केन्द्रीय भूमिजल बोर्ड

जल शक्ति मंत्रालय, जल संसाधन, नदी विकास और गंगा संरक्षण विभाग

भारत सरकार

Central Ground Water Board

Ministry of Jal Shakti,
Department of Water Resources, River Development
and Ganga Rejuvenation
Government of India

Report on

AQUIFER MAPPING AND MANAGEMENT PLAN

Hospet Taluk, Bellary District, Karnataka

दक्षिण पश्चिमी क्षेत्र, बेंगलुरु

South Western Region, Bengaluru

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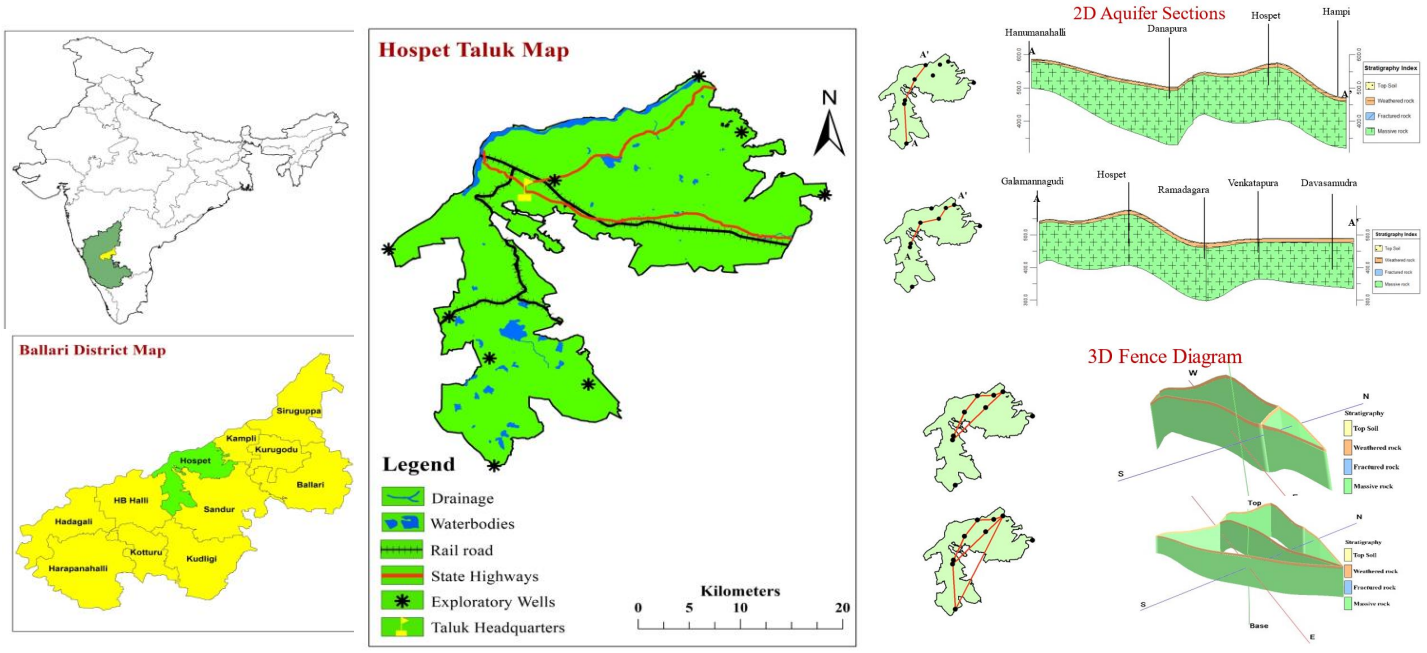
AQUIFER MAPS AND MANAGEMENT PLAN, HOSPET TALUK, BELLARY DISTRICT, KARNATAKA STATE

(AAP – 2021-2022)



By

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AUGUST 2022

AQUIFER MAPS AND MANAGEMENT PLAN, HOSPET TALUK, BELLARY DISTRICT, KARNATAKA STATE

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AQUIFER MAPS AND MANAGEMENT PLAN, HOSPET TALUK, BELLARY DISTRICT, KARNATAKA STATE

1 SALIENT INFORMATION

Name of the taluk: **Hospet**

District: Bellary

State: Karnataka

Area: 934 sq.km.

Population: 459991 (Census, 2011)

Annual Normal Rainfall: 700 mm

1.1 Study area

Aquifer mapping studies have been carried out in Hospet taluk, Bellary district of Karnataka, covering an area of 934 sq. kms under National Aquifer Mapping Project. Hospet taluk of Bellary district is located between North Latitudes 15°22'55.35" – 14°59'55"and East Longitudes between 76°16' 20.50" – 76°39'20" and is falling in Survey of India Toposheets No 57A/7,8,11 and 3. The study area is bounded on the North and west by Gangavati taluk of Koppal district, by Kurugudo and Kampli taluk of Bellary district on the East and on the South by Sandur and Kudligi taluks of Bellary district. Location map of Hospet taluk of Bellary district is presented in **Fig-1**. Hospet is taluk head quarter with 3 hoblies and there are 74 villages of which 67 are inhabited and 7 are un inhabited in this taluk.

