

SHIMOGA DISTRICT



FIG.24 SHIMOGA DISTRICT

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1. Location

Shimoga district is located in the western part of Karnataka State and has a geographical area of 8465 sq. km. It is bounded by Uttara Kannada district on the northwestern side, Udupi district on the southwestern side, Chikmagalur district on the south and southeastern side, Davanagere district on the eastern side and Haveri district on the northeastern side. It lies between 13^o 27' to 14^o 39' N Longitude and 74^o 37' to 75^o 53' N Latitude.

2. Demography

As per the 1991 census, Shimoga district has a population of 1,452,259. The total number of villages / habitations in the district are 4,424. Shimoga is the district headquarters and Shimoga and Bhadravati are the only cities. Shimoga district has 7 taluks viz., Bhadravati, Hosanagara, Sagar, Shikarpur, Shimoga, Sorab and Tirthahalli.

3. Climate, Drainage and Soil

Extreme western parts of Shimoga district forms part of the Western Ghats and Malnad region, which includes the mountainous and forest areas lying to the western edge of the ghats. Remaining portion of the district falls under southern maidan area consisting of broad undulating plateau with elevations ranging from 600 to 1000 m. Shimoga district receives an average annual rainfall of 1526.5 mm (Ref: Climate of Karnataka State, published by India Meteorological Department, 1984). The district is blessed with very good drainage system and is drained by Tunga, Bhadra, Tungabhadra, Varada, Dandavati, Sharavati rivers and has Linganamakki reservoir and the world famous Jog falls. Shimoga district experience temperature variation between 19.2 ° to 30.6 ° C. This district is grouped under the Southern Transition Zone and Hilly zones of ten fold Agro-climatic classification of Karnataka. Black, red and lateritic soils cover the district.

4. Geology and Groundwater occurrence

The district forms the main extent of the schistose rocks deposited within the larger Shimoga basin and consists of bands of amphibolite, quartzite and garnetiferous schist (Bababudan group) and conglomerate, quartz-chlorite schist, greywacke, carbonate, manganiferous iron formation and metavolanic (Chitradurga group). In the metasediments, bedding planes, folds, faults and the fractures act as conduits for water movement and facilitate water accumulation. The schistose rocks are poor aquifers and yield water of poorer quality in very less quantity. Laterites are seen in the northwestern portion of the district and laterite capping generally acts as shallow aquifer. The gneisses are exposed in the southwestern half of the district. From the groundwater point of view, gneisses are classified as crystalline formations. The fracture / fissure system developed along with joints and faults traversing the rocks facilitate groundwater circulation and hold moderate quantity of water. The quality of groundwater is governed by the mineralogical composition

of the rocks. Groundwater occurs in the water table conditions in the weathered and decomposed mantle and also under semi-confined conditions in the deeper fractures.

5. Groundwater quality characterization

To understand and gather information on groundwater quality, 10010 samples collected from 1042 villages / habitations in Shimoga district have been analysed by RDED.

The water samples have been analysed for only 14 parameters such as Turbidity, Colour, Conductivity, Hydrogen ion concentration (pH), Total Dissolved Salts (TDS), Total Hardness (TH), Calcium Hardness (CaH), Chloride (Cl), Sulphate (SO₄), Fluoride (F), Nitrate (NO₃), Alkalinity (Alk), Iron (Fe) and Bacteria. The data is presented in the Table.

5.1 Physical Characters

Turbidity

There are 1405 samples covering 459 villages have reported higher turbidity in the range between 10.2 and 357 JTU. The samples having higher turbidity are from Sagar (682 out of 1740 samples), Hosanagara (429 out of 3593 samples), Tirthahalli (180 out of 1503 samples), Shikarpur (71 out of 615 samples), Sorab (42 out of 754 samples) and Shimoga (lone sample out of 1192 samples). No abnormal turbidity is recorded from Bhadravati taluk. Extreme Turbidity value of 357 JTU is reported from Heggodi village in Sagar taluk.

Colour

Colour intensity in the range of 26 to 175 HU is recorded in 824 samples from 389 villages. Highest colour intensity of 175 HU is reported from Chennashettikoppa village of Sagar taluk. The abnormal samples are from Hosanagara (297 samples from 109 villages), Sagar (250 samples from 110 villages), Shikarpur (59 samples from 38 villages), Sorab (34 samples from 29 villages), Tirthahalli (184 samples from 103 villages) taluks. In Bhadravati and Shimoga taluks, Colour parameter has not been recorded.

