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GROUND WATER QUALITY ANALYSIS AND MAPPING FOR RAICHUR CITY USING GIS

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Abstract

This paper aims to assess the ground water quality and map the same using Geographical Information System (GIS) of Raichur City, Karnataka. The primary data sources for the study include the toposheet of Raichur viz., which ware used to base map for the study. Water bodies and road network were prepared based on the survey of India map by digitization. The digitization and analysis of the thematic maps were performed within the framework of the well-known Desktop GIS software; Arc GIS Desktop 9.2 used. Identification of 2 to 3 sample location points for ward wise water quality analysis field test of samples were carried out for the identified sampling points using field kit (pH, total hardness, calcium hardness, total alkalinity, chloride, fluoride and iron content testing field kits). Field data collected from all 35 wards were incorporated in the prepared format. Identified 73 sample location points were created in the ArcMap collected field data of sampling location points from all the 35 wards were added as attribute data to the identified sampling location points. After adding all the data, GIS analysis were carried out.

Keywords: Ground Water, GIS, Water quality Analysis

INTRODUCTION

Water is the elixir of life (Vidvan Vishvam, 2003) and plays a vital role in the earth's ecosystem. It is one of the most critical, scarce, precious and replenishable natural resource which cannot be created (Prasad, 2008). The utilizable water resources of India are estimated to be 1123 BCM, out of which, 690 BCM are surface water resources and 433 BCM occur as ground water resources (Kumar, 2009). Groundwater serves as the main sources of water in the urban environment, which is used for drinking, industrial and domestic purposes and often, it is over exploited. Rapid industrialization, improper solid and toxic waste management practices in urban areas often lead to the degradation of groundwater, which then turns un-potable for future use. Ground water pollution not only affects the water quality but also threats human health, economic development and social prosperity (Milovanovic,2007). The quality of water generally is defined in terms of its physical, chemical and biological parameters (Ketata Mouna, et al., 2011) and measured as Water Quality Index (WQI) to assess whether water is potable or not. WQI provides a single number that expresses overall water quality at certain location, based on several water quality parameters (Yogendra and Puttaiah, 2008). Hence, for any city, a groundwater quality map becomes a valuable parameter for evaluating potability and also as a precautionary indication of potential environmental health problems (Challerjee, et al., 2009). GIS and remote sensing has been used extensively to assess the water quality all over the world (Shomar et al., 2010; Asadi et al., 2007; Ketata Mouna et al.,2011; Mitra, 1998; Liou sm et al., 2004). The Advancement of Geographical Information System (GIS) and Spatial Analysis help to integrate the laboratory analysis data with the geographic data and to model the spatial distributions of water quality parameters,most robustly and accurately. With the development of GIS and Remote Sensing it helps the decision makers for proper

understanding the problems by visually and the data inputs provided from the field, different parameters can be set for analyzing the problems. The objective of the study is to assess and map the groundwater quality of Raichur all 35 wards.

STUDY AREA

Raichur is located at a distance of 412 kms from Karnataka state capital, Bangalore.The town is the district headquarters of the Raichur district. The city municipal council Jurisdiction extends up to an area of 60 sq.kms, housing 2,32,456 populace with 35 wards. It is One of important educational, administrative and trade center in the state. Raichur is located between two rivers Tungabhadra and Krishna, which flow at a distance of 20 and 30 kms from the town. The town has the most prestigious and profit making power generation unit, viz, Raichur thermal power station with 8 units each 210 MW capacity. The agriculture development around the town is extensive due to the presence of the Tungabhadra canal and proposed upper Krishna project. In addition, this, many small-scale industries are exist in and around the town. Raichur district is situated in north-eastern part of Karnataka state. It falls in the northern median region, between 15º 12' North latitudes and 77º 21' East longitudes. The altitude of the place is 400m above the MSL.

METHODOLOGY

Data Collection

Several maps and other information need to be studied to collect data within the search radius. Some are discussed below.

(a) Topographic Maps: The topography of the area indicates low and high area, natural surface water drainage pattern, streams, and rivers. A topographic map will help find sites that are not on natural surface water drains or flood plains. Topographical maps may be procured from Survey of India toposheet no rec_56h08.img.

(b) Boundary Maps: Boundary maps are collected from town planning office of Raichur, Which indicate the boundary of Raichur region also indicates village boundary.

(c) Ward Maps: ward maps are collected from city municipal council office Raichur, which indicates the all wards boundary of Raichur region.

Data preparation

ArcGIS suite applications i.e. ArcCatalog and ArcMap were used . ArcCatalog was used for viewing the metadata, for creating new shape files and managing the special data assets. ArcMap was used for the editing purpose. It is meant for the design and interaction by viewing, editing or analysing the geographical data in a visual context. The process carried out for extraction of various features from Toposheet can be explained in fallowing steps.

Digital thematic maps were generated by employing the following procedures:

- Scanning of the available primary paper maps.
- Geo referencing the scanned maps to earth coordinates. On screen digitizing of the primary maps. Thereby generating the digital thematic maps.
- Addition of the attribute data to the locations.