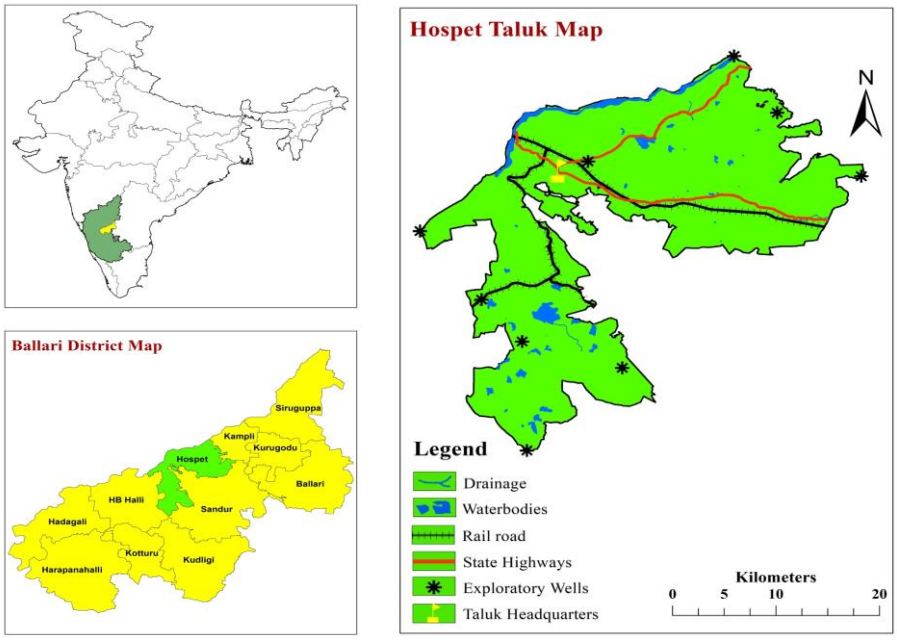

Fig 1: Location Map of Hospet Taluk, Bellary district

1.2 Population

According to 2011 census, the population in Hospet taluk is 459991. Out of which 229338 are males and 230653 are females. Rural population is 188965 and urban population comprises of 271026. The average sex ratio of Hospet taluk is 1006. The decadal variation in population from 2001-2011 is 22.68 % in Hospet taluk.

1.3 Rainfall

The climate of the taluk is characterized by dryness in the major part of the year and a hot summer. The period from December to February is the dry, comparatively cold season. The summer season starts from March to May is followed by the south-west monsoon season from June to September. October and November form the retreating monsoon or post monsoon season. In December the mean temperature is the lowest, the mean daily minimum temperature is 16.7^0C and the mean daily maximum temperature is 29.7 ^{0}C.

The area falls under Northern 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. The rainfall data in respect of Hospet station from the year 2007 to 2017 is analyzed and presented in **Table-1**.

The data pertaining to 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 Hospet taluk for the period 2007 to 2017 is 700 mm with 40 rainy days. Seasonal rainfall pattern indicates that, major amount of (450 mm) rainfall was recorded during South-West Monsoon seasons, which contributes about 65% of the annual normal rainfall, followed by North-East Monsoon season (170 mm) constituting 24% and remaining (80 mm) 11% in Pre-Monsoon season. Overall, the rainfall is scanty and unevenly distributed.

Computations were carried out for the 30 year blocks of 1981-2010, the mean monthly rainfall at Hospet taluk is ranging between 12 mm during pre-monsoon period to 816 mm during September in North East monsoon. The coefficient of variation percent for pre-monsoon, SW monsoon and NE monsoon are 68, 32 & 58 percent respectively. Annual CV at this station works out to be 25 percent. Standard Deviation for pre-monsoon, SW monsoon and NE monsoon are 54,145 and 99 respectively (**Table.2**)

Table1: Statistical Analysis of Annual Rainfall Data of Hospet taluk, Bellary district (2007 to 2017)

STATION	Rainfall (mm)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Annual
Hospet		593.8	618.7	574.9	881.3	997.7	492	501.6	774.4	719.6	433.3	566.33	700

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

Table 2: Statistical analysis of Rainfall data of Hospet taluk, Bellary district

Statistical parameter	Pre Monsoon	South West Monsoon	North East monsoon	Annual Rainfall
Average Rainfall (mm)	80	449	169	698
Minimum Rainfall (mm)	12	175	37	399
Maximum Rainfall (mm)	297	816	460	1175
Standard Deviation (mm)	54	145	99	173
CV (%)	68	32	58	25

1.4 Agriculture & Irrigation

Agriculture is the main occupation in Hospet taluk. Major Kharif crops are Paddy, Jowar, Maize, Bajra, Bengal gram and Vegetables. Main crops of Rabi season are Jowar, Maize and Bajra **(Table.3).** Water intensive crops like paddy and sugarcane are grown in an area of 17131 ha and 3502 ha respectively. Among pulses, Bengal gram is grown extensively in an area of 307.9 ha. Paddy is grown extensively covering an area of 17131 ha which comprises of 55 % of total net area sown of taluk. Jowar & Bengal gram are grown in 6 % and 1 % of net area sown respectively. The taluk is referred as the land of paddy and is one of the largest producers of rice in the state of Karnataka. 71195 tonnes of paddy were produced during the year 2017-18 which is the highest for any crop in the entire district.

Table.3: Cropping pattern in Hospet taluk 2017-2018

Year	Paddy	Jowar	Maize	Pulses	Pulses	Oil seeds	Sugar cane	Cotton	Fruits	Vegetables
	(Ha)									
2017-18	17131	1959.1	7317.59	738.3	738	689.5	3502.12	1389.33	5508.88	3494.33

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

It is observed that net sown area accounts 33 % and area sown more than once is 17% of total geographical area in Hospet taluk **(Table-4).** Area not available for cultivation and Fallow land cover 27 % & 13% of total geographical area respectively.

Table 4: Details of land use in Hospet taluk 2016-2017 (Ha)

Taluk	Total Geographical Area	Area under Forest	Area not available for cultivation	Total Fallow land	Net sown area	Area sown more than once
Hospet	93400	24970	24934	11900	31069	15808

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

The erratic rainfall pattern has highlighted the importance of planned irrigation. The Tungabhadra dam across Tungabhadra River commenced during 1945 near Mallapur town.

The unique feature of Tungabhadra dam is that it is built across the river that forms natural boundary of Bellary and Raichur districts and is a joint venture of Government of Karnataka and Andhra Pradesh. The composite dam has central spillway. The gross storage capacity of the dam is 132.00 TMC and live storage is 116.84 TMC. The rate of silt in Tungabhadra reservoir is 5.27 hectare per 100 sq. km. per year, which has reduced the capacity of reservoir by 11 TMC from 1953 to 1985. This dam provides irrigation facility for 362,795 hectares of agricultural land of Bellary and Raichur district of Karnataka and 162,093 hectares of Andhra Pradesh. This project envisages construction of three canals, the Left Bank Canal, the Right Bank High Level Canal, and the Low-Level canals. While the former one passes through the Raichur district, the Right Bank High Level and Low-Level Canal pass through Bellary district. The Tungabhadra project was basically conceived as a protective system of irrigation so that its benefits could be spread over as large area as possible. The command area of right bank canal and high-level canal is 351 km. long and provides irrigational facilities to 118,414 hectares of agricultural land.

