



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

**Mudigere Taluk, Chikmagalur District,
Karnataka**

दक्षिण पश्चिमी क्षेत्र, बेंगलुरु

South Western Region, Bengaluru

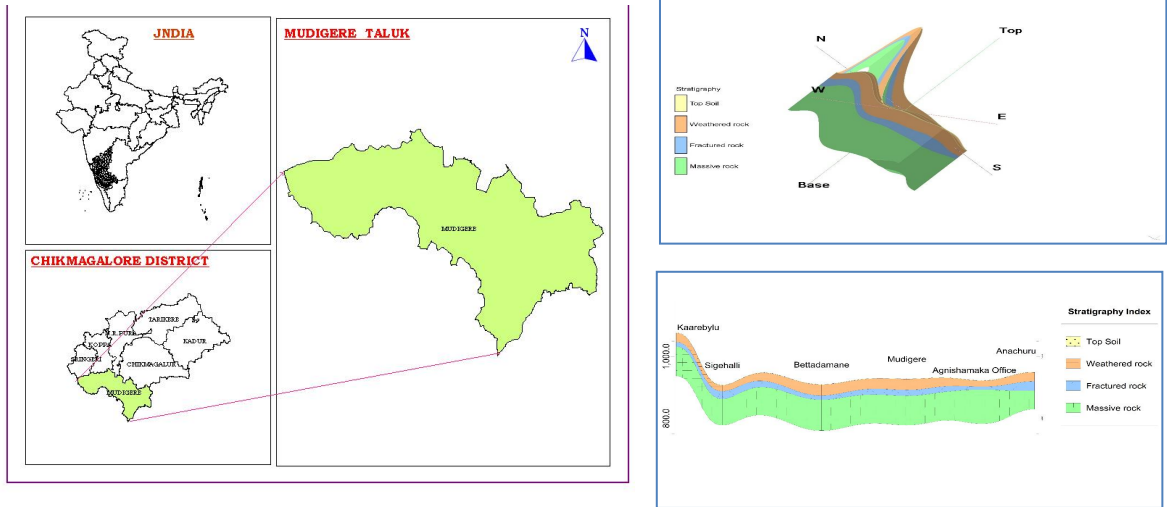
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REPORT ON AQUIFER MAPS AND MANAGEMENT PLAN, MUDIGERE TALUK, CHIKMAGALUR DISTRICT, KARNATAKA STATE

AAP: -2022-23



By

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(AAP 2022-23)

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AQUIFER MAPS AND MANAGEMENT PLAN, MUDIGERE TALUK, MUDIGERE DISTRICT, KARNATAKA STATE

1. SALIENT INFORMATION

Name of the taluk: mudigere

District: Chikmagalur

State: Karnataka

Area: 1156 sq.km.

Population: 1,28,134

Annual Normal Rainfall: 2315 mm

1.1 Study area

Aquifer mapping studies have been carried out in Mudigere taluk, Chikmagalur district, Karnataka state under National Aquifer Mapping Programme. The taluk is covering an area of 1156sq.kms. The geographical extents of Mudigere taluk of Chikmagalur district is located between North Latitudes $12^{\circ}50'0''$ and $13^{\circ}20'0''$ and East Longitudes between $75^{\circ}5'0''$ to $75^{\circ}45'0''$ and is falling in Survey of India Toposheets bearing no.48O/7, 48O/8, 48O/11, 48O/12, 48P/9.. The study area is bounded on the North by Chikmagalur & NR Pura taluk of Chikmagalur district, on the Northwest & West by Koppa & Sringeri taluks of Chikmagalur, on the South by Dakshin Kannada district & on the East by Hassan district. Mudigere town is taluk head quarter and there are about 140 villages falling under its jurisdiction. Location map of Mudigere taluk of Chikmagalur district is presented in Fig. 1 & 2.

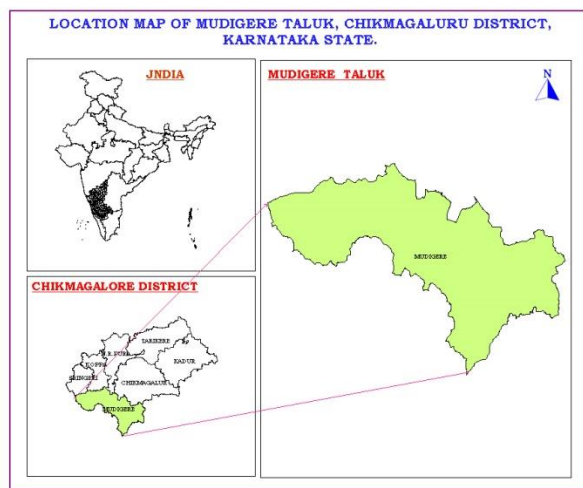


Fig . 1Location map of Mudigere taluk.

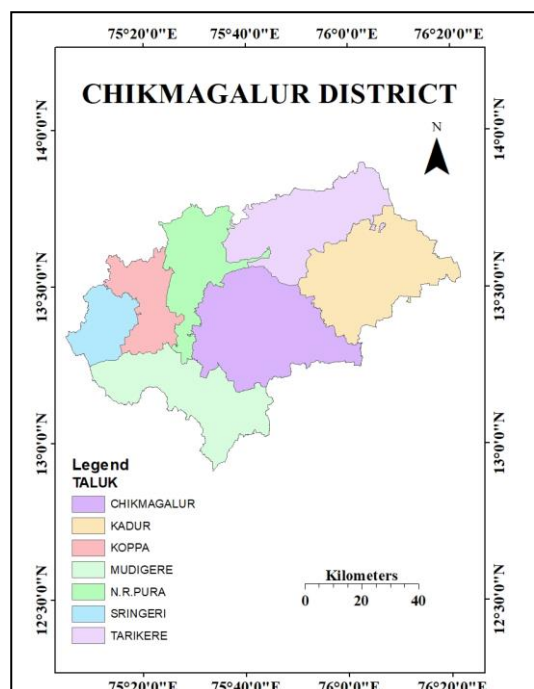


Fig . 2Map of Chikmagalur Dist. Showing all the 7 taluks

1.2 Population

According to 2011 census, the population in Mudigere taluk is 1,28,134. Out of which 63,102 are males while 65,032 are female. The average sex ratio is 1007. The taluk has an overall population density of 111

persons per sq.km. The literacy rate of Mudigere taluk is 77.34%, out of which 83.8 % males are literate and 71.09 % females are literate. The decadal change in population for the period (2001-2011) is -2.37 %.

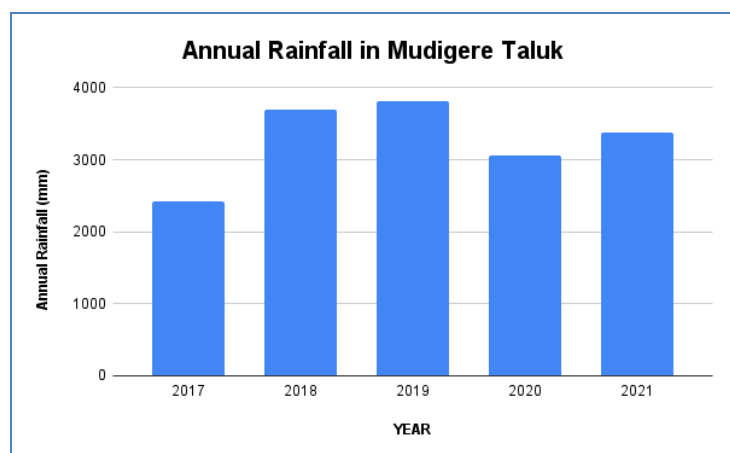
1.3 Rainfall

Mudigere taluk receives rainfall from south west monsoon from June to September and north east monsoon from October to December. During May and retreating monsoon months, the area gets rainfall in association with thunderstorm followed by heavy pre-monsoon/retreating showers. The monthly rainfall data from 2017 to 2021 is given in Table 1. The rainfall data reveals that the annual rainfall ranges from 2417 to 3810 mm. The highest annual rainfall is observed in the year 2019.

Table 1: Monthly rainfall data of Mudigere taluk (unit:mm)

YEAR	January	February	March	April	May	June	July	August	September	October	November	December	Annual Rainfall
2017	2.8	1.8	32.5	42.2	155.5	623	552	575	246	170	15	2	2417
2018	0.4	0.4	51	77	285	1040	1057	896	115	150	21	9	3701
2019	0	2	3	63	66	358	747	1466	551	461	65	28	3810
2020	1	0	16	48	180	391	560	977	571	270	36	15	3066
2021	109.7	52.3	8.5	126.1	324.3	597.1	720.1	429	367	359	254	39	3386

Table 1: Rainfall data of Mudigere taluk



1.4 Agriculture & Irrigation

Agriculture is the main occupation in Mudigere taluk, Chikmagalur district. Major Kharif crops are Maize, Paddy, Ragi, Sugarcane, Mulberry, Coconut, Cotton, etc. Main crops of Rabi season are Ragi. The water intensive crops like sugarcane and paddy are grown significantly in the taluk. The net irrigated area is 5184 ha. It is also observed that net sown area accounts about 60744 ha & % of Net Area Irrigated to Net Area Sown is 8.53 as per District at a glance 2019-20. The details of the land utilization is given in Table 2. The land use map is given in Fig. 3.

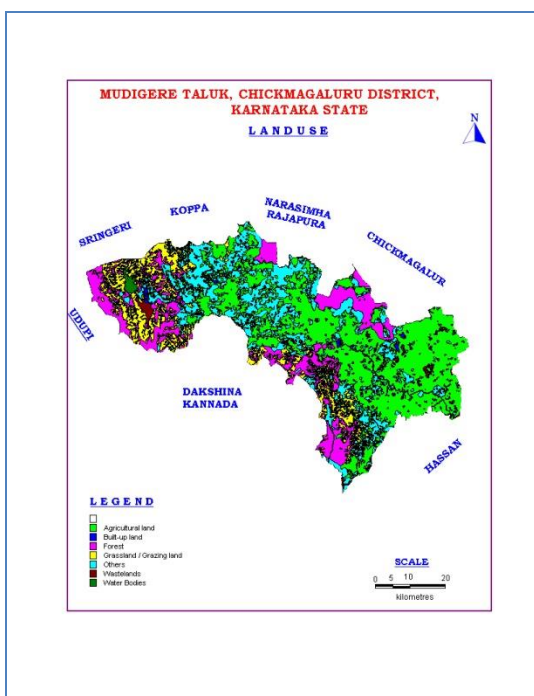


Fig.3 : The land use map

Tanks are the major source of irrigation followed by Groundwater (24%). Groundwater for irrigation in agriculture sector is developed through 109 Tube wells. Groundwater development is low as canal water is made available for irrigation through 131 canals. The ground water thus extracted is utilized for irrigation by adopting different efficient water use irrigation practices such as sprinklers irrigations and drip irrigations. As a major part of the taluk is hilly and covered by forest, groundwater development is low.

