# KOLAR DISTRICT


FIG.19 KOLAR DISTRICT

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## 1. Location

Kolar district is located in the southeastern part of Karnataka State with a geographical area of 8,223 sq. km. It is bounded by Bangalore (Rural) district on western side, Tamil Nadu State on southeastern side, Andhra Pradesh State on north and northeastern side and Tumkur district on northwestern side. It lies between 12° 45' to 13° 59' N Latitude and 77° 21' to 78° 34' E Longitude.

## 2. Demography

As per the 1991 census, Kolar district has a population of 2,216,889. The total number of villages / habitations in the district are 3,742. Kolar district has 11 taluks viz. Bagepalli, Bangarpet, Chintamani, Chikballapur, Gauribidanur, Gudibanda, Kolar, Malur, Mulbagal, Sidlaghatta and Srinivaspura.

## 3. Climate, Drainage and Soil

Kolar district is grouped under southern maidan region. The annual average rainfall in the district is 711.4 mm. (Ref: Climate of Karnataka State, Published by India Meteorological Department, 1984). Kolar district experiences temperature variation between 18.5° C and 43° C. Ponnaiar and Palar rivers drain Kolar district. The district is grouped under eastern dry zone of ten fold Agro-climatic classification of Karnataka. Major portion of the district is covered by red sandy soil with lateritic patches.

## 4. Geology and Groundwater occurrence

Kolar district consists of immense expanse of migmatitic gneisses classified as Peninsular gneisses and the younger granites are seen as elongated NS trending patches intruding the gneisses. 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. The quality of groundwater is governed by the mineralogical composition of the rocks. The ultramafic, metavolcanic and schistose rocks are seen as scattered masses. These schistose rocks are poor aquifers and yield poorer quality water in very less quantity. The joint pattern in the metavolcanic rocks control movement of water and they normally yield better quality water. Groundwater in general 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, 7510 samples collected from 3211 villages/habitations in Kolar 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 (CalH), Chloride (Cl), Sulphate ($SO_4$), Fluoride (F), Nitrate ($NO_3$), Alkalinity (Alk), Iron (Fe) and Bacteria and the data is presented in the Table.

### 5.1 Physical characters

#### Turbidity

In the district, 167 samples covering 129 villages / habitations show higher Turbidity ranging between 10.1 and 7050 JTU. The samples showing higher turbidity are from: Bagepalli (1 out of 712 samples), Bangarpet (5 out of 1091 samples), Chikballapura (131 out of 551 samples), Gauribidanur (1 out of 1237 samples), Kolar (1 out of 622 samples), Malur (12 out of 718 samples), Mulbagal (1 out of 665 samples), Sidlaghatta (1 out of 520 samples) and Srinivaspura (1 out of 623 samples) taluks. Highest Turbidity value of 7050 JTU is recorded from Chokkahalli village in Chikballapura taluk.

#### Colour

Some 56 samples from 40 villages have shown higher Colour intensity in the range from 45 to 85 HU. Highest colour intensity of 85 HU is recorded from Ganganamidde village of Chikballapura taluk. The analytical table provided does not contain Colour intensity data for the remaining taluks.

#### Electrical Conductivity (EC)

The EC value in different taluks are: Bagepalli 88-5310 m mhos/cm, Bangarpete 90-18000 m mhos/cm, Chikballapur 7-14866 m mhos/cm, Chintamani 220-3790 m mhos/cm, Gauribidanur 0.75-7340 m mhos/cm, Gudibanda 240-4200 m mhos/cm, Kolar 29-6740 m mhos/cm, Malur 203-4988 m mhos/cm, Mulbagal 192-7940 m mhos/cm, Sidlaghatta 190-3920 m mhos/cms and Srinivaspur 100-6370m mhos/cm.

#### Hydrogen Ion Concentration (pH)

About 236 samples covering 181 villages have shown the abnormal pH value in the range of 0.8-9.2. The range of pH values recorded in different taluks are: Bagepalli 8.6-8.9 (10 samples), Bangarpete 8.6-9.2 (9 samples), Chikballapur 5.57-6.82 (30 samples), Chintamani 8.6-8.7 (8 samples), Gauribidanur 8.6-8.9 (73 samples), Kolar 8.6-8.7 (9 samples), Malur 6.3-9.2 (69 samples), Mulbagal 8.6-8.8 (16 samples), Sidlaghatta 8.6 (8 samples) and Srinivaspur 0.8-8.7 (4 samples).

