



## केंद्रीय भूमि जल बोर्ड

जल संसाधन, नदी विकास और गंगा संरक्षण

विभाग, जल शक्ति मंत्रालय

भारत सरकार

### **Central Ground Water Board**

Department of Water Resources, River  
Development and Ganga Rejuvenation,  
Ministry of Jal Shakti  
Government of India

## **AQUIFER MAPPING AND MANAGEMENT OF GROUND WATER RESOURCES**

**YELBURGA TALUK,  
KOPPAL DISTRICT, KARNATAKA**

दक्षिण पश्चिमी क्षेत्र, बैंगलोर

South Western Region, Bengaluru



## **AQUIFER MANAGEMENT PLAN OF YELBURGA TALUK, KOPPAL DISTRICT, KARNATAKA STATE**

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# **AQUIFER MANAGEMENT PLAN OF YELBURGA TALUK, KOPPAL DISTRICT, KARNATAKA STATE**

## **1.0 SALIENT INFORMATION**

Name of the taluk: Yelburga

District: Koppal; State: Karnataka

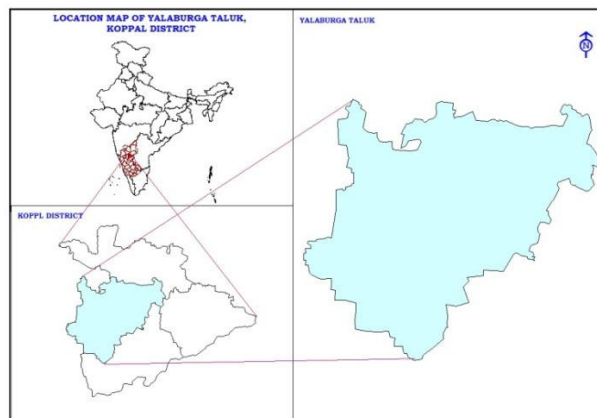
Area: 1514 sq.km.

Population: 2,67,442

Annual Normal Rainfall: 558 mm

### **1.1 Aquifer management study area**

Aquifer mapping studies have been carried out in Yelburga taluk, Koppal district of Karnataka, covering an area of 1514 sq.kms under National Aquifer Mapping Project. Yelburga taluk of Koppal district is located between north latitude  $15^{\circ}18'21.2''$  and  $15^{\circ}44'59.3''$  & east longitude  $75^{\circ}48'37.8''$  and  $76^{\circ}20'04.3''$ , and is covered in parts of Survey of India Toposheet Nos. 48 M/14, 48 M/15, 57A/2, 57A/3 and 57A/6. Yelburga taluk is bounded by Kushtagi taluk on north, Koppal taluk on south, Gangavathi taluk on east and Ron & Gadag taluks on western side. Location map of Yelburga taluk of Koppal district is presented in **Fig. 1**.



**Fig. 1:Location map of Yelburga taluk**

Yelburga is the taluk head quarter and there is no other town in this taluk. There are 138 inhabited and 6 uninhabited villages in Yelburga taluk.

### **1.2 Population**

According to 2011 census, the population in Yelburga taluk is 2,67,442 in which 2,52,628 constitute the rural population and 14,814 constitute urban population. The study area has an

overall population density of 177 persons per sq.km. The decadal variation in population from 2001-2011 is 16.21% in Koppal District.

### 1.3 Rainfall

Yelburga taluk enjoys arid climate. Dryness and hot weather prevails in major part of the year. The area falls under Northern dry agro-climatic zone of Karnataka state and is categorized as drought prone.

The climate of the study area is quite agreeable and free from extremes. The year is usually divided into four seasons: summer from March to May; rainy season or south-west monsoon season from June to September; post-monsoon season covering the months of October and November and dry or winter Season from December to February.

There is one rain gauge station located in Yelburga taluk (**Table 1**). The data in respect of this station from the year 1981 to 2010 is analysed and presented in **Table 2**. The data pertaining to these gauges is of long-term nature and are well maintained. It is presumed that they are representative of the taluks and the same is used for analysis. Normal annual rainfall in Yelburga taluk for the period 1981 to 2010 is 558.3 mm.

