



## केंद्रीय भूमि जल बोर्ड

जल संसाधन, नदी विकास और गंगा संरक्षण मंत्रालय

भारत सरकार

Central Ground Water Board

Ministry of Water Resources, River Development and Ganga

Rejuvenation

Government of India

Report on

## **AQUIFER MAPPING AND MANAGEMENT PLAN**

**Huvinahadagali Taluk, Bellary District, Karnataka**

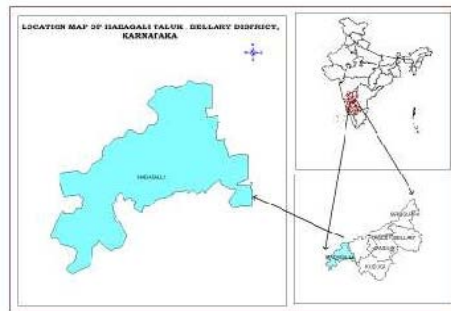
दक्षिण पश्चिमी क्षेत्र, बेंगलोर

South Western Region, Bengaluru



Government of India  
Ministry of Water Resources, River Development  
& Ganga Rejuvenation  
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HUVINAHADAGALI TALUK AQUIFER MAPS AND MANAGEMENT PLANS,  
BELLARY DISTRICT, KARNATAKA STATE



By

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**CONTENTS**

<b>Sl. No.</b>	<b>Chapter Title</b>	<b>Page No.</b>
<b>1</b>	<b>SALIENT INFORMATION</b>	<b>1</b>
<b>2</b>	<b>AQUIFER DISPOSITION</b>	<b>8</b>
<b>3</b>	<b>GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES</b>	<b>11</b>
<b>4</b>	<b>GROUND WATER RESOURCE ENHANCEMENT</b>	<b>12</b>
<b>5</b>	<b>DEMAND SIDE INTERVENTIONS</b>	<b>13</b>
<b>6</b>	<b>SUMMARY</b>	<b>15</b>

**HUVINAHADAGALI TALUK AQUIFER MAPS AND MANAGEMENT PLANS,  
BELLARY DISTRICT, KARNATAKA STATE**

**1. SALIENT INFORMATION**

**Name of the taluk** : HUVINAHADAGALI  
**District** : Bellary  
**State** : Karnataka  
**Area** : 954 sq.km  
**Population** : 1,88,238 (2011)  
**Annual Normal Rainfall** : 620 mm

**1.1 Aquifer management study area**

Aquifer mapping studies have been carried out in Huvinahadagali taluk, Bellary district of Karnataka, covering an area of 954 sq.kms under National Aquifer Mapping Project. Huvinahadagali taluk of Bellary district is located between north latitude  $14^{\circ} 43' 9.12''$  &  $15^{\circ} 09' 7.92''$  and east longitude  $75^{\circ} 39' 50.5''$  &  $76^{\circ} 06' 45.72''$ , and is covered in parts of Survey of India Toposheet Nos. 48N/9, 48N/10, 48N/13, 48M/16 and 57A/4. Huvinahadagali taluk is bounded by Mundargi and Shirahatti taluks of Gadag district on the north Harapanahalli taluk of Davanagere district on south, Hagaribommanahalli taluk on east and Haveri and Ranebennur taluks of Haveri district on western side. Location map of Huvinahadagali taluk of Bellary district is presented in Fig-1.

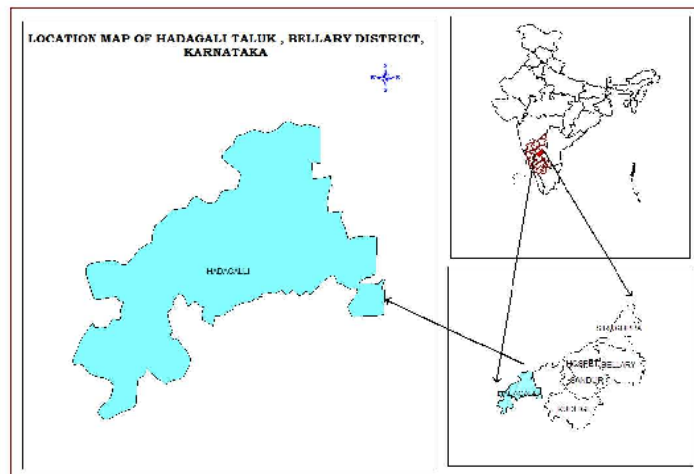


Fig 1: Location Map of Huvinahadagali taluk, Bellary district

Administratively, Huvinahadagali town is taluk head quarter and there is no other town in this taluk. There are 56 inhabited and 1 uninhabited villages in Huvinahadagali taluk.

