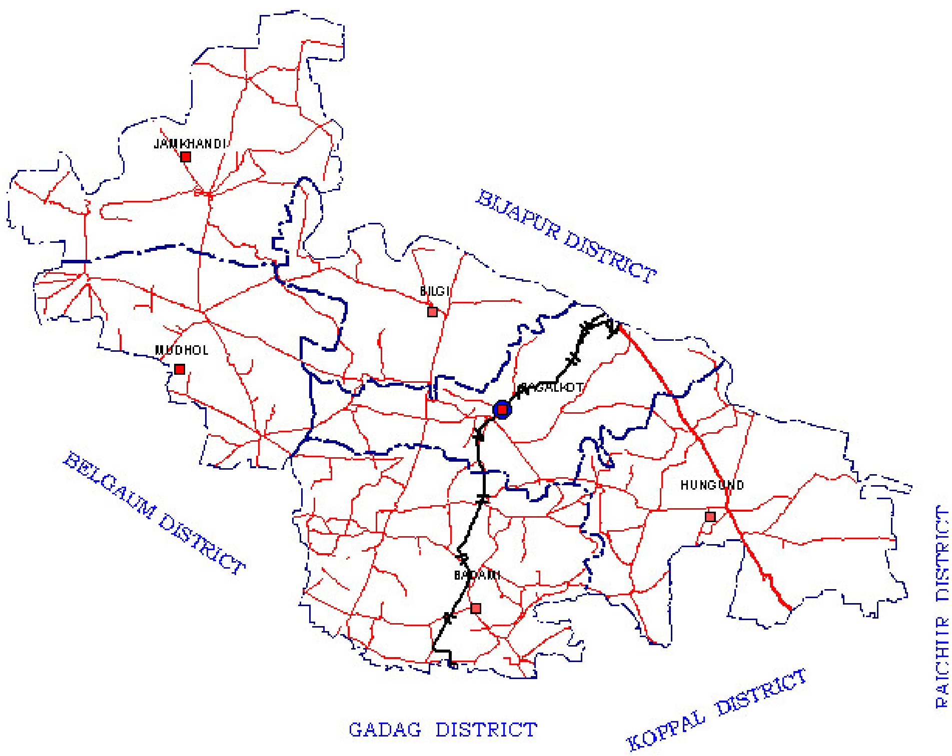
GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES
CENTRAL GROUND WATER BOARD

GROUND WATER INFORMATION BOOKLET

BAGALKOTE DISTRICT, KARNATAKA STATE



SOUTH WESTERN REGION
BANGALORE
APRIL 2011

CONSERVE WATER - SAVE LIFE

GOVERNMENT OF INDIA

MINISTRY OF WATER RESOURCES

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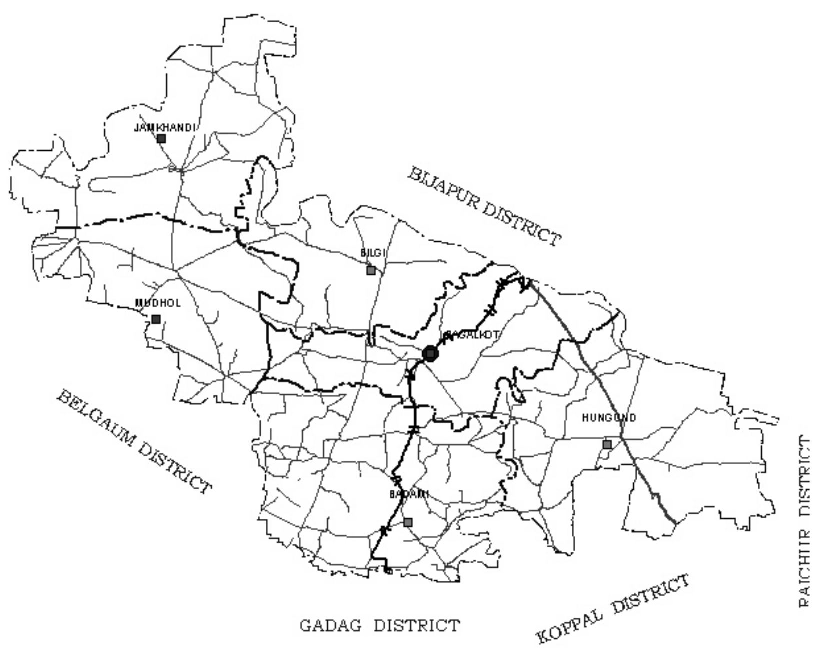


SOUTH WESTERN REGION

BANGALORE

APRIL 2011

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 **Bagalkote** 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 **S.S.Hegde**, **Scientist 'C'**. 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.

(Dr.K.Md.Najeeb)
Regional Director

BAGALKOTE DISTRICT AT A GLANCE

Sl.No	Items	Statistics
1	GENERAL INFORMATION	
	i) Geographical area (Sq km)	6595.0
	ii) Administrative Divisions (As on 31/3/2006)	
	Number of Taluks	6
	Numbers of Villages	623
	iii) Population (As on 2001 census)	16,51,892
	iv) Average Annual rainfall (mm)	579 mm (Av. 10 years: 1996-2005)
2	GEOMORPHOLOGY	
	i) Major physiographic units	Undulating plains interspersed with sporadic dissected hills to rugged topography.
	ii) Major Drainages	Krishna main basin: Malaprabha & Ghataprabha sub-basins.
3	LAND USE (Sq.km)	
	i) Forest area:	811.26
	ii) Net area sown:	4697.83
	iii) Cultivable area:	4754.59
4	MAJOR SOIL TYPES	Red sandy soil, red loamy soil & black cotton soil
6	IRRIGATION BY DIFFERANT SOURCES	
	(Area in Ha & Numbers of Structures)	
	Dugwells	27030
	Tube wells/Borewells	56865
	Tanks/Ponds	677
	Canals	50630

Sl.No	Items	Statistics
	Others sources (including Lift irrigation) Net Irrigated Area Gross Irrigated Area	77670 212872 -
7	NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB (as on 31-3-2007) No of Dug wells No of Piezometers	 28 10
8	PREDOMINENT GEOLOGICAL FORMATIONS	Sandstone, Quartzite, Limestone, Shales, Basalt, Schist, Granite and Gneiss.
9	HYDROGEOLOGY Major water bearing formation (Pre-monsoon Depth to water level during 2010) (Post-monsoon Depth to water level during 2010) Long term water level trend in 10 years (1997-2006) in m/yr.	 Weathered & fractured sandstones, shales, limestones, basalts, gneisses, granites and schists. Min. 0.42 mbgl : Max. 14.55 mbgl Min. 0.36 mbgl : Max. 11.30 mbgl. Rise: Min. 0.03 m/yr to Max. 4.43 m/yr Fall: Min. 0.08 m/yr to Max. .39 m/yr
10	GROUND WATER EXPLORATION BY CGWB (As on 31-03-2007) No of well drilled (EW, OW, PZ, Total) Depth range (m) Discharge (lps) Storativity (S) Transmissivity (m2/day)	 31, 02, 25 -100 <1.0 – 9.85 - 0.1 to 665 m^2/day

Sl.No	Items	Statistics
11	GROUND WATER QUALITY NHS samples Presence of Chemical constituents more than permissible limits Type of water	 *EC: 607 – 7000 micromhos/cm at 25°C* *>3000 micromhos/cm at 25°C- 7 nos (out of 24 nos)* Cl: 28-638ppm >500ppm- 6nos (out of 24 nos) Carbonate & Bicarbonate Sodium Bicarbonate
12	DYNAMIC GROUND WATER RESOURCES (2004)- in MCM Annual replenish able Ground water Resources Net Annual Ground Water draft Projected Demand for Domestic and Industrial Uses upto 2025 Stage of Ground Water Development in %	 424.55 392.32 48.60 92.45
13	AWARENESS AND TRAINING ACTIVITY Mass Awareness Programmes organized Date Place No of participants	 Nil
	Water Management Training Programmes organized Date Place No of participants	Nil

Sl.No	Items	Statistics
14	EFFORTS OF ARTIFICIAL RECHARGE & RAIN WATER HARVESTING Projects completed by CGWB (No & Amount spent) Projects under technical guidance of CGWB (Numbers)	Nil
15	GROUND WATER CONTROL AND REGULATION Number of OE Blocks No of Semi Critical Blocks No of Blocks notified	 5 - (Badami, Jamkhandi (p), Mudhol(p), Hungund (p),Bagalkote (p)). Nil Nil
16	MAJOR GROUND WATER PROBLEMS AND ISSUES	Resource scarcity in non-canal command area due to over-exploitation; Water logging and quality deterioration in canal command area. Sporadic fluoride and nitrate pollution.