**Table 1: Rain gauge and its location in Yelburga taluk**

Station	Latitude	Longitude	Altitude
Yelburga	15°36'	76°00'	605

Statistical analysis

Computations were carried out for the 30 year blocks of 1981- 2010 on Mean, Standard deviation and coefficient of variation of each month premonsoon, monsoon, post monsoon and annual and are shown in **Table 2**.

The mean monthly rainfall at Yelburga taluk is ranging between 1mm during January and February to 142 mm during September. The CV percent for pre monsoon, monsoon and post monsoon season 113, 212 and 135 percent respectively. Annual CV at this station works out to be 254 percent.

**Table 2: Statistical Analysis of Rainfall Data of Yelburga Taluk, Koppal District for the Period 1981 to 2010**

Station		Jan	Feb	Mar	Apr	May	Pre	Jun	Jul	Aug	Sep	SW	Oct	Nov	Dec	NE	Annual
YELBURGA	NRM	3	1	6	18	49	77	74	63	78	133	347	93	18	6	117	540
	STDEV	10	4	22	22	40	54	55	44	60	86	137	65	25	15	69	181
	CV%	27	36	28	82	124	143	133		129	154	253	143	71	42	168	299

## 1.4 Agriculture & Irrigation

Agriculture is the main occupation in Yelburga taluk. Major Kharif crops are maize, bajra, jowar, tur and vegetables. Main crops of Rabi season are maize, groundnut, and sunflower (**Table 3**). Water intensive crops like sugarcane and paddy are grown in 0.04% of total crop area. Maize is grown in 9% and oil seeds in 27% of total crop area of taluk. Bajra & jowar account 16% of total crop area.

**Table 3: Cropping pattern in Yelburga taluk 2014-2015 (Ha)**

Year	Paddy	Maize	Bajra	Jowar	Pulses	Fruits	Vegetables	Oil seeds	Sugarcane	Cotton
Area under cultivation (in ha)										
2014-2015	275	12029	8445	13785	43042	1412	9644	36849	54	9211

Source: District at a glance 2014-15, Govt. of Karnataka

It is observed that net sown area accounts 89.6% and area sown more than once is 5.24% of total geographical area in Yelburga taluk (**Table 4**). Area not available for cultivation and Fallow land cover 4.63% & 1.47% of total geographical area respectively. 99.5% of net area irrigated is only from bore wells and 0.5% from tanks (**Table 5**).

**Table 4: Details of land use in Yelburga taluk 2014-2015 (Ha)**

Taluk	Total Geographical Area	Area under Forest	Area not available for cultivation	Fallow land	Net sown area	Area sown more than once
Yelburga	151400	80	7021	2222	135642	7937

Source: District at a glance 2014-15, Govt. of Karnataka

**Table 5: Irrigation details in Yelburga taluk (in ha)**

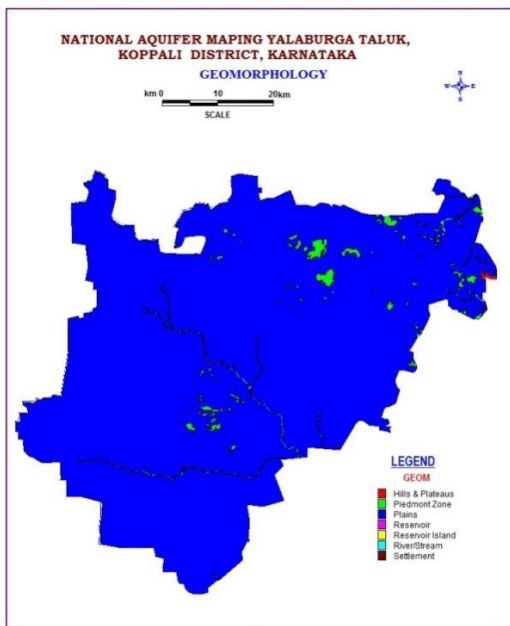
Source of Irrigation	Net area irrigated (Ha.)	% of area
Canals	0	0
Tanks	40	0.5
Wells	0	0
Bore wells	7897	99.5
Lift Irrigation	0	0
Other Sources	0	0
<b>Total</b>	<b>7937</b>	

Source: District at a glance 2014-15, Govt. of Karnataka

### 1.5 Geomorphology, Physiography & Drainage

The taluk is moderately plain with shallow troughs and mounds of granite hills appear to have a rugged topography. The general slope of the land in the taluk being north-west to south-east, the average elevation of the taluk is about 500mts amsl. The taluk is drained by tributaries of Tungabhadra river which are ephemeral in nature. The drainage pattern in the taluk is dentritic to sub-dentritic and general drainage density varies from 1.2-7.0kms/sq.km.