Table 2: Distribution of land utilization in Mudigere taluk.

Sl. No	Particulars	Area (ha)
1.	Forests	30604
2.	Land not available for cultivation	9632
3.	% of Forest Area to Geo Graphical Area	26.50
4.	Net Sown Area (NSA)	22379
5.	NetIrrigatedArea(NIA)hectares)	7503
6.	Percentage NIA to NSA (Percentage)	33.5
7.	Cropping pattern	Area (ha)
	Paddy	4573
	Ragi	0
	Totalcereals	4574
	Totalpulses	9
	Totaloilseeds	0
	Sugarcane	0
	Total Condiments & spices	15777
	Coconut	22
	Cotton	0

Source: Chikmagalur district at a Glance (2019-20)

1.5 Geomorphology, Physiography & Drainage

In general, the geomorphology of the taluk is a table land comprising of plains to undulating as well as mountainous undulating plains and hills. Physiographically, the taluk may be divided into two distinct units viz., mountainous terrain and flat plains. The major part of the area is hilly tract. The western & South-western parts

of the taluk forms a continuous hill ranges covered by forests. It has an average elevation of 990 m (3,250 ft) above MSL. The taluk forms a part of Krishna basin. The drainage pattern of the area can be described as dendritic in nature. The source of the Hemavati River lies in the Western Ghats at an elevation of about 1,219 metres located in Mudigere taluk. The drainage map is given in Fig. 5.

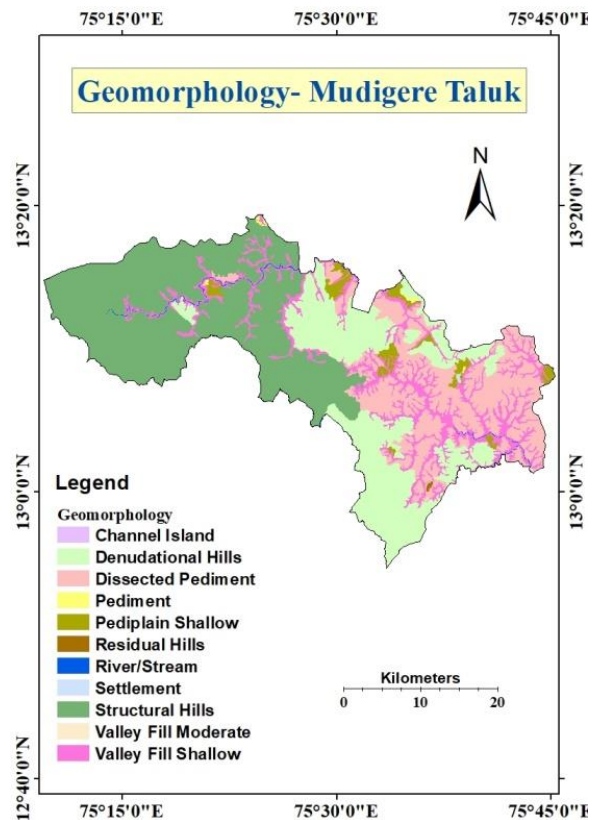


Fig. 4: Geomorphology map

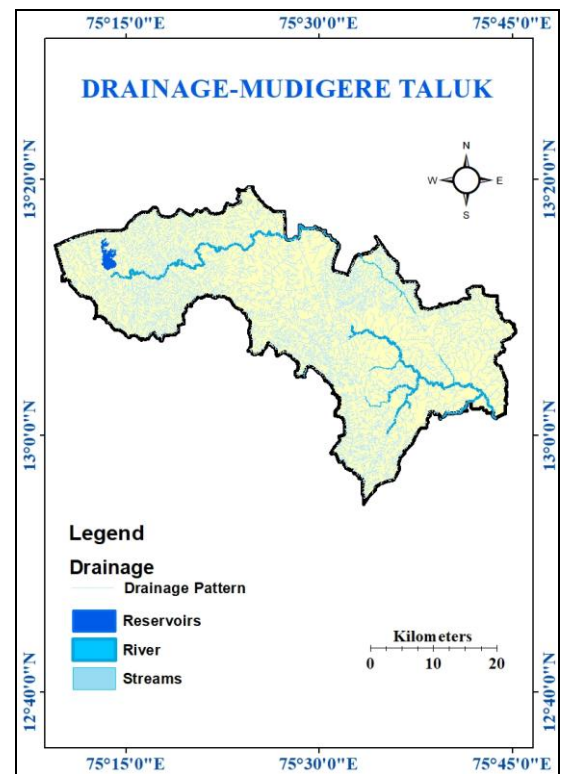


Fig. : Drainage map

1.5 Soils

The major soil type in the district comprises of Rocky, Kaolinitic, clayey skeletal types. However, hilly area soil and mixed red & black soil are also found to occur in small areas in the taluk. The soil map of Mudigere taluk is given in Fig. 6.

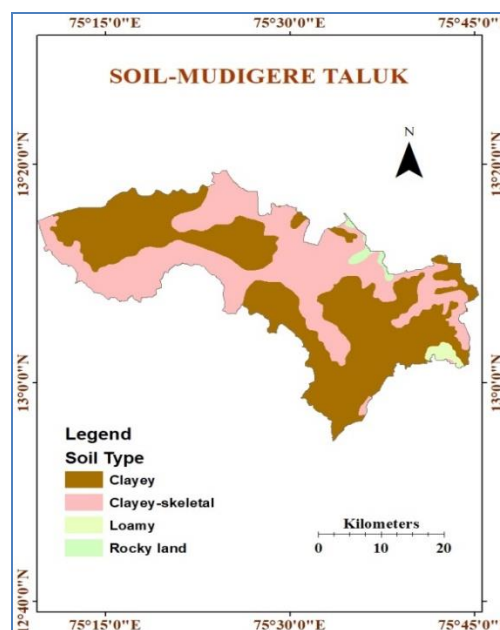


Fig.6: The soil map

1.6 Ground water resource availability and extraction

As per the ground water resources estimation 2022 (Table-3), the data on ground water resources shows that the net annual ground water availability is 3854.74 ham. The existing gross groundwater extraction for irrigation is 1165.56 ham. The stage of ground water development is 25.91 % and falling under 'SAFE' category.

Assessment Unit Name	Assessment Unit Type	Annual Extractable Ground Water Resource (Ham)	Ground Water Extraction for Irrigation Use (Ham)	Ground Water Extraction for Industrial Use (Ham)	Ground Water Extraction for Domestic Use (Ham)	Total Extraction (Ham)	Annual GW Allocation for Domestic Use as on 2025 (Ham)	Net Ground Water Availability for future use (Ham)	Stage of Ground Water Extraction (%)	Categorization (Over-Exploited/Critical/Safe/Saline)
Mudigere	BLOCK	5204.89	1165.56	0.00175	183.19208	1348.75	184.59	3854.74	25.913132	SAFE

Table 3: ground water resources estimation 2020

1.7 DATA GAP ANALYSIS

a. Exploratory Data Availability

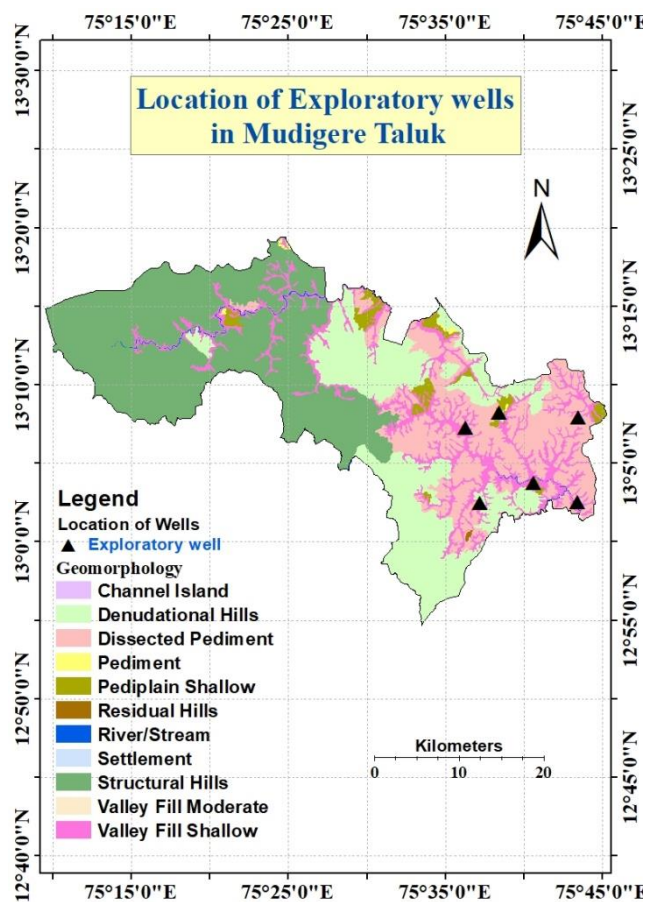


Fig7: Location of existing exploratory wells in the taluk

LATITUDE	LONGITUDE	VILLAGE
13.1207	75.6047	Agnishamaka Office
13.0421	75.7239	Sighalli
13.0413	75.6205	Anachuru
13.1367	75.6403	Mudigere
13.1318	75.7246	Kaarebylu
13.0620	75.6767	Bettadamane

Table 4: Location of existing exploratory wells in the taluk



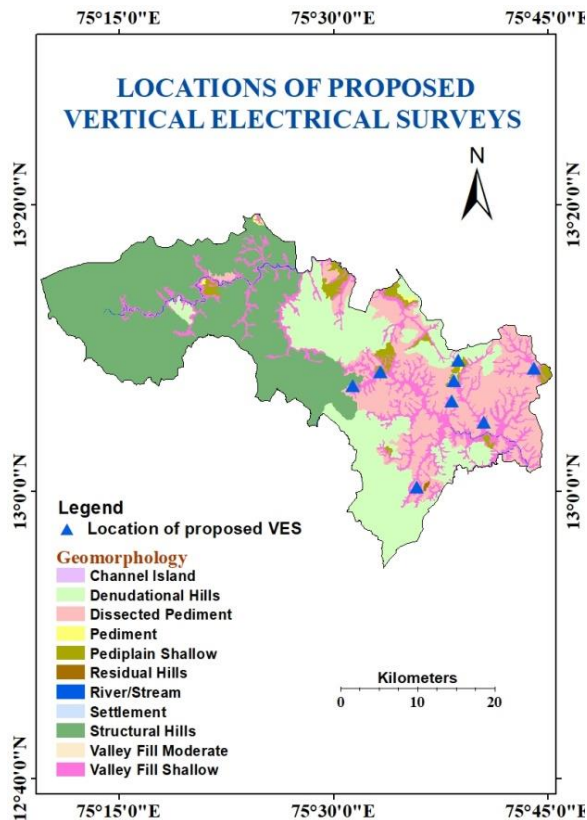
Fig8: Google earth image of the taluk

- From the above map it is observed that exploratory wells are spreaded into eastern part of the taluk. From figure 7 it is clear that the wells are located in plain area.

