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

Kumta Taluk, Uttara Kannada District, Karnataka

दक्षिण पश्चिमी क्षेत्र, बेंगलुरु

South Western Region, Bengaluru

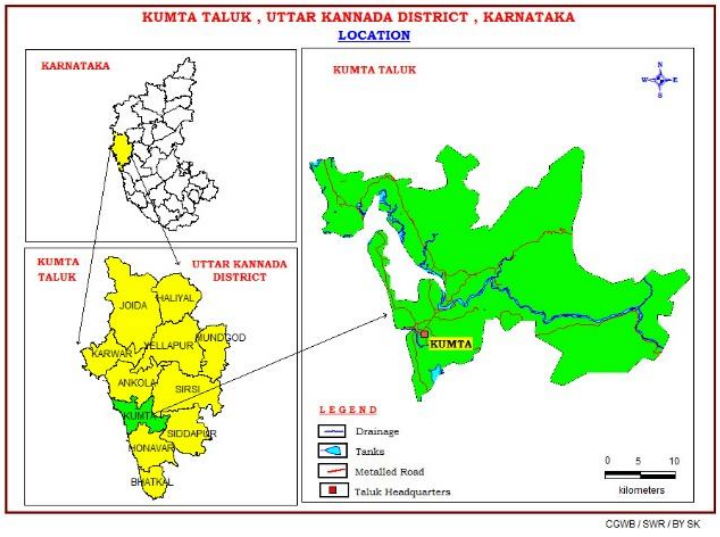
FOR OFFICIAL USE ONLY
No. SWR/RP/NQM/2023-24/27

भारत सरकार
जल शक्ति मंत्रालय
जल संसाधन, नदी विकास
एवं गंगा संरक्षण विभाग
केन्द्रीय भूमिजल बोर्ड
दक्षिण पश्चिम क्षेत्र,
बेंगलुरु

Government of India
Ministry of Jal Shakti
Department of Water Resources,
River Development &
Ganga Rejuvenation
Central Ground Water Board
South Western Region,
Bengaluru

AQUIFER MAPS AND MANAGEMENT PLAN, KUMTA TALUK, UTTARA KANNADA DISTRICT, KARNATAKA STATE

(AAP – 2022-2023)



By

Sreehari Sarangan M S, Sc-C, CGWB, SWR, Bengaluru

MAY 2023

AQUIFER MAPS AND MANAGEMENT PLAN, KUMTA TALUK, UTTARA KANNADA DISTRICT, KARNATAKA STATE

CONTENTS

AQUIFER MAPS AND MANAGEMENT PLAN, KUMTA TALUK, UTTARA KANNADA DISTRICT, KARNATAKA STATE

1. SALIENT FEATURES

Name of the Taluk	: Kumta
District	: Uttara Kannada
State	: Karnataka
Area	: 582 sq.km
Population (Census 2011)	: 154,280
Normal annual rainfall	: 3444 mm

1.1. Study area

Aquifer mapping studies were carried out in Kumta taluk, Uttara Kannada district, Karnataka State under National Aquifer Mapping Project during the AAP 2022-23. The taluk is covering an area of 582 sq.km. The geographical extents of Kumta taluk of Uttara Kannada district is located between North Latitudes 14° 20’ 42” and 14° 28’ 40.44” and East Longitudes 74° 17’ 40.56” and 74° 41’ 38.04”. The taluk is covered in parts of Survey of India Toposheet Nos. 57 D/7, D/11, D/15, D/8, D/2 and D/16. Kumta taluk is bounded by Ankola taluk towards North, Siddapura and Sirsa towards East, Honavar taluk towards South and Arabian Sea towards West. Taluk administration of Kumta is divided into 3 Hoblies and 231 Grama Panchayaths. Kumta town is the taluk head quarter. There are 94 villages present in the taluk. Location map of Kumta taluk is presented in **Fig. 1.** Aghanashini river is the major river of Kumta. The river joins the Arabian Sea at Kumta. While joining the sea, the river has created some islands and beautiful beaches such as Om and Kudle.Salt fields at Sanikatta near Gokarna is famous for salt manufacturing.

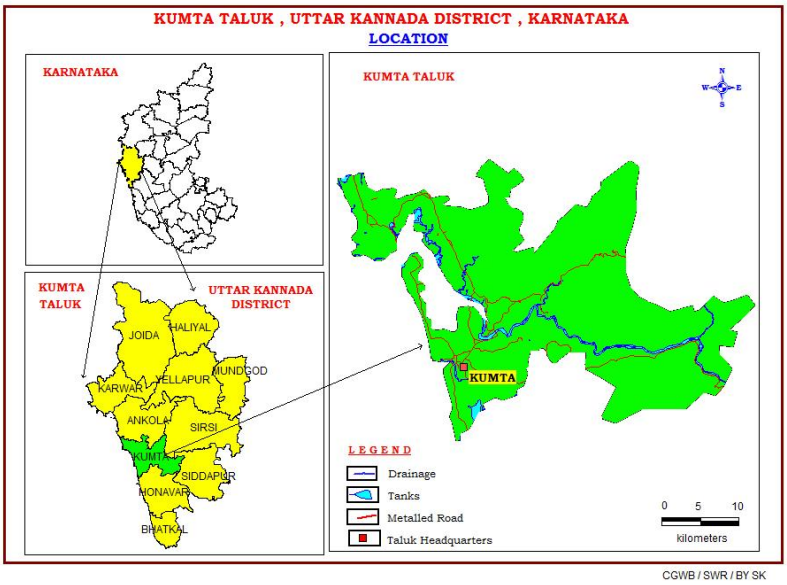


Fig. 1: Location Map

1.2 Population

According to 2011 census, the human population in Kumta taluk is 154280 out of which 76.2% constitutes the urban population and only 23.8% constitutes the rural population. The taluk has an overall population density of 262 persons per sq.km. The population details are given in Table-1.

Table-1: Population details

Total	Male	Female	Children population	Sex Ratio	Population density	Literacy	Urban Population	Rural Population
154280	77704	80368	76576	985	262	78.87 %	76.2 %	23.8 %

Source: District at a glance 2018-19, Govt. of Karnataka

1.3 Rainfall and Climate

Kumta Taluk is a coastal region and comes under coastal agro climatic zone. It has tropical climate. It has a well-defined rainy season of about five months between June and November when the south west monsoon brings most of the rainfall and the climate remains hot and humid. The winds are predominantly south westerly during the summer monsoon and north easterly during the winter monsoon. The climatic year may broadly be classified into four seasons. The dry season is from January to February with clear and bright weather. It is followed by hot weather from March to May. During this season thunderstorms are common in the month of May. The monsoon season is from June to September. The presence of Western Ghats in Uttara Kannada causes orographic precipitation

Kumta taluk enjoys semi-arid climate. Dryness and hot weather prevails in major part of the year.

The data in respect of rain gauge stations from the year 1981 to 2010 is analyzed and presented in Table 1. 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 Kumta taluk for the period 1981 to 2010 is 3444 mm.

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 premonsoon, monsoon, post monsoon and annual and are shown in Table 1.

The mean monthly rainfall at Kumta taluk is ranging between 1 mm during January to 1039 mm during July. The CV percent for premonsoon, monsoon and post monsoon season is 62, 26 & 43 percent respectively. Annual CV at this station works out to be 20 percent.

The 10 years average monthly, seasonal and annual rainfall data of Kumta taluk is given in Table -1. The Kumta taluk has received less than normal annual rainfall in last 10 years during 2012, 2013, 2014, 2015, 2017 and 2018.

STATION		JAN	FEB	MAR	APR	MAY	PRE MONSOON	JUN	JUL	AUG	SEP	SOUTH WEST MONSOON	OCT	NOV	DEC	NORTH EAST MONSOON	ANNUAL RAINFALL
KUMTAA TALUK	Normal Rainfall (mm)	1	0	10	15	111	137	947	1039	741	341	3067	193	40	8	241	3444
	STDEV	3	1	35	35	162	166	296	385	287	236	676	117	65	20	144	725
	CV%	240	178	195	70	99	62	37	38	49	53	26	55	124	184	43	20

Table 1 : Statistical Analysis of Rainfall Data of Kumtaa Taluk, Uttar Kannada District for the Period 1981 to 2010

Table ____: ANNUAL RAINFALL OF KUMTAA TALUK, UTTARA KANNADA DISTRICT (2010 to 2019)																
Year	**Jan.**	**Feb.**	**Mar.**	**Apr.**	**May.**	**PRE**	**Jun.**	**Jul.**	**Aug.**	**Sep.**	**MON**	**Oct.**	**Nov.**	**Dec.**	**POST**	**Annual**
2010	4	0	0	59	52	115	883	1545	437	704	3569	453	290	4.0	747	4431
2011	0	0	0	87	12	99	977	1167	1144	629	3917	75	6	0	81	4097
2012	0	0	0	52	0	52	870	808	1042	373	3093	162	50	0	212	3357
2013	0	49	0	0	0	49	870	808	1042	373	3093	162	50	0	212	3354
2014	0	0	0	18.1	157	175.1	486	1044	1261	324	3115	107	2	0	109	3399.1
2015	7	0	29	7	68	111	685	740	590	365	2380	95	84	0	179	2670
2016	0	0	0	0	57	57	1967	1251	683	360	4261	260	1	3	264	4582
2017	0	0	0	0	94	94	1193	777	636	336	2942	103	14	6	123	3159
2018	0	0	0	5	203	208	882	761	520	118	2281	162	15	0	177	2666
2019	0	0	0	0	0	0	964.3	1604	1089	643	4300.3	602	22	0	624	4924.3

