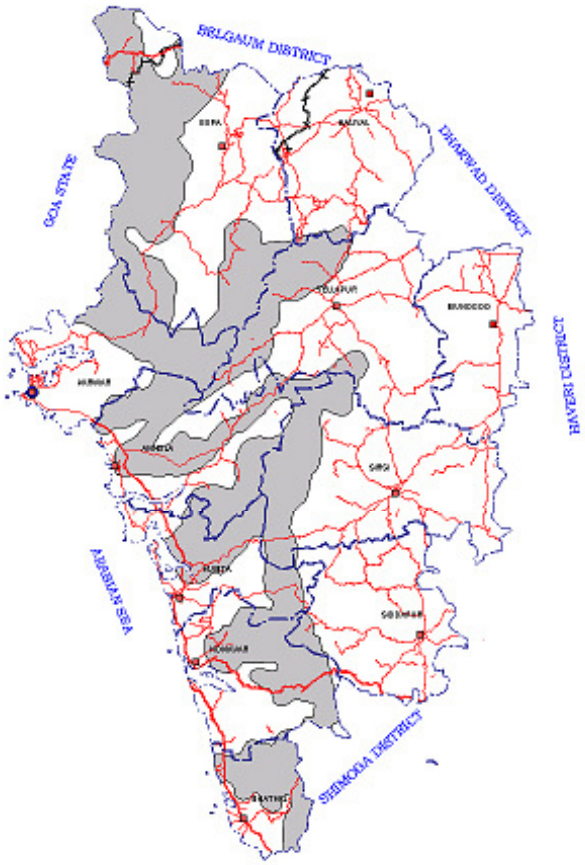
जल वर्ष 2007 Water Year 2007

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
UTTARA KANNADA DISTRICT, KARNATAKA



SOUTH WESTERN REGION
BANGALORE
NOVEMBER 2008

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 **Uttara Kannda** 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 G.S.Deshpande** , Scientist-B and **Shri B.K.Kallapur**, Scientist-D 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

UTTARA KANNADA DISTRICT AT A GLANCE

Sl No			ITEMS	STATISTICS
I			**GENERAL INFORMATION**	
	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 (2001 census) :	
		a)	Total Population :	13.54 lakhs
		b)	Rural Population :	9.66 lakhs
		c)	Urban Population :	3.88 lakhs
		d)	Density of Population :	132 Persons/Sq.km
		e)	Literacy percentage :	76.60%
II			**GEOMORPHOLOGY**	
			Major physiographic divisions	i) coastal plains, ii) Western ghats iii) Eastern table land
			Major Drainages	Kali, Sharavathi, gangavali and Aganashini
III			**Land use (2005-2006)**	
		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
IV			**MAJOR SOIL TYPES**	Hilly soil, lateritic soil, loamy soil and semi-black cotton soil.
V			**AREA UNDER PRINCIPAL CROPS (2002-03) figures in ha**	Paddy – 80311 Maize -- 1542 Pulses – 2426 Spices – 15787 Oil seeds- 3452 Fruits -- 6924 Vegetables- 302 Sugarcane- 1008 Cotton – 6197 Coconut-- 7197
VI			**IRRIGATION BY DIFFERENT SOURCES**	Source Area(ha) Dugwells –7302 Borewells-2090 Lift - 596 Tanks/Ponds-4754

		Canals - 94 Other sources – 10601 Net irrigated area -25437	
VII	**NUMBER OF GROUND WATER MONITORING STATIONS OF CGWB**		
	No of Dugwells	34	
	No of piezometers	10	
VIII	**PREDOMINANT GEOLOGICAL FORMATIONS**		
	Recent	Alluvium	
	Lower Precambrian	Dharwar system	Meta-sedimentary & Metavolcanics.
	Archaean Formation	Peninsular gneisses	Gneisses,mig-matites and granites

VII	**HYDROGEOLOGY**		
	Major Water Bearing Formations		
	Shallow aquifers 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		
	Deeper aquifers of fractured and jointed Schists, gneisses and metavolacanics and meta sedimentaries up to 200 mbgl.		
	Premonsoon Water levels during 2007 (mbgl)	1.91 to 29.88 mbgl.	
	Post monsoon Water levels during 2006 (mbgl)	0.36 to 16.85 mbgl.	
	Long term water level trends (1998-2007)m/year	**NHS dugwells**	**NHS Piezometers**
	Premonsoon Rising trends	9	2
	Premonsoon Falling trends	27	9
	Postmonsoon Rising trends	30	6
	Post monsoon Falling trends	7	5
IX	**GROUND WATER EXPLORATION BY CGWB**	**Phase I**	**Phase II**
	No of wells drilled	5 EW, 4OW	33
	Depth range (m)	16-47	89-200
	Discharge (l/sec)	0.05 – 3.75	0-8.5
	Transmissivity (m2/day)	7.1 – 446	2.09–24.41
X	**GROUND WATER QUALITY**		
	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,		
XI	**DYNAMIC GROUND WATER RESOURCES (As per revised estimation as per 1997 methedology) AS ON 31ST MARCH 2004**		
a)	Net annual ground water availability (ham)	70765	

	b)	Existing gross ground water draft for all uses (ham)	17452
	c)	Allocation for domestic and industrial use for next 25 years in (ham)	3127
	d)	Balance ground water irrigation potential available (ha)	64161.78
	e)	Stage of development as on March 2004 (%)	24.66
XII		**AWARENESS AND TRAINING ACTIVITIES**	
		Mass awareness programme arranged	Nil
		Water Management training programme arranged	Nil
XIII		GROUND WATER CONTROL AND REGULATION	
		Number of OE blocks	Nil
		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 13^0 55' 02" to 15^0 31' 01" and east longitudes $74^0$0'35" to $75^0$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 town. The district is divided in to four subdivisions, namely - Bhatkal subdivision, comprising of Bhatkal, Honnavar taluks, Karwar subdivision, comprising of Haliyal, Karwar, Supa taluks, Kumata subdivision, comprising of Kumata, Ankola and Sirsi subdivision comprising of sirsi, Yellapur, Siddapur and Mundgod taluks.

1.3 ACCESSIBILITY.

The district head quarters Karwar is located around 500 kms from Bangalore city on Panjim – Mangalore National highway No 17. The National high way No 17 enters the district from South and passes through Karwar, Ankola, Kumta, Honnavar, Bhatkal and leaves the district through Northern direction. 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 Trivendrum passes through the western most part of the district in 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 places by metalled roads The administrative map of Uttara Kannada district is given as Figure-1.

