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

Honnavara Taluk, Uttara Kannada District, Karnataka

दक्षिण पश्चिमी क्षेत्र, बेंगलुरु

South Western Region, Bengaluru

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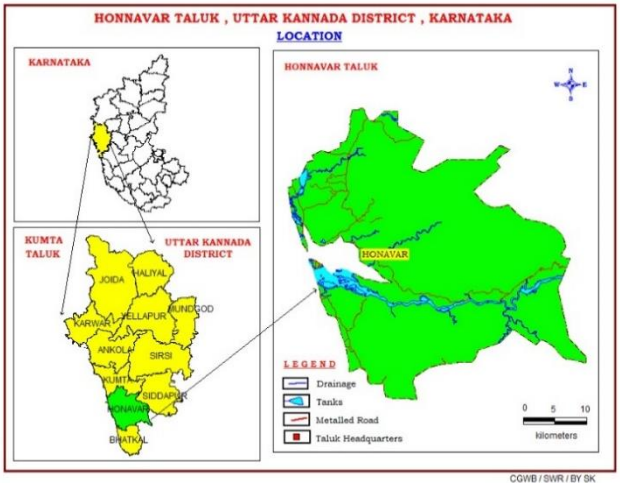
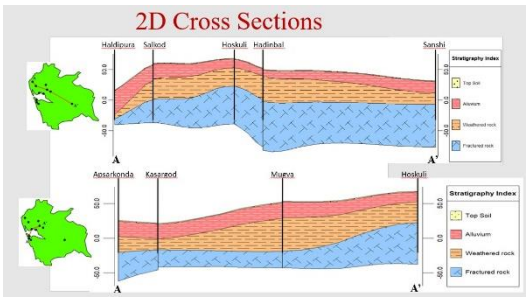
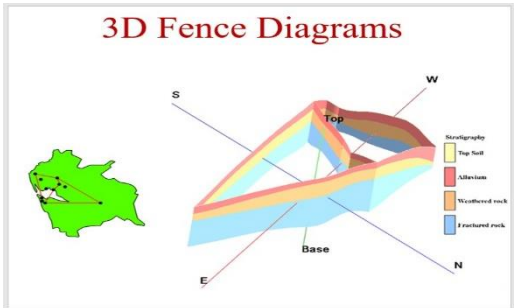
Bengaluru

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

CONTENTS

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

1. SALIENT FEATURES

Name of the Taluk	: Honavar
District	: Uttara Kannada
State	: Karnataka
Area	: 756.1 sq.km
Population (Census 2011)	: 166,264
Normal annual rainfall	: 3682 mm

1.1. Study area

Aquifer mapping studies were carried out in Honavar taluk, Uttara Kannada district, Karnataka State under National Aquifer Mapping Project during the AAP 2022-23. The taluk is covering an area of 756.1 sq.km. The geographical extents of Honavar taluk of Uttara Kannada district is located between North Latitudes 14° 06' 22.32" and 14° 25' 55.56" and East Longitudes 74° 24' 29.16" and 74° 43' 54". 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. Honavar taluk is bounded by Kumta taluk towards North, Siddapura and Shimoga district (Sagar Taluk) towards East, Bhatkal taluk towards South and Arabian Sea towards West. Taluk administration of Honavar is divided into 3 Hoblies and 231 Grama Panchayaths. Honavar town is the taluk head quarter. There are 94 villages present in the taluk. Location map of Honavar taluk is presented in **Fig. 1.** Sharavati river is one of the main attractions of Honavar. The river joins the Arabian Sea at Honavar. While joining the sea, the river has created some islands.

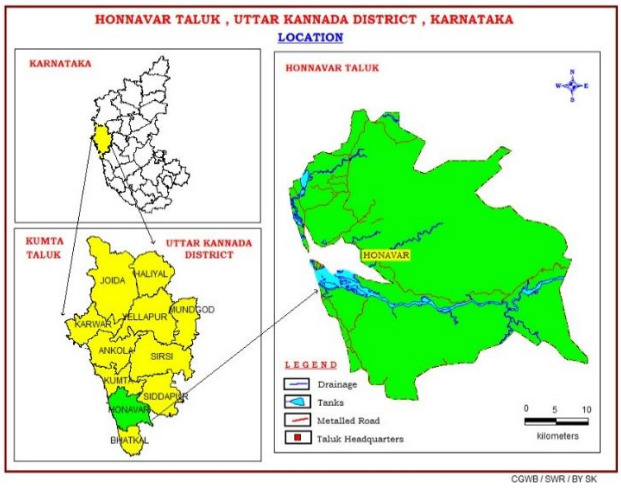


Fig. 1: Location Map

1.2 Population

According to 2011 census, the human population in Honavar taluk is 166264 out of which 88.51% constitutes the urban population and only 11.49% constitutes the rural population. The taluk has an overall population density of 221 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
166264	83196	80368	15861	998	221	76.17 %	88.51 %	11.49 %

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

1.3 Rainfall and Climate

Honavar 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

Honavar 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 Honavar taluk for the period 1981 to 2010 is 3682 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 Honavar taluk is ranging between 1 mm during January to 1109 mm during July. The CV percent for pre monsoon, 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 Honavar taluk is given in Table 2. The Honavar taluk has received less than normal annual rainfall in last 10 years during 2012, 2013, 2015, 2016, 2017 and 2018. Highest rainfall occurred during the year 2019 (5223.9 mm) and lowest rainfall received during the year 2015 (2985 mm) (Fig .2).

STATION		JAN	FEB	MAR	APR	MAY	PRE MONSOON	JUN	JUL	AUG	SEP	SOUTH WEST MONSOON	OCT	NOV	DEC	NORTH EAST MONSOON	ANNUAL RAINFALL
HONAVARA TALUK	Normal Rainfall (mm)	1	0	7	14	126	148	991	1109	820	352	3272	207	46	9	262	3682
	STDEV	3	0	20	23	150	151	293	382	301	239	586	143	76	21	161	628
	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 Honavara Taluk, Uttar Kannada District for the Period 1981 to 2010

Table ____: ANNUAL RAINFALL OF HONAVARA 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	3	0	0	23	67	93	897	1744	603	584	3828	320	211	7.0	538	4459
2011	0	0	0	133	24	157	1039	1300	1172	613	4124	55	19	0	74	4355
2012	0	0	0	25	0	25	1029	689	1166	405	3289	260	67	0	327	3641
2013	0	12	0	0	0	12	1029	689	1166	405	3289	260	67	0	327	3628
2014	0	0	0	4	97	101	491	1128	1503	413	3535	83	3	0	86	3722
2015	1	0	43	22	154	220	794	746	656	377	2573	98	92	2	192	2985
2016	0	0	0	0	31	31	1442	1147	496	291	3376	89	5	0	94	3501
2017	0	0	0	0	58	58	1170	861	824	283	3138	192	12	0	204	3400
2018	0	0	0	11	117	128	1156	830	671	54	2711	139	20	0	159	2998
2019	0	0	1	1.1	0	2.1	821.8	1630	1477	712	4640.8	554	27	0	581	5223.9

