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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

PUTTUR TALUK, DAKSHIN KANNADA DISTRICT, KARNATAKA

दक्षिण पश्चिमी क्षेत्र, बैंगलोर

South Western Region, Bengaluru

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Ministry of Jal Shakti
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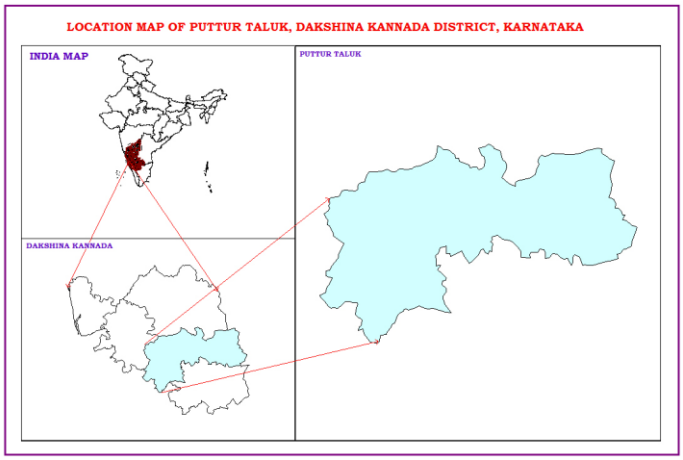
Central Ground Water Board

AQUIFER MANAGEMENT PLAN OF PUTTUR TALUK, DAKSHIN KANNADA DISTRICT, KARNATAKA STATE



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AQUIFER MANAGEMENT PLAN OF PUTTUR TALUK, DAKSHIN KANNADA DISTRICT, KARNATAKA STATE

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AQUIFER MANAGEMENT PLAN OF PUTTUR TALUK, DAKSHIN KANNADA DISTRICT, KARNATAKA STATE

1.0 SALIENT INFORMATION

Name of the Taluk: **Puttur**

District: Dakshin Kannada

State: Karnataka

Area: 1030 sq.km

Population: 2, 87,851

Annual Normal Rainfall: 3674 mm

1.1 Aquifer Management Study area

Aquifer mapping studies were carried out in PutturTaluk, Dakshin Kannada district of Karnataka, covering an area of **1030sq.kms** under National Aquifer Mapping Project. Puttur Taluk of Dakshin Kannada district is located between North latitude 12°34'and 12°53'andEast longitude 75°09' and 75°45'and is covered in parts of Survey of India Toposheet Nos.48P/1, 48P/2, 48P/5, 48P/6, 48P/9 and 48P/10.Puttur Taluk is bounded by Belthangady Taluk on North, Sakleshpur Taluk of Hassan district on East, Bantwal Taluk on West and North-West, Sullya Taluk on South and parts of Kerala on South-West. Location map of Puttur Taluk of Dakshin Kannada district is presented in **Figure 1.1**

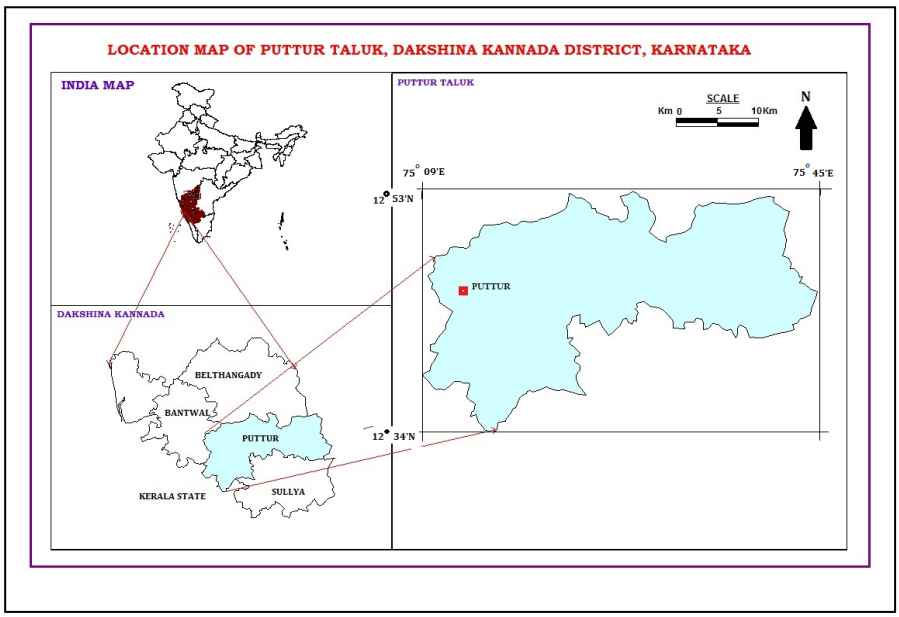

Figure 1.1: Location Map of Puttur Taluk, Dakshin Kannada district, Karnataka

Taluk administration of Puttur is divided into 3 Hoblies and 41 Gram Panchayats. There are 66 inhabited and no uninhabited villages in the Taluk.

1.2 Population

According to 2011 census, the population in Puttur Taluk is 2,87,851 of which rural population is 2,26,977 constituting about 78.85%, and the urban population is 60,874 constituting only about 21.15% of the total population. The Taluk has an overall population density of 279 persons per sq.km.

