



## 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**

**HOSADURGA TALUK,**

**CHITRADURGA DISTRICT, KARNATAKA**

दक्षिण पश्चिमी क्षेत्र, बेंगलोर

South Western Region, Bengaluru



## **AQUIFER MANAGEMENT PLAN OF HOSADURGA TALUK, CHITRADURGA DISTRICT, KARNATAKA STATE**

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# AQUIFER MANAGEMENT PLAN OF HOSADURGA TALUK, CHITRADURGA DISTRICT, KARNATAKA STATE

## 1.0 SALIENT INFORMATION

Name of the taluk: Hosadurga

District: Chitradurga

State: Karnataka

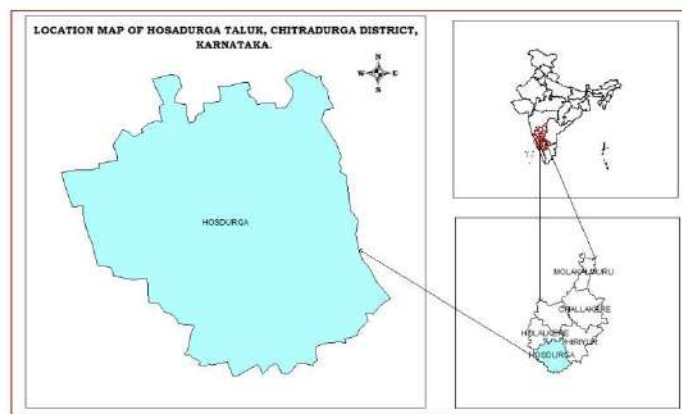
Area: 1,445 sq.km.

Population: 2,35,116

Annual Normal Rainfall: 723 mm

### 1.1 Aquifer management study area

Aquifer mapping studies have been carried out in Hosadurga taluk, Chitradurga district of Karnataka, covering an area of 1445 sq.km under National Aquifer Mapping Project. Hosadurga taluk of Chitradurga district is located between north latitude  $13^{\circ}34'29.2''$  and  $14^{\circ}00'11.4''$  & east longitude  $76^{\circ}06'00.7''$  and  $76^{\circ}33'51.2''$ , and is covered in parts of Survey of India Toposheet Nos. 57C/1, 57C/2, 57C/5, 57C/6, 57C/9 and 57C/10. Hosadurga taluk is bounded by Holalkere taluk on north, C.N. Halli taluk of Tumkur district on south, Hiriyur taluk on east and Kadur and Tarikere taluks on western side. Location map of Hosadurga taluk of Chitradurga district is presented in **Fig. 1**.



**Fig: 1. Location map of Hosadurga taluk, Chitradurga district**

Taluk administration of Hosadurga taluk, which is taluk head quarter and there is no other town in this taluk. There are 198 inhabited and 27 uninhabited villages in Hosadurga taluk.

## 1.2 Population

According to 2011 census, the population in Hosadurga taluk is 2,35,116, in which 2,06,746 constitute the rural population and 28,370 constitute urban population. The study area has an overall population density of 163 persons per sq.km. The decadal variation in population from 2001-2011 is 7.14 %.

## 1.3 Rainfall

Hosadurga taluk enjoys semiarid climate. Dryness and hot weather prevails in major part of the year. The area falls under Central 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 Hosadurga 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 taluk and the same is used for analysis. Normal annual rainfall in Hosadurga taluk for the period 1981 to 2010 is 723 mm.

**Table1: Raingauge and its location in Hosadurga taluk**

Station	Latitude	Longitude	Altitude
Hosadurga	13°46'	76°19'	725

## 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 pre monsoon, monsoon, post monsoon and annual and are shown in **Table 2**.

The mean monthly rainfall at Hosadurga taluk is ranging between 2 mm during January to 150 mm during October. The CV percent for pre monsoon, monsoon and post monsoon season is 67, 38 & 51 percent respectively. Annual CV at this station works out to be 31 percent.