BAGALKOTE DISTRICT

1.0 Introduction:

Bagalkote is a newly formed district in November 1997 by bi-furcating Bijapur district. Bagalkote town is the district headquarters. The district is located in the northern part of the state of Karnataka. Historically Bagalkote district is significant because it was the Capital of the Chalukyan Empireof South India under Pulakesi I. The Chalukyas ruled from 550 AD to 753 AD when the Rashtrakutas deposed this dynasty. The 12^{th} Century social reformer Basavanna's ' Aikya Mantap' or holy samadhi and famous shiva temple is located in Kudalsangama in Hungund taluk of the district. Badami was the Capital of Chalukya dynasty. Badami, Aihole, Pattadakallu, Kudalasangama, Banashankari and Mahakoota are the important historical places in the district.

Bagalkote district is bound by Bijapur in the north, Belgaum in the west, Dharwar in the south and Raichur in the east. The district comprising of 6 taluks, occupies an area of 6593 sq.kms (constituting around 3.4 percent of the area of the state) and lies between 15° 49' & 16° 46' north latitude and 74° 58' & 76° 20' east longitude (Fig-1). The area is a gently undulating to a plain terrain, dotted with isolated hills. The elevation ranges from 480 to 729 metres amsl, sloping from west to east. The district falls in the Northern dry Agro-climatic zone and experiences a semi-arid climate. It is one of the drought -prone districts of the State.

The district is drained by the river Krishna and its tributaries Ghatprabha and Malaprabha. All these rivers enter district on the western side and flow in an easterly direction to join the Bay of Bengal. Krishna River enters the district at Terdal village in Jamkhandi taluk and flows in south-easterly direction and forms the northern boundary of the district separating it from Bijapur district. The Ghataprabha River flows in the middle part of the district and joins the Krishna in Chikkasangama village in Bilgi taluk. The Malaprabha flowing in the southern part, joins the Krishna at Kudal Sangama in Hungund Taluk. The Ghataprabha and Malaprabha canal systems serve the western parts of the district. The Dam across the Krishna river at Almatti and the canal systems serve the eastern parts. Rainfall being as low as 560 mm annually, these canals are the lifelines, providing much needed irrigation and drinking water to the district. (The drainage in the district is shown in the figure –2).

Central Ground Water Board has carried out Systematic when it was in the undivided Bijpur district and Reappraisal hydrogeological surveys after the formation of the district. Exploratory drilling was carried out during 1975-76, 1988-90 & 2004-07 in the district. Seventy bore wells were drilled by CGWB under ground water exploration programme.

Fig- 1

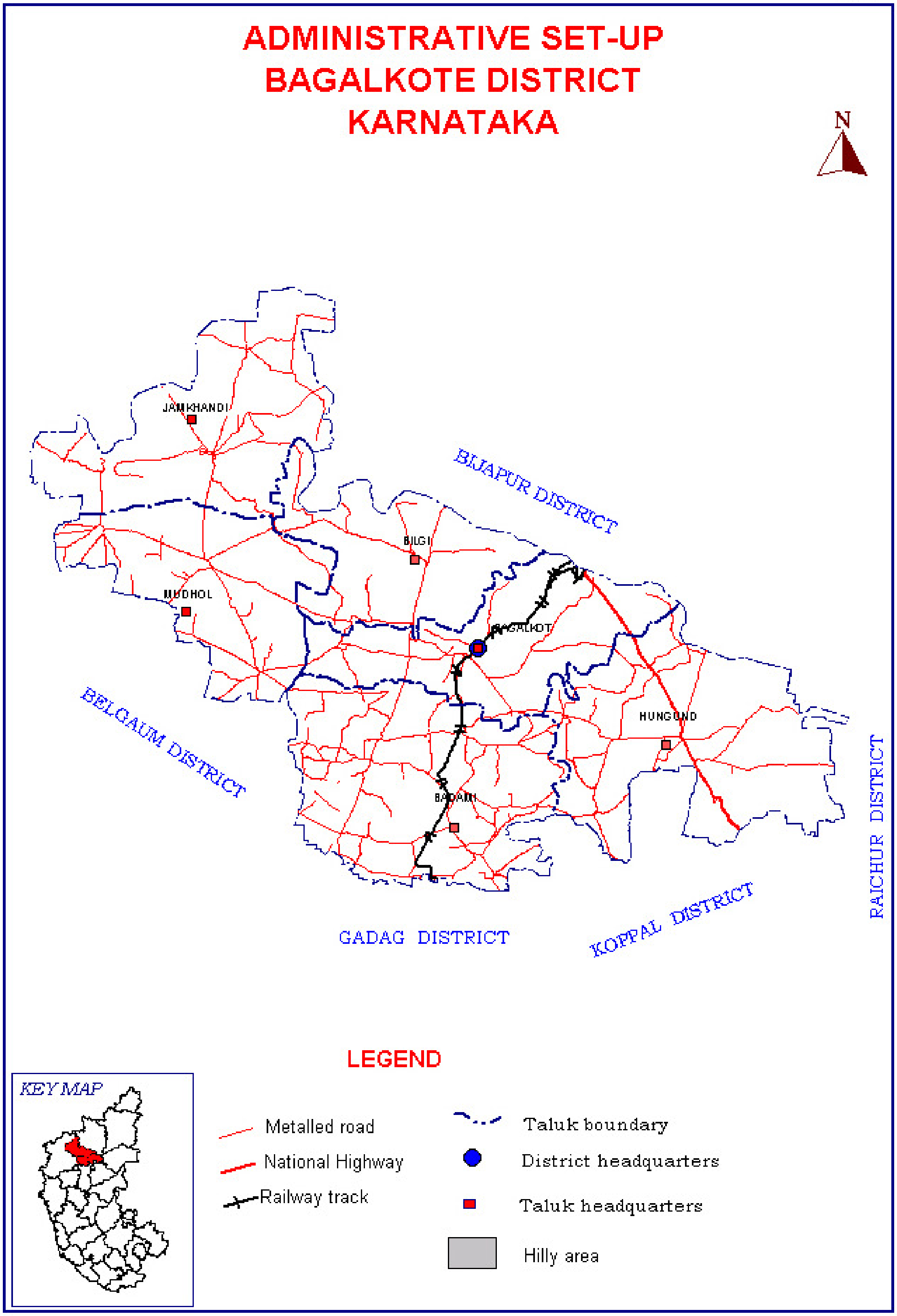
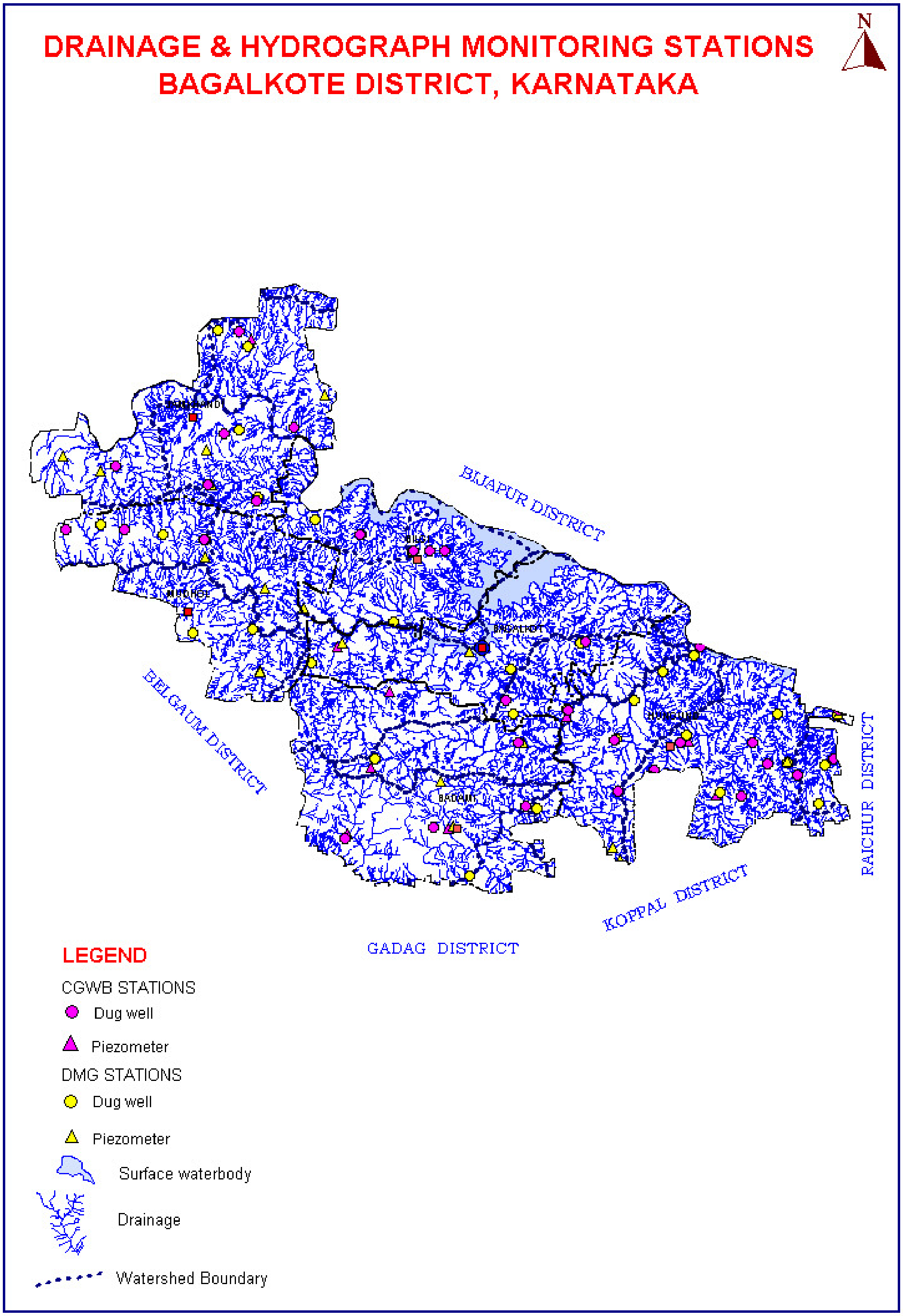

