



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

HIREKERUR

TALUK, HAVERI DISTRICT, KARNATAKA

दक्षिण पश्चिमी क्षेत्र, बैंगलोर

South Western Region, Bengaluru



AQUIFER MANAGEMENT PLAN OF HIREKERUR TALUK, HAVERI DISTRICT, KARNATAKA STATE

CONTENTS

Sl. No.	Title	Page No.
1	Salient Information	1
2	Aquifer Disposition	7
3	Ground Water Resource, Extraction, Contamination and other Issues	9
4	Ground Water Resource Enhancement	11
5	Demand Side Interventions	12

AQUIFER MANAGEMENT PLAN OF HIREKERUR TALUK, HAVERI DISTRICT, KARNATAKA STATE

1. SALIENT INFORMATION

Name of the taluk	: Hirekerur
District	: Haveri
State	: Karnataka
Area	: 807sq.km.
Population	: 2,31,115
Annual Normal Rainfall	: 815 mm

1.1 Aquifer management study area

Aquifer mapping studies were carried out in Hirekerur taluk, Haveri district of Karnataka, covering an area of 807 sq.kms under National Aquifer Mapping Project. Hirekerur taluk of Haveri district is located between north latitude 14°16'31.0" and 14°36'32.0" & east longitude 75°13'23.0" and 75°38'17.0", and is covered in parts of Survey of India Toposheet Nos. 48 N/2, 48 N/6, 48 N/7,48 N/10 and 48 N/11. Hirekerur taluk is bounded by Byadgi and Haveri taluks on north, Shikaripura of Shimoga district and Honnali taluk of Davangere district on south, Ranebennur taluk on east and Soraba taluk of Shimoga district on western side. Location map of Hirekerur taluk of Haveri district is presented in **Fig-1**.

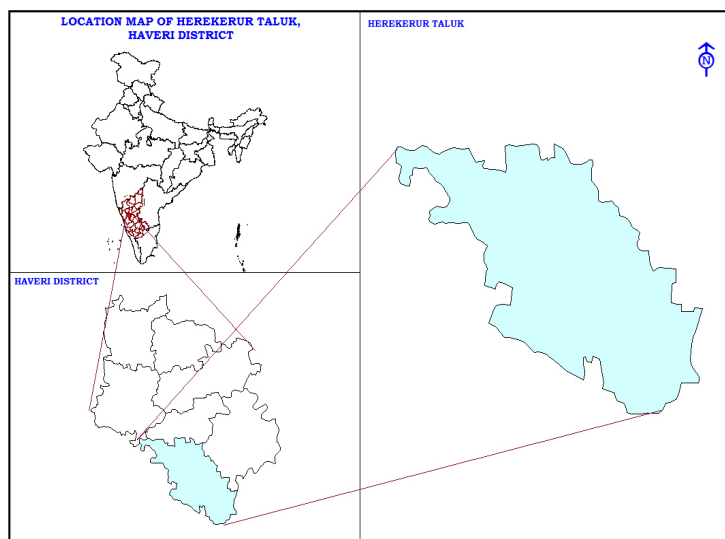


Fig.1: Location Map of Hirekerur taluk, Haveri district

Hirekerur has a population of about 2.31 lakh. Hirekerur taluk is divided into 3 Hoblies and 38 Gram Panchayaths. Hirekerur is the largest town in the taluk, which is the taluk headquarters also. There are 126 inhabited and 3 uninhabited villages in the taluk.

1.2 Population

According to 2011 census, the population in Hirekerur taluk is 2,31,115 of which rural population is 2,11,924 constituting about 92%, and the urban population is 19191, constituting about 8% of the total population, basically due to Hirekerur town. The taluk has an overall population density of 286 persons per sq.km and showed a decadal increase of about 8.78% during 2001-2011.

1.3 Rainfall

Hirekerur taluk enjoys arid climate. Dryness and hot weather prevails in major part of the year. The area falls under Northern Transition 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 Hirekerur 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 Hirekerur taluk for the period 1981 to 2010 is 815 mm.

Table 1: Rain gauge and its location in Hirekerur taluk

Station	Latitude	Longitude	Altitude
Hirekerur	14°26'	75°25'	610

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 Hirekerur taluk is ranging between nil during January to 174mm during July. The CV percent for pre monsoon, monsoon and post monsoon season is 64, 29&61 percent respectively. Annual CV at this station works out to be 28 percent.