### 1.2 Population

According to 2011 census, the population in Huvinahadagali taluk is 195219, in which 167252 constitute the rural population 27967 constitute urban population. The study area has an overall population density of 185 persons per sq.km. The decadal variation in population from 2001-2011 is 19.45% and 15.58% rural population respectively in Huvinahadagali taluk.

### 1.3 Rainfall

Huvinahadagali taluk enjoys semi-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 normal annual rainfall in Huvinahadagali taluk for the period 1981 to 2010 is 620 mm. Seasonal rainfall pattern indicates that, major amount of (387 mm) rainfall was recorded during South-West Monsoon seasons, which contributes about 62% of the annual normal rainfall, followed by North-East Monsoon season (149 mm) constituting 24% and remaining (84 mm) 14% in Pre-Monsoon season (Table-1).

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 H.Hadagali taluk (Table-1). The data in respect of this station from the year 1981 to 2010 is analysed and presented in table-1. Normal annual rainfall in H.Hadagali taluk for the period 1981 to 2010 is 620 mm.

Table 1: Rain gauge and its location in H.Hadagali taluk

Sl. No.	Station	Latitude	Longitude	Altitude
1	H.Hadagali	15°10'	75°55'	527

### 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 H.Hadagali taluk is ranging between nil during February to 136mm during September. The CV percent for pre-monsoon, monsoon and post- monsoon season is 62, 36 & 60 percent respectively. Annual CV at this station works out to be 26 percent.

Table 2. Statistical Analysis of Rainfall Data of H.Hadagali Taluk, for the Period 1981 to 2010

STATION		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
H.HADAGALI	NRM	1	0	8	27	49	85	70	97	136	99	41	9	620
	STD.EV	2	2	30	28	38	70	39	56	96	64	62	18	159
	CV%	327	405	391	105	78	82	57	58	70	64	152	202	26

### Assessment of Drought

Rainfall data of H.Hadagali taluk has been analysed for 105 years using IMD method to assess the drought condition in H.Hadagali taluk. The results of the classification are listed in the Table-3. It is observed that the H.Hadagali taluk has experienced alternating no drought to moderate drought conditions over the years.

Table 3. Classification of drought and its periodicity (IMD, 1971)

% Deviation (Di)		>0	0 to -25	-50 to -75	Probability of drought occurrences
Category		No drought	Mild (Normal)	Moderate	
		Years			
Taluk	H.Hadagalli	48	38	19	Once in 6 years

The details of the drought assessment are discussed as herein under. Out of 105 years of analysis in H.Hadagali taluk, "No Drought" condition in the is experienced in 48 years, "Mild Drought" condition is 38 years and "Moderate Drought" condition experienced in 19 years. Based on occurrence and frequency of past drought events, the probability of occurrence of various intensities of drought at each station has been studied. It has been observed that the frequency of occurrence of drought is **once in 6 years** at H.Hadagali.

### 1.4 Agriculture & Irrigation

Agriculture is the main occupation in Huvinahadagali taluk. Major Kharif crops are maize, bajra, jowar, tur and vegetables. Main crops of Rabi season are maize, horse gram, groundnut, and sunflower (Table-2). Water intensive crops like sugarcane and paddy are grown in 10.6% of total crop area. Maize is grown in 31% and oil seeds in 16% of total crop area of taluk. Bajra & jowar account 13% of total crop area.

