DHARWAD DISTRICT

FIG.13 DHARWAD DISTRICT

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1. Location

Dharwad district is located in the northern portion of Karnataka State with a geographical area of 4230 sq. km. It is bounded by Belgaum district on northern and northwestern side, Uttara Kannada district on southwestern side, Haveri district on southern side and Gadag district on eastern side. It lies between 15° 02' to 15° 43' N Latitude and 74° 43' to 75° 34' E Longitude.

2. Demography

As per the 1991 census, Dharwad district has a population of 1,374,895. The total number of villages / habitations in the district are 494. Dharwad and Hubli are the bigger cities. Dharwad district has 5 taluks viz., Dharwad, Hubli, Kalghatgi, Kundgol and Navalgund.

3. Climate, Drainage and soil

Dharwad district forms part of the maidan area and receives an annual rainfall between 450-900 mm. The average annual rainfall is around 691 mm. It is a drought prone area. Dharwad city proper receives rainfall up to 750 mm per annum. The rainfall is confined to the monsoon period spread over 40 to 45 rainy days. Shimsha, Tuparihalla, Bennihalla, Hirehalla, Bedtihalla and Guligahalla drain the district. Neerasagara, Unkal etc are the important tanks. Dharwad district experiences temperature variation between 18^0 to 38^0 C. Red lateritic soils, medium black soils, red loamy and mixed soils are encountered in this district.

4. Geology and Groundwater occurrence

The eastern part of the district consists of peninsular gneisses and the unclassified crystallines. From the groundwater point of view, these rocks 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. Groundwater mainly occurs in the water table conditions in the weathered and decomposed mantle and under semi-confined conditions in the deeper fractures. The western half of the district is covered by greywacke/argillite/phyllites. These rocks are compact and lack primary porosity. Deeper fractures are seldom present because of compactness. Groundwater occurrence is confined to the weathered mantle only. As such limited quantity of water of poorer quality occurs in these rocks.

5. Groundwater quality characterization

To understand and gather information on groundwater quality, 1874 groundwater samples collected from 312 villages / habitations in Dharwad district have been analysed by RDED.

The water samples have been analysed for 14 parameters only such as Turbidity, Colour, Conductivity, Hydrogen ion concentration (pH), Total Dissolved Salts (TDS),

Total Hardness (TH), Calcium Hardness (CalH), Chloride (Cl), Sulphate (SO_4), Fluoride (F), Nitrate (NO_3), Alkalinity (Alk), Iron (Fe) and Bacteria. The data is presented in the Table.

5.1 Physical characters

Turbidity

Only 8 samples show higher turbidity in the range between 11 and 35 JTU. The samples showing higher turbidity are from Hubli (2 out of 264 samples), Kundgol(the lone sample) and Navalgund (5 out of 266 samples) taluks. No abnormal turbidity is recorded in Dharwad and Kalghatgi taluks. The sample with highest turbidity is from Navalgund.

Colour

No abnormality of colour intensity is reported in the entire district.

Electrical Conductivity (EC)

The EC value in the different taluks are: Dharwad 129.2 to 31242 m mhos/cm, Hubli 389 to 2114 m mhos / cm, Kalghatgi 10 to 2810 mmohs/cm, Kundgol 390 to 11010 mmhos/cm and Navalgund 20 to 8000 mmhos/cm.

Hydrogen Ion Concentration (pH)

In total, 503 samples covering 158 villages have shown the variation in pH value from acidic to basic in the range of 1.18 to 10.32. The ranges of pH value recorded in the taluks are: Dharwad 1.18 - 6.31 (2 samples), Hubli 6.4-9.3 (11 samples), Kalghatgi 6.21-10.32(418 samples), Kundgol (no abnormal pH) and Navalgund 3.1-9.8 (72 samples). Highest (10.32) value is reported from Kalghatgi taluk.

5.2 Chemical characters

Total Dissolved Salts (TDS)

Only 40 samples covering 25 villages / habitations have higher content of TDS in the range of 2001 - 8020 ppm. The ranges of abnormal TDS content in different taluks are: Dharwad 2001-3169 ppm (5 samples),Hubli 2001 to 2420 (4 samples), Kalghatgi (no abnormal TDS content is reported in the entire taluk), Kundgol 2220-8020 ppm (20 samples) and Navalgund 2102-4000 ppm (11 samples). Highest record of 8020 ppm is from Bagawad village in Kundgol taluk.