1.3 Rainfall

Puttur Taluk experiences semi-arid climate. The area falls under Coastal agro-climatic zone of Karnataka state and is categorized as drought prone in rabi season

The climate of the study area is quite agreeable and free from extremes. The year is usually divided into four seasons namely 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 Puttur Taluk (**Table 1.1**). The data in respect of this station from the year 1981 to 2010 is analyzed and presented in **Table 1.2**. 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 rainfall. 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 PutturTaluk for the period 1981 to 2010 is 3674 mm.

Table 1.1: Rain Gauge and its location in PutturTaluk

Station	Latitude	Longitude	Altitude (m)
Puttur	12.70	75.20	3920.8

Statistical analysis

The mean monthly rainfall at Puttur Taluk is ranging between 2 mm during February to 1069 mm during July. The CV percent for premonsoon, monsoon and post monsoon season is 66, 19 & 34 % respectively. Annual CV at this station works out to be 15 %.

Table 1.2: Statistical Analysis of Rainfall Data of PutturTaluk, Dakshin Kannada District, Karnataka for the Period 1981 to 2010

STATION		JAN	FEB	MAR	APR	MAY	PRE MONSOON	JUN	JUL	AUG	SEP	SOUTH WEST MONSOON	OCT	NOV	DEC	NORTH EAST MONSOON	ANNUAL RAINFALL
Puttur	Normal Rainfall (mm)	5	2	16	32	167	222	920	1069	769	292	3050	283	104	14	401	3674
	STDEV	15	8	47	38	142	146	274	318	255	176	585	120	89	27	137	560
	CV%	303	432	291	117	85	66	30	30	33	60	19	43	86	193	34	15

Assessment of Drought

Rainfall data of Puttur Taluk has been analysed for 46 years using IMD method to assess the drought condition in Puttur Taluk. The results of the classification are listed in the **Table 1.3**. It is observed that the Puttur Taluk has experienced alternating no drought to acute drought conditions over the years.

Table 1.3: Classification of drought and its periodicity (IMD, 1971)

% Deviation (Di)		>0	0 to -25	-25 to -50	50 to 75	<-75	Probability of drought occurrences
Category		No drought	Mild (Normal)	Moderate	Severe	Acute	
		Years					
Taluk	Puttur	4	41	1	0	0	Once in 46 years

The details of the drought assessment are discussed as herein under. Out of 46 years of analysis in Puttur Taluk, “No Drought” condition is experienced in 4 years, “Mild Drought” condition is experienced in 41 years and “Moderate Drought” condition experienced in 1 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 46 years** at Puttur Taluk.

1.4 Agriculture and Irrigation

Agriculture is the main occupation in Puttur Taluk. Horticulture crops like Areca nut, Cashew nut, Rubber, Coconut, Pepper, Banana, Jackfruit, Cocoa, Mango are the major crops grown accounting for almost 65.34 % of the total crop area followed by fruits (24.48 %), paddy (7.68 %) and pulses (0.07 %) **(Table 1.4)**.

Table 1.4: Cropping pattern in Puttur Taluk during 2017-2018 (Ha)

Paddy	Jowar	Bajra	Maize	Ragi	Wheat	Pulses	Fruits	Vegetables	Oil seeds	Sugarcane	Cotton	Horticulture crops
3170	0	0	0	0	0	30	10090	995	0	0	0	26939

It is observed that net sown area accounts for about 29.5 % of total geographical area, while area sown more than once is 0.99 % of total geographical area and net irrigated area is about 15.67 % of total geographical area in the Taluk **(Table 1.5).** As per the data available, the Taluk uses 8122 Dug wells and 5664 Borewells for irrigation purpose. Ground water and rainwaterare the source for irrigation **(Table 1.6).** Land use pattern of the Taluk is represented as **Figure.1.2**.

Table 1.5: Details of land use in Puttur Taluk during 2017-2018 (Ha)

Taluk	Total Geographical Area	Area under Forest	Area not available for cultivation	Fallow land	Net sown area	Area sown more than Once	Net irrigated area
Puttur	103000	27386	24828	1133	30389	1024	16143

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

Table 1.6: Irrigation details in Puttur Taluk (Ha)

Source of Irrigation	Net area irrigated (Ha)	% of area w.r.t net area irrigated by all sources
Canals	0	0
Tanks	0	0
Wells	8122	50.3
Bore wells	5664	35.08
Lift Irrigation	44	0.27
Other Sources (e.g. Rainfed)	2313	14.32
Total	**16143**	