ADMINISTRATIVE SET-UP
BAGALKOTE DISTRICT
KARNATAKA
N
JAMKHANDI
BIJAPUR DISTRICT
BILGI
MUDHOL
BAGALKOT
HUNGUND
BELGAUM DISTRICT
BADAMI
RAICHUR DISTRICT
GADAG DISTRICT
KOPPAL DISTRICT
LEGEND
KEY MAP
Metalled road
National Highway
Railway track
Taluk boundary
District headquarters
Taluk headquarters
Hilly area

Fig-2


DRAINAGE & HYDROGRAPH MONITORING STATIONS
BAGALKOTE DISTRICT, KARNATAKA
N
BIJAPUR DISTRICT
BELGAUM DISTRICT
RAICHUR DISTRICT
KOPPAL DISTRICT
GADAG DISTRICT
LEGEND
CGWB STATIONS
Dug well
Piezometer
DMG STATIONS
Dug well
Piezometer
Surface waterbody
Drainage
Watershed Boundary

2.0 Rainfall & Climate:

There are 6 rain gauges located in each of the 6 taluks (Table 1). The data in respect of these stations from the year 1996 to 2005 are analyzed. The Data are collected from The Directorate of Economics & Statistics and Drought Monitoring Cell, which are the agencies of Government of Karnataka. Average rainfall (10 years) of the district is 559.9 mm, ranging from 502.3mm in Mudhol taluk to 633.45 mm in Hungund taluk (Table-1). Thus, in general, rainfall in the district gradually increases from west to east. The seasonal distribution indicates that, about 66% of the annual rainfall is received during SW monsoon (June-Sept), 21% during post-monsoon period (Oct-Dec) and the remaining during other seasons. The annual average number of rainy days is 41. Thunderstorms are common during summer bringing relief from swelter.

Table 1: Rainfall details of Bagalkote district (10 years)

Taluk	Actual rainfall in mm										
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	**Average**
Badami	771	434	811.8	500.3	696.8	501	404	311	724	614	**576.79**
Bagalkote	836	619	892.7	676.9	488.5	433	381	236	421	509	**549.31**
Bilgi	791	643	844.7	665.8	617	479	412	239	501	474	**566.65**
Hungund	793	510	931.9	664.2	645.4	597	525	367	691	610	**633.45**
Jamkhandi	554	553	949.5	580.2	565.5	654	406	209	414	423	**530.82**
Mudhol	709	570	738.2	451.4	614.4	350	339	155	544	552	**502.30**
										District average	**579.90**

The nearest meteorological observatory located at Bijapur and the normals (Table.2) of the observatory may be taken as representative of meteorological conditions in the districts. There are two Hydrometeorological observatories maintained by Water Resources Development Organisation at Mahalingapur and Almatti dam site. Normally, the months of January and February are dry and cool. The month of April is the hottest with mean daily maximum temperature being above 30°C. However, daily temperatures may go above 40°C. With the onset of monsoon there is an appreciable drop in the temperature. Night temperatures are lowest in the cold season; touching 10°C. Humidity is high during monsoon season. During the winter months mist is common leading to foggy conditions occasionally.

Table:2. Climatic Normals. (Bijapur Observatory).

Month	Temp		R.humidity	
	Max.	Min.	Max.	Min.
Jan	30.1	14.0	66	30
Feb	32.2	15.1	61	30
Mar	35.0	18.0	62	32
Apr	35.7	19.5	72	46
May	34.0	20.6	78	58

Jun	27.5	20.6	85	76
Jul	25.2	19.8	90	92
Aug	25.6	19.4	92	87
Sep	27.0	19.0	89	81
Oct	30.1	18.6	81	64
Nov	29.3	17.1	70	47
Dec	29.3	13.9	67	35
Annual average	**30.1**	**18.0**	**76**	**57**

3.0 Geomorphology & Soil Types:

In general, the topography in the southern part of the district is rugged and undulating while in the northern part it is gently undulating to rolling plains with a number of low lying, flat hills. The southern and south-western parts of the district covering Badami, Bagalkote and western parts of Hungund taluks are traversed by chains of detached hills trending in EW direction. The ortho-quartzites and the banded hematite quartzites have formed well defined linear ridges in the central part of the district. The ground elevation ranges from 480 to 729 metres amsl, sloping towards ESE.