Thus, the total net area irrigated is 207032.74 **(Table.5)** & agriculture is the most important occupation of the taluk. **(Fig.2).** Ground water is an important source of irrigation along with surface water. As per CADA data on March 2021, 417 sq.km is the canal command area in the taluk about 32.95 sq km is water logged which is already reclaimed since inception.

Table.5: Irrigation details in Hospet taluk (ha)

Source of Irrigation	Km in length/No.	Net area irrigated	% of area
Canals	159 km	13173	14
Tanks	23	642	0.68
Wells	616	0	--
Tube/Bore wells	2661	6891.69	7.37
Lift Irrigation	74	6536	7
Other Sources	--	3892	4.16

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

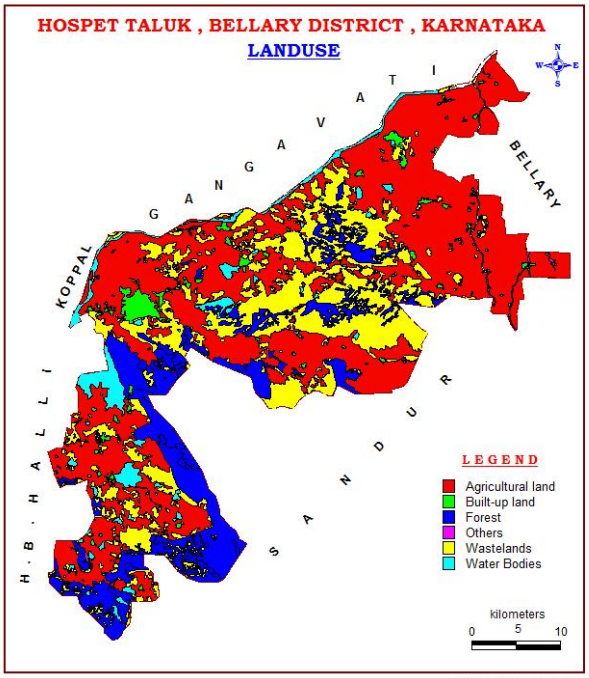

Fig. 2: Land Use and Land cover

1.5 Geomorphology, Physiography & Drainage

Hospet taluk falls in the northern dry region with flat terrain dotted by rocky hills. The taluk is more or less vast plain at an average elevation of 450 m above mean sea level. The general slope is towards northward which is along Tungabhadra River **(Fig.3)**. The hilly portions are restricted in the central part of the taluk.

The entire Hospet taluk falls in Krishna River basin and Tungabhadra sub basin. Tungabhadra River which is a tributary of Krishna River drains the northern and western boundary of the taluk adjoining Koppal district. Hagari also called as Vedavathi the other tributary originates near Mullaianagiri hills in Chikamagalur district and enters the eastern part of the Bellary district and drains Hadagali and Kudlugi taluks before joining to Tungabhadra after running about 92 kms at Bagavadi village in Siruguppa taluk. Hagari is a 6^{th} order stream with a form factor of 0.6. Drainage density of Hagari river is 1.7 with an average slope of 1.75. The Drainage pattern is dendritic to sub-dendritic **(Fig. 4).** It is denser in the southern part.

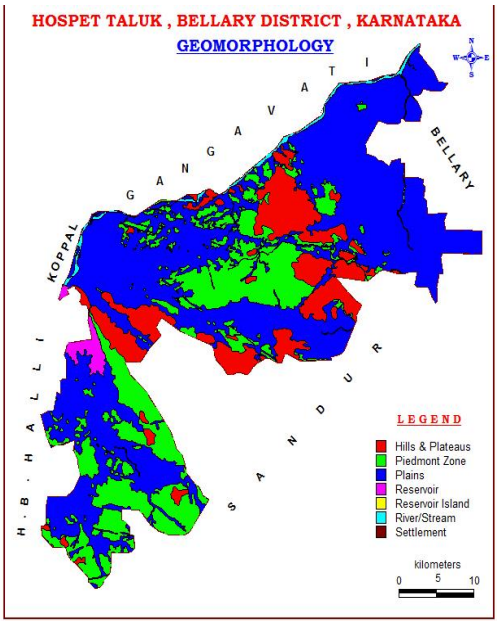

Fig-3: Geomorphology Map

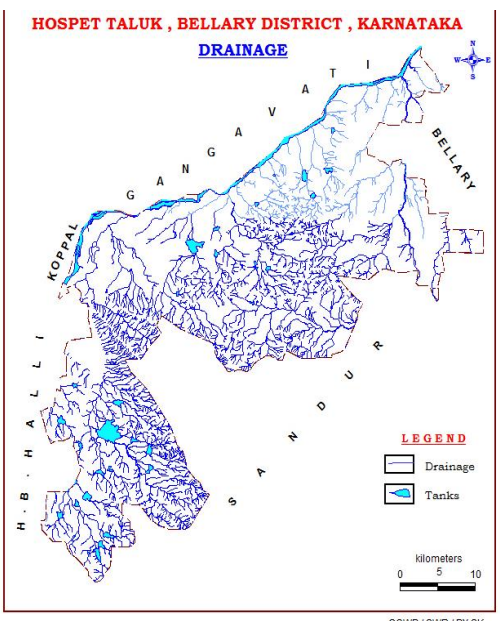

Fig-4: Drainage Map

1.6 Soil

The soil types found in the taluk are mixture of clayey, skeletal, loamy and rocky land. The soil is rich in calcium and poor in nitrogen, phosphate and potash. Under rain fed condition, these soils yield the crops of jowar, groundnut and cotton and when suitably irrigated, yield paddy and sugarcane as well. **(Fig. 5).** Clay content is high in the soil type with rocky land in the hill areas of central and southern portion of the taluk.