Table 2: Cropping pattern in Huvinahadagali 2014-2015 (Ha)

Year	Paddy	Maize	Bajra	Jowar	Pulses	Fruits	Vegetables	Oil seeds	Sugarcane	Cotton	Ragi
	Area under cultivation (ha)										
2014-2015	5828	24294	2584	7468	13528	348	2396	12408	3529	5941	273

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

It is observed that net sown area accounts 41% and area sown more than once is 6% of total geographical area in Huvinahadagali taluk (Table-3). Area not available for cultivation and Fallow land cover 9% & 1% of total geographical area respectively. 73% of net area irrigated is only from bore wells and 4% from lift irrigation (Table-4). The land use pattern is shown in the figure -2.

Table 3: Details of land use in Huvinahadagali 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
H.Hadagali	169027	2877	14922	1622	69607	10817

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

Table 4: Irrigation details in Huvinahadagali taluk (in ha)

Source of Irrigation	No. of structures	Net area irrigated	Gross area irrigated	% of gross area irrigated
Canals	0	0	0	0
Tanks	10	94	101	0.3
Wells	1016	761	1312	4.5
Bore wells	3152	13692	21516	73
Lift Irrigation	707	4869	5934	20
Other Sources	0	549	611	2.1
<b>Total</b>		<b>19965</b>	<b>29474</b>	

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

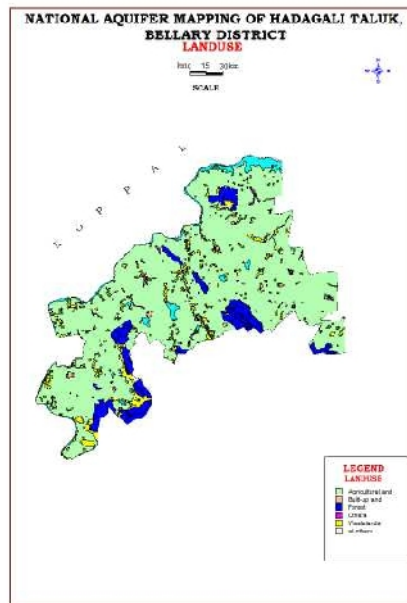


Fig 2: Land use Map

### 1.5 Geomorphology, Physiography & Drainage

H.Hadagali taluk may be classified as Northern Maidan region with monotonous, treeless, and expansive plateau landscape. The hills and ridges are the general features of the northern maidan

region. The north eastern part is occupied by hillocks and plains to south and west. The average elevation of the taluk is 500 m amsl (Fig.-3).

The H.Hadagali taluk falls in Krishna basin. The Tungabhadra perennial river forms major drainage system. Tungabhadra drains from south western part, than flows north east to east west and drains out of the Bellary district. The tributaries of Tungabhadra run south to north from the southern part of H. Hadahgali taluk. These are seasonal rivers flows during monsoon season. A lift irrigation project on River Tungabhadra at Singatalur irrigates the central part of the Huvinahadagali taluk. There are many lift irrigation schemes by the individual farmers all along the Tungabhadra river irrigating about 3 to 4 Km stretch of land from the river and paddy is grown in these areas. Number of minor streams which rises locally and ultimately drains into Tungabhadra. The drainage in the district is dendritic to sub-dendritic in nature (Fig.-4).