Table 2 Annual rainfall pattern of Kumta taluk during 2010-2019

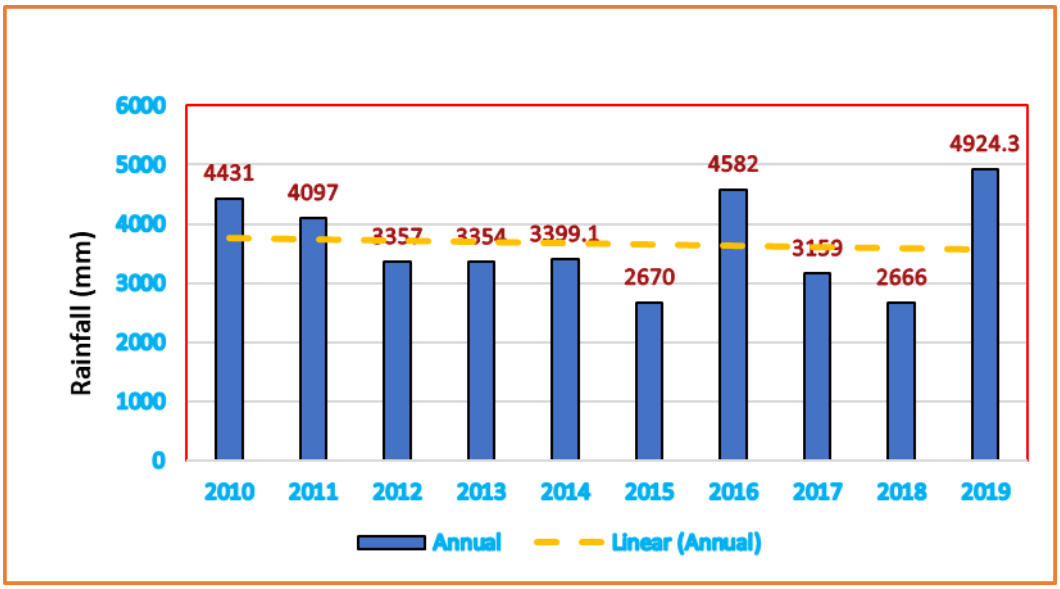


Fig. 2: Annual Rainfall Trend Analysis (2010-2019**)**

The mean maximum temperature is 37°C and the minimum temperature is 16°C. Relative humidity ranges from 64 to 89%. The taluk enjoys semi-arid climate. Dry and hot weather prevails in major part of the year. The area falls under Southern Dry agro-climatic zone of Karnataka state. The taluk depends mainly on monsoon for agricultural operations.

1.4 Agriculture & Irrigation

Agriculture is the main occupation in Kumta taluk. Major Kharif crops are paddy, maize, ragi and vegetables. Important crops of Rabi season are maize, vegetables and oilseeds (Table-3). Water intensive crops like paddy and sugarcane are grown in 54.36 and 0.99% respectively of the total crop area. However, paddy is grown during Kharif period and is mainly dependent on rain water. Horticulture and plantation crops like Coconut,Aracanut grown in 39.79% of total crop area in the taluk. Spices like black pepper,coco are taken in arecanut plantation as inter crop and short duration crop vegetable is grown which require ground water during post monsoon season especially during summer.

Table-3: Cropping pattern 2018-2019 (Ha)

Crop	Paddy	Holticulture and Plantation crops	Groundnut	Sugar cane	Total crop
Area(ha)	5500	4026	490	100	10116

Area %	54.36	39.79	4.84	0.99	100

Source: District at a glance 2018-19, Govt. of Karnataka

Majority of the geographic area is (76.35 %) is covered by forest as show in in fig.3& Table 4 where the eastern part of the Taluk is characterised with Forest which is part of Malanadu. Remaining area is made available for various activities including agriculture. It is observed that net sown area accounts for 14.55 % and area sown more than once is Nil of total geographical area in the taluk. Area not available for cultivation, the other uncultivable land and fallow land cover are 9.15%, 4.86% and 3.46 % respectively of total geographical area.

Total Geographical Area	Area under Forest	Area not available for cultivation	Other uncultivable land	Fallow land	Net sown area	Gross sown area
58331	39641	5340	2838	2023	8488	9763
% of the area	67.95	9.15	4.86	3.46	14.55	16.73

Source: District at a glance 2018-19, Govt. of Karnataka

Table-4: Details of land use 2018-2019 (Ha)

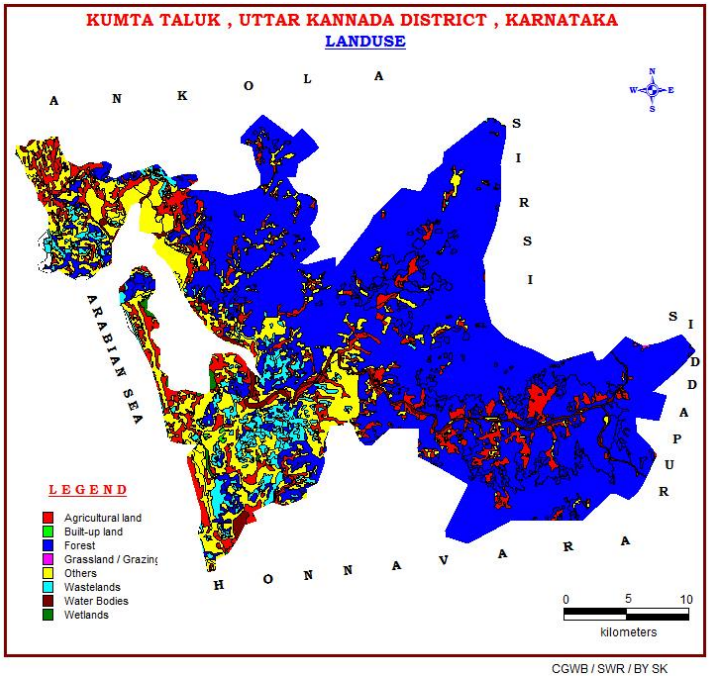


Fig.3 Land use pattern in Kumta Taluk

Dug wells and tanks constitute majority of minor irrigation sources. Dug wells (86.6%) play an important role in supporting the minor irrigation activities followed by Tanks (9.29 %) as depicted in Fig.4

Table-5: Details of Irrigation

Source of Irrigation	No of structures
Canals	0
Tanks	188
Dug Wells	1752
Bore/Tube wells	11
Lift Irrigation	0
Other Sources	72
Total	2023

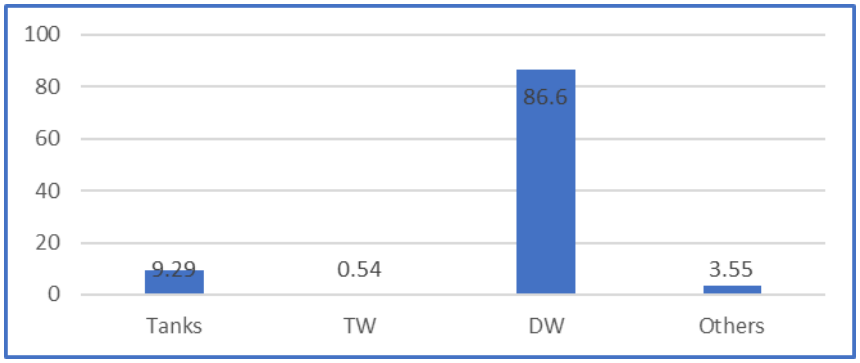


Fig. 4: Sources of Irrigation

1.5 Geomorphology, Physiography & Drainage

The major part of the taluk is covered by hilly areas belonging to Sahyadri hill ranges.Geomorphologically, the taluk is classified as denudational uplands with about 20-25% of the district falling in this category. The taluk shows various land forms like hills and plateaus, piedmont zone, plains, reservoir, reservoir islands, river/stream and tanks, etc. After hilly area the next important geomorphological unit is piedmont zone.Coastal plain is common in the western side. In plain land, the slope runs from east to west and also towards centre. The general topographic elevation ranges from 0 to 495m amsl from west to east of the taluk. Aghanashini river is the major river basin in the Taluk. The taluk is drained by 1st to 4th order streams which flow towards central and central to west. The drainage system is well developed in the taluk byAghnashini. The general drainage pattern is dendritic to sub-dendritic in nature (Fig. 5 and 6).

