



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

Somvarpet Taluk, Kodagu District, Karnataka

दक्षिण पश्चिमी क्षेत्र, बेंगलुरु

South Western Region, Bengaluru

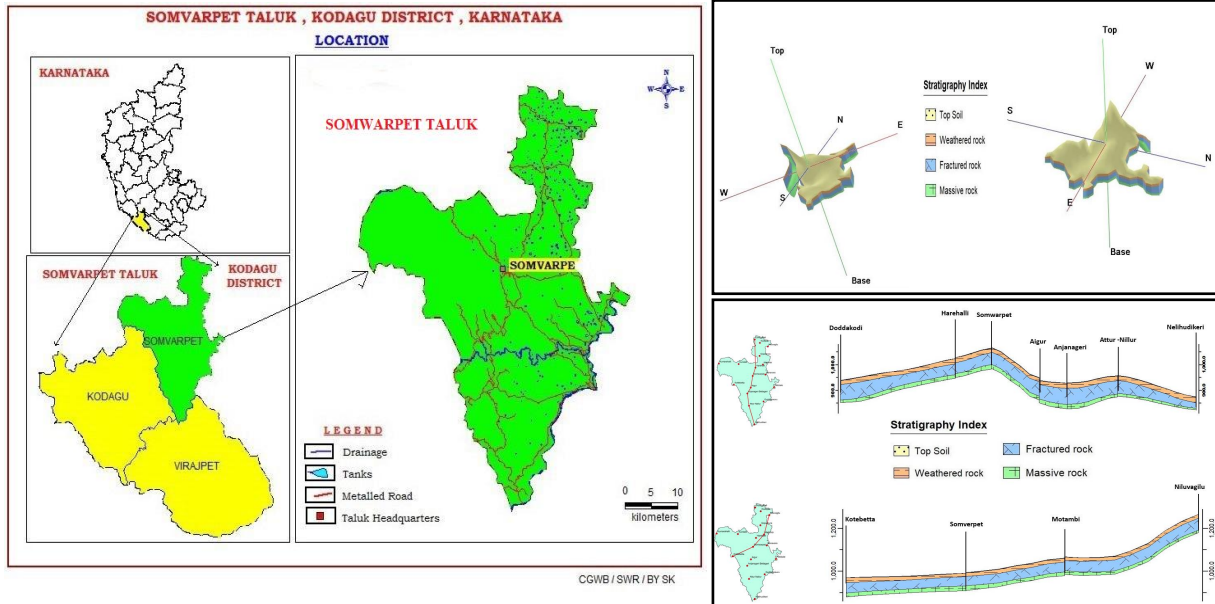
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AQUIFER MAPS AND MANAGEMENT PLAN, SOMVARPET TALUK, KODAGU DISTRICT, KARNATAKA STATE

(AAP: – 2022-2023)



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AQUIFER MAPS AND MANAGEMENT PLAN, SOMVARPET TALUK, KODAGU DISTRICT, KARNATAKA STATE

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AQUIFER MAPS AND MANAGEMENT PLAN, SOMVARPET TALUK, KODAGU DISTRICT, KARNATAKA STATE

1. SALIENT FEATURES

Name of the taluk: **SOMWARPET**

District: **KODAGU**;

State: **KARNATAKA**

Area: 1015 sq.km.

Population: 2,06,505

Actual Annual Rainfall (2022): 2397 mm

1.1. Study Area

Aquifer Mapping Studies have been carried out in Somwarpet taluk, Kodagu district of Karnataka, covering an area of 1015 sq.kms under National Aquifer Mapping (NAQUIM) during the AAP 2022-23. The Somwarpet taluk is located between North Latitudes 12.295773 and 12.833943 and East Longitudes between 75.641433 to 76.018752 and is falling in parts of Survey of India Toposheets 48P/10, 48P/13,48P/14, & 48P/15. The study area is bounded, on the North by Alur taluk, on the South East by Virajpet & Periyapatna taluk, on the East by Arkalgud taluk, on the South West by Kodagu Taluk. Location map of Somwarpet taluk of Somwarpet district is presented in **Fig-1**. Somwarpet is the taluk Headquarter. There are 135 villages and 40 gram panchayats in this taluk.

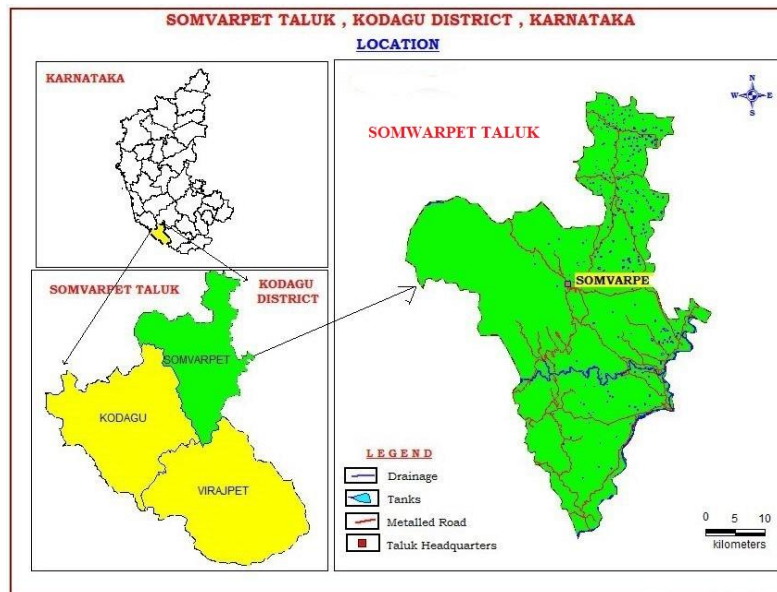


Fig. 1: Location Map

1.2 Population

According to 2011 census, the population in Somwarpet taluk is 2,06,505. Out of which 1,01,888 are males while 1,04,617 are females. The average sex ratio of Somwarpet taluk is 1027. The Somwarpet taluk has an overall population density of 203 persons per sq.km. The decadal variation in population from 2001-2011 is 0.28 % in Somwarpet taluk. Details of Population of Somwarpet taluk is given in Table-1.

Table-1: Details of Population of Somwarpet taluk, Kodagu district

Male	Female	SC	ST	TOTAL	No. of Villages	No. of GPs	Literacy %	Density
1,01,888	1,04,617	34,527	10,537	2,06,505	135	40	81.5	203

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

1.3 Rainfall and Climate

Somwarpet taluk experiences tropical climate characterized by slight to medium humidity due to proximity to coast. It is known to be quite pleasant and healthy, characterized by high humidity, heavy rainfall and cool summer. A major part of the year consists of rainy season as the monsoon period starting in June lasts till the ends of September. Even during the post monsoon months of October and November certain parts of the district receive a significant amount of rainfall. Because of the cloudy weather, the day would be quite sultry during October and it is only during the second half of the November that the weather becomes brighter. The period from December to February is the cold season marked by a bright weather, foggy mornings and cool nights. The day temperature begins to rise sharply during March and marks the commencement of the summer season, which lasts till the end of May. The southwest monsoon sets in usually during the early part of June. Generally, June, July and August are the months of heavy rainfall and the precipitation in July is incessant and very heavy. The normal annual rainfall and rainy days in Somwarpet taluk for the period 1951 to 2000 is 2190 mm and 103 respectively . The taluk depends mainly on monsoon for agricultural operations. The annual actual rainfall for the period from 2013 to 2022 is given in **Table-2a**. The annual average rainfall during this period is 2105 mm. The rainfall trend analysis for the period 2013-2022 of Somwarpet taluk is presented in **Table-2b** and in **Fig 2** which shows *increasing* trend.

Table 2a: Monthly Actual Rainfall (in mm)

YEAR	JAN	FEB	MAR	APR	MAY	PRE-MON	JUN	JUL	AUG	SEP	SWM	OCT	NOV	DEC	POST-MON	ANN.
2013	0.0	51.0	113.0	7.0	0.0	171.0	166.0	294.0	431.0	185.0	1076.0	41.0	48.0	0.0	89.0	1336.0
2014	0.0	0.0	0.0	3.6	82.0	85.6	204.0	1074.0	544.0	290.0	2112.0	83.0	7.0	0.0	90.0	2287.6
2015	0.0	0.0	25.0	133.0	147.0	305.0	701.0	266.0	260.0	192.0	1419.0	91.0	86.0	4.0	181.0	1905.0
2016	0.0	0.0	0.0	6.0	115.0	121.0	467.0	537.0	484.0	188.0	1676.0	12.0	6.0	38.0	56.0	1853.0
2017	73.0	0.0	3.0	42.4	88.0	206.4	219.0	457.0	460.0	270.0	1406.0	64.0	9.0	22.0	95.0	1707.4
2018	0.0	8.0	73.0	82.0	294.0	457.0	732.0	1173.0	1054.0	129.0	3088.0	107.0	0.0	0.0	107.0	3652.0
2019	0.0	0.0	0.0	37.0	39.0	76.0	120.4	288.0	808.0	405.0	1621.4	236.0	26.0	18.0	280.0	1977.4
2020	0.7	0.6	9.3	68.0	100.2	178.8	176.7	285.7	626.9	302.1	1391.4	174.1	27.8	12.2	214.1	1784.3
2021	48.8	26.3	1.9	89.5	163.3	329.8	249.1	584.6	247.0	266.3	1347.0	224.0	230.4	18.9	473.3	2150.1
2022	0.0	0.1	25.2	84.3	228.0	337.6	150.4	908.2	604.8	127.4	1790.8	178.8	38.1	52.0	268.9	2397.3

(Source: Directorate of Economics and Statistics)

Table- 2b: Actual Annual rainfall (mm) in rain gauge station from 2013 to 2022

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Average
Rainfall(mm)	1336	2288	1905	1853	1707	3652	1977	1784	2150	2397	2105.0

(Source: Directorate of Economic and Statistics)

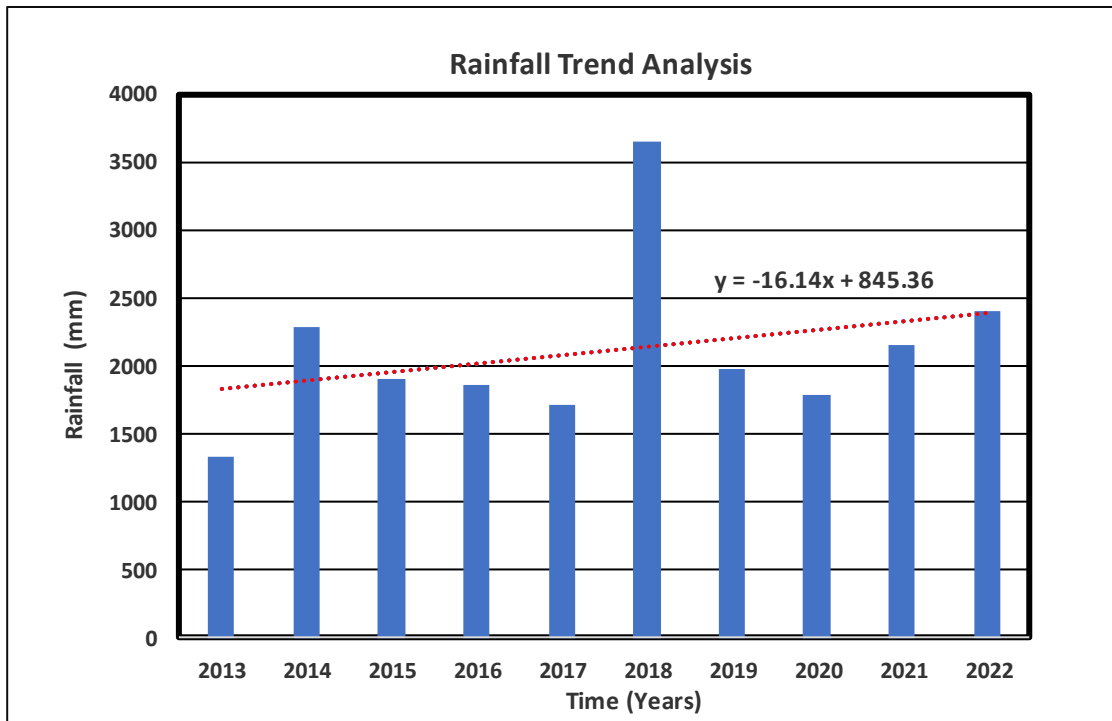


Fig. 2: Rainfall Trend Analysis

1.4 Agriculture & Irrigation

Agriculture is the main occupation in Somwarpet Taluk. Major crops are paddy, maize, coconuts, arecanuts, condiments, spices. Water intensive crops like paddy is grown in 38.72% of the total crop area. However, paddy is grown during Kharif period and is mainly dependent on rain water. Coconuts and arecanuts are grown in 4.56%, oil seeds in 0.81%, fruits grown in 6.63%, vegetables grown in 0.75% and condiments and spices grown in 34.19 % of total crop area in the taluk. The short duration crop vegetable is grown in 187 Ha (0.75%) of the crop area which require ground water during post monsoon season especially during summer.