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

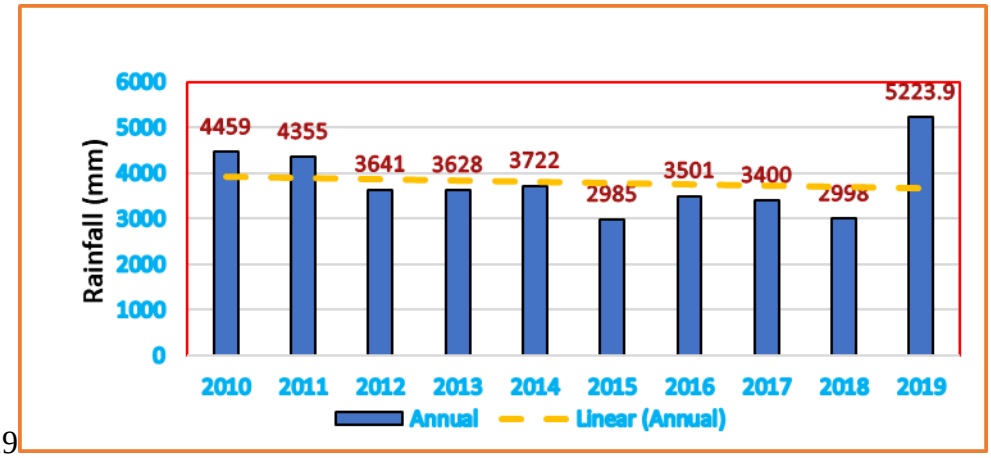


Fig. 2: Annual Rainfall Trend Analysis (2010-2019**)**

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 Honavar 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 40 and 0.34% 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 57% 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)	4100	5797	225	35	10157
Area %	40.36	57.07	2.22	0.34	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 12.42 % and area sown more than once is 1.92% of total geographical area in the taluk. Area not available for cultivation, the other uncultivable land and fallow land cover are 6.6 %, 3.6% and 0.54 % respectively of total geographical area.

Total Geographical Area	Area under Forest	Area not available for cultivation	Other uncultivable land	Fallow land	Net sown area	Area sown more than once	Gross sown area
75480	57632	4984	2987	407	9380	1453	10833
% of the area	76.35	6.6	3.6	0.54	12.42	1.92	14.35

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

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

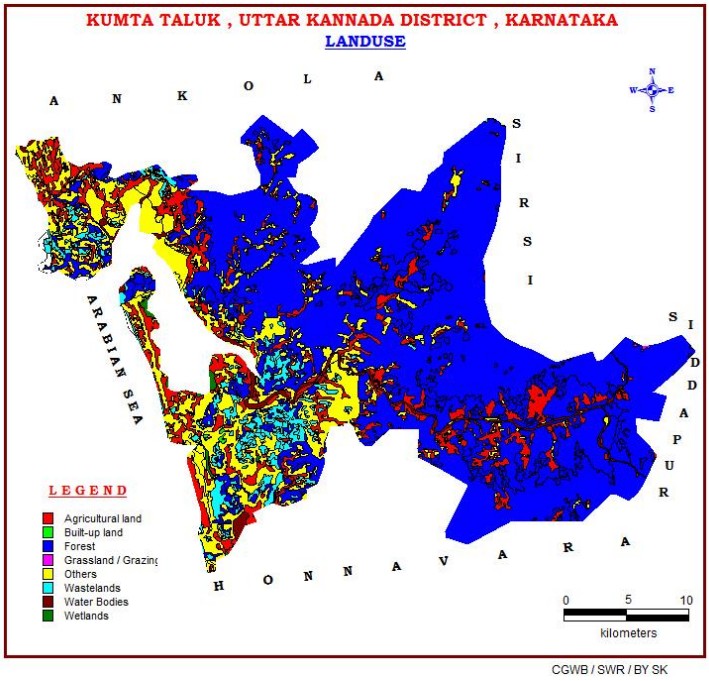


Fig.3 Land use pattern in Honavar Taluk

Dug wells and tanks constitute majority of minor irrigation sources. Dug wells (63.42%) play an important role in supporting the minor irrigation activities followed by Tanks (32.36 %) as depicted in Fig.4

Table-5: Details of Irrigation

ource of Irrigation	o of structures
Canals	0
Tanks	893
Dug Wells	1750
Bore/Tube wells	35
Lift Irrigation	0
Other Sources	81
Total	2759

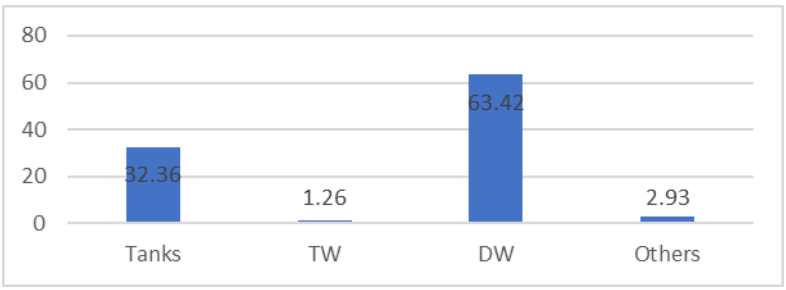


Fig. 4: Sources of Irrigation

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. Sharavati river and Badagani river confluence at Honavara Port area where both debouche into Arabian sea.The Basavaraj Durga Island is an isolated island 1.3 km off to Pavinkurva beach. 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 by Sharavati and Badagani river basins. The general drainage pattern is dendritic to sub-dendritic in nature (Fig. 5 and 6).