Geomorphology and drainage maps are presented in **Fig 2** and **Fig.3**.



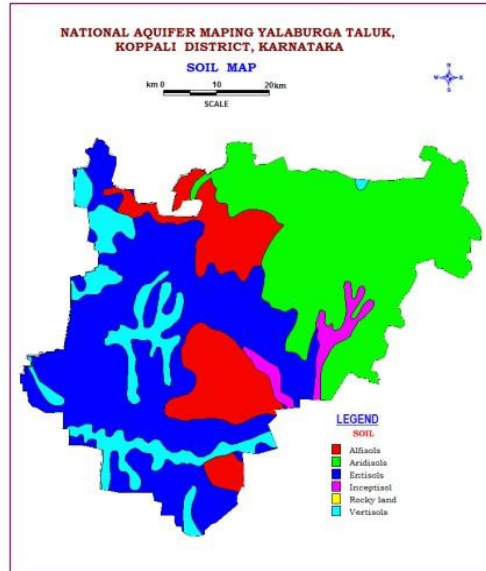
**Fig. 2: Geomorphology**



**Fig. 3 :Drainage**

### 1.6 Soil

Soils are the weathering product of parent rock. The taluk is characterized by large stretch of barren plains covered with six types of soils. These soils are seen in gneissic terrain. Nalas are generally filled with loose sand, and kanker mixed grey sandy soil. The soil map of Yelburga taluk is given in **Fig. 4**.



**Fig. 4: Soil map of Yelburga taluk**

### 1.7 Ground water Resource availability and Extraction

Aquifer wise total ground water resources up to 200 m depth are given in **Table 6**.

**Table 6: Total Ground Water Resources (2017) (Ham)**

Taluk	Annual replenishable GW resources	Fresh In-storage GW resources		Total availability of fresh GW resources
		Phreatic	Fractured (Down to 200m)	
Yelburga	11513			Dynamic + phreatic in-storage + fractured
		6547	3409	21469

### 1.8 Existing and future water demands (as per GEC-2017)

- Net ground water availability for future irrigation development : 1465 Ham
- Domestic (Industrial sector) demand for next 25 years : 271 Ham

### 1.9 Water level behavior

#### (a) Depth to water level

##### Aquifer - I

- Pre-monsoon: 8.13 – 16.10 mbgl (**Fig.5**)
- Post-monsoon: 4.40 – 16.90 mbgl (**Fig.6**)

##### Aquifer - II

- Pre-monsoon: 9.02 mbgl (**Fig.7**)
- Post-monsoon: 8.84 mbgl (**Fig.8**)