- From geomorphology of the taluk it is observed that the western- north western part is covered by hills. Therefore, it may be concluded the the area in between **North Latitudes 13°5'0" and 13°20'0"** and **East Longitudes between 75°5'0" to 75°30'0"** are difficult to collect data.

b. Availability of Geophysical data

In Mudigere taluk, no data is available for Geophysical information. Therefore around 8 no of Vertical Electrical Surveys have been proposed in the taluk. The proposed locations are mostly in the plain area which have been confirmed through google earth. As the area is hilly and covered by dense forest in the northern, western and southern part, Geophysical investigations may not be feasible to conduct.



Sl. No	Village	Latitude	Longitude
1	Taruve	13.12305	75.52234
2	Halemudigere	13.12931	75.64019
3	Hesgal	13.15306	75.64561
4	Banakal	13.13937	75.55457
5	Daradahalli	13.10568	75.6382
6	Chinniga	13.08138	75.67499
7	Nandipura	13.14357	75.73407
8	Urubage	13.00554	75.59748

Table5: Location of Proposed VES in Mudigere Taluk

Fig 9: proposed VES in Mudigeretaluk

c. Ground Water Monitoring Data availability

- In the taluk, Groundwater level data from 23 wells are available out of which 5 no of borewells will provide waterlevel of semi-confined/deeper aquifer and 18 no of dugwells will provide water level of phreatic aquifer. The data are spreaded across the taluk, only west-south west part is not having water level data. As from the Geomorphology it is observed that the area is hilly, it may be unapproachable and difficult for data collection.

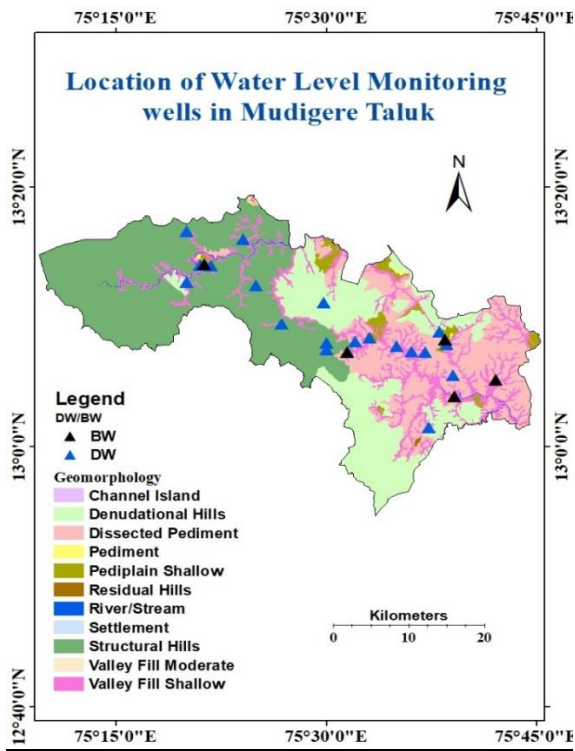


Fig 10: Existing GW level monitoring stations

Sl. No	LATITUDE	LONGITUDE	LOCATION	Type of well
1	13.26667	75.40111	Balehole	DW
2	13.13528	75.53472	Bankal	DW
3	13.12222	75.60139	Bidaralli	DW
4	13.14833	75.63444	Bilagula	DW
5	13.14	75.55139	Chackmakki	DW
6	13.13222	75.64306	Halemudigere	DW
7	13.2075	75.41667	Hire Bile	DW
8	13.12944	75.58389	Horatti	DW
9	13.27694	75.33444	Hornad	DW
10	13.13333	75.5	Jannapura	DW
11	13.09167	75.65083	Jn Bylu	DW
12	13.23333	75.35028	Kalasa	DW
13	13.125	75.50028	Kottigehara	DW
14	13.12167	75.61778	Mudigere Hand Post	DW
15	13.21139	75.33417	ThodluKaregadde	DW
16	13.137934	75.641614	Mudigere (Rural)	BW
17	13.121432	75.524696	Kottigehara	BW
18	13.086388	75.70197	Gonibedu	BW
19	13.23277	75.363043	Kalasa	DW
20	13.158252	75.446951	Sunkasale	DW
21	13.184958	75.497134	Niduvale	DW
22	13.025373	75.62203	Devavrunda	DW
23	13.234722	75.355556	Kalasa	BW
24	13.064828	75.652287	Hanthuru	BW

Table6: Location of existing waterlevel monitoring stations in Mudigere Taluk

d. Ground Water Quality Data availability

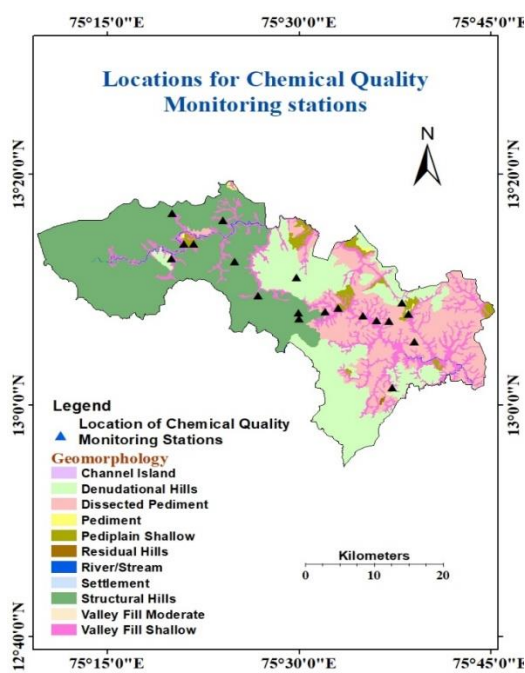


Fig 11: Existing GW quality monitoring stations

Sl No.	Latitude	Longitude	Village	Type of well
1	13.34	75.55	Sangameswarapete	Dug Well
2	13.27	75.72	Aladagudde	Dug Well
3	13.24	75.65	Aldur	Dug Well
4	13.26	75.63	Bannur_CKM	Dug Well
5	13.33	75.77	Chikkamagalur Town	Dug Well
6	13.36	75.53	Gori Gundi	Dug Well
7	13.2	75.68	Handi	Dug Well
8	13.32	75.72	Hukkunda	Dug Well
9	13.33	75.55	Hunsehalli	Dug Well
10	13.31	75.58	Kanati	Dug Well
11	13.29	75.8	Karthikere	Dug Well
12	13.26	75.68	Kooduvalli	Dug Well
13	13.29	75.73	Mugthihalli	Dug Well
14	13.3	75.77	Rampura	Dug Well
15	13.33	75.72	Thali Halla	Dug Well
16	13.25	75.7	Vasthare	Dug Well
17	13.33	75.78	Chikmagalur Town	Dug Well
18	13.37	75.52	Kadubugere	Dug Well

Table7: Location of existing Chemical quality monitoring stations

- In the taluk, Chemical quality data from 18 wells are available .The data are spreaded across the taluk west-sourth west & part of east are not having water level data. As from the Geomorphologyit is observed that the area is hilly, it may be unapproachable and difficult for data collection.

1.9 Water Well Behaviour

The water level data have been monitored from the representative dug well and borewells for both pre and post-monsoon seasons. During pre-monsoon season in i) aquifer-I (phreatic) water level ranges from 2.01 to 11.65 mbgl, ii) aquifer-II (fractured) water level ranges from 2.20 to 15.55 mbgl , whereas in post-monsoon it varies from 0.92 to 8.95 m bgl in aquifer-I (phreatic) and 2.01-11.65 mbgl in aquifer-II (fractured) . The pre-monsoon decadal average water level for aquifer-I varies from 1.95 to 13.47 mbgl. The post-monsoon decadal average water level for aquifer-I varies from 0.55 to 10.98 mbgl.

Depth to water level

Aquifer-I

- (a) Pre-monsoon: 2.01-11.65mbgl (May 2022)
- (b) Post-monsoon: 0.92-8.95mbgl (Nov 2022)

Aquifer-II

- (a) Pre-monsoon: 2.20-15.55mbgl (May 2022)
- (b) Post-monsoon: 2.01-11.65 mbgl (Nov 2022)

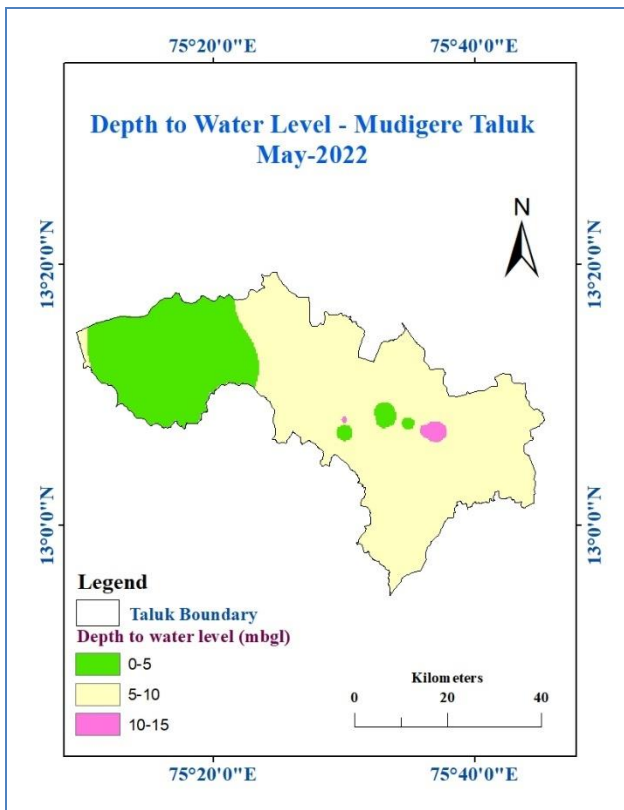


Fig 12: Depth to Water Level of Aquifer I (Pre-monsoon)