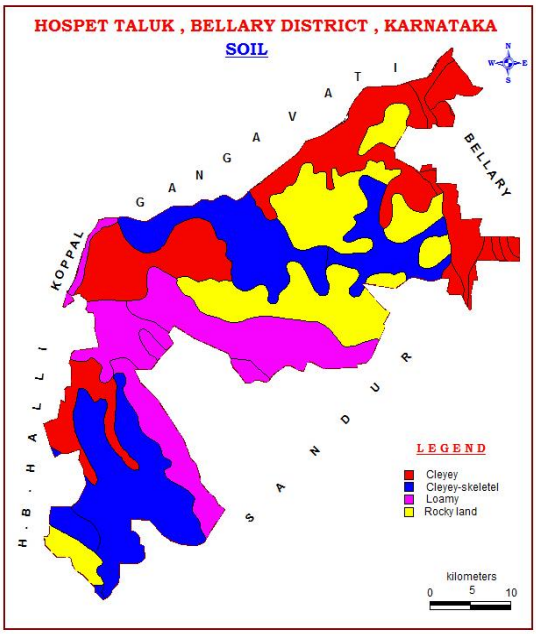

Fig. 5: Soil map

1.7 Ground water resource availability and extraction

Aquifer wise total groundwater resources up to 200 m depth is given in **Table.6** below.

Table.6: Total Ground Water Resources (2017) (Ham)

Taluk	Annual replenishable GW resources	Fresh In-storage GW resources		Total availability of fresh GW resources
Hospet	9595	Phreatic	Fractured (Down to 200m)	Dynamic + phreatic in-storage + fractured
		11665	**3169**	**24429**

1.8 Existing and future water demands (GEC 2017)

- Net ground water availability for future irrigation development: 54.08 MCM
- Domestic and Industrial sector demand for next 25 years: 9.26 MCM

1.9 Water level behavior

(a) Depth to water level

Aquifer - I

- Pre-monsoon: – 2.20 to 12.58 mbgl, May, 2019 (**Fig.-6**)
- Post-monsoon: – 1.01 to 2.09 mbgl, Nov,2020 (**Fig.-7**)

Aquifer -II

- Pre-monsoon: – 1.74 – 5.21 mbgl (May 2019)
- Post-monsoon: – 1.4 – 2.4 mbgl (Nov 2019)

(b) Water level fluctuation

- **Aquifer-I** Seasonal Fluctuation: Rise ranges 0.49 – 1.19 m

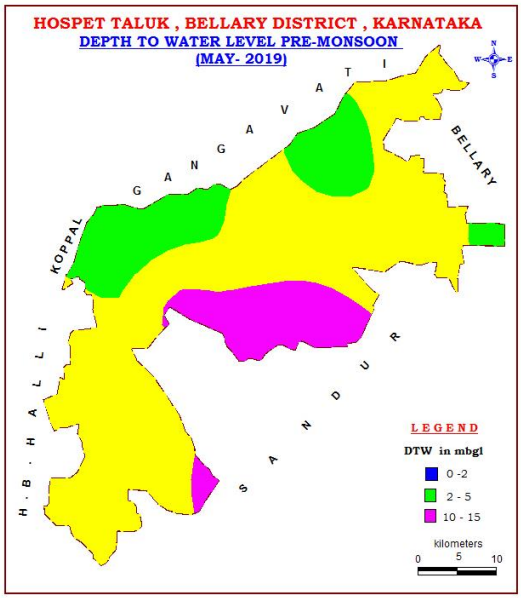

Fig-6: Pre-monsoon Depth to Water Level (Aq-I)

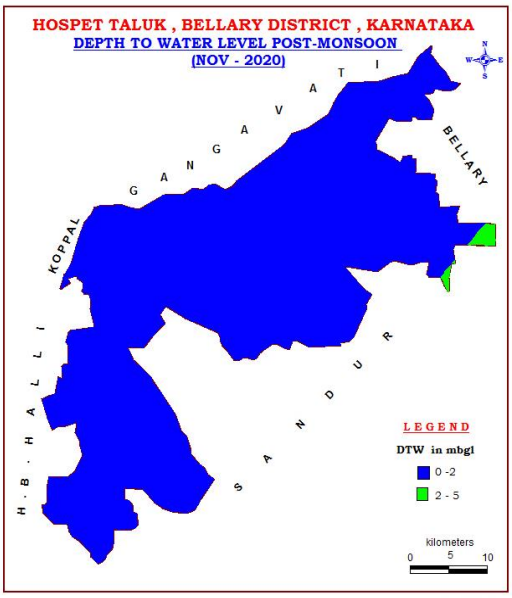

Fig-7: Post-monsoon Depth to Water Level (Aq-I)

2 AQUIFER DISPOSITION

2.1 Aquifer Types

In Hospet taluk, mainly two types of aquifer systems

i. Aquifer-I (Phreatic aquifer) Weathered Banded Gneissic complex
ii. Aquifer-II (Fractured aquifer) Fractured Banded Gneissic complex

In Hospet taluk, Banded Gneissic complex (BGC) is the main water bearing formations **(Fig-8).** A small portion in the eastern nook of the taluk is covered by granite. Ground water occurs within the BGC under water table condition and in fractured Granitic Gneiss under semi-confined condition. In Hospet taluk, bore wells were drilled from a minimum depth of 64.5 mbgl to maximum of 119.2 mbgl. Depth of weathered zone ranges from 6 mbgl to 16.5 mbgl. Ground water exploration reveals that aquifer-II fractured formation was encountered between the depth between 30.05 mbgl to 59.66 mbgl. Yield ranges from 15 to 306 lpm. Transmissivity value ranges from 21 – 191 m2/day. The basic characteristics of each aquifer are summarized in **Table.7.**