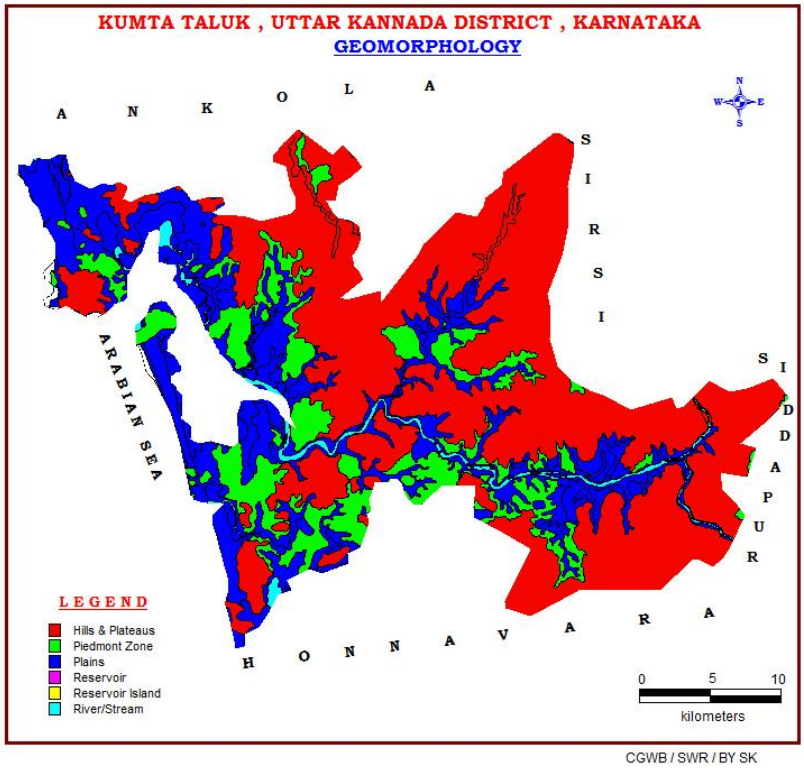


Fig. 5: Geomorphology map

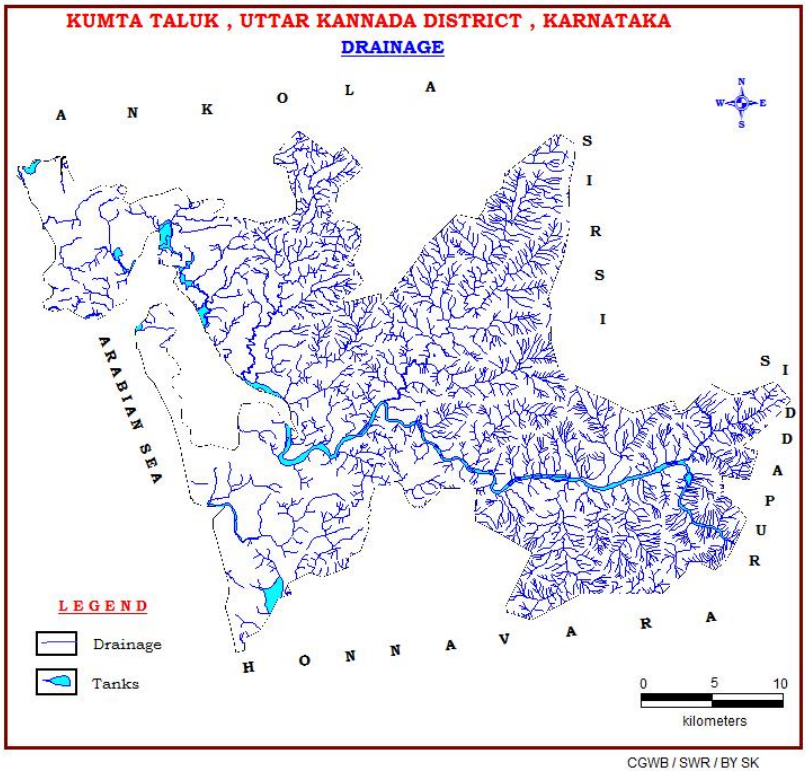


Fig. 6: Drainage map

1.6 Geology and Soils

Honavar 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.**

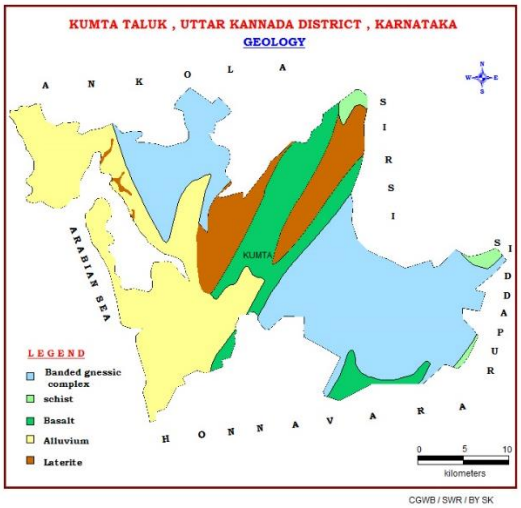


Fig. 7: Geology map

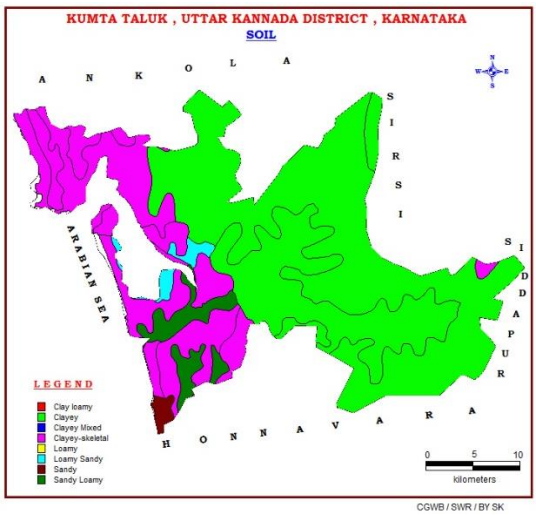


Fig. 8: Soil map

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 5669.92 ham. The existing gross groundwater for irrigation is 1778.9 ham. Net GW availability for future use is 3525.83 Ham. The stage of groundwater development is 37.64 % 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)
5669.92	1778.9	2.23	352.94	2134.06	362.97	3525.83	37.64	Safe

1.8 Existing and future water demands (as per GWRA-2020 and 2022)

The details of dynamic (Phreatic) ground water resources for Honavar 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 22.35 % to 37.64 % 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
7308.15	1285.02	185.26	1470.28	197.02	5095.30	22.35	Safe

1.9 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 2.74 to 19.41 mbgl, whereas in postmonsoon it varies from 1.7 to 16.45 mbgl. Honavar area is showing deeper water level in the taluk. Water level fluctuation between pre and post monsoon indicate that fluctuation is mostly restricted to <2 m.In Aquifer II, the water level ranges from

3.22 to 14.83 mbgl in premonsoon and 2.3 to 14.68 mbgl during post monsoon as per Ground water Department, Govt of Karnataka data**.** (Table 9) and the maps shown in Fig 9 to 14.