Electrical Conductivity (EC)

The EC value recorded in the taluks of the district are: Bhadravati 100 to 5180 mmhos/cm, Hosanagara 20 to 1060 mmhos/cm, Sagar 50 to 31000 mmhos/cm, Shikarpur 30 to 1800 mmhos/cm, Shimoga 32 to 4800 mmhos/cm, Sorab 110 to 2070 mmhos/cm and Tirthahalli 10 to 850 mmhos/cm.

Hydrogen ion concentration (pH)

About 240 samples covering 140 villages have shown pH value in the range of 4.6 to 9.1. The range of pH values recorded in different taluks is, Hosanagara 6 to 8.6 (24 samples), Sagar 5 to 6.4 (143 samples), Shikarpur 6.1 to 6.4 (9 samples), Shimoga 5.1 to 9.1 (2 samples), Sorab 6 to 6.4 (30 samples) and Tirthahalli 4.6 to 6.4 (32 samples). No abnormal pH values have been recorded in Bhadravati taluk. The highly acidic pH value of 4.6 is reported from the Shinganabidare village in Tirthahalli taluk.

5.2 Chemical Characters

Total Dissolved Salts (TDS)

Only 51 samples from 34 villages have reported higher TDS content in the range of 2010 to 3110 ppm. They are from Bhadravati (18 samples from 12 villages with TDS content of 2040 to 3110 ppm) and Shimoga (33 samples from 22 villages with TDS content of 2010 to 3000 ppm) taluks. No abnormal TDS values have been reported from Hosanagara, Sagar, Shikarpur, Sorab and Tirthahalli taluks.

Total Hardness (TH)

In the entire district, only 43 samples from 33 villages have reported higher TH content beyond permissible limit in the range of 610 to 1050 ppm. The ranges of higher TH value in different taluks are: Bhadravati (14 samples from 10 villages with TH content of 610 to 1050 ppm), Sagar (a lone sample with TH content of 765 ppm), Shikarpur (10 samples with TH content of 613 to 828 ppm), Shimoga (15 samples with TH content of 630 to 980 ppm) and Sorab (3 samples with TH content of 723.4 to 909.1 ppm). The maximum TH content (1050 ppm) is reported from Vaddarahatti village in Bhadravati taluk. No abnormal TH values have been recorded from Hosanagara and Tirthahalli taluks.

Calcium Hardness (CaH)

Just 13 samples from 12 villages, have recorded higher CaH content ranging from 201 to 425 ppm. The abnormal samples are from Sagar (2 samples with CaH 262 and 425 ppm), Shikarpur (8 samples with CaH 201 to 291 ppm) and Sorab (3 samples with CaH 214.6 to 336.7 ppm). CaH values in Bhadravati, Hosanagara, Shimoga and Tirthahalli taluks are within the permissible limit.

Chloride (Cl)

Only 5 samples from Bhadravati taluk have reported Chloride content beyond the permissible limit and the value ranges from 1100 to 1910 ppm. Other taluks have not reported abnormal Chloride content.

Sulphate (SO₄)

In the entire district, only 5 samples from Bhadravati (a lone sample), Sagar (a lone sample) and Shimoga (3 samples) taluks have reported higher Sulphate content in the range of 420 to 1143 ppm with permissible limit being 400 ppm. Highest Sulphate content of 1143 ppm is reported from Igina Byllu village of Sagar taluk.

Fluoride (F)

The analytical data has revealed that 138 samples from 91 villages / habitations have recorded abnormal Fluoride content in the range of 1.6 to 9.3 ppm. The ranges of higher concentrations reported in different taluks are: Hosanagara (27 samples from 21 villages with Fluoride content of 1.6 to 8 ppm), Sagar (37 samples from 18 villages with Fluoride content of 1.6 to 9.3 ppm), Shikarpur (12 samples from 8 villages with Fluoride content of 1.6 to 2 ppm), Shimoga (2 samples from 2 villages with Fluoride content of 1.7 to 3 ppm), Sorab (3 samples from 3 villages with Fluoride content of 2 ppm) and Tirthahalli (57 samples from 39 villages with Fluoride content of 1.6 to 6.6 ppm). Highest concentration of Fluoride (9.3 ppm) is reported from Marthur village in Sagar taluk. Bhadravati taluk has Fluoride content within the permissible limit.