Different types of soils are found in the district depending upon the distribution of geological formations and are mostly insitu in nature. The soils can be classified into different groups as described below:

i). Soils in Basaltic terrain: Soils of this type are again classified as shallow, moderate and deep black cotton soils. They are usually light black to black in colour and vary in thickness from 25 cms to 8 mtrs and have high water holding capacity. These soils are fertile but when occupy the low-lying area cause water –logging conditions in canal command areas.

ii).Soils in Limestone terrain: These are dark grey in colour, clayey and calcarious. These have high water holding capacity and low permeability. Low in N and but high in K. When compared to black cotton soil are low in nutrients.

iii). Soils in Sandstone terrain:This soil is grayish to yellowish brown in colour. Thickness varies from 1.5 to 1.8m. More permeable and low in P, high in K and medium N content. Alkaline in nature.

iv). Soils in Schist and phyllite terrain: These soils are clayey in nature and limited in thickness. They are well drained with moderate permeability. They are less fertrile.

v). Soils in Gneissic terrain: These soils are generally sandy-loam in nature with grayish to pinkish in colour. Moderate in fertility, good water holding capacity and low in permeability.

3.1 Agriculture and Irrigation : Agriculture is the main occupation of the people in the district. The geographical area is 658777 Ha and ‘Net Sown area’ is 469783 Ha which is 71.3% of the geographical area. The major crops grown are Jowar, maize, wheat, bajra, sugarcane, sunflower, pulses and groundnut. Net Irrigated area is 212872 Ha which constitutes 45.3% of the Net Sown area and the remaining 54.7% of the area is rainfed.

Out of the net irrigated area, nearly 60% is through surface water resources and the remaining 40% through groundwater. A major dam has been built across the Krishna at Alamatti in Basavanabagewadi taluk of Bijapur district, which provides irrigation facility to Karnataka and Andhra Pradesh States. Thus, the Krishna, the Malaprabha and the Ghataprabha canal systems cater to the irrigation needs in parts of Mudhol, Jamkhandi, Bilgi and Badami taluks of the district.

3.2 Geology and mineral wealths: The district is underlain mainly by the crystalline formations of different ages. The pre-Cambrian formations include granites, gneisses, metasediments of Dharwar super Group, shales, sandstones, quartzites and limestones of Kaladgi series, basalts of Eocene to upper Cretaceous and laterites of Pleistocene age. Laterites and river alluvium (Recent) occur as insignificant , stray patches.

Though the district is endowed with a fairly rich mineral and rock wealths. It is famous for good quality limestone deposit and world-class I pink granites of Ikal area. Limestones and dolomites which are supporting many cement industries are available in plenty at places like Bagalkote, Khajjidoni, Gaddanakeri, Petlur, Varachagallu, Bommanabudni, Hireshellikeri and Chikshellikeri of the district. The other important minerals found in the district are dolomite, iron ores (Ramthal- Hungund taluk) copper ores (Khajjadoni , Gaddanakeri and Kaladgi- Bagalkote taluk), argillites(Katageri-Badami taluk) quartz breccias (Bagalkote). Basalts, Laterites, Granites, Sandstones and quartzites are widely distributed and used as building material. The important idustrial products of the district are polished pink granite, cement, ilkal sarees and sugar.

4.0 Ground Water Scenario:

4.1 Hydrogeology: Groundwater occurs in these hard rock formations in the interconnected interstices of weathered residuum and planar porosities like joints, fractures and shears in unweathered parts. The thickness of weathered zone varies widely in different formations (Figure 3). GW occurs under water table condition in phreatic zone and semi-confined to confined conditions in the fractures at depth. In shallow or phreatic aquifer (NHS), the pre-monsoon (May 2006) depth to water level ranges from 0.41 mbgl to 14.55 mbgl and the general range of water level is 5 to 10m bgl (Figure 4). During post-monsoon (Nov 2006) it ranges from 0.36 mbgl to 11.30 mbgl and the general range of water level is 5 to 10m bgl (Figure 5). Annual water level fluctuation ranges from 0.05 m to 3.25 m and average fluctuation is 1.65 m. The long term water level trend (1996-2005) reveals that out of the analysed 30 dugwells, 27% of the wells show rise in the range of 0.03 m to 4.43 m and the remaining 73% wells show fall in water level ranging from 0.08m to 1.39. The fall in the long term water level mainly observed in non-command area of the district indicates the effect of high groundwater development where rainfall is the sole source of recharge. Similarly, the rise in water level corresponds to the canal command areas of the district where, recharge to groundwater takes place through applied irrigation and canal seepages in addition to rainfall.