## 5.2 Chemical characters

### Total Dissolved Salts (TDS)

In the entire district, 175 samples covering 147 villages / habitations have higher TDS content in the range of 2001-8622 ppm. The ranges of abnormal TDS content in different taluks are: Bagepalli 2040-4250 ppm (7 samples), Bangarpete 2015-5590 ppm (19 samples), Chikballapur 2001-8622 ppm (13 samples), Chintamani 2280-2370 ppm (2 samples), Gauribidanur 2010-4600 ppm (27 samples), Gudibanda 2040-2630 ppm (7 samples), Kolar 2130-4210 ppm (28 samples), Malur 2103-3242 ppm (13 samples), Mulbagal 2030-4960 ppm (38 samples), Sidlaghatta 2020-2450 ppm (7 samples) and Srinivaspur 2030-3980 ppm (14 samples). The highest value of 8622 ppm is reported from Anakanur village in Chikballapura taluk.

### Total Hardness (TH)

In total 497 samples spread across 386 villages have indicated TH value beyond the permissible limit in the range between 604 and 2032 ppm. The range of TH values above the permissible limit in different taluks are: Bagepalli 620-930 ppm (11 samples), Bangarpete 604-2032 ppm (175 samples), Chikballapur 632-1168 ppm (18 samples), Chintamani 610-800 ppm (26 samples), Gauribidanur 610-1370 ppm (65 samples), Gudibanda 620-990 ppm (6 samples), Kolar 610-900 ppm (27 samples), Malur 602-1626 ppm (89 samples), Mulbagal 610-970 ppm (21 samples), Sidlaghatta 610-850 ppm (18 samples) and Srinivaspur 610-950 ppm (41 samples). The highest TH content of 2032 ppm is reported from Byatarayanahalli village in Bangarpete Taluk.

### Calcium Hardness (CaIH)

In the entire district, 250 samples spreading across 180 villages have shown higher CaIH content ranging from 201-664 ppm. The ranges of CaIH values in different taluks are: Chikballapur 204-640 ppm (94 samples) and Malur 201-664 ppm (156 samples). The analytical data provided for the other taluks in the district does not contain CaIH content.

### Chloride (Cl)

Only 42 samples analysed from 38 villages / habitations have Cl content beyond the permissible limit ranging from 1020-2788 ppm. The abnormal Cl content noted in different taluks are: Bagepalli 1170-1330 ppm (3 samples), Bangarpete 1028-2788 ppm (9 samples), Chikballapur 1562 ppm (1 sample), Gauribidanur 1440 ppm (1 sample), Gudibanda 1370 ppm (1 sample), Kolar 1020-2040 ppm (10 samples), Malur 1035-1053 ppm (2 samples), Mulbagal 1010-2630 ppm (9 samples) and Srinivaspur 714 ppm (1 sample). Highest Cl content of 2788 ppm is reported from Gollahalli majra Barli (bovi manegalu) village in Bangarpet taluk. Samples analysed in Chintamani and Sidlaghatta taluks have Cl content well within the permissible limit of 1000 ppm.

**Sulphate ($SO_4$)**

In the entire district, 51 samples from 43 villages have shown the higher Sulphate content in the range of 410-1000 ppm. The abnormal samples in different taluks of the district are: Bangarpete 628-873 ppm (2 samples), Chikballapur 410-1000 ppm (46 samples), Gauribidanur 420 ppm (1 sample), Malur 413 ppm (1 sample) and Srinivaspur 714 ppm (1 sample). Highest Sulphate content of 1000 ppm is recorded from Nimmakalakunte village in Chikballapur taluk. Samples analysed in Chintamani, Gudibanda, Kolar, Mulbagal and Sidlaghatta taluks have not reported any abnormality in $SO_4$ content.

**Fluoride (F)**

The analytical data has revealed higher fluoride content in 828 samples from 505 villages / habitations have shown abnormal Fluoride content in the range of 1.51-10.3 ppm. The range of fluoride concentration in different taluks are: Bagepalli 1.3-2.8 ppm (337 samples), Bangarpete 1.51-2.90 ppm (217 samples), Chikballapur 1.6-10.3 ppm (40 samples), Chintamani 1.7-1.9 ppm (2 samples), Gauribidanur 1.51-2 ppm (25 samples), Gudibanda 1.6-2.6 ppm (124 samples), Kolar 1.55-2 ppm (7 samples), Malur 1.5-2.7 ppm (66 samples), Mulbagal 1.53-1.8 ppm (11 samples) and Srinivaspur 1.6-1.52 ppm (2 samples). Highest concentration of Fluoride, 10.3 ppm is reported from Jathavara village in Chikballapura taluk.

**Nitrate ($NO_3$)**

There are 975 samples covering 672 villages / habitations analysing higher $NO_3$ content ranging between 101-1942 ppm. The range of Nitrate concentration in different taluks are: Bagepalli 101-729 ppm (62 samples), Chintamani 101-1942 ppm (60 samples), Gauribidanur 101-246 ppm (302 samples), Gudibanda 105-190 ppm (8 samples), Kolar 101-248 ppm (55 samples), Malur 101-223 ppm (7 samples), Mulbagal 100.5-251 ppm (122 samples), Sidlaghatta 101.8-242 ppm (111 samples) and Srinivaspur 101-270 ppm (248 samples). Highest Nitrate content of 1942 ppm is recorded from Nandanavana village in Chintamani taluk.