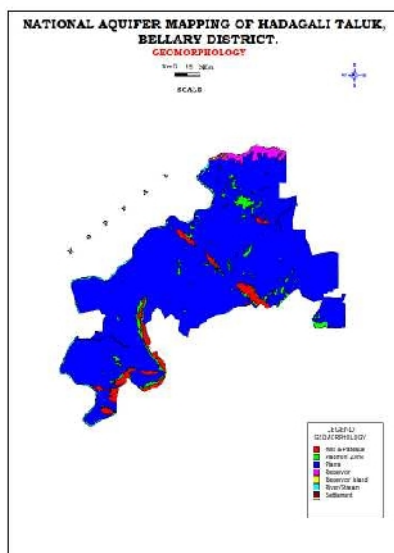


Fig 3: Geomorphology Map

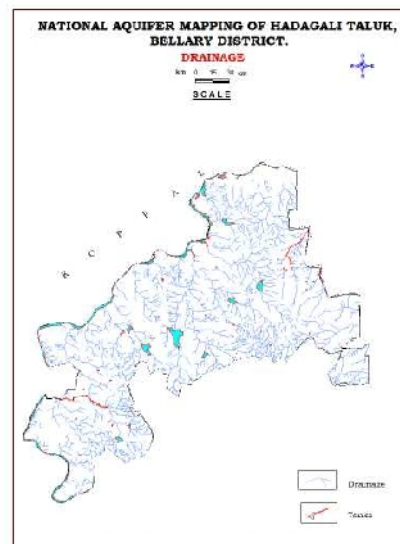


Fig 4: Drainage Map

### 1.6 Soil

The soils of the Huvinahadagali taluk are derived from gneiss, granite rocks and schist. The sandy loam soil mixed with black and grey soil occurs along the stream beds. The red soils are the major type of soil, found mainly at elevated places especially in the north eastern and eastern part of the taluk. The black soil is found in the prolonged submerged areas all along the banks of Tungabhadra River and in the western and central part of the taluk. The distribution of the soil type is shown in the figure -5.



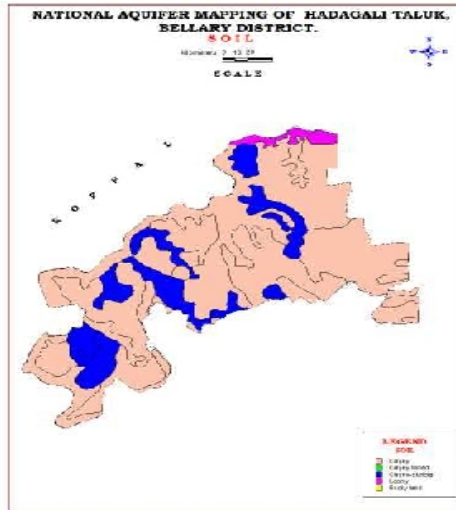


Fig 5: Soil Map

### 1.7 Ground water resource availability and extraction

Table 5. Dynamic Ground Water Resources of Karnataka (as on March 2013)

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
H.Hadagalli	7201	5849	774	6623	1418	441	92	CRITICAL

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

Table 6: Total Ground Water Resources (2013) (Ham)

Taluk	Annual replenishable GW resources	Fresh In-storage GW resources		Total availability of fresh GW resources
		Phreatic	Fractured (Down to 200m)	Dynamic + phreatic in-storage + fractured
Hadagalli	7201	13077	1836	22114

### 1.8 Existing and future water demands (as per GEC-2013)

Net ground water availability for future irrigation development : 441 HAM

Domestic (Industrial sector) demand for next 25 years : 1418 HAM

### 1.9 Water level behavior

#### (a) Depth to water level

#### Aquifer - I

Pre-monsoon: 3.24 – 16.17mbgl (Fig.-6)

Post-monsoon: 1.43 – 14.04 mbgl (Fig.-7)

**Aquifer - II**

Pre-monsoon: 3.95 to 16.65 mbgl (Fig.-8)

Post-monsoon: 3.33 to 21.35 mbgl (Fig.-9)

**(b) Water level fluctuation**

**Aquifer-I (Fig.-10)**

Seasonal Fluctuation: Rise ranges 0.0 – 7.27 m;

Fall ranges 0.2 0.64 m

**Aquifer-II (Fig.-11)**

Seasonal Fluctuation: Rise shows 0.0 to 3.60 m;

Fall ranges 0.97 – 4.70 m

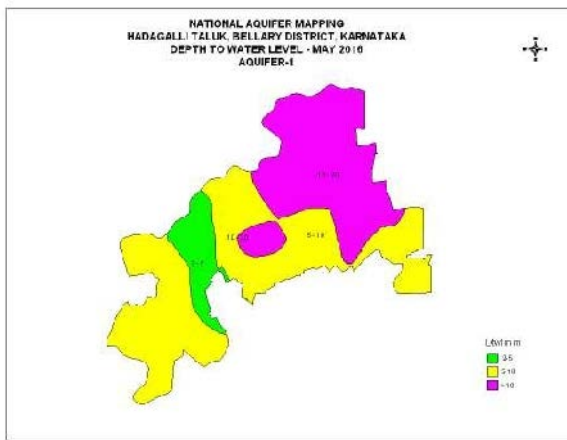


Fig 6: Pre-monsoon Depth to Water Level (Aq-I)