Fig-3

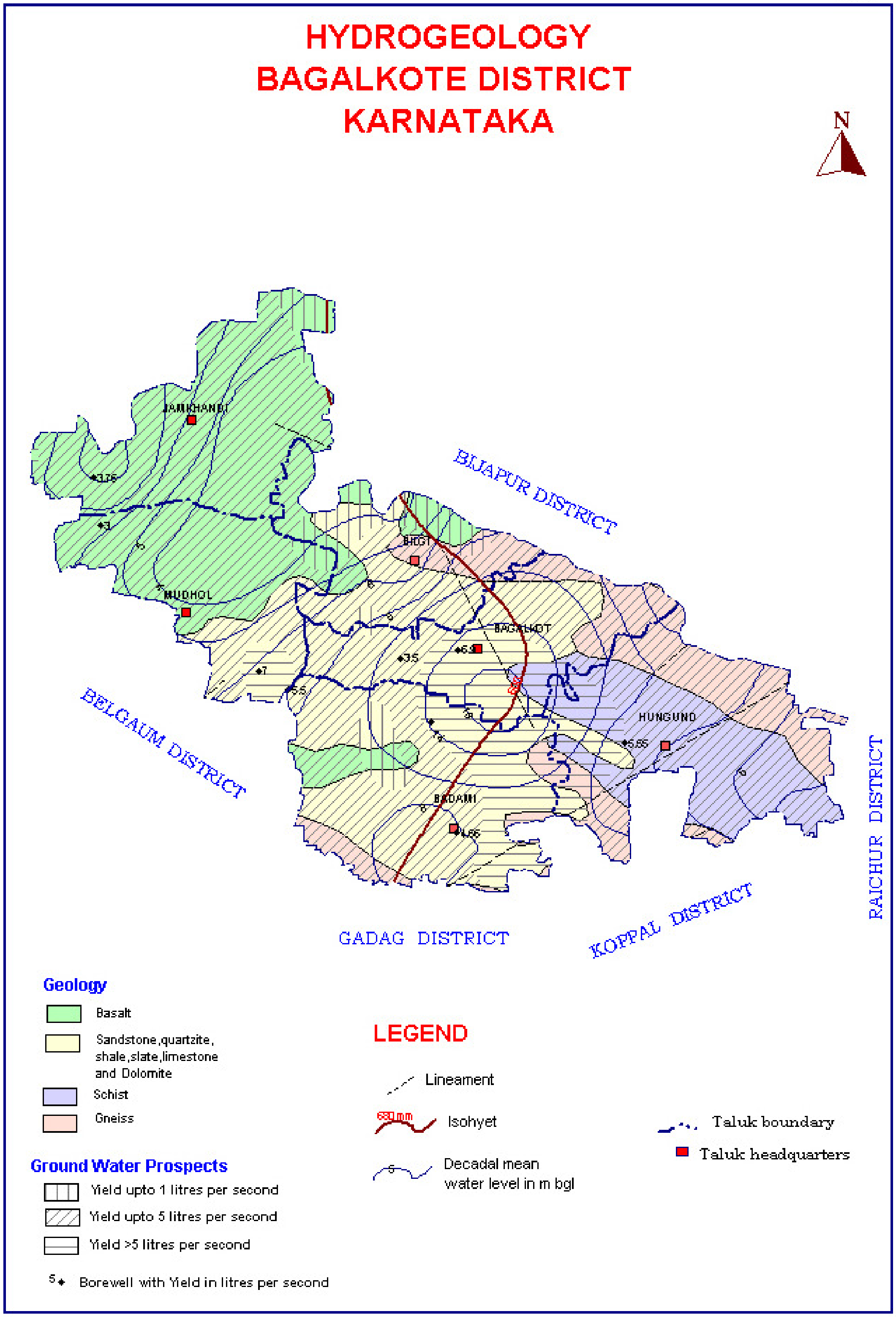

HYDROGEOLOGY
BAGALKOTE DISTRICT
KARNATAKA
N
JAMKHANDI
MUDHOL
BILGI
BAGALKOT
HUNGUND
BADAMI
BIJAPUR DISTRICT
BELGAUM DISTRICT
GADAG DISTRICT
KOPPAL DISTRICT
RAICHUR DISTRICT
Geology
Basalt
Sandstone,quartzite, shale,slate,limestone and Dolomite
Schist
Gneiss
LEGEND
Lineament
Isohyet
Taluk boundary
Taluk headquarters
Decadal mean water level in m bgl
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

Fig-4

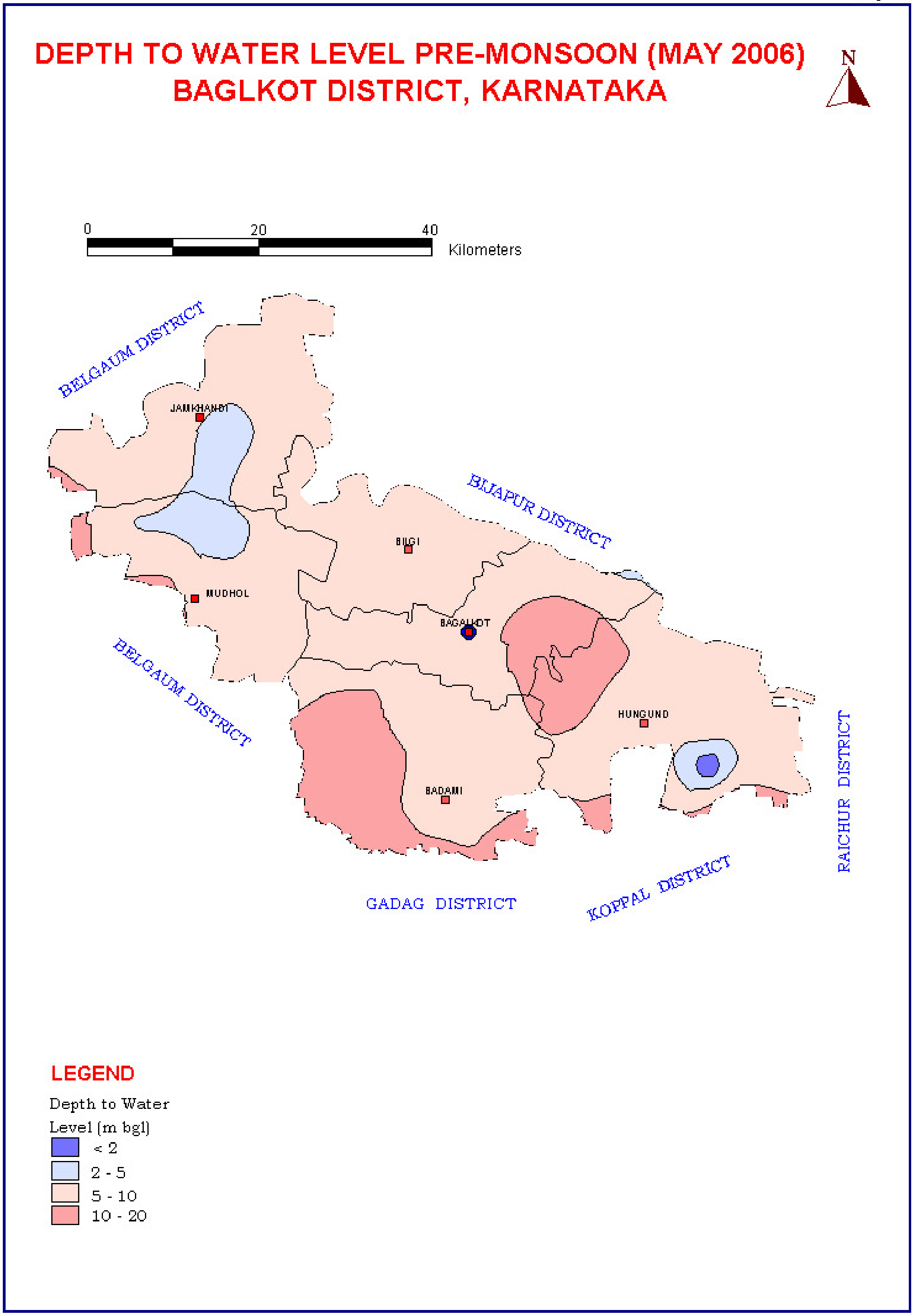

DEPTH TO WATER LEVEL PRE-MONSOON (MAY 2006)
BAGLKOT DISTRICT, KARNATAKA
N
0
20
40
Kilometers
BELGAUM DISTRICT
JAMKHANDI
BIJAPUR DISTRICT
BILGI
MUDHOL
BAGALKOT
BELGAUM DISTRICT
HUNGUND
BADAMI
RAICHUR DISTRICT
GADAG DISTRICT
KOPPAL DISTRICT
LEGEND
Depth to Water
Level (m bgl)
< 2
2 - 5
5 - 10
10 - 20