**Alkalinity (Alk)**

About 100 samples covering 86 villages in the entire district have analysed excess alkalinity ranging between 604-1020 ppm. The range of Nitrate concentration in different taluks are: Bagepalli 610-810 ppm (11 samples), Bangarpete 604-1020 ppm (24 samples), Chintamani 616-756 ppm (5 samples), Gauribidanur 610-730 ppm (18 samples), Gudibanda 610-640 ppm (3 samples), Kolar 620-810 ppm (3 samples), Malur 601-871 ppm (13 samples), Mulbagal 610-820 ppm (7 samples), Sidlaghatta 610-610 ppm (2 samples) and Srinivaspur 610-890 ppm (8 samples). Highest Alkalinity content of 1020 ppm is recorded from Marikuppam village in Bangarpete taluk.

**Iron (Fe)**

Totally 211 samples from 146 villages/habitations have analysed iron content in excess ranging between 1.02-30 ppm. The abnormal samples in different taluks are: Bangarpete 1.1-24.2 ppm (59 samples), Chikballapur 1.3 & 30 ppm (2 samples), Gauribidanur 3.2 ppm (1 sample), Malur 1.02-2.7 ppm (148 samples) and Srinivaspur 1.1 ppm (1 sample). The extreme Fe value of 30 ppm is recorded from Makakuhosahalli village in Chikballapura taluk Samples analysed in Chintamani, Gudibanda, Kolar, Mulbagal and Sidlaghatta taluks have not reported any abnormal iron content.

**Bacteria (*E.coli*)**

As many as 1789 samples covering 1518 villages have shown the presence of Bacteria in the analysed drinking water. The bacterial count in the district varies between 1 to 965 numbers/100ml. The bacterial count in different taluks are: Bagepalli 1-4 numbers/100ml (198 samples), Bangarpete 125-965 numbers/100ml (98 samples), Chikballapura 1-2 numbers/100ml (268 samples), Chintamani 1-16 numbers/100ml (251 samples), Gauribidanur 2-16 numbers/100ml (270 samples), Gudibanda 1-3 numbers/100ml (91 samples), Kolar 1-7 numbers/100ml (253 samples), Malur 10-86 numbers/100ml (12 samples), Mulbagal 1-8 numbers/100ml (167 samples), Sidlaghatta 1-17 numbers/100ml (185 samples) and Srinivaspura 1-10 numbers/100ml (196 samples).

**5.3 Spatial Variation**

**Bacteria (*E.coli*)**

The map indicates that, bacteria are more commonly seen in the analysed water samples and they spread unevenly throughout the district.

**Fluoride (F)**

The isoconcentration map (Fig.19A) depicts that, Fluoride variation seen in the district is almost equal in the eastern and western half of the district. In the eastern half, Malur and Bangarpet are more affected in comparison to Kolar and Mulbagal taluks. In the western half, Bagepalli, Gudibanda and Gauribidanur taluks are more affected in comparison to Sidlaghatta and Chintamani taluks. Confinement of high Fluoride concentration to specific region clearly indicates the lithological control over the ground water regime.

**Total Dissolved Salts (TDS)**

The isoconcentration map (Fig.19B) shows that, slightly higher concentration of TDS is seen in the eastern half of the district when compared to western half, where tiny patches of higher concentration are confined to Bagepalli and Chikballapur taluks.

**Total Hardness (TH)**

Total Hardness isoconcentration map (Fig. 19C) reveals that, slightly higher concentration of TH is seen in the eastern half of the district when compared to western half.

**Iron (Fe)**

The spatial variation map (Fig.19D) shows that, slightly higher concentration is more in the southern half, while the northern half has a lone patch in the central portion of Chikballapur taluk