Total Hardness (TH)

In the entire district, 247 samples spread across 103 villages have indicated higher TH value ranging from 602 to 4212 ppm. The range of TH values above the permissible limit in different taluks are: Dharwad 604-3169 ppm (115 samples),

Hubli 608 to 1820 ppm (30 samples), Kalghatgi 608 - 1371 ppm (32 samples), Kundgol 358.2-757.3 ppm (21 samples) and Navalgund 602-4212 ppm (49 samples). The maximum TH content (4212 ppm) is reported from Navalgund taluk.

Calcium Hardness (CalH)

There are 104 samples spread across 51 villages having higher CalH ranging from 200.3 to 1592.2 ppm. The maximum abnormal samples are from Dharwad (56 samples with CalH 200.3 – 1056.3 ppm) taluk followed by Hubli (12 samples with CalH 200.3 - 426 ppm), Kalghatgi (the lone sample with CalH 689.46 ppm), Kundgol (27 samples with CalH 203.9 – 1592.2 ppm) and Navalgund (8 samples with CalH 206 - 437 ppm) taluks.

Chloride (Cl)

Only 21 samples analysed from 12 villages / habitations have shown Cl content beyond the permissible limit ranging between 1013 and 2099.2 ppm. The abnormal Cl content noted in other taluks is: Dharwad 1013 to 1206.3 ppm (5 samples) and Kundgol 1065-2099.2 ppm (16 samples). Highest Cl content, 2099.2 ppm is reported from Kundgol taluk. Hubli, Kalghatgi and Navalgund taluks have not reported any abnormal concentration of Cl in the analysed samples.

Sulphate (SO_4)

In the entire district, 18 samples covering 14 villages / habitations have more SO_4 content in the range of 476.9 - 1222 ppm. The variation in Sulphate content reported are: Kundgol 476.9 - 1222 ppm (17 samples) and Navalgund 420 ppm(the lone sample). Dharwad, Hubli and Kalghatgi have not reported any abnormal concentration of Sulphate.

Fluoride (F)

The analytical data has revealed higher fluoride content in 128 samples from 71 villages / habitations in the range of 1.51- 21.3 ppm. The concentrational variation reported in different taluks are: Dharwad 1.6-3.2 ppm (51 samples), Hubli 1.6 to 21.3 ppm (7 samples), Kalghatgi 1.6-1.8 ppm (3 samples), Kundgol 1.51 – 2.8 ppm (12 samples) and Navalgund 1.6 to 3.8 ppm (55 samples). Highest concentration of Fluoride (21.3 ppm) is reported from Thirumalakoppa village in Hubli taluk.

Nitrate (NO_3)

Only 22 samples covering 14 villages / habitations have analysed NO_3 content beyond the permissible limit. These samples are from Dharwad (the lone sample with Nitrate 153 ppm) and Kundgol (21 samples with Nitrate content-128.9 –1306.8ppm) taluks. Hubli, Kalghatgi and Navalgund taluks have not shown abnormal concentration of Nitrate in the analysed samples.

Alkalinity (Alk)

Only one samples in the entire district has analysed Alkalinity in excess. The abnormal sample is from Mardagi village in Dharwad taluk with alkalinity of 735 ppm. Rests of the taluks in the district have not shown abnormality in the analysed samples

Iron (Fe)

Quite a good number of samples, 430 samples covering 142 villages / habitations, have analysed iron in excess in the range of 1.02 to 16 ppm. The concentration variation of Fe in different taluks are: Hubli (107 samples with Fe content 1.1-3.6 ppm), Kalghatgi (247 samples with Fe content 1.02-3.6 ppm) and Navalgund (76 samples with Fe content 1.1-16 ppm). No abnormal Fe content is recorded in Dharwad and Kundgol taluks. The highest Fe value of 16 ppm is recorded in a sample from Sasvihalli village in Navalgund taluk.