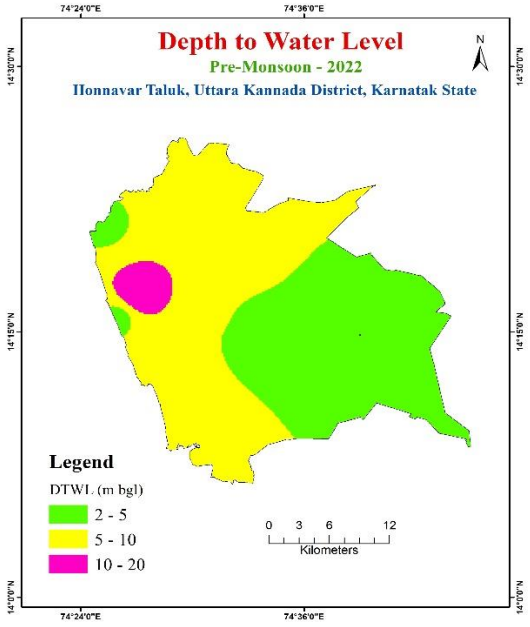
Table 8: Depth to water level of Pre and Post-monsoon (2019), CGWB

Sl No	Location	Type	Latitude	Longitude	Depth	MP	May-22	Nov-22
1	Honavar	DW	14.28	74.45	24	0.95	19.41	16.45
2	Chandavar	DW	14.4	74.47	9.8	0.48	6.27	5.74
3	Dibbanagal	DW	14.26	74.52	10.9	0.9	5.47	6.6
4	Gerusoppa Kpc Colony	DW	14.25	74.65	5.52	0.8	2.55	3.15
5	Haldipur	DW	14.35	74.42	6.84	0.5	3.63	3.75
6	Hirematha	DW	14.26	74.43	5.45	1	2.74	3.6
7	Idagunji	DW	14.23	74.48	9.27	0.7	6.52	6.53
8	Kabbinahakkalu	DW	14.26	74.67	6.9	0.7	4.7	1.7
9	Moodkani	DW	14.25	74.55	7.2	0.9	3.17	2.8

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

Sl No	**Location**	**Bore/Dug**	**Depth (m)**	**Latitude**	**Longitude**	**May-22**	**Nov-22**
1	Hadinbal	Bore Well	82.00	14.288	74.51	11.75	11.35
2	Haldipur	Bore Well	38.00	14.345	74.424	3.20	2.3
3	Honavar	Bore Well	70.00	14.281	74.451	14.83	14.68

Aquifer I



`Fig. 9: Pre monsoon water level

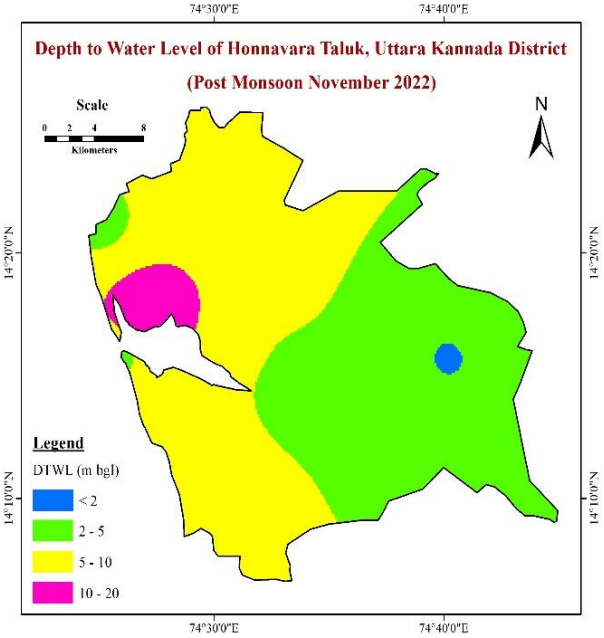


Fig. 10: Post monsoon water level

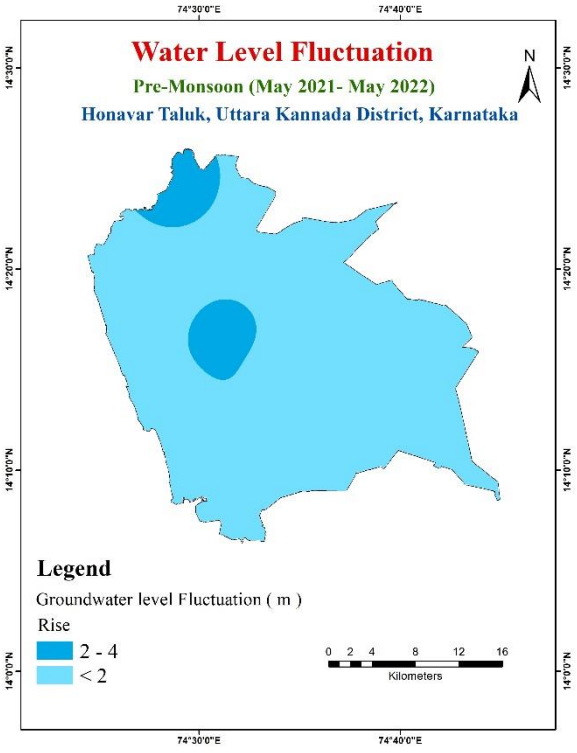


Fig. 11: Fluctuation Map

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 Honavar 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 Honavar are recommended for drilling.

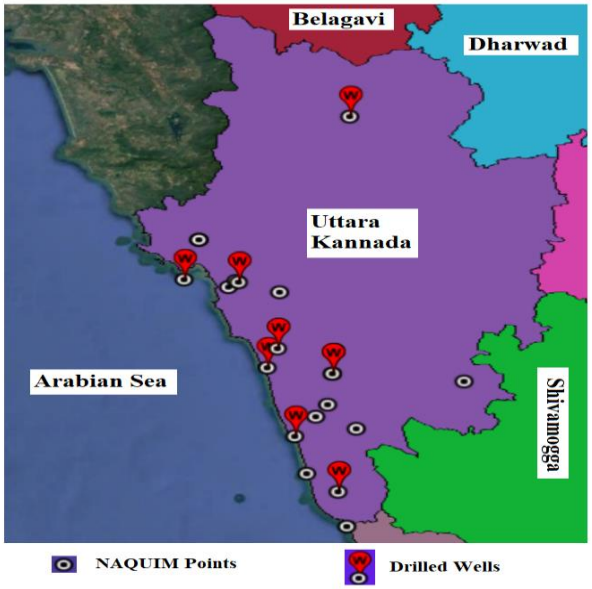
The last layer which is having a resistivity in the range of 1100-3500 Ohm.m. is inferred as massive formation. In this resistivity range also, the curve is extending at some of the sites.