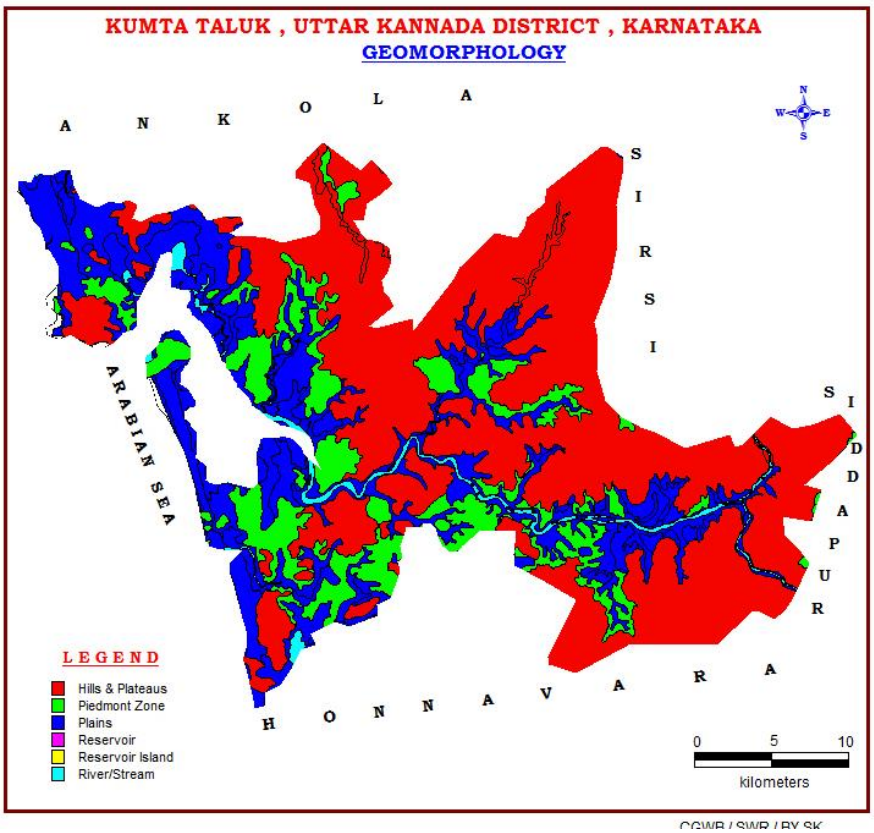


Fig. 5: Geomorphology map

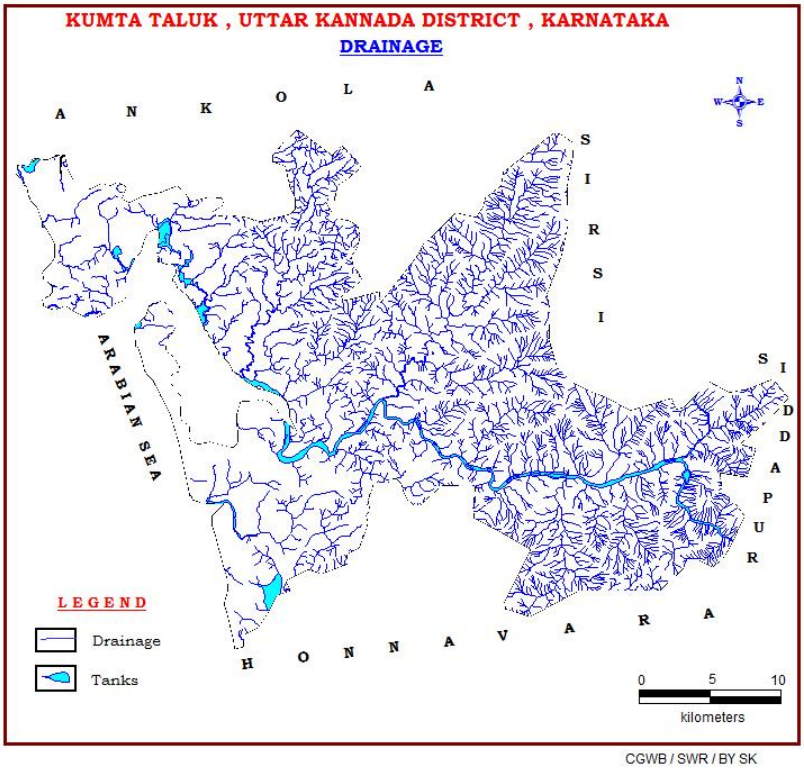


Fig. 6: Drainage map

1.6 Geology and Soils

Kumta Taluk consists of rock formations of Archaean complex characterised by a system of ridges and a plateau on the west. Laterites occur overlying the schist and granites, and alluvium along the rivers and lagoons of the coast.

The identification of stream pattern in the taluk is helpful in identification and interpretation of many geological features. The soil types of the taluk are grouped into three viz., clayey, clayey sketal and rocky land. It is less permeable compare to the sandy soil. It is having good moisture holding capacity and is fertile. These soils are fertile and generally produce good yields. The geology and soil maps have been given in **Fig. 7 and 8.**

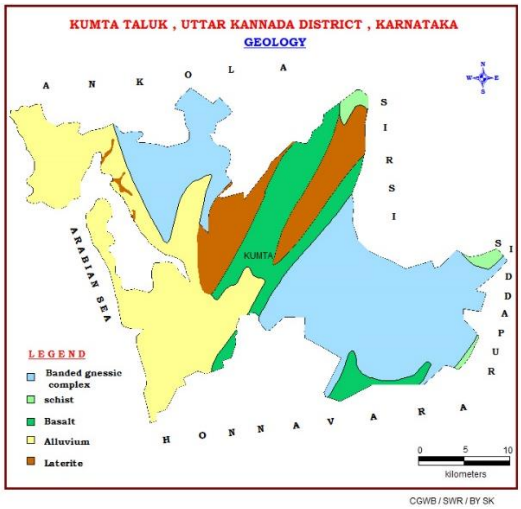


Fig. 7: Geology map

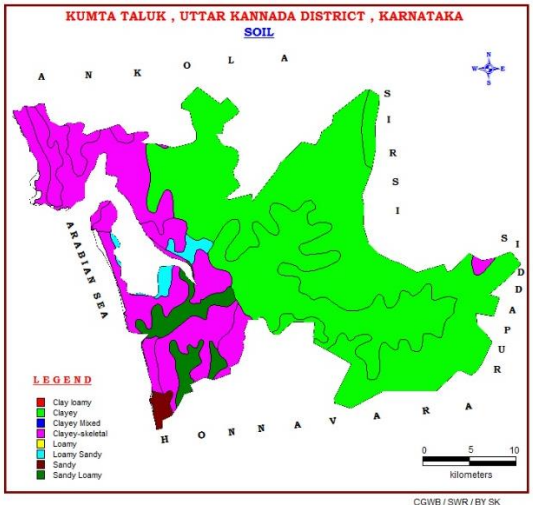


Fig. 8: Soil map

1.7 Ground water resource availability and extraction

As per the ground water resource estimation 2022 (Table 6), the data on ground water resources shows that the net annual ground water availability is 5103.76 ham. The existing gross groundwater for irrigation is 842.39 ham. Net GW availability for future use is 3919.49 Ham. The stage of groundwater development is 23.02% and falling under safe category.

Table.6. Dynamic Ground Water Resource, (March 2022, Figures in Ham)

Annual Extractable GW Resource (Ham)	GW Extraction for Irrigation Use (Ham)	GW Extraction for Industrial Use (Ham)	GW Extraction for Domestic Use (Ham)	Total Extraction (Ham)	Annual GW Allocation for for Domestic Use as on 2025 (Ham)	Net GW Availability for future use (Ham)	Stage of GW Extraction (%)	Categorization (Over-Exploited/ Critical/ Semi-critical/ Safe/Saline)

5103.76	842.39	5.07	327.5	1174.96	336.81	3919.49	23.02	Safe

The details of dynamic (Phreatic) ground water resources for Kumta taluk as on March 2020 is shown in Table.7**.** It is observed that the stage of ground water extraction is marginally increased in the taluk from 18.51 % to 23.02 % from 2020 to 2022. Comparison of the resource calculation shows that the ground water availability is reducing gradually from 2020 2022.

Table.7 Detail of Dynamic Ground Water resource, (as on March 2020)

Net Annual Ground Water Availability	Existing Gross Ground Water Draft for Irrigation	Existing Gross GW 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 Develop-ment	Existing Stage of Ground Water Development	Category
5948.46	834.05	157.06	991.11	161.77	4357.79	18.51	Safe

1.8 Water level behavior

The water level data have been monitored from the representative dug wells and borewells under NHS monitoring programme for both pre and post monsoon seasons during 2022 in Aquifer I (Table 8). During premonsoon season water level ranges from 3.05to 12.9 mbgl, whereas in post monsoon it varies from 2.5 to 12.4 mbgl. Kumta area is showing deeper water level in the taluk due to elevated topography. Water level fluctuation between pre and post monsoon indicate that fluctuation is mostly restricted to <2 and 2-4 m. In Aquifer II, the water level ranges from 4.6 to 9.51 mbgl in premonsoon and 3.1 to 8.25 mbgl during post monsoon as per Ground water Department, Govt of Karnataka data. (Table 9) and the maps shown in Fig 9 to 14.