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

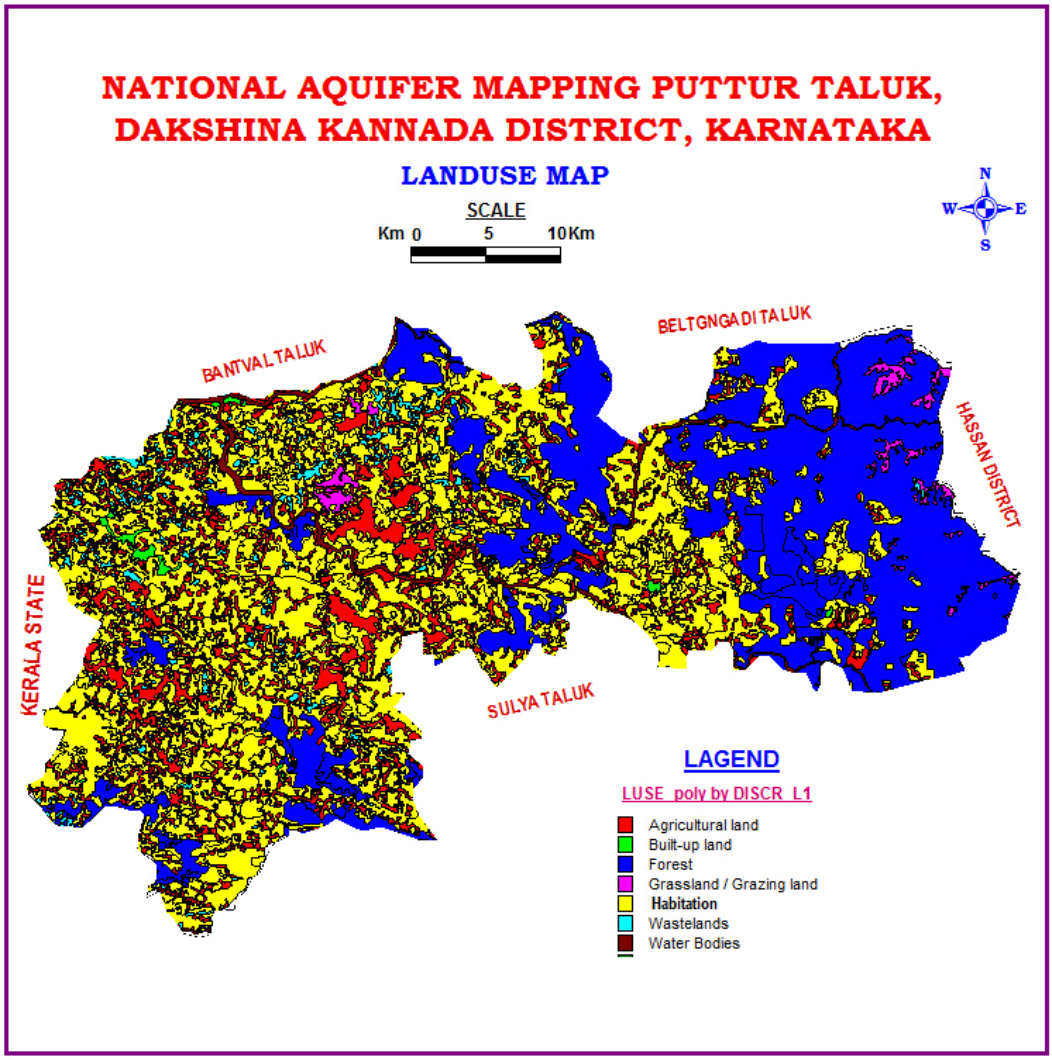

Figure.1.2: Land use Map of Puttur Taluk, Dakshin Kannada District

1.5 Geomorphology, Physiography and Drainage

The Taluk is categorised as Upland Pediplain **(Figure. 1.3).** Physiographically, it can be divided into three physiographic units viz., hills and plateau, piedmont zones and pediplains. The eastern part of the Taluk is hilly with thick forest cover which forms part of the Western Ghats. The hills of the area range in elevation from 1200 to 1500 m above mean sea level. The ground surface is flat, gently sloping forming broad valleys and flat-topped hills. The Taluk is mainly drained by Kumaradhara river flowing in North-West direction. This river joins Nethravathi river at Uppinagadi village in the Taluk. **(Figure. 1.4)**.

