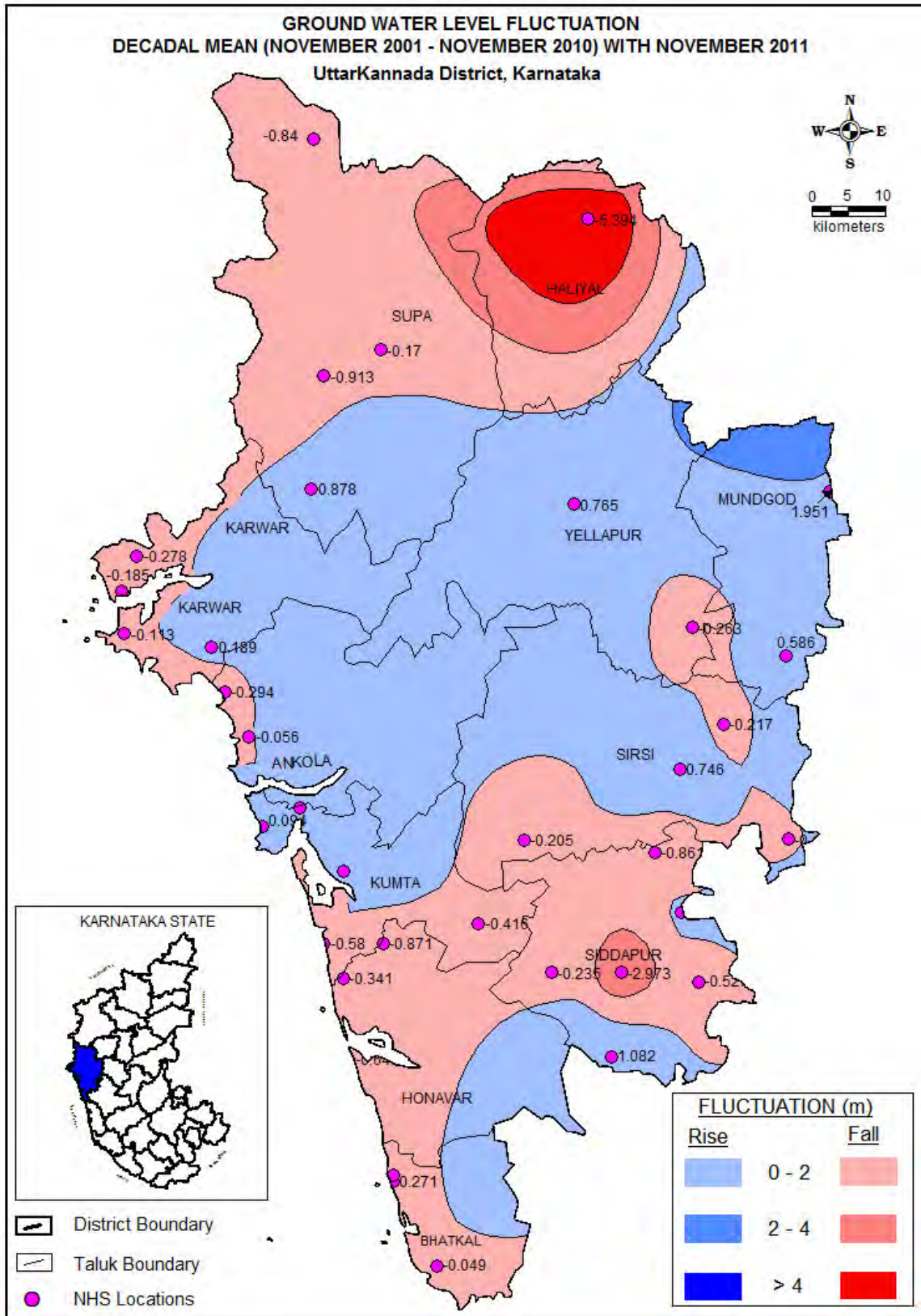


Fig. 7



#### **4.1.4 Ground Water Level Trends.**

Though the ground water recharge in the area is a regular natural phenomenon, the groundwater recharge varies in proportion to the developmental activities.

The premonsoon water levels for the last 10 years shows rising trends in 25% of the national hydrograph network stations and declining trends between 0.001 and 1.113 m/yrs.

The postmonsoon water levels for the last 10 years shows rising trends in 81% of the national hydrograph network stations in the district. The declining postmonsoon water level trends range between 0.025 and 0.166 m/yrs.