Nitrate (NO₃)

In the entire District, none of the analysed samples have reported higher concentration of Nitrate.

Alkalinity (Alk)

Only 28 samples in the entire district have analysed alkalinity in excess of the permissible limit ranging between 607 and 800 ppm. They are from Bhadravati (11 samples from 9 villages with Alkalinity content of 610 to 710 ppm), Shikarpur (a lone sample with Alkalinity content of 607 ppm) and Shimoga (16 samples from 7 villages with Alkalinity content of 610 to 800 ppm). Hosanagara, Sagar, Sorab and Tirthahalli taluks have shown Alkalinity content within the permissible limit. Highest Alkalinity content of 800 ppm is reported from Hosudi village in Shimoga taluk.

Iron (Fe)

Iron in excess of the permissible limit is reported in 1158 samples from 442 village/habitations. Abnormal iron content in the district ranges between 1.1 and 6.5 ppm. These samples are from Bhadravati (36 samples from 11 villages with Fe content of 2 to 4 ppm), Hosanagara (254 samples from 100 villages with Fe content of 1.1 to 1.5 ppm), Sagar (505 samples from 151 villages with Fe content of 1.1 to 1.5 ppm), Shikarpur (91 samples from 47 villages with Fe content of 1.2 to 2 ppm), Shimoga (4 samples from 4 villages with Fe content of 1.3 to 6.5 ppm), Sorab (78 samples from 39 villages with Fe content of 1.2 to 1.6 ppm) and Tirthahalli

(190 samples from 90 villages with Fe content of 1.1 to 6.2 ppm). Highest Fe content of 6.5 ppm is reported from Yelavatti Tanda village in Shimoga taluk.

Bacteria (*E.coli*)

Quite a good number of samples, 1786 covering 709 villages have shown presence of Bacteria with the bacterial count ranging between 1 to 10 numbers per 100 ml. Bacterial incidence in different taluks of the district are: Bhadravati (132 out of 613 samples with Bacterial count of 1 to 8 numbers/100 ml), Hosanagara (250 out of 3593 samples with Bacterial count of 2 to 8 numbers/100 ml), Sagar (379 out of 1740 samples with Bacterial count of 1 to 10 numbers/100 ml), Shikarpur (140 out of 615 samples with Bacterial count of 1 to 5 numbers/100 ml), Shimoga (235 out of 1192 samples with Bacterial count of 1 to 9 numbers/100 ml), Sorab (123 out of 754 samples with Bacterial count of 1 to 5 numbers/100 ml) and Tirthahalli (527 out of 1503 samples with Bacterial count of 1 to 10 numbers/100 ml).

5.3 Spatial Variation

Bacteria (*E.coli*)

The map indicates that, bacteria is commonly reported in the analysed water samples and more than 65% of the sampled villages are affected by the bacterial incidence and are spread throughout the district.

Fluoride (F)

The isoconcentration map of fluoride (Fig.24A) depicts that, only two isolated patches- one in the western portion of the Hosanagara taluk and one in the central portion of the district have recorded slightly higher Fluoride content.

Total Dissolved Salts (TDS)

The isoconcentration map (Fig. 24B) shows that, excepting two patches in the eastern portion of the district, TDS content in the district is within the permissible limit of 2000 ppm.

Total Hardness (TH)

Total hardness on the isoconcentration map (Fig. 24C) reveals that, entire district is having TH content within permissible limit.

Iron (Fe)

The spatial variation map (Fig. 24D) shows that, discontinuous patches trending almost in E-W direction are observed in the central portion of the district comprising Sagar taluk, isolated patches in northern half of Hosanagara and Tirthahalli taluks, eastern portion of Bhadravati taluk and few isolated patches in the northern portions of Sorab and Shikarpur taluks have higher Fe content.