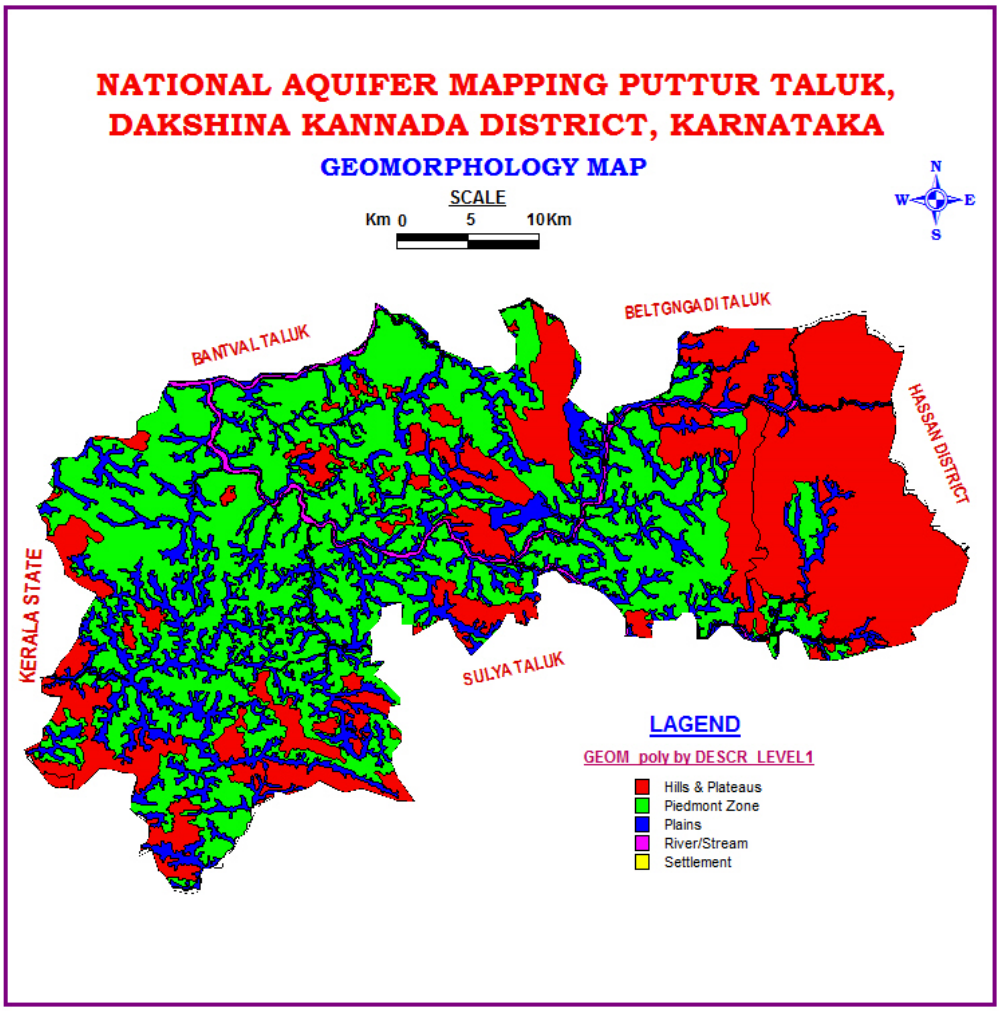

Fig 1.3: Geomorphology Map of Puttur Taluk, Dakshin Kannada District

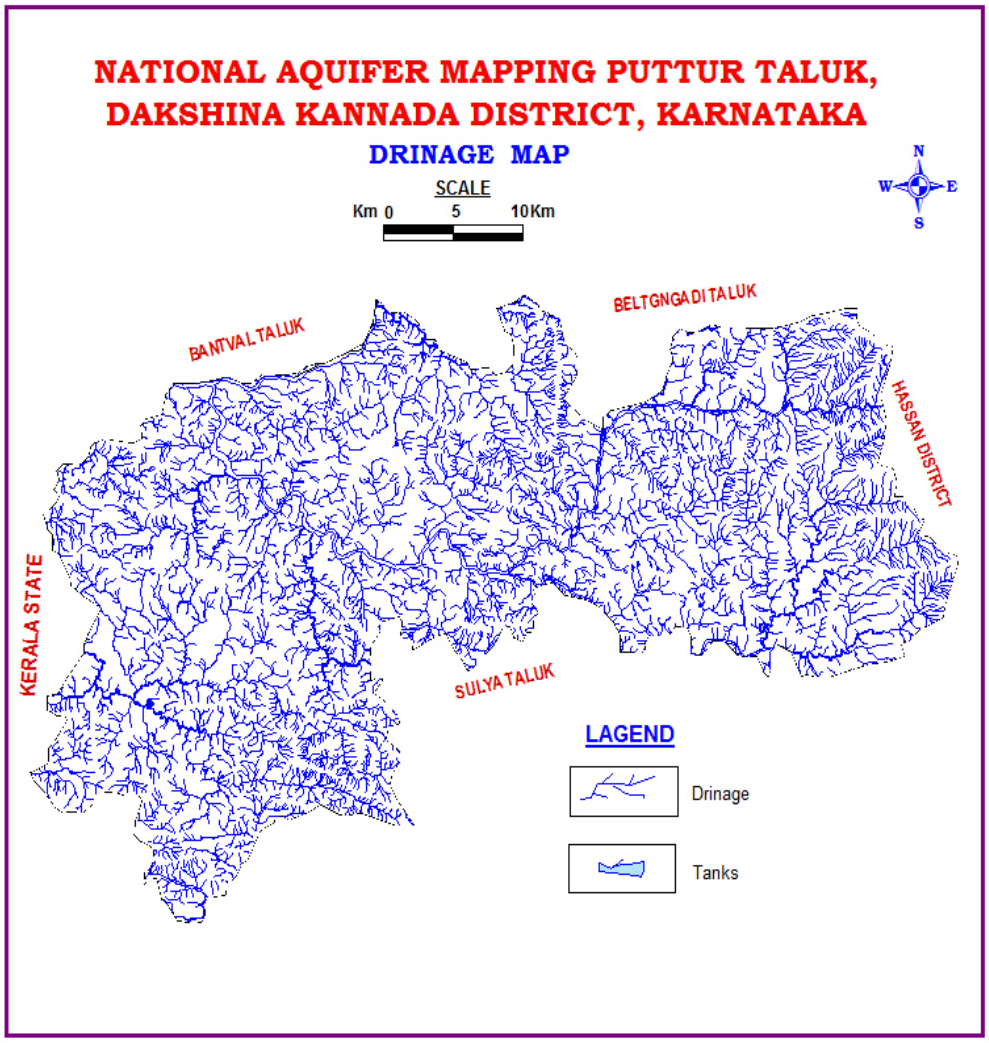

Fig 1.4: Drainage Map of Puttur Taluk, Dakshin Kannada District

1.6 Soil

The taluk comprises of mainly of two soil types namely Hilly area soil and laterite gravelly soil. The northern part comprises of hilly area and the southern part consist of laterite soil. The soil map is shown in **Figure 1.5**.