Table 8: Depth to water level of Pre and Post-monsoon (2019), CGWB

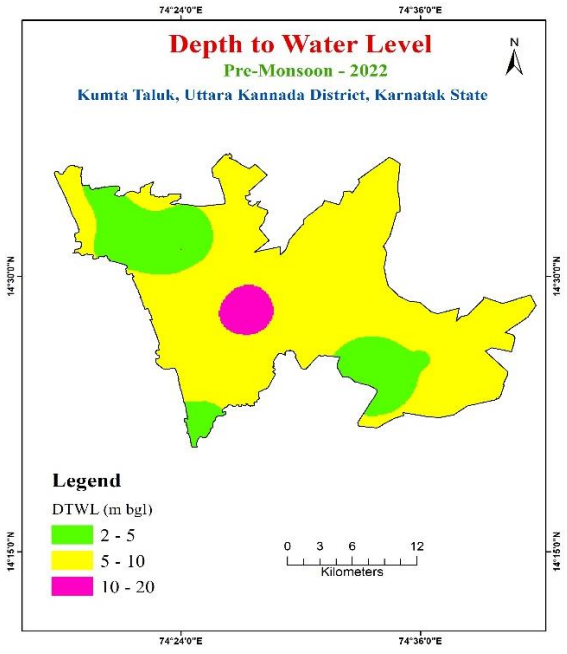
Location	Type	Latitude	Longitude	Depth	MP	May-22	Nov-22
Alakod	DW	14.32	74.48	12.15	0.7	10.2	9.3
Antarvalli	DW	14.47	74.45	14.65	0.7	12.9	12.4
Badal	DW	14.43	74.6	8.7	0.63	4.99	4.97
Bargi	DW	14.53	74.4	8.5	0.6	2.54	2.63
Deevalli	DW	14.42	74.55	7.4	0.75	3.74	3.55
Dhareshwara	DW	14.37	74.4	6.62	0.7	3.8	3.67
Gokarn	DW	14.55	74.32	12	0.7	5.46	5.51
Kumta1	DW	14.4	74.4	14.35	0.66	6.37	7.14
Madangeri	DW	14.58	74.37	12.05	0	6.16	5.88
Mirjan	DW	14.49	74.42	10	0	6.31	7.16

Torke	DW	14.56	74.35	10	0.75	3.05	2.50

Table 9: Depth to water level of Pre and Post-monsoon (2022) (State GW Directorate, Govt. of Karnataka)

Location	Bore/Dug	Depth (mtrs)	Latitude	Longitude	Altitude	May-22	Nov-22
Gokarn	DW	5.00	14.548	74.321	10.15	2.60	1.20
Harita	DW	8.00	14.506	74.517	22.56	10.00	4.25
Harita	BW	60.00	14.483	74.493	21.22	9.51	8.25
Hiregutti	DW	6.45	14.563	74.387	4.59	4.55	3.65
Hiregutti	BW	60.00	14.563	74.388	4.44	4.60	3.10
Kumta	DW	10.75	14.431	74.419	15.43	4.40	4.80
Muroor	DW	13.65	14.443	74.471	9.67	11.49	10.89
Muroor	BW	82.00	14.4	74.481	6.71	5.50	5.00
Santeguli	DW	10.00	14.427	74.58	33.50	5.00	4.00
Santeguli	BW	60.00	14.426	74.582	35.35	6.30	5.16

Aquifer I



`Fig. 9: Pre monsoon water level

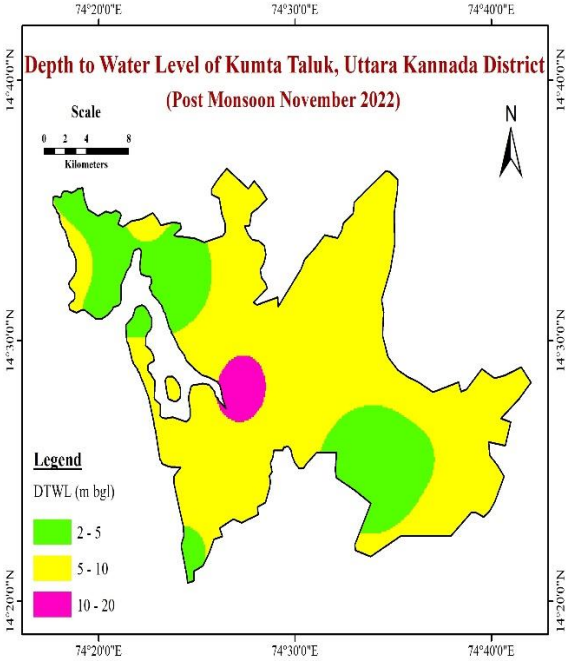


Fig. 10: Post monsoon water level

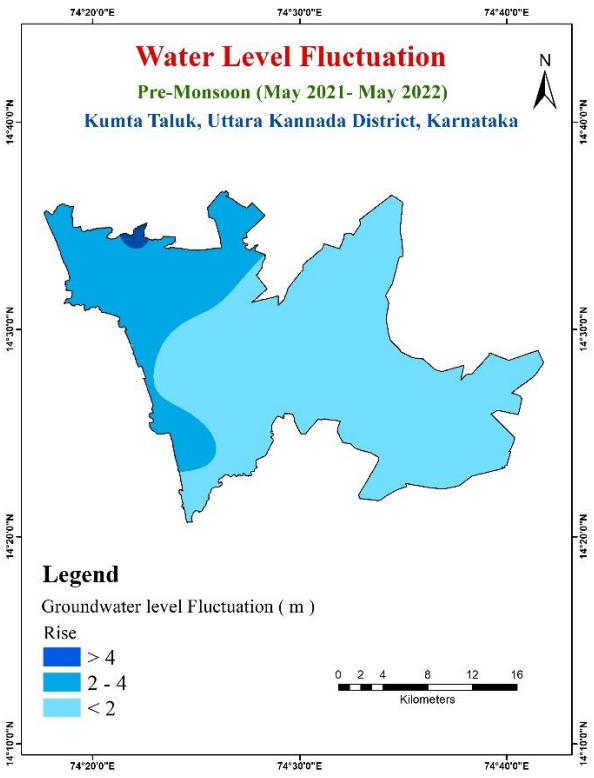


Fig. 11: Fluctuation Map

2 DATA GAP ANALYSIS

2.1 Exploration

The past exploration data has been analyzed and it was that few EW drilled in the Uttar Kannada district is falling in Kumta taluk by CGWB exploration team.The vast spread of thick forest may be one reason for not getting additional space for drilling.

2.2 VES and Profiling

Five VES had been conducted and the field data obtained was analysed quantitatively using model curves which has given rise to three to five geoelectric layers. At about 60% of the sites the bottom most layer is indicating high resistivity, which represents massive/hard formation in nature.

The lithological interpretation indicates the presence of a maximum of three layered geoelectric formations in the study area. Viz, lateritic top soil, weathered and hard formations. Based on the resistivity contrast the weathered layer can be differentiated as highly weathered and weathered. This trend is not uniform throughout the area. This is underlain by hard formation.

Top soil: The first layer obtained from the interpretation is considered as top soil with a resistivity in the range of 120-7200 Ohm.m. The thickness of this layer is varying in the range of 0.8 to 4.5mts. The higher order of resistivity value indicates lateritic in nature and the lower order indicates loamy/sandy soil. This zone is underlain by weathered formation.

Weathered zone: Depending on the type of VES curve and resistivity range this zone can be discussed under two distinct geoelectric formations.

The resistivity in the range of 17-90 Ohm.m. indicates highly weathered formation which is extending upto a depth of 28mts. (at some sites upto 130 Ohm.m.).

The second range of resistivity is 110-280 Ohm.m. which may be referred to weathered formation and is extending upto depth of 50mts.

Hard formation: The fourth geoelectric layer can be demarcated as semi weathered/fractured zones and massive formation.

The weathered zone is followed by a layer of resistivity in the range of 320-1100 Ohm.m. which may be inferred as hard formation with fractures at depth. This zone is extending to a deeper depth of 110mts. At some of the sites the depth of this layer could not be ascertained as the trend of the curve is extending in nature. Hence such sites in the taluks of Karwar, Bhatkal and Kumta are recommended for drilling.

The last layer which is having a resistivity in the range of 1100-3500 Ohm.m. is inferred as massive formation. In this resistivity range also, the curve is extending at some of the sites.

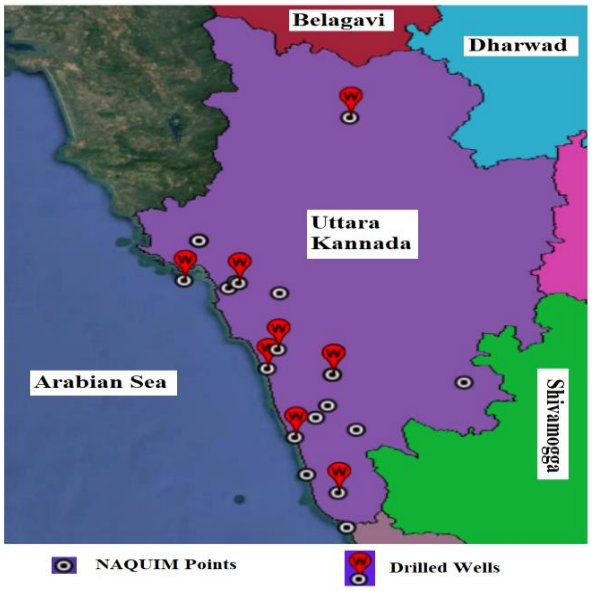
The field data obtained and interpreted results reveals the following observations in the study area. The top soil thickness is varying in the range of 2.4 - 6.0mts. which is minimum in Ankola taluk and maximum in Bhatkal taluk. It is followed by the highly weathered formation (lithomorgic clay) in Karwar, Kumta and Bhatkal taluks upto a maximum depth of 22mts. Whereas in Ankola and Kumtaa taluks the top soil is underlain by weathered formation(demarcated on the basis of higher resistivtiy range). The depth to massive formation ranges from 60 to 80mts in all the taluks which is expected with fractures at depth.