The list of factors

- Water bodies map
- Drainages
- State highways and other roads
- Canals
- Railway tracks
- Unmetalled roads
- Ward wise maps

RAICHUR CITY TOPOSHEET

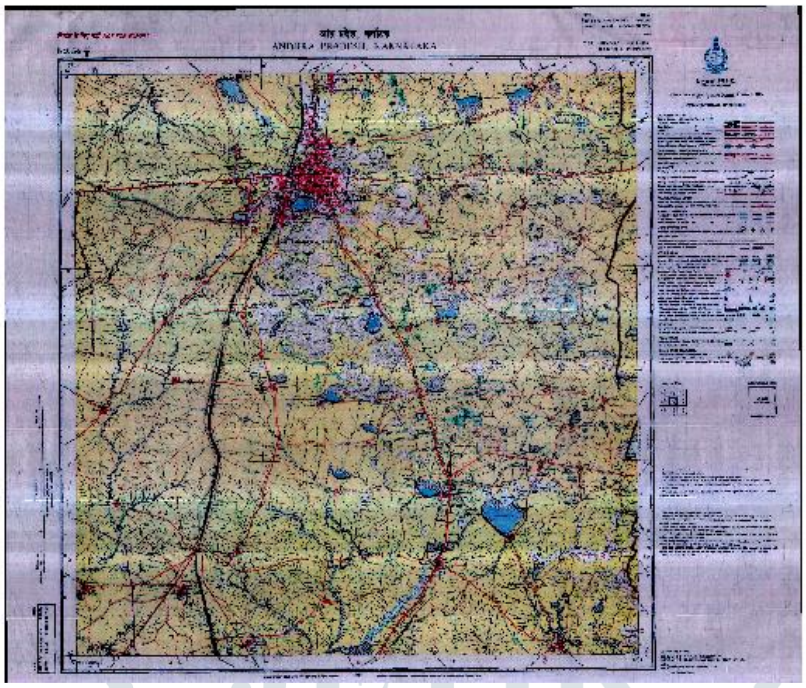

Fig.1 Raichur Toposheet

Water bodies map

Water bodies map indicating the ponds, lakes and river located in the Raichur region was prepared through digitization of survey of india toposheet map (rec_56h08.img).The region is also drained by one river, namely Krishna river.

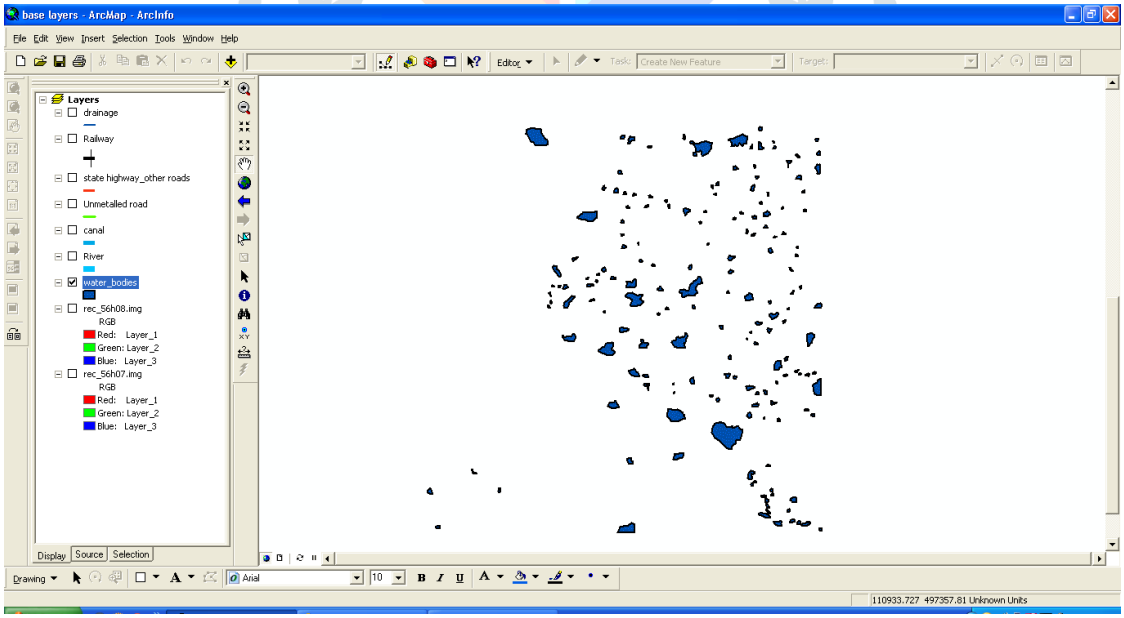

Fig.2 Water bodies map

Drainages map

Drainages is located at the Raichur city region was prepared through digitization of the survey of India toposheet map (rec_56h08.img).