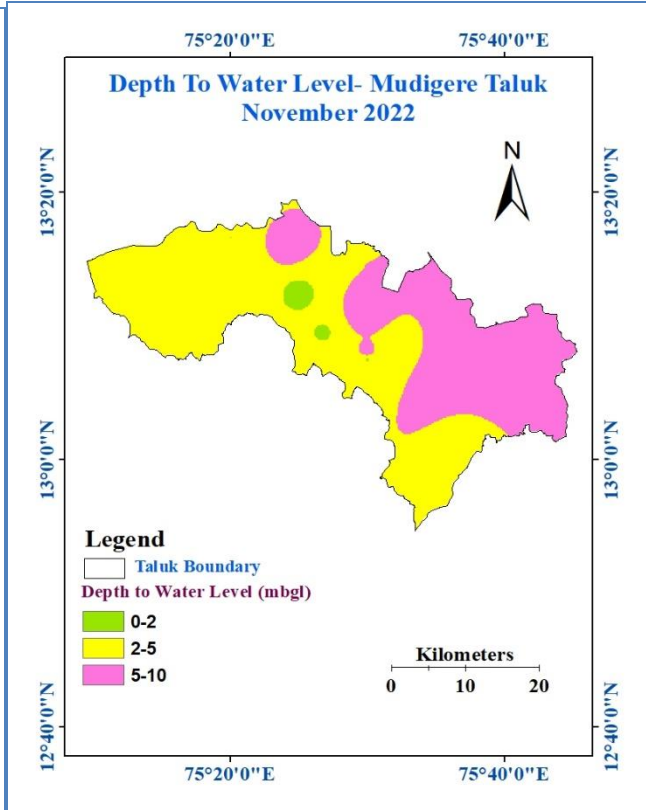


Fig 13: Depth to Water Level of Aquifer I (Post-monsoon)

Pre Monsoon: Aquifer I

LOCATION	LAT	LONG	2022 May Depth to water Level (m)	Type of Well
Balehole	13.26667	75.40111	8.23	DW
Bankal	13.13528	75.53472	5.1	DW
Bidaralli	13.12222	75.60139	10.75	DW
Bilagula	13.14833	75.63444	5.5	DW
Chackmakki	13.14	75.55139	3.9	DW
Hire Bile	13.2075	75.41667	5.1	DW
Horatti	13.12944	75.58389	3.95	DW
Hornad	13.27694	75.33444	4.4	DW
Jannapura	13.13333	75.5	11.18	DW
Jn Bylu	13.09167	75.65083	7.4	DW
Kalasa	13.23333	75.35028	2.76	DW
Kottigehara	13.125	75.50028	2.01	DW
Mudigere Hand Post	13.12167	75.61778	11.65	DW
ThodluKaregadde	13.21139	75.33417	3.71	DW

Table8: Depth to Water Level Data for Aquifer I (pre-monsoon)

Pre Monsoon: Aquifer II

Village	Type of Well	Latitude	Longitude	2022 May Depth to water Level (m)
Mudigere (Rural)	BW	13.137934	75.641614	15.55
Kottigehara	BW	13.121432	75.524696	2.20
Gonibedu	BW	13.086388	75.701970	7.85
Hanthuru	BW	13.064828	75.652287	12.80

Table9: Depth to Water Level Data for Aquifer II (pre-monsoon)

Post monsoon: Aquifer I

LOCATION	LAT	LON	2022 November Depth to water Level (m)	Type of well
Balehole	13.2667	75.4011	7.83	DW
Bankal	13.1353	75.5347	3.33	DW
Bidaralli	13.1222	75.6014	8.44	DW
Bilagula	13.1483	75.6344	5.3	DW
Chackmakki	13.14	75.5514	2.8	DW
Hire Bile	13.2075	75.4167	0.92	DW
Horatti	13.1294	75.5839	7.35	DW
Hornad	13.2769	75.3344	2	DW
Jannapura	13.1333	75.5	6.58	DW
Jn Bylu	13.0917	75.6508	7.13	DW
Kalasa	13.2333	75.3503	2	DW
Kottigehara	13.125	75.5003	1.74	DW
Mudigere Hand	13.1217	75.6178	8.95	DW

Post				
ThodluKaregadde	13.2114	75.3342	3.21	DW
Sunkasale	13.15825	75.44695	1.65	DW
Niduvale	13.18496	75.49713	7.85	DW
Devavrunda	13.02537	75.62203	2.4	DW

Table 10: Depth to Water Level Data for Aquifer I (post-monsoon)

Post monsoon: Aquifer II

Village	Type of well	Latitude	Longitude	2022 November Depth to water Level (m)
Mudigere (Rural)	BW	13.137934	75.641614	14.05
Kottigehara	BW	13.121432	75.524696	2.15
Gonibedu	BW	13.086388	75.701970	4.00
Hanthuru	BW	13.064828	75.652287	9.90

Table 11: Depth to Water Level Data for Aquifer II (post-monsoon)

The long term groundwater trend (2011-2022) for pre-monsoon period shows a fall in the range 0.01/year to 3.15 m/year and rise in the range of 0.08m/year to 6.9m/year (Table 14). The long-term groundwater trend (2011-2022) for post-monsoon period shows a fall in the range 0.04 m/year to 0.5 m/year and rise in the range of 0.07m/year to 3.11 m/year (Table 15). Both during pre-monsoon & post-monsoon period monitoring stations are mostly showing rising trend.

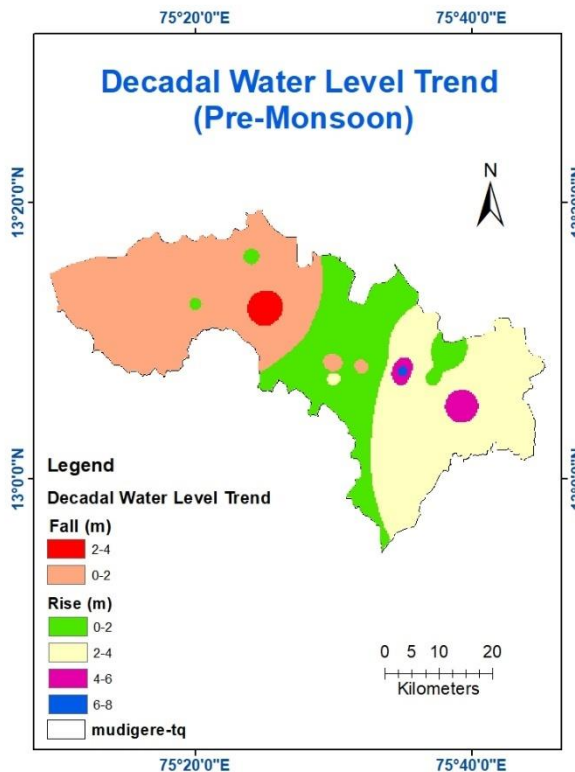


Fig 14: Decadal Water Level Trend (Pre-monsoon)

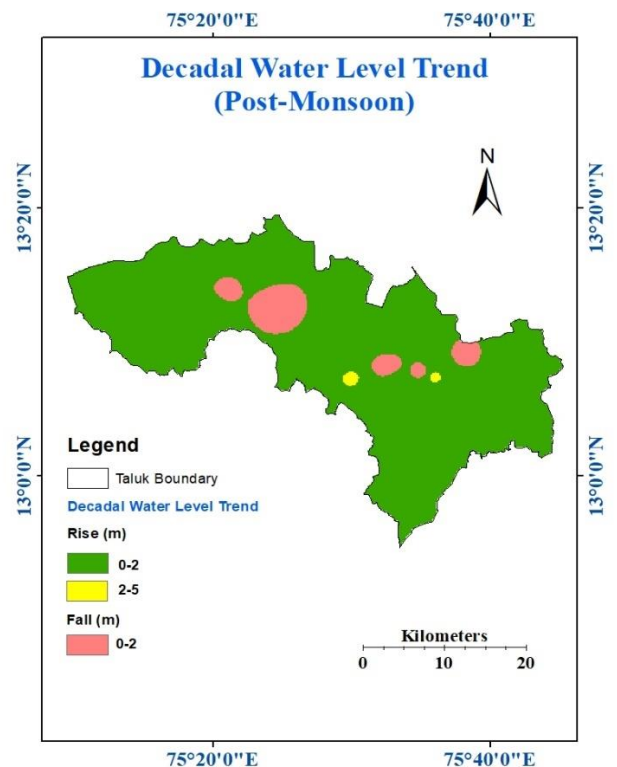


Fig 15: Decadal Water Level Trend (Post-monsoon)

VILLAGE	LAT	LONG	FLUCTUTATION
Balehole	13.2667	75.4011	0.120
Bankal	13.1353	75.5347	-0.400

Bidaralli	13.1222	75.6014	2.720
Bilagula	13.1483	75.6344	1.170
Chackmakki	13.1400	75.5514	0.610
Hire Bile	13.2075	75.4167	-3.150
Horatti	13.1294	75.5839	6.910
Hornad	13.2769	75.3344	-0.650
Jannapura	13.1333	75.5000	-1.890
Jn Bylu	13.0917	75.6508	5.120
Kalasa	13.2333	75.3503	-0.010
Kottigehara	13.1250	75.5003	3.540
Mudigere Hand Post	13.1217	75.6178	1.410
ThodluKaregadde	13.2114	75.3342	0.080

Table 12: Decadal Water Level Fluctuation (Pre-monsoon)

LOCATION	LAT	LONG	FLUCTUTION
Balehole	13.2667	75.4011	0.25
Bankal	13.1353	75.5347	-0.38
Bidaralli	13.1222	75.6014	2.54
Bilagula	13.1483	75.6344	-0.49
Chackmakki	13.14	75.5514	-0.05
Hire Bile	13.2075	75.4167	-0.37
Horatti	13.1294	75.5839	-0.47
Hornad	13.2769	75.3344	0.33
Jannapura	13.1333	75.5	0.28
Jn Bylu	13.0917	75.6508	0.34
Kalasa	13.2333	75.3503	-0.04
Kottigehara	13.125	75.5003	3.11
Mudigere Hand Post	13.1217	75.6178	0.79
ThodluKaregadde	13.2114	75.3342	0.07

Table 13: Decadal Water Level Fluctuation (Post-monsoon)

2.0 AQUIFER DISPOSITION

Most of the area in Mudigere taluk is covered by schist followed by gneissic rock formation. Weathered, fractured and jointed schist and gneiss serve as potential aquifers in the area.

- **Aquifer-I (Phreatic aquifer)** comprising weathered Schist and Granitic Gneisses.
- **Aquifer-II (Fractured aquifer)** comprising Fractured Schist and Granitic Gneisses.

In this taluk bore wells were drilled from a minimum depth of 120mbgl to a maximum of 150mbgl. Depth of weathered zone ranges from 20-36mbgl. Ground water exploration reveals that aquifer-II fractured formation was encountered between the depth of 30-60mbgl. Yield ranges from 0.75-2.25lps. The details of wells drilled are given in Table 14. The basic characteristics of weathered and fractured aquifers are given in Table 15.