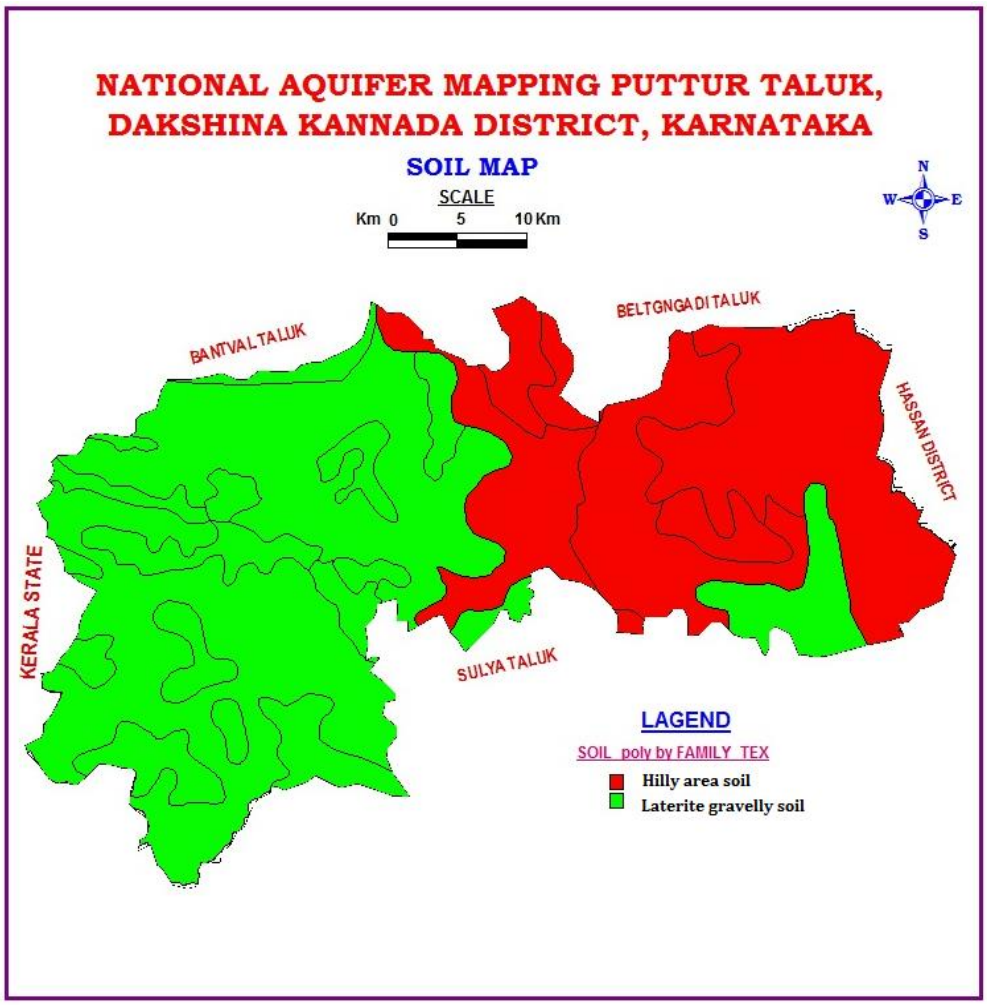

Fig 1.5: Soil Map of Puttur Taluk, Dakshin Kannada District

1.7 Ground water resource availability and extraction

Aquifer wise total ground water resources up to 200 m depth are given in **Table 1.9** below.

Table 1.9: Total GW Resources (2017) (Ham)

Taluk	Annual Replenishable GW resources	Fresh In-storage GW resources		Total availability of fresh GW resource
		Phreatic	Fractured (down to 200 m)	Dynamic + Phreatic in-storage + fractured
Puttur	3487	53569	4702	61758

1.8 Existing and future water demands (As per GEC 2017)

Net ground water availability for future irrigation development: 853Ham

Domestic and Industrial sector demand for next 25 years: 451 Ham

1.9 Water level behaviour

(a) Depth to water level

Aquifer-I

Pre-monsoon: 4.05to13.03 mbgl **(Figure.1.6)**

Post-monsoon: 2.35to12.03 mbgl **(Figure.1.7)**

Aquifer-II

Pre-monsoon: 8.05 to 19.93 mbgl

Post-monsoon: 6.20 to 15.61 mbgl

(b) Water level fluctuation

Aquifer-I

Seasonal Fluctuation: Fall in the range of 0.07 m to 0.91 m and rise in the range of 0.5m to 4.75m.

Aquifer-II

Seasonal Fluctuation: Fall in the range of 2.58 m to 3.85 m.