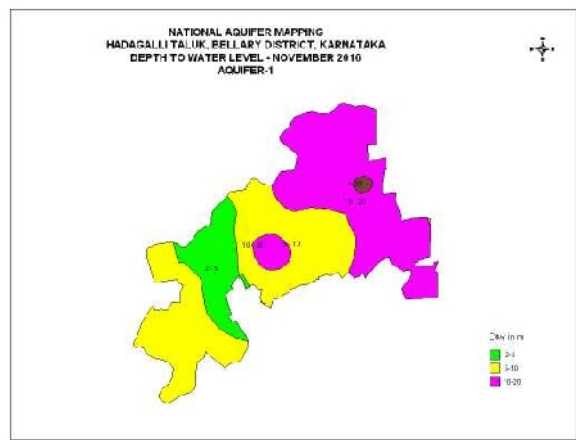


Fig 7: Post-monsoon Depth to Water Level (Aq-I)

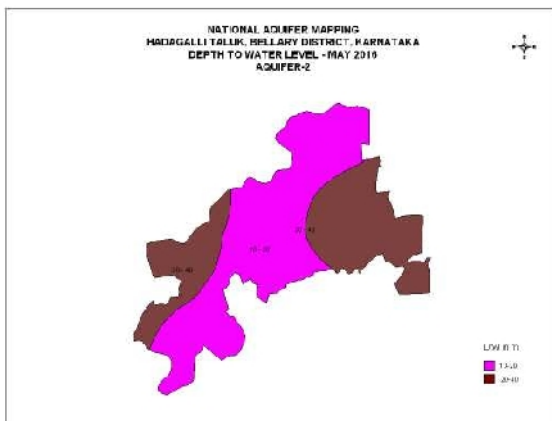


Fig 8: Pre-monsoon Depth to Water Level (Aq-II)

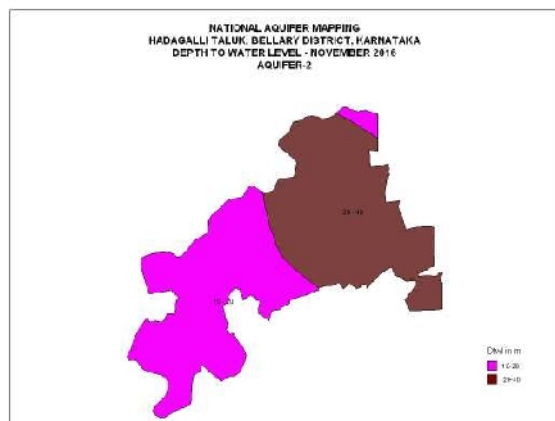


Fig 9: Post-monsoon Depth to Water Level (Aq-II)

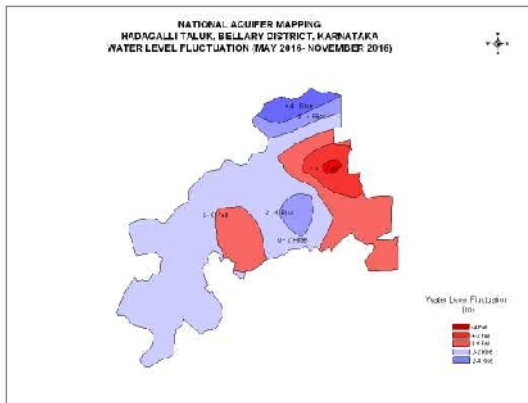


Fig 10: Water Level Fluctuation (Aq-I)