Fig-5

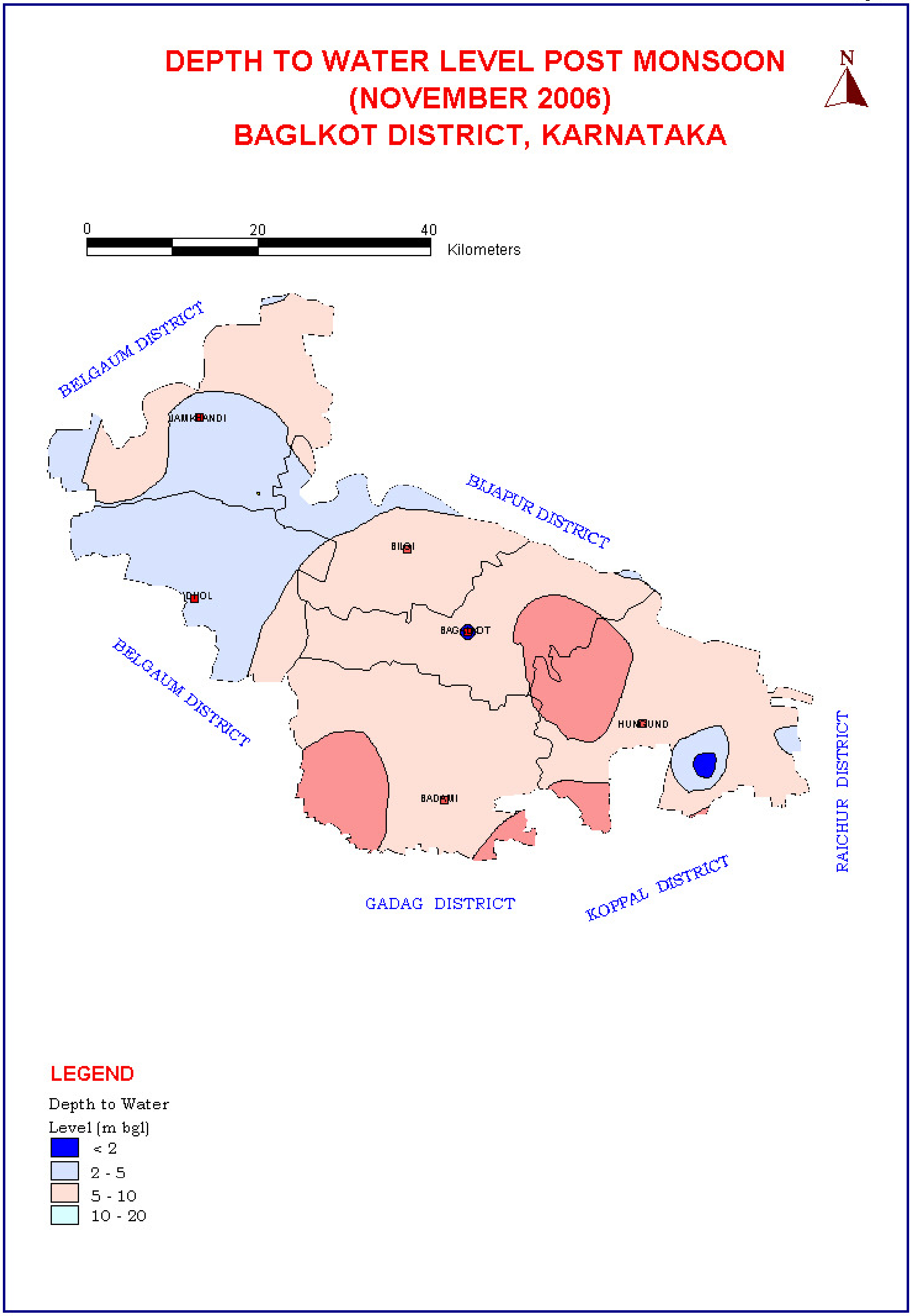

DEPTH TO WATER LEVEL POST MONSOON
(NOVEMBER 2006)
BAGLKOT DISTRICT, KARNATAKA
N
0
20
40
Kilometers
BELGAUM DISTRICT
BIJAPUR DISTRICT
BILGI
BELGAUM DISTRICT
RAICHUR DISTRICT
GADAG DISTRICT
KOPPAL DISTRICT
LEGEND
Depth to Water
Level (m bgl)
< 2
2 - 5
5 - 10
10 - 20

Table: 3. Dynamic Ground Water Resources of Bagalkote District as on 31st March 2004;

Taluk	Total annual GW recharge	Net annual GW availability	Existing gross GW draft for irrigation	existing gross GW draft for domestic and industrial uses	Existing gross GW draft for all uses	Allocation for domestic and industrial water supply till 2025	Net GW availability for future irrigation development	Stage of GW development	Balance GW irrigation potential available	Categorisation of % area of taluks. SAFE	SEMI-CRITICAL	CRITICAL	OVER-EXPLOITED
	HAM	HAM	HAM	HAM	HAM	HAM	HAM	%	HA				
Badami	6429.86	6108.37	9262.12	910.70	10172.82	1265.11	1.24	166.5	1.45	-	-	-	100
Bagalkote	3722.66	3540.23	5080.72	523.77	5604.49	729.27	251.61	158.3	293.67	4	-	-	96
Bilgi	6680.88	6511.10	725.10	287.97	1013.06	445.69	5384.24	15.5	6259.83	66	-	-	34
Hungund	5767.08	5478.72	6049.73	509.30	6559.03	721.06	32.19	119.7	38.40	2	-	44	54
Jamkhandi	11147.00	10882.62	6300.25	694.60	6994.85	971.37	5078.70	64.3	5860.77	37	-	-	63
Mudhol	10213.05	9934.32	8438.33	450.00	8888.34	726.80	2100.90	89.5	2453.69	27	-	-	73
Total	43960.53	42455.36	35856.25	3376.34	39232.59	4859.3	12848.88	92.41	14907.81				

4.2 Ground Water Resources: The Resource estimation and categorization is carried out as per the recommendations of GEM-97 Methodology. As per the dynamic ground water resource estimation carried out as on March 2004, the 'Annual Net Groundwater Availability' is 42455.36 HAM. The 'Existing GW draft for all uses' (irrigation, domestic and industrial) is 39232.60 HAM. The net GW availability for future irrigation development after allocating for domestic and industrial uses till 2025 is 12848.88 HAM. The talukawise resource status and stage of GW development is shown in Table 3.

4.3 Groundwater Quality: Groundwater is generally mildly alkaline, moderate to very hard and is of Sodium -Bicarbonate type. In phreatic zone it is more mineralized than in fractured zones. Specific conductance varies from 607 to 7000 *micro mhos/cm at 25°C* and chloride values range from 28 to 638 ppm. The concentrations of both these are found to be higher than the 'permissible limit' of Drinking water Standards in some isolated pockets. Otherwise, water is suitable for drinking and irrigation purposes. Nitrate pollution is noticed on a wide scale and is more prevalent in dug wells than in bore wells. Higher concentrations (>1.5ppm) of fluoride is found in many bore well samples and it is found in lesser (within permissible limit of 1.5 ppm) concentration in dug well samples. The concentration in general, increases with the depth of bore wells and this indicates the possible geogenic nature of fluoride (Figure 6).

4.4 Status of Groundwater Development: The stage of development is the lowest in Bilgi taluk (15.55%) and the highest in Badami taluk (166.53). It is observed that the taluks which are not having canal irrigation facility have witnessed higher groundwater development of more than 100%. Accordingly, Hungund (119.7%), Bagalkote (158.3%) and Badami (166.5) are mainly groundwater dependent for agricultural activity and hence, withdrawals have exceeded the annual replenishment. Thus, the average stage of groundwater development in for the district is 92.45% (Table 3).

5.0 Groundwater Management Strategy:

Bagalkote district is basically agriculture-dominated district where it is the main occupation of the rural population which constitutes 71 % of the total population (2001 census). As per the data available (Hassan District at a glance-2005-06), total irrigated area constitutes 45 % of the net sown area. The contributions of surface water, in irrigated agriculture through major and medium irrigation projects, tanks and lift irrigation schemes is 55 %. It is apparent that groundwater is playing equally vital role in agriculture sector apart from being the main source of drinking water in major part of the district. The non-command parts of the five out of six taluks (ie except Bilgi taluk) are showing high groundwater development and are falling in Over-Exploited category (Figure 7). Hence, judicious use of ground water and its sustainable management is all the more important. Water-economy irrigation practices like drip and sprinkler irrigation methods should be popularized. Efforts should be oriented towards conservation and augmentation of groundwater. In canal command areas conjunctive use approach can be adopted. In deeper ground water areas of the district and groundwater over development areas, artificial recharge measures like percolation tanks and checkdams are to be implemented to augment the groundwater resource. Point recharge structures