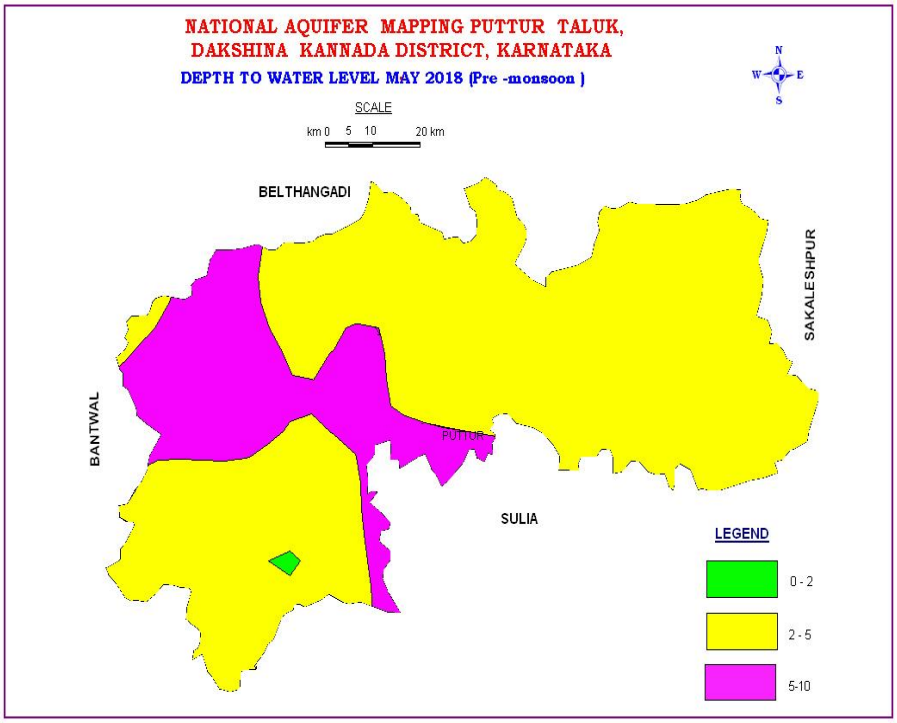

Figure.1.7: Depth to Water Level, Post-Monsoon (DW)

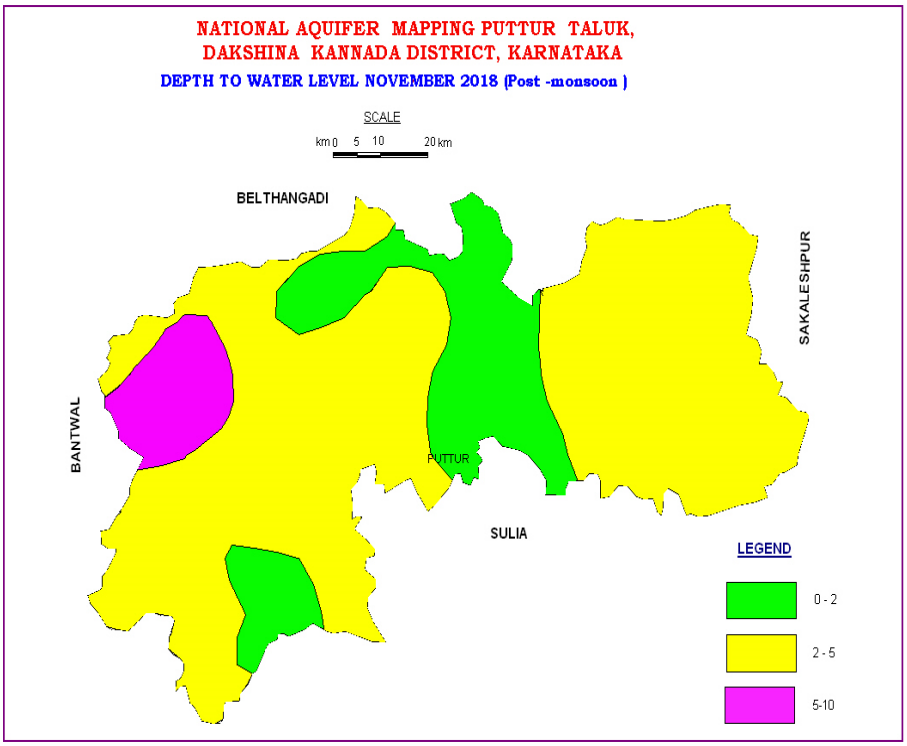

Figure.1.6: Depth to Water Level, Pre-Monsoon (DW)

2.0 AQUIFER DISPOSITION

2.1 Number of Aquifers: In Puttur Taluk, there are mainly two types of aquifer systems;

i.Aquifer-I(Phreaticaquifer)comprisingof Weathered Granitic gneiss and Charnockite

ii. Aquifer-II (Fractured aquifer) comprising of Fractured Granitic gneiss and Charnockite

In Puttur Taluk, fractured granitic gneiss is the major water bearing formation. Some portion is covered with Charnockite **(Figure.2.1)**. Groundwater occurs within the jointed and fractured granitic gneiss under semi-confined to confined conditions. In Puttur Taluk, borewells were drilled from a minimum depth of 60.0 mbgl to a maximum of 143mbgl in granitic gneiss terrain **(Table 2.1)**. Depth of weathered zone (Aquifer-I) ranges from 22.60mbgl to 24.20mbgl. Yield ranges from 2.84lps to 4.6lps. No drilling activity has been undertaken in Charnockite terrain. Hence data is not available.