Bacteria (*E.coli*)

Nearly 101 samples covering 90 villages have shown the presence of Bacteria. In the analytical data supplied, exact bacterial count is not given hence, ranges of bacterial count is unknown. The number of bacterial incidence reported in different taluks are: Dharwad (24 samples), Hubli (16 samples), Kalghatgi (47 samples), Kundgol (no incidence of bacteria is reported in the taluk) and Navalgund (14 samples).

5.3 Spatial Variation

Bacteria (*E.coli*)

The map depicting bacterial incidence indicates that, bacteria are more commonly seen in the analysed water samples in Dharwad, Kalghatgi and Navalgund taluks in the west whereas, it is rare in Hubli and Kundgol taluk in the southeast. Bacterial contamination is point specific and varies considerably.

Fluoride (F)

The isoconcentration map of Fluoride (Fig.13A) indicates that, generally fluoride concentration is fairly constant and within the permissible limit. However, few isolated patches having higher fluoride content are seen in the northern, southeastern and northwest portions of the district.

Total dissolved Salts (TDS)

The isoconcentration map generated (Fig.13B) depicts that; in general, the TDS content in the district is within the tolerance limit. Southeastern corner and the peripheral regions in the northern parts of the district have abnormal TDS content.

Total Hardness (TH)

The map showing TH variation (Fig.13C) reveals that, only the southeastern region comprising Kundgol and the northern part encompassing Navalgund taluk have higher concentration of TH, while the rest of the district shows lower TH levels.

Iron (Fe)

Isoconcentration map generated (Fig.13D) has shown confinement of higher content of iron to the southwestern and the northeastern portions of the district with remaining part having iron below the permissible limit.

6. Conclusion

The water quality data of Dharwad district has reflected the presence of excess Total Hardness, Calcium Hardness, Iron and the Bacteria. Hardness can be reduced by some conventional methods. To overcome from the problem related to the excess Iron content, an attention is required during the source development such as use of galvanized iron / PVC pipes and proper casing. The most important component, which is much more harmful, is the presence of Bacteria viz. *E. coli* in drinking water. The consumption of such water may cause the diseases such as Malaria, Diarrhea etc. Probably, these 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 Dharwad 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	As (0.05) ppm	Cond - mmhos /cm	pH (6.5-8.5)	TDS (2000) ppm	TH (600) ppm	CalH (200) ppm	Cl (1000) ppm	SO_4 (400) ppm	F (1.5) ppm	NO_3 (100) ppm	Alk (600) ppm	Fe (1) ppm
1	Dharwad	142	104	750	No. of samples beyond permissible limit	24	-	-	-	-	2	5	115	56	5	-	51	1	1	-
					No. of Village affected	23	-	-	-	-	2	3	44	22	3	-	25	1	1	-
					Range	Present	-	-	-	129.2-31242	1.18-6.31	2001-3169	604-3169	200.3-1056.3	1013-1206.3	-	1.6-3.2	153	735	-
2	Hubli	75	44	264	No. of samples beyond permissible limit	16	2	-	-	-	11	4	30	12	-	-	7	-	-	107
					No. of Village affected	14	2	-	-	-	8	4	15	10	-	-	5	-	-	35
					Range	Present	18-21.6	-	-	389-2114	6.4-9.3	2001-2420	608-1820	200.3-426	-	-	1.6-21.3	-	-	1.1-3.6
3	Kalgatgi	100	90	561	No. of samples beyond permissible limit	47	-	-	-	-	418	-	32	1	-	-	3	-	-	247
					No. of Village affected	39	-	-	-	-	90	-	16	1	-	-	3	-	-	76
					Range	Present	-	-	-	10-2810	6.21-10.32	-	608-1371	689.46	-	-	1.6-1.8	-	-	1.02-3.6
4	Kundgol	60	16	33	No. of samples beyond permissible limit	-	1	-	-	-	-	20	21	27	16	17	12	21	-	-
					No. of Village affected	-	1	-	-	-	-	11	11	13	9	13	6	13	-	-
					Range	-	11	-	-	390-11010	-	2220-8020	358.2-757.3	203.9-1592.2	1065-2099.2	476.9-1222	1.51-2.8	128.9-1306.8	-	-
5	Navalgund	64	58	266	No. of samples beyond permissible limit	14	5	-	-	-	72	11	49	8	-	1	55	-	-	76
					No. of Village affected	14	4	-	-	-	58	7	17	5	-	1	32	-	-	31
					Range	Present	11-35	-	-	20-8000	3.1-9.8	2102-4000	602-4212	206-437	-	420	1.6-3.8	-	-	1.1-16
	Total	441	312	1874	No. of samples beyond permissible limit	101	8	-	-	-	503	40	247	104	21	18	128	22	1	430
					No. of villages affected	90	7	-	-	-	158	25	103	51	12	14	71	14	1	142
					Range	Present	11-35	-	-	10-31242	1.18-10.32	2001-8020	602-4212	200.3-1592.2	1013-2099.2	420-1222	1.51-21.3	128.9-1306.8	735	1.02-16