**6. Conclusion**

The water quality data of Kolar district has reflected the presence of excess Total Hardness, Fluoride, Nitrate, Iron and Bacteria. Hardness can be reduced by some conventional methods. In case of Fluoride, utmost care has to be taken, since many samples have analyzed excess of Fluoride. Though a little amount of Fluoride is essential for the bone development in the infants, excess consumption of Fluoride will induce physical disabilities and Dental Fluorosis. Therefore, it is very essential to treat the water to the desirable standard before it is supplied for the drinking purpose. The iron content can be reduced by proper development of the source, usage of galvanized iron or PVC pipes and proper casing. Changing irrigation practice and lesser application of chemical fertilizers can reduce the Nitrate levels. 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, Diorrhoea etc. Probably, the organisms might 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 Kolar 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 | Bagepalli | 411 | 347 | 712 | No. of samples beyond permissible limit | 198 | 1 | - | - | - | 10 | 7 | 11 | - | 3 | - | 337 | 62 | 11 | - |
| | | | | | No. of villages affected | 169 | 1 | - | - | - | 10 | 7 | 11 | - | 3 | - | 217 | 56 | 9 | - |
| | | | | | Range | 1-4 | 11 | - | - | 88-5310 | 8.6-8.9 | 2040-4250 | 620-930 | - | 1170-1330 | - | 1.3-2.8 | 101-729 | 610-810 | - |
| 2 | Bangarpete | 514 | 438 | 1091 | No. of samples beyond permissible limit | 98 | 5 | - | - | - | 9 | 19 | 175 | - | 9 | 2 | 214 | - | 24 | 59 |
| | | | | | No. of villages affected | 73 | 5 | - | - | - | 7 | 15 | 111 | - | 6 | 1 | 106 | - | 20 | 42 |
| | | | | | Range | 125-965 | 10.6-21.8 | - | - | 90-18000 | 8.6-9.2 | 2015-5590 | 604-2032 | - | 1028-2788 | 628-873 | 1.51-2.90 | - | 604-1020 | 1.1-24.2 |
| 3 | Chikballapur | 365 | 249 | 551 | No. of samples beyond permissible limit | 68 | 131 | 56 | - | - | 30 | 13 | 18 | 94 | 1 | 46 | 40 | - | 5 | 2 |
| | | | | | No. of villages affected | 50 | 95 | 40 | - | - | 23 | 10 | 15 | 70 | 1 | 39 | 30 | - | 4 | 2 |
| | | | | | Range | 1-2 | 10.5-7050 | 45-85 | - | 7-14866 | 5.57-6.82 | 2001-8622 | 632-1168 | 204-640 | 1562 | 410-1000 | 1.6-10.3 | - | 616-756 | 1.3-30 |
| 4 | Chintamani | 388 | 295 | 487 | No. of samples beyond permissible limit | 251 | - | - | - | - | 8 | 2 | 26 | - | - | - | 2 | 60 | 6 | - |
| | | | | | No. of villages affected | 236 | - | - | - | - | 8 | 2 | 25 | - | - | - | 2 | 52 | 5 | - |
| | | | | | Range | 1-16 | - | - | - | 220-3790 | 8.6-8.7 | 2280-2370 | 610-800 | - | - | - | 1.7-1.9 | 101-1942 | 610-770 | - |
| 5 | Gouribidanur | 345 | 307 | 1237 | No. of samples beyond permissible limit | 270 | 1 | - | - | - | 73 | 27 | 65 | - | 1 | 1 | 25 | 302 | 18 | 1 |
| | | | | | No. of villages affected | 194 | 1 | - | - | - | 51 | 25 | 57 | - | 1 | 1 | 16 | 165 | 15 | 1 |
| | | | | | Range | 2-16 | 13 | - | - | 0.75-7340 | 8.6-8.9 | 2010-4600 | 610-1370 | - | 1440 | 420 | 1.51-2 | 101-246 | 610-730 | 3.2 |
| 6 | Gudibanda | 146 | 106 | 284 | No. of samples beyond permissible limit | 91 | - | - | - | - | - | 7 | 6 | - | 1 | - | 124 | 8 | 3 | - |
| | | | | | No. of villages affected | 78 | - | - | - | - | - | 7 | 6 | - | 1 | - | 69 | 8 | 2 | - |
| | | | | | Range | 1-3 | - | - | - | 240-4200 | - | 2040-2630 | 620-990 | - | 1370 | - | 1.6-2.6 | 105-190 | 610-640 | - |
| 7 | Kolar | 381 | 287 | 622 | No. of samples beyond permissible limit | 253 | 1 | - | - | - | 9 | 28 | 27 | - | 10 | - | 7 | 55 | 3 | - |
| | | | | | No. of villages affected | 220 | 1 | - | - | - | 8 | 19 | 18 | - | 10 | - | 5 | 52 | 3 | - |
| | | | | | Range | 1-7 | 12 | - | - | 29-6740 | 8.6-8.7 | 2130-4210 | 610-900 | - | 1020-2040 | - | 1.55-2 | 101-248 | 620-810 | - |
| 8 | Malur | 408 | 298 | 718 | No. of samples beyond permissible limit | 12 | 25 | - | - | - | 69 | 13 | 89 | 156 | 2 | 1 | 66 | 7 | 13 | 148 |
| | | | | | No. of villages affected | 11 | 23 | - | - | - | 47 | 12 | 67 | 110 | 1 | 1 | 49 | 7 | 12 | 100 |
| | | | | | Range | 10-86 | 10.1-68 | - | - | 203-4988 | 6.3-9.2 | 2103-3242 | 602-1626 | 201-664 | 1035-1053 | 413 | 1.5-2.7 | 101-223 | 601-871 | 1.02-2.7 |
| 9 | Mulbagal | 431 | 340 | 665 | No. of samples beyond permissible limit | 167 | 1 | - | - | - | 16 | 38 | 21 | - | 9 | - | 11 | 122 | 7 | - |
| | | | | | No. of villages affected | 154 | 1 | - | - | - | 15 | 31 | 21 | - | 9 | - | 9 | 87 | 7 | - |
| | | | | | Range | 1-8 | 12 | - | - | 192-7940 | 8.6-8.8 | 2030-4960 | 610-970 | - | 1010-2630 | - | 1.53-1.8 | 100.5-251 | 610-820 | - |
| 10 | Sidlaghatta | 330 | 233 | 520 | No. of samples beyond permissible limit | 185 | 1 | - | 2 | - | 8 | 7 | 18 | - | - | - | - | 111 | 2 | - |
| | | | | | No. of villages affected | 155 | 1 | - | 2 | - | 8 | 7 | 16 | - | - | - | - | 79 | 2 | - |
| | | | | | Range | 1-17 | 12 | - | 3 | 190-3920 | 8.6-8.6 | 2020-2450 | 610-850 | - | - | - | - | 101.8-242 | 610-610 | - |
| 11 | Srinivaspura | 442 | 311 | 623 | No. of samples beyond permissible limit | 196 | 1 | - | - | - | 4 | 14 | 41 | - | 6 | 1 | 2 | 248 | 8 | 1 |
| | | | | | No. of villages affected | 178 | 1 | - | - | - | 4 | 12 | 39 | - | 6 | 1 | 2 | 166 | 7 | 1 |
| | | | | | Range | 1-10 | 14 | - | - | 100-6370 | 0.8-8.7 | 2030-3980 | 610-950 | - | 1070-2100 | 714 | 1.6-1.52 | 101-270 | 610-890 | 1.1 |
| | Total | 4161 | 3211 | 7510 | No. of samples beyond permissible limit | 1789 | 167 | 56 | 2 | - | 236 | 175 | 497 | 250 | 42 | 51 | 828 | 975 | 100 | 211 |
| | | | | | No. of villages affected | 1518 | 129 | 40 | 2 | - | 181 | 147 | 386 | 180 | 38 | 43 | 505 | 672 | 86 | 146 |
| | | | | | Range | 1-965 | 10.1-7050 | 45-85 | 3 | 0.75-18000 | 0.8-9.2 | 2001-8622 | 604-2032 | 201-664 | 1020-2788 | 410-1000 | 1.51-10.3 | 101-1942 | 604-1020 | 1.02-30 |