The field data obtained and interpreted results reveals the following observations in the study area. In Honavara taluk, 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. Though the lithology is uniform in Honavara taluk, 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 Honavara 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	Honavara	Chandavar	14.4056	74.5540	0	18	18	18-80	Well drilled
2	Karnataka	Honavara	Manki	14.2104	74.4643	0	19	19	25-70	Well drilled
3	Karnataka	Honavara	Gundabal	14.3091	74.5420	0	7	7	7.0-40	
4	Karnataka	Honavara	Kolagadde	14.2719	74.5140	0	6	6	10.0-50	
5	Karnataka	Honavara	Samshi	14.2338	74.6080	0	8	8	8.0-75	

Table-10 Details of VES interpretation in Honavara Taluk



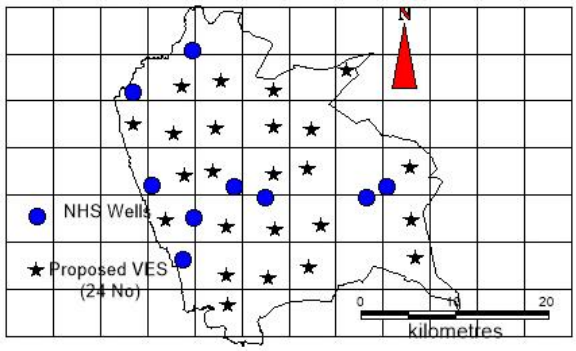


Fig.12 Tentative VES locations in Uttar Kannada district and proposed VES locations for current studies.

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 Honavar 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 Bhadravati. 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 Map

Ground water occurs within the weathered and fractured formations under water table condition and semi-confined condition. CGWB had drilled only two BW in the Taluk in Kasargod area tapping Recent alluvium with a depth of 18.5m. State GWD has drilled 21 no Bore wells were drilled from a minimum depth of 90 mbgl to a maximum of 150 mbgl. Depth of weathered zone ranges from 24 mbgl to 100 mbgl (Fig.13). Yield ranges from 0.02 to 1.5 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	Location	Longitude	Latitude	TD	Casing	Discharge (lps)
1	Anantwadi-1	74.4111	14.2781	100	40	1.5
2	Manki-1	74.3392	14.1856	120	50	1.5
3	Sulebilu	74.3361	14.1236	120	50	1
4	Hamakki	74.4697	14.4700	112	24	1
5	Sanshi	74.6206	14.2347	108	38	0.02
6	Honavar-1	74.4569	14.2825	114	60	1
7	Honavar-2	74.4742	14.2697	150	50	0.02
8	Honavar-3	74.4567	14.2344	150	70	1.2
9	Hadinbal	74.5161	14.2944	150	56	0.04
10	Salkod-1	74.4925	14.3267	150	45	0.04
11	Salkod-2	74.4444	14.3211	104	60	1.5
12	Anantwadi-	74.4444	14.2781	118	64	1.5

	2					
13	Manki-2	74.3739	14.2764	117	54	0.04
14	Magod	74.9936	14.3772	120	40	0.08
15	Chittara	74.4919	14.2878	117	36	0.04
16	Mugva	74.4606	14.2875	100	89	1.5
17	Karki	74.4611	14.2839	120	100	1.2
18	Apsarkonda	74.4483	14.2417	90	45	1
19	Nagare	74.4814	14.2836	90	55	1.5
20	Hoskuli	74.4983	14.3033	90	36	1.2
21	Kulakod	74.4772	14.2825	102	60	1.5

