

BANGALORE (U) DISTRICT

FIG.3 BANGALORE (U) DISTRICT

Sl.No.	CONTENTS	Page		
1)	Location	78	TABLE:	COMPREHENSIVE ANALYSIS OF WATER QUALITY DATA 83
2)	Demography	78		
3)	Climate, Drainage and soil	78		
4)	Geology and Groundwater occurrence	78		
5)	Groundwater quality Characterization	78		
5.1	Physical characters	79	LIST OF FIGURES	
5.2	Chemical characters	79	FIG.3A FLUORIDE VARIATION (F)	84
5.3	Spatial variation	81	FIG.3B VARIATION OF TOTAL DISSOLVED SALTS (TDS)	85
6)	Conclusion	82	FIG.3C VARIATION OF TOTAL HARDNESS (TH)	86
			FIG.3D IRON VARIATION (Fe)	87

1. Location

Bangalore (Urban) district is located in the southeastern portion of Karnataka State with geographical area of nearly 2190 sq. km. It is bounded by Bangalore (Rural) district on the southwestern, western, northern and northeastern portion and Tamil Nadu State on the southeastern side. It lies between 12° 39' to 13° 14' N Latitude and 77° 19' to 77° 51' E Longitude.

2. Demography

As per the 1991 census, Bangalore (Urban) district has a population 4,839,162. The total number of villages / habitations in the district are 1,285.

3. Climate, Drainage and Soil

The climate of the district is salubrious and very agreeable. It is free from extremes. The main features of the climate of the district are the agreeable range of temperatures and the two rainy seasons. Two other important features are the predominant low clouding and the more or less steady temperatures during the entire year. The climate of Bangalore (Urban) district is classified as the seasonally dry tropical savanna climate with temperature varying between 16° C to 35° C. The district receives an average annual rainfall of 793.6 mm and is drained by Arkavathi and Suvarnamukhi rivers. It has a major reservoir at Tippagondannahalli (TGR), which supplies water to about 25 % of Bangalore City's public. Major portion of the district is covered by red sandy soil.

4. Geology and Groundwater occurrence

Bangalore (Urban) district consists of Peninsular Gneisses covering almost 98 % of the areal extent. Small patches of porphyritic granite are also seen in Bangalore south and Bangalore north taluks. From the groundwater point of view the rocks are classified as crystalline formations. Fracture / fissure system developed along with joints 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, 3,904 groundwater samples collected from 890 villages / habitations in Bangalore (Urban) 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

About 1066 samples analysed from 584 villages / habitations have recorded higher turbidity values in these sample range of 11 to 349 JTU (permissible limit 10 JTU). They are from Anekal (279 out of 1026 samples), Bangalore north (183 out of 1238 samples) and Bangalore south (234 out of 1640 samples) taluks.

Colour

None of the sample analysed in the entire district has shown higher colour intensity and all the samples have colour intensity less than 25 HU.

Electrical Conductivity (EC)

The EC values recorded in different taluks are: Anekal 187-30844 m mhos/cm, Bangalore north 250-9860 m mhos/cm and Bangalore south 220-12040 m mhos/cm.

Hydrogen Ion Concentration (pH)

Totally 256 samples covering 137 villages have recorded pH value in the range of 5.18 - 9.93. The ranges of pH value recorded in the other taluks are: Anekal 5.51-9.93 (98 samples), Bangalore north 5.68-8.81 (53 samples) and Bangalore south 5.18-8.7 (105 samples).

5.2 Chemical Characters

Total Dissolved Salts (TDS)

Some 154 samples covering 142 villages/habitations have higher TDS content in the range of 2007-15120 ppm. The ranges of abnormal TDS content in different taluks are: Anekal 2010-15120 ppm (9 samples), Bangalore north 2010-4840 ppm (80 samples) and Bangalore south 2007-4470 ppm (65 samples). The highest value of 15120 ppm is reported from Vaddarapalya village of Anekal Taluk.