6. Conclusion

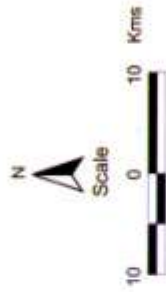
The water quality data of Shimoga district has reflected the presence of excess Turbidity, Colour, higher concentration of Iron and Bacteria in the drinking water source. Turbidity and colour can be reduced by simple filtration. Proper development of the source and usage of galvanized iron or PVC pipes and proper casing can reduce the iron content. The most important component, which is much more harmful, is the presence of Bacteria viz., *E.coli* in drinking water. Consumption of such water may cause diseases such as Malaria, Diarrhea etc. Probably, the organisms have been introduced into the groundwater regime by anthropogenic activities. This clearly indicates non-hygienic / poor sanitation condition prevailing at village levels. To overcome this both the user and the administrator must be trained properly and awareness has to be created regarding hygienic aspects.

Table: Comprehensive analysis of water quality data of Shimoga District

Sl. No.	Name of the taluks	Number of villages/habitations	Number of sampled villages	Number of samples analysed	Water quality scenario	Bact (c/100 ml) -0	Tur (10 JTU)	Color (25 HU)	Cond - mmhos /cm	pH (6.5-8.5)	TDS (2000) ppm	TH (600) ppm	CaH (200) ppm	Cl (1000) ppm	SO ₄ (400) ppm	F (1.5) ppm	NO ₃ (100) ppm	Alk (600) ppm	Fe (1) ppm		
1	Bhadravali	219	104	613	No. of samples beyond permissible limit	132	-	-	-	-	18	14	-	5	1	-	-	11	36		
					No. of Village affected	72	-	-	-	12	10	-	4	1	-	-	9	11	-	-	-
					Range	1-8	-	100-5180	-	2040-3110	610-1050	-	1100-1910	1080	-	-	610-710	2-4	-	-	-
2	Hosangara	709	144	3593	No. of samples beyond permissible limit	250	429	297	-	24	-	-	-	-	-	27	-	-	254		
					No. of Village affected	93	117	109	-	16	-	-	-	-	21	-	-	100	-	-	-
					Range	2-8	10.6-100	28-80	20-1060	6-8.6	-	-	-	1.6-8	-	-	1.1-1.5	-	-	-	-
3	Sagar	793	181	1740	No. of samples beyond permissible limit	379	682	250	-	143	-	1	2	-	1	37	-	-	505		
					No. of Village affected	127	160	110	-	65	-	1	2	-	18	-	-	151	-	-	-
					Range	1-10	10.3-357	26-175	50-31000	5-6.14	-	765	262-425	-	1143	1.6-9.3	-	1.1-1.5	-	-	-
4	Shikarpur	223	99	615	No. of samples beyond permissible limit	140	71	59	-	9	-	10	8	-	-	12	-	1	91		
					No. of Village affected	61	45	38	-	7	-	8	7	-	-	8	-	-	1	47	
					Range	1-5	10.2-67.8	30-80	30-1800	6.1-6.4	-	613-828	201-291	-	-	1.6-2	-	607	1.2-2	-	-
5	Shimoga	311	175	1192	No. of samples beyond permissible limit	235	1	-	-	2	33	15	-	-	3	2	-	16	4		
					No. of Village affected	130	1	-	-	2	22	11	-	3	2	-	7	4	-	-	
					Range	1-9	12	-	32-4800	5.1-9.1	2010-3000	630-980	-	420-1143	1.7-3	-	610-800	1.3-6.5	-	-	
6	Sorab	383	148	754	No. of samples beyond permissible limit	123	42	34	-	30	-	3	3	-	-	3	-	-	78		
					No. of Village affected	73	36	29	-	22	-	3	3	-	-	3	-	-	39	-	-
					Range	1-5	10.8-38.5	35-75	110-2070	6-6.4	-	723.4-909.1	214.6-336.7	-	-	2	-	-	1.2-1.6	-	-
7	Tirthahalli	907	191	1503	No. of samples beyond permissible limit	527	180	184	-	32	-	-	-	-	-	57	-	-	190		
					No. of Village affected	153	100	103	-	29	-	-	-	-	39	-	-	90	-	-	-
					Range	1-10	10.2-192.8	30-100	10-850	4.6-6.4	-	-	-	-	1.6-6.6	-	-	1.1-6.2	-	-	-
Total	3545	1042	10010	10010	No. of samples beyond permissible limit	1766	1405	824	-	240	51	43	13	5	5	138	0	28	1138		
					No. of Village affected	709	459	389	-	141	34	33	12	4	5	91	0	17	442	-	-
					Range	1-10	10.2-357	26-175	10-31000	4.6-9.1	2010-3110	610-1050	201-425	1100-1910	420-1143	1.6-9.3	-	607-800	1.1-6.5	-	-