By considering the geophysical survey results the sites were recommended for drilling. The discharge ranged from 1.5 to 5.4lps.. In Kumta taluk the general lithology is schist, granite, and granite gneiss. The drilling results in this taluk indicated a maximum casing upto a depth of 44mts.and fractures tapped at depths of 55, 72mts. The discharge range

in this taluk is 0.77 to 5.4lps. Though the lithology is uniform in Kumtaa and Bhatkal taluks, variation in yield was observed. Shallow fractures were encountered at the depths of 17 and 32mts. with negligible yield in Bhatkal taluk where as in Kumtaa taluk a maximum of 2.6lps yield was obtained from deeper fractures.(Table-10)

Sl No	State	Block/Taluk	Location	Lat	Long	Identified weathered formation (m)		Thickness of weathered formation (m)-Aq-I	Depth range of fracturesinferred (m)(Aq-II)	Remarks(Site recommended &Well drilled)
1	Karnataka	Kumta	Chandavar	14.4056	74.5540	0	18	18	18-80	Well drilled
2	Karnataka	Kumta	Manki	14.2104	74.4643	0	19	19	25-70	Well drilled
3	Karnataka	Kumta	Gundabal	14.3091	74.5420	0	7	7	7.0-40	
4	Karnataka	Kumta	Kolagadde	14.2719	74.5140	0	6	6	10.0-50	
5	Karnataka	Kumta	Samshi	14.2338	74.6080	0	8	8	8.0-75	

Table-10 Details of VES interpretation in Kumtaa Taluk



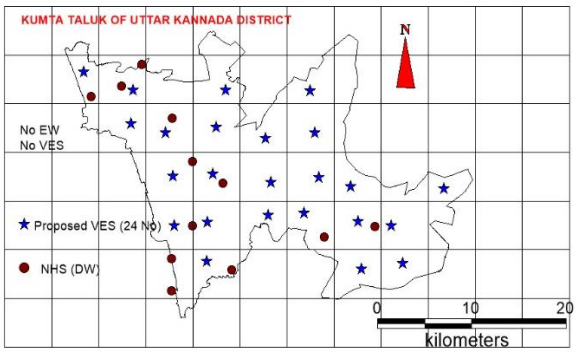


Fig.12 Tentative VES locations in Uttar Kannada district and proposed VES locations for current studies.

3.AQUIFER DISPOSITION

The occurrence and movement of water in the subsurface is broadly governed by geological frameworks i.e., nature of rock formations including their porosity (primary and secondary) and permeability. The principal aquifers in the area are Gneisses and Schist and the occurrence and movement of ground water in these rocks is controlled by various factors and it primarily depends on the degree of interconnection of secondary pores/voids developed by fracturing and weathering in the hard rock.

3.1Aquifer types

In Kumta taluk, there are mainly two types of aquifer systems;

- Aquifer-I (Phreatic aquifer) comprising weathered Laterite and Weathered residuum.
- Aquifer-II (Fractured aquifer) comprising Fractured Granitic Gneisses.

Main aquifers in the study area are the weathered and fractured zones of meta-sedimentaries, granites, gneisses and laterites. The alluvial patches are found along the major stream courses such as Aghanashini.Occurrence and movement of ground water are controlled by the degree of weathering, fracturing and the geomorphologic set up in the area.

3.2 Aquifer Maps

Ground water occurs within the weathered and fractured formations under water table condition and semi-confined condition. CGWB had drilled only few EW in the Taluk(Kumta & Mirjan). State GWD has drilled 14 no Bore wells were drilled from a minimum depth of 90 mbgl to a maximum of 130 mbgl. Depth of weathered zone ranges from 9.8 mbgl to 79 mbgl (Fig.13). Yield ranges from 0.02 to 4.3 lps. The basic characteristics of each exploratory well is summarized in Table -11.The 2D aquifer disposition and 3D aquifer fence diagrams have been prepared and presented in Fig. 14, 15.Aquifer map is prepared for Kumta Taluk is presented in Fig.16

Sl No	BW Location	Longitude	Latitude	TD (m)	Casing	Discharge
1	Divgi	74.4464	14.4519	122	79	1.5
2	Hegde	74.4303	14.4569	93	35	0.04
3	Kimani	74.3994	14.5147	91	26	0.5

4	Nilkod	74.5164	14.3789	114	36	1.6
5	Navagrama (ohm Beach)	74.3283	14.5450	95	30	1.5
6	Mulakeri	74.3608	14.2389	75	13	1.5
7	Tannirkuli	74.4278	14.4561	116	25	0.02
8	Jaddimule	74.4386	14.4547	98	35	3
9	Kaire	74.4286	14.4847	95	35	3
10	Mirjan	74.4350	14.4828	100	9.8	4.3
11	Bargi	74.3931	14.3844	90	15	4.3
12	Holangedde	74.4319	14.4094	137	57	1
13	Kudle Beach	74.3172	14.5275	100	10	1
14	Santeguli	74.3967	14.4269	100	40	4.3
15	Kumta	74.4247	14.0311	171.8		
16	Mirjan-1	74.4252	14.9880	171.7		