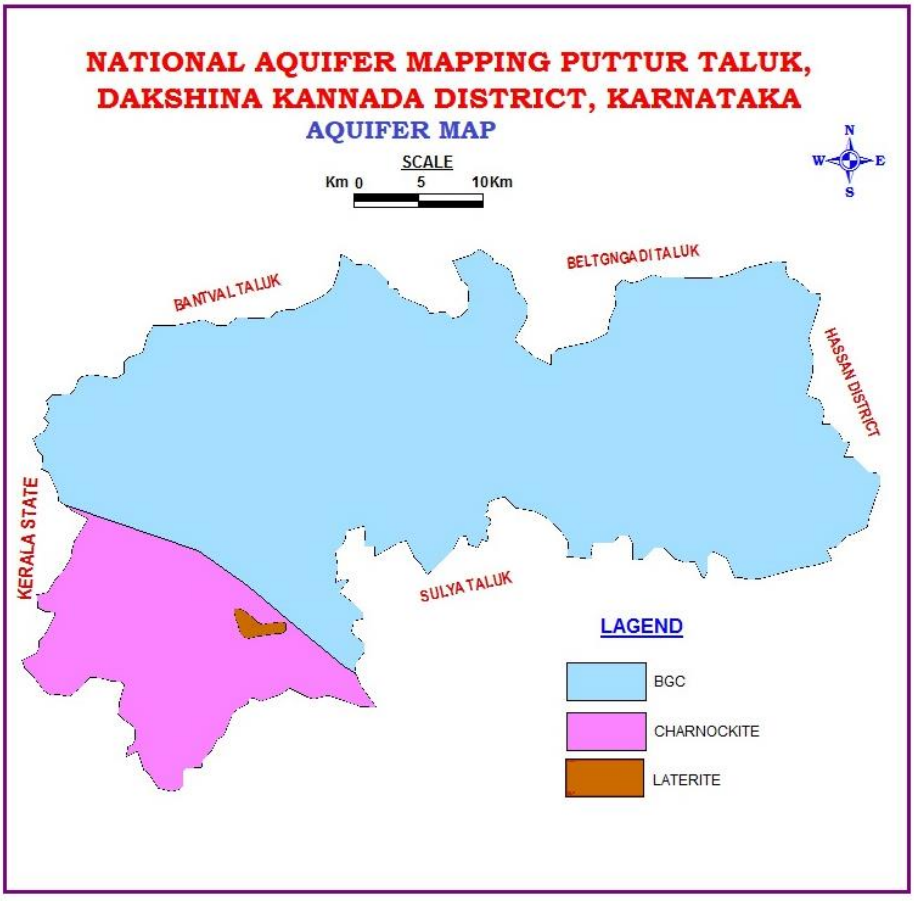

Figure. 2.1: Geology Map of Puttur Taluk, Dakshin Kannada District

Table 2.1: Details of Ground water Exploration

Sl. No.	Location	Latitude (N)	Longitude (E)	Depth Drilled (m bgl)	Casing Depth (m bgl)	Fracture Zones (mbgl)	SWL (mbgl)	Q (lps)	DD (m)
1.	Sadkukku EW	12.809722	75.20972222	60	22.60	Data unavailable	14.29	2.84	0.96
2.	Sadkukku OW	12.809722	75.20972222	53.94	22.60	53.50-53.70	9.517	4.07	2.46
3.	Araiadaka EW	12.70416667	75.32638889	143.8	23.10	Data unavailable	8	4.6	16.9
4.	Araiadaka OW	12.70416667	12.70416667	143.8	24.20	Data unavailable	7.1	4.3	16.51

3.0 GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES

a. Aquifer wise resource availability and extraction

(a) Present Dynamic Ground Water Resource (2017)

Taluk	Command/ Non-Command	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
		Ham	Ham	Ham	Ham	Ham	Ham	%	
Puttur	Non-Command	3487	2425	429	2854	451	853	82	Semi Critical

(b) Present total Ground Water Resource (Ham)

Taluk	Annual Replenishable GWResources	FreshIn-storage GW Resources		Totalavailabilityof GW Resource
		Phreatic	Fractured	Dynamic+phreaticin-storage+ fracturedin-storage
Puttur	3487	53569	4702	61758

(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 (%)
	2011			2013			2017		
Puttur	6282	5993	95	6309	6234	99	3487	2854	82

b. Chemical Quality of Ground Water and Contamination

Ground Water Quality (May 2014)

The water samples collected from shallow aquifers of Ground Water Monitoring Stations were collected during pre-monsoon and analysed in the Regional Chemical Laboratory, South Western Region, Bangalore for pH, Electrical Conductivity (EC), Chloride, Nitrate and Fluoride by employing Standard methods. Based on the hydro chemical data, the portability of these samples has been assessed as per the Standards prescribed by the Bureau of Indian Standards (BIS 10500: 2012) and categorized into 'Desirable', 'Permissible' and 'Unsuitable' classes.

The electrical conductivity in water samples is an indication of total dissolved ions. Thus, the higher the EC, the higher the levels of dissolved ions in the sample. The BIS has recommended a drinking water standard for total dissolved solids a limit of 500 mg/l (corresponding to about EC of 750 µS/cm at 25^0C) can be extended to a TDS of 2000 mg/l (corresponding to about 3000 µS/cm at 25^0C) in case of no alternate source. Water samples having TDS more than 2000 mg/l

are not suitable for drinking purpose**.** The perusal of the data indicates that the distribution of electrical conductivity in the Taluk shows wide variations from 311 to 1994 μS/cm at 25˚ C.

One of the essential elements for maintaining normal development of healthy teeth and bones is Fluoride. Lower concentrations of fluoride usually below 0.6 mg/l may contribute to dental caries. However, continuing consumption of higher concentrations, above 1.2 mg/l however cause dental fluorosis and in extreme cases even skeletal fluorosis. Most of the fluoride found in groundwater is of geogenic origin. Distribution of fluoride in the Taluk ranges from 0.0 mg/l to 0.4 mg/l.Thus, majority of samples in the Taluk shows fluoride concentration is either nil or below 1.0 mg/l rendering them suitable for drinking.