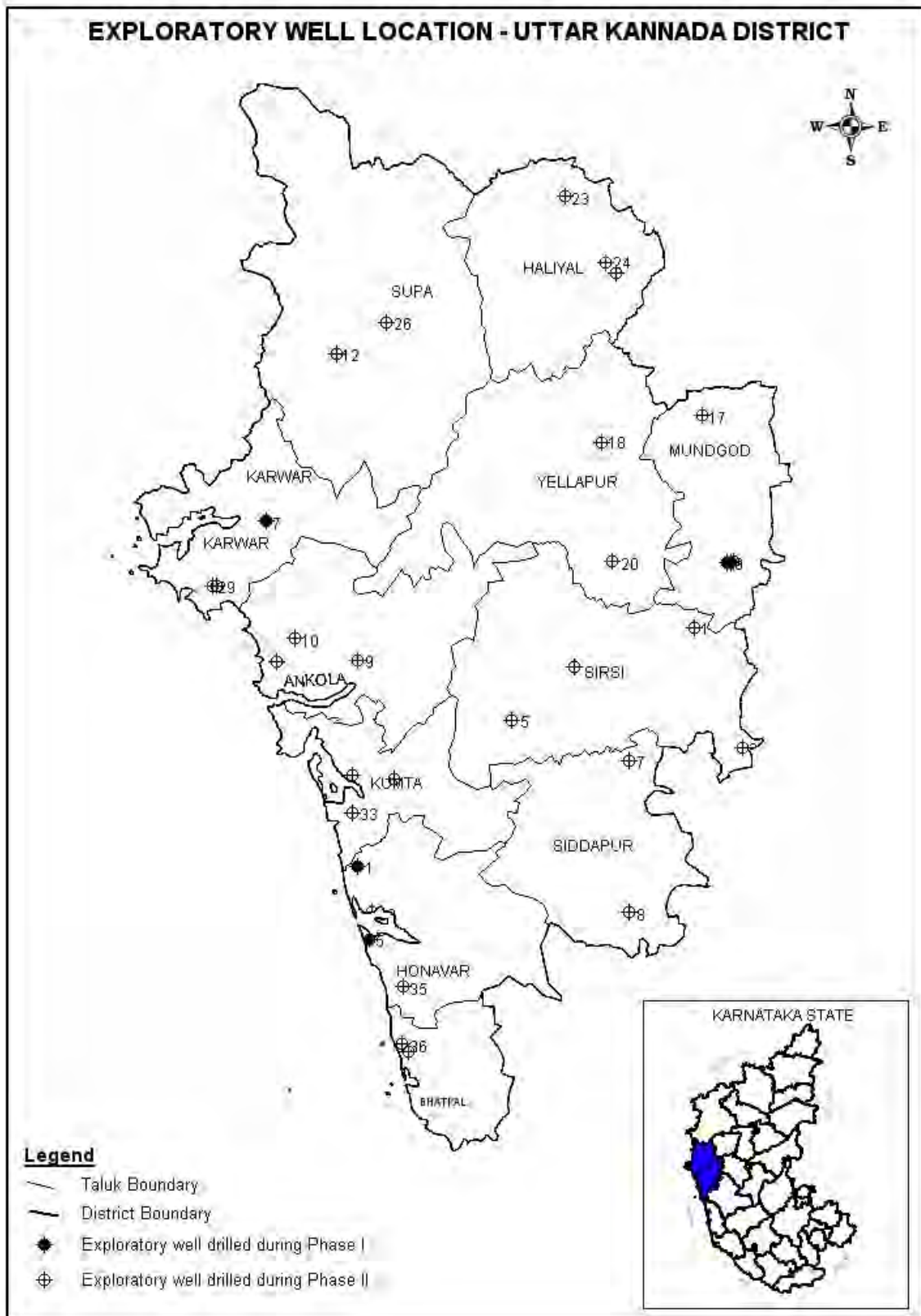
The premonsoon water levels in network piezometers (bore wells) for the last 10 years shows declining trends in 82 % of the stations and the postmonsoon water levels for the last 10 years shows declining trends in 45 % of the piezometers in the district. The premonsoon declining water level trends in these piezometers range between 0.005 and 0.80 m/year. The post monsoon declining water level trends in these piezometers range between 0.015 and 0.147 m/year.

#### **4.1.5 RESULTS OF GROUND WATER EXPLORATION**

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 as depicted in Figure-8. The ground water exploration in the district was carried out in two phases. During the first phase in 1988-89, 5 exploratory wells and four observation wells were constructed in coastal alluvium of Honnavar and Karwar taluks (Appendix-VIA). The depth of the wells ranged between 16-47 m. wells constructed in the range of 15-16m depth. The discharge recorded were in the range of 1.88 to 225 lpm for a drawdown of 1.6 to 10.39 m. Aquifer material encountered was fine to medium sand with alternative layers of silt and clay.

During the second phase of exploration which started during 2003-04 and continuing till date 33 wells were drilled with depth range of 89 to 200 m in hard rock areas of Ankola, Haliyal, Honnavar, Karwar, Kumta, Mundgod, Siddapur, Sirsi, Supa, and Yellapur taluks. The aquifers tested reveal an effective porosity of about 1-3% in these rocks(Appendix-VIB). The yield cum recuperation tests conducted on these wells show that the discharge of the wells ranges from negligible to 8.5 lps. The salient features of exploratory bore wells drilled and the aquifer tested are presented as appendix-I. The transmissivity of aquifer material in general range from 2.09 to 24.41 m<sup>2</sup>/day.

Fig. 8



## 5.0 GROUND WATER RESOURCES

### 5.1 RESOURCES

Ground water generally occurs in the weaker zones of geological formations under unconfined to semi-confined conditions. The main known source for recharge of dynamic water resources is the annual precipitation. Percolation from the surface water conservation structures and seepages from irrigation canals and return flow from irrigated agricultural lands also act as recharge components. The ground water resource estimation study for the whole state has been carried out for the year 2004, jointly by CGWB, SWR, Bangalore and Karnataka state ground water department (MGD) for the year 2009 using Ground Water Estimation Methodology 1997. The ground water estimation study indicates net annual ground water availability as 51060 ham for the district for the year 2009 (Table 2).