Table-3: Cropping pattern 2017-18 (Ha)

Crop	Paddy	Maize	Bajra	Jowar	Ragi	Wheat	Pulses	Fruits	Vege tables	Oil seeds	Condiments & Spices	Coconuts Arecanuts	Total crop
Area(ha)	9630	3558	00	00	00	00	08	1650	187	202	8503	1135	24,873
Area %	38.72	14.30	00	00	00	00	0.03	6.63	0.75	0.81	34.19	4.56	100

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

About 20.54% of the geographical area is covered by forest. It is observed that net sown area accounts for 43.51% and area sown more than once is 10.96% of total geographical area in Somwarpet taluk. Area not available for cultivation and fallow land cover are 24.87% & 4.15% respectively of total geographical area. About 86.77% of net area irrigated is from canals, 2.85% are from bore wells, 0.79% from lift irrigation and 1.59% is from other sources. Thus major source of irrigation is canal (**Fig.-3**) and the irrigation from other sources is only 1.59%. The details of land use and the details of Irrigation are given in **Table 4 and 5** respectively. The land use pattern is given in **Fig.-4**.

Table-4: Details of land use 2017-18 (Ha)

Total Geographical Area	Area under Forest	Area not available for cultivation	Fallow land	Net sown area	Area sown more than once	Gross sown area
101500	20849	25241	4216	44167	11130	55088
% of the area	20.54	24.87	4.15	43.51	10.96	54.27

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

Table-5: Details of Irrigation (2017-18)

Source of Irrigation	Length in Km/No of structures	Gross area Irrigated (Ha)	Net area Irrigated (Ha.)	% of area
Canals	60	2039	1856	86.78
Tanks	512	180	171	7.99
Dug Wells	0	0	0	0
Bore/Tube wells	3199	70	61	2.85
Lift Irrigation	4	20	17	0.79
Other Sources		37	34	1.59
Total	3715	2,346	2139	100

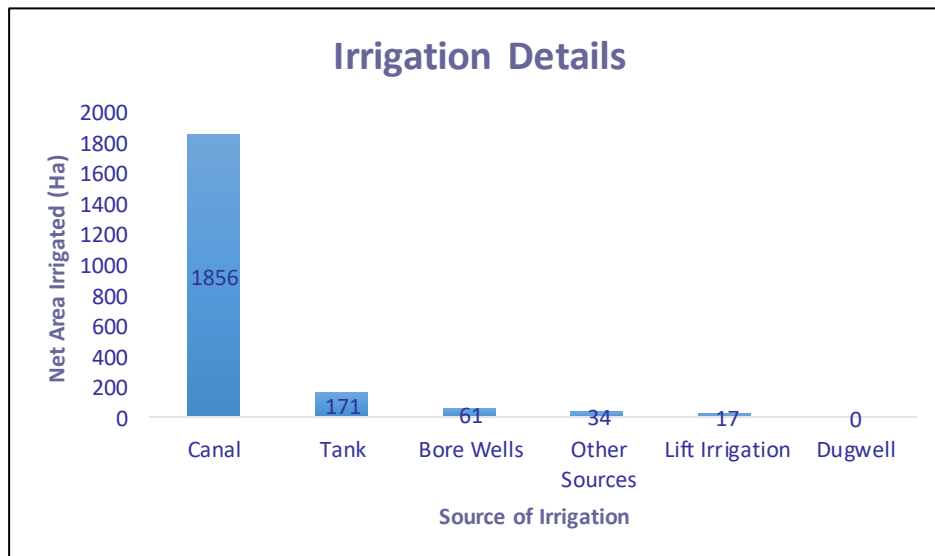


Fig.3: Irrigation Details

1.5 Geomorphology, Physiography & Drainage

Geomorphologically, the taluk is classified as hills & piedmont zones with about 70 - 80% of the taluk falling in this category. The taluk shows various land forms like hills and plateaus, piedmont zone, plains, river/stream, tanks, reservoirs and settlements, etc. In plain land, the master slope runs from north-east to south-west. The general topographic elevation ranges from to 1200m amsl from west to 800m amsl towards east of the taluk. The Somwarpet taluk is endowed with a number of perennial and non-perennial rivers/streams. The taluk is drained by 1st to 4th order streams which flow towards east. The drainage system is well developed in the taluk. The general drainage pattern is dendritic to sub-dendritic in nature (Fig. 5 and 6).

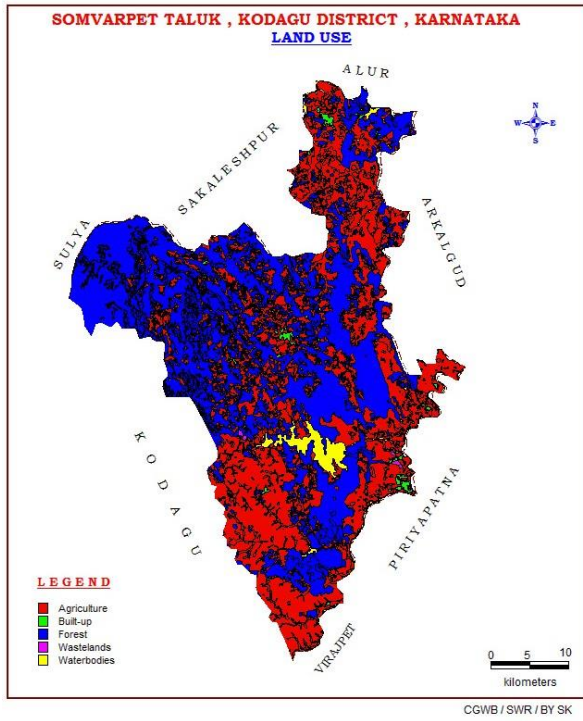


Fig. 4: Land use/land cover map

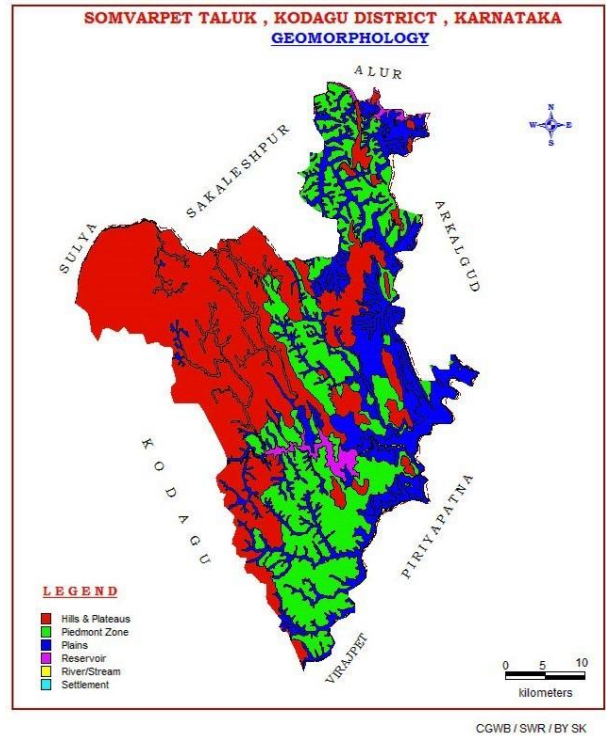


Fig.5: Geomorphology

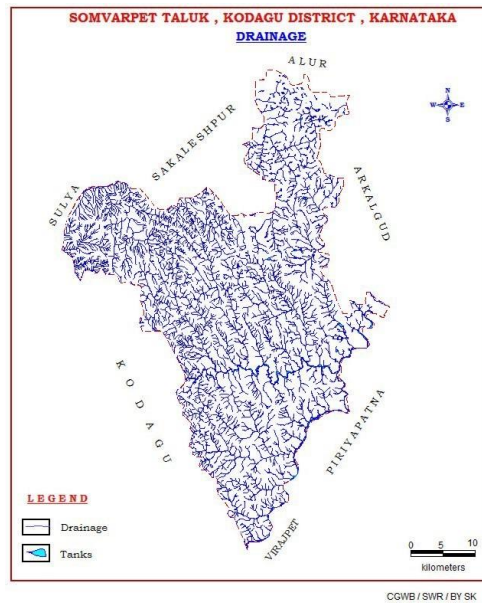


Fig.6: Drainage Map

1.6 Geology and Soils

Geologically, the taluk is mainly composed of igneous and metamorphic rocks of Pre-Cambrian age either exposed at the surface or covered with a thin mantle of residual and transported soils. The rock formation in the taluk falls into two groups, banded gneissic complex and laterite formation. The identification of stream pattern in the taluk is helpful in identification and interpretation of many geological features. The soil type of the taluk is clayey sketal, clayey & lateritic. It is having good moisture holding capacity and is fertile. These soils are fertile and generally produce good yields. Lateritic soil is found distributed in the south-western parts characterised by high iron and aluminium content and is suitable for Paddy, Sugarcane, Arecanut and Plantation crops, viz. crops like Cardamom & plantains. The texture of the soil varies from fine to coarse. The soil in valleys and intermediate slopes is rich in loam whereas in upper slopes it is much coarse in nature. The geology and soil maps have been given in **Fig. 7 and 8**.

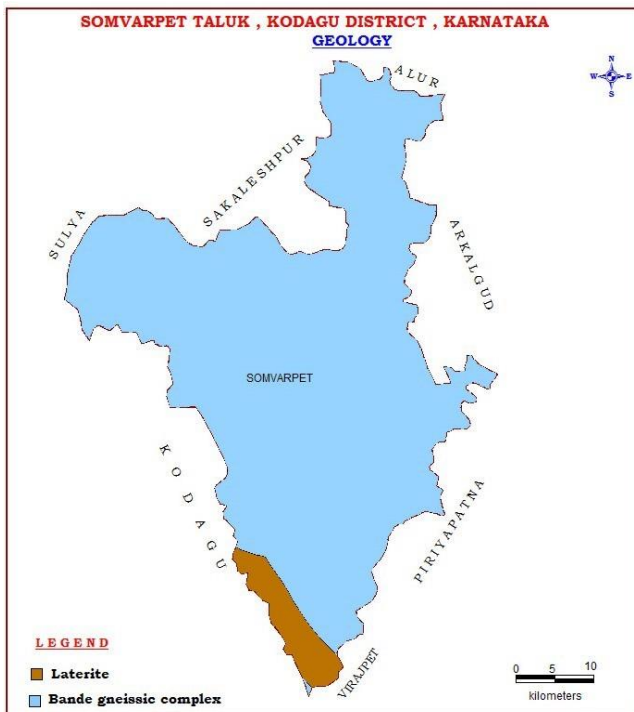


Fig. 7: Geology map

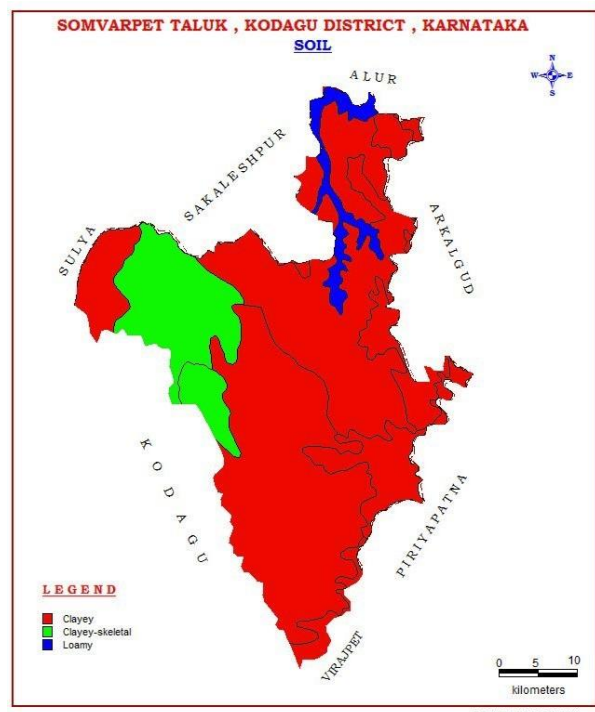


Fig. 8: Soil map

1.7 Ground water resource availability and extraction

Aquifer wise total ground water resources up to 200 m depth is given in Table-6 below

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

Taluk	Annual replenishable GW resources	Fresh In-storage GW resources		Total availability of fresh GW resources
		Phreatic	Fractured (Down to 200m)	Dynamic + phreatic in-storage + fractured
Somwarpet	10,799	64759	4,058	79,616

1.8 Existing and Future Water Demands (as per GWRA 2022)

- Net ground water availability for future irrigation development: **2281.65 Ham**
- Domestic (Industrial sector) demand for projected year 2025: **182 Ham**

1.9 Water level behaviour

The depth to water level has been monitored from 19 dugwells of CGWB, 3 dug wells of SGWD, Karnataka for phreatic aquifer (Aquifer-I). Similarly for fractured aquifer (Aquifer-II), 2 borewells of CGWB and 5 borewells SGWD, Bangalore has been used for water level monitoring to depict the ground water regime of the taluk. The depth to water level and seasonal water level fluctuation data is shown in **Table.8 (CGWB)** and **Table. 9 (SGWD)** for both Aquifer-I(Phreatic) and Aquifer-II(Fractured) respectively.