Sl. No	Village	Latitude	Longitude	Total depth drilled(mbgl) mtr	Depth of casing pipe lowered (mbgl)mtr	Water tapped zones fractures	yield of well (Ips)
1	Agnishamaka Office	13° 7'14.60"N	75°36'16.76"E	140	20	30	2.25
2	Sighalli	13° 2'31.68"N	75°43'26.02"E	130	20	45	1.88
3	Anachuru	13° 2'28.71"N	75°37'13.75"E	120	30	60	0.75
4	Mudigere	13° 8'11.99"N	75°38'25.25"E	150	36	55	1.38
5	Kaarebylu	13° 7'54.60"N	75°43'28.54"E	140	30	45	1.50
6	Bettadaman e	13° 3'43.29"N	75°40'36.02"E	150	36	50	1.67

Table 14: The details of Exploratory wells in Mudigere Taluk

Aquifers	Weathered Zone (Aq.-I)	Fractured Zone (Aq.-II)
Prominent Lithology	Weathered Granitic Gneiss / schists	Weathered Granitic Gneiss / schists
Thickness range (mbgl)	20-36	Fractures upto60mbgl
Depth range of occurrence of fractures (mbgl)	30-35	36-60
Range of yield potential (lps)	-	0.75-2.25lps
Quality Suitability for Domestic &Irrigation	Suitable	Suitable

Table 15: The details of Aquifer I & Aquifer II in Mudigere Taluk

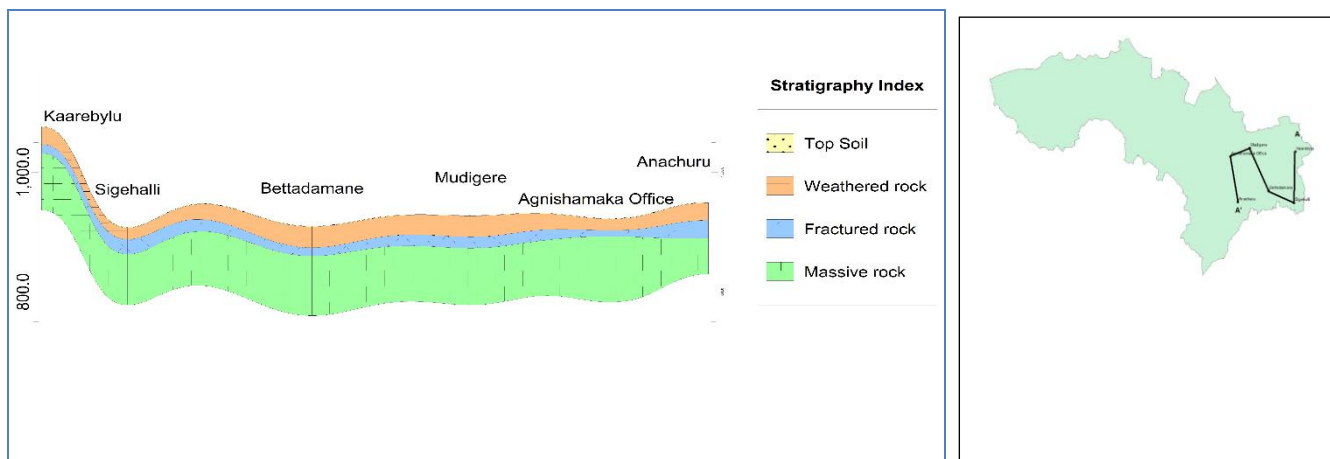


Fig 16: Cross Section of Exploratory wells drilled in Mudigere Taluk

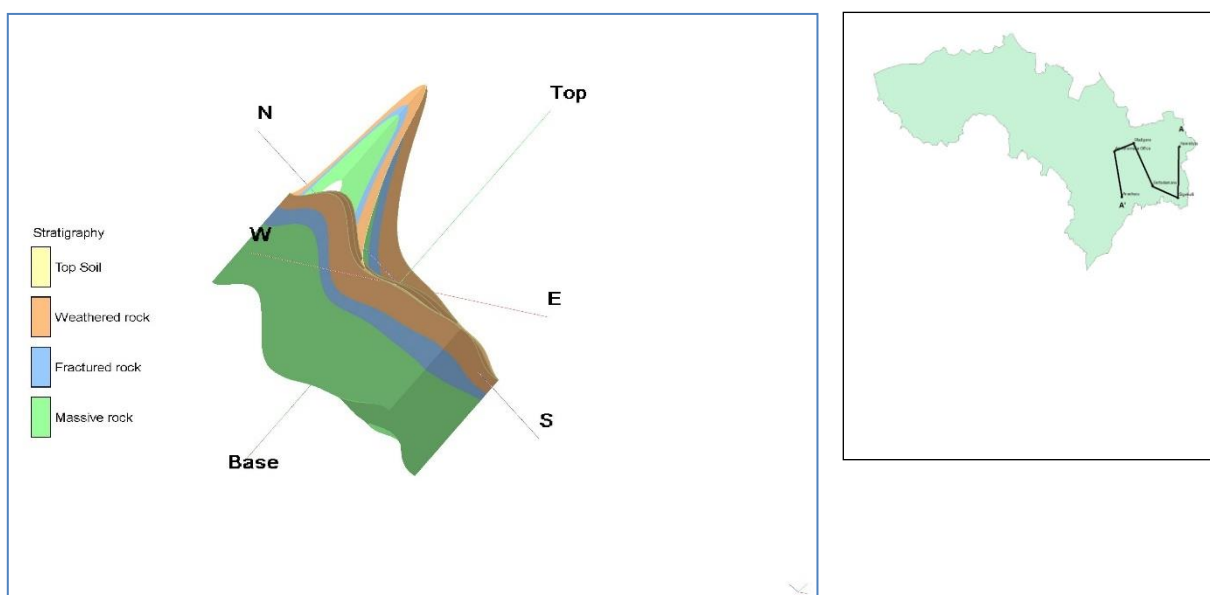


Fig 17: Fence Diagram of Exploratory wells drilled in Mudigere Taluk

3.0 GROUND WATER QUALITY

Interpretation from Chemical Analysis of Aquifer - I results in Mudigere taluk (Table 18) shows that the Electrical Conductivity ranges from 100 to 430 μ /mhos/cm in the aquifer-I at 25oC. The Nitrate value ranges from 1.37 to 37.54 mg/l and Fluoride concentration in groundwater ranges between 0.03 to 0.1 mg/l. All the values of EC, Nitrate , Fluoride are within permissible limit. The detailed chemical analysis is given below:

Hydro-chemical data of water samples analysed in 2022

Location	pH (6.5-8.5)	EC in m S/cm	TH (600)	Ca (200)	Mg (100)	Na	K	HCO ₃	Cl (1000)	SO ₄ (400)	NO ₃ (45)	SiO ₂	PO ₄	F (1.5)
Bankal	6.96	240	81	16	10	9.43	12.78	68	25	18	12.82	14.8	0.06	0.06
Bidarahalli	7.45	250	101	16	15	8.01	3.34	117	11	2	3.6	42.06	0.23	0.10
Bilagula	7.48	180	51	10	6	12.66	7.66	49	21	7	14.45	18.43	0.14	0.07

Chackmakki	7.39	180	51	14	4	10.58	3.07	61	18	3	5.58	25.94	0.13	0.44
Hale Mudigere	6.84	220	101	16	15	9.27	1.86	92	25	3	9.81	27.86	0.14	0.04
Hirebyle	7.16	100	40	8	5	4.21	0.89	43	7	2	1.37	22.4	0.12	0.02
Horanad	7.49	120	51	12	5	3.98	0.94	37	14	3	3.18	11.35	0.19	0.05
Horatti	6.79	220	71	16	7	9.89	14	31	32	9	34.44	3	0.08	0.03
J.N.Bylu	6.98	360	121	26	13	27.3	1.92	61	60	3	36.15	25.42	0.34	0.03
JannapuraChiga	7.22	430	207	22	36	4.7	0.58	141	50	2	31.19	40.26	0.16	0.05
Kottigehara	6.72	220	71	10	11	14.44	5.44	37	21	24	27.21	3.51	0	0.04
Mudigere Handpost	7.22	320	91	14	13	27.36	8.2	43	46	24	37.54	10.29	0	0.04