Total Hardness (TH)

Higher TH content in the range of 604-4600 ppm is recorded in 95 samples covering 67 villages/habitations. The ranges of abnormal TH content in the taluks are: Anekal 605-4600 ppm (29 samples), Bangalore north 604-1527 ppm

(54 samples) and Bangalore south 610-1023 ppm (12 samples). The highest value of 4600 ppm is reported from Vaddarapalya village of Anekal taluk.

Calcium Hardness (CaH)

A good number of samples, 632 samples collected from 325 villages have indicated higher CaH content in the range of 201-3400 ppm (permissible limit 200 ppm). The ranges in different taluks are - Anekal 205-3400 ppm (205 samples), Bangalore north 201-718 ppm (226 samples) and Bangalore south 201-805 ppm (201 samples). The highest content of 3400 ppm is reported from Vaddarapalya village of Anekal Taluk.

Chloride (Cl)

Only 20 samples covering 17 villages/habitations have higher Cl content in the range of 1009-5918 ppm. The ranges of abnormal Cl content in different taluks are - Anekal 1009-5918 ppm (13 samples), Bangalore north 1059-1469 ppm (5 samples) and Bangalore south 1019-1269 ppm (2 samples). Highest value of 5918 ppm is reported from Vaddarapalya village of Anekal Taluk.

Sulphate (SO₄)

The 14 samples collected from 8 villages/habitations have higher SO₄ content in the range of 447-1678 ppm and all are from Anekal taluk. The highest value of 1678 ppm is reported from Igluru village in Anekal taluk. Bangalore north and Bangalore south taluks have not reported abnormal SO₄ content.

Fluoride (F)

Totally 485 samples spread across 251 villages have analysed higher Fluoride content in the range of 1.51 - 7.2 ppm. The range of Fluoride concentration in different taluks are - Anekal 1.52 - 6.42 ppm (103 samples), Bangalore north 1.52 - 7.2 ppm (247 samples) and Bangalore south 1.51 - 4.62 ppm (135 samples). The maximum of 7.2 ppm is reported from Bilmaranahalli village in Bangalore north taluk.

Nitrate (NO₃)

In the entire district, none of the samples analysed have indicated higher concentration of Nitrate.

Alkalinity (Alk)

Only 51 samples covering 40 villages have reported higher Alkalinity in the range of 610-830 ppm. The range of Alkalinity in different taluks are - Anekal 610-710 ppm (11 samples), Bangalore north 610-830 ppm (13 samples) and Bangalore south 610-770 ppm (27 samples). The maximum Alkalinity of 830 ppm is reported from Pillalli village in Bangalore north taluk.

Iron (Fe)

Good number of samples, 1490 samples analysed from 651 villages / habitations have analysed the iron in excess of 1 ppm. These samples have analysed 1.01-14.82 ppm Fe. The concentration range of Fe in different taluks is - Anekal 1.01-10.15 ppm (434 samples), Bangalore north 1.01-9.78 ppm (473 samples) and Bangalore south 1.01-14.82 ppm (583 samples). The highest iron content of 14.82 ppm is recorded from Jothipur village in Bangalore south taluk.

Bacteria (*E.coli*)

Totally 1199 samples (31%) analysed from 630 villages have shown the presence of the Bacteria in the analysed water samples. The bacterial count generally varies between 1 and 900 Nos. / 100 ml of water. The range of bacterial count in different taluks are: - Anekal 1-364 Nos. / 100 ml (320 samples), Bangalore north 1-324 Nos. / 100 ml (374 samples) and Bangalore south 1-900 Nos. / 100 ml (505 samples). But, as per the drinking water specifications, the water should not contain bacteria.

5.3 Spatial Variation**Bacteria (*E.coli*)**

The map depicting bacterial incidence indicates that, bacteria is more commonly encountered in the entire district and is spread randomly. Bacterial contamination is point specific and varies considerably.