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

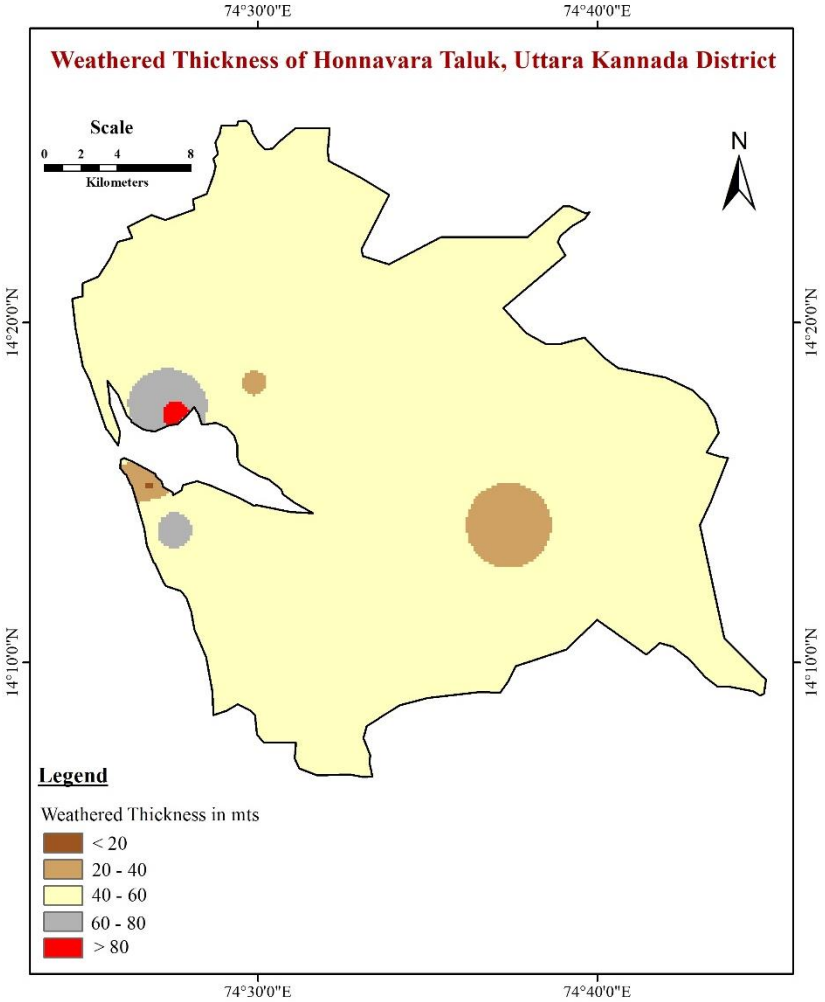


Fig.13 Weathered thickness map

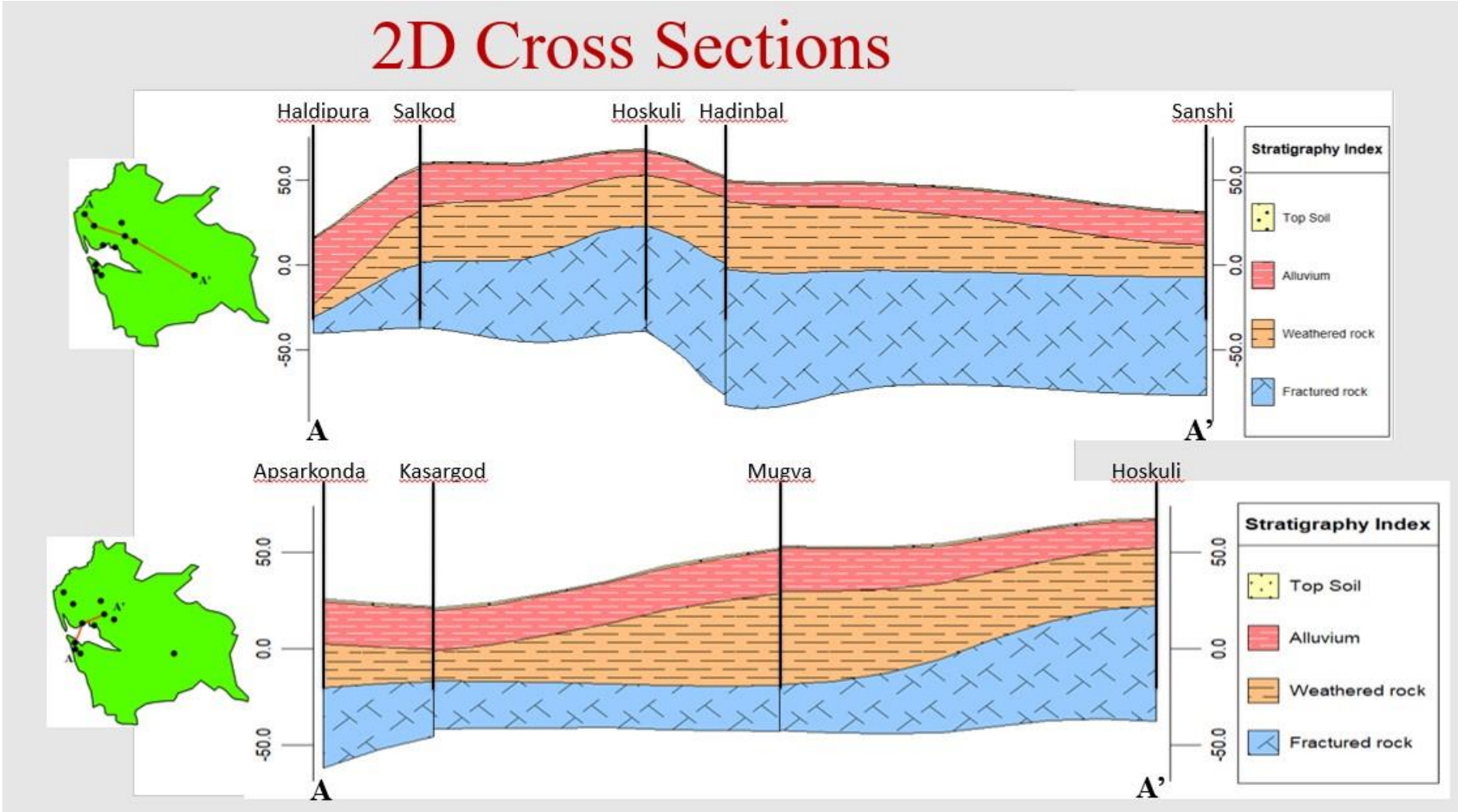


Fig.13 2D Aquifer disposition

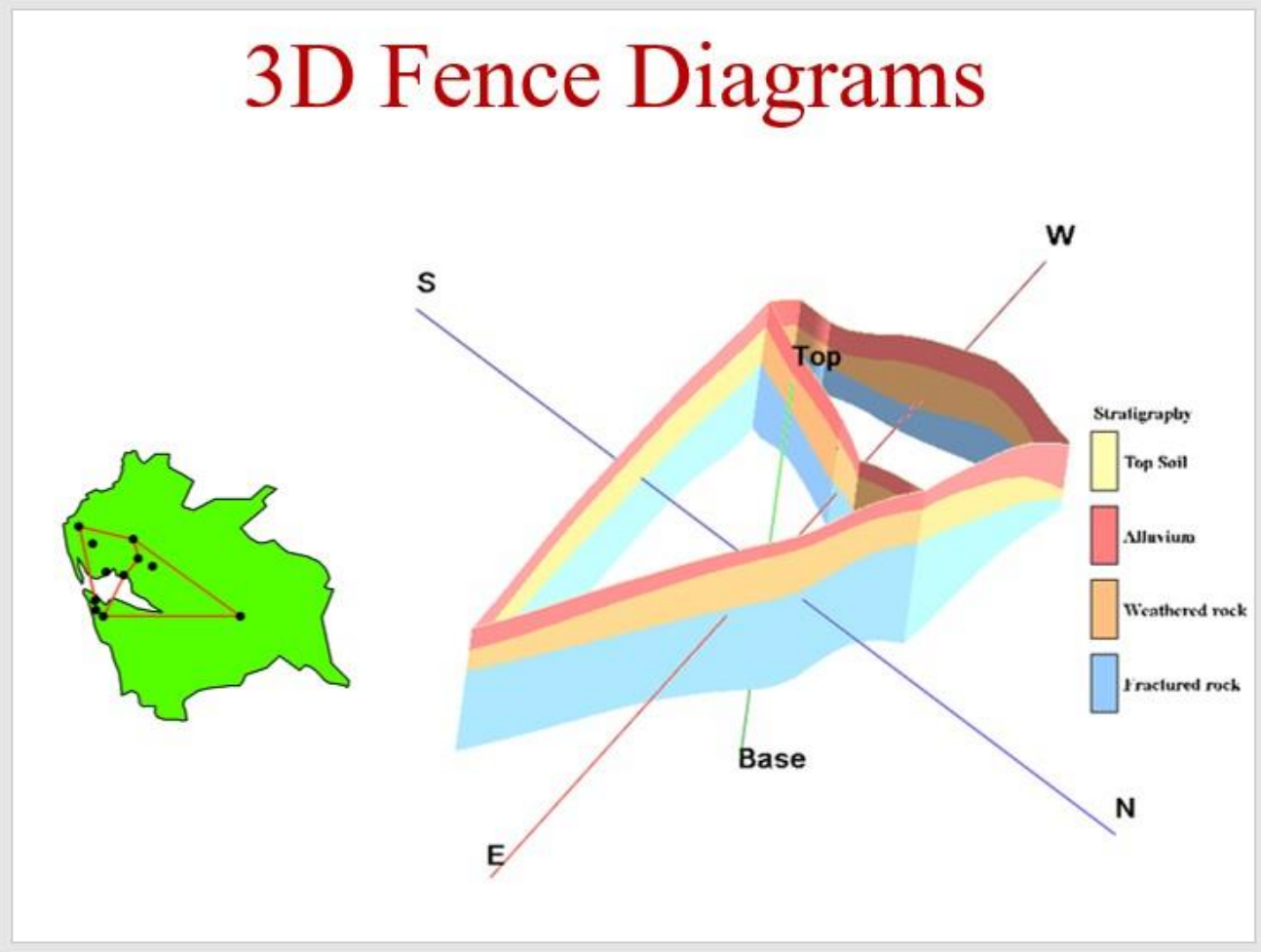


Fig.14 3D Aquifer fence diagram

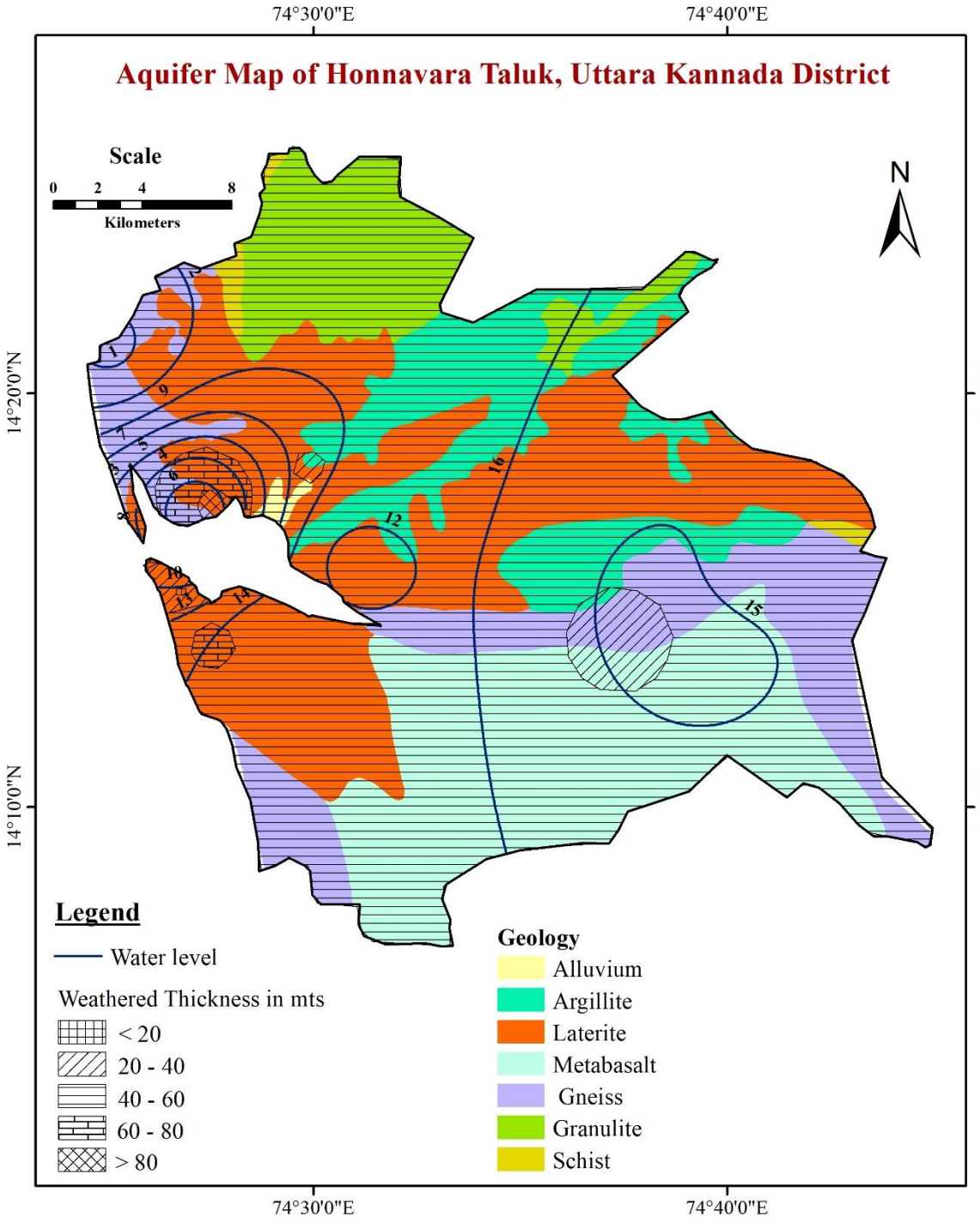


Fig.16 Aquifer Map of Honavar Taluk

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 Bhadravati 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 2020 is less compare to 2022 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
Honavar	7308	1470	22.23%	5669	2134	37.64 %

4.2 Chemical quality of ground water and contamination

The water samples were collected in different parts of Honavar 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	LAT	LONG	PH	EC	TH	Ca	Mg	Na	K	CO3	HCO3	Cl	SO4	NO3	F
1	CHANDAVAR(MALLAPUR)	14 24 04	74 28 48	7.23	150	45	8	6	12.05	1.01	0	37	14	0	25.08	ND