**Table- 2 Ground water resources in Uttara Kannada district as on march-2009**

SI No	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)	Net annual ground water availability (ham)
1	Ankola	4683	57	468	120	3197
2	Bhatkal	7804	431	790	474	5715
3	Haliyal	1021	600	1039	302	6425
4	Honnavar	3605	62	1	132	2352
5	Karwar	1506	32	149	70	1057
6	Kumta	3997	101	60	168	2607
7	Mundgod	4722	502	1090	262	4485
8	Siddapur	6640	414	98	510	5425
9	Sirsi	8227	679	900	457	7100
10	Supa	9446	119	41	245	5911
11	Yallapur	9257	479	974	197	6786
12	Total	60908	3476	5610	2937	51060

### 5.2 GROUND WATER DRAFT

The taluk wise ground water draft for domestic, industrial and for irrigation purposes computed for the district in the ground water estimation studies carried out by CGWB, SWR, Bangalore and State ground water department, Karnataka, for the year 2009 is given in table –3

**Table-3 Ground water draft for various purposes during the year 2008-09**

Sl No	Taluk	Ground water draft for drinking and industries (ham)	Irrigation Bore well & Dug well draft (ham)	Existing gross ground water draft for all uses (ham)
	Name of taluk	Monsoon (days 153) NonMonsoon (212 days)	Non-monsoon & Monsoon	For year (2008-09)
1	Ankola	213	672	885
2	Bhatkal	629	1804	2433
3	Haliyal	151	1698	1849
4	Honnavar	187	744	931
5	Karwar	123	391	514
6	Kumta	229	866	1095
7	Mundgod	178	1252	1430
8	Siddapur	374	3123	3497
9	Sirsi	379	2670	3049
10	Supa	141	1354	1496
11	Yallapur	219	953	1172
12	Total	2823	15527	18351

The perusal of the preceding table show the annual draft for domestic and industrial uses as 2823 ham and for irrigation purposes the draft computed was 15527 ham. Total draft during the year 2009 was 18351 ham. The maximum draft was observed in Siddapur taluk with 3497 ham and minimum annual draft of 514 ham was observed in Karwar taluk.

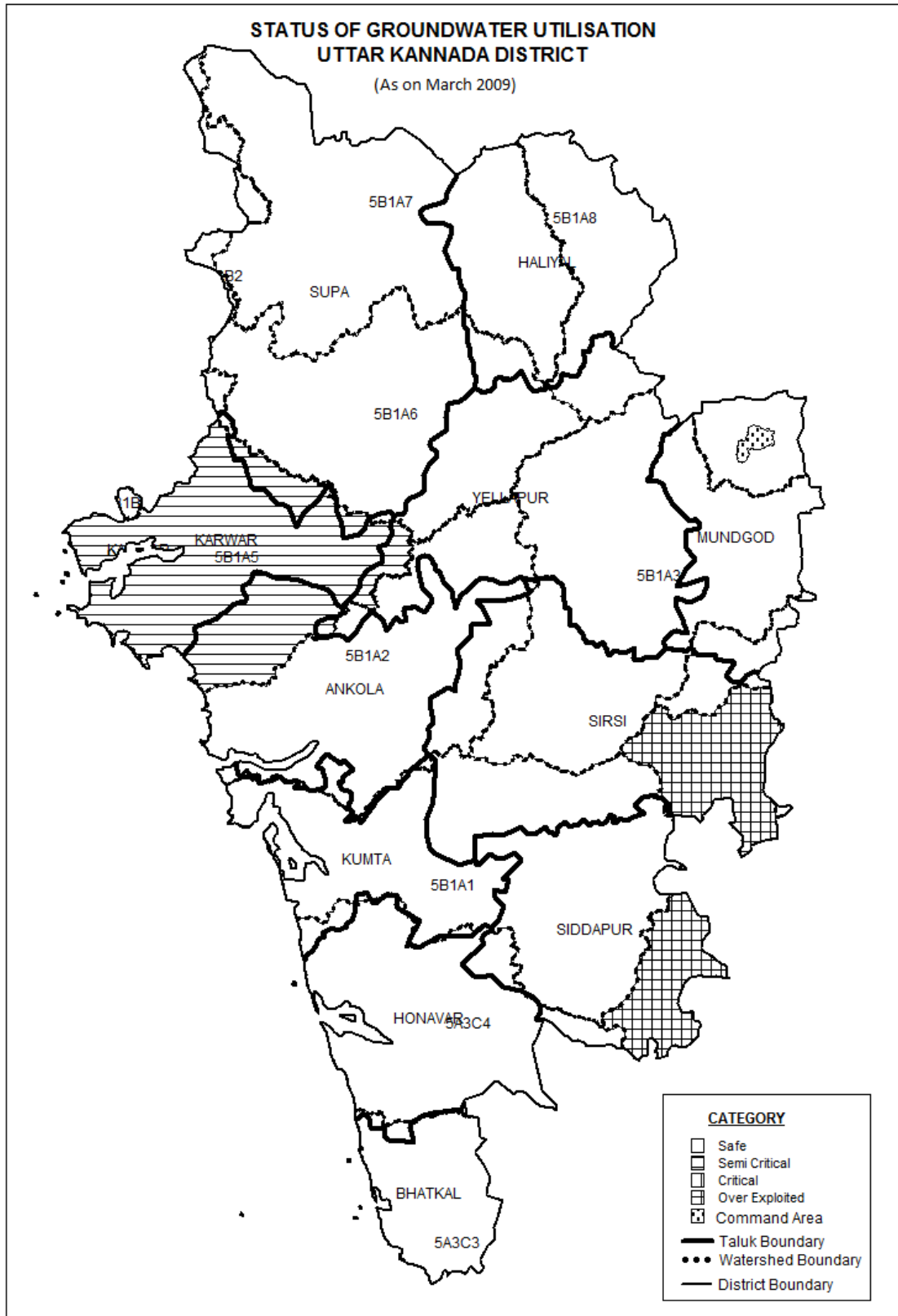
### 5.3 STAGE OF GROUND WATER DEVELOPMENT

The taluk wise stage of ground water development details computed for the district in the ground water estimation studies carried out by CGWB, SWR, Bangalore and State ground water department, Karnataka, for the year 2009 is given in table 4, and map showing watershed wise stage of ground water development is presented as Figure-9.