Table-11: Exploration details of BW drilled by State GWD/CGWB

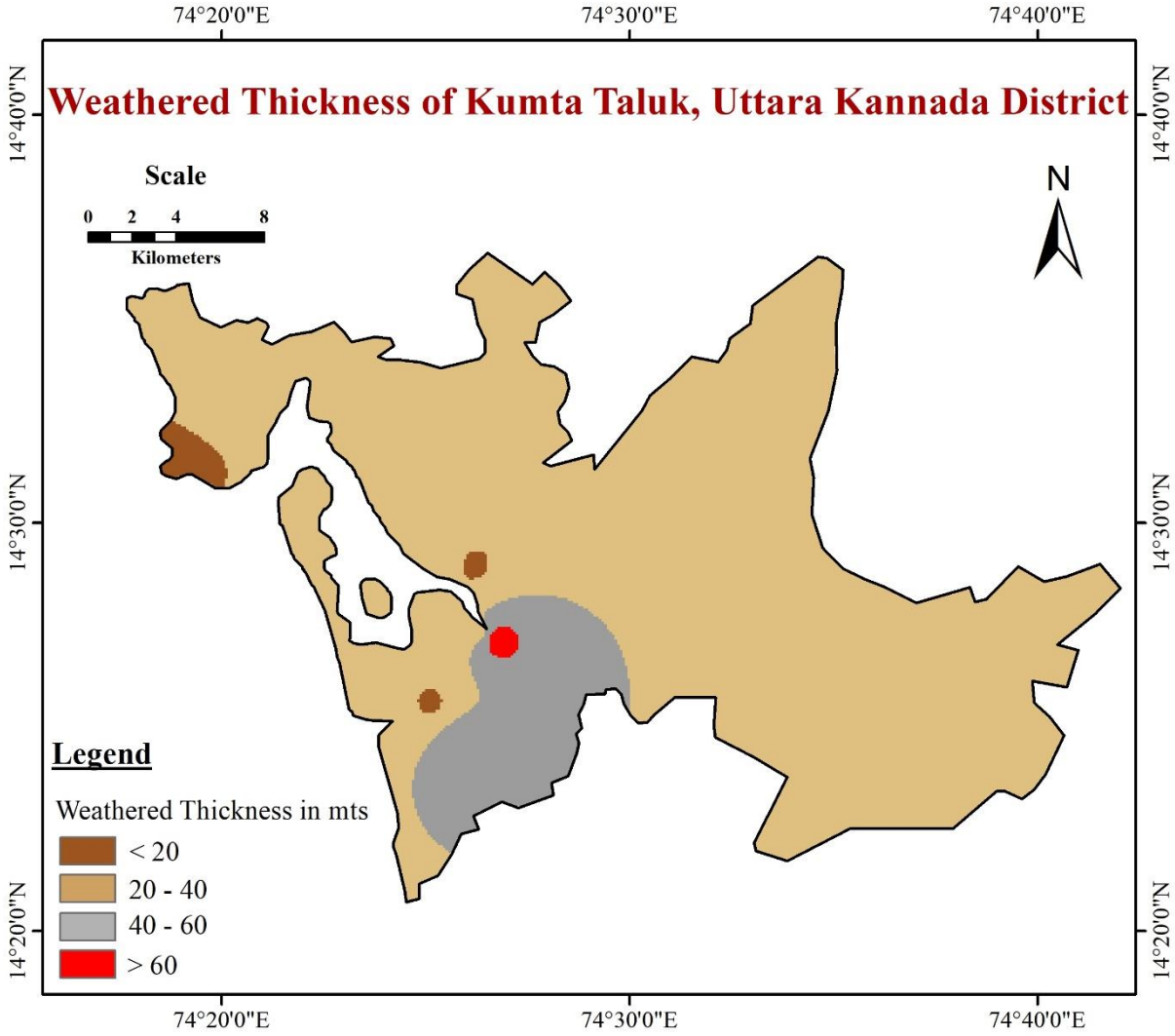


Fig.13 Weathered thickness map

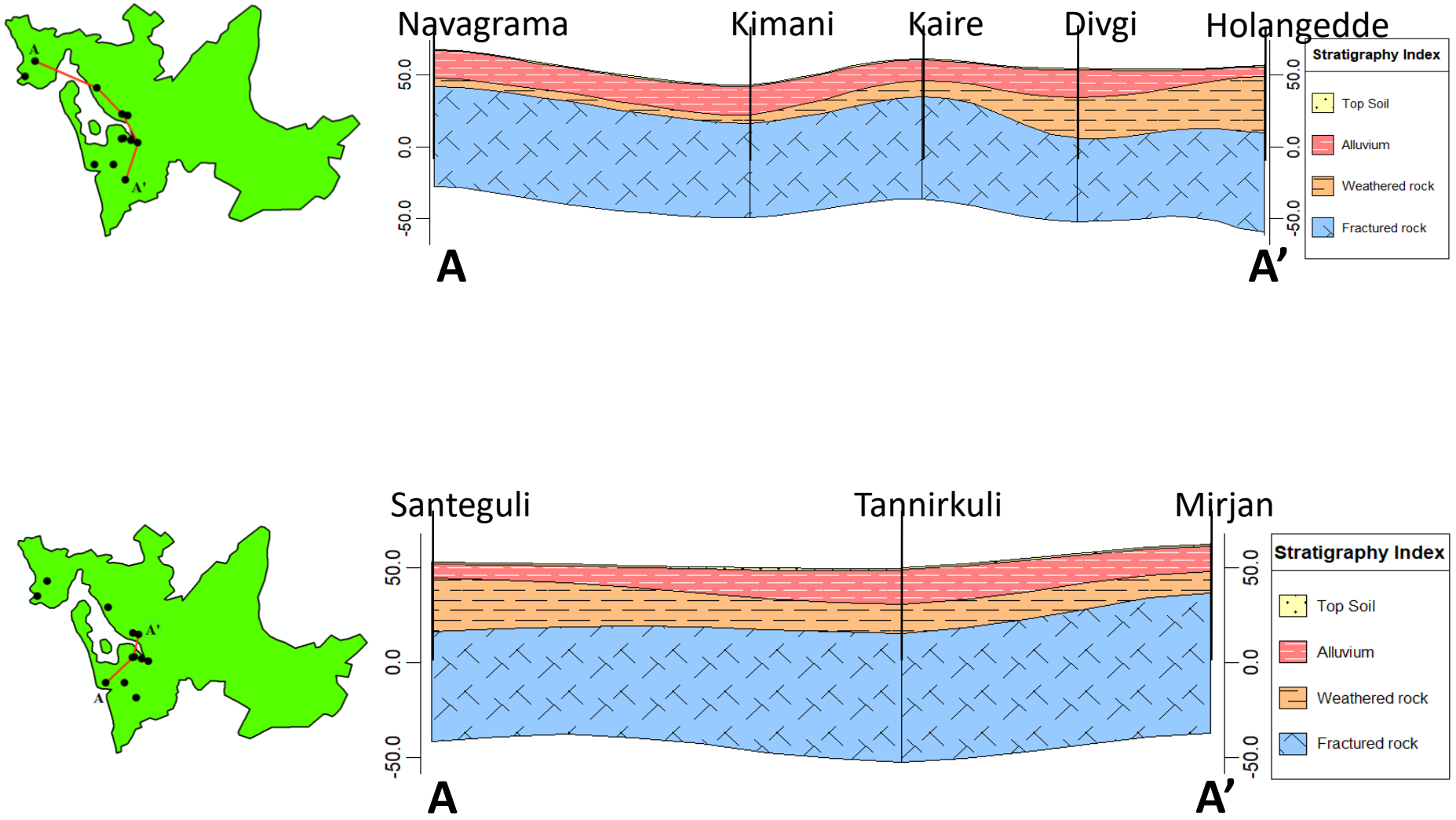


Fig.14 2D Aquifer disposition

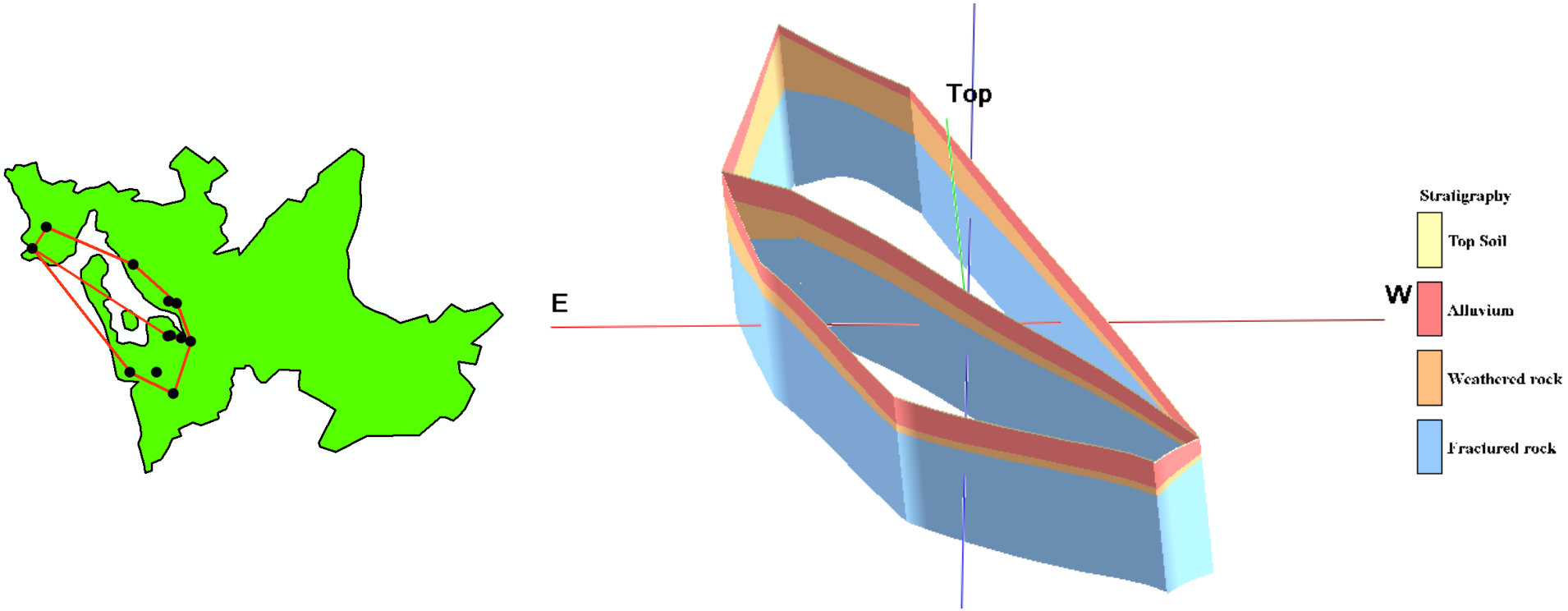


Fig.15 3D Aquifer fence diagram

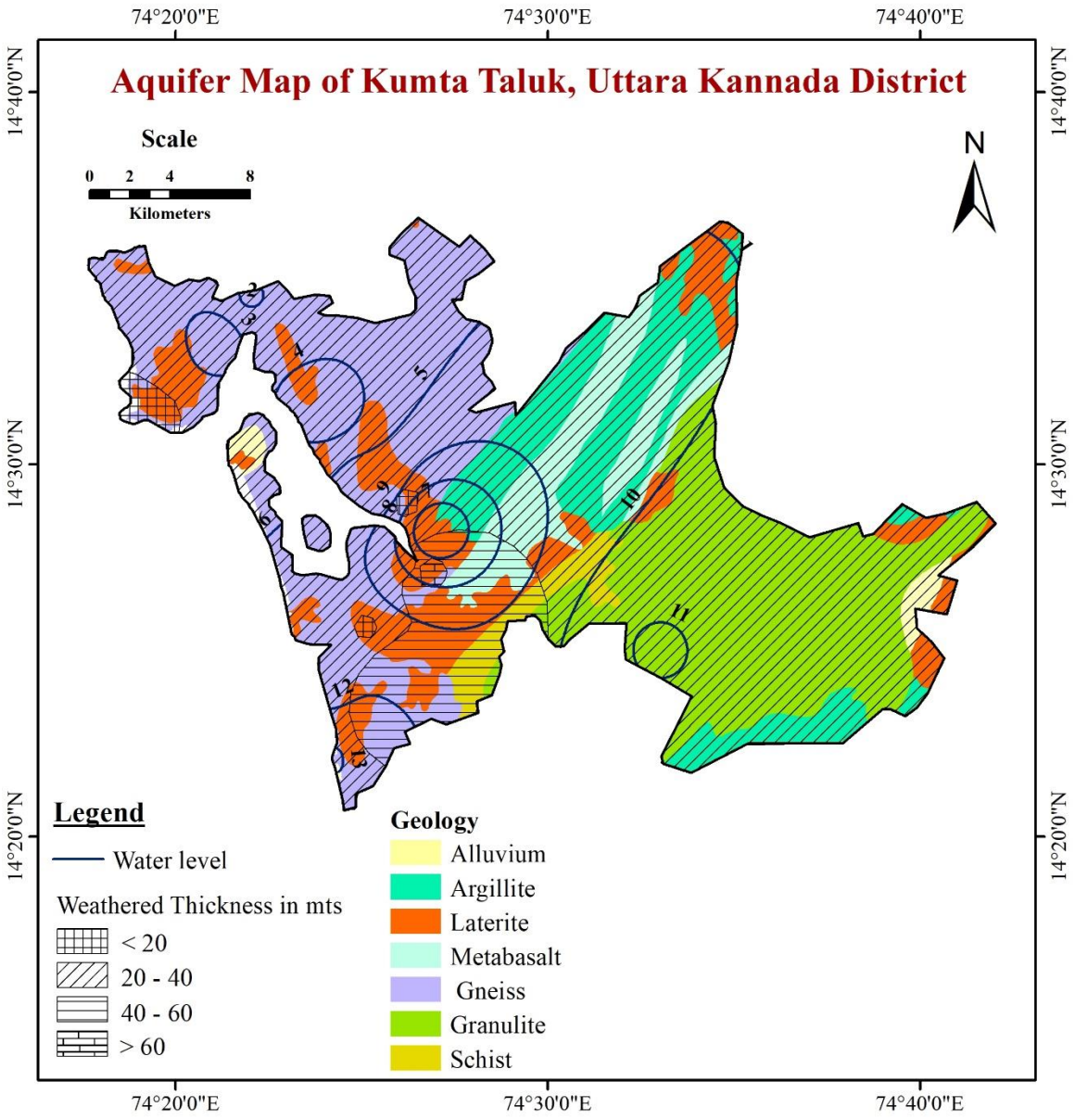


Fig.16 Aquifer Map of Kumta Taluk

4 GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES

The main ground water issues are limited Ground Water Potential / Limited Aquifer Thickness / Sustainability, deeper water levels especially in Aquifer II, salinity intrusion in the back water areas adjoining river Aghnashini/salt pans at Sanikatta region which are all inter-related or inter dependent.

4.1 Comparison of Ground Water Resource and Extraction

The Dynamic Ground Water Resource 2020 and as on 2022 have already been summarised above and are shown in Table-12. It is observed that the ground water availability in 2022 is less compare to 2020 due to decrease in rainfall and in water table. It is attributable to the improvement in the irrigation practice, influence of command area and also due to the water conservation / recharge activities carried out in the taluk by various state govt. and other agencies.

Table 12 : Comparison of groundwater availability and draft scenario (in ham)

Taluk	March 2020			March 2022		
	GW availability	GW Extraction	Stage of GW development	GW availability	GW Extraction	Stage of GW development
Kumta	5353.61	99.11	18.51%	5103.76	1174.96	23.02 %

4.2 Chemical quality of ground water and contamination

The water samples were collected in different parts of Kumta taluk during May 2022 and also in March 2023 and the data is given below in Table 13. The results of quality parameters shows that all the chemical constituents are within the permissible limit.

Table 13: Water quality parameters

Sl No	SITE_NAME	Taluk	LAT	LONG	PH	EC	TH	Ca	Mg	Na	K	CO3	HCO3	Cl	SO4	NO3	F
1						µS/cm	<.....mg/L.....>										
2	ALAKOD	Kumta	14 29 05	74 29 41	6.89	110	30	4	5	7.39	0.88	0	25	18	0	2.61	ND
3	ANTARVALLI	Kumta	14 28 27	74 27 47	7	90	25	6	2	8.48	0.55	0	25	14	0	4.2	0.27
4	BADAL	Kumta	14 25 56	74 36 50	7.06	90	25	6	2	9.87	0.92	0	25	14	0	3.43	ND
5	BARGI	Kumta	14 31 36	74 24 19	7.27	180	45	12	4	11.69	7.56	0	49	21	2	8.56	0.54

6	DEEVALLI	Kumta	14 25 06	74 33 12	7.1	130	45	6	7	7.92	0.54	0	49	11	0	2.48	ND
7	DHARESHWARA	Kumta	14 22 11	74 24 39	7.6	100	30	4	5	7.96	1.55	0	25	14	5	4.89	ND
8	GOKARNA(A)	Kumta	14 32 58	74 19 27	7.86	200	61	10	9	15.38	1.6	0	55	28	6	2.75	0.1
9	KUMTA	Kumta	14 25 38	74 25 16	7.3	170	51	10	6	13.04	1.85	0	55	18	3	9.72	ND
10	MADANGERI	Kumta	14 34 41	74 22 31	7.91	330	91	22	9	25.36	1.19	0	68	50	5	35.42	ND
11	MIRJAN	Kumta	14 29 43	74 25 22	7.28	80	25	6	2	5.95	0.79	0	25	14	0	0	ND
12	TORKE	Kumta	14 33 25	74 21 04	7.6	240	81	14	11	13.79	0.53	0	37	57	3	1.11	ND

In general, ground water quality in Kumta taluk is good for drinking purpose. Ground water samples have also been tested and found suitable for agriculture & irrigation purposes.

During summer months it is observed that saline water intrusion in the back water inlets of Aghanashini river especially in Salt fields of Sanikatta and adjoining areas.

5.GROUND WATER RESOURCE ENHANCEMENT

As per GWRA 2022, Kumta Taluk is in Safe category where the stage of ground water development is within 23%.So little scope exist in enhancing the GW resource of the Taluk. Being a coastal taluk in Konkan coast and Tourism activities are gaining attention day by day, recharging the aquifer is still worthy. Recharging of phreatic aquifer (Aquifer-I) in the taluk can be done through construction of artificial recharge structures, viz. Check dams, percolation tanks & subsurface dykes. 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. Artificial Recharge Structures and Water Conservation Plans are proposed in the taluk through utilizing the uncommitted surface runoff of 24.92MCM (Table 14). By constructing 131 check dams, 22 percolation ponds and 1 subsurface dyke in the taluk, 0.23 lakhs hectares of additional irrigation potential can be created. (Table 15).

Table 14: Quantity of non-committed surface runoff & expected recharge through AR structures (As per Master Plan on Artificial Recharge in Karnataka, 2020)

Artificial Recharge Structures Proposed	Kumta taluk
Non committed monsoon runoff available (MCM)	25.15
Number of Check Dams	128
Number of Percolation Tanks	23