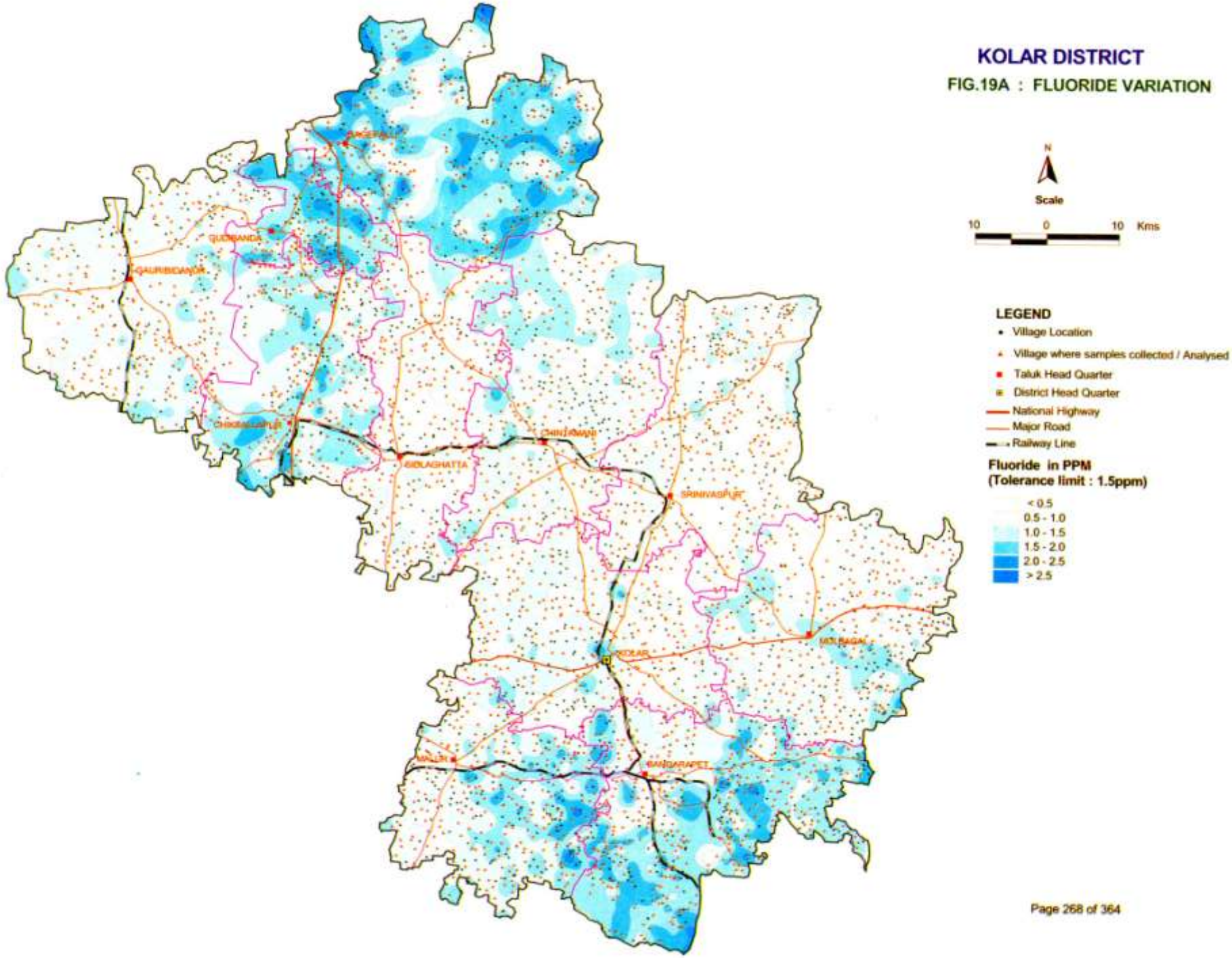
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FIG.19A : FLUORIDE VARIATION
N
Scale
10 0 10 Kms
LEGEND
Village Location
Village where samples collected / Analysed
Taluk Head Quarter
District Head Quarter
National Highway
Major Road
Railway Line
Fluoride in PPM
(Tolerance limit : 1.5ppm)
< 0.5
0.5 - 1.0
1.0 - 1.5
1.5 - 2.0
2.0 - 2.5
> 2.5
GUDIBANDA
GAURIBIDANUR
CHIKKABALLAPUR
CHINTAMANI
SIDLAGHATTA
SRINIVASPUR
KOLAR
MULBAGAL
BANGARAPET
MALUR