Fluoride (F)

The isoconcentration map of Fluoride indicates that (Fig.3A), Fluoride concentration of more than 1.5 ppm is seen as isolated patches covering Bangalore north taluk in the northern portion and Anekal taluk in southern portion. Fluoride content in the drinking water in general, is within the permissible limit and safe for domestic consumption.

Total Dissolved Salts (TDS)

The spatial variation map generated for TDS (Fig.3B) depicts that, its concentration is less in most part of the district. Patches of slightly higher average concentration are seen in Anekal taluk.

Total Hardness (TH)

The map showing TH variation (Fig.3C) reveals that, higher average concentration is seen only in the northern portion covering Bangalore north taluk.

Iron (Fe)

Isoconcentration map generated for Iron (Fig.3D) reveals that, higher iron concentration is seen in patches of varying dimension and sizes containing dense closed spaced contours spread throughout the district.

6. Conclusion

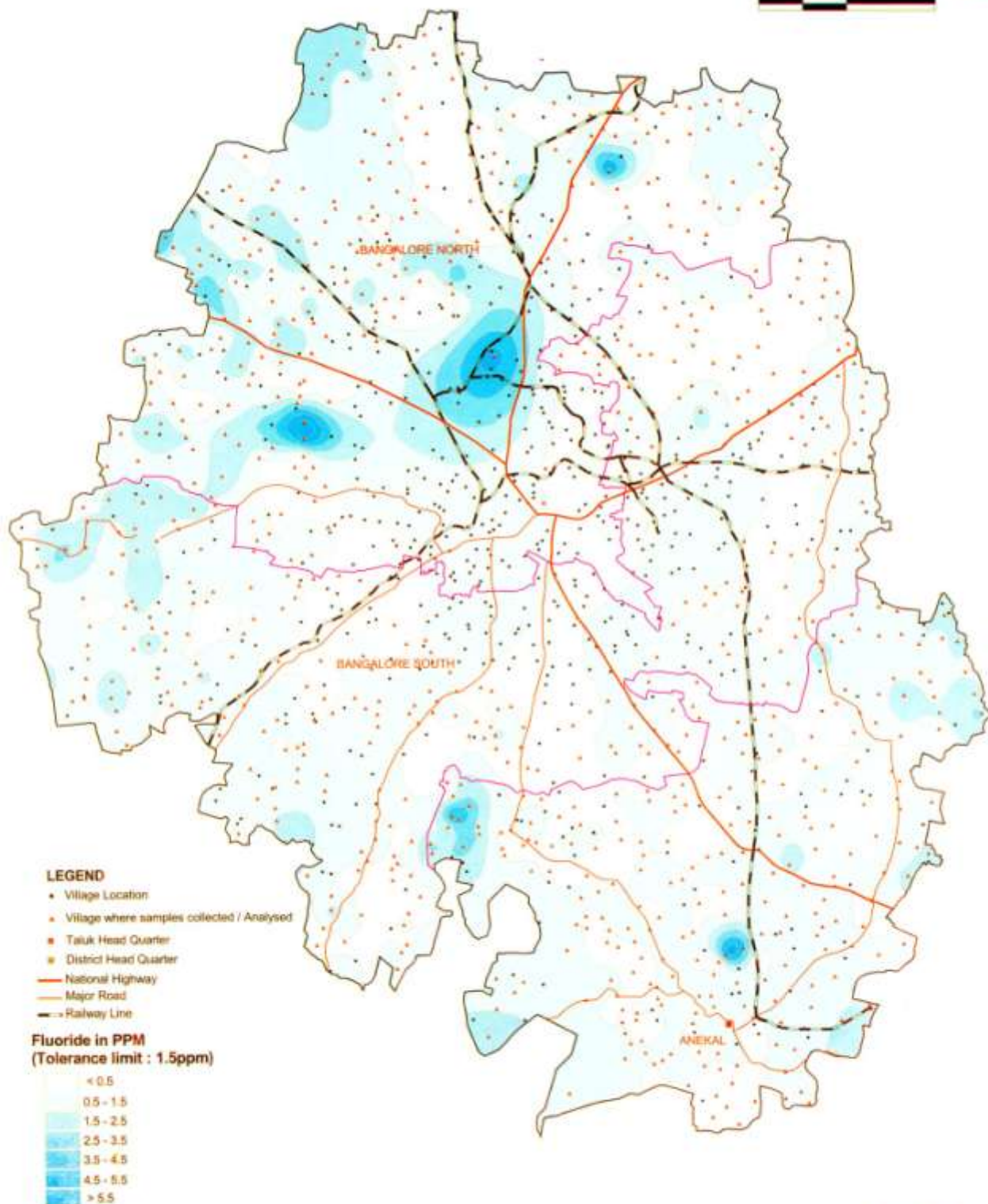
The water quality data has reflected the presence of excess Turbidity, Hardness, Fluoride, Iron and Bacteria. However, Turbidity can be reduced by simple infiltration and hardness can be reduced by some conventional methods. In case of Fluoride, utmost care has to be taken, since many samples have analyzed 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. To overcome 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 and harmful is, the presence of Bacteria viz. *E. coli* in the drinking water. The consumption of such water may cause the