1.9.1. Aquifer - I:

The pre-monsoon (May 2022) depth to water level of Phreatic Aquifer indicates that depth to water level ranged from 1.03 m bgl (Somverpet) to 12.60 (Hosapatana). The pre-monsoon depth to water level map (Fig.-9) depicts that the water level in the range of 2 to 5 and 5 to 10 m bgl is the general water level in the taluk. Depth to water level in the range of 0-2 m bgl and 10-20 m bgl is observed as isolated patches in some parts of the taluk.

From the perusal of post-monsoon (Nov 2022) depth to water level data, it is observed that depth to water level ranged from 0.15 m bgl to 11.55 m bgl in Somverpet town. The Depth to water level map (Fig.10) shows that the water level in the range of 2 to 5 and 5 to 10 m bgl is the general water level in the taluk. Depth to water level in the range of 0 to 2 m bgl and 10 to 20 m bgl is observed as isolated patches in some parts of the taluk.

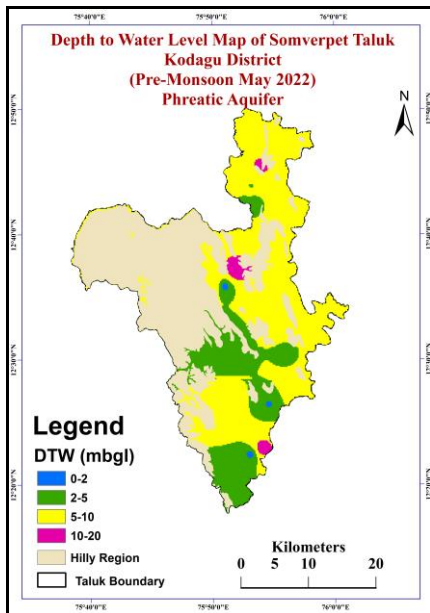


Fig.9: Pre-monsoon Depth to Water Level (Aquifer-I)

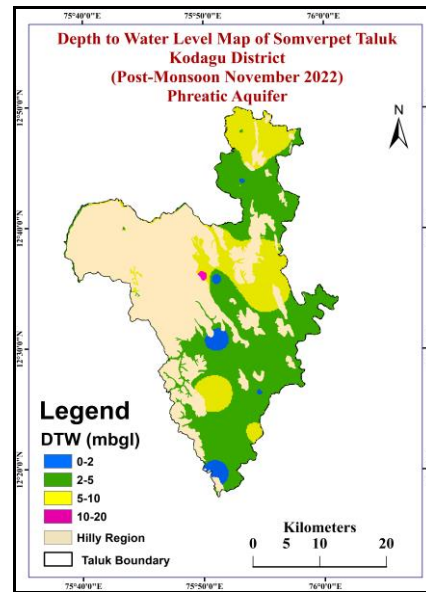


Fig.10: Post-monsoon Depth to Water Level (Aquifer-II)

1.9.2. Aquifer-II:

The pre-monsoon (May 2022) piezometric water level of deeper aquifer (Bore well) data indicates that the depth to water level ranged from 2.08 m bgl (Shanivarsaante) to 34.52 m bgl (Somverpet) in the taluk. The pre-monsoon piezometric water level map (**Fig.-11**) depicts that the water level in the range of 10 to 20 and 20 to 40 m bgl is the general piezometric level in the state. Shallower Piezometric water level in the range of 2 to 5 m bgl and 5 to 10 m bgl is observed as isolated patches in some parts of the taluk.

The post-monsoon (Nov 2022) piezometric water level of deeper aquifer (Bore well) data indicates that the depth to water level ranged from 2.04 m bgl (Sanivarashaante) to 35.75 m bgl (Somverpet). The post-monsoon piezometric water level map (**Fig.-12**) depicts that the water level in the range of 5 to 10, 10 to 20 and 20 to 40 m bgl is the general piezometric level in the state. Shallower Piezometric water level in the range of 2 to 5 m bgl is observed mainly in some parts of the taluk.

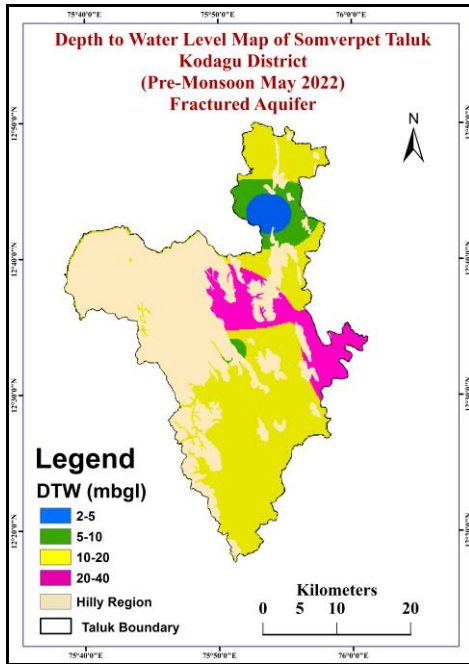


Fig.11: Pre-monsoon Depth to Water Level (Aquifer-II)

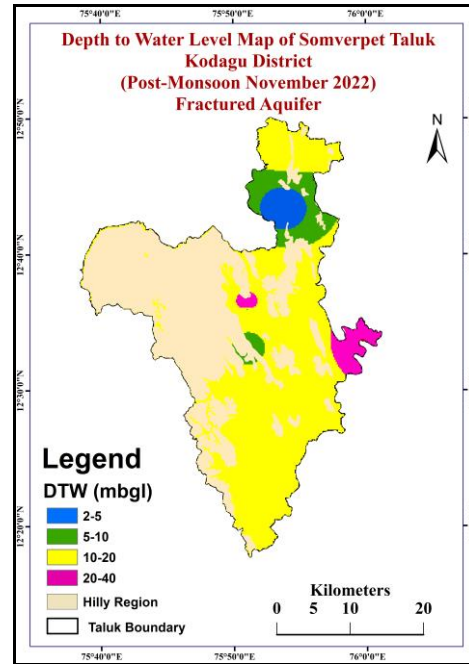


Fig.12: Post-monsoon Depth to Water Level (Aquifer-II)

1.9.3. Seasonal Water Level Fluctuation

Consequent upon seasonal rainfall, the water levels record a rise, indicating the buildup of storage in ground water reservoir. During the non-monsoon period, this gets depleted due to exploitation and natural discharge. Therefore, the water levels, in general show, a receding trend from December to May. The seasonal water level fluctuation for the year 2022 is available for 22 dug wells (Aquifer-I) and 5 piezometers (Aquifer-II). Out of 22 dug wells, 17 dugwells show rise in water level in the range of 0.20 m to 6.71 meter, while 5 dugwells show fall in water level in the range of 0.12 to 2.00 m. Out of 5 piezometers, 4 piezometers show rise in water level in the range of 0.04 m to 1.95 m. Fall in water level is shown in 1 piezometer only of 1.23 meter. The seasonal water level fluctuation map for Aquifer-I and Aquifer-II is shown in **Fig.13** and **Fig.14** respectively.

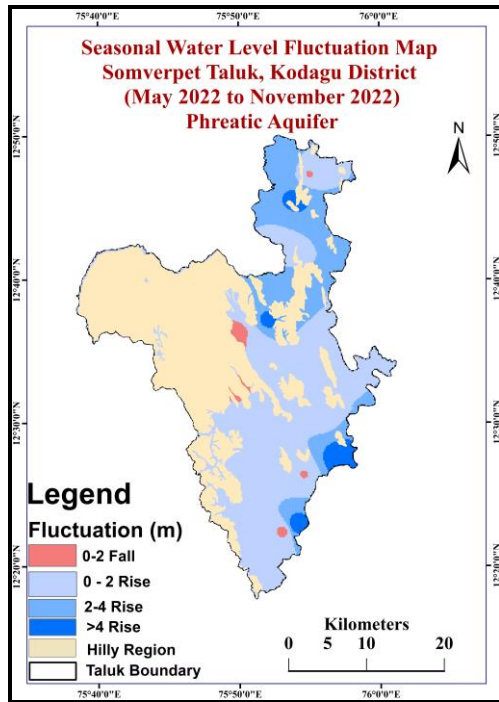


Fig.13: Seasonal Water Level Fluctuation Map of Aqifer - I

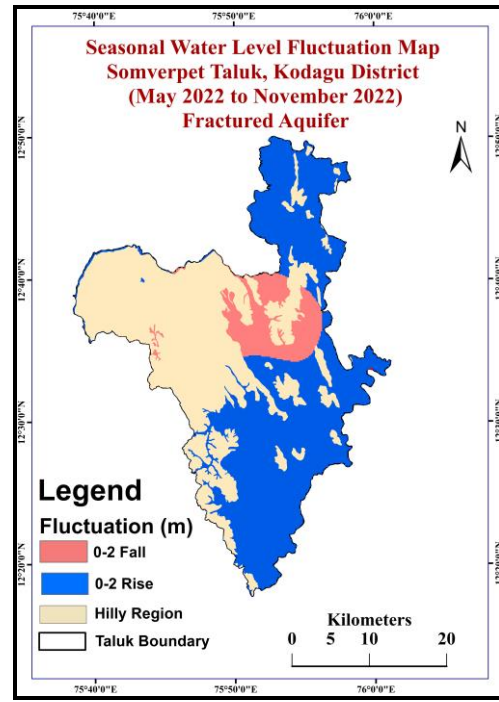


Fig.14: Seasonal Water Level Fluctuation Map of Aqifer - II

Table 8: Depth to Water Level Data Pre-monsoon & Post-Monsoon,CGWB,SWR, Bangalore

Sr. No	Village	Type of Well	Depth of the Well (mbgl)	Pre-monsoon Depth to water Level (May 2022) (mbgl)	Post-monsoon Depth to water Level (November 2022) (mbgl)	Seasonal Depth to Water level Fluctuation (meter)
Aquifer-I (Phreatic Aquifer)						
1	Abhyath Mangale	Dug Well	8	2.37	1.52	0.85
2	Basavanahalli A	Dug Well	10	1.83	1.95	-0.12
3	Basavanare	Dug Well	10	5.18	5.35	-0.17
4	Beluru	Dug Well	10	6.47	5.8	0.67
5	Gopalapura	Dug Well	6	2.6	2.4	0.2
6	Goudahalli	Dug Well	12	7.9	4.75	3.15
7	Hoodur	Dug Well	28	4.81	3.98	0.83
8	Hosapatna	Dug Well	19.2	12.6	6.55	6.05
9	Huduguru	Dug Well	5.85	2.79	0.85	1.94
10	Igoor	Dug Well	6.32	1.88	2.68	-0.8
11	Khowdikatte	Dug Well	21	14.7	9.7	5
12	Kodagarahalligrama	Dug Well	10.5	7.8	6.9	0.9