Table 16:Hydrochemical Data of Mudigere Taluk

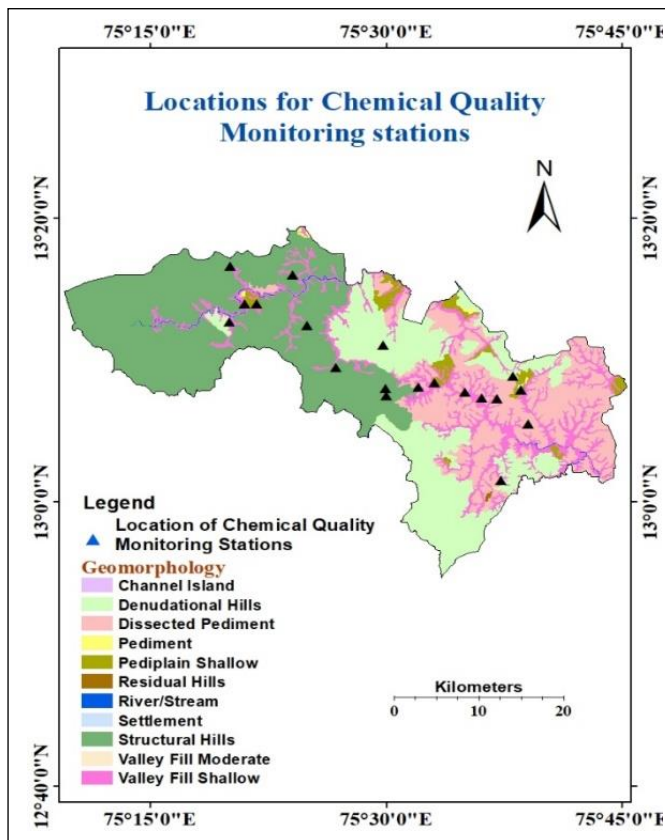


Fig 18: Locations of Groundwater monitoring stations in Mudigere Taluk

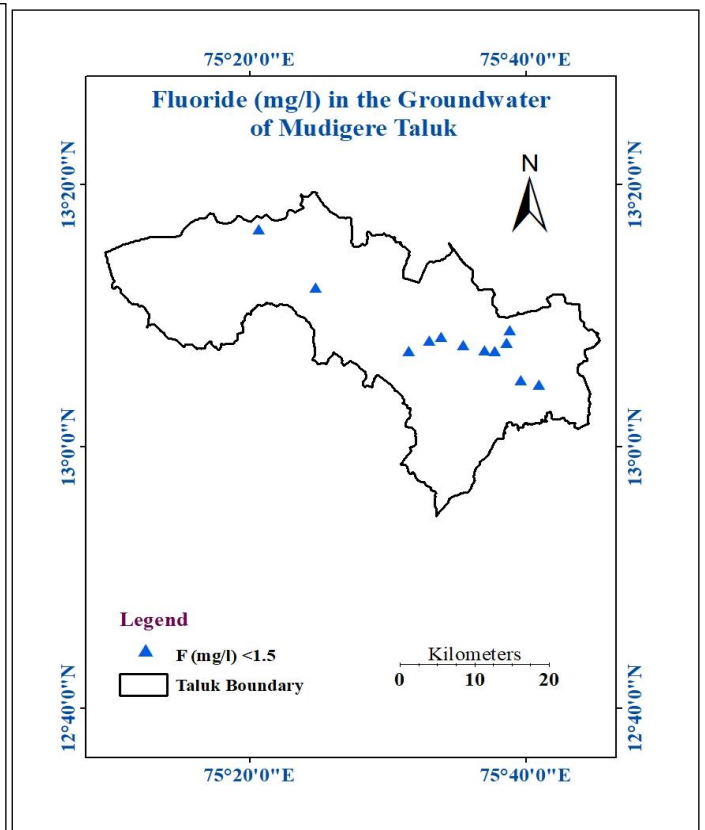


Fig 19: F in Groundwater of Mudigere Taluk

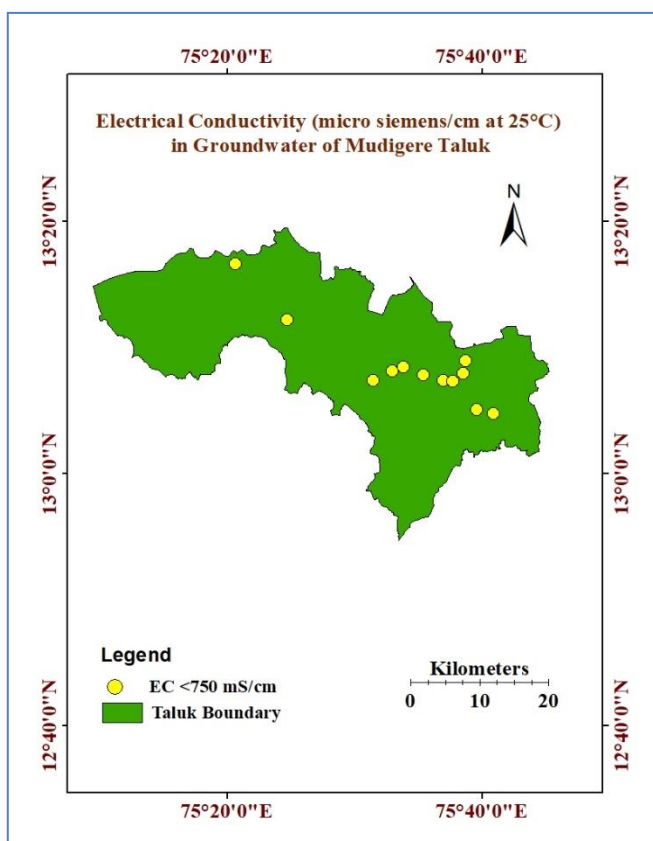


Fig 20: EC in Groundwater of Mudigere Taluk

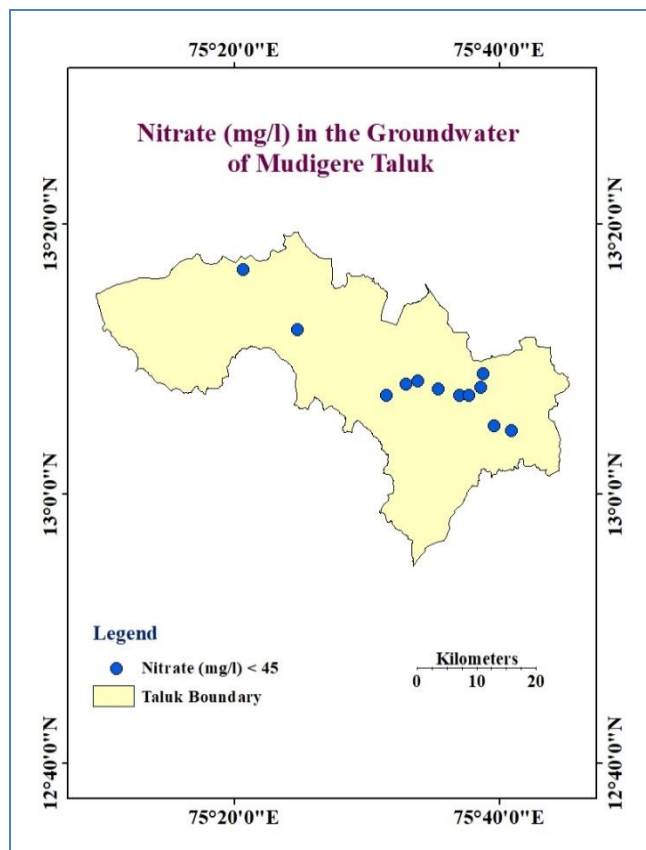


Fig 21: Nitrate in Groundwater of Mudigere Taluk

4. GROUND WATER RESOURCE ENHANCEMENT

4.1 Artificial recharge and proposed interventions

The overall stage of ground water development is 25.9% as per GEC 2020. The area feasible for recharge in the taluk is worked out as 786 sq.km and the surface surplus non-committed runoff availability is 57.530 MCM. As per Master Plan on Artificial Recharge, Karnataka and Goa, 2020 Various recharge structures are proposed in the taluk. However, the figures given are tentative and pre-field studies / DPR are recommended. prior to implementation of these recharge structures. Volume of water likely to be recharged is 43.147 MCM and Additional irrigation potential will be 0.052 Lakh Ha. The details pertaining to proposed recharge structures, cost estimates and likely Recharge benefits for Mudigere taluk, Chikmagalur district have been carried out and given in below:

Area Feasible for AR (Sq.Km)	Number of Recharge Structures Completed by various agency	Number of Proposed Recharge Structures						Cost of Recharge Structures (Rs. In Lakhs)				
		CD/MACD/VD	PT	PRS	Sub surface dyke	Pecolation tank	Check dam	Filter Beds	Sub surface dyke (@Rs 20 lakhs)	Pecolation tank (@Rs 20 lakhs)	Check dam(@Rs 10 lakhs)	Filter Beds(@Rs 1.5 lakhs)
786	65	0	28	2	52	242	0	30.68	1035.54	2418.25	0	

Availability of Surface non committed monsoon runoff (MCM)	Recharge Capacity of each structure (MCM)				Total Recharge capacity (MCM)	Total Cost in Lakhs
	Sub surface dyke	Percolation tank	Check dam	Filter Beds		
57.53	8.629	28.765	14.382	5.753	57.53	3484.471

Expected benefit of artificial recharge & RWH	
Vol. of water likely to be recharged (MCM)	Additional Irrigation Potential (Lakh Hectares)
43.147	0.052

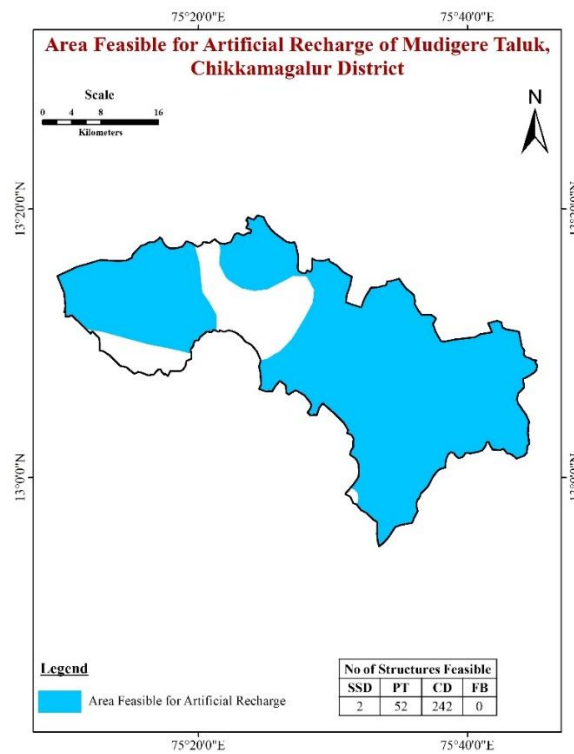


Fig 22: Area Feasible for AR in Mudigere Taluk

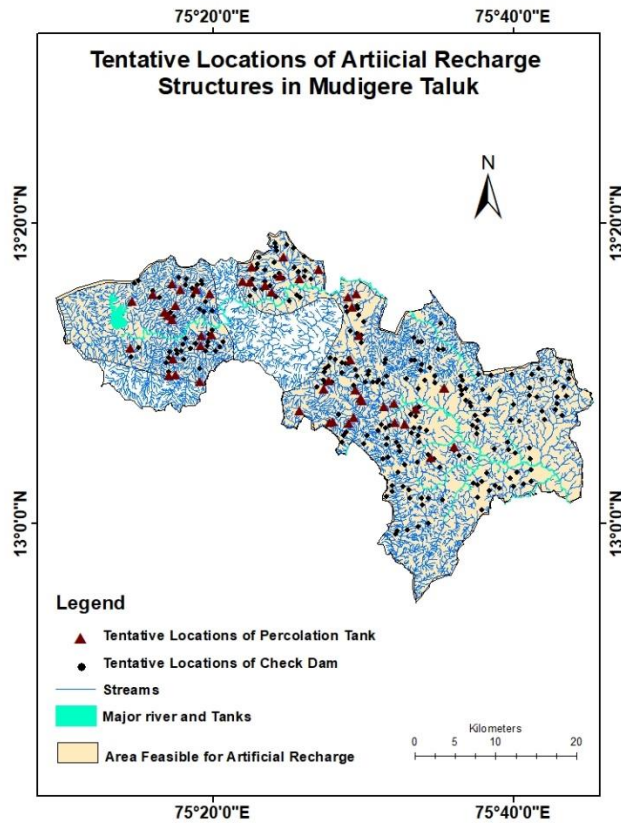


Fig 23: Tentative Locations of AR structures in Mudigere Taluk

Tentative Locations of Percolation Tank in Mudigere Taluk			
SI No	Longitude	Latitude	Village
1	75.574253	13.0734207	Hesagodu
2	75.60063646	13.08495632	Jogannanakere
3	75.54607637	13.11016338	Banakal
4	75.48312155	13.11130552	Atthigere
5	75.53425521	13.11204791	Binnadi
6	75.46187772	13.11210502	Mudhugundi
7	75.46604653	13.11330427	Mudhugundi
8	75.489232	13.11810126	Atthigere
9	75.42875807	13.12531287	Mudhugundi
10	75.55738357	13.12706707	Bankenahalli
11	75.52249116	13.1297511	Atthigere
12	75.53328439	13.13363438	Atthigere
13	75.49802649	13.13671817	Baluru
14	75.49659881	13.13917377	Baluru
15	75.49123833	13.14806265	Javali
16	75.45520877	13.14926001	Meguru
17	75.58984323	13.15069797	Palguni
18	75.58984323	13.15069797	Palguni
19	75.58984323	13.15069797	Palguni
20	75.58984323	13.15069797	Palguni
21	75.31844657	13.15784537	Samshi
22	75.46086901	13.15873001	Meguru
23	75.28389679	13.16429847	Samshi