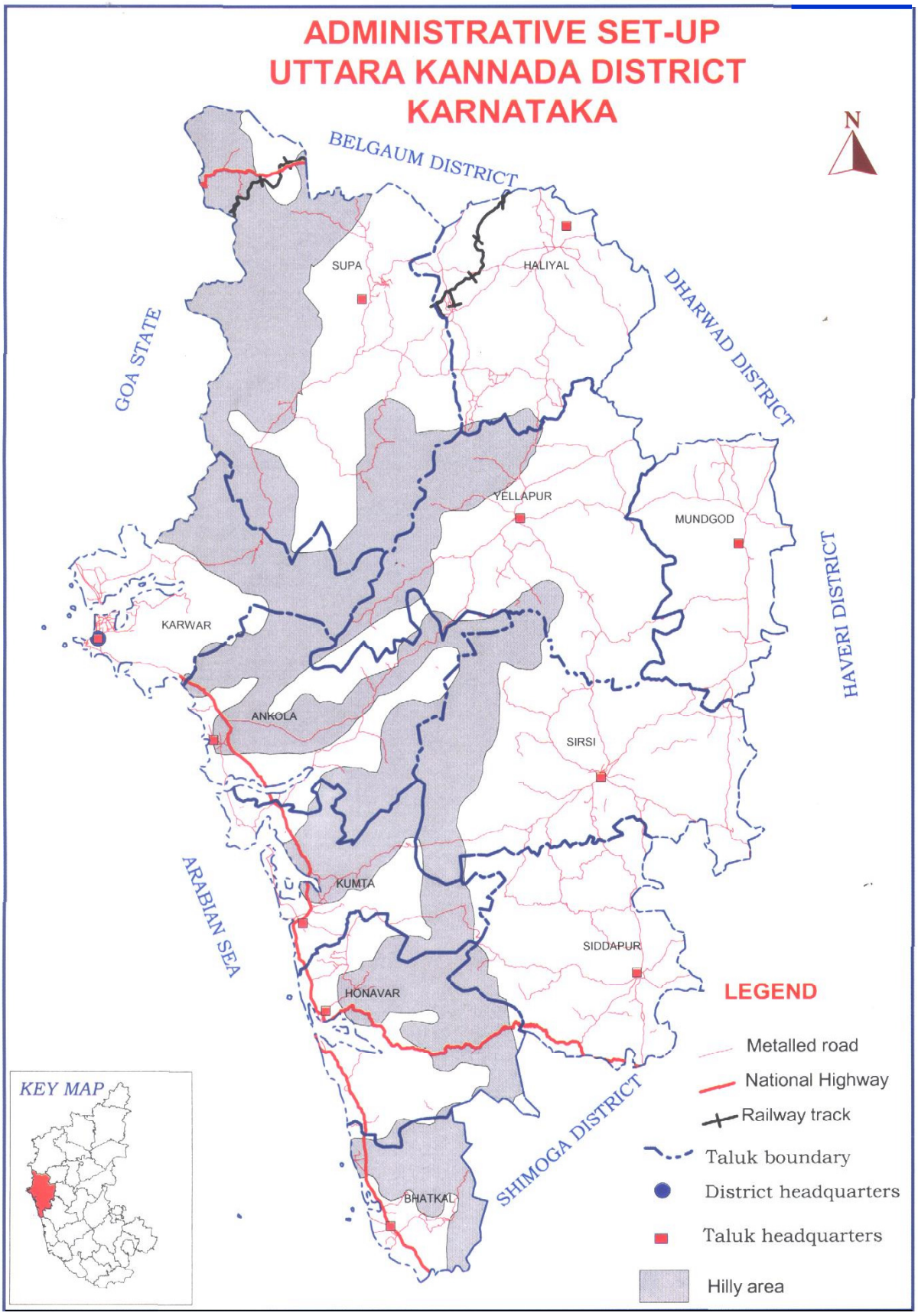
1.4 POPULATION.

The total population in the district is around 14.39 lakhs(as per 2001 census), out of which rural population constitutes 11.40 lakhs. The schedule cast population constitutes 1.75 lakhs, out of which 1.52 lakhs live in rural areas and remaining 0.23 lakh schedule caste population lives in urban areas of the district. The schedule tribe population constitutes 1.27 lakhs of which 1.16 lakhs live in rural areas and remaining 0.11 lakhs of schedule tribe people live in urban areas. The sex ratio in the district is 943 females for every 1000 males.

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).

Figure-1


ADMINISTRATIVE SET-UP
UTTARA KANNADA DISTRICT
KARNATAKA
N
BELGAUM DISTRICT
GOA STATE
DHARWAD DISTRICT
HAVERI DISTRICT
SHIMOGA DISTRICT
ARABIAN SEA
SUPA
HALIYAL
YELLAPUR
MUNDGOD
KARWAR
ANKOLA
SIRSI
KUMTA
SIDDAPUR
HONAVAR
BHATKAL
KEY MAP
LEGEND
Metalled road
National Highway
Railway track
Taluk boundary
District headquarters
Taluk headquarters
Hilly area

1.6 LAND USE AND CROPPING PATTERN.

The district has 813695 ha. of forest which constitutes 79 % of the total geographical area of the district. The land not available for cultivation is 50600 ha. ie; 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. of 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.