13	Kodlipet	Dug Well	13.6	8.45	6.35	2.1
14	Kushalanagara	Dug Well	15.55	9.66	2.95	6.71
15	Madalapura	Dug Well	7.8	4.37	3.12	1.25
16	Nanjarajpatna	Dug Well	8.5	1.3	2.05	-0.75
17	Shanivarasante	Dug Well	14.87	5.62	5.12	0.5
18	Shivaralli	Dug Well	16	11.68	5.75	5.93
19	Somvarpet1	Dug Well	17.97	9.55	11.55	-2.0
Aquifer-II (Fractured Aquifer)						
20	Nanjarajapatna	Borewell	45	----	18.6	---
21	Somvarpet	Borewell	45	----	4.2	---

Table 9: Depth to Water Level Data Pre-Monsoon & Post-Monsoon, SGWD, Bangalore

Sr. No	Village	Type of Well	Pre-monsoon Depth to water Level (May 2022) (mbgl)	Post-monsoon Depth to water (November 2022) (mbgl)	Seasonal Water level Fluctuation (meter)
Aquifer-I					
1	Somavarpet	Dug Well	1.03	0.15	0.88
2	Sanivarsante	Dug Well	4.82	1.2	3.62
3	Kodlipet	Dug Well	7.87	4.15	3.72
Aquifer-II					
4	Sanivarsante	Borewell	2.08	2.04	0.04
5	Beluru Bane	Borewell	7.19	6.49	0.7
6	Somavarpet	Borewell	34.52	35.75	-1.23
7	Madapura	Borewell	23.62	23.44	0.18
8	Kirikodli	Borewell	15.46	13.51	1.95

2. AQUIFER DISPOSITION

2.1. Depth wise Aquifer Systems

The data generated from ground water monitoring wells, micro level hydrogeological inventories, exploratory and observation wells, various thematic layers was utilized to decipher the aquifer disposition of the area. In the taluk if we consider the vertical distribution of aquifer, two types of aquifer system are observed i.e., Aquifer – I which is a shallow phreatic aquifer and Aquifer – II which constitutes the deeper fractured aquifer.

Ground water occurs within the weathered and fractured banded gneissic complex under water table condition and semi-confined condition. Borewell inventory reveals that depth of weathered zone ranges from 7.6 mbgl to 42 mbgl (Fig.15). Fractured gneissic complex is the major water bearing formation (Fig-16). In the taluk bore wells were drilled to a maximum depth of 200 mbgl. Fractured formation was encountered between the depths of 35 mbgl to 135 mbgl. Yield ranges from Negligible to 8.2 lps.

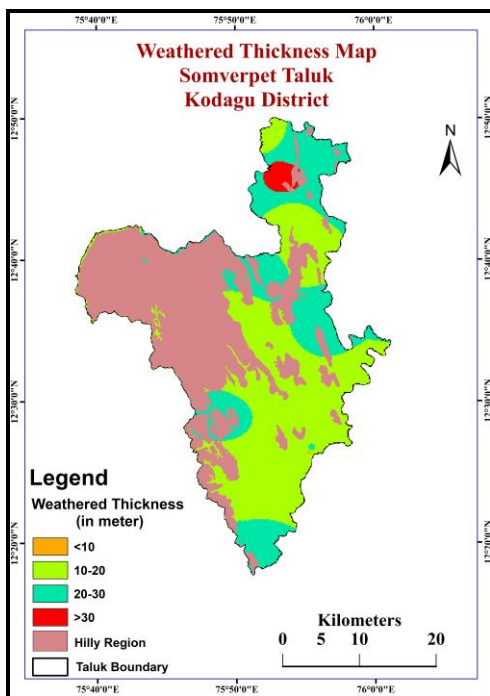


Fig.15: Weathered Thickness Map

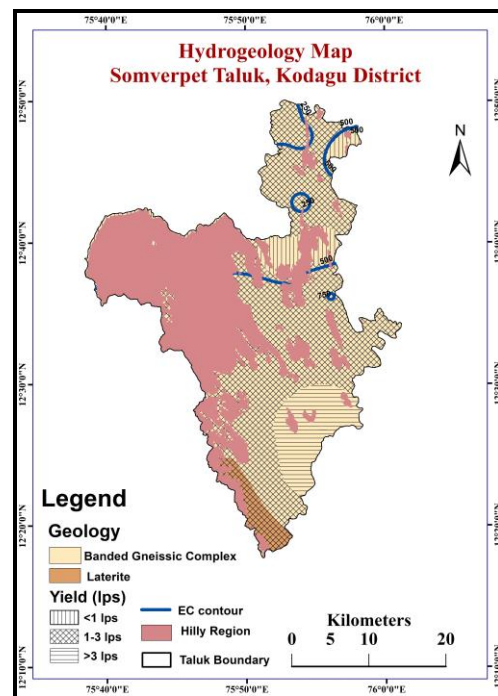


Fig.16: Hydrogeology Map

2.1.1. Aquifer-I (Shallow Phreatic aquifer)

Aquifer – I comprises of Laterite, weathered granitic schists and gneisses. The spatial distribution of depth of occurrence and aquifer thickness of Aquifer-I is depicted in Fig. 17. It indicates that the depth of occurrence of aquifer – I ranges from 7 to 42 m bgl. The shallow depth of occurrence of 7-15 mbgl occurs only about 10% of the taluk area while the deeper depth of occurrence of 15-20 mbgl occurs in about 50 % of the taluk. The perusal of the map for aquifer thickness indicates that it ranges from 3 to 8 m, however aquifer thickness of 3 to 5 m is observed in about 70 % of the area of the taluk. The aquifer thickness of 1 to 3 m is observed in 30% of the taluk area.

2.1.2. Aquifer-II (Deeper Fractured aquifer)

It comprises of fractured granite gneiss and schistose rock. The spatial distribution of depth of occurrence and aquifer thickness of Aquifer-II is depicted in Fig. 18. It indicates that the depth of occurrence of fractures in aquifer – II ranges from 35 to 135 m bgl. However, it mainly occurs in the depth range of 60 to 85 m bgl covering about 75% of the area throughout the taluk. The perusal of the map for fractured aquifer thickness indicates that it ranges from 1 to 10 m, however aquifer fracture thickness of 3 to 5 m is observed in about 50% of the area throughout the taluk.

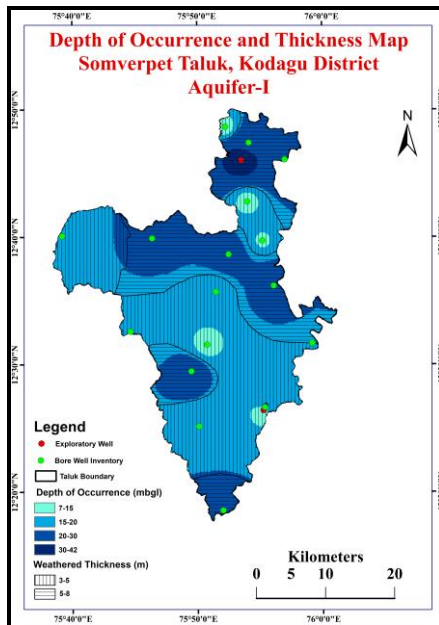


Fig.17: Depth of Occurrence and Thickness Map Somverpet Taluk, Kodagu District Aquifer-I

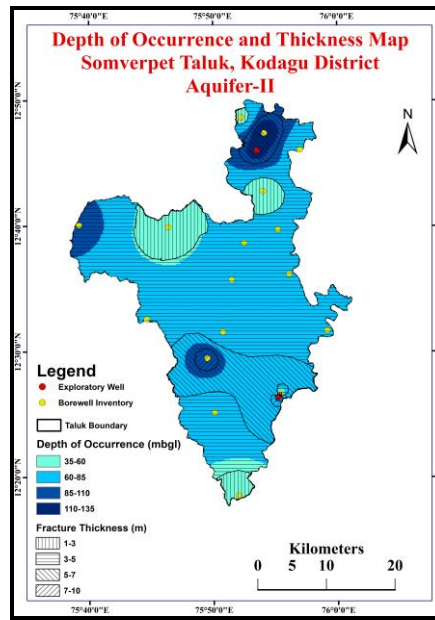


Fig.18: Depth of Occurrence and Thickness Map Somverpet Taluk, Kodagu District Aquifer-II

Table.10a: Details of Groundwater Exploration in Somverpet Taluk

Sl. No	Location	Latitude	Longitude	Depth (m bgl)	Casing (m)	Lithology	SWL (mbgl)	Q (lps)
1	Bambaloor EW	12.767	75.892	113	41.83	Granitic gneiss	13	1.3
2	Bambaloor OW1	12.767	75.892	94	41.83	Granitic gneiss	12	2.3
3	Bambaloor OW2	12.767	75.892	134	41.83	Granitic gneiss	16	3.5
4	Basavanahalli EW	12.44	75.921	113	10	Granitic gneiss	4	8.2
5	Basavanahalli OW	12.44	75.921	70	7.6	Granitic gneiss	4	6

Table 10b: Well Inventory Data, Somverpet Taluk

Sl.No	Location	Latitude	Longitude	Depth (m bgl)	Casing (m)	Lithology	Fracture zones (m)	Q (lps)
1	Kundalli	12.665	75.773	45	22	Granitic gneiss	22-23, 34-35	0.5
2	Harehalli	12.644	75.875	76	25	Granitic gneiss	25-26, 66-67	0.75
3	Gopalpura	12.713	75.9	55	12	Granitic gneiss	12-13, 66-67	1.25
4	Kodlipet	12.79	75.902	152	25	Granitic gneiss	25-26, 134-135	1.5
5	Doddakodi	12.811	75.871	55	12	Granitic gneiss	12-13, 49-50	1
6	Niluvagilu	12.768	75.95	80	25	Granitic gneiss	25-26, 59-60	0.75
7	Molambi	12.662	75.92	92	14	Granitic gneiss	14-15, 61-62	0.8
8	Banavara	12.603	75.935	76	27	Granitic gneiss	27-28, 60-61	1.5
9	Somwarpet	12.595	75.858	85	15	Granitic gneiss	15-16, 64-65	1.75
10	Aigur	12.526	75.846	80	12	Granitic gneiss	12-13, 67-68	2.3
11	Anjanageri Bettageri	12.491	75.825	121	25	Granitic gneiss	25-26, 98-99	2.5
12	Attur Nallur	12.419	75.835	80	18	Granitic gneiss	18-19, 69-70	2
13	Nelihudikeri	12.309	75.867	45	24	Granitic gneiss	24-25, 39-40	1.8
14	Guddehosuru	12.444	75.923	58	24	Granitic gneiss	24-25, 44-45	1.25
15	Hebbale	12.528	75.986	90	19	Granitic gneiss	19-20, 76-77	2.25
16	Kumarahalli	12.668	75.653	110	17	Granitic gneiss	17-18, 94-95	0.8
17	Kottebetta	12.543	75.744	85	18	Granitic gneiss	18-19, 74-75	1.2

2.2. 3-D aquifer disposition and Cross-Sections

2.2.1. Aquifer disposition – Rockworks output

Sub-surface aquifer disposition are prepared based upon the outcome of ground exploration programme. Four zones are categorized namely Top soil, Weathered, Fractured and Massive zones. These zones are represented using rockworks to depict the subsurface sections and models and presented in **Fig.-19, Fig.-20 and Fig.21**.

The 3-D representation is presented in **Fig. -19**. The disposition of Aquifer-I and Aquifer-II followed by massive formation can be observed in the 3-D aquifer disposition. The depth of the top soil is in the range of 0 to 1 m bgl, followed by weathered aquifer observed upto 42 m, which is followed by fractured aquifer which is disposed from 12 to 135 m bgl depth followed by massive formation devoid of any ground water.