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

STATION		JAN	FEB	MAR	APR	MAY	PRE	JUN	JUL	AUG	SEP	SW	OCT	NOV	DEC	NE	Annual
HOSADURGA	NRM	2	3	12	41	90	148	78	79	90	118	365	150	50	10	210	723
	STDEV	5	9	22	39	67	99	48	47	59	80	139	89	59	16	107	224
	CV%	306	272	176	96	75	67	61	60	66	68	38	59	119	163	51	31

#### 1.4 Agriculture & Irrigation

Agriculture is the main occupation in Hosadurga taluk. Major Kharif crops are ragi, maize, jowar, and vegetables. Main crops of Rabi season are ragi, maize, horse gram, groundnut, and sesamum (**Table 3**). Water intensive crop like paddy is grown in negligible area in the taluk. Ragi is grown in 41 % and maize in 9.5% of total crop area of taluk. Pulses account 13.7% of total crop area.

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

Year	Paddy	Maize	Ragi	Bajra	Jowar	Pulses	Fruits	Vegetables	Oil seeds	Sugarcane	Cotton
Area under cultivation (in ha)											
2014-2015	25	6488	27909	12	606	9335	5989	1825	4176	0	1337

It is observed that net sown area accounts 47% and area sown more than once is 10.8% of total geographical area in Hosadurga taluk (**Table 4**). Area not available for cultivation and Fallow land cover 8.8% & 4.65% of total geographical area respectively. 100% of net area irrigated is only from borewells (**Table 5**).

**Table 4.: Details of land use in Hosadurga 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
Hosadurga	144500	19074	12672	6720	68200	15634

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

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

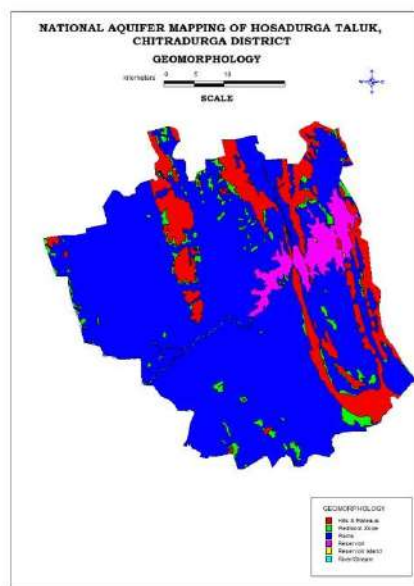
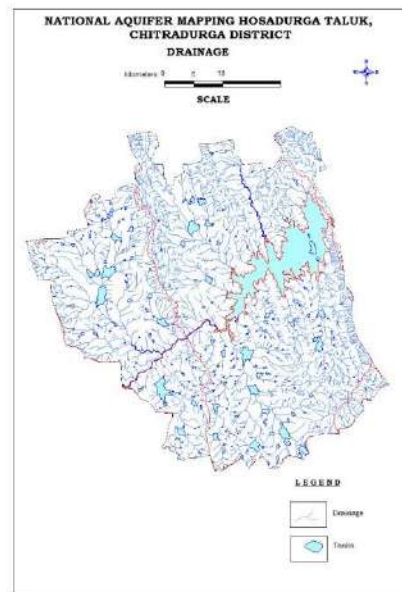
Source of Irrigation	Gross area irrigated (Ha.)	% of area
Canals	0	0
Tanks	0	0
Wells	0	0
Bore wells	12645	100
Lift Irrigation	0	0
Other Sources	0	0
<b>Total</b>	<b>12645</b>	<b>100</b>