Nitrate is a problem as a contaminant in drinking water (primarily from groundwater and wells) due to its harmful biological effects. High concentrations can cause methemoglobinemia and have been cited as a risk factor in developing gastric, an intestinal cancer. The distribution of nitrate in the Taluk indicated that the values are in the range of 3.0 mg/l to 15.5 mg/l. Nitrate in drinking water should not exceed 45 mg/l as per BIS (IS: 10500: 2012) standard, here all the samples are within permissible limit.

Thus, the samples collected from the Taluk indicates that the ground water is suitable for drinking purpose.

4. GROUNDWATER RESOURCE ENHANCEMENT

4.1 Aquifer-wise space available for recharge and proposed interventions:

Recharge of phreatic aquifer (Aq-I) in the Taluk, through construction of artificial recharge structures, viz Vented dams, Check-dams, Nala bund, percolation tanks & point recharge structures (**Table 4.1**). 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 4.1: Quantity of non-committed surface run-offand expected recharge through AR structures

Artificial Recharge Structures Proposed	Puttur Taluk
Non-committed monsoon runoff available (MCM)	38.341
Proposed Number of sub-surface dyke	01
Proposed Number of Percolation tanks	35
Tentative total cost of the project (Rs. In lakhs) @Rs 20 lakhs	710.583
Expected recharge (MCM)	24.92
Expected rise in water level (m)	1.57
Cost Benefit Ratio (Rupees /cu.m. of water harvested)	2.85

4.2 Improvement in GW availability due to Recharge, Puttur 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	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	%	%
Puttur	3487	2854	82	2492	5979	34	48

After implementation of Artificial Recharge structures for GW recharge, the annual groundwater availability will increase from 3847 Ham to 5979 Ham and the expected improvement in stage of development is 34.27 % from 82 % to 47.73 %.

5.0 DEMAND SIDE INTERVENTIONS

5.1 Advanced irrigation practices

It is observed that the Taluk comes under non-command areas. So, ground water through dug wells and borewells is used for irrigation purpose in the Taluk.Water use efficiency measures have to be adopted for saving the ground water resources. Presently, draft through irrigation is 2425 Ham. Efficient irrigation practices like Drip irrigation and sprinkler has to be adopted by the farmers in the existing16143 Ha of net irrigated area. Implementation of efficient irrigation techniques will contribute in saving groundwater by 727.5 Ham and thus will improve stage of development by 21.02 % from 82 % to 60.98 % **(Table 5.1).**

Table 5.1: Improvement in GW availability due to saving by adopting water use efficiency

Taluk	Cumulative annual ground water availability	Existing gross groundwater draft for all uses	Expected improvement in stage of ground water development after implementing AR structures	Saving due to adopting WUE measures	Cumulative annual groundwater availability	Expected improvement in stage of ground water development after the implementation of the project	Expected improvement in overall stage of groundwater development
	Ham	Ham	%	Ham	Ham	%	%
Puttur	3487	2854	34	727.5	4214.5	14	68

5.2 Change in cropping pattern

In Puttur Taluk, the water intensive crops grown are paddy and commercial crops (e.g. arecanut, coconut, banana etc.). Paddy is grown in an area of 3170 Hectares and is mostly rainfed. Commercial crops are grown in an area of 26939 Hectares and give more income

to farmers. It may not be possible to change cropping pattern in Puttur Taluk. Only water efficient irrigation practices can be employed.

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 42.55% in the Taluk, the areas which are in semi-critical category can be brought to safe category. An additional area of 0.035 lakh hectares may be brought under irrigation.

5.4 Regulation and Control

In the Puttur Taluk, there are no major or minor irrigation projects. Hence, Taluk comes under non-command area falling under semi-critical category. The overall stage of development in the Taluk is 82 %. Karnataka Ground Water Authority has to take necessary action for controlling the over exploitation of ground water in the Taluk. Groundwater recharge component needs to be made mandatory in the Taluk to save the situation from deteriorating further.

5.5 Other interventions proposed:

Puttur Taluk receives high amount of rainfall during monsoon. There is good availability of seepage water during post monsoon period. There is extensive scope for seepage and rain water harvesting through construction of percolation tank, and farm ponds. Moisture and water use efficiency is possible to boost up agricultural production and to solve drinking water problem (District Irrigation Plan, Pradhan Mantri Krishi Sinchai Yojana, Dakshin Kannada district). Periodical maintenance of artificial recharge structures should also be incorporated in the Recharge Plan.

5.6 Summary

The summary of Management plan of Puttur Taluk is given in **Table 5.2**.

Table 5.2: Summary of Management plan of PutturTaluk

Puttur Taluk is 'Semi-critical' and present stage of GW Development (2017)	82 %
Net Annual Ground Water Availability (MCM)	34.87
Existing Gross Ground Water Draft for all uses (MCM)	28.54
Total GW Resources (Dynamic & Static up to the depth of 200 m bgl) (MCM)	617.58
Expected additional recharge from monsoon surplus runoff (MCM)	24.92
Change in Stage of GW development (%)	82 % to 48 %.
Expected Saving due to adopting WUE measures (MCM)	7.275
Change in Stage of GW development (%)	82 % to 68 %