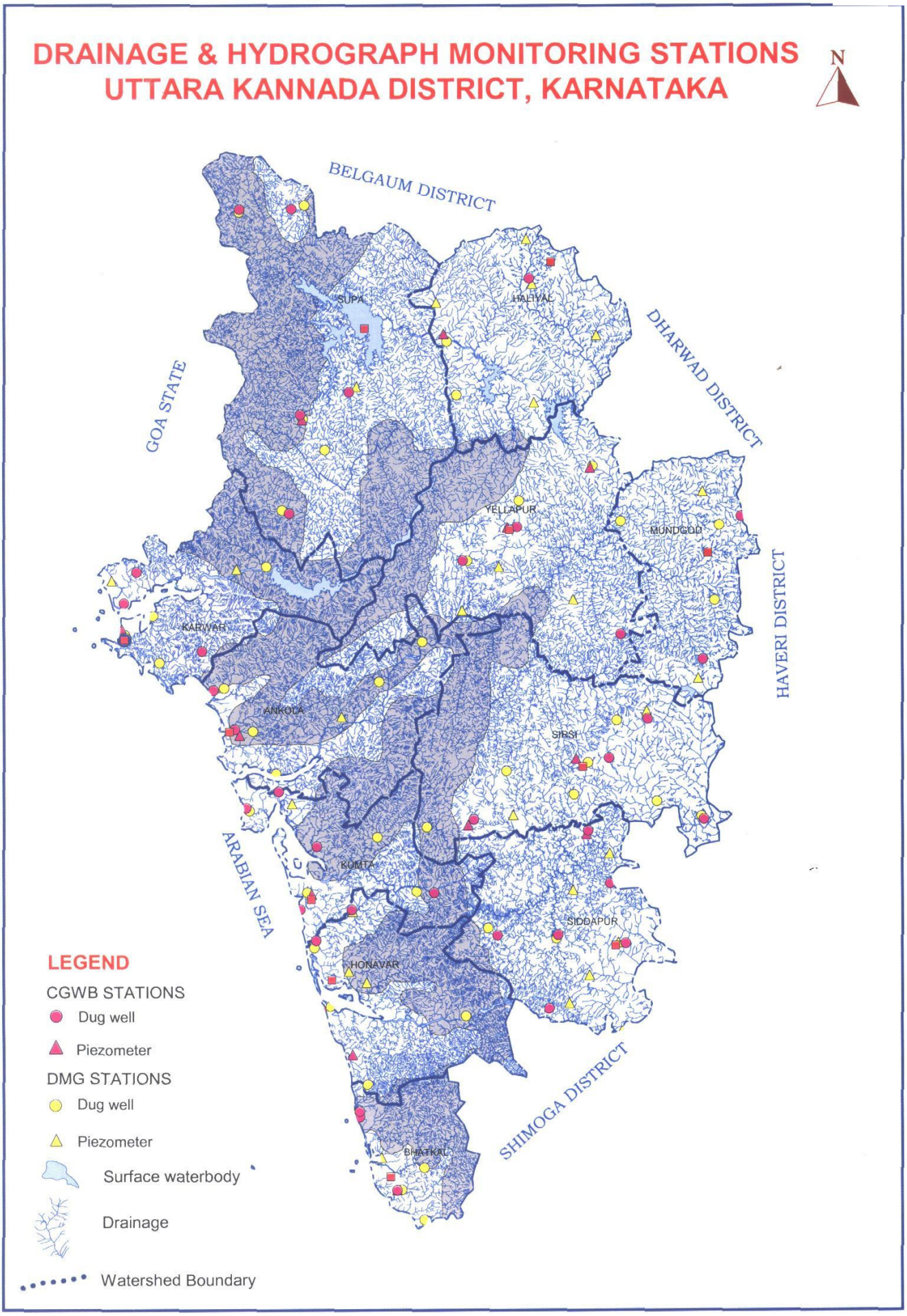
Out of 113277 ha of cultivated land during 2005-06, 25437 ha was under irrigation (22% of total cultivated area), out of which 94 ha was irrigated under canals, 4754 ha was irrigated under tanks, 7302 ha was irrigated by dugwells, 2090 ha was irrigated by tube/bore wells. The source wise irrigation data for Uttara Kannada district is given as table-4.

1.9 INDUSTRIES

In the district there are 2 big and 2 medium industries and 7736 small industries are located in the district. 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, Honnavar taluks 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. A report compiled by Shri K. Keerthiseelan, Scientist-C, on “Hydrogeology and Ground Water Potential in Uttara Kannada district, Karnataka State” during the year 1990-91 covers Uttara Kannada district.


DRAINAGE & HYDROGRAPH MONITORING STATIONS
UTTARA KANNADA DISTRICT, KARNATAKA
N
BELGAUM DISTRICT
GOA STATE
DHARWAD DISTRICT
HAVERI DISTRICT
SHIMOGA DISTRICT
ARABIAN SEA
SUPA
HALIYAL
YELLAPUR
MUNDGOD
KARWAR
ANKOLA
SIRSI
KUMTA
SIDDAPUR
HONAVAR
BHATKAL
LEGEND
CGWB STATIONS
Dug well
Piezometer
DMG STATIONS
Dug well
Piezometer
Surface waterbody
Drainage
Watershed Boundary

2.0 . RAINFALL AND CLIMATE

The Uttara Kannada District experiences tropical monsoon climate. Genarally the weather is hot and humid on the coastal areas throughout the year. The district falls under the Hilly agroclimatic zone except for western parts of Karwar, Ankola, Kumta, Honnavar and Bhatkal taluks which fall under coastal agroclimatical 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^{o}C. Thereafter they will 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% (Halyal 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 occurs in 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. The same is the case on an annual basis it being around 30%. July is the wettest month with normal monthly rainfall in all stations is recorded in excess of 300mm. Annual rainfall in the district varies from 1176.8 mm in Mundgod taluk to around 4145.6 m.m in Bhatkal. Rainfall distribution during the last five years is varied. For the period between 2001-2005 at ankola, normal rainfall is recorded except during the year 2003 when excess rainfall was recorded. During the year 2001 in all the stations deficient rainfall was recorded except at Ankola, Bhatkal, Honavar , Karwar ,and Kumta. During 2002 also there was deficient rainfall in all stations except at Ankola , Honavar, Karwar and Kumta. During 2003 Ankola has received excess rainfall and all other stations have normal rainfall except at Haliyal, Mundgod, Siddapura and Yellapur. During 2004 Bhatkal raingauge station recorded excess rainfall and other stations recorded normal rainfall except Haliyal, Sirsi and Yellapur. During 2005 all stations have recorded normal rainfall except supa.

Table – 1 Taluk wise annual rainfall data

SL NO	STATION	ANNUAL NORMAL RAINFALL
1	Ankola	3554.6
2	Bhatkal	4145.6
3	Haliyal	1166.3
4	Honnavar	3672.5
5	Karwar	3209.0
6	Kumta	3466.3
7	Mundgod	1176.8
8	Siddapur	3038.6
9	Sirsi	2457.7
10	Supa	2323.0
11	Yallapur	2439.2

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 tableland 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 locateed 915 m.amsl and near Goa state boarder. 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 the costal alluvial soil is occurring on western most parts of the district. The most rugged hilly parts of the district are covered by hilly type soil and surrounded by the areas covered by lateritic soil having less rugged features. On eastern parts, the lateritic soils change to red loamy soils. Some parts on eastern most parts of of Mundgod taluk are covered by semi-black cotton soils.

4.0 GROUND WATER SCENARIO

4.1.1 Occurence 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 weaker, weathered and fractured zones of metavolcanics, metasedimentaries, granites and gneisses, laterites, along with the alluvial patches found along the major stream courses.

Since, the hard rocks in the area do not posses the primary porosity, the secondary structures like joints, fissures and faults present in these formation act as a porous media. It is generally constitute a 3% of volume of formation to facilitate to house the ground water. The ground water under atmospheric influence is the phreatic zone, which generally occurs with in the depth range of 3.00 to 30.00 mbgl .The fracture zones occur at various depth zones within the depth of 185.00mbgl are expected to be saturated with ground water. 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 few to 14.00 metres thickness, holds the bank storage. and occurs as narrowstrip along the sea coast and the creeks occurs up to a depth of 50m.