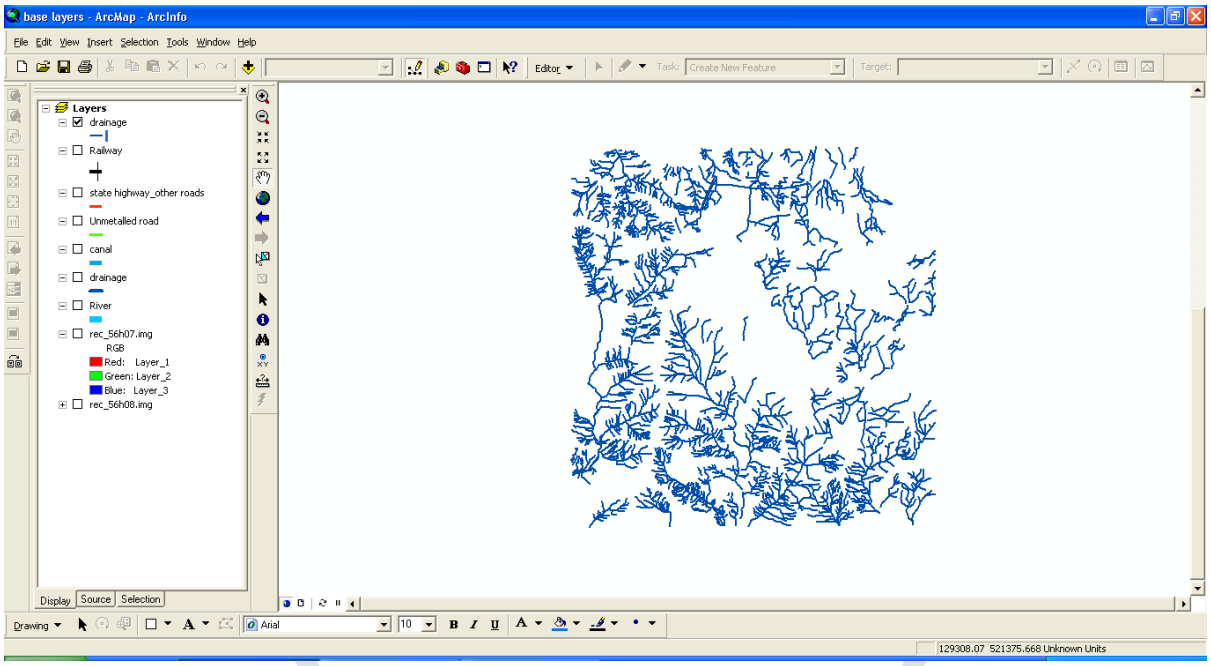

Fig.3 Drainages map

State Highways and other roads map

The road network map delineating the state highway and other major roads in the Raichur region was prepared. There are one NH 23 highway in the Raichur region. it is the basic map of the study and helps in generating many thematic maps required for overlay analysis.

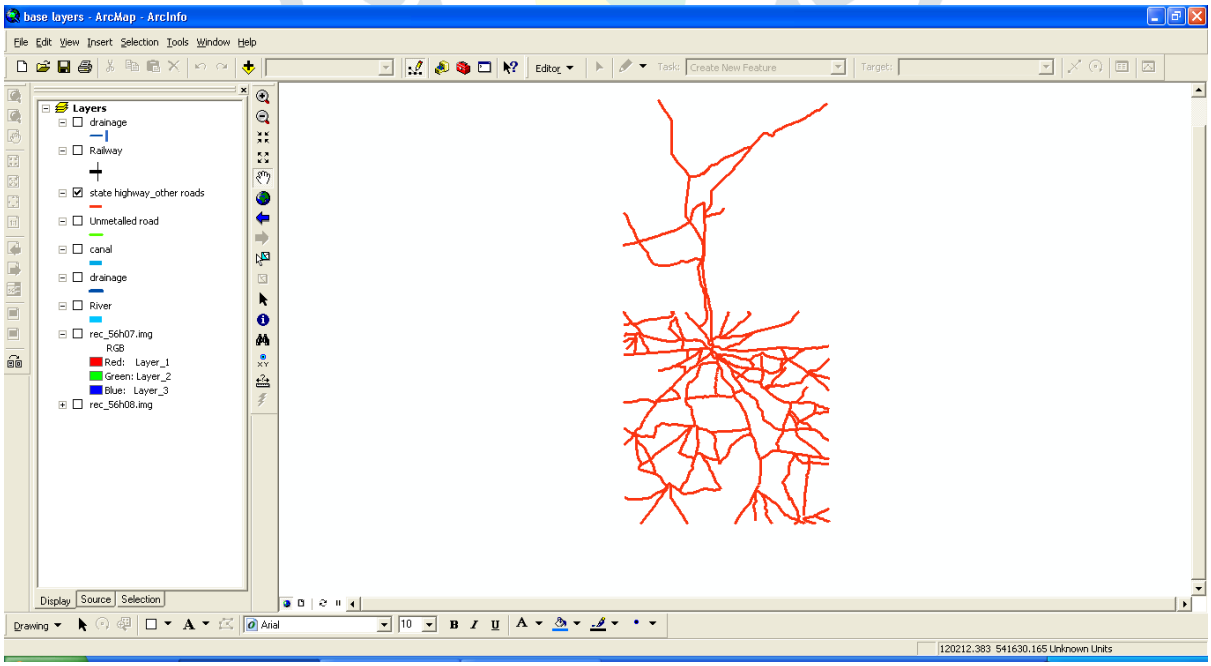

Fig.4 State Highways and other roads map

Canal map

Canal is located at the Raichur city regions was prepared through digitization of the survey of India toposheet (rec_5608.img).