diseases such as Malaria, Diarrhoea etc. Probably, these 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 Bangalore (Urban) 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 - mimhos /cm	pH (6.5-8.5)	TDS (2000) ppm	TH (600) ppm	Ca/H (200) ppm	Cl (1000) ppm	SO ₄ (400) ppm	F (1.5) ppm	NO ₃ (100) ppm	Alk (600) ppm	Fe (1) ppm			
1	Anekal	305	262	1026	No. of samples beyond permissible limit No. of villages affected	320	279	-	-	98	9	29	205	13	14	103	-	11	434			
						179	167	-	-	53	58	106	11	8	63	-	-	-	-	-	10	196
						1-364	11-316	-	187-30844	5.51-9.53	2010-15120	605-4600	205-3400	1009-5918	447-1678	1.52-6.42	-	610-710	1.01-10.15	-	-	-
2	Bangalore north	485	284	1238	No. of samples beyond permissible limit No. of villages affected	374	331	-	-	53	80	54	226	5	-	247	-	13	473			
						197	183	-	-	34	45	33	108	4	-	112	-	-	-	-	10	215
						1-324	11-349	-	250-9860	5.68-8.81	2010-4840	604-1527	201-718	1059-1469	-	1.52-7.2	-	610-830	1.01-9.78	-	-	-
3	Bangalore south	518	344	1640	No. of samples beyond permissible limit No. of villages affected	505	456	-	-	105	65	12	201	2	-	135	-	27	583			
						254	234	-	-	50	39	11	111	2	-	76	-	-	-	-	20	240
						1-900	11-205	-	220-12040	5.18-8.7	2007-4470	610-1023	201-805	1019-1269	-	1.51-4.62	-	610-770	1.01-14.82	-	-	-
Total	1368	890	3604	No. of samples beyond permissible limit No. of villages affected	1199	1066	-	-	256	154	95	632	20	14	485	-	51	1490				
					630	584	-	-	137	142	67	325	17	8	251	-	-	-	-	40	651	
					1-900	11-349	-	187-30844	5.18-9.93	2007-15120	604-4600	201-3400	1009-5918	447-1678	1.51-7.2	-	610-830	1.01-14.82	-	-	-	-