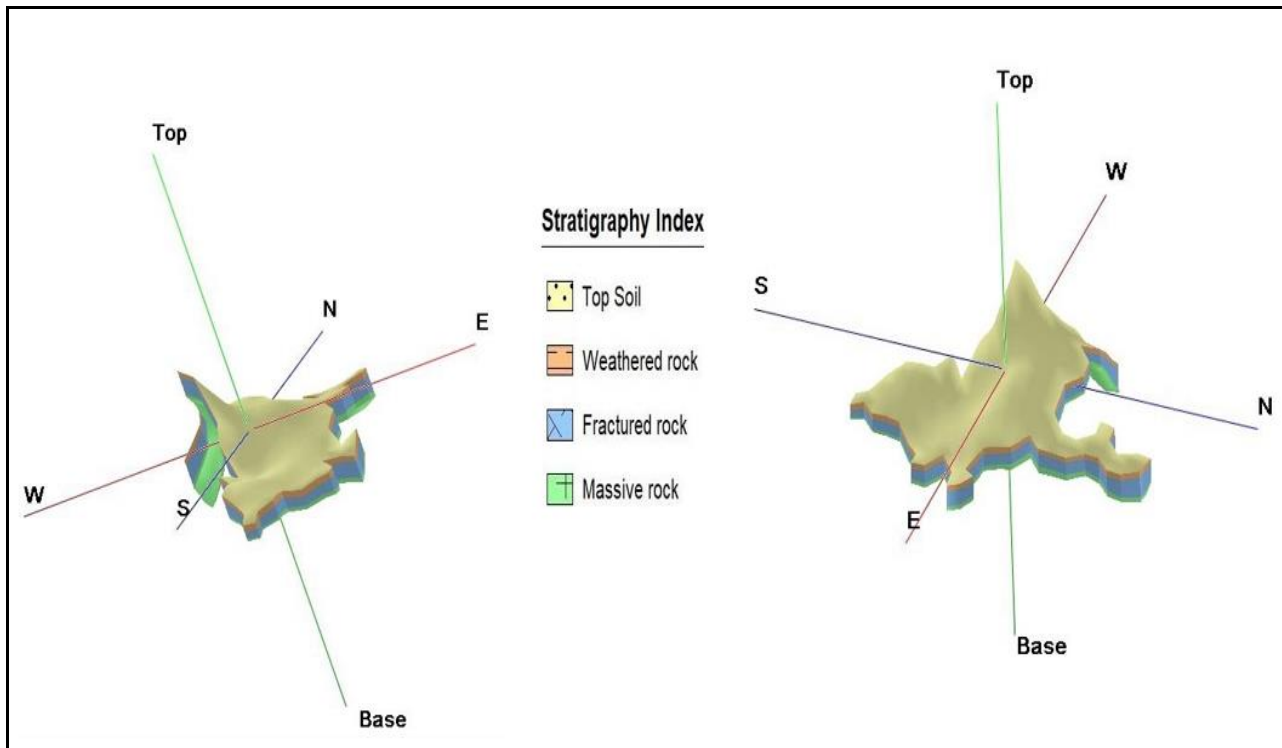


Fig.19: 3D Aquifer Disposition Map

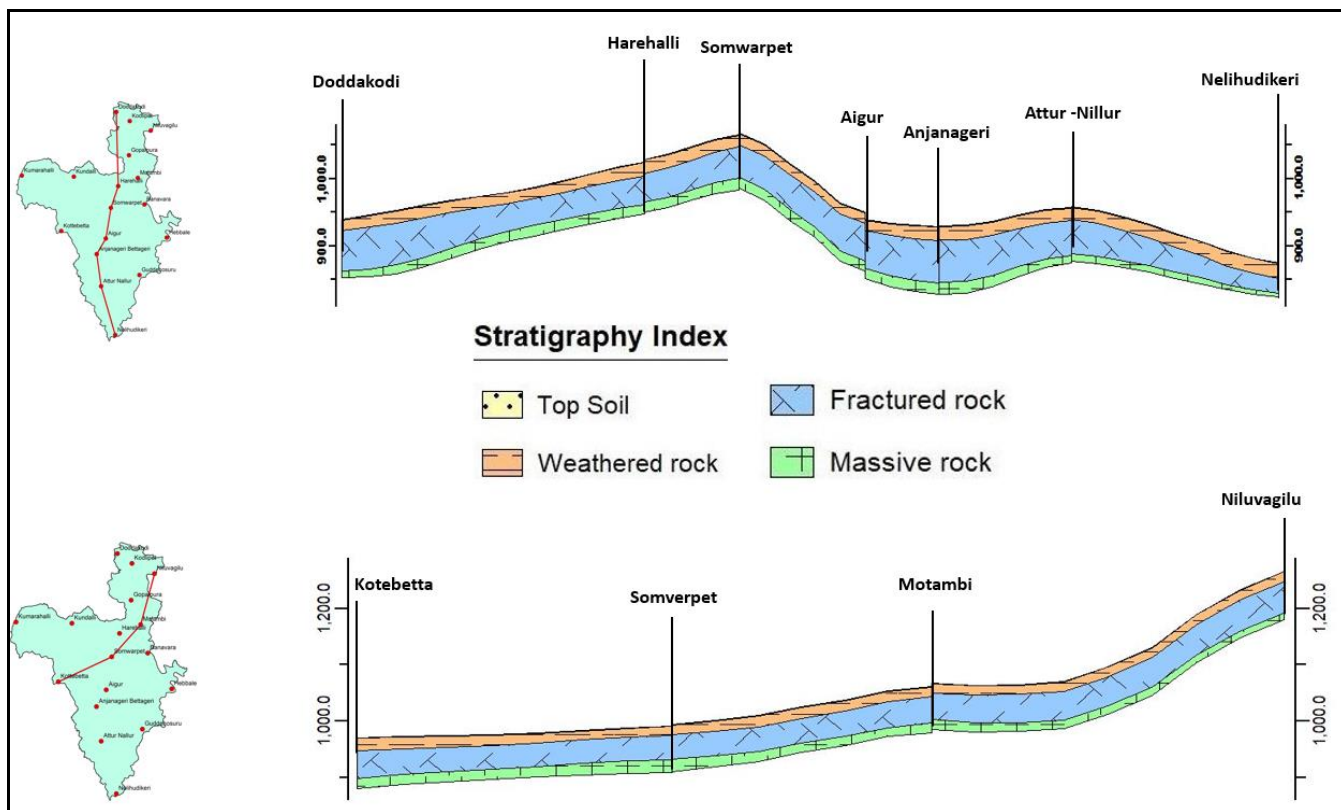


Fig.20: 2D Cross section Map

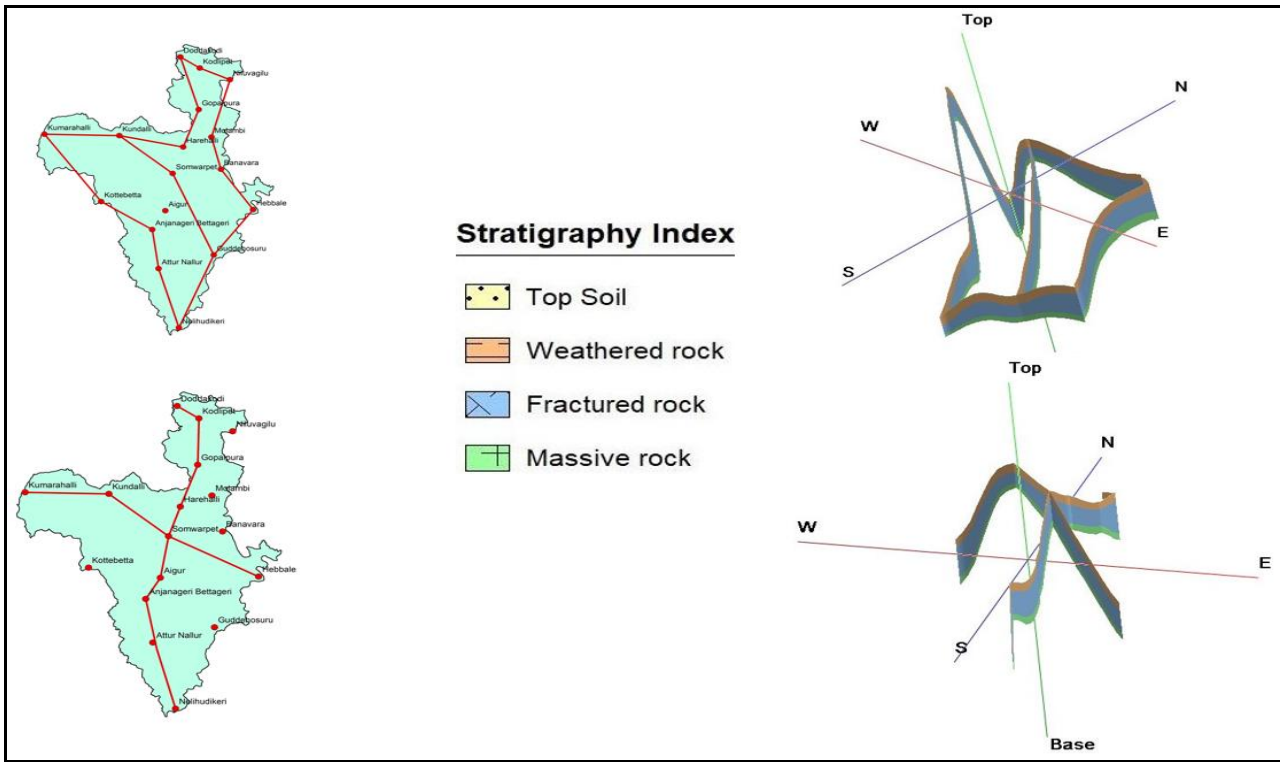


Fig.21: Fence Diagrams

3. GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES

3.1. Aquifer wise resource availability and extraction

Table 10: Present Dynamic Ground Water Resource of Somverpet Taluk (2022)

Annual extractable ground water resources (ham)	Existing gross ground water draft for irrigation (ham)	Existing gross ground water draft for domestic and industrial water supply (ham)	Existing gross ground water extraction for all uses (ham)	Allocation for domestic and industrial use for next 25 years (ham)	Net ground water availability for future irrigation development (ham)	Existing stage of ground water extraction (%)	Category
4015.43	1519.9	209.6	1729.5	182	2281.65	43.07	SAFE

Table 11: Comparison of ground water availability and draft scenario in Somverpet taluk

Taluk	GW availability (in ham)	GW draft (in ham)	Stage of GW development (%)	GW availability (in ham)	GW draft (in ham)	Stage of GW development (%)	GW availability (in ham)	GW draft (in ham)	Stage of GW development (%)
	2017			2020			2022		
Somverpet	10799	2667	25	8641	2246	26	4015.43	1729	43

It is evident from the above table (Table-10 and Table-11) that GW extraction is decreasing annually. But simultaneously stage of development also increasing due to decrease in GW availability. Since the net extraction is below 60%, the taluk is categorized as “safe”.

3.2. Chemical quality of ground water and contamination

Interpretation from Chemical Analysis results in Somverpet taluk is mentioned as under and the data is shown in Table.12. The pH ranges from 7.56 to 8.46 in Aquifer-I and 6.24 to 8.19 in Aquifer-II at 25^o C. EC values ranges from 90 to 990 μ/mhos/cm in aquifer-I at 25°C (Fig.-22) and from 177 to 754 μ/mhos/cm in the aquifer-II(Fig.25). Nitrate concentration in ground water ranges from 1.44 to 44.95 mg/l in the Aquifer-I (Fig.23) and ranges from 0.49 to 63.90 mg/l in the Aquifer-II(Fig.26). Fluoride concentration in ground water ranges between 0.1 to 0.54 mg/l in the aquifer-I (Fig-24) and ranges between 0.02 to 0.11 mg/l in the aquifer-II(Fig.27).

In general, ground water quality in Somverpet taluk is good for drinking purpose except at 2 places of Aquifer-II where nitrate is found to be greater than the permissible limit (45 mg/L) as per “Indian Standard Drinking Water Specification 2012”.

