



## 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**

**MUNDARGI TALUK,**

**GADAG DISTRICT, KARNATAKA**

दक्षिण पश्चिमी क्षेत्र, बैंगलोर

South Western Region, Bengaluru



## **AQUIFER MANAGEMENT PLAN OF MUNDARGI TALUK, GADAG DISTRICT, KARNATAKA STATE**

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# **AQUIFER MANAGEMENT PLAN OF MUNDARGI TALUK, GADAG DISTRICT, KARNATAKA STATE**

## **1.0 SALIENT INFORMATION**

Name of the taluk: **Mundargi**

District: Gadag; State: Karnataka

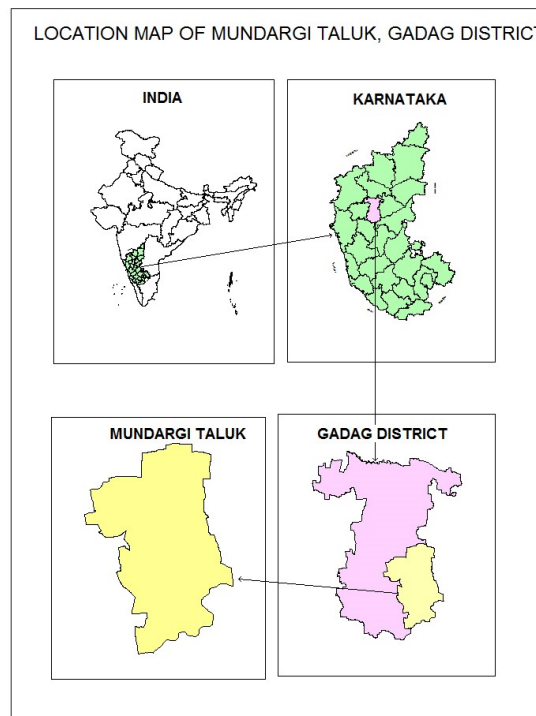
Area: 884 sq.km.

Population: 131897

Annual Normal Rainfall: 554 mm

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

Aquifer mapping studies have been carried out in Mundargi taluk, Gadag district of Karnataka state covering an area of 1543 sq.kms under National Aquifer Mapping Project. Mundargi taluk of Gadag district is located between North Latitudes  $14^{\circ} 59' 55.32''$  and  $15^{\circ}25'31.8''$  and East Longitudes between  $75^{\circ} 38' 25.08''$  and  $75^{\circ} 57' 5.05''$  and is falling in Survey of India Topsheets Nos 48M/11, 48M/12, 48M/15, and 48M/16. The study area is bounded on the North by Gadag taluk of Gadag district, west by Shirahatti taluk of Gadag district, on the east by Koppal district and on the south by Ballary district. Mundargi is the taluk head quarter. There are 58 villages in the taluk. Location map of Mundargi taluk of Gadag district is presented in **Fig-1**.



**Fig-1: Location map of Mundargi taluk**

## 1.2 Population

According to 2011 census, the population in Mundargi taluk is 131897. Out of which 66856 are male while 65041 are female. The average sex ratio in the taluk is 973. The Mundargi taluk has an overall population density of 149 persons per sq.km. The decadal variation in the population from 2001-2011 is 22.37% in Mundargi taluk.

## 1.3 Rainfall

Mundargi taluk has semi-arid climate. The area falls under Northern transitional agro-climatic zone of Karnataka state. The normal annual rainfall in Mundargi taluk for the period 1951 to 2000 is 554 mm. Seasonal rainfall pattern indicates that major amount of rainfall was recorded during South-West Monsoon seasons followed by North-East Monsoon season and remaining part is in Pre-Monsoon season. The actual annual rainfall in Mundargi taluk for the period from 2006 to 2017 is given in **Table-1**.

**Table-1: The actual annual rainfall in Mundargi taluk for the period from 2006 to 2017**

Normal rainfall	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
554	348.7	951.7	553.0	750.4	680.9	416.7	359.9	473.0	572.9	303.4	228.4	531.5

## 1.4 Agriculture & Irrigation

Agriculture is the main occupation in Mundargi taluk. Major Kharif crops are Maize, Bajra, Jowar, Pulses, Paddy, Oilseeds, Cotton and Vegetables. Main crops of Rabi season are Maize, Bajra, Jowar and Sunflower (**Table-2**). Water intensive crops like sugarcane and paddy are grown in 9% of total crop area. Cereals are grown in 47%, Pulses are grown in 19% of total crop area and oil seeds in 17% of total crop area of the taluk. Fruits and vegetables account for 7% of total crop area.