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

### 1.5 Geomorphology, Physiography & Drainage

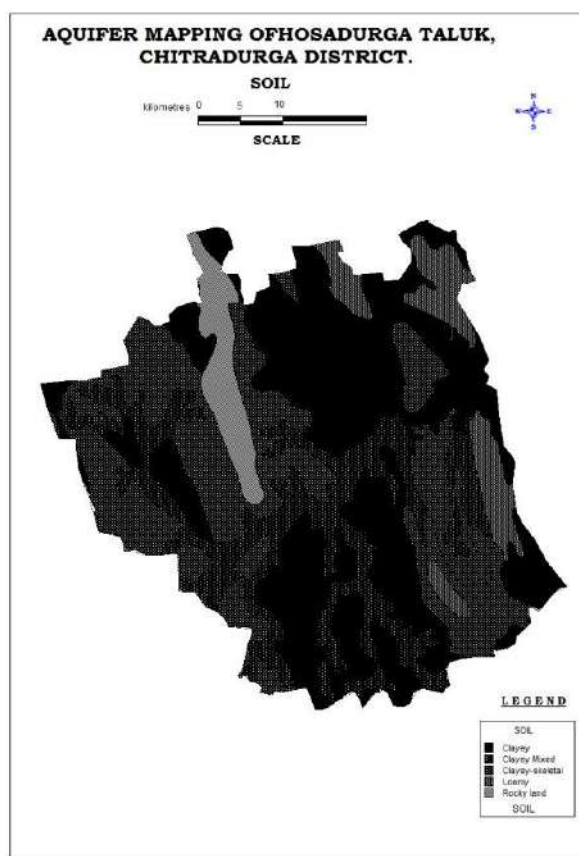
Granitic/gneissic landscape and schistose landscape are the major plan surfaces that have been subdivided into various landform units such as hills, pediments, plains and valleys. These landscapes are rugged noticed with number of hill ranges with elevation ranging from 550 to 1200 m above MSL. The landforms observed in the study area are Channel island, denudational hills, dyke ridge, inselberg, linear ridge, pediment, pediment inselberg complex, pediplain moderate pediplain, shallow reservoir, reservoir island, residual hills, river/stream, structural hills, valley and valley fill shallow.

Physiographically the taluk comprises of undulating plains, interspersed with sporadic ranges and isolated low ranges of rocky hills. The taluk forms part of the southern maidan region, has extensively undulating plateau. Geomorphology map of the taluk is given in **Fig. 2**. The taluk is drained by Vedavathi River in Krishna River basin. The Drainage map is shown in **Fig. 3**.

**Fig. 2: Geomorphology****Fig 3: Drainage**

## 1.6 Soil

The soils of the Hosadurga taluk are derived from gneiss and schist rocks. Soil types of the taluk comprise deep & shallow black soil, mixed red & black soil, red loamy & sandy soil (Fig.4).



**Fig. 4: Soil Map of Hosadurga Taluk**

## 1.7 Ground water resource availability and extraction

Aquifer wise total groundwater resource up to 200 m depth is 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
Hosadurga	9348	Phreatic	Fractured (Down to 200m)	Dynamic + phreatic in-storage + fractured
		2571	3817	15736

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

- Net ground water availability for future irrigation development : 972 Ham
- Domestic (Industrial sector) demand for next 25 years : 593 Ham

## 1.9 Water level behavior

### (a) Depth to water level

#### Aquifer - I

- Pre-monsoon: 4.10 – 14.30 mbgl (**Fig.5**)
- Post-monsoon: 6.77 -18.10 mbgl (**Fig.6**)

#### Aquifer - I

### (b) Water level fluctuation

- Seasonal Fluctuation: Rise ranges 0 -1.42 m; (**Fig. 7**)  
Fall ranges 0.69 – 10.70 m