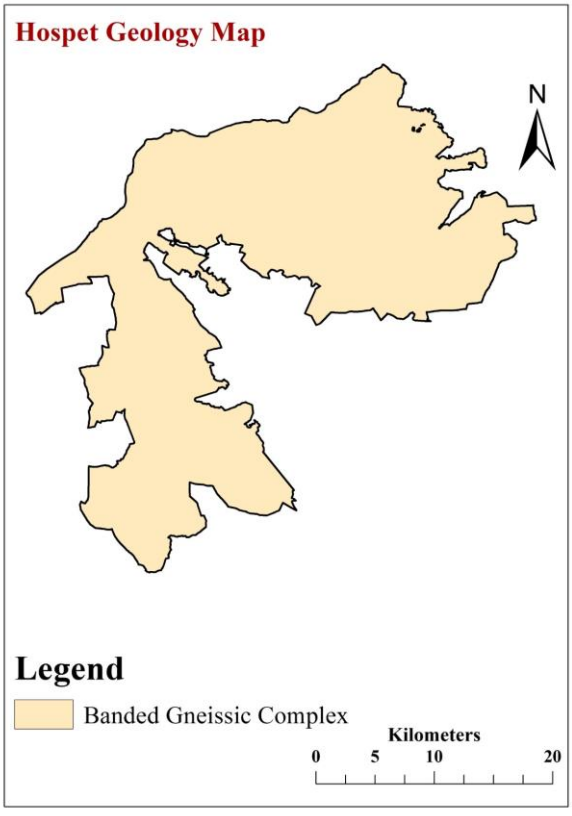

Fig-8: Geology Map

Table.7: Basic characteristics of each aquifer

Aquifers	Weathered Zone (Aq.-I)	Fractured Zone (Aq.-II)
Prominent Lithology	Weathered Banded Gneissic Complex	Fractured Banded Gneissic Complex
Thickness range (mbgl)	6 – 16.5	Upto 60
Depth range of occurrence of fractures (mbgl)	Dried up	30.05 – 59.66
Range of yield potential (lpm)	Negligible	15 - 306
T (m^2/day)	---	21 - 191
Quality Suitability for Domestic & Irrigation	Suitable with sporadic occurrence of EC, fluoride and nitrate	Suitable with sporadic occurrence of fluoride and nitrate

2.2. 2 D, 3 D aquifer disposition and basic characteristics of each aquifer

The sub-surface aquifer disposition of the study area were prepared based on the drilling data obtained from exploratory drilling programme for generating 2D and 3D sections and fence diagrams/models through Rock works software. The outputs thus generated are presented in **Fig 9(a) and Fig 9 (b).**