Table-12: Quality of ground water in Somverpet taluk, Kodagu District

S. No.	Location	pH	EC (μ S/cm)	NO ₃ (mg/L)	F (mg/L)
Aquifer-I (Phreatic Aquifer)					
1	Nilvagailo	7.75	450	24.04	0.54
2	Basavanare	7.69	250	6.81	0.22
3	Kodlipet	7.85	320	26.3	0.32
4	Shivaralli	8.2	370	1.45	0.38
5	Gopalapura	8.11	550	38.55	0.38
6	Shanivarasante	7.79	390	38.79	0.27
7	Goudahalli	7.65	130	3.76	0.23
8	Howaikatte	7.56	460	8.21	0.21
9	Somvarpet	7.8	370	30.42	0.2
10	Beluru	7.62	90	2.7	0.19
11	Igoor	8.25	550	15.56	0.32
12	Huduguru	8.15	320	16.57	0.43
13	Madalapura	8.16	500	1.44	0.45
14	Kushal Nagar	8.32	800	1.58	0.46
15	Basavanahalli	8.32	990	40.15	0.45
16	Hosapatna	8.34	400	34.33	0.35
17	Nanjarajpatna	8.4	450	18.9	0.35
18	Thayagathoor	8.31	740	44.95	0.34
19	Abhayath Mangala	8.37	630	23.79	0.34
20	Kodagarahalli Grama (Maruthi Nagar)	8.46	620	43.5	0.1
21	Ponnathumattai	8.17	440	2	0.42
Aquifer-II (Fractured Aquifer)					
1	Harehalli	6.96	425	33.76	0.02
2	Gopalpura	6.24	223	25.32	0.02
3	Kodlipet	6.76	219	3.01	0.11
4	Doddakodi	8.11	177	2.82	0.03
5	Niluvagilu	6.47	676	27.59	0.05
6	Molambi	6.44	410	14.63	0.09
7	Banavara	6.25	754	60.45	0.06
8	Somwarpet	6.79	580	3.15	0.03
9	Aigur	6.69	638	5.46	0.05
10	Anjanageri Bettageri	8.19	529	0.49	0.06
11	Attur Nallur	7.83	666	10.81	0.02
12	Nelihudikeri	6.58	610	63.9	0.02
13	Guddehosuru	6.52	560	18.99	0.04

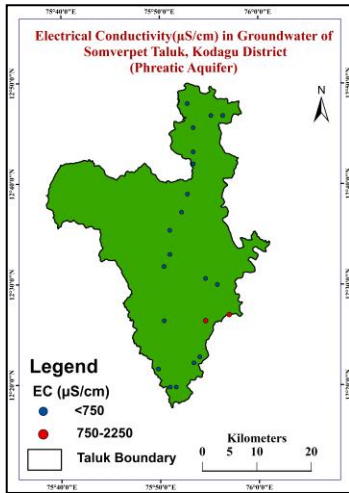


Fig-22. Distribution of EC (Phreatic Aquifer)

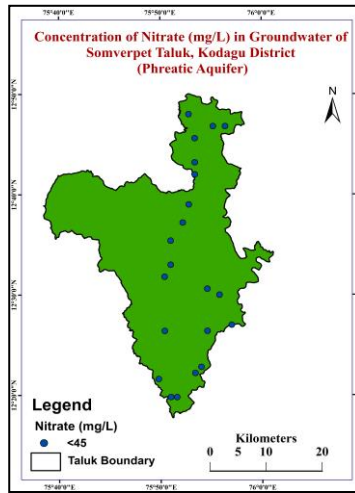


Fig-23. Distribution of Nitrate (Phreatic Aquifer)

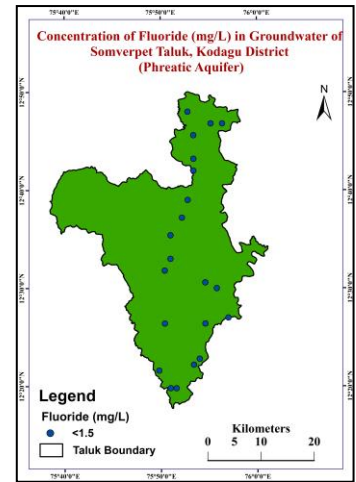


Fig-24. Distribution of Fluoride (Phreatic Aquifer)

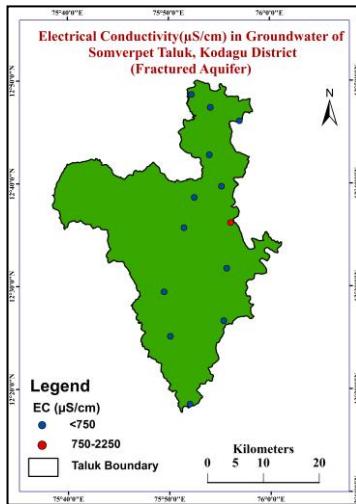


Fig-25. Distribution of EC (Fractured Aquifer)

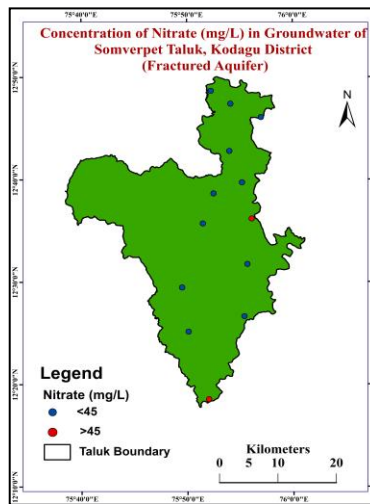


Fig-26. Distribution of Nitrate (Fractured Aquifer)

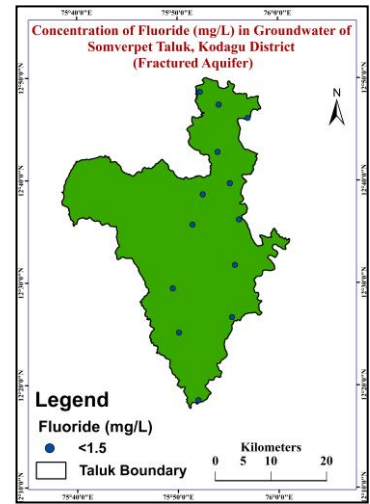


Fig-27. Distribution of Fluoride (Fractured Aquifer)

4. GROUND WATER MANAGEMENT PLAN

4.1. Resource Enhancement by Supply Side Interventions

Recharge to dry **phreatic aquifer zone (Aq-I)** through construction of artificial recharge structures, viz; check dams, percolation tanks & Sub surface dyke (**Table-13**) is recommended. 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. The area feasible for artificial recharge is given in **Fig.28**.

The entire area of Somverpet taluk is feasible for recharge i.e., **856 sq.km.** and the surface surplus non-committed runoff availability is **40.744 MCM**, which is considered for planning of AR structures. For this, a total of **1** sub-surface dyke, **37** percolation tank and **207** Check dams are proposed. The volume of water expected to be conserved/recharged @**75%** efficiency is **30.558 MCM** through these AR structures. The approximate cost estimate for construction of these AR structures is **2828.15** lakhs. The additional area which can be brought under assured ground water irrigation will be about **3700** hectares. The tentative list of the proposed Percolation tanks and Check dams are listed in Annexure-I and II respectively. **However, the figures given are tentative and pre-field studies / DPRs are recommended prior to implementation of these recharge structures.**

Table-13: Quantity of Non-committed Surface Runoff & Expected Recharge through AR Structures

District	Taluk	Area feasible for AR (Sq.km)	Number of Proposed Recharge Structures				Cost of Recharge structures (Rs. In lakhs)				Availability of surface non-committed monsoon run off (MCM)
			Sub surface dykes	Percolation Tanks	Check Dam	Filter Bed	SSD (@ 20 lakhs)	PT (Rs. @ 20 lakhs)	CD (@ Rs.10 lakhs)	Filter Bed@ 1.5 lakhs	
Kodagu	Somverpet	856	1	37	207	0	21.73	733.4	2073.03	0	40.744
Recharge from each structure (MCM)			Total Recharge (MCM)		Total cost in lakhs		Expected Benefit of Artificial Recharge and RWH				
Subsurface dykes	Percolation Tanks	Check Dam					Filter Beds	Volume of water likely to be recharged (MCM)		Additional Irrigation Potential likely to be created (hectares)	
6.112	20.372	10.2	4.07	40.744	2828.15	30.558		3700			

(Note: The numbers proposed are tentative and detailed feasibility studies are required in field to finalize the actual locations for the construction of AR structures.)

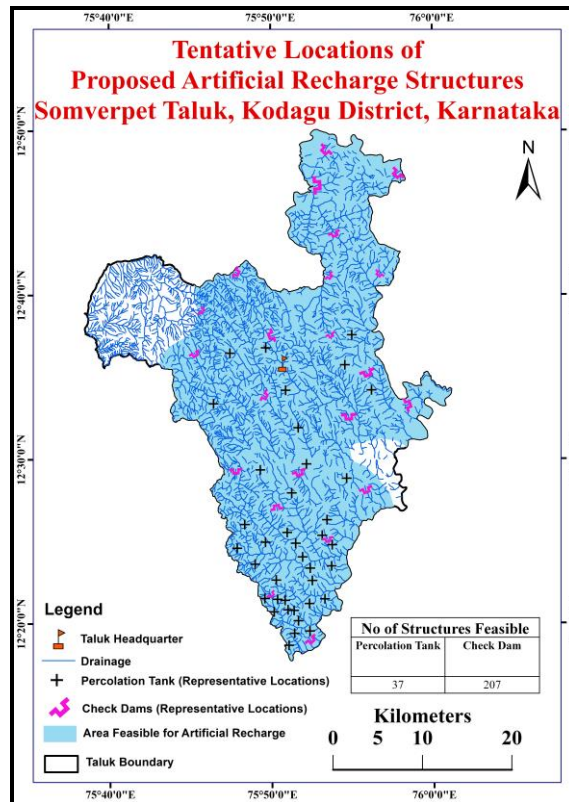


Fig.28: Tentative Locations of Proposed Artificial Recharge Structures

4.2. Resource Savings by Demand Side Interventions

4.2.1. Advanced Irrigation Practices

It is observed that canals, tanks and borewells contribute 95% of the source for irrigation in Somverpet taluk. Water intensive crops like paddy is grown in 39% of the net irrigated area in the taluk. Water Use Efficiency (WUE) practices like Drip Irrigation, Sprinkler Irrigation needs to be strengthened to save irrigation water (appx.20%) of the existing ground water draft for irrigation .

4.3. Ground Water Development Plan

In Somverpet taluk, the present stage of ground water extraction (2022) is merely 43% with net ground water availability for future use of **2281.65** ham and total extraction of **1729.5** ham. The ground water draft for irrigation purpose is estimated to be **1519.9** ham and there is further scope for developing the resource for irrigation as a part of development with appropriate scientific backing. The implementation of the plan should be based on site specific detailed hydrogeological and scientific surveys for pinpointing the sites for construction of additional abstraction structures. As per tentative estimates, **68 dug wells and 490 bore wells** are recommended to be constructed in feasible areas which is likely to create about **800** hectares of additional irrigation potential (Table.14).

Table – 14: Feasibility of Additional GW abstraction structures based on GWRA 2022 availability

Annual Extractable GW Resource (Ham)	4015.43
Total Extraction / Draft (Ham)	1729.5
Stage of GW Extraction (%)	43
GW Resources available to increase SOE to 60% (Ham)	2409.258
Balance GWR available to enhance SOE 60% (Ham)	679.758
DW unit draft (Ham)	1.00
BW unit draft (Ham)	1.25
No. of DW feasible considering 10% of balance GWR with unit draft of 1 ham	68
No. of BWs feasible considering 90% of balance GWR with unit draft of 1.25 ham	490
GW Resource to be developed through Dugwell (ham)	68
GW Resource to be developed through Borewell (ham)	612
Additional Irrigation Potential created by Dug Wells (Ha)	80
Additional Irrigation Potential created by Bore Wells (Ha)	720
Total additional Irrigation Potential created by Borewells and Dugwells (ha)	800

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

4.4. Regulation and Control

Somverpet taluk has been categorized as "Safe". However, the mandatory guidelines like rainwater harvesting and artificial recharge issued by Karnataka Ground Water Authority(KGWA) needs to be strictly implemented to avoid the taluk from safe category to semi critical or higher category in the future.

4.5. Other Interventions proposed

- Periodical maintenance of artificial recharge structures should also be incorporated in the Recharge Plan.
- Excess nitrate concentration is found in ground water samples in some pockets requires remedial measures viz.
 - Dilution of nitrate rich ground water through artificial recharge & water conservation.
 - Roof top rain water harvesting.
 - Improving quality by proper drainage and limited usage of Nitrogenous fertilizers.

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, hilly and plateau areas which are all inter-related or inter dependent and Inferior Ground Water Quality due to nitrate contamination especially in some patches. The summary of ground water management plan of Somverpet taluk is given in **Table-15**.