**Table-4 Taluk wise stage of ground water development studies in Uttara Kannada district for year 2009**

Taluk	Allocation for domestic and industrial use for next 25 years in (ham)	Net ground water availability for future irrigation development (ham)	Stage of development in %	Categorisation as on March 2004(%)			
				Safe	Semicritical	Critical	O.E area
Ankola	253	2272	28	100	-	-	-
Bhatkal	777	3133	43	100	-	-	-
Haliyal	181	4546	29	100	-	-	-
Honnavar	223	1386	40	100	-	-	-
Karwar	148	518	49	100	-	-	-
Kumta	272	1468	42	100	-	-	-
Mundgod	214	3019	32	100	-	-	-
Siddapur	425	1909	64	60	-	-	<b>40</b>
Sirsi	439	4011	43	70	-	-	<b>30</b>
Supa	171	4386	25	100	-	-	-
Yallapur	260	5574	17	100	-	-	-
Total	3363	32222	37.5	-	-	-	

Fig. 9



A perusal of preceding table shows that the district is falling mainly in safe category except for part of two taluks. The stage of ground water development is highest in siddapur taluk with 64% development and lowest development is in Yellapur taluk with 17 %. The ground water development for the whole district as a whole is 37.5%.

#### **4.3 Unit Area Annual Ground Water Recharge**

Sustainability of ground water resource depends mainly on two factors viz. Annual ground water recharge and annual ground water draft. The annual ground water recharge depends on the quantity and intensity of rain fall, the infiltration characteristics of the soil, the depth to ground water level, the slope of the area and the geomorphology. The ground water recharge is assessed separately for the monsoon and non monsoon period due to rainfall as well as due to other sources. The annual ground water recharge includes all the above.

The recharge from other sources includes return seepage from irrigated area, seepage from canals, seepage from water bodies, seepage from influent rivers etc. The recharge can be expressed in metres. In the state of Karnataka, the unit area recharge is grouped into four categories viz. 0.025-0.10m, 0.10-0.15m, 0.15-0.25m and 0.25-0.50m. In Uttara Kannada district the unit area annual recharge is in the range of 0.025-0.10m in all the taluks and is shown in figure. 10.

## **6.0 GROUND WATER QUALITY**

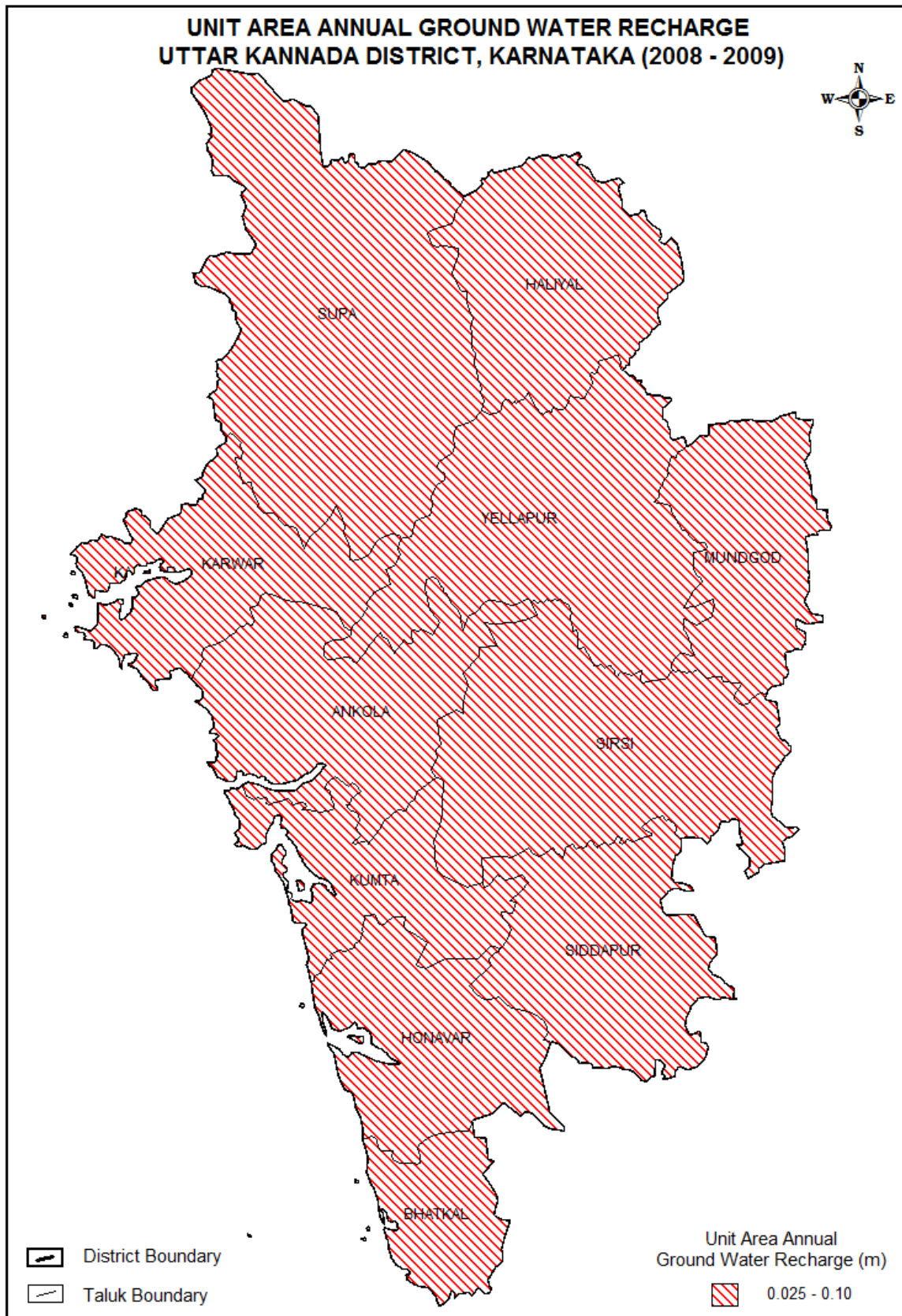
The range in concentration of all major constituents in ground water both during 1989 and 2005 are within safe limits as per BIS and ISMR standards. The concentration of Nitrates found to be higher during 2005 at Mainahalli(92ppm), Majalli(92ppm) and at Banavasi (81ppm). This may be attributed to more use of fertilizers at these locations. During 1989 all constituents in ground water of Murdeshwar hydrograph station shown in excess, may be because of construction activity in the vicinity at that time which resulted in heavy pumping and consequent deterioration of quality in coastal aquifer.