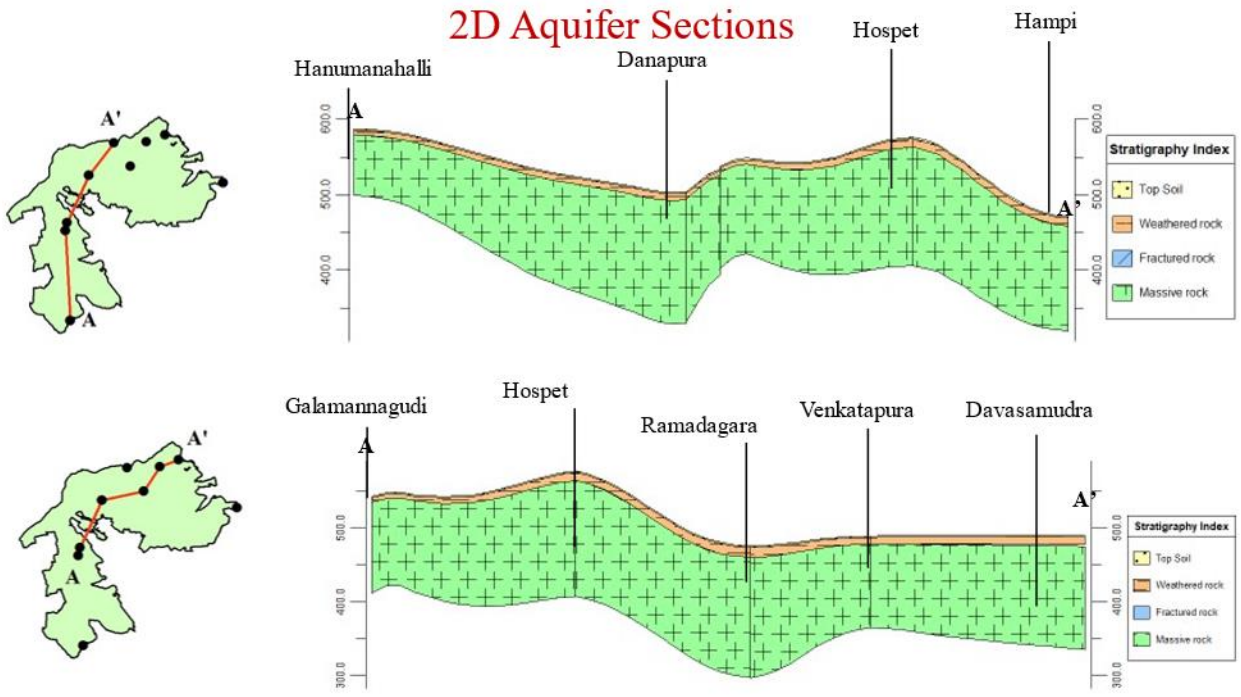

Fig 9 (a): The 2D aquifer dispositon in Hospet taluk, Bellary district

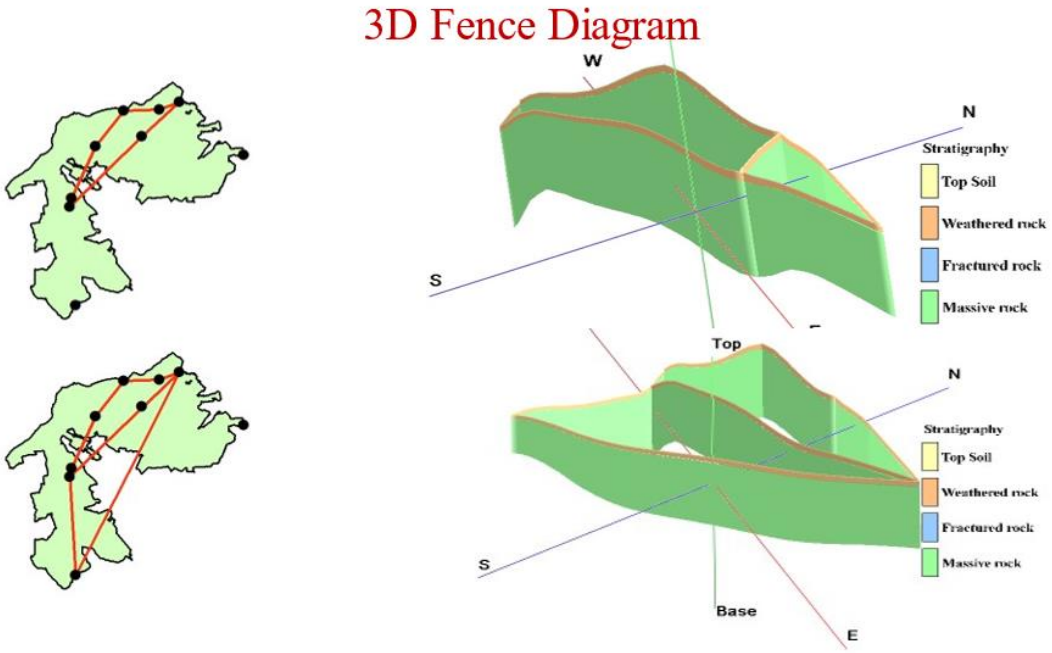

Fig 9 (b): The 3D aquifer dispositon in Hospet taluk, Bellary district

3 GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES

3.1 Aquifer wise resource availability and extraction

The ground water resource estimated as on 2017 is summarized below in **Table.8(a)**. The taluk is categorised as "Safe" with stage of ground water extraction of 39 % as on 2017. As mentioned above, Total Availability of Ground Water Resource (Phreatic + Phreatic In-storage + fractured In-storage)is estimated to be 24429 ham for the taluk.

Table.8(a) Present Dynamic Ground Water Resource (2017) 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
Hospet	9595	3274	508	3783	926	5401	39	Safe

a) Ground Water Resource availability and Stage of extraction as on 2020

The Ground Water Resource availability and stage of extraction as on 2020 is shown in **Table.8(b).** The comparison of Ground Water Availability and Draft Scenario in Hospet taluk is presented in **Table.8(c)**

Table. 8(b) Ground Water Resource availability and stage of extraction as on 2020

Annual Extractable ground water resource (ham)	GW extraction for Irrigation use (ham)	GW extraction for Industrial use (ham	GW extraction for Domestic use (ham)	Total GW extraction (ham)	Stage of GW extraction (%)	Category	Annual GW allocation for Domestic use as on 2025 (ham)	Net GW availability for future use (ham)
6967	2652	0	625	3277	47	Safe	662	3653

Table.8(c) Comparison of Ground Water Availability and Draft Scenario in Hospet taluk

Taluk	GW Availability (Ham)	GW Draft (Ham)	Stage of GW Development	GW Availability (Ham)	GW Draft (Ham)	Stage of GW Development
	2017			2020		
Hospet	9595	3783	**39**	6967	3277	**47**

From the above Table, it is clear that the Net Annual Ground Water Availability is reduced from 2017 to 2020 and there is slight reduction in the quantum of Total Ground Water Extraction. Correspondingly, the Stage of Ground Water Extraction is increased from 39 to 47% from 2017 to 2020.

3.2 Chemical quality of Groundwater and Contamination

Summarized Chemical Analysis results (**Table.9**) from the NHS in Hospet taluk is mentioned as under:

Electrical Conductivity: In general, EC values range from 540 to 2510 µ/mhos/cm in the aquifer-I at 25^{o}C. (**Fig 10**)

Fluoride: Fluoride concentration in groundwater ranges between 0.07 to 5.7 mg/l in the aquifer-I. and 0.13 to 1.1 mg/l in aquifer II (**Fig 11**)

Nitrate: Nitrate value ranges from 0.5 and 98 mg/l in the Aquifer –I and in Aquifer II, it ranges from 14 to 188 mg/l. (**Fig 12**)

Table.9: Quality of ground water, 2019 in Hospet Taluk

GW Quality:	Particulars	Phreatic Aquifer (Aquifer-I)	Fractured Aquifer (Aquifer-II)
	EC (µS/cm at 25°C)	540 – 2510	-
	F (mg/l)	0.07 -5.7	0.13 – 1.1
	NO_3 (mg/l)	0.5 – 98	14 – 188