**Table-2: Cropping pattern in Mundargi taluk 2016-2017 (Ha)**

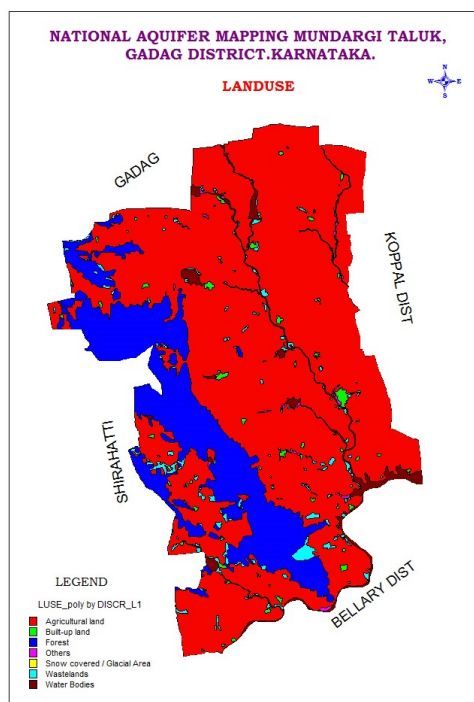
Paddy	Jowar	Bajra	Maize	Wheat	Minor millets	Green gram	Tea	H.Gram	Cowpea	Bengal gram	Fruits	Vegetables	Oil seeds	Sugarcane	Cotton
2292	13562	571	13319	1789	1933	1872	953	232	282	9868	594	4407	11818	4019	4031

It is observed that net sown area account 60% and the area sown more than once is 19% of the total geographical area in Mundargi taluk. Area not available for cultivation and Fallow land cover 5% & 14% of the total geographical area respectively. Forest area comprises 20% of the total geographical area. The details of land use in Mundargi taluk is presented in **Table-3** and in **Fig. 2**.

**Table 3: Details of land use in Mundargi taluk 2016-2017 (Ha)**

Total Geographical Area	Area under Forest	Area not available for cultivation	Other uncultivable land	Fallow land	Net sown area	Area sown more than once	Total area sown
88398	17646	4411	445	12458	54438	16404	69842

Source: District at a glance 2017-18, Govt. of Karnataka



**Fig- 2: Land use pattern**

In Mundargi taluk there is no canal irrigation. Major part of the irrigation in the taluk is from 3328 number of bore wells. There are 6 lift irrigation schemes irrigating 708 hectare of land. About 67% of net area irrigated is only from bore wells and 24% is from other sources, 6% of net area irrigated is through tanks and lift irrigation contributes only 3% of net irrigated area. The irrigation details in Mundargi taluk is presented in **Table 4**.

**Table 4: Irrigation details in Mundargi taluk (in ha)**

Source of Irrigation	No. of structures	Net area irrigated (Ha.)	% of area
Canals		nil	
Tanks	9	1378	6
Wells		75	0.33
Bore wells	3328	15166 (16188 - Gross)	67
Lift Irrigation	6	708	3
Other Sources		5465	24
<b>Total</b>		<b>22792</b>	

Source: District at a glance 2017-18, Govt. of Karnataka

## 1.5 Geomorphology, Physiography & Drainage

Eastern part of Mundargi taluk is a plain region formed of gneissic formation. In the western part of the district North West - south east trending hill range popularly known as “Kappada Gudda” formed of schist belt of Dharwar super group. The elevation in the plain area varies from 500 m amsl in the South eastern part (Hesrur) to 620 m amsl in the northern part (Halligudi) of the taluk. The taluk has it's the regional slope which is towards south east. The elevation of the hill range Kappada gudda varies from 600mamsl to 979mamsl. The differential altitude is significant because it is likely to cause irregular ground water flow patterns on the micro level scale (**Fig.3**). The topography is dominantly controlled by geological structures. The entire Mundargi taluk falls in Tungabhadra river sub basin of Krishna river basin. Hirehalla nala along with its tributaries drains the major part of the taluk to Tungabhadra River. The hire halla flows in northwest south east direction. The Drainage pattern is dendritic to sub-dendritic (**Fig. 4**).