In general the quality of ground water in the urban areas is good and useful for all purposes. At few places it is observed, that the concentrations of  $\text{NO}_3$  and  $\text{SO}_4$  are found to be increased considerably. However, these chemical constituents are found within the permissible limits except at few localities.

A perusal of data available on the quality of ground water reveals that few chemical constituents increased over the period as described earlier. On the basis of the Electrical Conductivity, Nitrate and Fluoride distribution in the ground water samples from both CGWB and State ground water departments observation wells a chemical map is prepared and presented as Figure -11. The perusal of the electrical conductivity distribution map shows that in the major part of the district the EC values range between less than 250 and 750 micro mhos/ cm. The EC values in the ground waters in small patches on



Fig.10



northern parts of Honavar town, around Bhatkal town and north of Mundgod town shows higher values of electrical conductivity.

Even though none of the national hydrograph stations have shown excess fluoride (>1.5), the data collected from state departments show major parts of Sirsi and Siddapur taluks and small part of Mundgod taluk having fluoride above the safe limit of 1.5 mg/l. Small patches in Karwar, Sirsi, Siddapur and mundgod taluk are showing higher concentration of Nitrate in the ground water. The chemical data indicates the ground water is suitable for both drinking and irrigation in most part of the district. The vulnerable areas for groundwater contamination are presented in figure 12.

## 7.0 STATUS OF GROUND WATER DEVELOPMENT

### 7.1 DRINKING WATER SUPPLY FROM GROUND WATER :

As on march 2006 in utara Kannada district as many as 6607 boreholes were drilled for drinking water purpose, out of which 684 borewells are being used for piped water supply and another 786 borewells/dug wells are used for mini water supply. Taluk wise data of number of bore wells drilled, No of piped water supply scheme and number of mini water scheme is given in table No- 5

Table-5 Talukwise status of water supply.

SI No	Taluk	No of borewells drilled	pipd water supply schemes	Minewater schemes
1	Ankola	543	45	46
2	Bhatkal	464	19	53
3	Haliyal	625	71	116
4	Honnavar	677	60	88
5	Karwar	473	27	47
6	Kumta	695	73	86
7	Mundgod	637	62	76
8	Siddapur	578	48	60
9	Sirsi	869	94	86
10	Supa	415	165	47
11	Yellapur	626	25	81
12	Total	6607	689	786