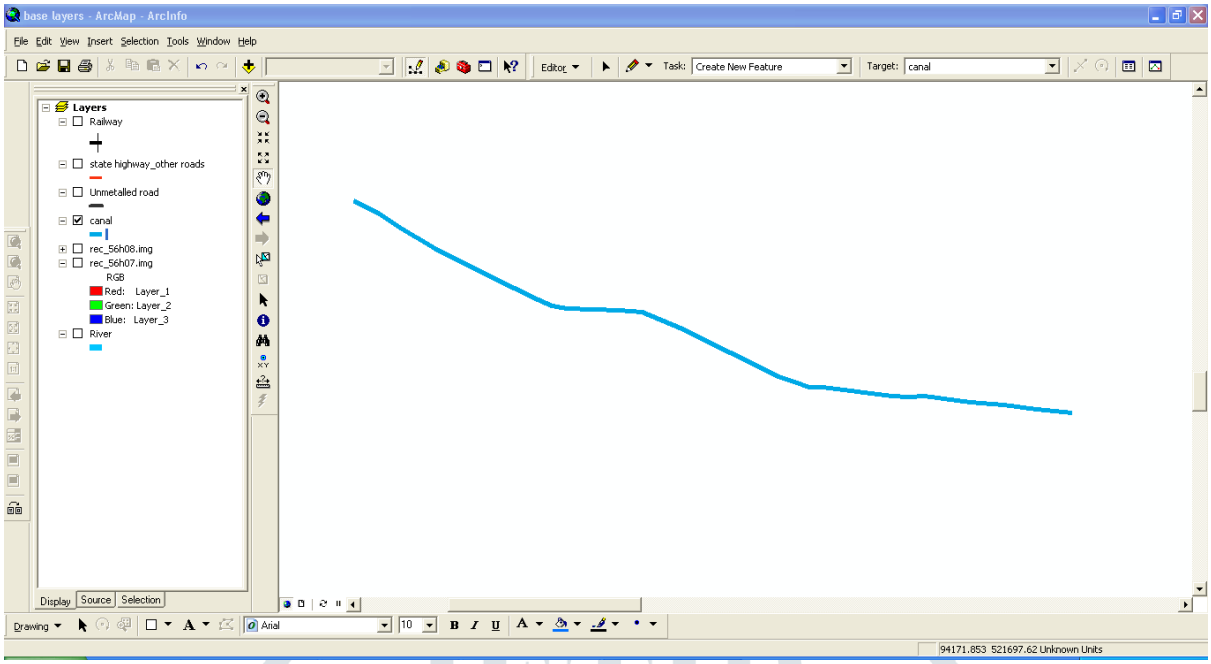

Fig.5 Canal map

Railways track map

Railway track is located at the Raichur city regions was prepared through digitization of the survey of India Toposheet (rec_5608.img)

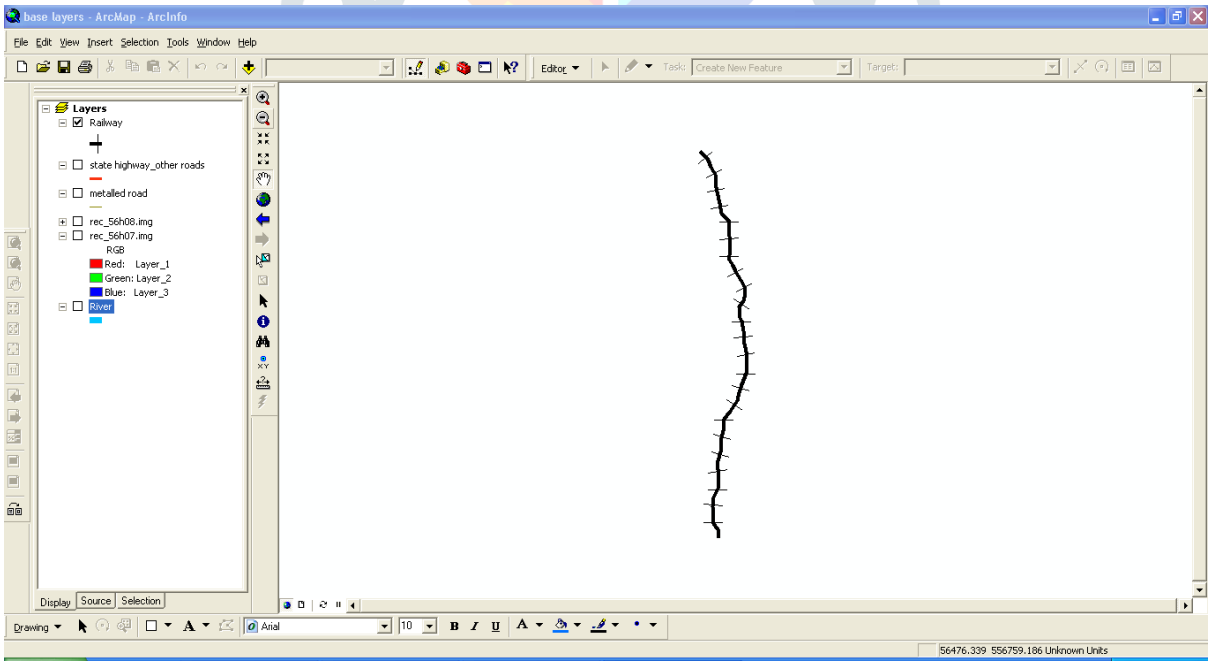

Fig.6 Railways track map

Unmetalled roads map

Unmetalled Roads is located at the Raichur city regions was prepared through digitization of the survey of India Toposheet (rec_5608.img)