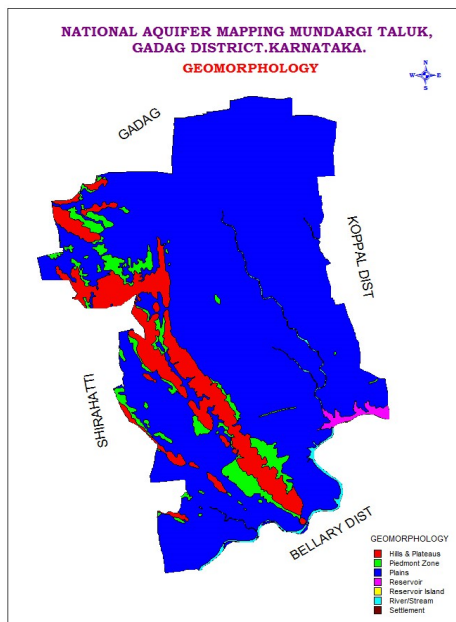


Fig. 3: Geomorphology map

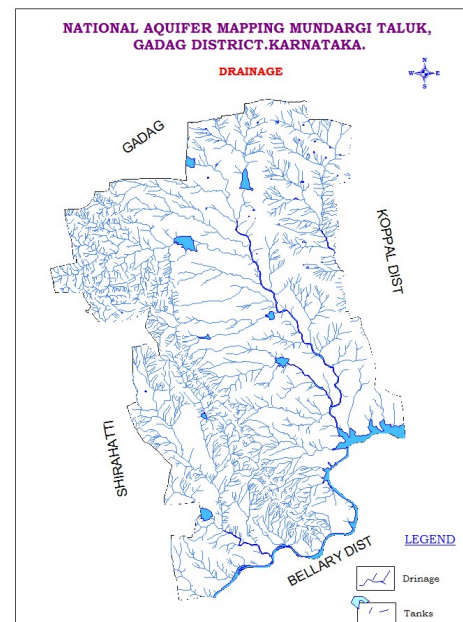
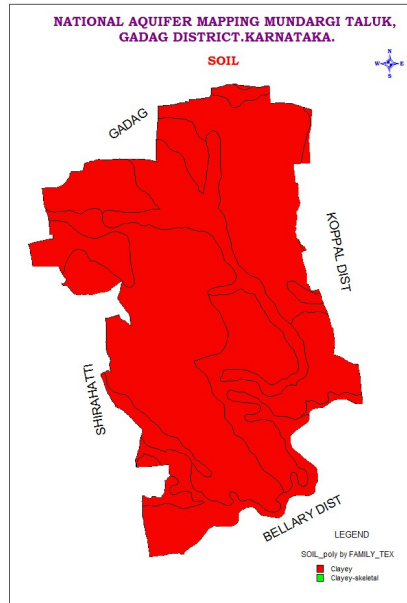


Fig.4: Drainage map

## 1.6 Soil

The soils of Mundargi taluk can broadly be classified into Black cotton soils. These soils clayey in nature and vary in depth and texture depending on the parent rock type, physiographic settings and climatic conditions. Black cotton soils are mature soils with high humus and are mildly alkaline in nature. Black cotton soils are the product of highly weathered and decomposed gneissic rocks (**Fig. 4**).



**Fig- 5: Soil map**

### 1.7 Ground water resource availability and extraction

Aquifer wise total ground water resources up to 200 m depth are given in **Table-5**.

**Table 5: Total Ground Water Resources (2017) (Ham)**

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
9321	10079	3487	13566

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

- Net ground water availability for future irrigation development : 9321 HAM
- Domestic (Industrial sector) demand for next 25 years : 394 HAM

### 1.9 Water level behavior

#### (a) Depth to water level

##### Aquifer - I

- Pre-monsoon: 5.65 – 23.13 mbgl (**Fig.-6**)
- Post-monsoon: 3.62 – 11.20 mbgl (**Fig.-7**)

##### Aquifer - II

- Pre-monsoon: (**Fig.-8**)
- Post-monsoon: (**Fig.-9**)