Fig-11

Fig.7

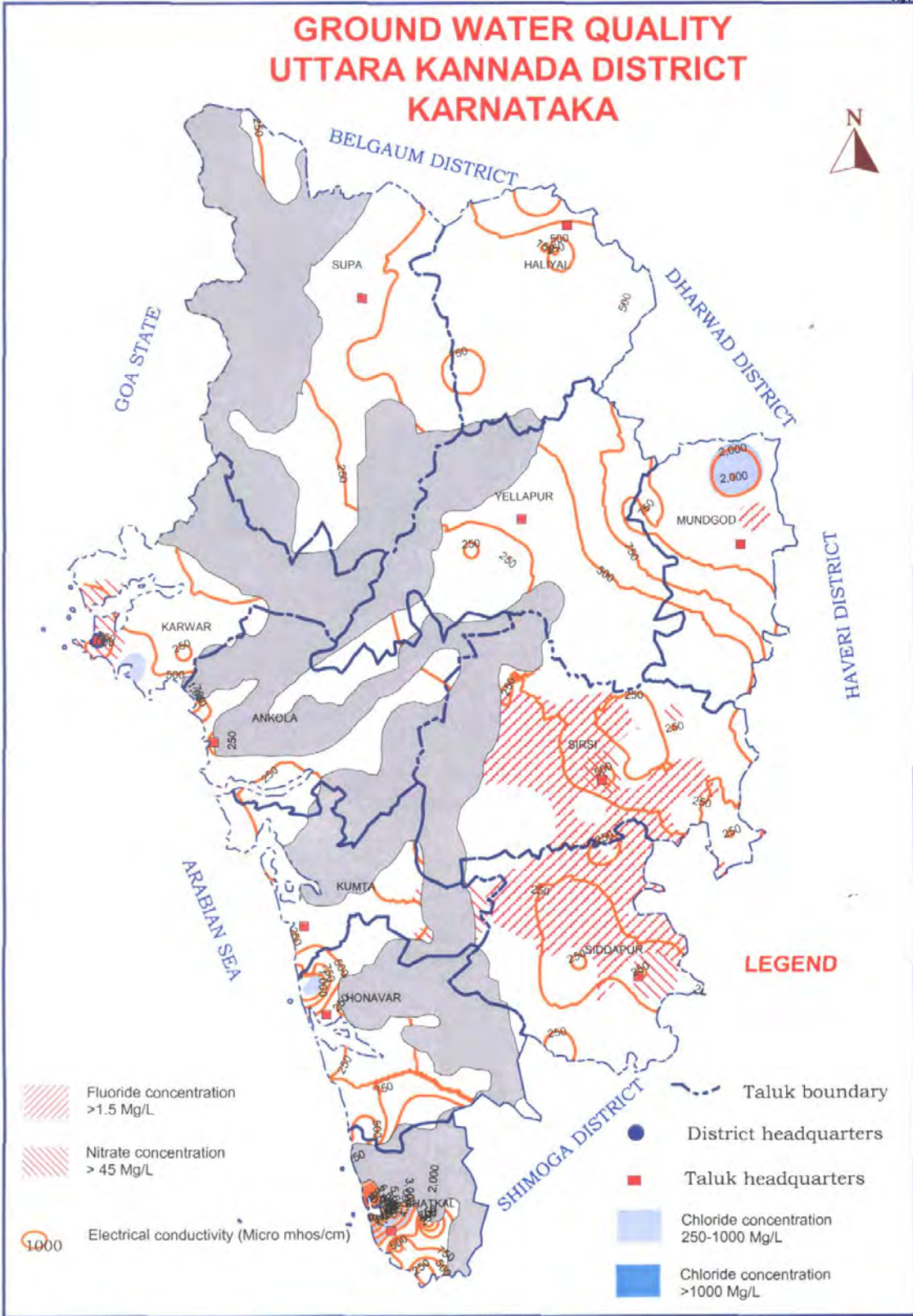
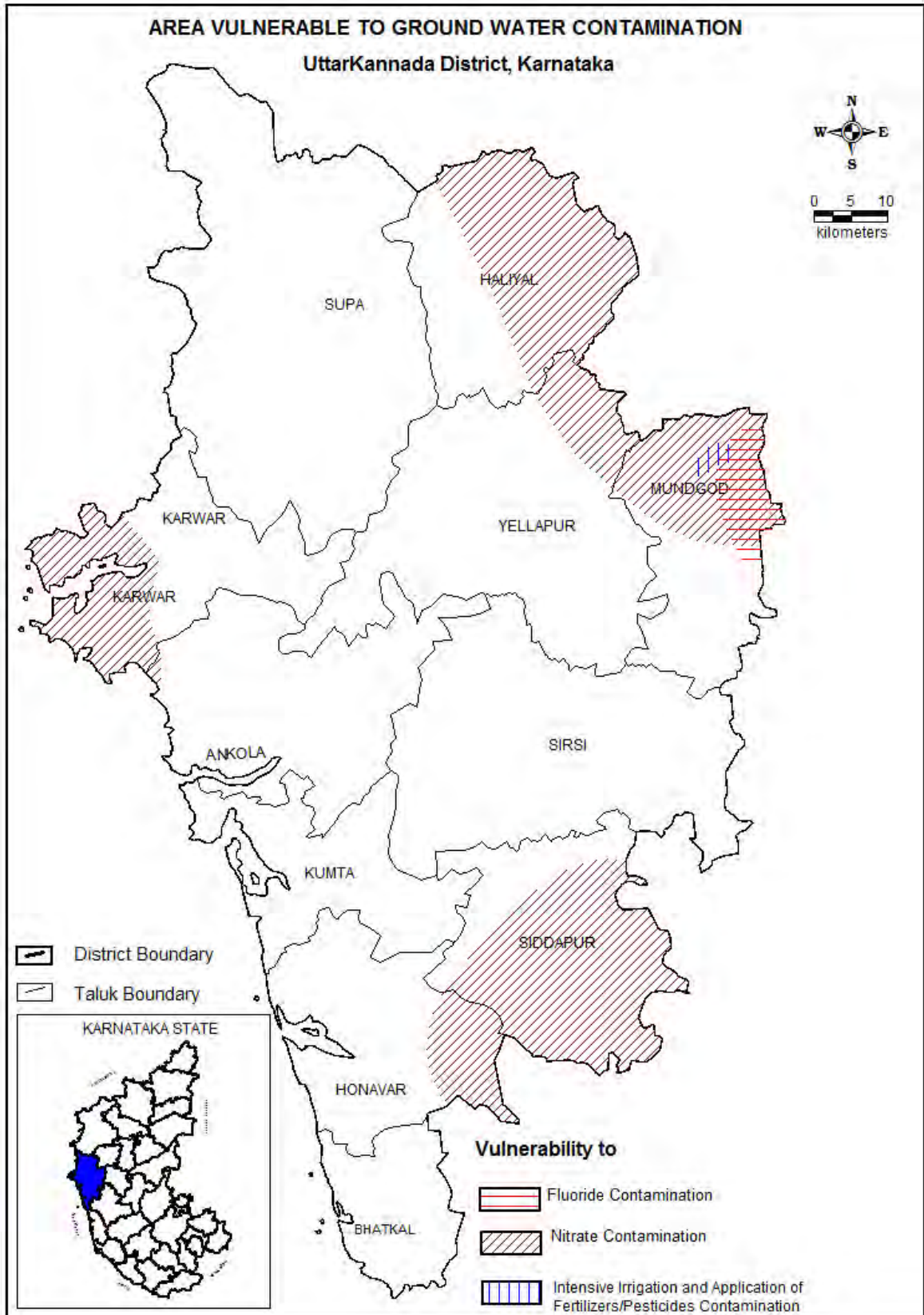


Fig. 12



## **7.2 IRRIGATION SCENARIO FROM GROUND WATER RESOURCES:**

In UttaraKannada district during 05-06 net area under irrigation from ground water resources was 9342 ha constituting 36.92 % of area irrigated from all sources. Of which 7302 hectares was under irrigation from dugwells (77.75%) and 2090 ha was under irrigation from borewells (22.25%). Taluk wise net area irrigated from dugwell and borewell is already given in table-4. The perusal of the table shows Kumtataluk is having maximum of 1699 ha followed by Sirsi with 1560 ha and honnavar 1442 ha irrigated by dugwells. Mundgodtaluk has maximum of 964 ha followed by Halyataluk with 638 ha under borewell irrigation.