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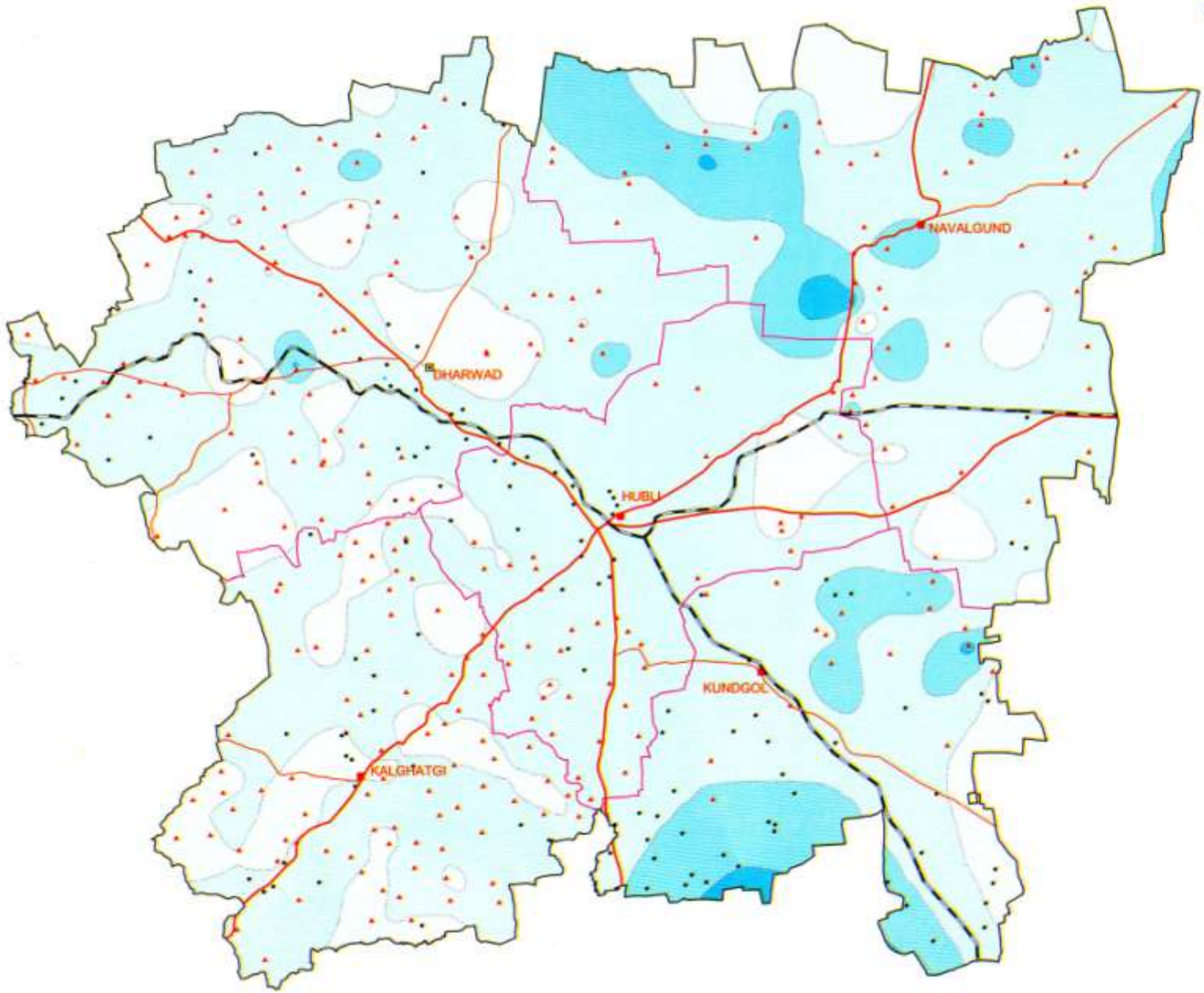
FIG.13A : FLUORIDE VARIATION