Number of Subsurface dykes	01

Number of Filter beds	04
Tentative total cost of the project (Rs. in lakhs)	1753.44
Expected recharge (MCM) @50%	18.662
Additional irrigation potential (in hectares)	2300

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 groundwater development
	HAM	HAM	%	HAM	HAM	%	%
Kumta	5103.76	1174	23.02	1866	6969	6.18	16.84

Table 15: Improvement in GW availability due to Recharge as per GWRA 2022

5.1 Strategic Action Plan:

The provision for minimum protective irrigation can only improve the agricultural growth in the taluk which is dependent on rain. This objective can be achieved by utilizing the rain water more efficiently by harvesting structures like farm ponds, check-dams, barrages and other surface structures. The Strategic Action Plan, prepared for the taluk has included the irrigation infrastructure for major irrigation, minor irrigation, ground water recharge, harvesting of rain water, improvement of irrigation efficiency and strengthening the adoption of micro-irrigation. Considering the existing infrastructure in the taluk and considering the irrigation potential required to be created to meet the gap between demand and supply of all the sectors of water use, the Strategic Action Plans are developed under PMKSY project and the same is given below.

5.2 Demand side interventions

(a)Advanced irrigation practices

It is observed that 86 % of irrigation is done through Ground water based sources (Dug wells) . Only 9% of the irrigation through surface water such as tanks/ponds and thus, by adopting the below mentioned techniques will reduce the load on in ground water sources.

- Efficient irrigation practices like Drip irrigation & sprinkler needs to be adopted by the farmers in the existing gross irrigated area.
- Efficient irrigation techniques will contribute in saving ground water and thus will improve stage of development.

(b)Other interventions proposed

- Periodical maintenance of artificial recharge structures should also be incorporated in the Recharge Plan.
- Roof top rain water harvesting.
- Micro irrigation.

6.Management strategies &Aquifer Management Plan

Average stage of ground water development in the district is 23 % and remaining 77 % is yet to be tapped for various developmental activities. Considering the fact that Kumta Taluk is known for plantation crops such as coconut and arecanut , use of ground water through sustainable irrigation practices may yield more production and the per capita income of people will go up. Therefore effective utilization of ground water resource is the challenging part in management of groundwater resource in Kumta taluk. Hence, it is pertinent to formulate a practical and scientific management plan suitable to the area. In the present study, sustainable management plan for groundwater resources is being proposed after a detailed understanding of the aquifer disposition down to the target depth of 200 m bgl and estimation of available resources.

Even though the study area receives good annual rainfall and has best climatic conditions ,it has been experiencing incidents of water scarcity in summer months for consummating domestic and irrigation requirements. It is observed that even in the years of normal rainfall, summer water scarcity problems are existing in areas close to Malnadu area in the east. This perplexing condition is attributed due to natural reasons such as highly undulating topography with steep slopes create result in low recharge rate. In addition to this ,limited weathered residuum limits groundwater storage in the aquifer system. In situ conservation of rain water and conservation of surplus run-off during monsoon and other artificial recharge measures to supplement the domestic and irrigation needs are the possible solutions to overcome this problem.

6.1 Sustainable plan

The effective utilization of existing resources is kept under consideration while preparing sustainable plans which can be done easily in case of Kumta Taluk as the block is in safe category and resources are under utilised. The average stage of development in all blocks is about 23% which means that there is scope for further ground water development for irrigation in all blocks where the stage of extraction is low. While formulating various ground water development and management plans, geology and geomorphological features of the area should be given due importance.