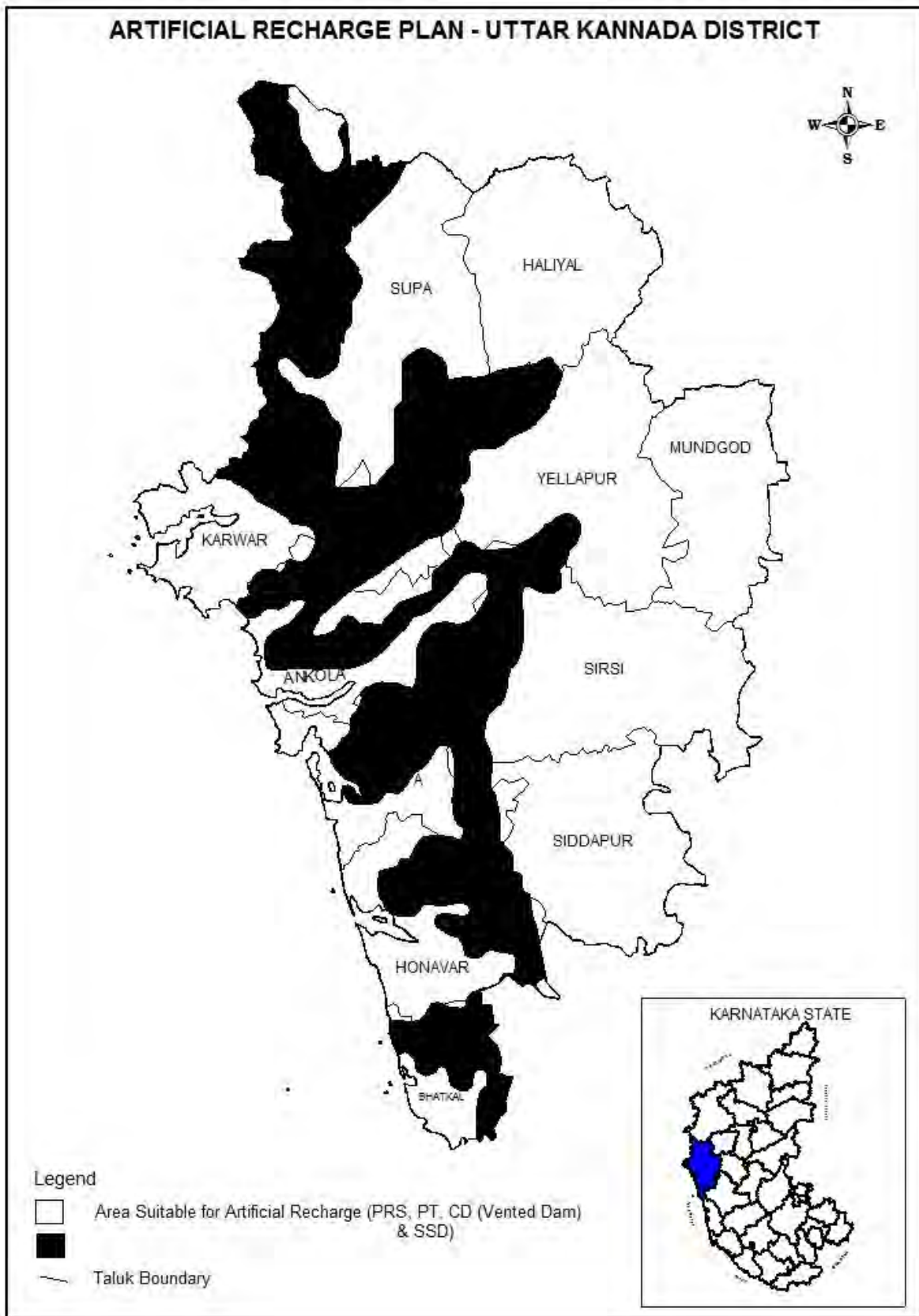
## **8.0 GROUND WATER MANAGEMENT STRATEGY**

Even though the district receives good rainfall, because of undulating topography and very permeable formation at the surface most of the rainwater escapes either as surface flow or base flow and in many parts of the district after march there is acute shortage of water even for drinking. So the water supply sources should be supported by suitable artificial recharge structures or ground water conservation structures in the vicinity to augment the present water supply. The areas suitable for artificial recharge and suitable structures are given in figure 13.

The present ground water development is of low key and still plenty of scope is there for further development. Still dugwells are the more common abstraction structures for ground water irrigation. But in recent times bore wells are becoming more popular. But for irrigation as far as possible dug wells only should be suggested against bore wells because dugwells along with suitable artificial structures in the vicinity are more effective and chances of borewell failure are more. The dug wells as they are depending only on phreatic aquifers the cropping pattern will be as per the availability from the phreatic aquifer but borewells as they draw water from phreatic as well as deep seated aquifers the cropping pattern will not respond to the changes in shallow aquifers and in long run it may lead to over development of ground water.

The selection of sites for construction of artificial structures and ground water abstraction structures is site specific so after detailed hydrogeological investigation only sites may be selected.