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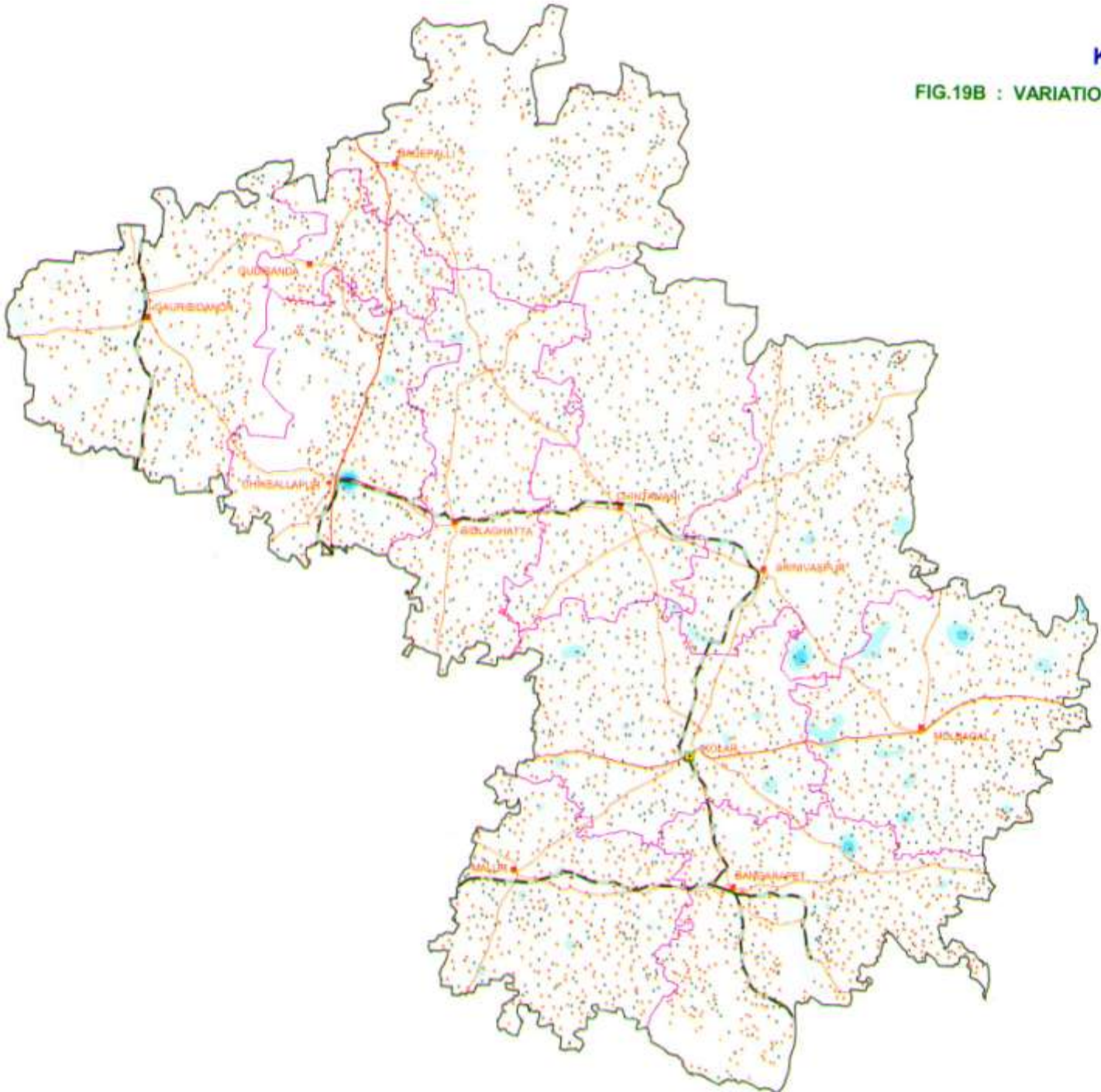
## FIG.19B : VARIATION OF TOTAL DISSOLVED SALTS (TDS)