Ground water in the above aquifer material generally occurs under unconfined to semi-confined and confined conditions, in the shallower zones

under phreatic condition and under semi-confined and confined condition in the deeper zones. The ground water is being exploited from within the depth range of 3.00 to 31.00mbgl through dugwells and 30.00 to 200.00mbgl through dug-cum-bore wells and Bore wells. The hydrogeological map depicting all hydrogeological details of the area is presented as Figure-4. The hilly tracks have thin weathered covers and the valley portions have thicker weathered zones.

4.1.2 Ground water levels

Out of 34 dug well national Hydrograph stations monitored in Uttara Kannada district during May 2007, The general depth to water levels in the national hydrograph stations (dug wells) recorded during May-2007 were in the range of 1.91 to 29.88 mbgl (Appendix-I). Out of 34 national Hydrograph stations monitored in Uttara Kannada district during November 2007, the general depth to water levels in the national hydrograph stations (dug wells) recorded during November –2007 were in the range of 0.36 to16.85 mbgl (Appendix-I). The water levels monitored in the 4 piezometer national hydrograph stations 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 2006 water levels available for the 30 national hydrograph network monitoring stations (Figure-5). The major part of the Uttara Kannada district is having the premonsoon water levels between 5 to 10 mbgl during 2006. The area having water levels less than 2 mbgl is observed around Karwar town.

Waterlevels betweem 2-5 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 water levels 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 waterlevels between 5-10 mbgl.

A post-monsoon depth to water table map has been prepared using national hydrograph network station dugwell data (Figire-6). The major part of the Uttara Kannada district is having the post monsoon water levels between 2 to 5 mbgl during 2006. 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.

4.1.3 Water Level Fluctuation

The perusal of the table shows is in the range of -0.19 – 13.03 m. The maximum water level fluctuation recorded is 13.03 m in Honnavar station and negative flucuation of –0.19 m is recorded at Murdeshwara station. The seasonal water level fluctuation, available for 10 piezometer hydrograph network stations in the range between –0.14 – 6.07m. The maximum water level fluctuation of 6.07 m recorded at Bandel piezometer national hydrograph station in Halyal taluk and minimum water level fluctuation of –0.14 m was recorded at Karwar piezometer national hydrograph station.

Fig-3

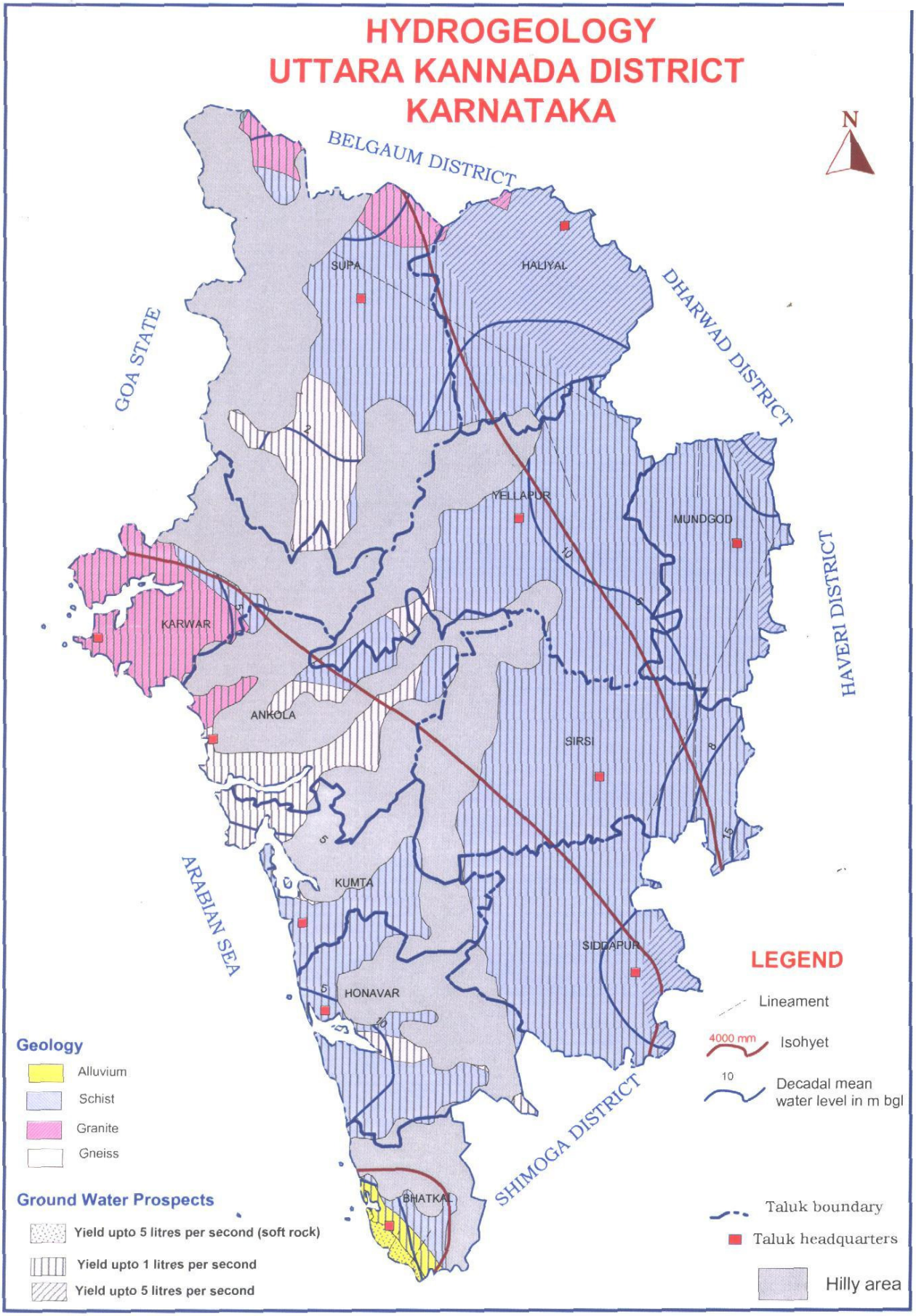

HYDROGEOLOGY
UTTARA KANNADA DISTRICT
KARNATAKA
N
BELGAUM DISTRICT
GOA STATE
DHARWAD DISTRICT
HAVERI DISTRICT
SHIMOGA DISTRICT
ARABIAN SEA
SUPA
HALIYAL
YELLAPUR
MUNDGOD
KARWAR
ANKOLA
SIRSI
KUMTA
SIDDAPUR
HONAVAR
BHATKAL
2
5
10
15
Geology
Alluvium
Schist
Granite
Gneiss
Ground Water Prospects
Yield upto 5 litres per second (soft rock)
Yield upto 1 litres per second
Yield upto 5 litres per second
LEGEND
Lineament
4000 mm
Isohyet
10
Decadal mean water level in m bgl
Taluk boundary
Taluk headquarters
Hilly area