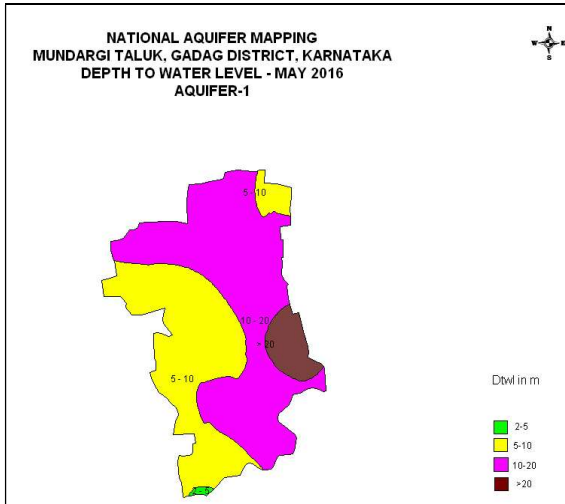
#### (b) Water level fluctuation

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

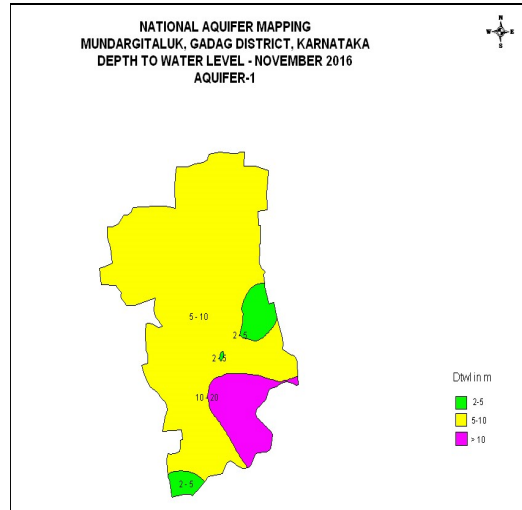
- Seasonal Fluctuation: Rise ranges 0.08 – 19.51 m;  
Fall ranges- nil

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

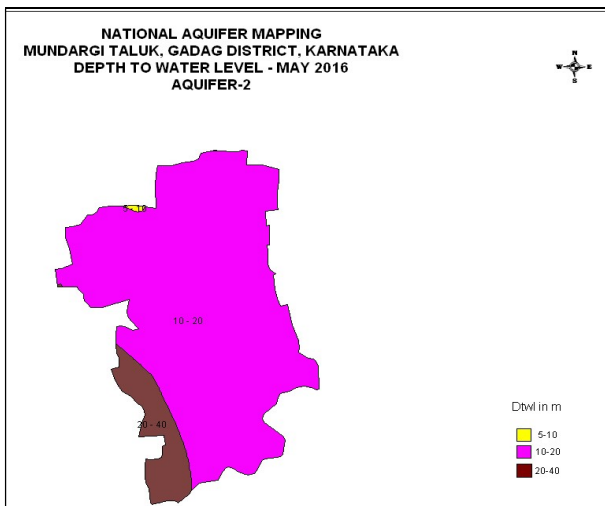
- Seasonal Fluctuation: Rise ranges 0.08 – 19.51 m;  
Fall ranges- nil