Table 2: Statistical Analysis of Rainfall Data of Hirekerur Taluk, Haveri District, Karnataka for the Period 1981 to 2010

STATION		JAN	FEB	MAR	APR	MAY	PRE	JUN	JUL	AUG	SEP	SW	OCT	NOV	DEC	NE	Annual
HIREKERUR	NRM	0	1	12	37	55	105	118	174	152	96	540	112	50	8	170	815
	STDEV	1	4	27	39	39	66	60	87	58	66	157	73	68	15	104	225
	CV%	263	468	237	108	71	64	50	50	38	69	29	65	136	198	61	28

Assessment of Drought

Rainfall data of Hirekerur taluk has been analysed for 104 years using IMD method to assess the drought condition in Hirekerur taluk. The results of the classification are listed in the **Table 3**. It is observed that the Hirekerur 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	-25 to -50	Probability of drought occurrences
Category		No drought	Mild (Normal)	Moderate	
		Years			
Taluk	Hirekerur	18	66	20	Once in 5 years

The details of the drought assessment are discussed as herein under. Out of 104 years of analysis in Hirekerur taluk, no Drought condition in the is experienced in 18 years, mild Drought condition is 66 years and moderate Drought condition experienced in 20 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 5 years at Hirekerur taluk.

1.4 Agriculture and Irrigation

Agriculture is the main occupation in Hirekerur taluk. Maize is major crop, grown in 51.45% of the total crop area followed by cotton, paddy, pulses, vegetables, oilseeds and jowar. They are grown in 26.6%, 5.75%, 4.64%, 3.03%, 3.74%and 2.55% of the total crop area

respectively. Vegetables and Fruits are some other crops grown in the taluk. Water -intensive crops like Paddy and Sugarcane are grown in 3922 ha and 1004 ha respectively in the taluk now **Table 4**.

Table 4.: Cropping pattern in Hirekerur taluk 2014-2015 (Ha)

Year	Paddy	Maize	Ragi	Jowar	Pulses	Fruits	Vegetables	Oilseeds	Sugarcane	Cotton
Area under cultivation (in ha)										
2014-2015	3922	35074	24	1739	3166	492	2066	2551	1004	18133

It is observed that net sown area accounts for about 73.62% of total geographical area, while area sown more than once is 15.09% of total geographical area in the taluk (**Table 5**). Ground water is the main source for irrigation in the taluk, as 10,244 hectares Irrigated area is catered through bore well which is 89% of the total irrigated area. 498 ha and 778 ha of irrigated area are met through tanks and other sources respectively (**Table 6**).

Table 5: Details of land use in Hirekerur 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
Hirekerur	80,694	8,876	7,530	1,880	59,409	12,178

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

Table 6: Irrigation details in Hirekerur taluk (Ha)

Source of Irrigation	Net area irrigated (Ha)	% of area
Canals	0	0
Tanks	498	4.32
Wells	0	0
Bore wells	10,244	88.92
Lift Irrigation	0	0
Other Sources	778	6.75
Total	11,520	

Source: District at a Glance 2014-15, Government of Karnataka

1.5 Geomorphology, Physiography and Drainage

The geomorphology of the taluk is characterized by vast stretches of undulated plains interspersed with sporadic ranges or isolated clusters of low ranges of rocky hills dotting the south central and southern parts (**Fig.2**). The taluk lies in the valley of the Varada and Kumudavati Rivers, with the Tungabhadra River flowing in the east. The Hirekerur taluk, falls under Krishna River basin. Drainage pattern in the taluk is dendritic to sub-dendritic (**Fig. 3**).