Fig- 4

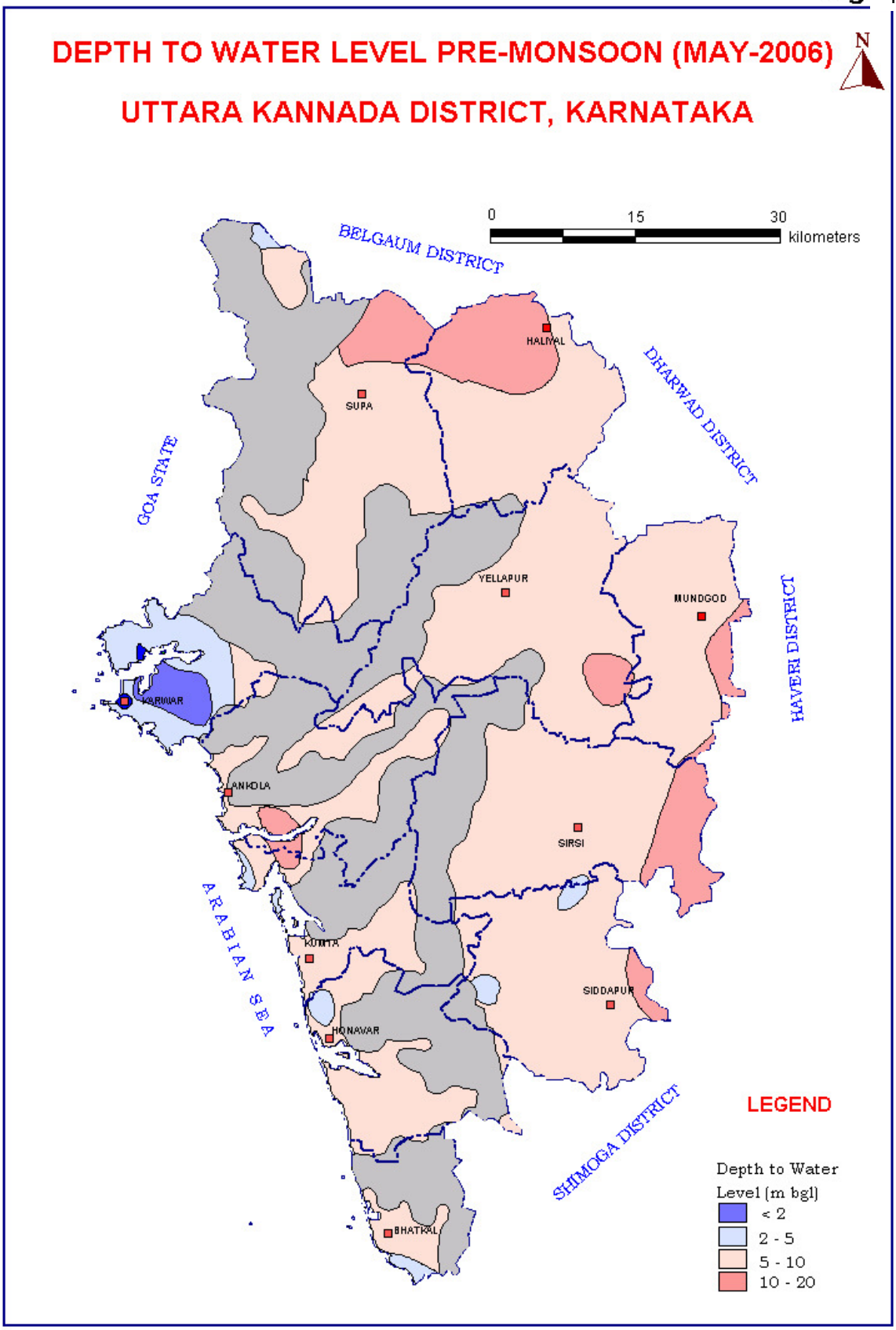
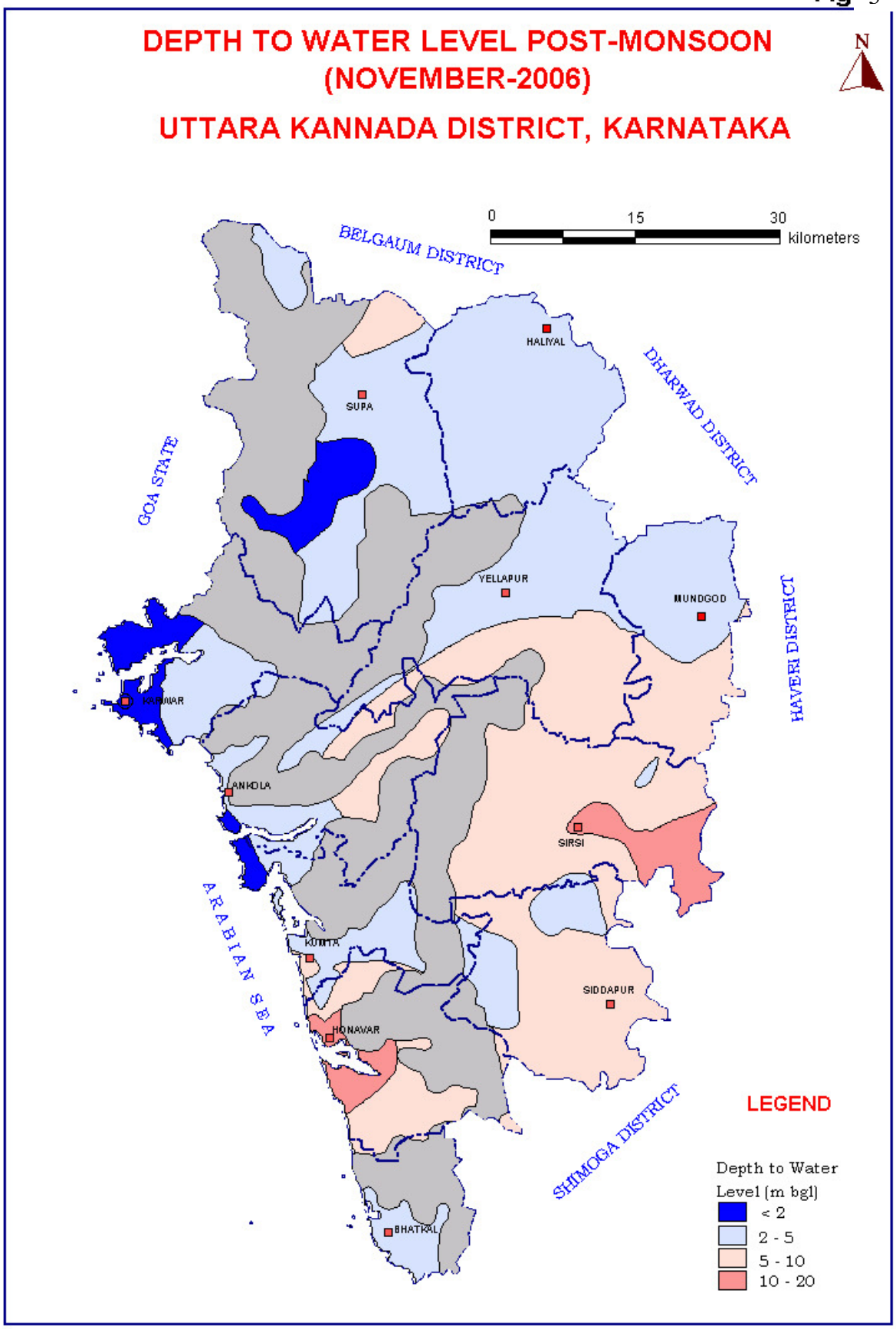