Fig-6

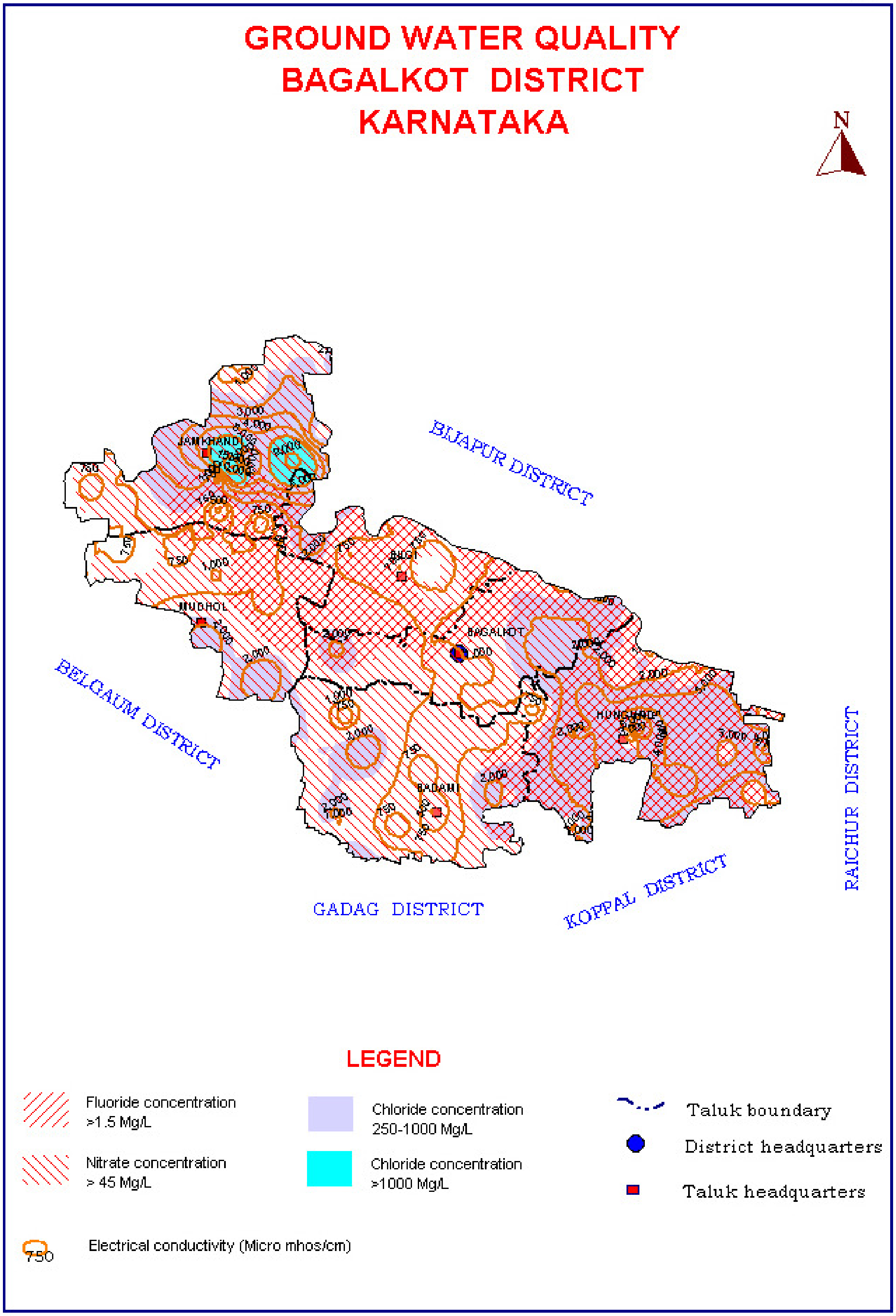
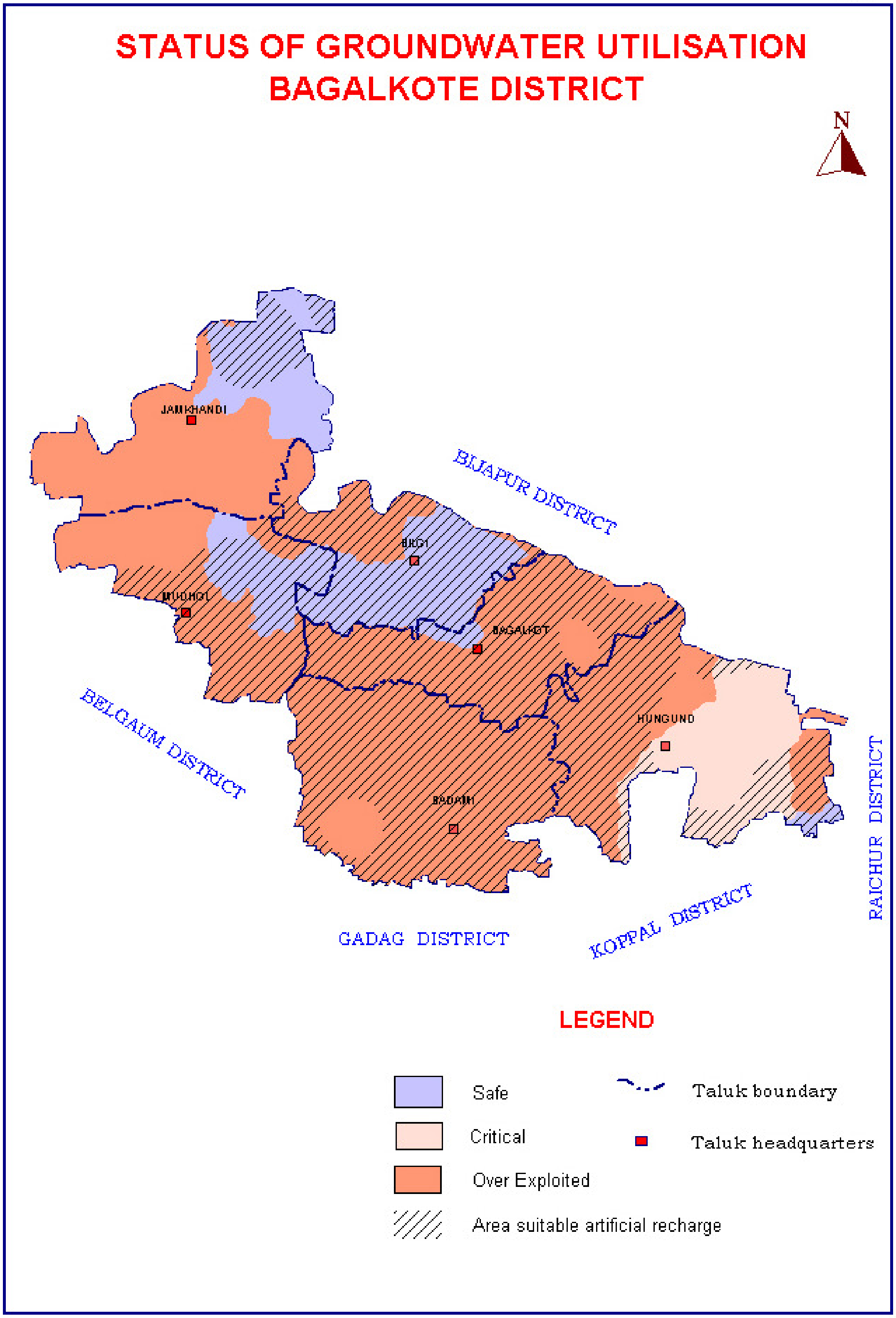