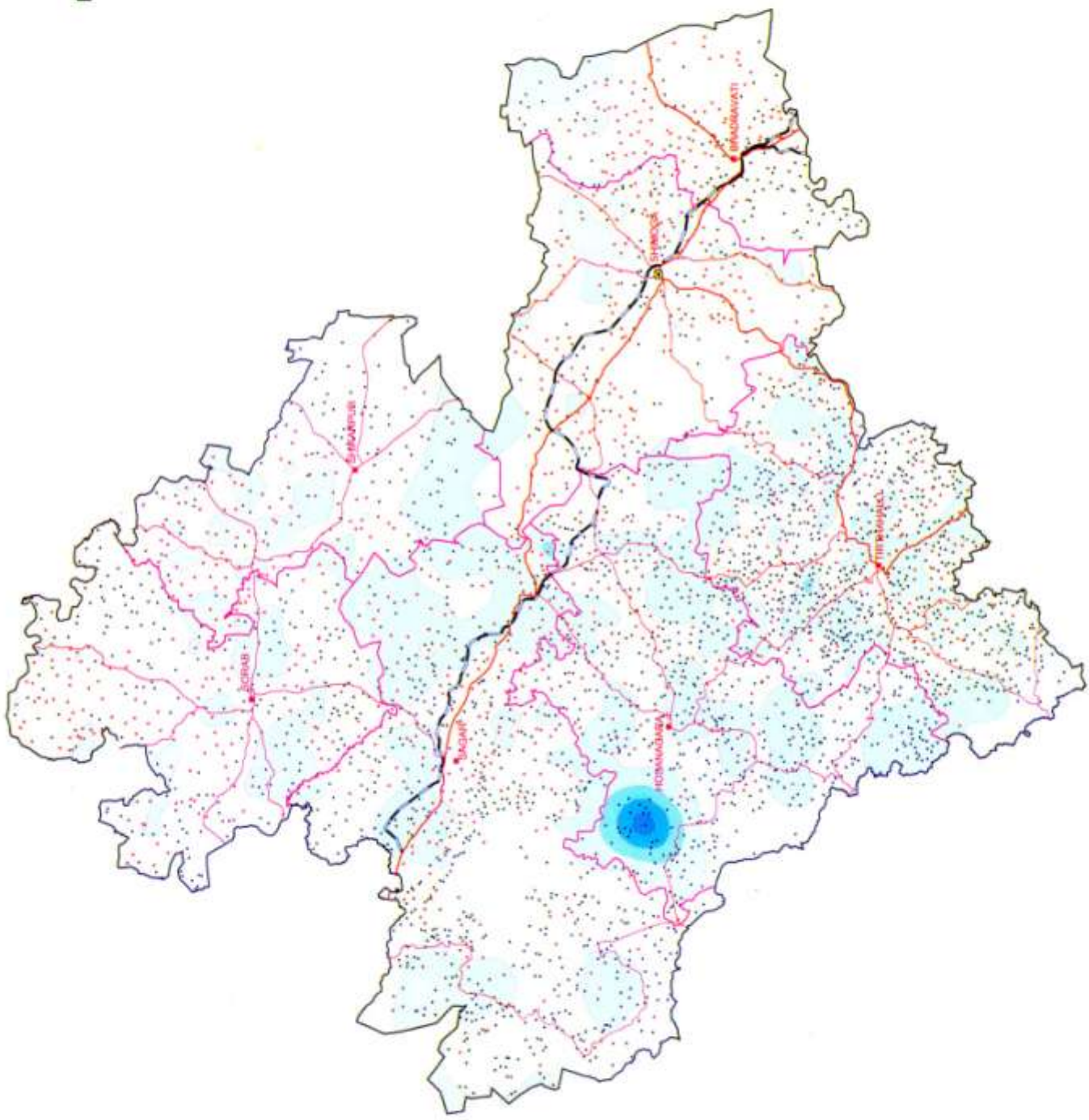
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FIG.24A : FLUORIDE VARIATION