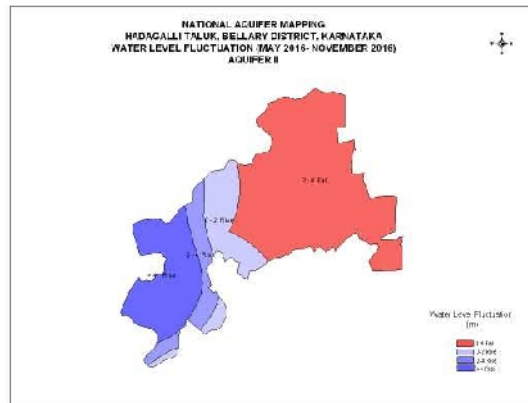


Fig 11: Water Level Fluctuation (Aq-II)

## 2. AQUIFER DISPOSITION

**2.1 Number of aquifers: In Huvinahadagali taluk, there are two aquifer systems;**

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

In **Huvinahadagali taluk**, granitic-gneisses and schist are the main water bearing formations (Fig-12). Ground water occurs within the weathered and fractured granitic-gneisses under water table condition and semi-confined condition. In the taluk bore wells were drilled from a minimum depth of 80 mbgl to a maximum of 200 mbgl (Table-6). Depth of weathered zone (Aquifer-I) ranges from 10.0 mbgl to 30 mbgl. Ground water exploration reveals that aquifer-II fractured formation was encountered between the depth of 22 to 200 mbgl. Yield ranges from 8.16 1134 lpm. The basic characteristics of each aquifer are summarized in Table-7.

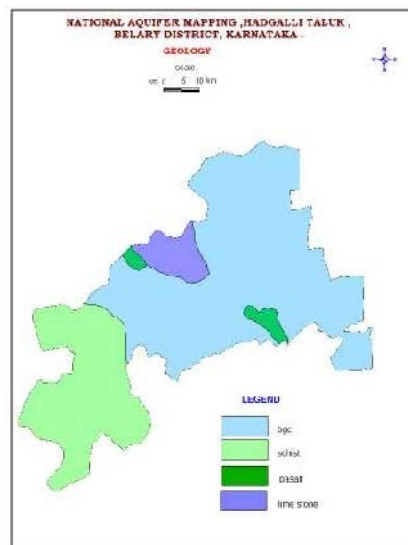


Fig 12: Geology Map

Table 7: Details of Ground water Exploration

Sl. No.	Location with coordinates	Depth drilled (m)	Depth of Well (m)	Thickness of weathering (m)	Casing lowered (m) agl	Fractures Encountered (mbgl)		Aquifer	SWL (mbgl)	Discharge (lpm) (cumulative)	D.D. (m)	T (m <sup>2</sup> /d)
						From	To					
1	Hirebannimatti-EW 14 54 54.3;75 41 44.1	116.16	116.16	23.50	24.00	30.48;57.0 97.0	32.12;61.0 99.0	Schist	6.85	72.60;414.60 900.0	1.88	395
2	Hirebannimatti-OW 14 54 54.6;75 41 44.0	85.60	85.60	23.50	24.00	32.12;66.68 81.96	34.12;68.68 83.96	Schist	7.04	261.60;846.0 1134.0	0.89	418
3	Mailara-EW 14 48 09.4;75 41 33.3	101.0	101.0	27.0	27.60	57.0;93.0	58.0;100.0	Schist	8.60	72.60;1134.0	13.18	6.68
4	Mailara OW 14 48 09.4;75 41 33.3	185.0	185.0	32.10	32.60	59.0;154.0 182.0	61.00;156.0 183.0	Schist	9.32	261.60;414.60 612.0	11.97	14.65
5	Hirehadagali EW 14 55 36.1;75 50 11.3	200.20	200.2	14.50	15.0	38.0	39.0	Schist	19.71	8.16;		
6	Navli EW 15 02 29.0;75 54 04.4	200.20	200.2	26.50	27.0	49.0;78.0	51.0;80.0	Granetic Gneiss	15.97	72.6;261.60	17.49	35.90
7	Navli OW 15 02 28.8;75 54 05.2	183.28	183.28	24.50	25.0	28.0;74.0 85.0	32.0;78.0 89.0	Granetic Gneiss	15.06	26.46;151.89 414.60	6.87	18.99
8	Kavli EW 15 07 21.9;76 00 18.8	200.20	200.2	19.50	20.0	74.0 189.0	76.0;191.0	Granetic Gneiss	33.23	261.60;332.40	7.72	10.46
9	Kavli OW 15 07 20.8;76 00 19.6	200.20	200.2	20.50	21.0	78.0;105.0	82.0;107.0	Granetic Gneiss	32.11	261.60;414.60	6.59	9.12
10	Sovenahalli EW 15 07 05.5;75 56 18.2	200.20	200.2	51.50	52.0	57.0	59.0	Granetic Gneiss	24.81	12.90		
11	Nagathibasapura EW 14 56 23.9;75 56 04.1	200.20	200.2	25.50	26.0	53.0;89.0	55.0;92.0	Schist	19.56	12.90;200.40	13.85	2.52
12	Nagathibasapura OW 14 56 24.7;75 56 03.9	162.0	162.0	21.50	22.0	32.0;91.0	36.0;95.0	Schist	19.19	72.60;504.60	7.28	10.13
13	Mahajanadahalli EW 14 55 08.1;76 03 51.2	200.20	200.20	9.50	10.0	89.0;93.0 147.0	91.0;95.0 149.0	Schist	56.41	Wet;0.84 4.68		
14	Huvinahadagali EW 15 01 00.1;75 55 26.7	200.2	200.2	28.50	29.0	72.0	74.0	Granetic Gneiss	15.34	12.9		
15	Naduvinahalli EW 14 51 00;75 45 45	200.20	200.2	25.0	25.60	84.0;126.0	87.60;131.0	Schist		72.60;149.40		