Table 15: Summary of Management Plan of Somverpet taluk

Net Ground Water Availability(ham) as per GWRA 2022	4015.43
Existing Ground Water Draft for all uses (ham)	1729.50
Existing Ground Water Draft for Irrigation Use (ham)	1519.9
Existing Stage of Ground Water Development (%)	43%, safe
Expected Recharge from Artificial Recharge Structures (ham)	3055.80
Additional Irrigation Potential Created (Ha)	3700
Cumulative Ground Water Availability (ham)	7071.23
Expected Improvement in Stage of Ground Water Development (%)	24.46
Saving Due to adopting Water Use Efficiency in Ham (20 % of existing Irrigation Draft)	303.98
Net Ground Water availability after AR & WUE (ham)	7375
Expected Improved Stage of Ground Water Development after implementation of AR & WUE (%)	23.45
Cumulative Improved Stage of Ground Water Development after all implementation (%)	19.50
Ground Water Resource Development Plan	
GW Resources available to increase SOE to 60% of existing Net Groundwater availability (ham)	2409.258
Balance GWR available to enhance SOE 60% (Ham)	679.758
DW unit draft (Ham)	1.00
BW unit draft (Ham)	1.25
No. of DW feasible considering 10% of balance GWR with unit draft of 1 ham	68
No. of BWs feasible considering 90% of balance GWR with unit draft of 1.25 ham	490
GW Resource to be developed through Dugwell	68

(ham)	
GW Resource to be developed through Borewell (ham)	612
Additional Irrigation Potential created by Dug Wells (Ha)	80
Additional Irrigation Potential created by Bore Wells (Ha)	720
Total additional Irrigation Potential created by Borewells and Dugwells (ha)	800
Excess Nitrate concentration	In limited places especially in deeper aquifer Dilution of nitrate rich ground water through artificial recharge & water conservation. Roof top rain water harvesting Improving quality by controlling usage of Nitrogenous fertilizers in agriculture field and maintaining the proper domestic drainage network system.

As per the resource estimation–2022, Somverpet taluk falls under **Safe category** with the stage of ground water extraction is 43 %. 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: The surface surplus non-committed runoff availability is 40.744 MCM, which is considered for planning of AR structures. For this, a total of 1 sub-surface dyke, 37 percolation tank and 207 Check dams are proposed. The volume of water expected to be conserved/recharged @75% efficiency is 30.558 MCM through these AR structures. The approximate cost estimate for construction of these AR structures is Rs. 28.2815 Cr. The additional area which can be brought under assured ground water irrigation will be about 3700 hectares. However, the figures given are tentative and pre-field studies / DPR are recommended prior to implementation of these recharge structures.

Ground water resource enhancement by demand side interventions: It is observed that canals, borewells and tanks contribute 95% of the source for irrigation in Somverpet taluk. Water intensive crops like paddy is grown in 39% of the net irrigated area in the taluk. Water Use Efficiency (WUE) practices like Drip Irrigation, Sprinkler Irrigation needs to be strengthened to save irrigation water (appx.20%) . This ultimately enhances the area under irrigation potential.

Ground Water Resource Development Plan: The present stage of ground water extraction (2022) is merely 43% with net ground water availability for future use of **2281.65** ham and total extraction of **1729.5** ham. The ground water draft for irrigation purpose is estimated to be **1519.9** ham and there is further scope for developing the resource for irrigation as a part of development with appropriate scientific backing. The implementation of the plan should be based on site specific detailed hydrogeological and scientific surveys for pinpointing the sites for construction of additional abstraction structures. As per tentative estimates, **68 dug wells and 490 bore wells** are recommended to be

constructed in feasible areas which is likely to create about **800** hectares of additional irrigation potential

Nitrate Contamination: Proper drainage of sewage and scientific disposal of sewage water by the concerned urban/rural agency needs to be adopted along with limited usage of Nitrogenous fertilizers by farmers to avoid nitrate contamination. All the ground water sources for drinking water supply may be checked for ground water quality parameters as per BIS norms.

WUE in Domestic Sector: WUE practices are the prime management option in domestic sector as well in view of having high density clusters of urban households and establishments. In premium apartments and infrastructure projects, use of three-way line for fresh water, bathroom water and toilet water will enable reuse of grey water for gardening, car washing and flushes etc. The water saver fixtures/ aerators can be used for kitchen & bathroom pipes, bath showers and water free urinals.

Regulation and Control: Taluk is categorised as "Safe". However, the mandatory guidelines like rainwater harvesting and artificial recharge issued by Karnataka Ground Water Authority needs to be strictly implemented to avoid the taluk from deteriorating from safe category to semi critical category in the future.

Annexure-I: Tentative Locations of Proposed Percolation Tanks, Somverpet Taluk, Kodagu District

S.No	Longitude	Latitude	Village	Gram Panchayath	Taluk
1	75.7739	12.5562	Shirangalli	Madapura	Somverpet
2	75.7909	12.6074	Thalthare Shetalli	Kiraganduru	Somverpet
3	75.7978	12.4096	Horur	Kedakal	Somverpet
4	75.8056	12.4336	Horur	Kedakal	Somverpet
5	75.8163	12.3933	Irale Valamudi	Chettalli	Somverpet
6	75.8218	12.4891	Anjanageri Bettageri	Haradoor	Somverpet
7	75.8262	12.3585	Shrimangala	Vaalnuru Thyagathuru	Somverpet
8	75.8270	12.4156	Horur	Kambibane	Somverpet
9	75.8278	12.6129	Hanagallu Shettalli	Haanagallu	Somverpet
10	75.8358	12.3449	Shrimangala	Vaalnuru Thyagathuru	Somverpet
11	75.8380	12.3772	Cherala	Chettalli	Somverpet
12	75.8392	12.3576	Shrimangala	Vaalnuru Thyagathuru	Somverpet
13	75.8470	12.3566	Koodluru Shettyhalli	Chettalli	Somverpet
14	75.8482	12.5698	Kusuburu	Belur	Somverpet
15	75.8492	12.4255	Kodagarahalli	Kodagarahalli	Somverpet
16	75.8500	12.3469	Abyathamangala	Vaalnuru Thyagathuru	Somverpet
17	75.8509	12.3110	Nelliyahadikeri	Nelliahudikeri	Somverpet
18	75.8542	12.4656	Kanbyle Bychanahalli	Nalkur Sirangala	Somverpet
19	75.8561	12.3463	Abyathamangala	Vaalnuru Thyagathuru	Somverpet
20	75.8567	12.3232	Nelliyahadikeri	Nelliahudikeri	Somverpet
21	75.8580	12.4145	7 Th Hosakote	7th Hoskote	Somverpet
22	75.8607	12.3359	Abyathamangala	Vaalnuru Thyagathuru	Somverpet
23	75.8610	12.5317	Yadavare	Aigur	Somverpet
24	75.8651	12.4006	7 Th Hosakote	7th Hoskote	Somverpet
25	75.8694	12.4950	Maluru	Nalkur Sirangala	Somverpet
26	75.8721	12.3533	Palnuru Thyagathuru	Vaalnuru Thyagathuru	Somverpet
27	75.8725	12.3254	Nelliyahadikeri	Nelliahudikeri	Somverpet
28	75.8729	12.3892	Attur Forest	Guddehosuru	Somverpet
29	75.8751	12.3767	Nanjarajapatna	Nanjarayapatna	Somverpet
30	75.8853	12.4225	7 Th Hosakote	7th Hoskote	Somverpet
31	75.8880	12.3581	Nanjarajapatna	Nanjarayapatna	Somverpet
32	75.8904	12.4383	7 Th Hosakote	7th Hoskote	Somverpet
33	75.8949	12.3914	Attur Forest	Guddehosuru	Somverpet
34	75.8956	12.4129	Attur Forest	Guddehosuru	Somverpet
35	75.9092	12.5954	Gonimaruru	Ganaguru	Somverpet
36	75.9107	12.4803	Anekad Forest	Guddehosuru	Somverpet
37	75.9165	12.6259	Chikkakanagalu	Aluru Siddapura	Somverpet

(Source: Master Plan, CGWB, 2020. It is likely that the number of structures proposed may vary depending upon the ground truth verification and feasibility criteria)

Annexure-II: Tentative Locations of Proposed Check Dams Somverpet Taluk, Kodagu District

S.No	Longitude	Latitude	Village	Gram Panchayath	Taluk
1	75.8568	12.4065	7 Th Hosakote	7th Hoskote	Somverpet
2	75.8692	12.4256	7 Th Hosakote	7th Hoskote	Somverpet
3	75.8810	12.4382	7 Th Hosakote	7th Hoskote	Somverpet
4	75.9167	12.6409	Kanthe Basavanahalli	Aluru Siddapura	Somverpet
5	75.9256	12.6454	Aluru	Aluru Siddapura	Somverpet
6	75.9190	12.6460	Malambi	Aluru Siddapura	Somverpet
7	75.9229	12.6572	Malambi	Aluru Siddapura	Somverpet
8	75.9339	12.6620	Hosahalli	Aluru Siddapura	Somverpet
9	75.9234	12.6676	Kanive Basavanahalli	Aluru Siddapura	Somverpet
10	75.9108	12.6705	Karugodu	Aluru Siddapura	Somverpet
11	75.9277	12.6800	Harohalli	Aluru Siddapura	Somverpet
12	75.9103	12.6815	Karugodu	Aluru Siddapura	Somverpet
13	75.9446	12.6942	Mylathapura	Aluru Siddapura	Somverpet
14	75.9371	12.6970	Menasa	Aluru Siddapura	Somverpet
15	75.9543	12.6970	Seegemarur	Aluru Siddapura	Somverpet
16	75.8790	12.5506	Beluru Basavanahalli	Belur	Somverpet
17	75.8528	12.5522	Kusuburu	Belur	Somverpet
18	75.8568	12.5656	Kusuburu	Belur	Somverpet
19	75.9344	12.7683	Chikkabhandara	Bessur	Somverpet
20	75.9494	12.7743	Niluvagilu	Bessur	Somverpet
21	75.9447	12.7746	Niluvagilu	Bessur	Somverpet
22	75.9374	12.7756	Besuru	Bessur	Somverpet
23	75.9178	12.7756	1st Koodluru	Bessur	Somverpet
24	75.9300	12.7766	Besuru	Bessur	Somverpet
25	75.9199	12.7819	Arehalli	Bessur	Somverpet
26	75.9285	12.7822	1st Koodluru	Bessur	Somverpet
27	75.9225	12.7829	1st Koodluru	Bessur	Somverpet
28	75.9276	12.7861	Koniganahalli	Bessur	Somverpet
29	75.9335	12.7873	Koniganahalli	Bessur	Somverpet
30	75.9619	12.7885	Agali	Bessur	Somverpet
31	75.9303	12.7926	Koniganahalli	Bessur	Somverpet
32	75.9175	12.7978	Neerugundha	Bessur	Somverpet
33	75.6788	12.6493	Kumaralli	Bettadalli	Somverpet
34	75.7104	12.6504	Kothanalli	Bettadalli	Somverpet
35	75.7365	12.6532	Kothanalli	Bettadalli	Somverpet
36	75.7193	12.6559	Kothanalli	Bettadalli	Somverpet
37	75.6628	12.6562	Kumaralli	Bettadalli	Somverpet
38	75.6773	12.6571	Kumaralli	Bettadalli	Somverpet
39	75.7006	12.6586	Kumaralli	Bettadalli	Somverpet
40	75.6526	12.6594	Kumaralli	Bettadalli	Somverpet
41	75.7116	12.6617	Kumaralli	Bettadalli	Somverpet