2	DIBBANGAL	14 15 54	74 31 44	6.74	280	81	16	10	21.2	8.23	0	68	32	8	26.82	ND
3	GERUSOPPA KPC COLONY	14 15 04	74 39 01	6.73	170	51	12	5	14.87	1.43	0	80	14	0	0.42	ND
4	HALDIPUR	14 20 22	74 25 46	7.4	190	71	16	7	8.91	4.06	0	74	18	6	2.18	ND
5	HIREMATHA	14 15 49	74 26 06	6.8	470	141	42	9	35.07	9.39	0	111	53	24	34.27	ND

6	IDAGUNJI	14 13 46	74 29 42	7.2	140	51	8	7	9.01	1.05	0	43	21	0	2.51	ND
7	KABBINAHAKKALU	14 16 06	74 40 54	6.76	130	40	8	5	10.34	1.1	0	49	14	0	0.73	ND
8	MANKI	14 11 42	74 28 33	7.61	170	61	20	2	10.01	1.78	0	43	21	5	10.07	ND
9	MOODKANI (GUDEKERI)	14 14 51	74 34 02	6.88	130	45	10	5	7.96	0.62	0	43	18	0	1.86	ND

In general, ground water quality in Honavar 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 Sharavati river especially in Kasargod,Upponi areas. Its a seasonal phenomenon and it disappear when monsoon starts.