Table 8: Basic characteristics of each aquifer

<b>Aquifers</b>	<b>Weathered Zone (Aq-I)</b>	<b>Fractured Zone (Aq-II)</b>
Prominent Lithology	Weathered Gneiss / Schist	Fractured / Jointed Gneiss / Schist
Thickness range (mbgl)	20	Fractures upto 200 mbgl
Depth range of occurrence of fractures (mbgl)	-	30 - 200 80% between 50 - 200
Range of yield potential (lps)	Poor yield	1 - 18
Specific Yield	2%	0.2%
T (m <sup>2</sup> /day)	-	2.52 – 418
Quality		
Suitability for Irrigation	Suitable	Suitable
Suitability for Domestic purposes	Suitable	Suitable
Remarks	Over exploited	Ground water potential fractures, 1 to 3 sets likely up to the depth of 200 m bgl.

### 3. GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES

**a. Aquifer wise resource availability and extraction**

**(a) Present Dynamic Ground Water Resource in HAM (2013)**

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
H.Hadagali	7201	5849	774	6623	1418	441	92	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
H.Hadagali	7201	13077	1836	22114

**(c) Comparison of ground water availability and draft scenario**

Taluk	GW availability (ham)	GW draft (ham)	Stage of GW development	GW availability (ham)	GW draft (ham)	Stage of GW development	GW availability (ham)	GW draft (ham)	Stage of GW development
	2009			2011			2013		
H.Hadagali	6078	6381	105%	6778	6272	93%	7201	6623	92%

**b. Chemical quality of ground water and contamination**

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

**Electrical Conductivity:** In general, EC values range from 600 to 4126  $\mu$ /mhos/cm at 25°C. The higher EC value is observed in the irrigated area where paddy is cultivated.

**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 0.1 – 1.8 mg/l. At Hagarapur the fluoride value is beyond the permissible limit of 1.5 mg/l.

**Nitrate:** Nitrate value ranges between 10 to 675 mg/l. The higher EC value is observed in the irrigated area where paddy is cultivated.