DEPTH TO WATER LEVEL PRE-MONSOON (MAY-2006)
UTTARA KANNADA DISTRICT, KARNATAKA
N
0
15
30
kilometers
BELGAUM DISTRICT
HALIYAL
SUPA
DHARWAD DISTRICT
GOA STATE
YELLAPUR
MUNDGOD
HAVERI DISTRICT
KARWAR
ANKOLA
SIRSI
ARABIAN SEA
KUMTA
SIDDAPUR
HONAVAR
SHIMOGA DISTRICT
BHATKAL
LEGEND
Depth to Water Level (m bgl)
< 2
2 - 5
5 - 10
10 - 20

Fig 5


DEPTH TO WATER LEVEL POST-MONSOON
(NOVEMBER-2006)
UTTARA KANNADA DISTRICT, KARNATAKA
N
0
15
30
kilometers
BELGAUM DISTRICT
HALIYAL
SUPA
DHARWAD DISTRICT
GOA STATE
YELLAPUR
MUNDGOD
HAVERI DISTRICT
KARWAR
ANKOLA
SIRSI
ARABIAN SEA
KUMTA
SIDDAPUR
HONAVAR
SHIMOGA DISTRICT
BHATKAL
LEGEND
Depth to Water Level (m bgl)
< 2
2 - 5
5 - 10
10 - 20

4.1.4 Ground Water Level Trends.

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

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

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

The premonsoon water levels for last 10 years have declining trends in 82 % of the national hydrograph network stations piezometers and the postmonsoon water levels for last 10 years have declining trends in 45 % of the piezometers drilled as national hydrograph network stations, in Uttara Kannada district. The premonsoon declining water level trends in these piezometers range between 0.005 and 0.80 m/year and . 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 borewells at selected places as depicted in Figure-3. The ground water exploration in the district was carried out in two phases. during 1988-89, by constructing 5 exploratory wells and four observation wells 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 altternative layers of silt and clay.

During the second phase of exploration which started during 2003-04 and continuing till date in hard rocks of the district in Ankola, Haliyal, Honnavar, Karwar, Kumta, Mundgod, Siddapur, Sirsi, Supa, and Yellapur taluks, total of 33 wells were drilled with depth range of 89 to 200 m and the aquifers tested reveal that an effective porosity of about 1-3%(Appendix-VIB). The yield cum recuperation tests conducted on these wells show that the discharge of the wells range from negligible to 8.5 lps. The salient features of exploratory borewells 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^2/day.

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. Though the main known source is the annual precipitation for recharge of dynamic water resources, the major via media are the percolation from the surface water conservation structures and seepages from the irrigation canals and return flow of water given to the crops from irrigated agricultural lands. The ground water resource estimation study for the whole state has been carried out for year 2004, jointly by CGWB, SWR, Bangalore and Karnataka state ground water department (MGD)for the year 2004 using Ground Water Estimation Methodology 1997.

The ground water estimation study indicates, total annual ground water recharge as 74425 ham and net annual ground water availability as 70765 ham for Uttara Kannada district for year 2004.

Table- 2 Ground water resources in Uttara Kannada district as on march-2004

Sl 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	6178	54	320	186	6406
2	Bhatkal	3103	62	154	135	3284
3	Haliyal	6105	78	294	169	6319
4	Honnavar	3635	115	299	791	4604
5	Karwar	1798	46	115	161	2016
6	Kumta	3943	103	30	295	4155
7	Mundgod	5544	364	249	192	6041
8	Siddapur	5770	214	34	479	6177
9	Sirsi	9981	531	153	458	10578
10	Joida	11136	77	12	173	10835
11	Yallapur	10446	84	158	200	10351
12	Total	67640	1727	1819	3239	70765

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 2004 is given in table –3

Table-3 Ground water draft for various purposes during the year 2003-04

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 (2003-04)
1	Ankola	187	663	849
2	Bhatkal	224	767	990
3	Haliyal	93	1144	1238
4	Honnavar	229	1413	1642
5	Karwar	188	558	745
6	Kumta	194	1259	1453
7	Mundgod	150	1219	1370
8	Siddapur	305	2708	3014
9	Sirsi	353	3312	3666
10	Joida	137	1101	1237
11	Yallapur	181	1069	1250
12	Total	2241	15212	17452

The perusal of the preceding table show the annual draft for domestic and indusrial uses was 2241 ham and for irrigation purposes the draft computed was 15212 ham. Total draft during the year 2004 was 17452 ham. The maximum draft observed in Sirsi taluk with 3666 ham and minimum annual draft of 745 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 2004 is given in table –4, and map showing watershed wise stage of ground water development is presented as Figure-7 .