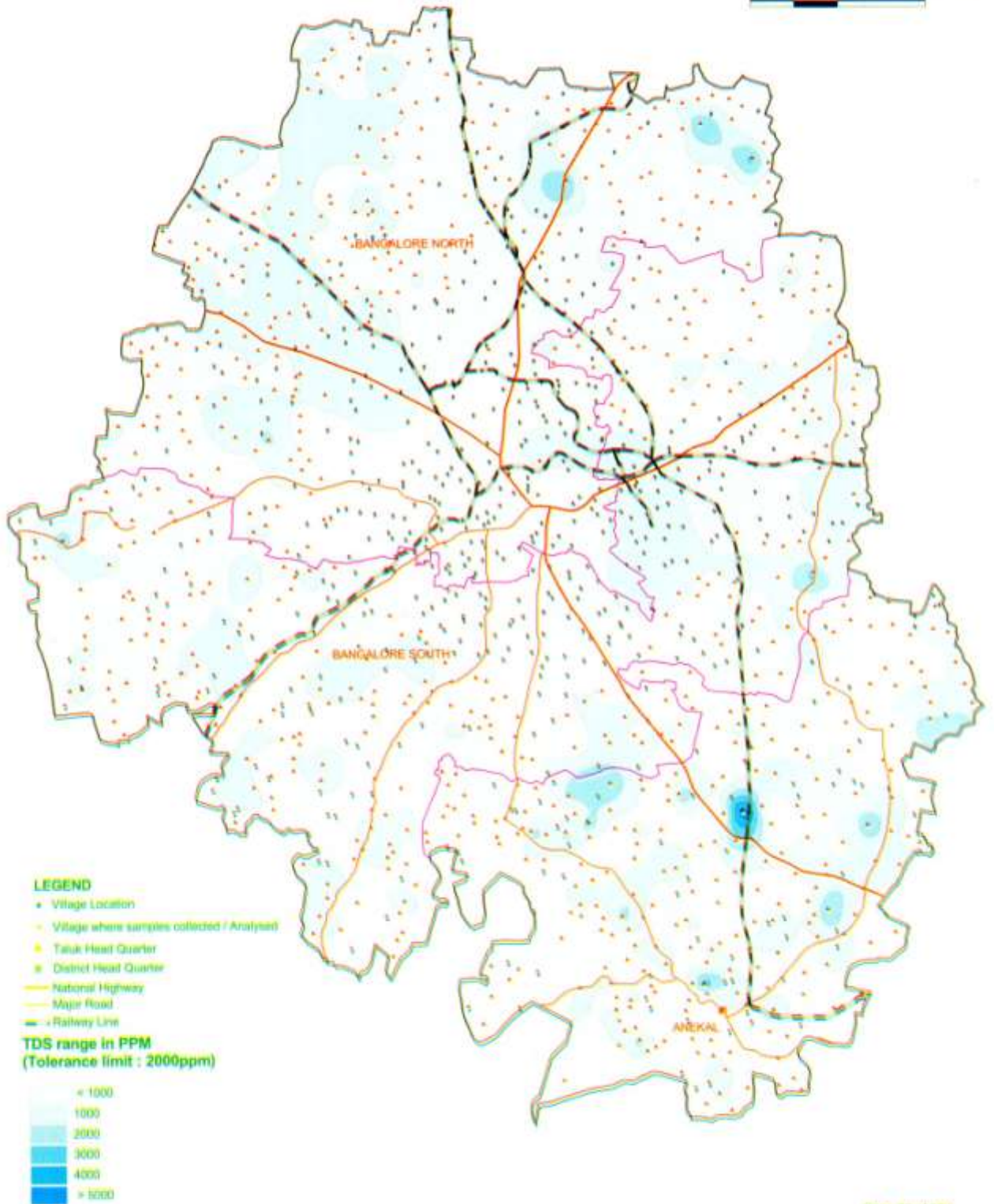
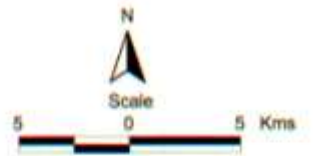
BANGALORE URBAN DISTRICT