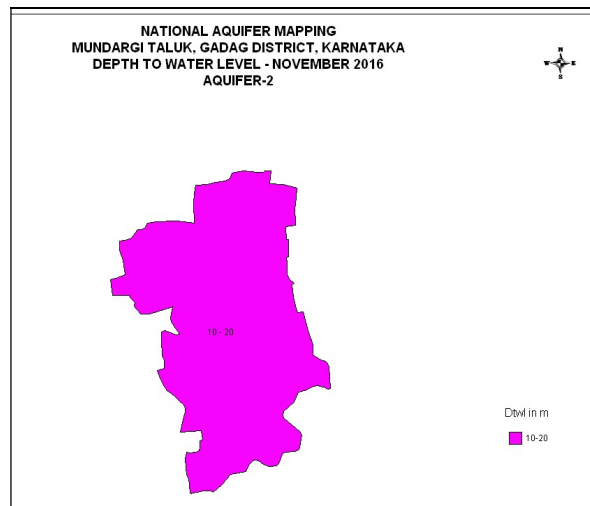
**Fig-6: Pre-monsoon DTW (Aquifer I)**



**Fig-7: Post-monsoon DTW (Aquifer-I)**

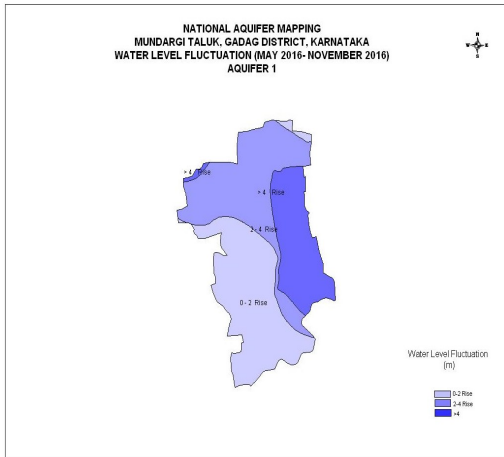


**Fig-8: Pre monsoon DTW (Aquifer II)**

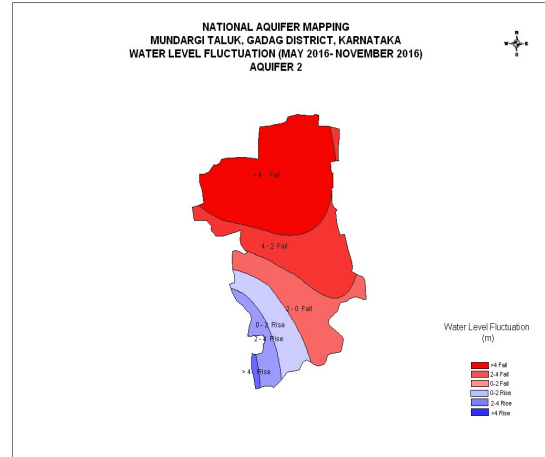


**Fig-9: Post monsoon DTW (Aquifer II)**





**Fig-10: Water Level Fluctuation (Aq-I)**



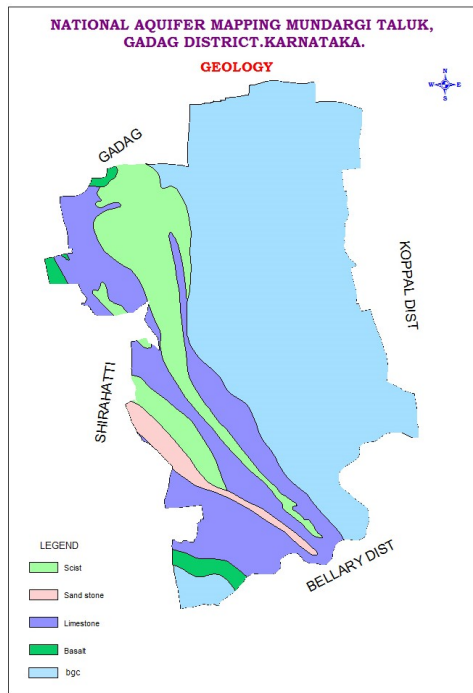
**Fig-11: Water Level Fluctuation (Aq-II)**

## 2 AQUIFER DISPOSITION

**2.1 Number of aquifers:** In Mundargi taluk there are mainly two types of aquifer systems

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

In Mundargi taluk, Gneiss is the main water bearing formations (**Fig-12**). Ground water occurs within the weathered and fractured Gneiss under water table condition and semi-confined condition. In Mundargi taluk exploratory bore wells were drilled from a minimum depth of 90mbgl to a maximum of 108 mbgl. Depth of the weathered zone ranges from 5 mbgl to 18 mbgl. Ground water exploration reveals that aquifer-II fractured formation was encountered between the depth of 10 to 90 mbgl. Yield ranges from negligible to 5 lps. The basic characteristics of each aquifer are summarized in **Table-6**.