New irrigation techniques like drip and sprinkler irrigation methods have to pay a vital role in the taluk where these techniques have major impact in boosting the production of coconut and cash crops. Since it supplies water directly to the crop, rather than the land around, water

losses occurring through evaporation and distribution are significantly reduced. There is water saving of 30-70 per cent for different crops like coffee, arecanut, nut meg, banana and plantains under drip/sprinkler method of irrigation. Farmers may be encouraged to adopt these modern irrigation techniques to have optimal use of the available resources.

6.2 Augmentation plan

Topography of the area is suitable for implementing various artificial recharge structures such as percolation ponds, check dams (CD), and sub-surface dykes\ etc. Enough measures must be taken to prevent building up of saturated soil condition especially along steep valley slops and hilly area to avoid land slide. Periodic de-siltation as well as cleaning of existing check dams, bunds and ponds are recommended for increasing the storage capacity as well as infiltration rate. In order to reduce the surface run off, gully plugs are suitable for along 1st order streams , nallah bunds/cross bars for 2ndorder and check dams is recommended for 3rd and higher order. This is to ensure that flow in rivers during summer months by limiting rainfall run off.

6.3 Scope of Artificial Recharge structures

Since Kumta Taluk is a plantation/agriculture based taluk and there is ample scope for artificial recharge structures to maintain the availability of water through out the year for farming/plantation activities even though it is getting high rainfall and low groundwater development. The undulating topography and thin weathered aquifer systems resulted in limited water storage capacity

The main ground water issues are Sustainability of phreatic aquifer during the summer months, deeper water levels particularly in Aquifer II in some parts, hilly and plateau areas which are all inter-related or inter dependent. The summary of ground water management plan of Kumta taluk is given in Table-16.

Table 16: Summary of Management plan

Stage of GW Extraction and Category (2020)	23.02 %, Safe
Annual Extractable GW Resource (Ham)	5103.76
Total Extraction (Ham)	1174.96
Net GW Availability (Ham)	3919.49
Ground Water Draft for Irrigation (Ham)	842.39
Ground Water Resource Enhancement by Supply side Interventions	

No of Proposed AR structures SSD	1
PT	23
CD	128
FB	04
Expected Additional Recharge to GW due to AR (Ham)	1866
Additional Irrigation Potential that can be created (Ha)	2300
Total Estimated Expenditure (Rs. in Lakhs.)	1753.44
Change in Stage of GW Extraction (%)	23 to 16.84

As per the resource estimation – 2022, Kumta taluk falls under Safe category with the stage of ground water extraction is 23%. However, there is need to formulate management strategy to tackle the water scarcity related issues in the taluk in the coming days to avoid water crisis in the future. It is suggested to adopt a scientific and multi-pronged ground water management strategy covering supply side interventions aspects as mentioned in the management plan suggested above.

6.4 Ground water resource enhancement by supply side interventions: Quantity of surface water available through non-committed surface run-off is estimated to be 2514 Ham. This can be used to recharge the aquifer mainly through check dams (128), percolation tanks (23), and sub surface dyke structures (1). The volume of water expected to be conserved/recharged @50% efficiency is 1866 ham through these AR structures. The approximate cost estimate for construction of these AR structures is Rs. 1753.44 lakhs Cr. The additional area which can be brought under assured ground water irrigation will be about 2300 hectares. However, the figures given are tentative and pre-field studies / DPR are recommended prior to implementation of these recharge structures.

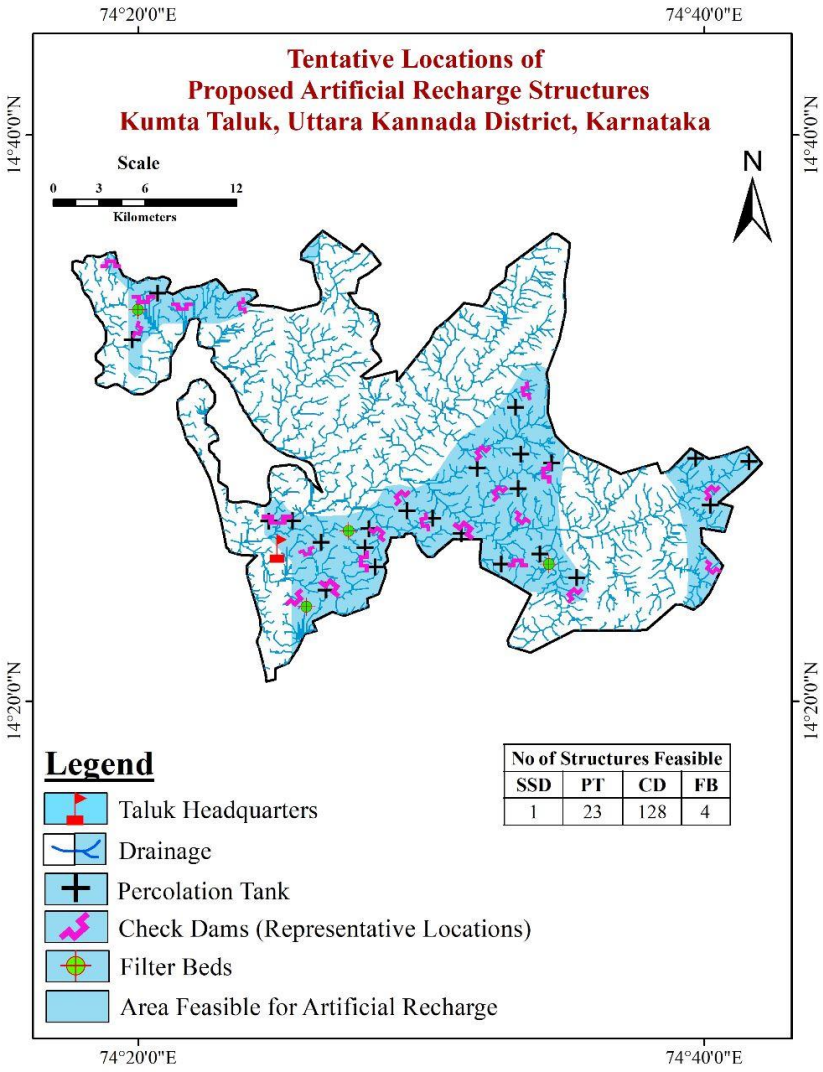


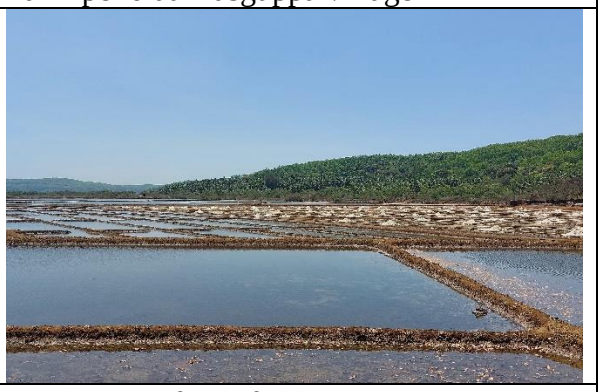
Fig.17:Tentative locations of proposed ARS

6.5 Ground water resource enhancement by demand side interventions: At present about 63% of irrigation is by wells and bore wells (ground water). The micro irrigation practices like drip and sprinkler irrigation are comparatively less practiced in comparison with traditional surface flooding mode of irrigation. The micro irrigation water efficient methodology needs to be adopted for growing horticulture and plantation crops/paddy which accounts for 94 % of the total cropped area in taluk

6.6 Summary

- Two aquifer systems were identified in the Taluk viz; the phreatic aquifer system (Aquifer-I) and the fracture aquifer system (Aquifer-II). The phreatic aquifer system comprises weathered zone with laterite/river alluvium at places. The deeper fractured crystalline aquifers are under confined to semi confined conditions and the potential fractures are encountered up to 140 m bgl. The water level in majority of area is within range of 5-10 m bgl(Phreatic aquifer)
- The Taluk is bestowed with abundant water resources (Total 51.03 MCM, and block is in Safe category and average stage of development is about 23 %.Therefore sufficient scope exist for future GW development.
- No major issues could not be identified from the Aquifer Mapping Studies in terms of groundwater availability or water quality. However shortage of drinking water in elevated areas is encountered during lean periods due to limited aquifer thickness and high rates of base flow. Also Salinity ingress is observed during summer months in places like Sanikatta areas due to Salt production in the back water of Aghanashini river.
- Aquifer Management plan proposes the need to construct various Artificial Recharge structures such as 128 Check dams, 23 Percolation Tanks ,1 SSD and 04 Filter Beds in convergence with ongoing MNREGS and PMKSY. This will create an irrigation potential of 2300 ha.
- Micro Irrigation practices like Drip and sprinkler irrigation can be adopted in to improve water use efficiency and crop yield.

Field Photos

	
Laterite mining at Musguppa village	Farm pond at Masguppa village
	
Laterite-Hard rock contact on road cutting at Dundkuli on NH	Areal view of Salt fields in Sanikatta,Gokarna on backwater areas of Aghanashini river
	
Salt pans at Sanikatta,near Gokarna	Hard rock exposures at Ohm Beach, Gokarna