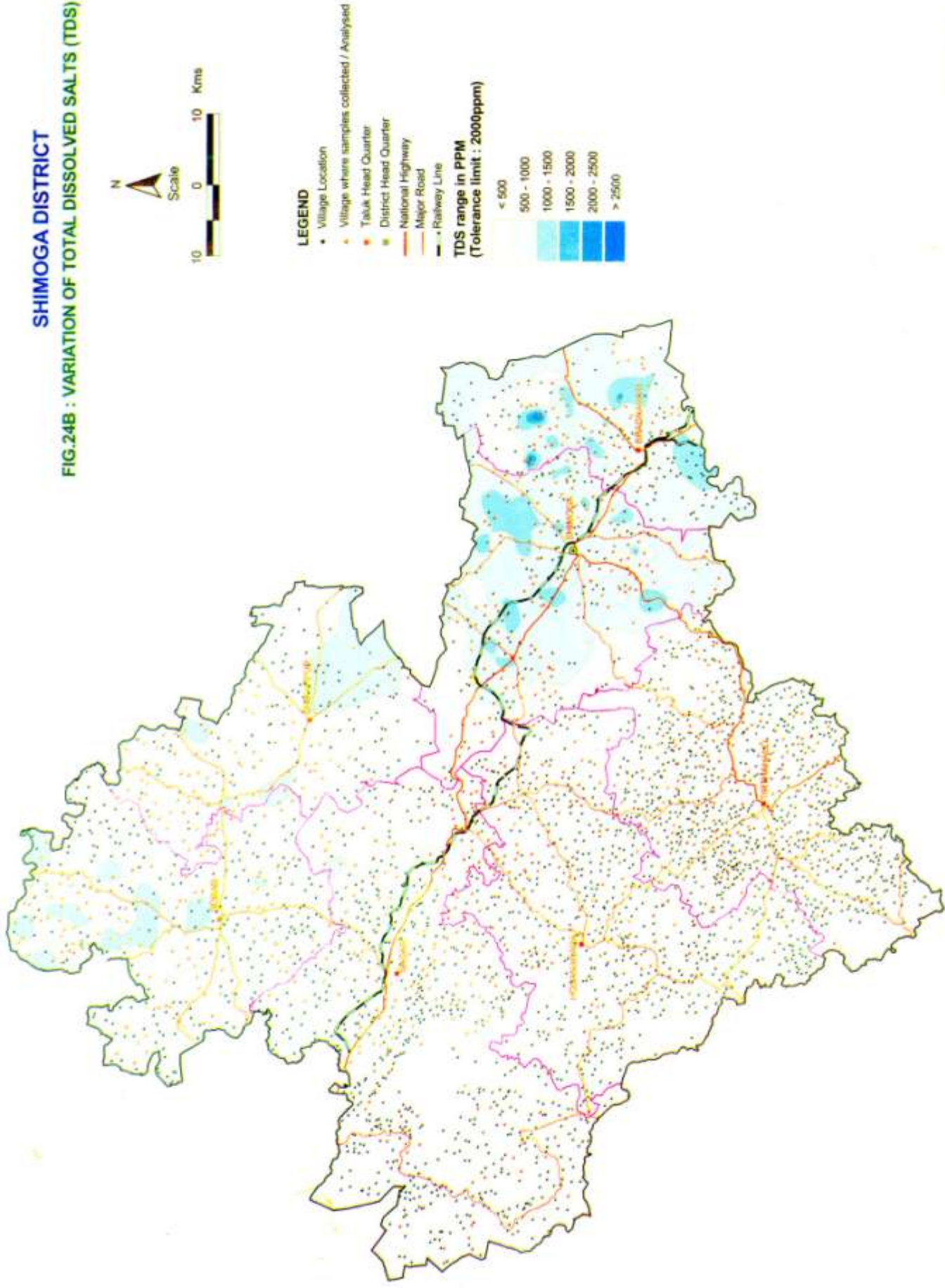
- LEGEND**
- Village Location
 - Village where samples collected / Analysed
 - Taluk Head Quarter
 - District Head Quarter
 - National Highway
 - Major Road
 - Railway Line

Fluoride in PPM
(Tolerance limit : 1.5ppm)



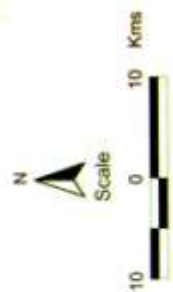
SHIMOGA DISTRICT

FIG.24B : VARIATION OF TOTAL DISSOLVED SALTS (TDS)