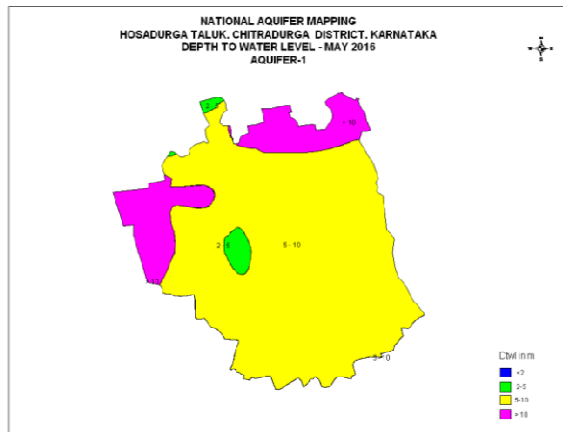


Fig. 5: Depth to water May 2016- Aquifer I

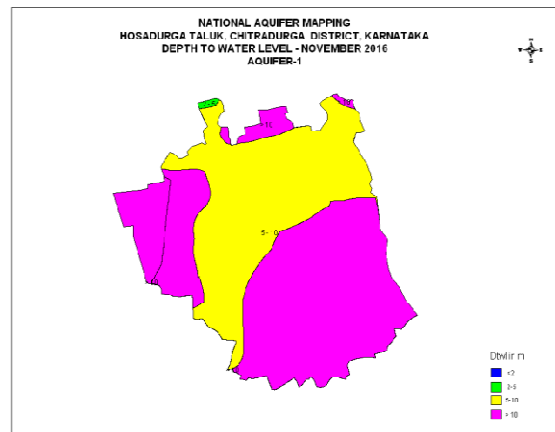


Fig. 6: Depth to water Nov 2016- Aquifer I

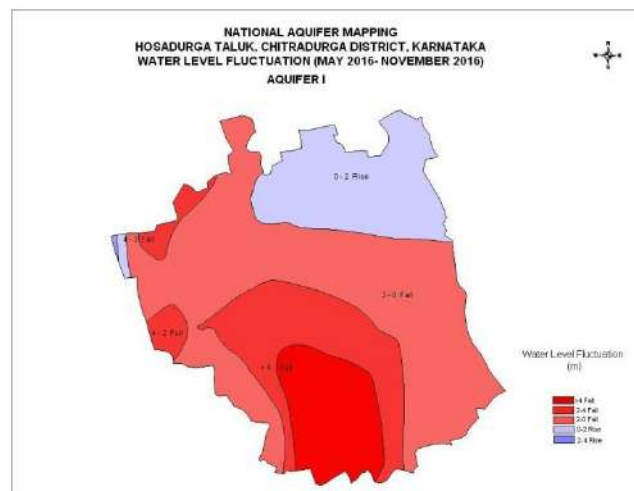


Fig. 7: Water level fluctuation (May 2016- Nov 2016)- Aquifer I

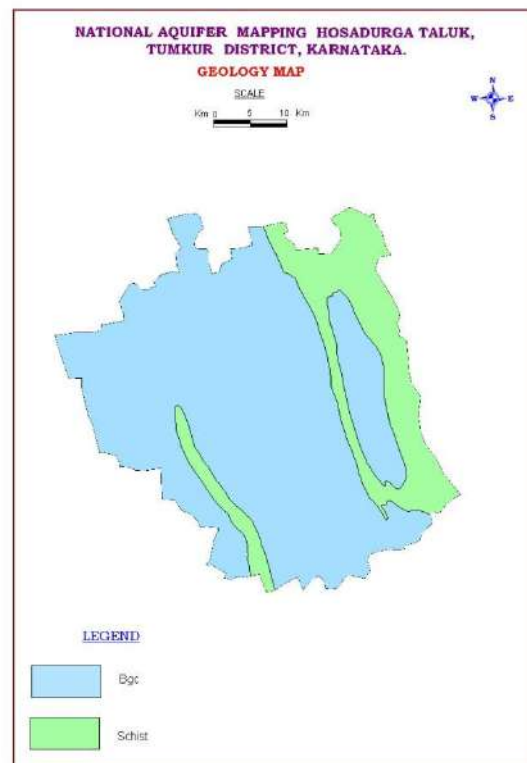


## 2.0 AQUIFER DISPOSITION

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

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

In Hosadurga taluk granite gneisses and schist are the main water bearing formations (**Fig. 8**). Ground water occurs within the weathered and fractured granitic-gneisses and schist under water-table condition and semi-confined condition. The depth of borewells drilled in the taluk is ranging from 64 to 200 mbgl. Depth of weathered zone ranges from 6.0 to 27 m bgl. Yield ranges from 0.64 to 5.5 lps. Transmissivity ranges from 0.5 to 75.88 m<sup>2</sup>/day. Storativity ranges from 0.07 to 0.21.