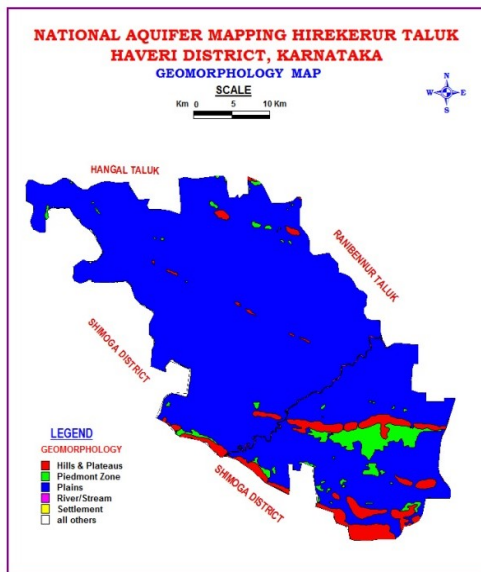


Fig.2: Geomorphology

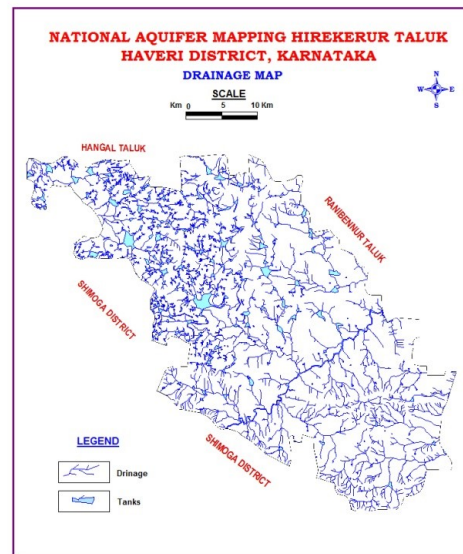


Fig. 3: Drainage

1.6 Soil

The taluk is having predominantly fertile black soil with varying clayey and sandy mixtures. Red loamy soil cover is also seen in some parts of the taluk (**Fig. 4**).

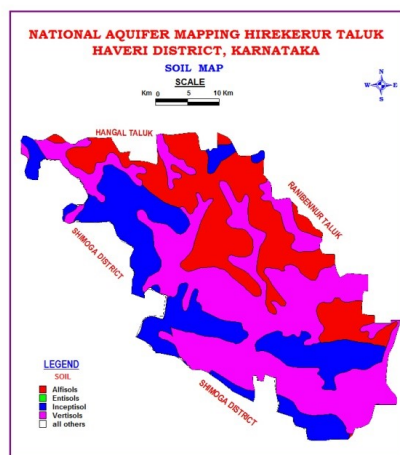


Fig. 4: Soil

1.7 Ground water resource availability and extraction

Aquifer wise total ground water resources up to 200 m depth are given in **Table 7** below.

Table 7: Total GW Resources (2017) (Ham)

Taluk	Annual Replenish able GW resources	Fresh In-storage GW resources		Total availability of fresh GW resources
		Phreatic	Fractured (down to 200m)	
Hirekerur	7420			Dynamic+ Phreatic in-storage+ fractured
		7330	2060	16810

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

Net ground water availability for future irrigation development: 13.46 MCM

Domestic and Industrial sector demand for next 25 years :5.10 MCM

1.9 Water level behaviour

(a) Depth to water level

Aquifer-I **

Pre-monsoon: 3.13-18.10 mbgl (**Fig.5**)

Post-monsoon: 3.24 -18.10 mbgl (**Fig.6**)

**This aquifer-I is totally de-saturated due to over-exploitation and has become totally dry. However, isolated patches in topographical lows are seen yielding for very short durations.

Aquifer-II

Pre-monsoon: 3.60- 27.60 mbgl (**Fig.7**)

Post-monsoon: 4.30- 39.80 mbgl (**Fig.8**)

(b) Water level fluctuation

Aquifer-I

Seasonal Fluctuation: (**Fig.9**) Fall ranges between 0.70 - 12.20m

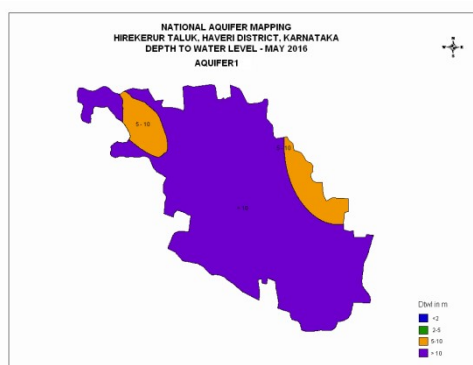


Fig. 5: Pre-monsoon Depth to WL (Aq-I)

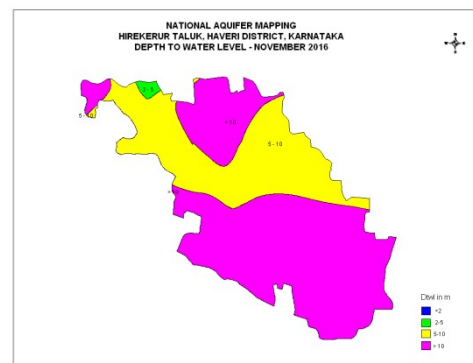


Fig.6: Post-monsoon Depth to WL (Aq-I)