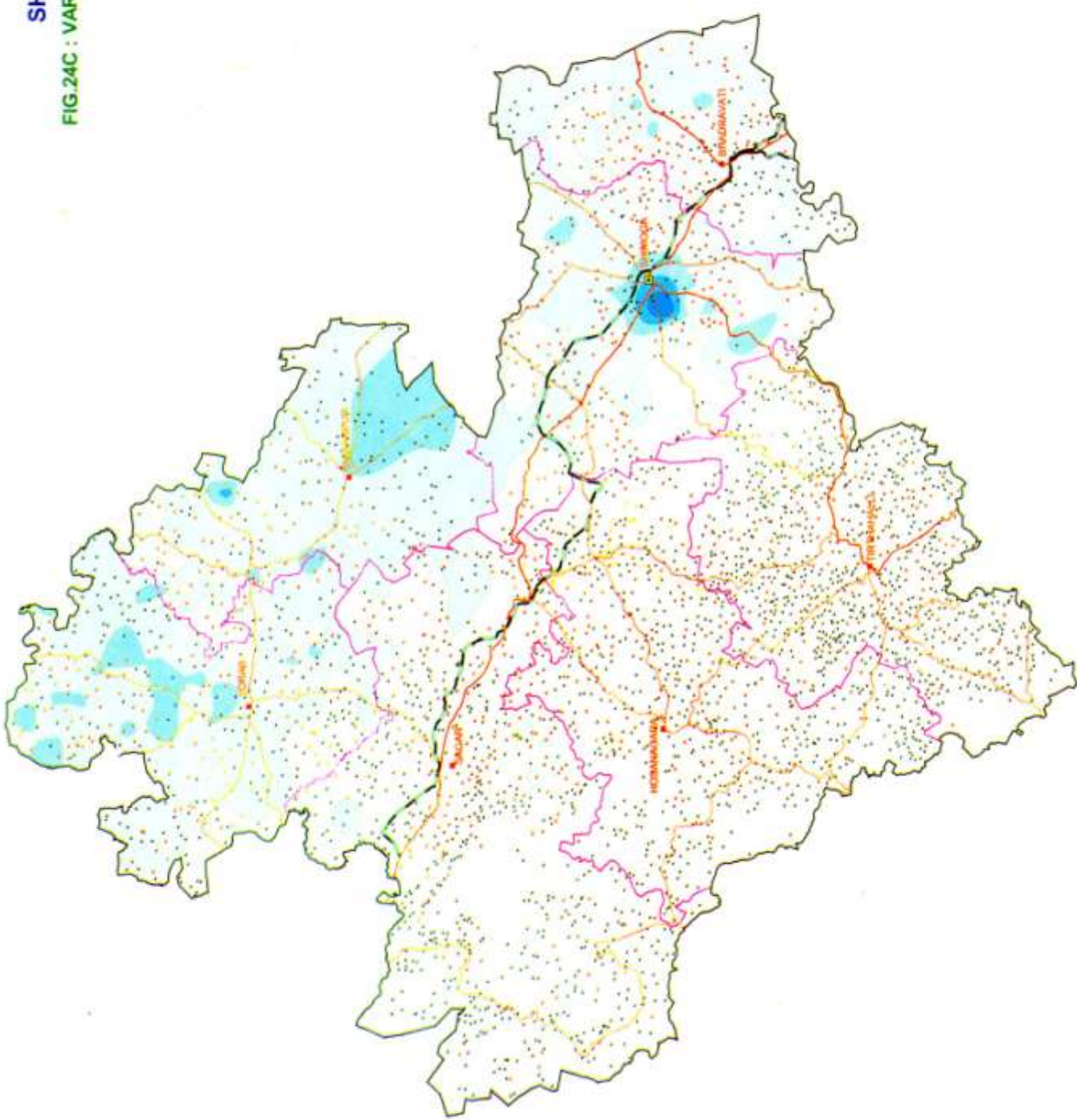
SHIMOGA DISTRICT

FIG.24C : VARIATION OF TOTAL HARDNESS (TH)



- LEGEND**
- Village Location
 - Village where samples collected / Analysed
 - Taluk Head Quarter
 - District Head Quarter
 - National Highway
 - Major Road
 - Railway Line

TH range in PPM
(Tolerance limit : 600ppm)



SHIMOGA DISTRICT
FIG.24D : IRON VARIATION