Table-4 Taluk wise stage of ground water development studies in Uttara Kannada district for year 2004

Taluk	Allocation for domestic and industrial use for next 25 years in (ham)	Net ground water availability for future irrigation developme nt (ham)	Average crop water require m-ent (m)	Balance ground water irrigation potential available (ha)	Stage of develop ment in %	Categorisation as on March 2004	
						Safe area (%)	Semicritical / Critical /O.E area (%)
Ankola	260	5497	0.82	6650.07	13.25	100	-
Bhatkal	314	2207	0.70	3123.38	30.15	100	-
Haliyal	130	5054	0.82	6114.24	19.59	100	-
Honnavar	319	2874	0.81	3495.02	35.66	100	-
Karwar	261	1199	0.82	1450.44	36.95	100	-
Kumta	269	2629	0.82	3180.83	34.97	100	-
Mundgod	212	4617	0.82	5583.69	22.68	100	-
Siddapur	425	3040	0.80	3754.20	48.79	100	-
Sirsi	496	6774	0.81	8283.54	34.66	100	-
Joida	190	9567	0.82	11574.98	11.42	100	-
Yallapur	251	9052	0.82	10951.39	12.08	100	-
Total	3127	52509		64161.78	24.66	100	-

The perusal of preceding table shows that the whole area is safe from from the stage of ground water development point ie; The stage of ground water development is highest in siddapur taluk with 48.79% development and lowest development is in Supa taluk with development about 11.42% The balance ground water irrigation potential for the district is 64161.71ha. The maximum balance of ground water irrigation potential is observed in Supa taluk with 11574 ha. and minimum balance of ground water irrigation potential of 1450.44 ha observed in Karwar taluk. The ground water development for the whole district as a whole is 24.66%.

6.0 GROUND WATER QUALITY

The range of values of different constituents in ground water both during 1989 and 2005 are with in safe imits as per BIS and ISMR standards. The concentration of Nitrates found higher during 2005 at Mainahalli(92ppm), Majalli(92ppm) and Banavasi (81ppm). This may be attributed to more use of fertilizers. During 1989 all constituents in ground water of Murdeshwar hydrograph station have analysed excess may be because of construction activity in the vicinity at that time hence the heavy pumping might have resulted in 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 NO_3 and SO_4 are found to be increased considerably. However, these chemical constituents found within the permissible limits except few localities. An immediate measures under taken in the urbanized areas would help in preventing further deterioration in the ground water quality.

A perusal of data available on the quality of ground water, reveals that few chemical constituents added up 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 centres a chemical map is prepared and presented as Figure -8.

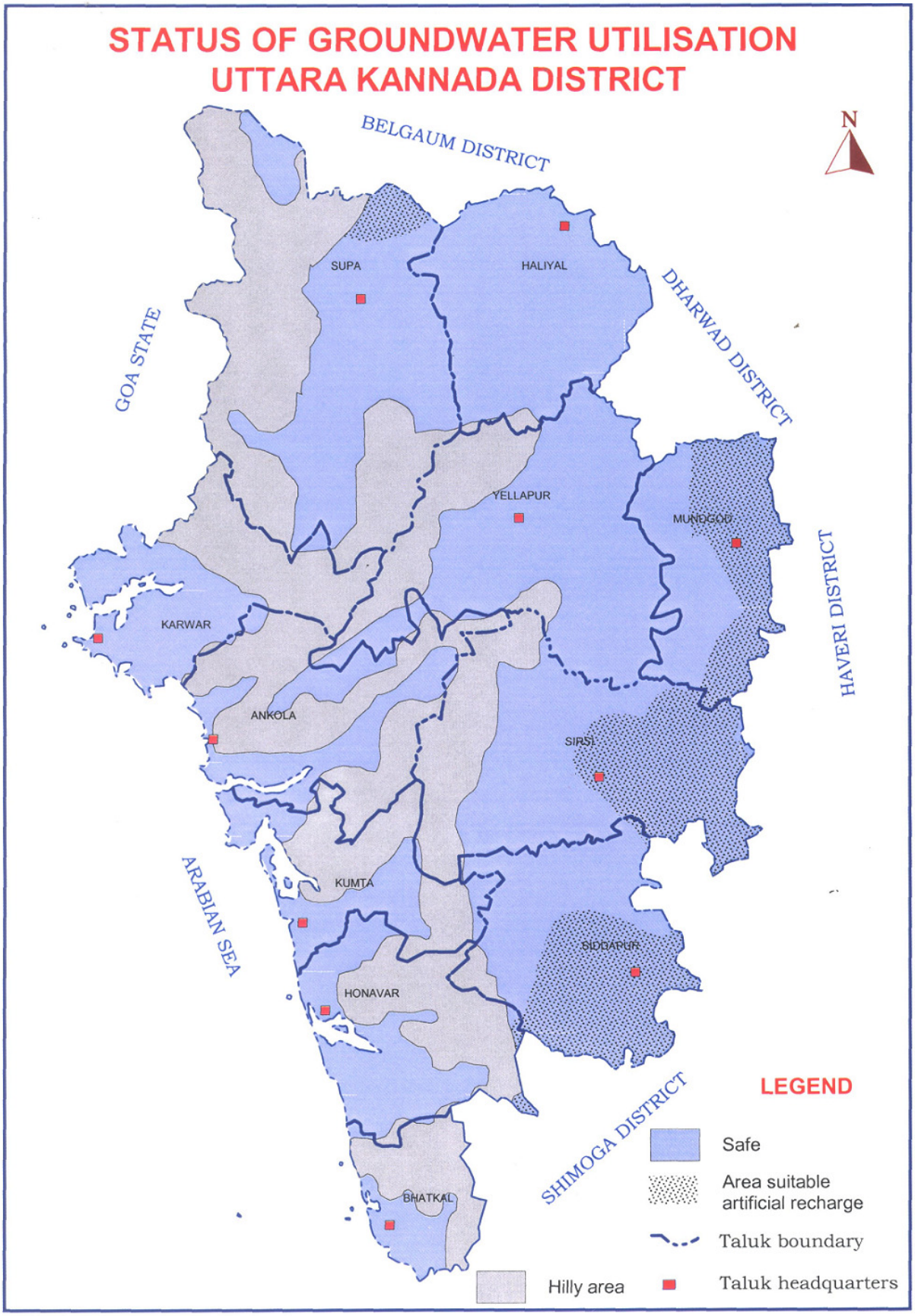
The perusal of the electrical conductivity distribution map shows that in the major part of the district the EC values range between less than 250 and 750 micro mhos/ cm. The EC values in the ground waters of small patches on northern parts of Honavar town, around Bhatkal town and north of Mundgod town have analysed higher values of electrical conductivity.

Even though none of the national hydrograph stations have analysed excess fluoride (>1.5), combined data collected from sate departments show major parts of Sirsi and Siddapur taluks and small part of Mundgod taluk having more fluoride content than safe limit ie: 1.5 mg.

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.