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

**TDS range in PPM**
**(Tolerance limit : 2000ppm)**

- < 1000
- 1000
- 2000
- 3000
- 4000
- > 5000

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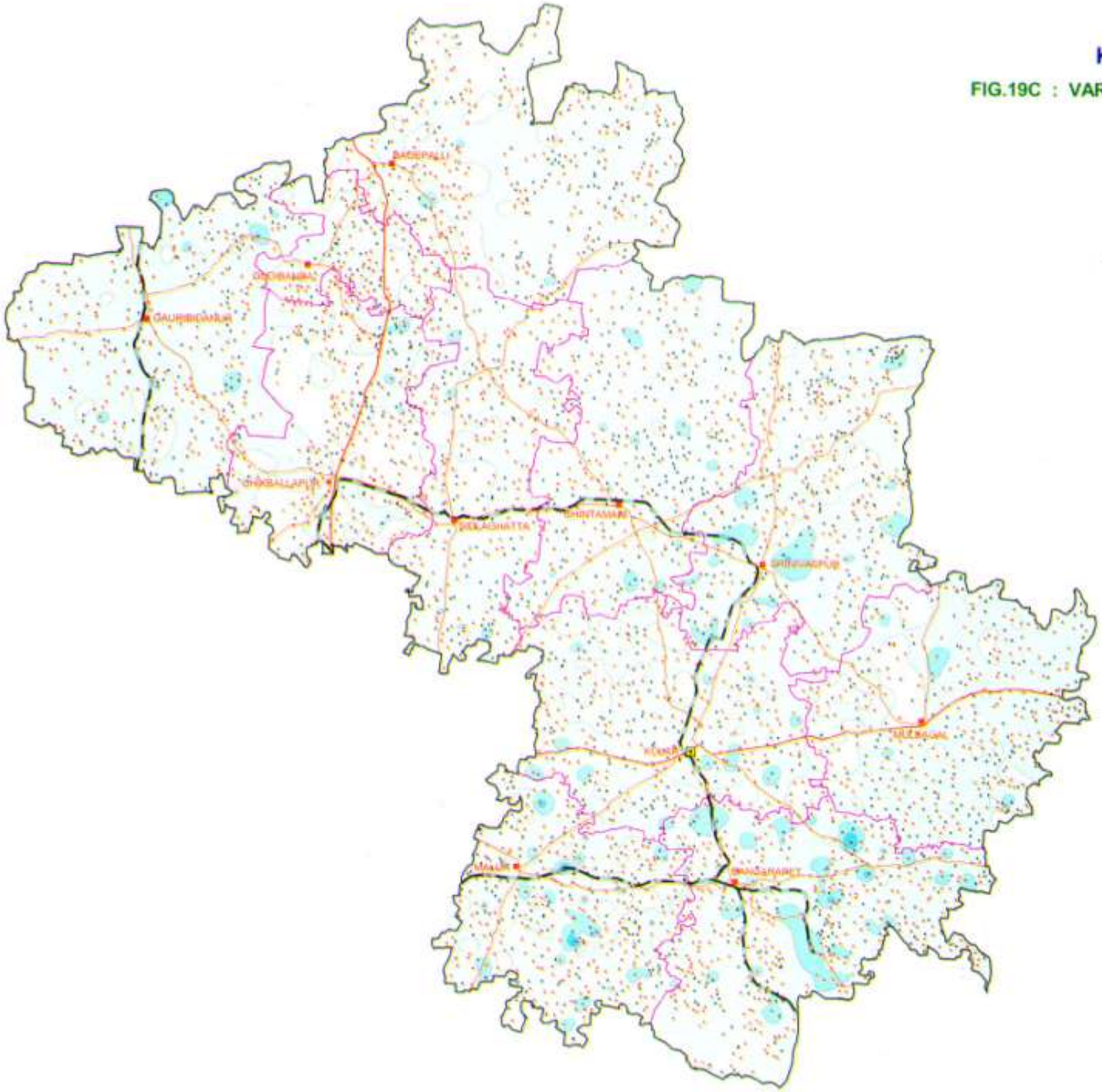
## FIG.19C : VARIATION OF TOTAL HARDNESS (TH)