#### (b) Water level fluctuation

##### Aquifer-I (Fig.9)

- Seasonal Fluctuation: Rise ranges 0.0 – 1.80 m;  
Fall is -1.20 m

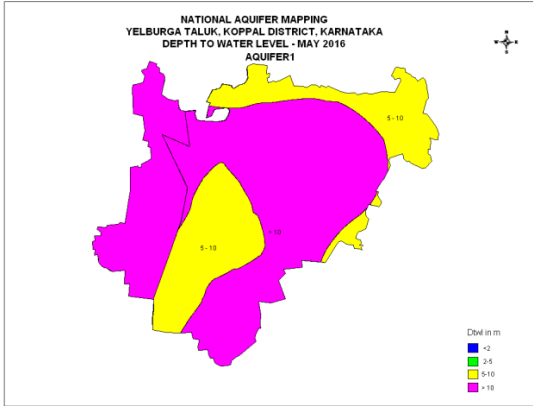


Fig. 5: DTW pre monsoon May 2016 Aquifer I

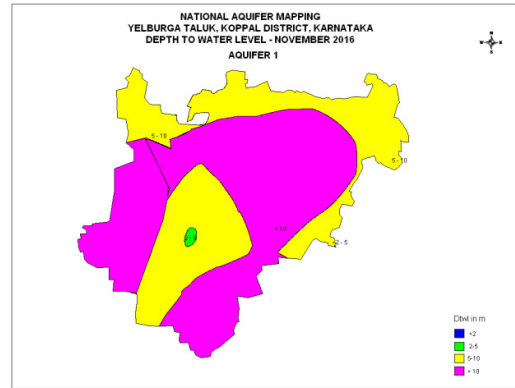


Fig. 6: DTW post monsoon Nov 2016 Aquifer

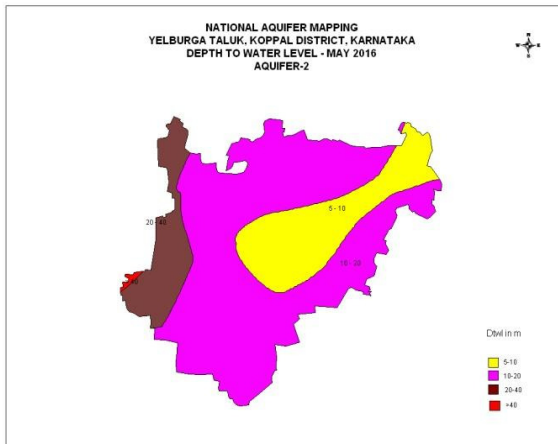


Fig. 7: DTW pre monsoon May 2016 Aquifer II

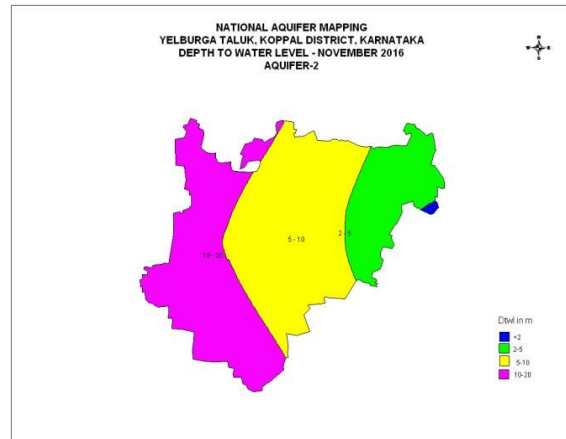


Fig.8: DTW post monsoon Nov 2016 Aquifer II

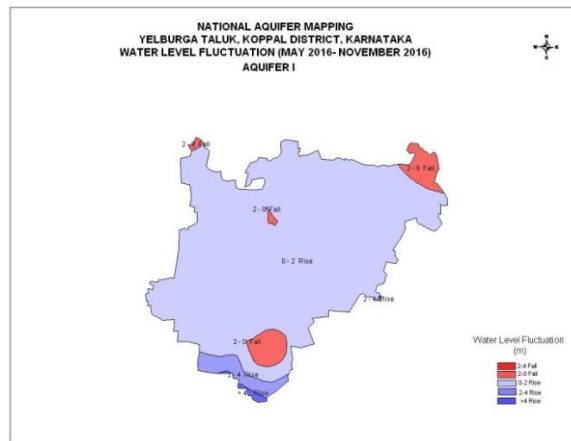


Fig.9: Water level fluctuation (May 2016-Nov 2016) Aquifer I

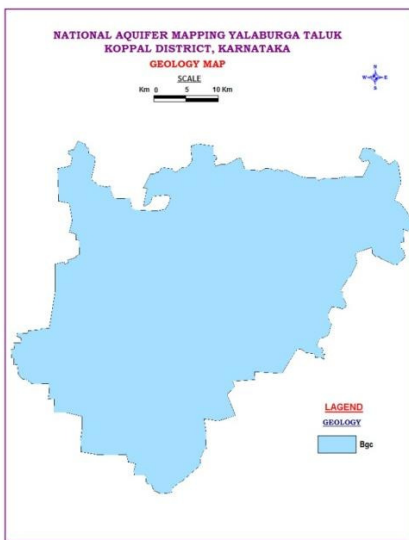


## 2.0 AQUIFER DISPOSITION

2.1 Number of aquifers: In Yelburga taluk, there are mainly two types of aquifer systems;

- i. **Aquifer-I (Phreatic aquifer)** comprising Weathered Granite Gneiss
- ii. **Aquifer-II (Fractured aquifer)** comprising Fractured Granite Gneiss

In **Yelburga taluk**, granitic-gneisses are the main water bearing formations (**Fig. 10**). Ground water occurs within the weathered and fractured granitic-gneisses under water table condition and semi-confined condition. In Yelburga taluk bore wells were drilled from a minimum depth of 35 mbgl to a maximum of 70 mbgl. Depth of weathered zone (Aquifer-I) ranges from 16 mbgl to 23.5 mbgl. Yield ranges from 0.35 to 6.18 lps.