24	75.29160625	13.1653835	Samshi
25	75.48553468	13.18212868	Javali
26	75.28863668	13.18285826	Samshi
27	75.24087614	13.19536471	Samshi
28	75.31892246	13.19822006	Samshi
29	75.4946127	13.20891016	Marakallu
30	75.32015978	13.20935594	Samshi
31	75.33148601	13.21011737	Kalasa
32	75.28722804	13.22639288	Kelagodu
33	75.28246912	13.23134216	Samshi
34	75.27875716	13.23505412	Samshi
35	75.48686139	13.24076932	Koove
36	75.29160625	13.24238286	Kelagodu
37	75.24268453	13.2470466	Samshi
38	75.48288126	13.25162423	Hadhi Oni
39	75.26579477	13.25400253	Samshi
40	75.32910655	13.25494641	Mavinakere (Kalasa) (Part 1,2,3)
41	75.49144458	13.25572497	Hadhi Oni
42	75.39833356	13.25729291	Kalasa
43	75.31435389	13.25961016	Kalasa
44	75.29687945	13.2600331	Kelagodu
45	75.3903733	13.26452951	Thalagoodu
46	75.28760075	13.2661201	Kelagodu
47	75.37421154	13.26838904	Horanadu
48	75.36588944	13.26947453	Horanadu
49	75.4286067	13.27188673	Thanodi
50	75.40701749	13.27502259	Thalagoodu
51	75.44959286	13.28213859	Thanodi
52	75.37602069	13.28527445	Horanadu

Tentative Locations of Check Dam in Mudigere Taluk			
SI No	Longitude	Latitude	Village
1	75.53533723	12.98770003	Byrapura
2	75.53704569	12.99193117	Vurubage
3	75.54883947	12.99228358	Byrapura
4	75.5607965	12.99653435	Byrapura
5	75.57192652	12.99964006	Byrapura
6	75.63130422	13.01453358	Devavrundha
7	75.56544633	13.02007178	Vurubage
8	75.58798498	13.02632027	Vurubage
9	75.5510694	13.02742718	Gutthi
10	75.57188505	13.02780536	Vurubage
11	75.56469149	13.02782496	Vurubage
12	75.62621279	13.02900244	Devavrundha
13	75.52491228	13.02936018	Gutthi
14	75.53158311	13.03474461	Gutthi
15	75.63976403	13.03598819	Devavrundha
16	75.55054019	13.03714097	Gutthi
17	75.65118798	13.03869454	Haramakki
18	75.54364892	13.04037898	Gutthi
19	75.66627537	13.04109578	Kannehalli

20	75.64611166	13.04122151	Haramakki
21	75.53168512	13.04167291	Gutthi
22	75.62639937	13.04276842	Kanachuru
23	75.67795695	13.04340185	Kiiragundha
24	75.62222692	13.04456307	Kanachuru
25	75.63117233	13.04615615	Kanachuru
26	75.68643972	13.04629024	Kiiragundha
27	75.66272891	13.04996777	Uggihalli
28	75.63645212	13.05567392	Angadi
29	75.67031449	13.0564996	Uggihalli
30	75.53828467	13.05685335	Gutthi
31	75.68563472	13.05923894	Bettadhamane
32	75.58448624	13.06196475	Byduvalli
33	75.54547172	13.064591	Gutthi
34	75.55985177	13.06736959	Hesagodu
35	75.57432628	13.06990549	Hesagodu
36	75.68470361	13.07095213	Chinniga
37	75.5211906	13.07097956	Kogile
38	75.57816443	13.07140808	Byduvalli
39	75.61761628	13.0723043	Kadadhalu
40	75.52678678	13.07325066	Kogile
41	75.60633481	13.07494086	Jogannanakere
42	75.57177392	13.07633067	Hesagodu
43	75.66814056	13.07750372	Anajuru
44	75.53979557	13.0798963	Kogile
45	75.60069097	13.08090024	Jogannanakere
46	75.6609047	13.08159027	Anajuru
47	75.6448336	13.08221317	Jogannanakere
48	75.68450602	13.08328564	J.I.Gonibeedu Agrahara
49	75.53949441	13.08513392	Kogile
50	75.52564263	13.08758726	Kogile
51	75.49999996	13.08788443	KogileBaramale Estate
52	75.66013697	13.08989063	Hoysalalu
53	75.5610735	13.09027469	Tripura
54	75.47606172	13.09027651	Atthigere
55	75.53627736	13.09040518	Kogile
56	75.52599558	13.0948942	Tharuve
57	75.56049968	13.09699983	Tripura
58	75.50415263	13.09766772	Tharuve
59	75.47757129	13.0977137	Atthigere
60	75.62571394	13.09926175	Daradhahalli
61	75.55339087	13.10015602	Kotragere
62	75.48065823	13.10134097	Atthigere
63	75.51587328	13.10286734	Tharuve
64	75.57011053	13.10296218	Bettagere
65	75.55588469	13.10564766	Kotragere
66	75.56223583	13.10599716	Tripura
67	75.52473283	13.10617358	Tharuve
68	75.62536252	13.10619693	Daradhahalli
69	75.54531349	13.10746502	Banakal
70	75.52924999	13.10835682	Tharuve
71	75.62122253	13.10838784	Daradhahalli
72	75.51958342	13.10981837	Tharuve

73	75.67323376	13.1131805	Hoysalalu
74	75.6264366	13.11459091	Daradhahalli
75	75.66397755	13.11462037	Halase
76	75.70129547	13.11494999	Kammaragodu
77	75.55796992	13.11874342	Bankenahalli
78	75.62367646	13.11945571	Halekote
79	75.71996432	13.11977037	Kammaragodu
80	75.55243848	13.1202601	Banakal
81	75.47210829	13.12028371	Meguru
82	75.63505604	13.12052654	Mudigere
83	75.69857934	13.12424612	Kammaragodu
84	75.63742073	13.12574426	Mudigere
85	75.71284912	13.1260482	Kammaragodu
86	75.55653076	13.12706634	Bankenahalli
87	75.56163881	13.12875187	Bankenahalli
88	75.61885782	13.12972374	Bidarahalli
89	75.66662674	13.13167076	Kunnahalli
90	75.71500884	13.1325542	Karbylu
91	75.61854293	13.1340306	Bidarahalli
92	75.61367898	13.13635124	Bidarahalli
93	75.63964072	13.1392555	Mudigere
94	75.69208731	13.1398824	Makodanahalli
95	75.71440124	13.14011687	Karbylu
96	75.72483409	13.14097336	Karbylu
97	75.68419736	13.14167628	Makodanahalli
98	75.60866227	13.14312048	Kenjige
99	75.65183947	13.14621615	Bilagula
100	75.60896719	13.14798625	Kenjige
101	75.63256355	13.14868377	Thathkola
102	75.61392353	13.14903453	Kenjige
103	75.56048387	13.1494303	B.Hosahalli
104	75.68448432	13.1506876	Kannapura (Part 1,2)
105	75.722418	13.15094787	Moodasosi
106	75.44843986	13.15131133	Mudhugundi
107	75.6070996	13.15220311	Kenjige
108	75.48927338	13.1530422	Javali
109	75.52196989	13.15473809	Baluru
110	75.45787107	13.15545532	Meguru
111	75.57915211	13.15583162	Baggasagodu
112	75.46524104	13.15644528	Meguru
113	75.51531051	13.15660851	Baluru
114	75.50169591	13.15683247	Baluru
115	75.51064176	13.15721122	Baluru
116	75.71290413	13.15726266	Moodasosi
117	75.516996	13.15861783	Baluru
118	75.60968334	13.15871106	Kenjigeguddadha Coffee Estate
119	75.56765758	13.15886758	Kannagere
120	75.45540498	13.15900471	Meguru
121	75.69851808	13.15960995	Nandhipura
122	75.72825171	13.16013615	J I Kannapura
123	75.54792167	13.1604077	B.Hosahalli
124	75.49318211	13.16294641	Javali
125	75.57963369	13.16322844	Baggasagodu

126	75.52526085	13.16335817	Baluru
127	75.60798192	13.16370497	Kenjigeguddadha Coffee Estate
128	75.64139727	13.16454947	Machagondanahalli
129	75.50532005	13.16492624	Baluru
130	75.6279542	13.16521036	Thathkola
131	75.66502263	13.16527491	Naduvnamadakallu
132	75.68732101	13.16566722	Nandhipura
133	75.47620998	13.166876	Javali
134	75.28384141	13.16770558	Samshi
135	75.45685399	13.16805305	Kelaguru
136	75.72847836	13.16893348	Kelagodu
137	75.50602909	13.16920974	Niduvale
138	75.5630831	13.16947262	B.Hosahalli
139	75.49133527	13.1704317	Javali
140	75.69396484	13.17136786	Nandhipura
141	75.31827213	13.1715805	Samshi
142	75.45706716	13.17175621	Kelaguru Coffee Estate
143	75.57338554	13.17252435	B.Hosahalli
144	75.46132431	13.17418371	Kelaguru
145	75.56400614	13.1760396	B.Hosahalli
146	75.48333455	13.17760251	Javali
147	75.48014905	13.17760461	Javali
148	75.47600198	13.17804211	Javali
149	75.28117622	13.17848456	Samshi
150	75.52344022	13.17849842	Heggudlu
151	75.7198048	13.17884858	Malahalli
152	75.55647802	13.18073493	B.Hosahalli
153	75.55347579	13.181301	B.Hosahalli
154	75.30049663	13.18174214	Samshi
155	75.52421718	13.18179341	Heggudlu
156	75.46879078	13.18216097	Kelaguru
157	75.48350338	13.18261573	Javali
158	75.46302349	13.18361359	Javali
159	75.28360844	13.18419089	Samshi
160	75.24207229	13.18457637	Samshi
161	75.29257783	13.18842918	Samshi
162	75.28472706	13.19018583	Samshi
163	75.32419879	13.19079729	Samshi
164	75.29788968	13.19082905	Samshi
165	75.33607388	13.19170391	Samshi
166	75.29194484	13.19192741	Samshi
167	75.58817852	13.19290008	Kundhuru
168	75.58276533	13.19338218	Kundhuru
169	75.30774456	13.19368731	Samshi
170	75.24999993	13.19454759	Samshi
171	75.34031987	13.19566402	Samshi
172	75.32653861	13.19681514	Samshi
173	75.29935946	13.19869911	Samshi
174	75.31362492	13.19972006	Samshi
175	75.49780133	13.20084602	Marakallu
176	75.34370951	13.20162852	Kalasa
177	75.56460394	13.20170748	B.Hosahalli
178	75.56074987	13.2017835	B.Hosahalli