**Fig.8: Geology of Hosadurga Taluk**

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

#### 3.1 Aquifer wise resource availability and extraction

Details of ground water resource is given in **Tables 7 a, b, c**

**Table 7 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
Hosadurga	9348	10478	579	11057	593	972	118	Overexploited( OE)

**Table 7 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
Hosadurga	9348	2571	3817	15736

**Table 7 c: Comparison of Ground water availability and Draft scenario in Hosadurga 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
	2			2011			2013			2017		
Hosadurga	8990	8530	95	9011	8680	96	9173	9025	98	9348	11057	118

#### 3.2 Chemical quality of ground water and contamination

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

**Electrical conductivity:** In general, EC values range from 910 to 1720  $\mu$ /mhos/cm at 25°C which are within the permissible limit in both the aquifers.

**Fluoride:** Fluoride concentration in ground water is of geogenic origin in areas underlain by younger gneisses and schists containing minerals like Flurospar & fluroapatite. F value ranges between 1.30 to 1.50 mg/l which are also within the permissible limit of 1.5 mg/l.

**Nitrate:** Nitrate value ranges between 10 to 18 mg/l which are within the permissible limit of 45 mg/l.

In general ground water quality in Hosadurga taluk is good for drinking purpose. 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 (**Table 8**). The choice of recharge structure should be site specific and such structures need to be constructed in areas already identified as feasible for artificial recharge. Improvement in ground water availability is given in **Table 9**.

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

Artificial Recharge Structures Proposed	Hosadurga taluk
Non committed monsoon runoff available (MCM)	13.3
Number of Check Dams	82
Number of Percolation Tanks	6
Number of Point Recharge structures	9
Tentative total cost of the project (Rs. in lakhs)	321.72
Expected recharge (MCM)	7.561
Expected rise in water level (m)	0.288
Cost Benefit Ratio (Rupees/ cu.m. of water harvested)	4.26

**Table 9: Improvement in ground water availability due to recharge, Hosadurga 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
Hosadurga	HAM	HAM	%	HAM	HAM	HAM	%	%
	9348	11057	118	756	0	9929	91	7

After implementation of Artificial Recharge structures, the annual ground water availability will increase from 9173 to 9929 ham and the expected improvement in stage of development is 7% from 98% to 91%

## **5.0 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 12645 ha of gross irrigated area by borewells.
- Irrigation draft is 8206 ham.
- Efficient irrigation techniques will contribute in saving ground water by 2462 ham and thus will improve stage of development by 17% from 91% to 74%. (**Table 10**)

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

Water intensive crops like paddy & sugarcane are not grown extensively in Hosadurga 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
	HAM	HAM	%	HAM	HAM	%	%
Hosadurga	9929	8206	91	2462	12391	74	17

### 5.3 Regulation and Control

- Hosadurga taluk has been categorized as **Overexploited(OE)** since the Stage of ground water development has reached **118%** (GEC 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.
  - Roof top rainwater harvesting.
  - Micro irrigation.

## 6.0 SUMMARY

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

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

Hosadurga taluk is overexploited & present stage of GW Development (2017)	118
Net Annual Ground Water Availability (MCM)	93.48
Existing Gross Ground Water Draft for all uses	110.57
Groundwater development feasibility	9.40
Total GW Resources (Dynamic & Static up to the depth of 200 mbgl (MCM)	157.36
Expected additional recharge from monsoon surplus runoff (MCM)	7.56
Change in Stage of GW development, %	98 to 91
Expected additional recharge from proposed irrigation development schemes through inter basin transfer (MCM)	0
Change in Stage of GW development, %	0
Expected Saving due to adopting WUE measures (MCM)	24.62
Change in Stage of GW development, %	91 to 74