**Fig. 10: Geology of Yelburga taluk**

## 3.0 GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES

### 3.1 Aquifer wise resource availability and extraction (Tables 7 a b c)

(a) Present Dynamic Ground Water Resource (2017)

Taluk	Net annual ground water availability	Existing gross ground water draft for irrigation	Existing gross ground water draft for domestic and industrial water supply	Existing gross ground water draft for all uses	Allocation for domestic and industrial use for next 25 years	Net ground water availability for future irrigation development	Existing stage of ground water development	Category
Yelburga	11513	10273	253	10526	271	1465	91	CRITICAL

(b) Present total Ground Water Resource (in ham)

Taluk	Annual replenishable GW resources (in ham)	Fresh In-storage GW resources (in ham)		Total availability of GW resource (in ham)
		Phreatic	Fractured	Dynamic + phreatic in-storage + fractured in-storage
Yelburga	11513	6547	3409	21469

(c) Comparison of ground water availability and draft scenario in Yelburga taluk

Taluk	GW availability (in ham)	GW draft (in ham)	Stage of GW development	GW availability (in ham)	GW draft (in ham)	Stage of GW development	GW availability (in ham)	GW draft (in ham)	Stage of GW development	GW availability (in ham)	GW draft (in ham)	Stage of GW development
	2009			2011			2013			2017		
Yelburga	7641	11106	145	8654	8058	93	8689	8262	95	11513	10526	91

### 3.2 Chemical quality of ground water and contamination

Interpretation from Chemical Analysis results in Yelburga taluk is mentioned as under:

**Electrical Conductivity:** In general, EC values range from 790 to 2300  $\mu$ /mhos/cm and some of the pockets of the taluk EC values ranges up to 4080  $\mu$ /mhos/cm at 25°C which is beyond the permissible limit.

**Fluoride:** Fluoride concentration in ground water is of geogenic origin in areas underlain by younger granites/ gneisses containing minerals like Fluorspar & fluoroapatite. F value ranges between 0.20 to 1.20mg/l and in most parts of the taluk F is within the permissible limit of 1.5 mg/l and at Yelburga proper its concentration is 2.0 mg/l which is beyond the permissible limit.

**Nitrate:** Nitrate value ranges between 1.35 to 14.68 mg/l which are within the permissible limit of 45 mg/l.

In general ground water quality in Yelburga taluk is good for drinking purpose except in some areas, where EC & fluoride is found to be greater than the permissible limit as per "Indian Standard Drinking Water Specification 2009". Ground water samples have also been tested and found suitable for agriculture & irrigation purposes.

## 4.0 GROUND WATER RESOURCE ENHANCEMENT

### 4.1 Aquifer wise space available for recharge and proposed interventions

Recharge dry **phreatic aquifer (Aquifer I)** in the taluk, through construction of artificial recharge structures, viz; check dams, percolation tanks & point recharge structures (**Tables 8 & 9**). The choice of recharge structures should be site specific and such structure need to be constructed in areas already identified as feasible for artificial recharge.

**Table 8: Quantity of non-committed surface runoff & expected recharge through AR structures**

Artificial Recharge Structures Proposed	Yelburga taluk
Non committed monsoon runoff available (MCM)	14.10
Number of Check Dams	87
Number of Percolation Tanks	6
Number of Point Recharge structures	9
Tentative total cost of the project (Rs. in lakhs)	340.45
Excepted recharge (MCM)	8.001
Expected rise in water level (m)	0.27
Cost Benefit Ratio (Rupees/ cu.m. of water harvested)	4.26