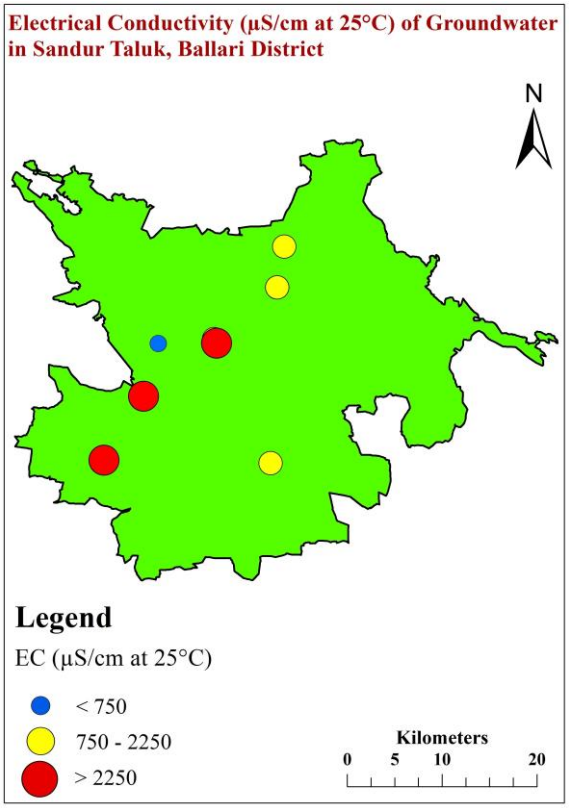

Fig 10: Distribution in EC

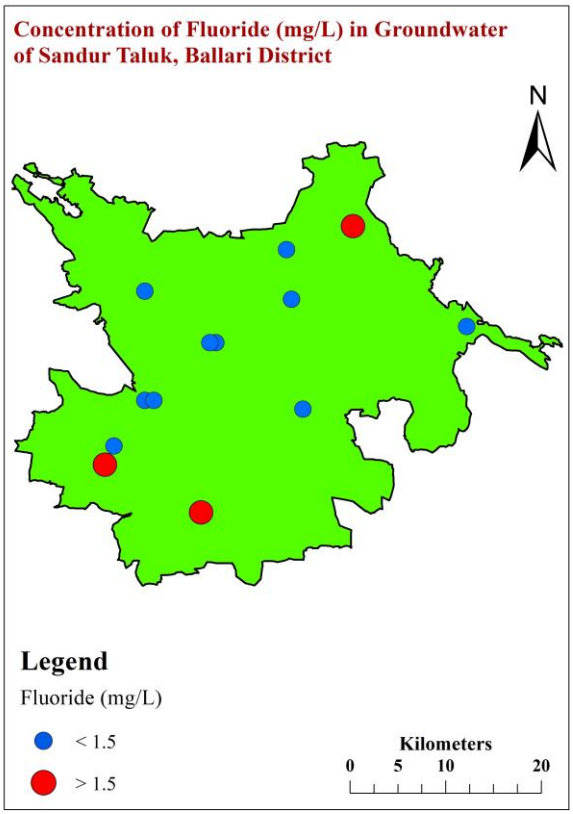

Fig 11: Distribution in Fluoride

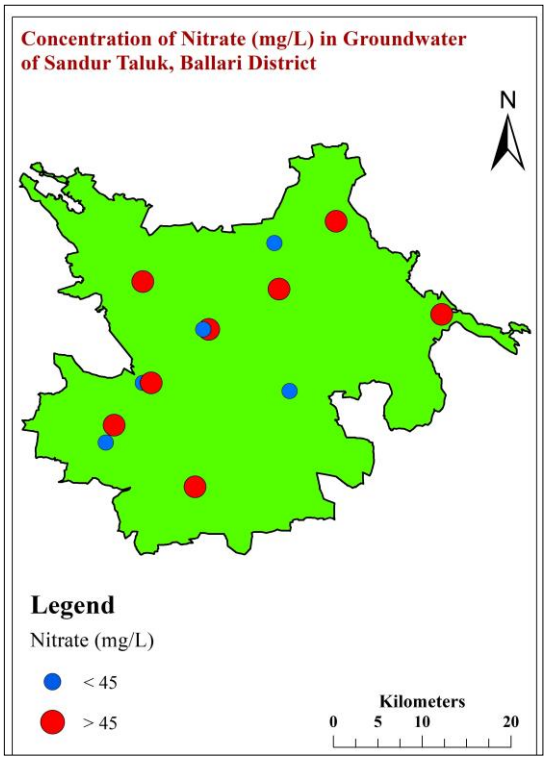

Fig 12: Distribution in Nitrate

4 GROUND WATER RESOURCE ENHANCEMENT

4.1 Resource Enhancement by Supply Side Interventions

An area of 458 sq.km is found feasible for artificial recharge **(Fig.13)**. The choice of recharge structures should be site specific and such structures needs to be constructed in areas already identified as feasible for artificial recharge**.** Various structures are already constructed by State government departments under MGNREGA and the details presented in **Table-10.**

Table.10. Details of AR structures in Hospet Taluk

Area feasible for Aquifer recharge (sq.Km)	Number of recharge structures constructed by various State Government departments			Number of proposed recharge structures				Cost of Recharge structures (Rs. In lakhs)				Availability of surface non committed monsoon runoff (mcm)
	CD/MACD/VD*	Percolation tank	Point recharge structures	Sub surface dykes	Percolation tank	Check dam	Filter beds	Sub surface dyke (@Rs 20 lakhs)	Percolation tank (@Rs 20 lakhs)	Check dam (@Rs 10 lakhs)	Filter beds (@Rs 1.5 lakhs)	
458	31	27	83	0	Need based #	Need based #	Need based #	0	0	0	0	0

 # Artificial Recharge structures are being implemented under MGNREGA as per feasibility

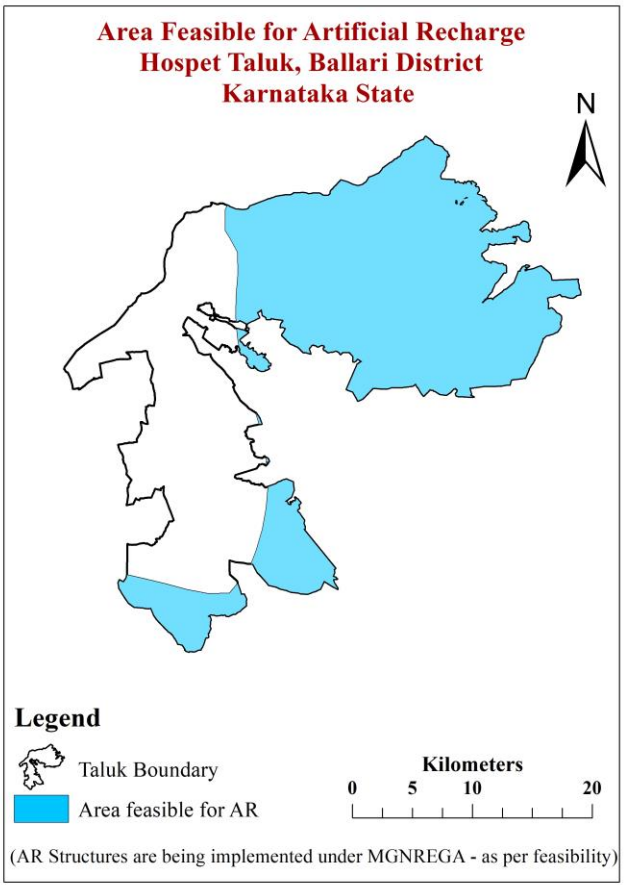

Fig 13: Map showing the area feasible for Artificial Recharge in Hospet Taluk

4.2 Demand Side Interventions

4.2.1 Advanced irrigation practices

Agriculture is the main occupation of the people which depends exclusively on ground water in the non-command areas. As per the prevailing hydro-geological conditions, the dug wells were dry and bore wells are being used to extract ground water. The area is prone to frequent droughts, particularly during the years of low rainfall below the normal. Increase in agricultural activity, ground water withdrawal, depletion of ground water levels, reduction in yield and ground water quality related issues etc., suggests the need for scientific ground water management, enhancement of storage capacity of the aquifers and protection of ground water quality.