Fig-6


STATUS OF GROUNDWATER UTILISATION
UTTARA KANNADA DISTRICT
N
BELGAUM DISTRICT
GOA STATE
DHARWAD DISTRICT
HAVERI DISTRICT
SHIMOGA DISTRICT
ARABIAN SEA
SUPA
HALIYAL
YELLAPUR
MUNDGOD
KARWAR
ANKOLA
SIRSI
KUMTA
SIDDAPUR
HONAVAR
BHATKAL
LEGEND
Safe
Area suitable artificial recharge
Taluk boundary
Taluk headquarters
Hilly area

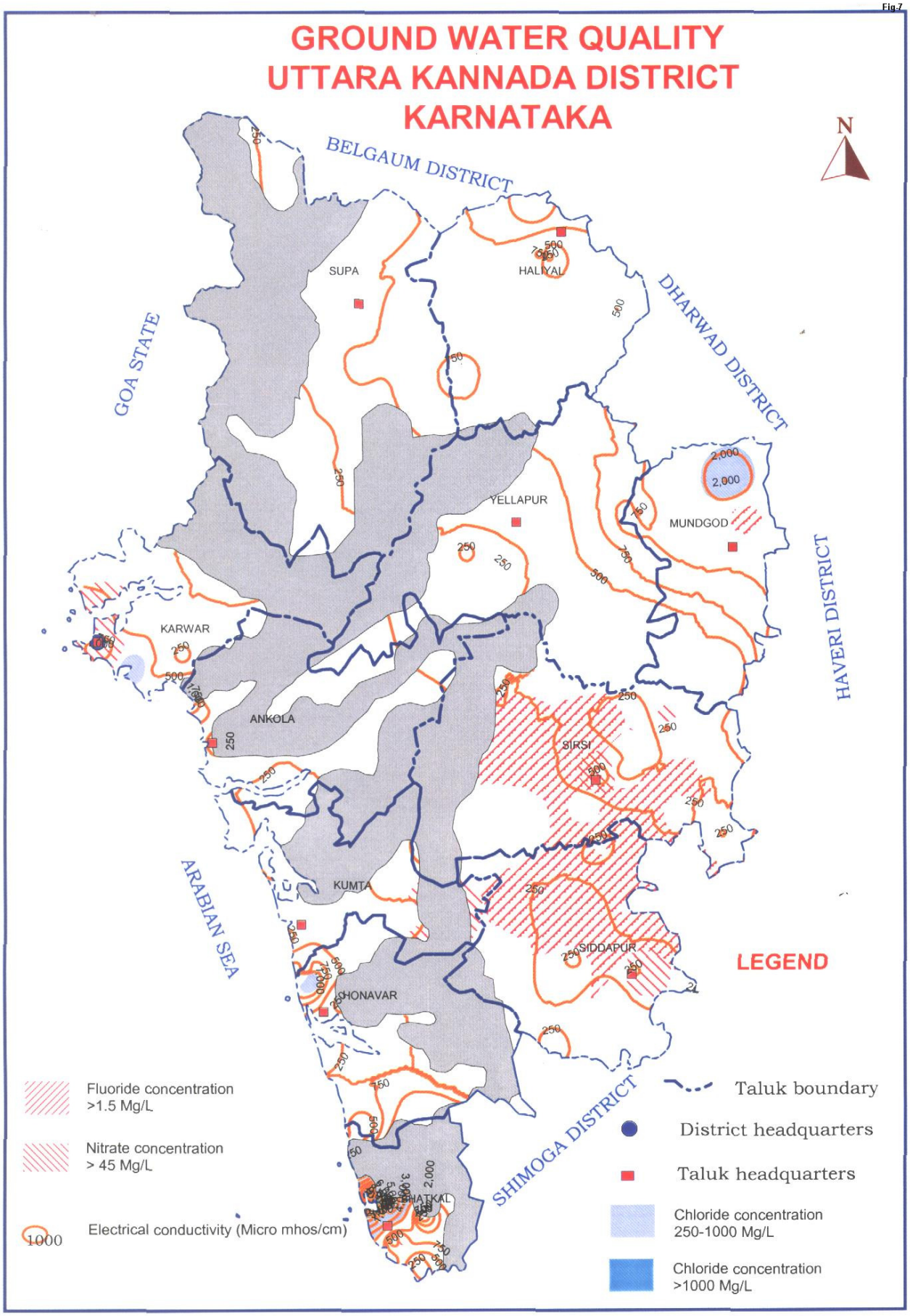


Fig-7
GROUND WATER QUALITY
UTTARA KANNADA DISTRICT
KARNATAKA
N
BELGAUM DISTRICT
GOA STATE
DHARWAD DISTRICT
HAVERI DISTRICT
SHIMOGA DISTRICT
ARABIAN SEA
SUPA
HALIYAL
YELLAPUR
MUNDGOD
KARWAR
ANKOLA
SIRSI
KUMTA
SIDDAPUR
HONAVAR
BHATKAL
LEGEND
Fluoride concentration >1.5 Mg/L
Nitrate concentration > 45 Mg/L
1000 Electrical conductivity (Micro mhos/cm)
Taluk boundary
District headquarters
Taluk headquarters
Chloride concentration 250-1000 Mg/L
Chloride concentration >1000 Mg/L

7.0 STATUS OF GROUND WATER DEVELOPMENT

7.1 DRINKING WATER SUPPLY FROM GROUND WATER :

As on march 2006 in uttara 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.

Sl No	Taluk	No of borewells drilled	piped water supply schemes	Miniwater 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	Joida	415	165	47
11	Yellapur	626	25	81
12	Total	6607	689	786

7.2 IRRIGATION SCENARIO FROM GROUND WATER RESOURCES:

In Uttara Kannada 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 hactares 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 Kumta taluk is having maximum of 1699 ha followed by Sirsi with 1560 ha and honnavar 1442 ha irrigated by dugwells. Mundgod taluk has maximum of 964 ha followed by Halyal taluk 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 accute 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 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 detail hydrogeological investigation only sites may be selected.

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 supply during summer. Construction of gully plugs, contour bunds and contour trenches at higher reaches and percolation tanks, nallabunds, check dams and vented dams at comparatively lower reaches along with subsurface dams will facilitate more recharge and less ground water to escape as 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 ingression are there. The areas around Bhatkal in coastal alluvium high salinity is observed. So it is necessary to have more observation stations on the coastal line to keep watch on the change 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. large areas in siddapur and sirsi taluks the fluoride contamination is reported. So it is necessary to demarcate the effected 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 dugwells, which penetrate partially the weathered, fractured zones of the aquifers, may be deepened further for the better productivity.
2) Construction of check dams and sub surface dykes at appropriate places across the nallahs and streams 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-borewell 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 now itself 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 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 compound 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 water shed approach. Desilting and maintaining of these tanks are utmost importance.so the natural recharge will take place without any hinderance 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 only should be recommended because borewell culture in long run leading to growing crops requiring high requirement of water, high power consumption to lift the water and also in hard rock terrain there are more chances for failure of bore well.
11) 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.