Fig. 13



## **9.0. GROUND WATER PROBLEMS AND SPECIAL STUDIES**

There are both quantity and quality related ground water problems exist in the district. Except Halyal and Mundgod taluks whole district receives high rainfall. The highly undulating topography and highly permeable shallow aquifers allow the ground water recharged during monsoon to escape as baseflow. Because of this most part of the district suffers scarcity of water during summer. Construction of gully plugs, contour bunds and contour trenches at higher reaches and percolation tanks, nalla bunds, check dams and vented dams at comparatively lower reaches along with subsurface dams will facilitate more recharge to ground water and less base flow. In urban and semi-urban areas rooftop rainwater harvesting coupled with point recharge structures will help in more recharge to the ground water as well as reduce load on surface water supply systems. But the depth to water in these areas must be more than 5 mbgl.

The quality problems related to ground water are in the coastal aquifers where chances of sea ingress are there. High salinity is observed the areas around Bhatkal in coastal alluvium. So it is necessary to have more observation stations on the coastal line to keep a watch on the changes in ground water quality. In Dandeli and Supa areas mining and other industries are producing toxic wastes and untreated effluents, which may cause deterioration in chemical quality which will be very difficult to reverse. So a constant check on ground water quality in these areas is required. Fluoride contamination is reported from large areas in siddapur and sirsi taluks. So it is necessary to demarcate the affected areas and to develop the shallow aquifers in these affected areas.

## **10.0 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) The dug wells, which penetrate partially the weathered, fractured zones of the aquifers, may be deepened further for better productivity.
- 2) Construction of check dams and sub surface dykes at appropriate places across nallahs and streams located in the water table depleting areas, and the areas where water quality problem exists may be taken on priority basis.
- 3) Sinking of the filter points and collector wells with the maximum depth of -4-6 m in the alluvial stretches of river banks and in coastal alluviums would be ideal ground water abstraction structures.
- 4) In the hard rock terrain, in the areas with shallow water table sinking of suitable dug well and dug-cum-bore well with a maximum depth of 8 and 30 m recommended respectively for the structures. As the whole district comes under safe category there is still scope for further ground water development. But all the ground water resources development should be incorporated with ground water conservation measures.
- 5) Even though the district receives good rainfall, considering the water scarcity in some pockets during peak summer, a comprehensive programme should be formulated to harvest the rain water through roof

top, check dams, surface tanks, and bunds to enhance the recharge to the ground water and also the subsurface dykes to arrest the sub surface flows and augment the groundwater resources.

- 6) 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.
- 7) Constant monitoring of ground water quality should be carried out in the fluoride contaminated areas and industrial and mining belts to prevent further deterioration and related problems. The determination of trace elements and organic compounds is to be done to help in categorizing the quality of water.
- 8) A detailed geophysical studies with the help of the state of the art technology should be conducted to demarcate the extent of potential aquifers and it's geometry, especially in coastal areas to know the relationship between sea water and ground water.
- 9) As the shallow aquifer is free from fluoride, compared to deeper aquifer this has to be preserved by watershed approach. Desilting and maintaining of these tanks are utmost importance. So the natural recharge will take place without any hindrance and this will recharge the shallow aquifer mainly, which can be used for drinking use, which is free from fluoride in major part of the area.
- 10) The farming community in the valley and low lying regions should be encouraged with financial assistance and necessary technical guidance to sink appropriate abstraction structures, to install pump sets, to practice modern irrigation methods thereby to strengthen their economy. It is also recommended to bring an estimated 64161ha of land to irrigate through balance of ground water resources. For irrigation as far as possible dug wells may be preferred over bore wells to avoid failure of both dug and bore wells due to heavy abstraction from bore wells.
- 11) Conjunctive use of both Surface and Ground water may be practiced in the canal command area to improve the quality of ground water and to prevent the water logging conditions and to make available the canal water to the tail end areas.



**Annexure 1**

<b>DISTRICT AND TALUK WISE RAINFALL FOR THE YEAR 2011, UTTARA KANNADA DISTRICT, KARNATAKA</b>																	
	DISTRICTS/ TALUKS	JAN	FEB	MAR	APR	MAY	PRE	JUN	JUL	AUG	SEPT	SWM	OCT	NOV	DEC	NEM	ANNUAL
		Rainfall (mm)															
	<b>UTTRA KANNADA</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>63</b>	<b>27</b>	<b>92</b>	<b>864</b>	<b>925</b>	<b>749</b>	<b>457</b>	<b>2994</b>	<b>105</b>	<b>44</b>	<b>0</b>	<b>150</b>	<b>3236</b>
<b>1</b>	ANKOLA	0	0	0	27	0	27	930	1411	869	437	3647	80	6	0	86	3760
<b>2</b>	BHATKAL	0	0	0	31	31	62	1137	1257	1271	626	4291	108	63	0	171	4524
<b>3</b>	HALIYAL	0	7	0	78	80	165	333	252	269	196	1050	88	33	0	121	1336
<b>4</b>	HONNAVAR	0	0	0	133	24	157	1039	1300	1172	613	4124	55	19	0	74	4355
<b>5</b>	KARWAR	0	0	0	18	0	18	964	1165	855	392	3376	72	22	0	94	3488
<b>6</b>	KUMTA	0	0	0	87	12	99	977	1167	1144	629	3917	75	6	0	81	4097
<b>7</b>	MUNDGOD	0	1	0	33	19	53	246	180	218	170	814	158	50	0	208	1075
<b>8</b>	SIDDAPUR	0	0	0	65	21	86	976	1164	621	636	3397	113	88	0	201	3684
<b>9</b>	SIRSI	0	0	14	92	72	178	1120	754	578	540	2992	184	81	0	265	3435
<b>10</b>	SUPA	0	3	0	82	10	95	983	732	592	347	2654	138	73	0	211	2960
<b>11</b>	YELLAPUR	0	0	0	43	26	69	797	790	651	438	2676	88	48	0	136	2881