**Fig-12: Geology map**

**Table-6: Details of Ground Water Exploration**

Sl.No	Location	Depth drilled (m)	Depth of Well (m)	Thickness of weathering (m)	Fractures Encountered (mbgl)		Aquifer	SWL mbgl	Discharge (lpm)	D.D. (m)
					From	To				
1	Bagewadi	108.45	108.45	18.20	18.0	18.50	Meta greywacke	9.41	5.25	6.19
					74.95	75.10				
					93.0	93.50				
2	Bagewadi	108.45	108.45	18.20	15.95	18.50	Meta greywacke	9.41	6.17	4.81
					30.15	30.20				
					50.05	50.05				
					85.0	85.10				
3	Doni	92.50	92.50	4.00	11.00	12.00	Argillites	10.10	4.23	10.3
					12.15	13.20				
					92.50					
4	Doni	92.50	92.50	6.05						

### 3.0 Ground water resource, extraction, contamination and other issues

#### 3.1 Aquifer wise resource availability and extraction

The details of ground water resource is given in **Table 7a, 7b and 7c**

**Table- 7a: Present Dynamic Ground Water Resource (2017) (in ham)**

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
Mundargi	9321	7238	365	7603	394	1690	82	Semicritical

**Table- 7b: Present total Ground Water Resource (2017) (in ham)**

Annual replenishable GW resources	Fresh In-storage GW resources		Total availability of fresh GW resources
9321	Phreatic	Fractured (Down to 200m)	Dynamic + phreatic in-storage + fractured
	10079	3487	13566

**Table- 7c: Comparison of ground water availability and draft scenario (in ham)**

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		
MUNDARGI	4953	4219	85	5197	4242	82	5211	4348	83	9321	7603	82

### 3.2 Chemical quality of ground water and contamination

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

**Electrical conductivity:** In general, EC values range from 783 to 3900  $\mu$ /mhos/cm at 25°C in the aquifer-I.

**Fluoride:** Fluoride concentration in ground water ranges from 1.07 to 2.56 mg/l in the aquifer-I

**Nitrate:** Nitrate value ranges from 4.2 and 85.1 mg/l in the Aquifer –I

**Table-8. Quality of ground water (Aquifer-I) in Mundargi taluk**

Sl. No	LOCATION	PH	EC	TH	Ca	Mg	Na	K	CO <sub>3</sub>	HCO <sub>3</sub>	CL	SO <sub>4</sub>	NO <sub>3</sub>	F
1	Basavapur	9.35	3900	450	64	71	596	16	60	610	355	634	85.1	2.50
2	Kalkeri	9.81	3140	170	36	19	612	8	87	781	355	186	122	2.56
3	Mundargi	8.57	2200	320	32	58	365	4	30	311	369	348	140	1.16
4	Mundargi 1	8.11	783	230	32	36	110	2	0	177	158	112	4.2	1.07

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

To enhance the ground water resources the dry **phreatic aquifer (Aq-I)** in the taluk to be recharged through the construction of artificial recharge structures like check dams, percolation tanks & point recharge structures (**Table-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. Improvement in Ground water availability is given in **Table-10**.

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

Artificial Recharge Structures Proposed	Mundargi taluk
Non committed monsoon runoff available (MCM)	6.8
Number of Check Dams	42
Number of Percolation Tanks	3
Number of Point Recharge structures	5
Tentative total cost of the project (Rs. in lakhs)	156
Excepted recharge (MCM)	4
Expected rise in water level (m)	0.33
Cost Benefit Ratio (Rupees/ cu.m. of water harvested)	0.39

**Table-10: Improvement in GW availability due to Recharge in Mundargi 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	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	%	%
Mundargi	9321	7603	82	400	78	4

### 3.4 Regulation and Control

- Mundargi taluk has been categorized as **Semicritical**, since the Stage of ground water development is 82% (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.

### 3.5 Other interventions proposed

- Periodical maintenance of artificial recharge structures should also be incorporated in the Recharge Plan.
- Any excess nitrate & fluoride concentration is found in ground water samples require remedial measures like:-
  - Dilution of nitrate rich ground water through artificial recharge & water conservation.
  - Roof top rainwater harvesting.

## 4 Summary

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

**Table-11: Summary of Management plan of Mundargi taluk**

Mundargi taluk is semi critical & present stage of GW Development (2017)	82 %
Net Annual Ground Water Availability (MCM)	93.21
Existing Gross Ground Water Draft for all uses	76.03
Expected additional recharge from monsoon surplus runoff (MCM)	4
Change in Stage of GW development, %	78
Excess nitrate & fluoride concentration	<ul style="list-style-type: none"> <li>• Dilution of nitrate rich ground water through artificial recharge &amp; water conservation.</li> <li>• Roof top rainwater harvesting.</li> </ul>