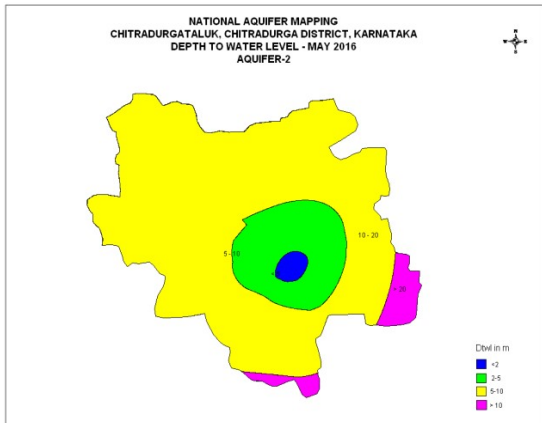


Fig.7: Pre-monsoon Depth to WL (Aq-II)

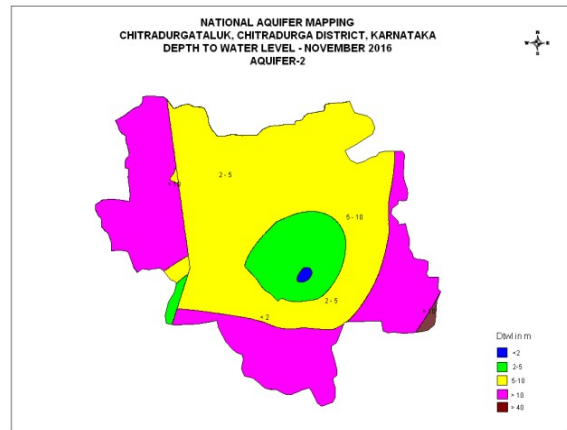


Fig. 8: Post-monsoon Depth to WL (Aq-II)

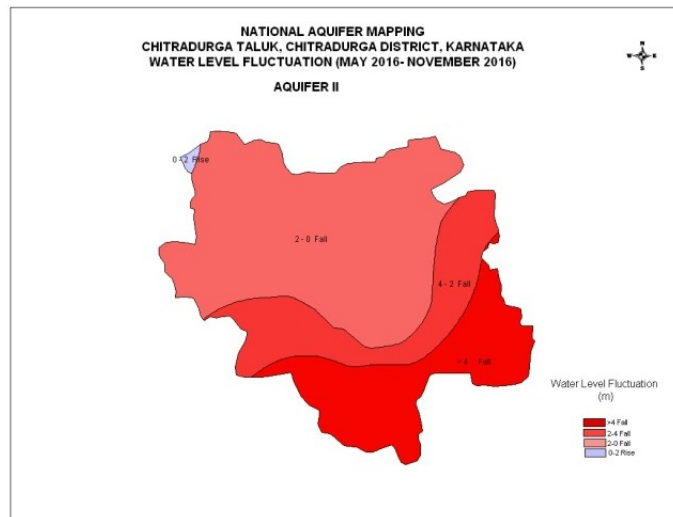


Fig.9: Water Level Fluctuation (Aq-I)

2. AQUIFER DISPOSITION

2.1 Number of aquifers: In Hirekerur taluk, there are mainly two types of aquifer Systems;

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

In Hirekerur taluk, fractured granitic-gneiss, and hornblende-schist are the main water bearing formations (**Fig. 10**). Ground water occurs within the jointed and fractured granitic-gneisses and schists under semi-confined to confined conditions. In Hirekerur taluk, generally the bore wells are drilled up to a maximum of 200mbgl (**Table 8**). Depth of weathered zone

(Aquifer-I) ranges from 10.6 - 23.20 mbgl. This aquifer-I or Phreatic Aquifer is totally de-saturated due to over-exploitation and has become totally dry. However, isolated patches in topographical lows are seen yielding seasonally, that too for very short durations. Yield ranges from 1.93 to 5.08 lps. Transmissivity ranges from 3 to 107 m²/day. The basic characteristics of each aquifer are summarized in **Table 9**.