42	75.7472	12.6638	Kumaralli	Bettadalli	Somverpet
43	75.7248	12.6638	Kumaralli	Bettadalli	Somverpet
44	75.6942	12.6671	Kumaralli	Bettadalli	Somverpet
45	75.6722	12.6692	Kumaralli	Bettadalli	Somverpet
46	75.7492	12.6697	Kumaralli	Bettadalli	Somverpet
47	75.6844	12.6707	Kumaralli	Bettadalli	Somverpet
48	75.6634	12.6710	Kumaralli	Bettadalli	Somverpet
49	75.7171	12.6714	Kumaralli	Bettadalli	Somverpet
50	75.7758	12.6717	Kundhalli	Bettadalli	Somverpet
51	75.7332	12.6720	Kumaralli	Bettadalli	Somverpet
52	75.7723	12.6721	Kundhalli	Bettadalli	Somverpet
53	75.7445	12.6722	Kumaralli	Bettadalli	Somverpet
54	75.7082	12.6751	Kumaralli	Bettadalli	Somverpet
55	75.6586	12.6755	Kumaralli	Bettadalli	Somverpet
56	75.7843	12.6777	Kundhalli	Bettadalli	Somverpet
57	75.7809	12.6792	Kundhalli	Bettadalli	Somverpet
58	75.7371	12.6794	Kumaralli	Bettadalli	Somverpet
59	75.6690	12.6803	Kumaralli	Bettadalli	Somverpet
60	75.6764	12.6809	Kumaralli	Bettadalli	Somverpet
61	75.7238	12.6819	Kumaralli	Bettadalli	Somverpet
62	75.6853	12.6825	Kumaralli	Bettadalli	Somverpet
63	75.7121	12.6828	Kumaralli	Bettadalli	Somverpet
64	75.6638	12.6831	Kumaralli	Bettadalli	Somverpet
65	75.7352	12.6843	Kumaralli	Bettadalli	Somverpet
66	75.6983	12.6867	Kumaralli	Bettadalli	Somverpet
67	75.6812	12.6904	Kumaralli	Bettadalli	Somverpet
68	75.6677	12.6906	Kumaralli	Bettadalli	Somverpet
69	75.6785	12.6912	Kumaralli	Bettadalli	Somverpet
70	75.7176	12.6913	Kumaralli	Bettadalli	Somverpet
71	75.7278	12.6926	Kumaralli	Bettadalli	Somverpet
72	75.6853	12.6975	Kumaralli	Bettadalli	Somverpet
73	75.6922	12.6986	Kumaralli	Bettadalli	Somverpet
74	75.6980	12.7020	Kumaralli	Bettadalli	Somverpet
75	75.7159	12.7033	Kumaralli	Bettadalli	Somverpet
76	75.8756	12.7585	Bembaluru	Byadagotta	Somverpet
77	75.8960	12.7633	Shivaralli	Byadagotta	Somverpet
78	75.8777	12.7658	Bembaluru	Byadagotta	Somverpet
79	75.8948	12.7723	Kanaralli	Byadagotta	Somverpet
80	75.8845	12.7779	Voorugutthi	Byadagotta	Somverpet
81	75.8907	12.7788	Kanaralli	Byadagotta	Somverpet
82	75.8981	12.7829	Byadagotta	Byadagotta	Somverpet
83	75.8727	12.7850	Kyathe	Byadagotta	Somverpet
84	75.8817	12.7865	Ichalapura	Byadagotta	Somverpet
85	75.9179	12.7938	Chikkakundha	Byadagotta	Somverpet

86	75.8721	12.7974	Kallalli	Byadagotta	Somverpet
87	75.8575	12.3766	Cherala	Chettalli	Somverpet
88	75.8632	12.3848	Cherala	Chettalli	Somverpet
89	75.8279	12.3871	Irale Valamudi	Chettalli	Somverpet
90	75.8736	12.6071	Harohalli(Melthe)	Doddamalthe	Somverpet
91	75.8899	12.6075	Volagundha	Doddamalthe	Somverpet
92	75.8655	12.6272	Doddahanakodu	Doddamalthe	Somverpet
93	75.8765	12.6287	Sulimolthe	Doddamalthe	Somverpet
94	75.8682	12.6372	Honnavalli	Doddamalthe	Somverpet
95	75.8748	12.7155	Appashettyhalli	Dundalli	Somverpet
96	75.8718	12.7216	Doddakolatthuru	Dundalli	Somverpet
97	75.8577	12.7262	Yadehalli	Dundalli	Somverpet
98	75.8884	12.7283	Bidaruru	Dundalli	Somverpet
99	75.8987	12.7298	Kerehalli	Dundalli	Somverpet
100	75.8612	12.7344	Madre (Hosahalli)	Dundalli	Somverpet
101	75.8713	12.7356	Koojageri (Koogajeri)	Dundalli	Somverpet
102	75.8870	12.7380	Halukene	Dundalli	Somverpet
103	75.8569	12.7417	Dhandalli	Dundalli	Somverpet
104	75.8733	12.7434	Madhre	Dundalli	Somverpet
105	75.8589	12.7475	Dhandalli	Dundalli	Somverpet
106	75.8683	12.7479	Doddabilaha	Dundalli	Somverpet
107	75.8852	12.7485	Harohalli	Dundalli	Somverpet
108	75.8737	12.7494	Doddabilaha	Dundalli	Somverpet
109	75.8552	12.7498	Dhandalli	Dundalli	Somverpet
110	75.8933	12.7508	Harohalli	Dundalli	Somverpet
111	75.8754	12.7531	Shiraha	Dundalli	Somverpet
112	75.8795	12.7566	Shiraha	Dundalli	Somverpet
113	75.8703	12.7678	Kirubalaha	Dundalli	Somverpet
114	75.9295	12.5542	Nidtha Forest li Bit	Ganaguru	Somverpet
115	75.9134	12.5769	Gonimaruru	Ganaguru	Somverpet
116	75.9230	12.6105	Sangaiahanapura	Ganaguru	Somverpet
117	75.9398	12.6156	Bhuvangala	Ganaguru	Somverpet
118	75.7847	12.5568	Garvale	Garwale	Somverpet
119	75.8654	12.6452	Shunti	Gowdalli	Somverpet
120	75.8790	12.6503	Harehalli	Gowdalli	Somverpet
121	75.8719	12.6546	Shunti	Gowdalli	Somverpet
122	75.8897	12.6632	Heggula	Gowdalli	Somverpet
123	75.8965	12.6661	Heggula	Gowdalli	Somverpet
124	75.8641	12.6693	Koralahalli	Gowdalli	Somverpet
125	75.8939	12.6762	Nandhigundha	Gowdalli	Somverpet
126	75.9005	12.6843	Kurudevalli	Gowdalli	Somverpet
127	75.8929	12.6896	Ramenahalli	Gowdalli	Somverpet
128	75.9173	12.4807	Atthuru	Guddehosuru	Somverpet
129	75.8568	12.6158	Kalkandhuru	Haanagallu	Somverpet

130	75.8297	12.6183	Yaduru	Haanagallu	Somverpet
131	75.8466	12.6221	Kalkandhuru	Haanagallu	Somverpet
132	75.8966	12.7221	Gudugalale	Handli	Somverpet
133	75.9248	12.7229	Sampigedhalu	Handli	Somverpet
134	75.9341	12.7237	Sampigedhalu	Handli	Somverpet
135	75.9060	12.7348	Bellaralli	Handli	Somverpet
136	75.8939	12.7370	Mudravalli	Handli	Somverpet
137	75.9159	12.7411	Bettadhalli	Handli	Somverpet
138	75.8970	12.7419	Mudravalli	Handli	Somverpet
139	75.9298	12.7429	Hallibylu	Handli	Somverpet
140	75.9067	12.7461	Avaredhalu	Handli	Somverpet
141	75.9121	12.7472	Hulukodu	Handli	Somverpet
142	75.9270	12.7476	Managale	Handli	Somverpet
143	75.9057	12.7487	Avaredhalu	Handli	Somverpet
144	75.9346	12.7500	Kitthuru	Handli	Somverpet
145	75.9303	12.7522	Kitthuru	Handli	Somverpet
146	75.9342	12.7556	Kitthuru	Handli	Somverpet
147	75.9093	12.7574	Avaredhalu	Handli	Somverpet
148	75.9177	12.7710	Hemmane	Handli	Somverpet
149	75.9308	12.7727	Doddabhandara	Handli	Somverpet
150	75.8040	12.5099	Jamburu	Haradoor	Somverpet
151	75.8235	12.5259	Kumbur	Haradoor	Somverpet
152	75.8322	12.4115	Attur Nallur	Kambibane	Somverpet
153	75.8344	12.4409	Attur Nallur	Kambibane	Somverpet
154	75.7874	12.4427	Haleri	Kedakal	Somverpet
155	75.7839	12.4702	Kadandalu	Kedakal	Somverpet
156	75.8203	12.5457	Biligeri	Kiraganduru	Somverpet
157	75.8209	12.5660	Kiragandhuru	Kiraganduru	Somverpet
158	75.8592	12.4530	Andhagove	Kodagarahalli	Somverpet
159	75.8950	12.7978	Keraganahalli	Kodlipet	Somverpet
160	75.8990	12.8015	Kirikodli	Kodlipet	Somverpet
161	75.8875	12.8058	Doddakodli	Kodlipet	Somverpet
162	75.9013	12.8058	Kirikodli	Kodlipet	Somverpet
163	75.9101	12.8088	Magadahalli	Kodlipet	Somverpet
164	75.8895	12.8108	Doddakodli	Kodlipet	Somverpet
165	75.8878	12.4748	Heruru	Nalkur Sirangala	Somverpet
166	75.8613	12.4904	Nakuru Shirangala	Nalkur Sirangala	Somverpet
167	75.8713	12.3185	Nelliyahadikeri	Nelliahudikeri	Somverpet
168	75.9170	12.6809	Mulluru	Nidtha	Somverpet
169	75.9220	12.6881	Mulluru	Nidtha	Somverpet
170	75.8939	12.6967	Madhegodu	Nidtha	Somverpet
171	75.9088	12.6977	Hunasekayihosalli	Nidtha	Somverpet
172	75.9237	12.6999	Nidtha	Nidtha	Somverpet
173	75.9120	12.7070	Hithlukeri	Nidtha	Somverpet

174	75.9223	12.7075	Doddahalli	Nidtha	Somverpet
175	75.8883	12.7118	Gopalapura	Nidtha	Somverpet
176	75.9304	12.7133	Kyathanahalli	Nidtha	Somverpet
177	75.9263	12.7139	Sidigalale	Nidtha	Somverpet
178	75.9100	12.7160	Chowdenahalli	Nidtha	Somverpet
179	75.9366	12.7194	Kyathanahalli	Nidtha	Somverpet
180	75.8245	12.4770	Uluguli	Sunticoppa	Somverpet
181	75.8324	12.6367	Doddatholur	Tholur Shettalli	Somverpet
182	75.8447	12.6428	Chikkatholuru	Tholur Shettalli	Somverpet
183	75.8343	12.6469	Doddatholur	Tholur Shettalli	Somverpet
184	75.8357	12.6534	Doddatholur	Tholur Shettalli	Somverpet
185	75.8364	12.6563	Doddatholur	Tholur Shettalli	Somverpet
186	75.8483	12.6563	Chikkatholuru	Tholur Shettalli	Somverpet
187	75.8299	12.6597	Tholuru Shettalli	Tholur Shettalli	Somverpet
188	75.8041	12.6617	Tholuru Shettalli	Tholur Shettalli	Somverpet
189	75.8243	12.6620	Tholuru Shettalli	Tholur Shettalli	Somverpet
190	75.8088	12.6634	Tholuru Shettalli	Tholur Shettalli	Somverpet
191	75.7983	12.6651	Koothi	Tholur Shettalli	Somverpet
192	75.8282	12.6653	Tholuru Shettalli	Tholur Shettalli	Somverpet
193	75.8227	12.6659	Tholuru Shettalli	Tholur Shettalli	Somverpet
194	75.7974	12.6707	Koothi	Tholur Shettalli	Somverpet
195	75.8086	12.6759	Koothi	Tholur Shettalli	Somverpet
196	75.7957	12.6768	Koothi	Tholur Shettalli	Somverpet
197	75.8127	12.6814	Koothi	Tholur Shettalli	Somverpet
198	75.8072	12.6849	Koothi	Tholur Shettalli	Somverpet
199	75.7940	12.6857	Koothi	Tholur Shettalli	Somverpet
200	75.7993	12.6884	Koothi	Tholur Shettalli	Somverpet
201	75.8055	12.6926	Koothi	Tholur Shettalli	Somverpet
202	75.8102	12.6933	Koothi	Tholur Shettalli	Somverpet
203	75.8088	12.6959	Koothi	Tholur Shettalli	Somverpet
204	75.9411	12.5815	Arasinaguppe	Thorenoor	Somverpet
205	75.9403	12.5904	Arasinaguppe	Thorenoor	Somverpet
206	75.8626	12.3394	Abyathamangala	Vaalnuru Thyagathuru	Somverpet
207	75.8415	12.3536	Shrimangala	Vaalnuru Thyagathuru	Somverpet

(Source: Master Plan, CGWB, 2020. It is likely that the number of structures proposed may vary depending upon the ground truth verification and feasibility criteria)