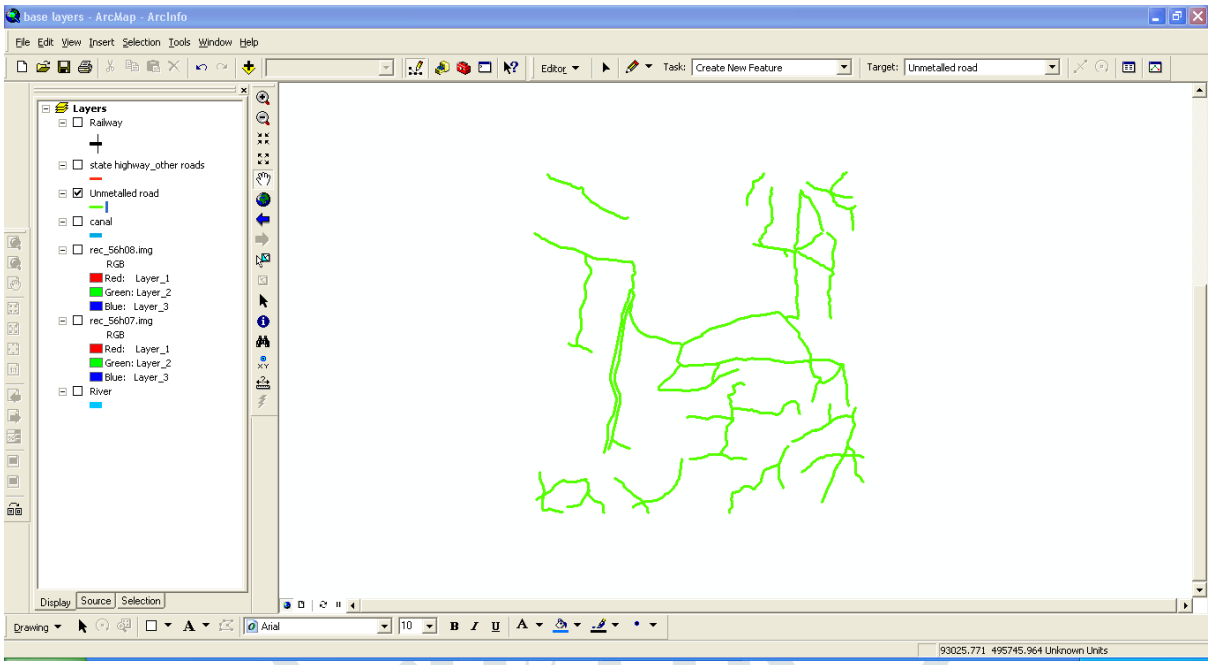

Fig.7 Unmetalled roads map

Raichur ward wise boundary

Ward wise maps is located at the Raichur city regions was prepared through digitization of the survey of India

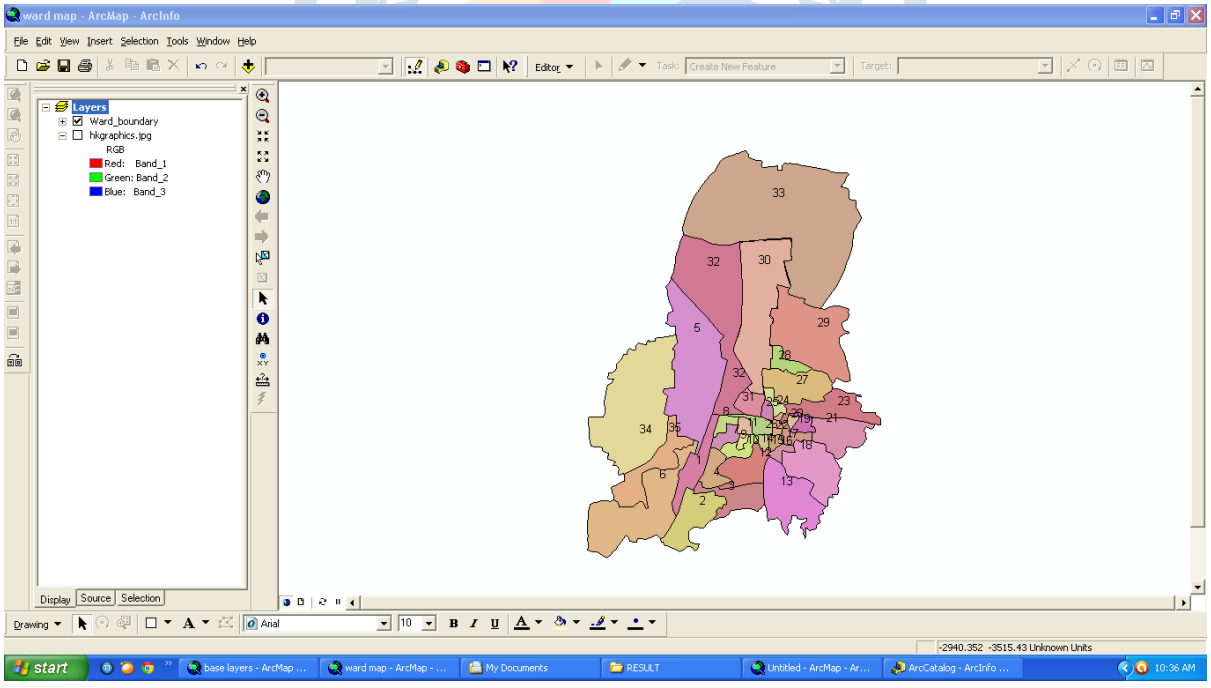

Fig.8 Raichur ward wise boundary map

Results and Discussion

Thematic maps preparation and GIS analysis.