In general ground water quality in Huvinahadagali taluk is good for drinking purpose except in some areas where nitrate & 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. GROUND WATER RESOURCE ENHANCEMENT

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

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

Table 9: Quantity of non-committed surface runoff & expected recharge through AR structures

Taluk	Taluk Area (sq km)	Area suitable for artificial recharge (sq km)	Non Committed Monsoon Run off (MCM)	No of Check Dams Feasible	No of Percolation Tanks Feasible	No of Point Recharge Structure Feasible	Total Cost including impact assessment (lakhs)	Total Recharge (MCM)	Expected Rise of water Level (m)	Cost Benefit Rs in Rs/cub m of harvested water
Hadagali	954	898	10.9	68	5	7	263.89	6.202	0.350	4.26

Artificial Recharge Structures Proposed	Huvinahadagali taluk
Non committed monsoon runoff available (MCM)	10.9
Number of Check Dams	68
Number of Percolation Tanks	5
Number of Point Recharge structures	7
Tentative total cost of the project (Rs. in lakhs)	263.89
Excepted recharge (MCM)	6.205
Expected rise in water level (m)	0.35
Cost Benefit Ratio (Rupees/ cu.m. of water harvested)	4.26

## 4.2. Improvement in GW availability due to Recharge, Huvinahadagali taluk

Table 10. Improvement in GW availability due to Recharge, Huvinahadagali 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 interbasin 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		%
H. Hadagali	7201	6623	92	451	5886	13537	49	43

### a. Alternate water sources

Proposed GW Recharge and Assured Supply of Drinking Water Schemes (Inter basin Transfer): Inter-basin transfer from Tunga Basin under Project-2 service canal is proposed in the “Integrated Irrigation Development Schemes” by Shri.G.S.Paramashivaiah, Retd. CE, Irrigation Department and submitted to the Govt. of Karnataka.

Under this project, it is proposed to fill Minor Irrigation tanks with 79 TMC of water to 19 taluks of Bellary, Davanagere, Tumkur and Kolar 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 Huvinahadagali taluk, it is calculated that about 5886 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 7201 to 13537 ham and the expected improvement in stage of development is 49% from 92 % to 43%

## 5. DEMAND SIDE INTERVENTIONS

### a. Advanced irrigation practices

It is observed that bore wells are the major 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 21516 ha of gross irrigated area by bore wells.



Irrigation draft is 5849 ham.

Efficient irrigation techniques will contribute in saving ground water by 1490 ham and thus will improve stage of development by 6% from 43% to 37% (Table-9).

#### b. Change in cropping pattern

Water intensive crops like paddy & sugarcane are grown in 6% of total cropped area by surface water from lift irrigation source in the Huvinahadagali taluk. Hence, change in cropping pattern has not been suggested.

Table 11: Improvement in GW availability due to saving by adopting water use efficiency

District	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 & YETTINAHOLE PROJECT	SAVING DUE TO CHANGED CROPPING PATTERN	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	HAM		%
Hadagalli	13537	6623	49	0	1750	15287	43	6

#### c. Regulation and Control

Huvinahadagali taluk has been categorized as Critical, since the Stage of ground water development has reached 96% (GE March 2013). 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.

#### d. Other interventions proposed

Periodical maintenance of artificial recharge structures should also be incorporated in the Recharge Plan.

Excess nitrate & fluoride concentration is found in ground water samples require remedial measures viz.

- Minimising the use of chemical fertilizer for paddy cultivation to reduce concentration of nitrate in ground water.

- o Roof top rain water harvesting.
- o Micro irrigation.

## 6. SUMMARY

The summary of Management plan of Huvinahadagali taluk is given in Table-12.

Table 12: Summary of Management plan of of Huvinahadagali taluk

Huvinahadagali taluk is over-exploited & present stage of GW Development (2013)	92%
Net Annual Ground Water Availability (HAM)	7201
Existing Gross Ground Water Draft for all uses	6623
Total GW Resources (Dynamic & Static upto the depth of 200 mbgl) (HAM)	22114
Expected additional recharge from monsoon surplus runoff (HAM)	451
Change in Stage of GW development, %	92 to 49
Expected Saving due to adopting WUE measures (Ham)	1750
Change in Stage of GW development, %	49 to 43



Unfilled Hirehadagali village tank during rainy days due to poor monsoon during 2015



Short duration crops like flower is grown around Hirehadagali village due to weak monsoon during 2015