N

Scale

10 0 10 Kms

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)

- < 0.5
- 0.5 - 1.5
- 1.5 - 2.5
- > 2.5

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FIG.13B : VARIATION OF TOTAL DISSOLVED SALTS (TDS)

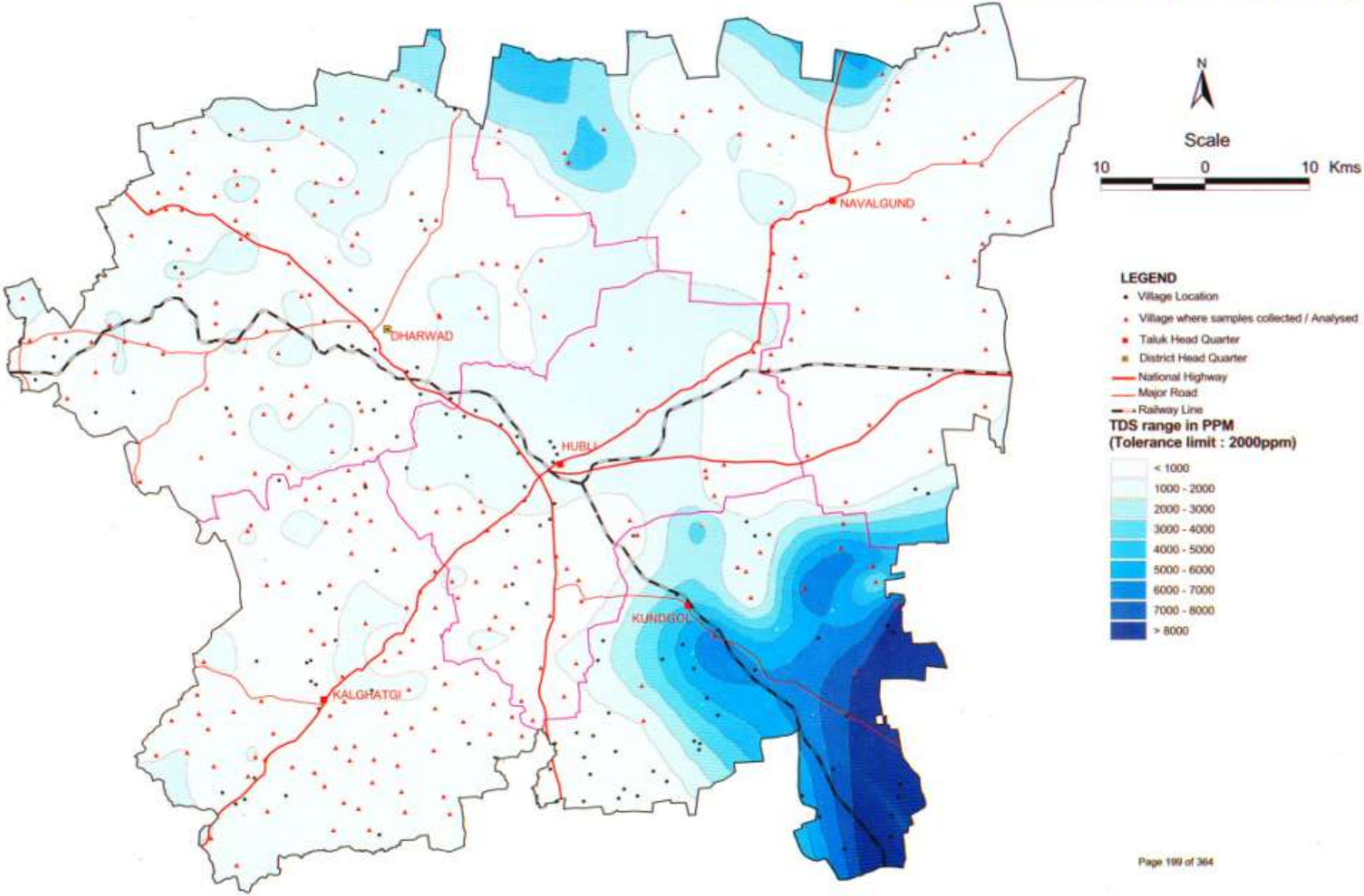

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FIG.13C : VARIATION OF TOTAL HARDNESS (TH)