5.GROUND WATER RESOURCE ENHANCEMENT

As per GWRA 2022, Honavar Taluk is in Safe category where the stage of ground water development is within 37%.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	Honavar taluk
Non committed monsoon runoff available (MCM)	29.42
Number of Check Dams	131
Number of Percolation Tanks	22
Number of Subsurface dykes	01
Number of Filter beds	0
Tentative total cost of the project (Rs. in lakhs)	1771.21
Expected recharge (MCM) @50%	18.69

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	%	%
Honavar	5669.92	2134	37.64	1869	7538.92	9.34	28.30

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 63 % of irrigation is done through Ground water based sources (Dug wells) . Only 37% 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 37 % and remaining 63 % is yet to be tapped for various developmental activities. Considering the fact that Honavar 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 Honavar 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 Honavar Taluk as the block is in safe category and resources are under utilised. The average stage of development in all blocks is about 37% 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), vented cross bars (VCB) contour bunding, trenching, pitting, terrace cultivation 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 Honavar 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 Honavar taluk is given in Table-16.

Table 16: Summary of Management plan

Stage of GW Extraction and Category (2020)	37.64 %, Safe
Annual Extractable GW Resource (Ham)	5669.92
Total Extraction (Ham)	2134.06
Net GW Availability (Ham)	3525.83
Ground Water Draft for Irrigation (Ham)	1778.9
Ground Water Resource Enhancement by Supply side Interventions	
No of Proposed AR structures	
SSD	1
PT	22
CD	131
FB	0
Expected Additional Recharge to GW due to AR (Ham)	1869
Additional Irrigation Potential that can be created (Ha)	2300
Total Estimated Expenditure (Rs. in Lakhs.)	1771.21
Change in Stage of GW Extraction (%)	37.64 to 28.3

As per the resource estimation – 2022, Honavar taluk falls under Safe category with the stage of ground water extraction is 37.64%. 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 2492 Ham. This can be used to recharge the aquifer mainly through check dams (131), percolation tanks (22), and sub surface dyke structures (1). The volume of water expected to be conserved/recharged @50% efficiency is 1869 ham through these AR structures. The approximate cost estimate for construction of these AR structures is Rs. 1771.21 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.

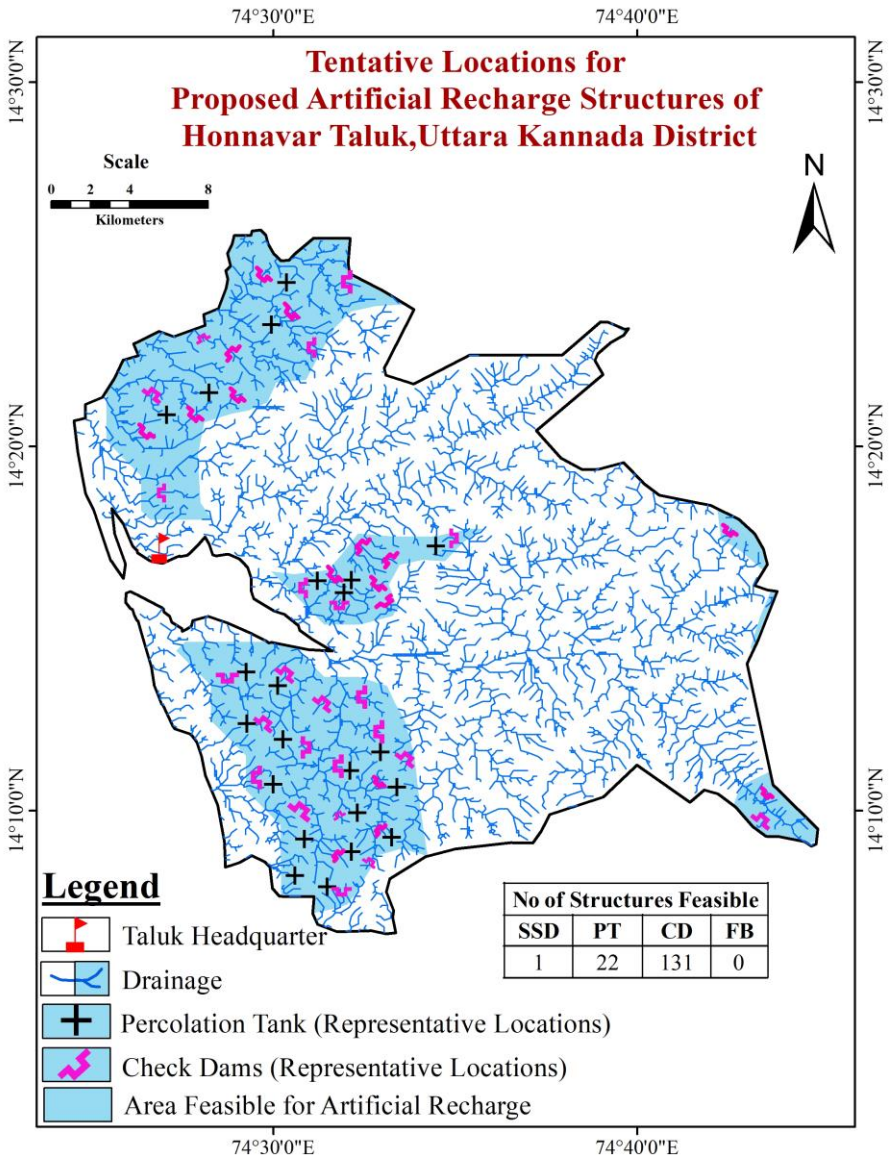


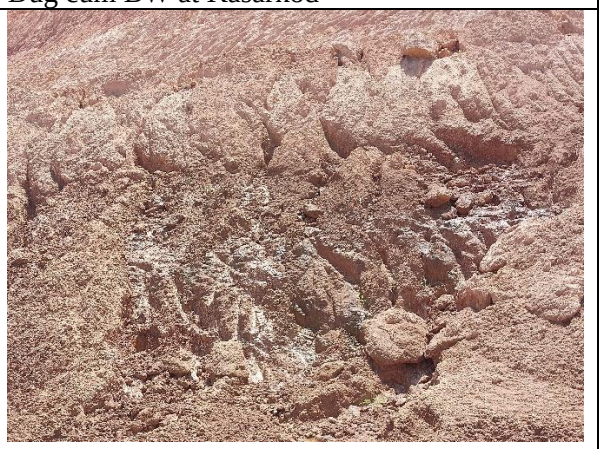
Fig 17:Tentative locations for proposed ARS

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 which accounts for 57 % 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 56.69 MCM, and block is in Safe category and average stage of development is about 37 %.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 Kasarkod,Uppani due to close proximity to brackish water surge in the Bhadravati river from sea.
- Aquifer Management plan proposes the need to construct various Artificial Recharge structures such as 131Check dams, 22 Percolation Tanks and 1 SSD 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 Exposure in Dibbanangal	Laterite exposure at NH road cutting at Honavar Town
	
Laterite shows highly porous nature	Dug cum BW at Kasarkod
	
GW seepage through Lateritic cutting at Idagunji	GW seepage through Lateritic cutting at Idagunji