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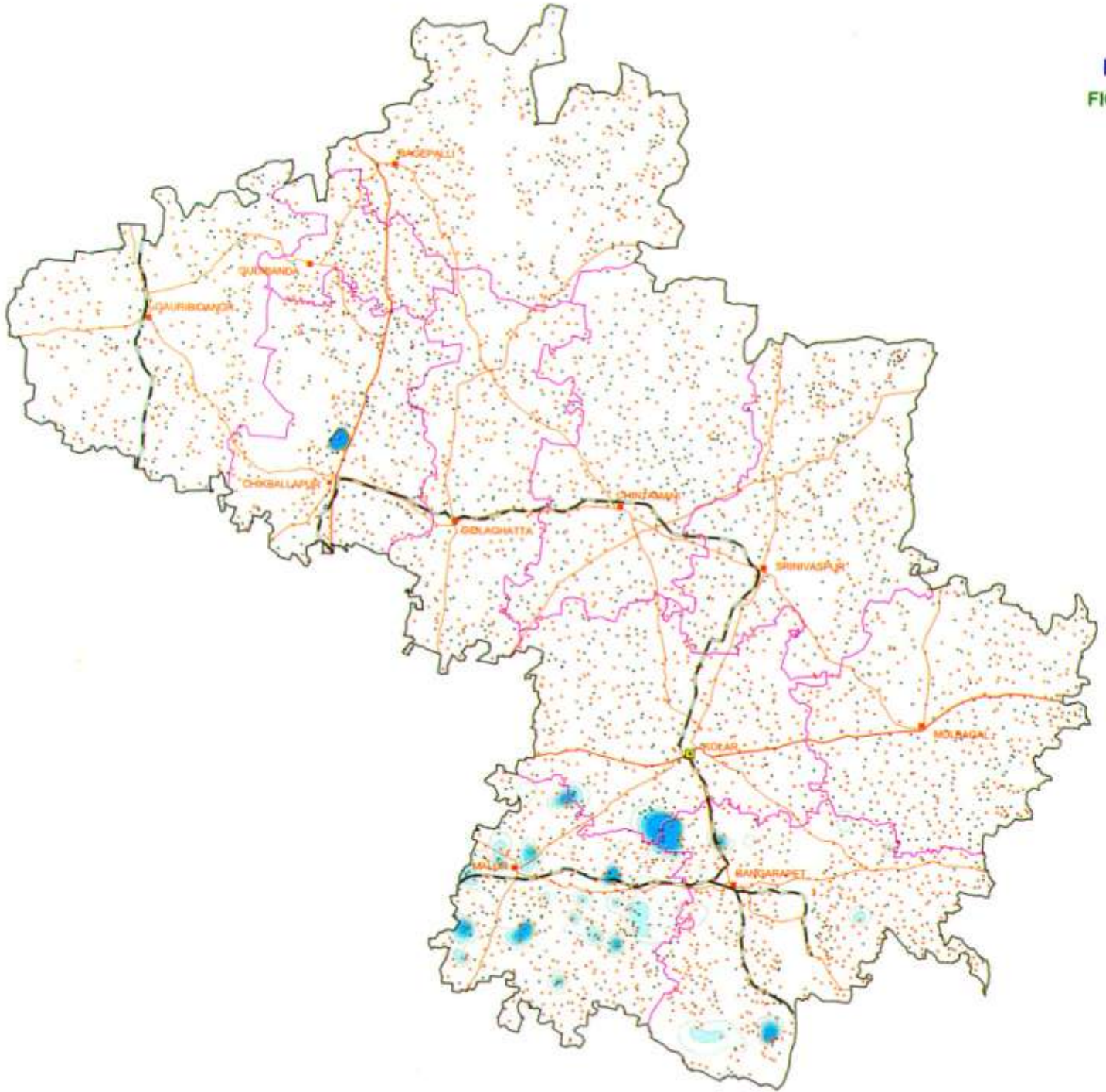
## FIG.19D : IRON VARIATION




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)**

- < 1.0
- 1.0
- 2.0
- 3.0
- 4.0
- > 5.0