**Table 9: Improvement in GW availability due to Recharge, Yelburga taluk**

Taluk	Net annual ground water availability	Existing gross ground water draft for all uses	Existing stage of ground water development	Expected recharge from proposed artificial recharge structures	Additional potential from proposed irrigation development schemes through inter basin transfer	Cumulative annual ground water availability	Expected improvement in stage of ground water development after the implementation of the project	Expected improvement in overall stage of ground water development
	HAM	HAM	%	HAM	HAM	HAM	%	%
Yelburga	11513	10526	91	800	7362	16851	49	46

### 4.1 Alternate water sources

- **Proposed GW Recharge and Assured Supply of Drinking Water Schemes (Inter basin Transfer):** Inter-basin transfer - Yettinahole is under progress as proposed by Irrigation Department Govt. of Karnataka.

- Under this project, it is proposed to fill Minor Irrigation tanks with 182 TMC of water to 35 taluks of Koppal, Bagalkot, Bidar, Bijapur, Gulburga, Yadgir and Raichur districts. 50% recharge is considered from the surface water proposed to fill the tanks for irrigation, which includes recharge from tanks, canal seepage and return flow from irrigation.
- For Yelburga taluk, it is calculated that about 7362 Ham can be considered as recharge from above project, if commenced.
- After implementation of Artificial Recharge structures and proposal of GW recharge scheme (inter-basin transfer), the annual ground water availability will increase from 8689 to 16851 ham and the expected improvement in stage of development is 46% from 95% to 49%.

## **5 DEMAND SIDE INTERVENTIONS**

### **5.1 Advanced irrigation practices**

It is observed that bore wells are only the source for irrigation in the taluk. Thus, by adopting the below mentioned techniques will contribute in ground water resource enhancement in the long run.

- Efficient irrigation practices like Drip irrigation & sprinkler needs to be adopted by the farmers in the existing 7897 ha of net irrigated area by bore wells.
- Irrigation draft is 10273 ham.
- Efficient irrigation techniques will contribute in saving ground water by 2280 ham and thus will improve stage of development by 6% from 49% to 43% (Table 8).

### **5.2 Change in cropping pattern**

Water intensive crops like paddy & sugarcane are not grown in Yelburga taluk. Hence change in cropping pattern has not been suggested.

**Table 10: Improvement in GW availability due to saving by adopting water use efficiency**

Taluk	Cumulative annual ground water availability after implementing ar structures & irrigation development schemes	Existing gross ground water draft for all uses	Stage of ground water development after implementing AR structures & proposed irrigation development schemes through inter basin transfer	Saving due to adopting WUE measures	Cumulative annual ground water availability	Expected improvement in stage of ground water development after the implementation of the project	Expected improvement in overall stage of ground water development
Yelburga	HAM	HAM	%	HAM	HAM	%	%
	16851	8262	49	2280	19131	43	6

### 5.3 Regulation and Control

- Yelburga taluk has been categorized as **critical**, since the Stage of ground water development has reached **91%** (GE March 2017). Hence, stringent action has to be taken up through Karnataka Ground Water Authority to control further ground water exploitation in the taluk.
- Ground water recharge component needs to be made mandatory in the non-command area of the taluk for further development of ground water.

### 5.4 Other interventions proposed

- Periodical maintenance of artificial recharge structures should also be incorporated in the Recharge Plan.
- Excess EC & fluoride concentration is found in some ground water samples require remedial measures viz.
  - Dilution of ground water through artificial recharge & water conservation.
  - Roof top rainwater harvesting.
  - Micro irrigation.

## 6 SUMMARY

The summary of Management plan of Yelburga taluk is given in **Table 11**.

**Table 11: Summary of Management plan of Yelburga taluk**

Yelburga taluk is critical & present Stage of GW Development (2017)	91%
Net Annual Ground Water Availability (MCM)	115.13
Existing Gross Ground Water Draft for all uses	105.26
Groundwater development feasibility	5.13
Total GW Resources (Dynamic & Static up to the depth of 200 mbgl (MCM)	214.69
Expected additional recharge from monsoon surplus runoff (MCM)	14.10
Expected additional recharge from proposed irrigation development schemes through inter basin transfer (MCM)	73.62
Change in Stage of GW development, %	95 to 49
Expected Saving due to adopting WUE measures (MCM)	22.80
Change in Stage of GW development, %	49 to 43