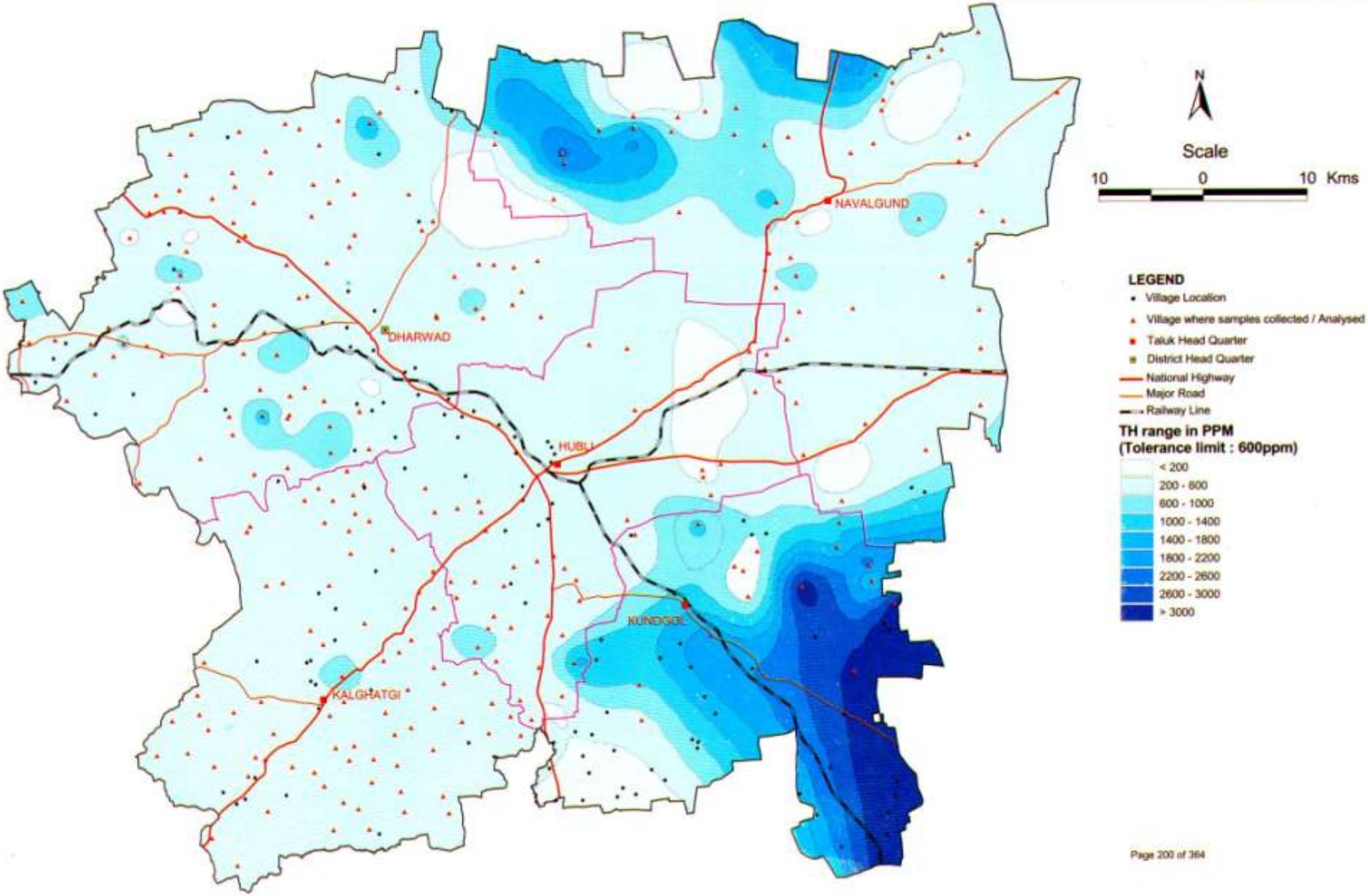

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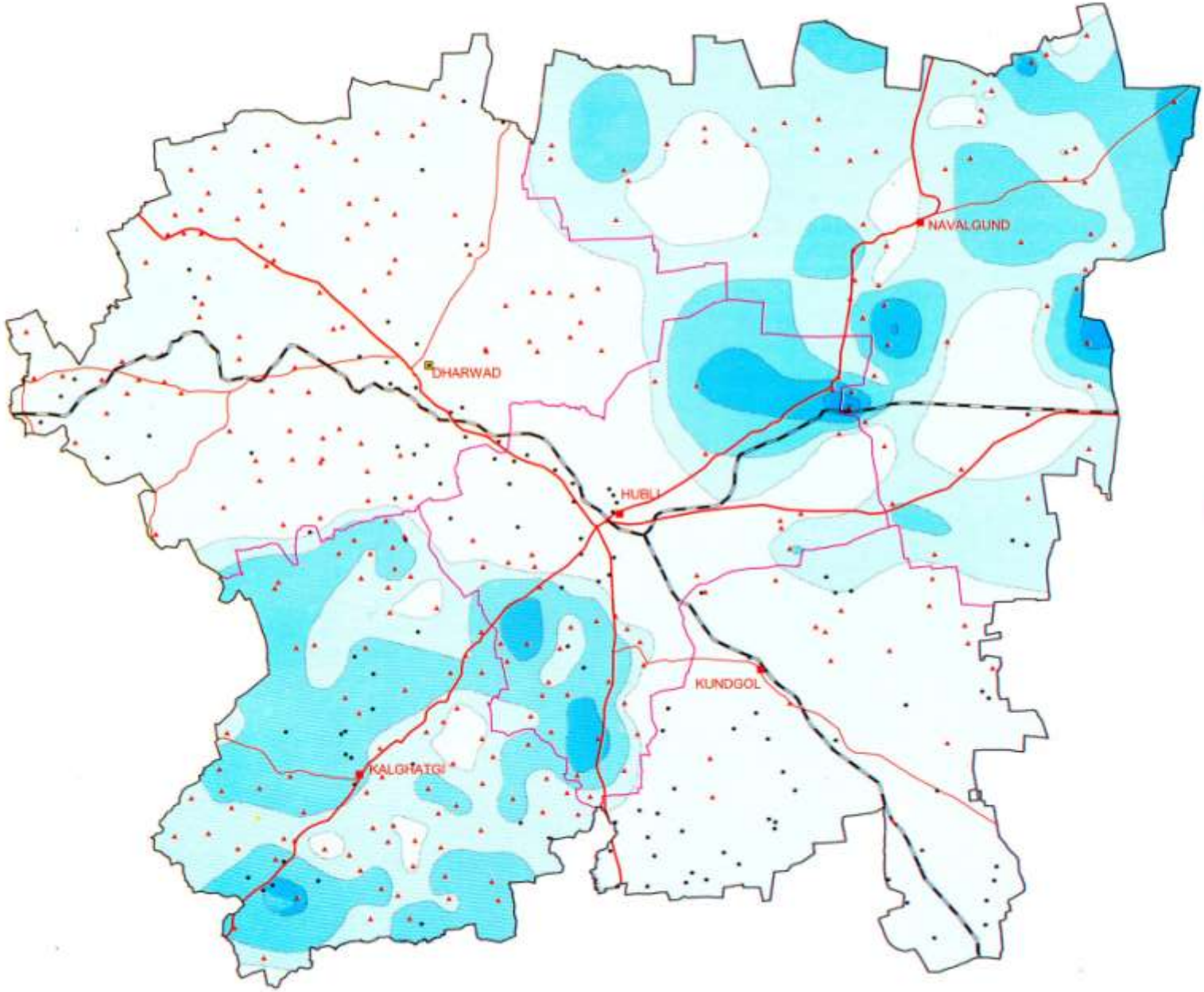
FIG.13D : IRON VARIATION



N

Scale

10 0 10 Kms

LEGEND

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

Fe range in PPM
(Tolerance limit : 1ppm)

- < 0.5
- 0.5 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- > 4