GROUND WATER QUALITY
BAGALKOT DISTRICT
KARNATAKA
N
BIJAPUR DISTRICT
BELGAUM DISTRICT
GADAG DISTRICT
KOPPAL DISTRICT
RAICHUR DISTRICT
JAMKHANDI
MUDHOL
BILGI
BAGALKOT
HUNGUND
BADAMI
LEGEND
Fluoride concentration >1.5 Mg/L
Nitrate concentration > 45 Mg/L
Chloride concentration 250-1000 Mg/L
Chloride concentration >1000 Mg/L
Taluk boundary
District headquarters
Taluk headquarters
750
Electrical conductivity (Micro mhos/cm)

Fig-7


STATUS OF GROUNDWATER UTILISATION
BAGALKOTE DISTRICT
N
JAMKHANDI
BILGI
MUDHOL
BAGALKOT
HUNGUND
BADAMI
BIJAPUR DISTRICT
BELGAUM DISTRICT
GADAG DISTRICT
KOPPAL DISTRICT
RAICHUR DISTRICT
LEGEND
Safe
Critical
Over Exploited
Area suitable artificial recharge
Taluk boundary
Taluk headquarters

would help in recharging deeper depleted fractures and fissures so as to have a sustainable yield from borewells. Technical management of groundwater should be kept in mind while extending institutional finance to farmers and awareness should be created in different user communities. Participatory approach in groundwater management especially in canal command areas is essential.

5.1 Groundwater Development: The average stage of groundwater development in the district is 92.45% as per the resource computation done in March 2004.The development is less in the taluks having surface water facility for irrigation. Hence, a higher development of more than 100% is witnessed in Bagalkote, Badami and Hungund taluks. Further development in the over-exploited areas of the above mentioned taluks should be restricted. In Jamkhandi and Mudhol taluks further development of groundwater should be done with all cautions. As groundwater level, in general, is declining, deepening of dug wells, conversion of dugwells into dug-cum-borewells is needed. The shallow zone of ground water can be developed for irrigation through dug wells in topographic low areas and dug-cum-borewells in valley slope areas having comparatively deeper water levels. Optimum depth of dug well is 10-12 m having a diameter of 6-7m.The optimum depth of dug-cum borewell is 15-20 m having a diameter of 6-7 m in dug part and 100 mm in lower borewell part to a depth of100 m. A minimum spacing of 75 to 100m between dugwells is recommended. The recommended optimum discharge of dugwells is 3 – 4 lps for the prevailing cropping pattern for a pumping of 4 to5 hrs and 3-5 H.P. pump is needed. The recommended command of each well is 1.2 hectare. Borewells are possible in all topographic conditions and pinpointing of site, depth, yield prospects etc, should be ascertained by suitable investigations. The minimum distance of 150 m between two borewells is necessary to avoid mutual interference.

5.2 Groundwater Conservation and Artificial Recharge: Fast, unchecked and indiscriminate withdrawal of groundwater through different abstraction structures has resulted in the decline of ground water level. Hence, arrest of further decline of water level and ground water resource augmentation is essential. Conservation and augmentation can be achieved by adopting water efficient irrigation practices, suitable cropping pattern and constructing appropriate artificial recharge structures.

Rain Water Harvesting would be a remedy in areas where there is ground water quality problem due to high nitrate, chloride and fluoride concentrations and water level decline.

Selection of a particular type of RWH structure is area specific. By studying the nature of geological formations, slope of the land, depth of weathering, depth to water level and availability of land and water source for these artificial recharge structures, different types of artificial structures are recommended and shown in the map. The northern part of the district constituting a gently undulating to plain land is suitable for construction of Percolation tanks, Nalla bunds and point recharge structures like recharging through existing borewells / dugwells and recharge pits. The moderate to high sloping, undulating terrain in the southern part of the district covering is suitable for artificial recharge structures like gully plugs, gabian structures, cement plugs, nala bunds, contour bunds and contour trenches. As mentioned earlier, the selection of a suitable artificial recharge structure is site specific and hence, scientific studies should be conducted while selecting the site for a specific type of structure. However, artificial recharge structures are recommended in such areas considering the long-term water level trends. Areas, where Artificial Recharge Structures are feasible of are demarcated in Fig-7.

6.0 Groundwater related issues and problems:

Resource depletion due to over development, **water-logging and soil salinity** in canal command areas and geogenic **and anthropogenic pollution** of ground water are the main issues related to groundwater in the district.

High groundwater development has taken place in Badami, (166.5%) Bagalkote (158.3%) and Hungund(119.7%) and in the non-command areas of Jamkhandi and Mudhol taluks. This has led to water scarcity in these areas which adversely affects the domestic and agricultural sectors mainly during summer months.
Mining at localized areas for iron ores is being done in Kamatgi and Amingarh areas. Cement industries and extensive Limestone quarrying at Bagalkote and many other places are likely to affect the ground water availability and quality.

Water – logging due to rise in water level is reported from the parts of Bilgi, Mudhol , Jamkhandi and Badami taluks falling in the Krishna, Ghataprabha and Malaprabha canal command areas. Though the exact area under water logging is not readily available, it is suspected that if not properly tackled, this may pose a threat in future resulting in loss of valuable arable land. Conjunctive use of surface and groundwater is a suitable management strategy in the command areas.

The nitrate pollution of shallow aquifers is observed on a wide scale especially in canal command areas which is possibly due to extensive application of nitrogenous chemical fertilizers, shallow water level condition and due to other human interventions. Higher fluoride concentrations are observed in dug wells at places and is comparatively more in deeper aquifers as evidenced in bore well samples. The fluoride is geogenic and its concentration is likely to increase with over-development of groundwater. Though the district is industrially backward, existing cement, textile and engineering industries may cause groundwater pollution locally.

7.0 Awareness and Training Activity: NIL

8.0 Areas notified by CGWA/SGWA:

No area is notified either by CGWA or State government

9.0 RECOMMENDATIONS

After analyzing the present groundwater scenario in Hassan district, the following recommendations are made to develop ground water on sustainable basis in different parts of the district.

a) Dugwells which are currently in use, may be further deepened to tap more saturated part of the phreatic aquifer and increase the yield. Wherever dugwells are more than 15 meter in depth, borewells of 100 to 150mm diameter to a depth of 50 m may be tried at the bottom to enhance the yield. Such measures will help in mitigating the irrigation water scarcity.
b) Pinpointing of sites for wells and borewells in feasible areas should be tried after taking technical guidance and scientific investigations. Otherwise, farmers have to suffer heavy financial burden in case of failures of wells.
c) In canal command areas of Badami,Bilgi, Jamkhandi and Mudhol taluks conjunctive use of surface and groundwater should be practiced. Withdrawing more groundwater through dugwells and shallow borewells and transferring it to upland and tail end areas will solve water scarcity in such areas and reduces the water-logging problem in the command area.
d) Water- use efficiency irrigation methods like drip irrigation and sprinkler irrigation can be practiced in groundwater irrigated agriculture to save water.
e) In situ rainwater harvesting in the villages where ground water carries excess nitrate and fluoride contents, will offer a solution for drinking water problems.
f) Artificial recharge measures like checkdams, percolation tanks, point recharge structures shoud be implemented on extensive scale especially in over-exploited areas like Badami, Bagalkote, Hungund and Mudhol taluks. Suitable artificial recharge structures should be constructed in different terrains which will arrest and store the run-off in rainy season which will otherwise goes waste. This stored water will recharge groundwater and will help in arresting soil erosion and also flood control.
g) Rejuvenation of existing MI tanks by de-silting would enhance their storage and percolation capacities.
h) Institutional financial assistance should be provided to poor farmers for deepening of dugwells and for new borewells. Incentives should be given for those who are interested in implementing rain Water Harvesting schemes. Construction of different Artificial Recharge Structures, which is generally not affordable to individuals, should be taken up by the government.

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