The important crops grown are paddy, jowar, bajra, maize, tur, cereals, grams, oil seeds, cotton and sugarcane. About 417 sq.km area (141 sq.km after the formation of new Kampli taluk) is being by canal irrigation and the remaining part of the irrigated area is fed by ground water. In view of this, Water Use Efficiency (WUE) practices like Drip irrigation needs to be strengthened to save irrigation water by way of precision farming mechanism. This ultimately enhances the area under irrigation

potential. This will help in enhancing a quantum of 982 ham and will ultimately enhances the area under irrigation potential resulting a stage of groundwater development improvement from 47 % to 41 % (**Table 11**).

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

Taluk	Net annual ground water availability	Existing gross ground water draft for all uses	Existing stage of ground water development	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	**%**
Hospet	**6967**	**3277**	**47**	**982**	**7949**	**41**	**6**

4.2.2 Change in cropping pattern

Farmers are facing inadequacy of groundwater for agriculture during summer and can opt for more rain-fed millets and water efficient Pulses for agricultural production. An area of 171.31 sq km is under paddy cultivation and 35.02 sq km is under sugarcane. Farmers may be encouraged to go for less water intensive crops and awareness programme and training may be organized. Usage of organic manure may be encouraged in place of chemical fertilizers.

4.2.3 Conjunctive use plan in water logged area

Out of the total 417 sq.km of the canal command area in the taluk about 32.95 sq km is water logged which is already reclaimed since inception. (Source: CADA as on March 2021). In addition to this reclamation, conjunctive use plan is also recommended to benefit the tail end area of the irrigation command. The figure may change since the formation of Kampli taluk as part of Hospet taluk falls in this new taluk.

4.3 Ground Water Development Plan

In Hospet taluk, the present stage of ground water extraction (2020) is 47 % with net ground water availability for future use is3653 ham and total extraction is 3277 ham(2020) The ground water draft for irrigation purpose is 2652 ham, thus indicating that ground water irrigation needs to be encouraged in the area after considering the safe level of extraction of 70%. To overcome these, it is imperative to have a robust ground water resource development plan for the area, which can be implemented in scientific manner. The implementation of the plan needs to be based on site specific detailed hydrogeological, geophysical and scientific surveys for pinpointing the sites for construction of dug wells and bore wells .In command area, dug wells and shallow bore wells are recommended to prevent water logging and to plan for conjunctive use of surface and ground water.

As per the conservative estimate and after considering the average unit draft figure for the taluk, about 250 dug wells (10-15 m depth; 3 to 5 m diameter) are recommended to be constructed in feasible areas. Further. as per the estimate about, 1500 borewells (100 to 150 m depth; 150 mm dia) are also recommended to be drilled in feasible areas so as to maintain the safe category of the taluk. The likely additional irrigation potential which can be created considering prevailing crop water requirement for the area is will be 2000 ha.

5 SUMMARY OF MANAGEMENT PLAN

- **Ground water resource enhancement**: Agriculture is the main occupation of the people which depends exclusively on ground water in the non-command areas. As per the prevailing hydro-geological conditions, the dug wells were dry and bore wells are being used to extract ground water. The area is prone to frequent droughts, particularly during the years of low rainfall below the normal. Increase in agricultural activity, ground water withdrawal, depletion of ground water levels, reduction in yield and ground water quality related issues etc., suggests the need for scientific ground water management, enhancement of storage capacity of the aquifers and protection of ground water quality.
- **Ground Water resource**: As per the resource estimation – 2020, Hospet taluk falls under "**Safe"** category with the stage of ground water extraction of **47** %. However, there is need to formulate management strategy to tackle the water scarcity related issues in the taluk during the summer and scarcity of water during the future days.
- **Advanced irrigation practices:** The important crops grown are paddy, jowar, bajra,maize, Tur, cereals, grams, oil seeds, cotton and sugarcane. About 417 sq.km area (141 sq.km after the formation of new kampli taluk) is being by canal irrigation and the remaining part of the irrigated area is fed by ground water. In view of this, Water Use Efficiency (**WUE**) practices like Drip irrigation needs to be

strengthened to save irrigation water by way of precision farming mechanism. This ultimately enhances the area under irrigation potential.

- **Water conservation and artificial recharge:** Need based artificial recharge structures like Percolation tanks and Check dams are recommended for the taluk. As such, concerned departments of Govt.of Karnataka are implementing watershed activities under various programmes including water conservation. Adopting soil and water conservation activities in the catchment of all water bodies and periodical maintenance of artificial recharge structures are also recommended.
- **Conjunctive use plan in water logged area:** Out of the total 417 sq.km of the canal command area in the taluk, about 3295 ha is water logged which is already reclaimed since inception. (Source: CADA as on March 2021). In addition to this reclamation, conjunctive use plan is also recommended to benefit the tail end area of the irrigation command. The figure may change since the formation of Kampli taluk as part of Hospet taluk falls in this new taluk.
- As mentioned above, about 250 dug wells and about 1500 bore wells are recommended in the taluk to bring additional area under ground water irrigation.
- **Change in cropping pattern**: Farmers are facing inadequacy of groundwater for agriculture during summer and can opt for more rain-fed millets and water efficient Pulses for agricultural production.
- **Drinking water Supply**: In view of ground water contamination with mainly higher concentration Fluoride and Nitrate, drinking water supply from surface water needs to be explored/ ensured.
- **Regulation and Control**: Taluk is categorized as "Safe". However, the mandatory guidelines like rainwater harvesting and artificial recharge issued by Karnataka Ground Water Authority needs to be strictly implemented in the taluk, so that quality of ground water will improve in due course of time.
- **Participatory management**: Awareness programmes and practice of participatory approach needs to be strengthened with the involvement of all the stake holders for sustainable management.