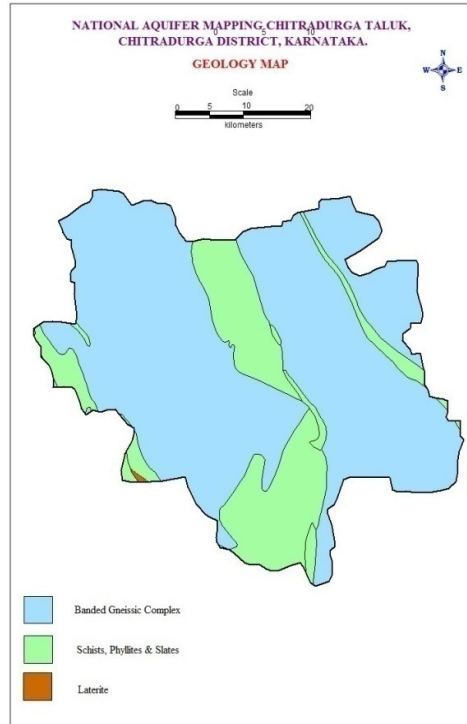


Fig.10 : Geology Map

Table 8: Details of Ground water Exploration

Sl. No.	Location	Latitude	Longitude	Depth Drilled (m bgl)	Casing Depth (m bgl)	Lithology	SWL (mbgl)	Q (lps)	DD (m)	T (m ² /day)
1.	Koda EW	14°31'21"	75°27'34"	151.3	22.25	Graywacke	13.73	2.93	10.46	24
2.	Koda OW	14°31'21"	75°27'34"	90.3	23.20	Graywacke	12.14	1.93	15.09	3
3.	Hirekerur EW	14°27'44"	75°24'34"	155.35	10.60	Graywacke	14.62	5.08	2.04	100
4.	Hirekerur OW	14°27'44"	75°24'34"	90	13.85	Graywacke	16.21	2.03	0.58	107

Table 9: Basic characteristics of each aquifer

Aquifers	Weathered Zone (Aq.-I)	Fractured Zone (Aq.-II)
Prominent Lithology	Weathered Gneiss/ Schist	Jointed /Fractured Granite Gneiss and Schist
Thickness range (mbgl)	10.6 - 23.20	Fractures down to 200mbgl depth
Depth range of occurrence of fractures (mbgl)	-	-
Range of yield potential (lps)	De-saturated, almost Dry	1.93 – 5.08
Specific Yield	-	0.2%
T (m ² /day)	-	3 - 107
Quality, Suitability for Irrigation	-	Suitable
Suitability for Domestic	-	Suitable
Remarks	Over Exploited	Ground water potential fractures, 1to3 sets likely up to the depth of 200mbgl.

3. GROUNDWATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES

a. Aquifer wise resource availability and extraction

(a) Present Dynamic Ground Water Resource (2017)

Taluk	Net Annual Ground Water Availability (Ham)	Existing Gross Ground Water Draft for Irrigation (Ham)	Existing Gross Ground Water Draft For Domestic and Industrial Water Supply (Ham)	Existing Gross Ground Water Draft for all Uses (Ham)	Allocation For Domestic and Industrial Use for Next 25 Years (Ham)	Net Ground Water Availability for Future Irrigation Development (Ham)	Existing Stage Of Ground Water Development (%)	Category
Hirekerur	7420	6011	463	6474	510	1346	87	Semi Critical

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

Taluk	Annual Replenish able GW Resources	Fresh In-storage GW Resources		Total availability of GW Resources
		Phreatic	Fractured	Dynamic + phreatic in-storage+ fractured in-storage
Hirekerur	7420	7330	2060	16810

(c) Comparison of Ground Water Availability and Draft Scenario in Hirekerur taluk

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
	2011			2013			2017		
Hirekerur	7874	6176	78	7723	6562	85	7420	6474	87

b. Chemical Quality of Ground Water and Contamination

In general, ground water quality in Hirekerur taluk is good for drinking purpose as per "Indian Standard Drinking Water Specification 2009".