FIG.3A : FLUORIDE VARIATION



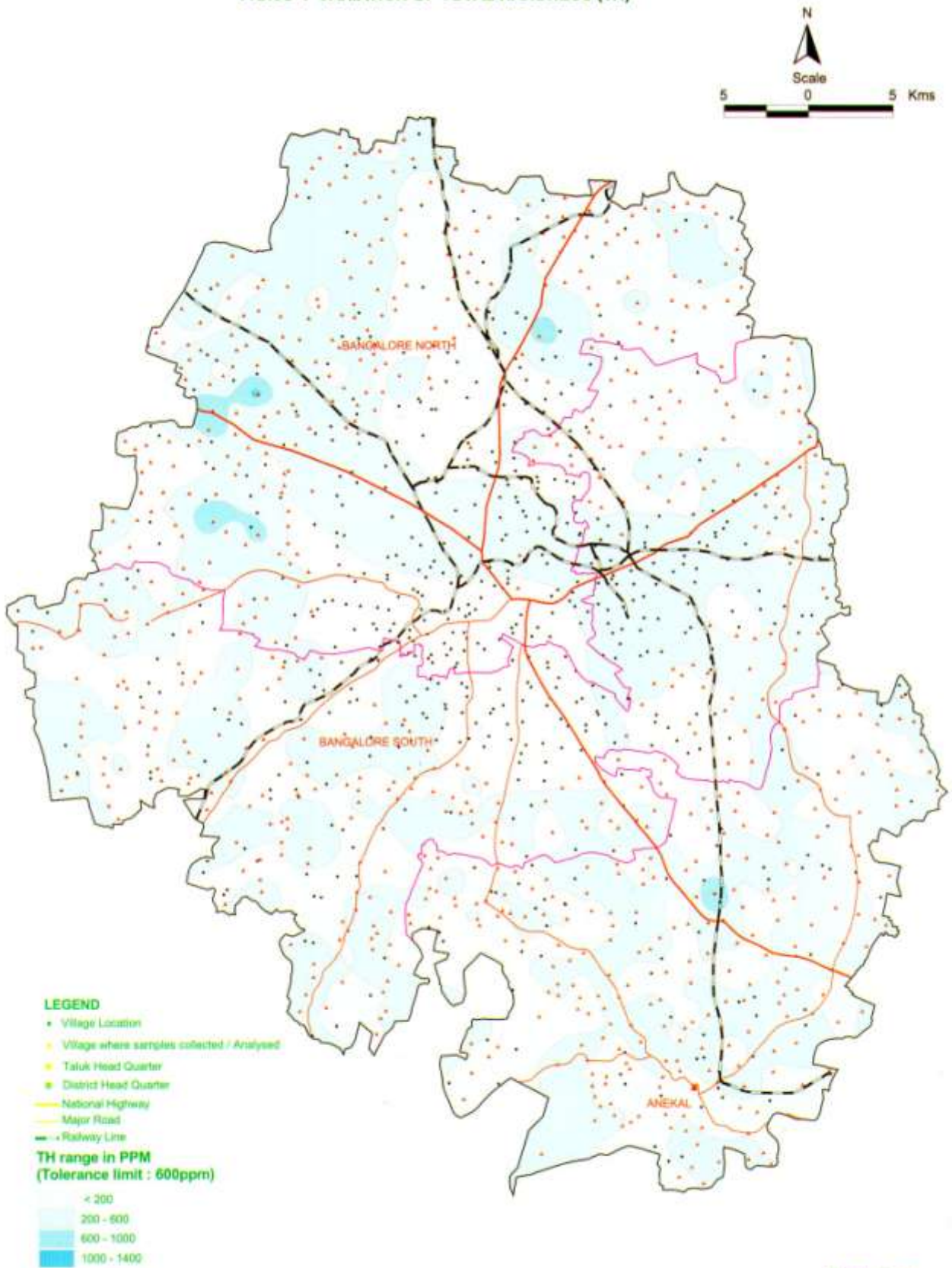
BANGALORE URBAN DISTRICT

FIG.3B : VARIATION OF TOTAL DISSOLVED SALTS (TDS)



BANGALORE URBAN DISTRICT

FIG.3C : VARIATION OF TOTAL HARDNESS (TH)



BANGALORE URBAN DISTRICT

FIG.3D : IRON VARIATION