179	75.32726814	13.20187002	Samshi
180	75.30221606	13.20494343	Samshi
181	75.55631613	13.20624175	Heggudlu
182	75.31963434	13.20793265	Samshi
183	75.497251	13.20926754	Marakallu
184	75.32803285	13.20942324	Samshi
185	75.49317928	13.21110286	Marakallu
186	75.48515929	13.2131365	Koove
187	75.33186099	13.2143854	Samshi
188	75.58570175	13.22197814	Kundhuru
189	75.50062836	13.22390544	KoradaThalaguru
190	75.2888941	13.22897789	Kelagodu
191	75.49445457	13.2309199	Koove
192	75.28080931	13.23145162	Samshi
193	75.28571703	13.23402661	Kelagodu
194	75.48185311	13.23465186	Koove
195	75.32271203	13.23489961	Kelagodu
196	75.332293	13.23592531	Mavinakere (Kalasa) (Part 1,2,3)
197	75.31785149	13.23747581	Kelagodu
198	75.49366255	13.23843937	Koove
199	75.48073318	13.24045097	Koove
200	75.49285487	13.24151838	Koove
201	75.32489458	13.2456426	Mavinakere (Kalasa) (Part 1,2,3)
202	75.41763145	13.24704186	K.Kelaguru
203	75.4299243	13.2506319	Hemmakki
204	75.27328197	13.2510287	Kelagodu
205	75.40290371	13.2516766	Ambinakodige
206	75.31089909	13.25242146	Kelagodu
207	75.37416782	13.252615	Kalasa
208	75.42584131	13.25358059	Hemmakki
209	75.26576627	13.25789299	Kelagodu
210	75.38764717	13.25967906	Kalasa
211	75.37968957	13.26031041	Kalasa
212	75.3096494	13.2610929	Kalasa
213	75.3958058	13.26392775	Thalagoodu
214	75.30222403	13.26471137	Kalasa
215	75.3155306	13.26487052	Kalasa
216	75.32130905	13.26573431	Horanadu
217	75.37400281	13.26590278	Kalasa
218	75.24596045	13.26642151	Samshi
219	75.3905115	13.26871776	Thalagoodu
220	75.25072003	13.2690591	Samshi
221	75.31972471	13.26916944	Horanadu
222	75.44194495	13.27138671	Thanodi
223	75.37674478	13.27139219	Horanadu
224	75.30362804	13.27146243	Kalasa
225	75.41111669	13.27167418	Thalagoodu
226	75.29489542	13.2730583	Kalasa
227	75.43457894	13.27385563	Thanodi
228	75.40153567	13.27393548	Thalagoodu
229	75.40676977	13.27746159	Thalagoodu
230	75.42728108	13.27961493	Thanodi
231	75.43551458	13.28001336	Thanodi

232	75.39101255	13.28178603	Thalagoodu
233	75.38141914	13.28283105	Thotadhuru
234	75.42353709	13.28398339	Thanodi
235	75.38179948	13.28785292	Thotadhuru
236	75.40035967	13.289718	Thotadhuru
237	75.38375071	13.29557717	Thotadhuru
238	75.43394887	13.29596771	Thanodi
239	75.40319563	13.30261552	Thanodi
240	75.42249699	13.30573976	Thanodi
241	75.40276371	13.30612952	Thanodi
242	75.41501204	13.30887284	Thanodi

Table 17: Present ground water availability and draft scenario (2022) in Mudigere Taluk and expected improvement in Stage of Ground Water Development in future, on implementation of artificial recharge schemes-

Taluk	Cumulative 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 Ground Water Availability after Artificial Recharge Structure Implementation	Stage of Ground Water Development after Artificial Recharge Structure Implementation	Expected Improvement in Overall Stage of Ground Water Development
	HAM	HAM	%	HAM	HAM	HAM	%
Mudigere	3854.74	1348.75	25.91313	4314.7	8169.44	16.50	9.4

4.2 Ground Water Development Plan

In Mudigere taluk, the present stage of ground water extraction (2022) is merely **25.9 %** with net ground water availability of **3854.74ham** and total extraction of **1348.75 ham**. The ground water draft for irrigation purpose is **1165.56ham**, thus indicating that ground water irrigation needs to be encouraged in the area. Also the less ground water development is most probably linked to the low ground water potential areas and limited aquifer thickness in Aquifer-II. 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 dugwells and Borewells.

In view of above, the focus of proposed ground water development plan is to up the ante of ground water development from the present 25.9 % to 60% in a systematic way by adopting scientific approach. About 1153 dugwells (15-30 m depth; 3 to 5 m diameter @ Rs. 3.00 lakh/dugwell) are recommended to be constructed in feasible areas. Further 497 borewells (40-100 m depth; 150 mm dia @ Rs. 2.00 lakh/borewell) are also recommended to be drilled in feasible areas. Additional irrigation potential which can be created considering crop water requirement of 0.65 m (Ha) will be **2730 ha**. The detailed ground water development strategy to uplift the ground water use in the feasible areas is presented in **Table-14**.

Table-18: Feasibility of additional GW abstraction structures based on GWRA 2022 availability

Balance GWR available to make SOE 60%	DW unit draft	BW unit draft	No. of DW feasible @ 65% with unit draft of 1 ham	No. of BWs feasible @ 35% with unit draft of 1.25 ham	Cost of Proposed DW's/year @ unit cost of Rs. 3 lakhs	Cost of Proposed BW's @ unit cost of Rs. 2 lakhs	Additional irrigation potential created considering crop water requirement of 0.65 m (Ha)	Additional irrigation potential created considering crop water requirement of 0.65 m (Ha)	Total irrigation potential created by DW's and BW's (ha)
1774.18	1	1.25	1153	497	3460	994	1774	955	2730

Note- Hydrogeological and scientific intervention is needed for pinpointing the sites for construction of dugwells and Borewells

4.3 Change in cropping pattern

Change in cropping pattern is necessary since cultivation of water intensive crops is prevalent in the Taluk. Though only 4573 hectares is covered under Paddy in the taluk which can effect groundwater availability. At present (2022), the stage of ground water extraction is @ 25.9 % and taluk has been categorised as Safe, thus **change in cropping pattern has not been suggested**.

4.4 Other interventions proposed

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

5. SUMMARY AND RECOMMENDATIONS

The main ground water issues are Low Ground Water Development, Limited Ground Water Potential / Limited Aquifer Thickness / Sustainability, Deeper Water Levels particularly in Aquifer-II in some parts of areas which are all inter-related or inter dependent. The summary of ground water management plan of Mudigere taluk is given below.

Stage of GW Extraction and Category (2022)	25.9 %, Safe
Annual Extractable GW Resource (Ham)	5204.89
Total Extraction (Ham)	1348.75
Total GW Resources (Dynamic & Static up to the depth of 200 mbgl) (Ham)	3854.74
Ground Water Draft for Irrigation (Ham)	1165.56
Ground Water Resource Enhancement by Supply side Interventions	
No of Proposed AR structures	
SSD	2
PT	52
CD	242
Expected Additional Recharge to GW due to AR (Ham)	4314.7
Additional Irrigation Potential that can be created (Ha)	5200
Total Estimated Expenditure (Rs. in Cr.)	34.84
Change in Stage of GW Extraction (%)	25.9 to 16.50
Ground Water Resource Development Plan	
Balance GWR available to enhance SOE 60% (Ham)	1774.18
No. of wells proposed	
DW – Depth: 15 to 30 m, Dia: 3 to 5 m, Unit Cost –Rs. 3.00 lakh, Av. Annual Gross draft – 0.6 ham	1153
BW – Depth: 40 to 100 m, Dia: 150 mm, Unit Cost – Rs. 2.00 lakh, Av. Annual Gross draft – 3.9 ham	470
Additional irrigation potential created considering crop water requirement of 0.65 m (Ha)	2730
Increase in Stage of GW Extraction (%)	25.9 to 60

As per the resource estimation – 2022, Mudigeretaluk falls under Safe category with the stage of ground water extraction is **25.9 %**. 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, demand side interventions, ground water development interventions and ground water quality protection aspects as mentioned in the management plan suggested above

- **Ground water resource enhancement by supply side interventions:** Quantity of surface water available through non-committed surface run-off is estimated to be 57.530 MCM. This can be

used to recharge the aquifer mainly through percolation tanks (52), check dams (242) and sub surface dyke structures (2). The volume of water expected to be conserved/recharged @75% efficiency is **4314.7** ham through these AR structures. The approximate cost estimate for construction of these AR structures is Rs. 34.84 Cr. The additional area which can be brought under assured ground water irrigation will be about 5200 hectares.

- **Ground water resource enhancement by demand side interventions:** At present majority 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 water intensive crop like paddy which is grown in 4573 ha and is dependent on ground water irrigation, efficient irrigation techniques will contribute in saving ground water.
- **Ground Water Resource Development Plan:** The present stage of ground water extraction (2022) is merely 25.9 % with net ground water availability of 3854.74 ham and total extraction of 1348.75 ham. The ground water draft for irrigation purpose is @ 1165.56 ham, thus indicating that ground water irrigation needs to be encouraged in the area. To overcome the low ground water development, 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 dugwells and Borewells.
- In view of above, the focus of proposed ground water development plan is to up the ante of ground water development from the present 25.9% to 60% in a systematic way by adopting scientific approach. About **1153 dugwells** (15-30 m depth; 3 to 5 m diameter @ Rs. 3.00 lakh/dugwell) are recommended to be constructed in feasible areas. Further **470 borewells** (40-100 m depth; 150 mm dia @ Rs. 2.00 lakh/borewell) are also recommended to be drilled in feasible areas. Additional irrigation potential which can be created considering crop water requirement of 0.65 m (Ha) will be **2730 ha**.
- **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.