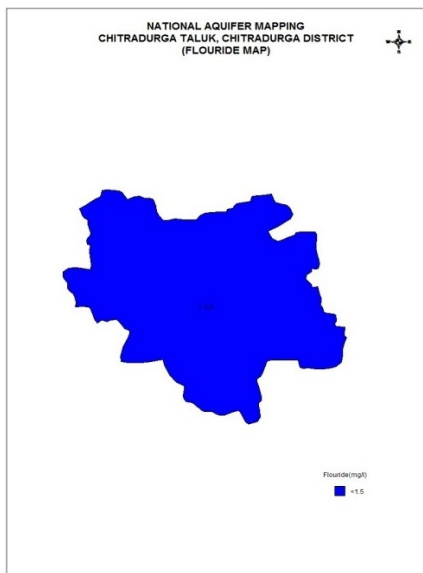


Fig.11: Fluoride Map

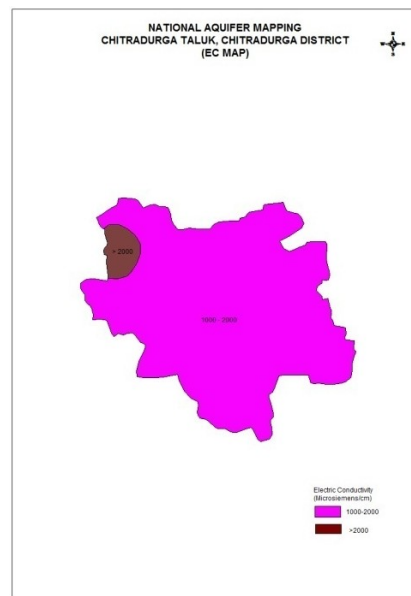


Fig. 12: Electrical Conductivity Map

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 11**). The choice of recharge structures should be site specific and such structures needs o be constructed in areas already identified as feasible for artificial recharge.

Table 11: Quantity of non-committed surface runoff and expected recharge through AR structures

Artificial Recharge Structures Proposed	Hirekerur Taluk
Non committed monsoon runoff available (Ham)	12118
Number of Check Dams	507
Number of Percolation Tanks	101
Number of Point Recharge structures	0
Tentative total cost of the project (R .in lakhs)	7093
Excepted recharge (MCM)	132

4.2 Improvement in GW availability due to Recharge, Hirekerur taluk

Taluk	Net annual ground water availability	Existing gross ground water draft for all uses	Existing stage of groundwater development	Expected recharge from proposed artificial recharge structures	Additional potential from proposed irrigation development schemes through inter-basin transfer	Cumulative annual groundwater availability	Expected improvement in stage of groundwater development after the implementation of the project	Expected improvement in overall stage of groundwater development
Hirekerur	HAM	HAM	%	HAM	HAM	HAM	%	%
	7420	6474	87	13200	-	20620	56	31

After implementation of Artificial Recharge structures for GW recharge, the annual ground water availability will increase from 7420 to 20620 ham and the expected improvement in stage of development is 56% i.e., from 87% to 31%.

5. DEMAND SIDE INTERVENTIONS

5.1 Advanced irrigation practices

It is observed that presently, ground water through bore wells is the lone source for irrigation in the taluk. Water use efficiency measures are need of the hour. Adopting these measures will contribute in ground water resource enhancement in the long run.

Efficient irrigation practices like Drip irrigation and sprinkler need to be adopted by the farmers in the existing 18,053 ha of gross irrigated area. Presently, draft through irrigation is 6799 ham. Efficient irrigation techniques will contribute in saving ground water by 1868 ham and thus will improve stage of development by 25%, bringing stage of GW development from 109% to 84% .

5.2 Change in cropping pattern

In Hirekerur taluk, Water intensive crops, like Paddy or Sugarcane are being grown in 3922 and 1004 ha respectively. Hence, change in cropping pattern is suggested in order to avoid the taluk to be categorised as ‘Over Exploited’.

5.3 Additional area of irrigation

After adopting various water use efficiency techniques and recharge measures and its resultant savings, the stage of development is expected to be 31% in the taluk, which will bring the taluk to the **Safe** category.

5.4 Regulations and Control

Hirekerur taluk has been categorized as **Semi Critical**, since the Stage of ground water development has reached 87% (GEMarch2017). Hence, stringent action has to be taken up through Karnataka Ground Water Authority to control ground water exploitation in the taluk.

Ground water recharge component needs to be made mandatory in the taluk to save the situation from deteriorating further.

5.5 Other interventions proposed:

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

5.6 Summary

The summary of Management plan of Hirekerur taluk is given in **Table 13**.

Table 13: Summary of Management plan of Hirekerur taluk

Hirekerur taluk is Semi critical and present stage of GW Development (2017)	87%
Net Annual Ground Water Availability (MCM)	74.20
Existing Gross Ground Water Draft for all uses (MCM)	64.74
Total GW Resources (Dynamic & Static up to the depth of 200mbgl) (MCM)	168.10
Expected additional recharge from monsoon surplus runoff (MCM)	132
Change in Stage of GW development, %	87 to 31