The primary data sources for the study include the toposheet of raichur viz., which ware used to base map for the study. Water bodies and road network were prepared based on the survey of India map by digitization. The digitization and analysis of the thematic maps were performed within the framework of the well known Desktop GIS software; Arc GIS Desktop 9.2 used

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ward no	Ward name	Sample point	latitude	longitude	pH	T H	C. H	Total alkalinity	Chloride	Fluoride	Iron

Table.1 Field data

Identified 73 sample location points were created in the ArcMap collected field data of sampling location points from all the 35 wards were added as attribute data to the identified sampling location points. After adding all the data, analysis for the following parameters were carried out.

pH
Total hardness
Calcium hardness
Total alkalinity
Chloride
Fluoride
Iron content

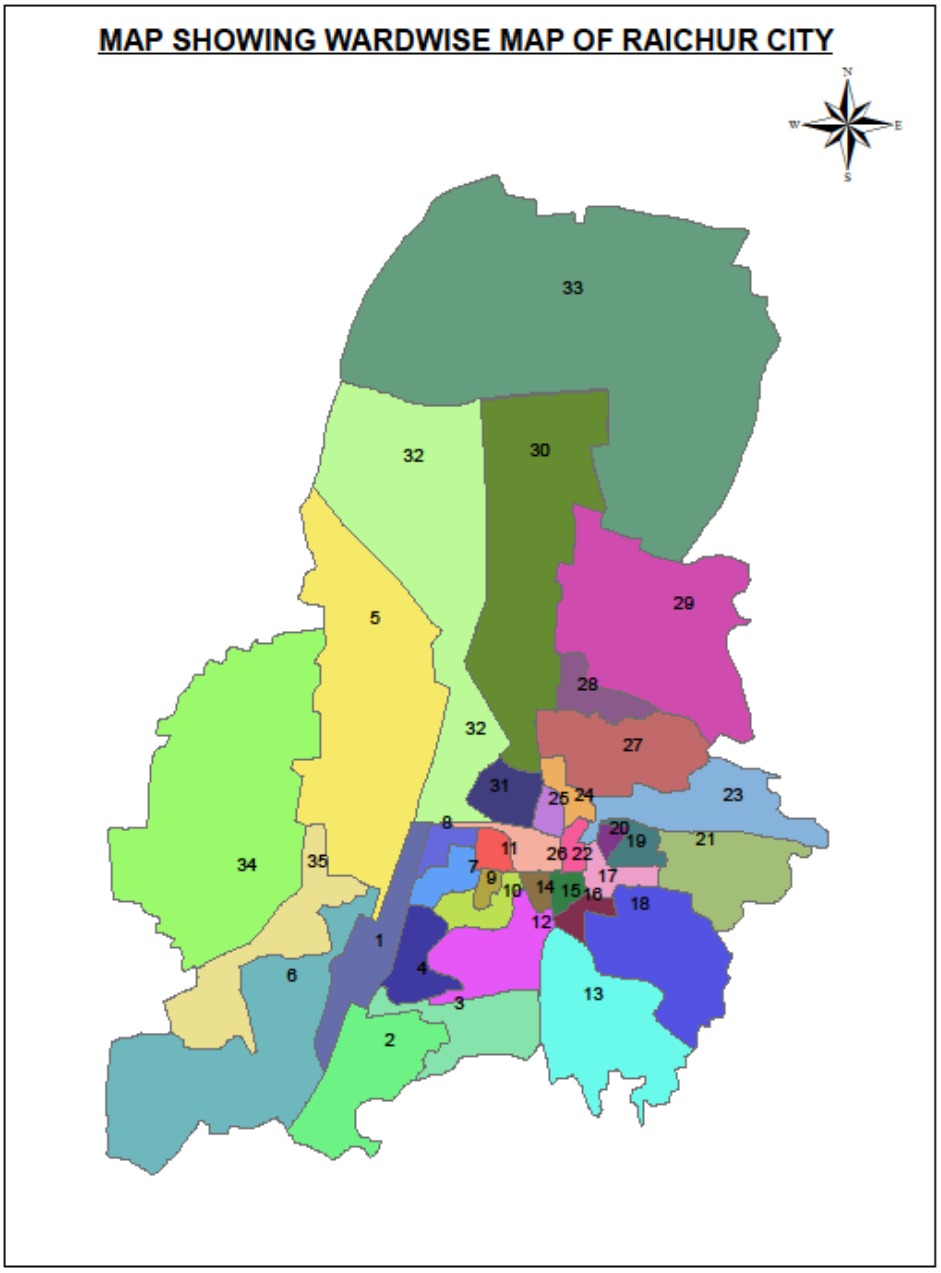

Fig.9 Raichur ward wise Map

Map showing bore well point positions

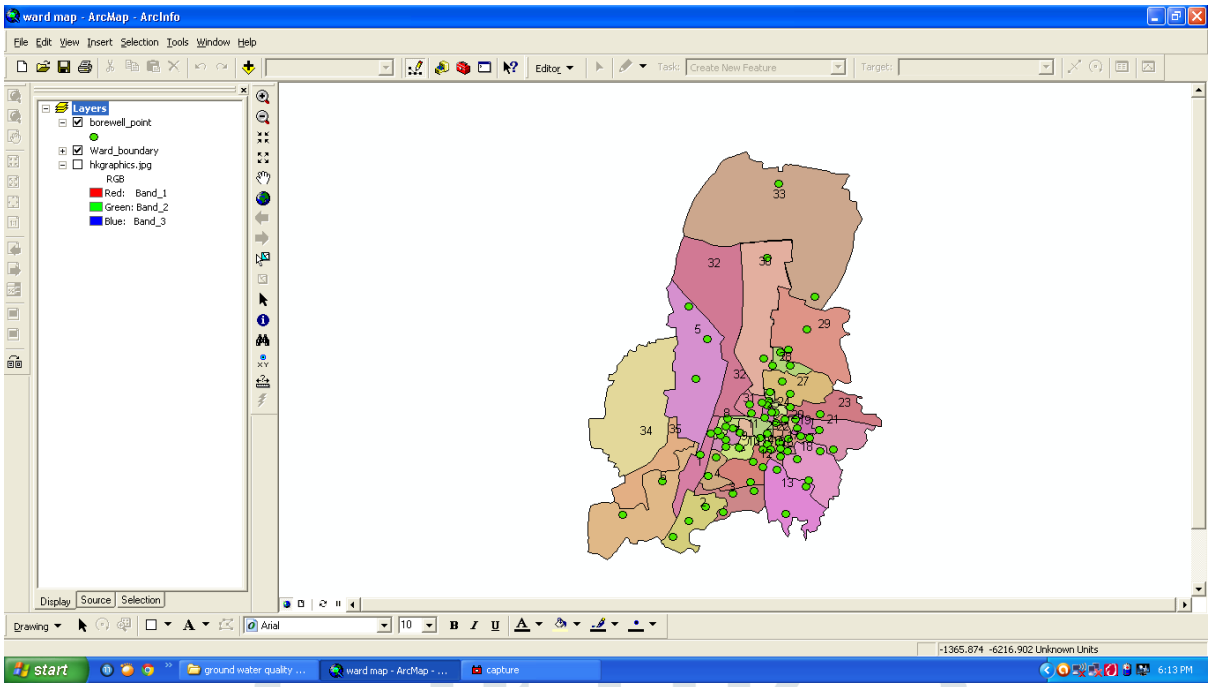

Fig.10 Map showing bore well point positions

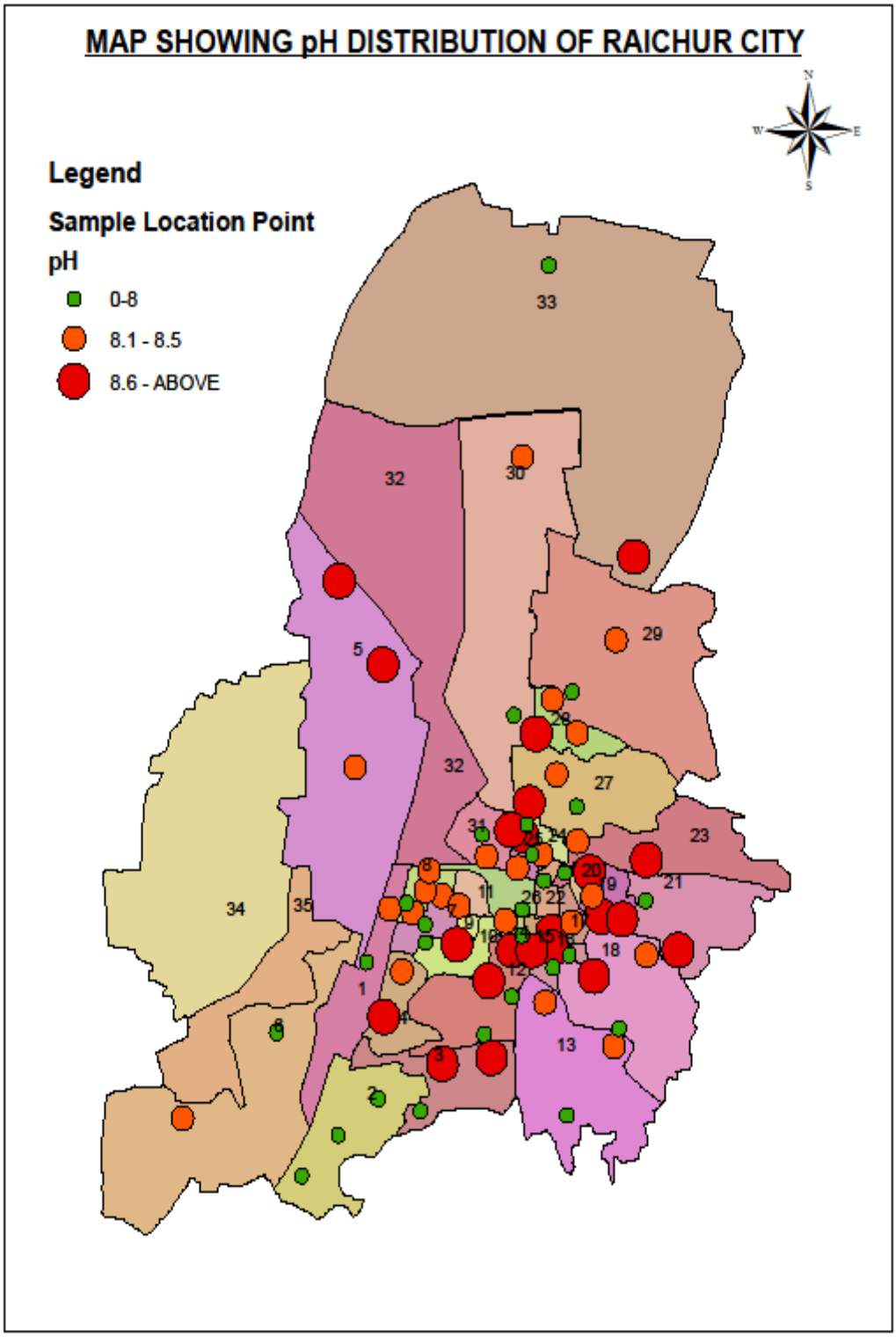

Fig.11 Map showing PH distribution of Raichur City

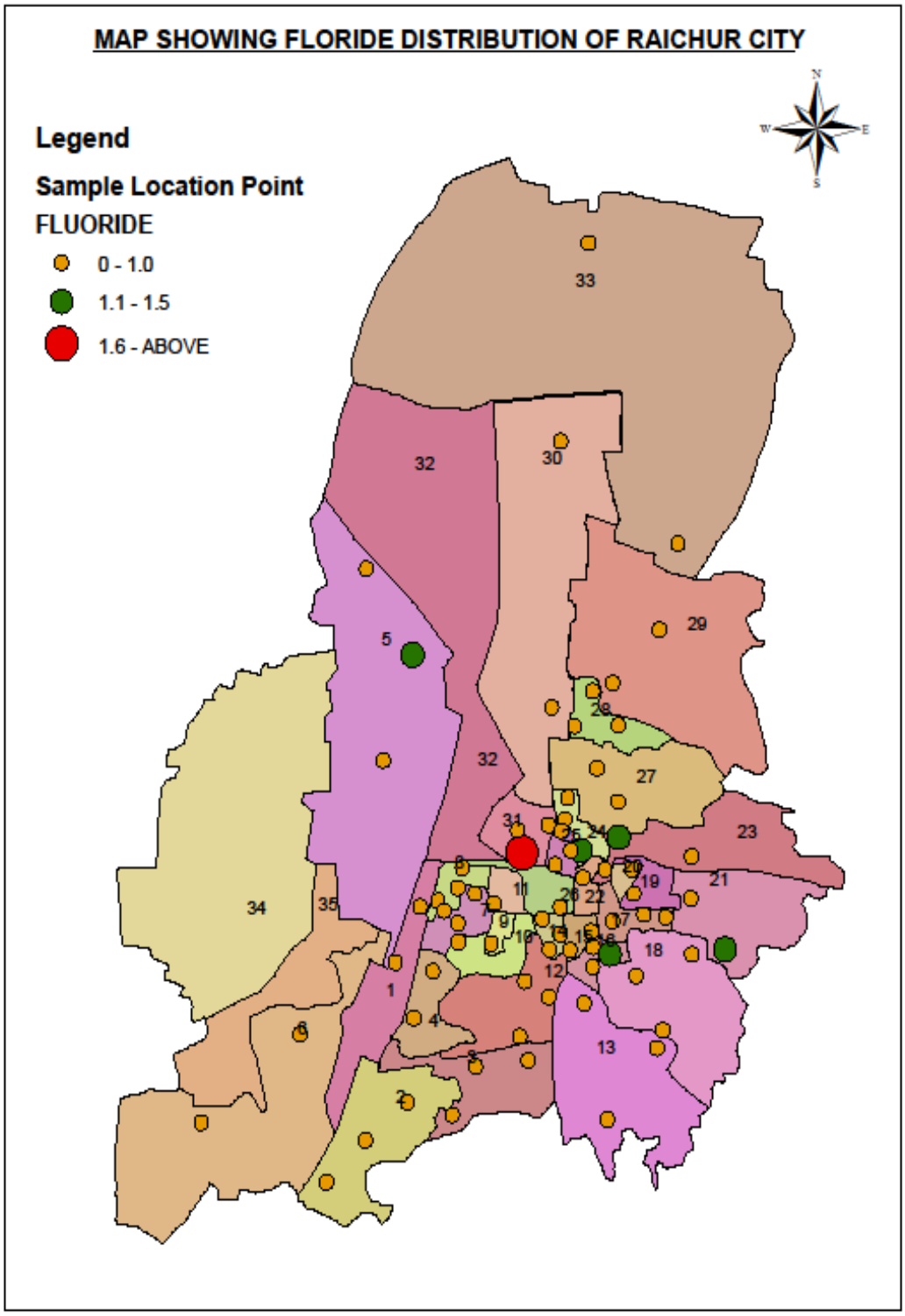

Fig.12 Map showing Floride distribution of Raichur City

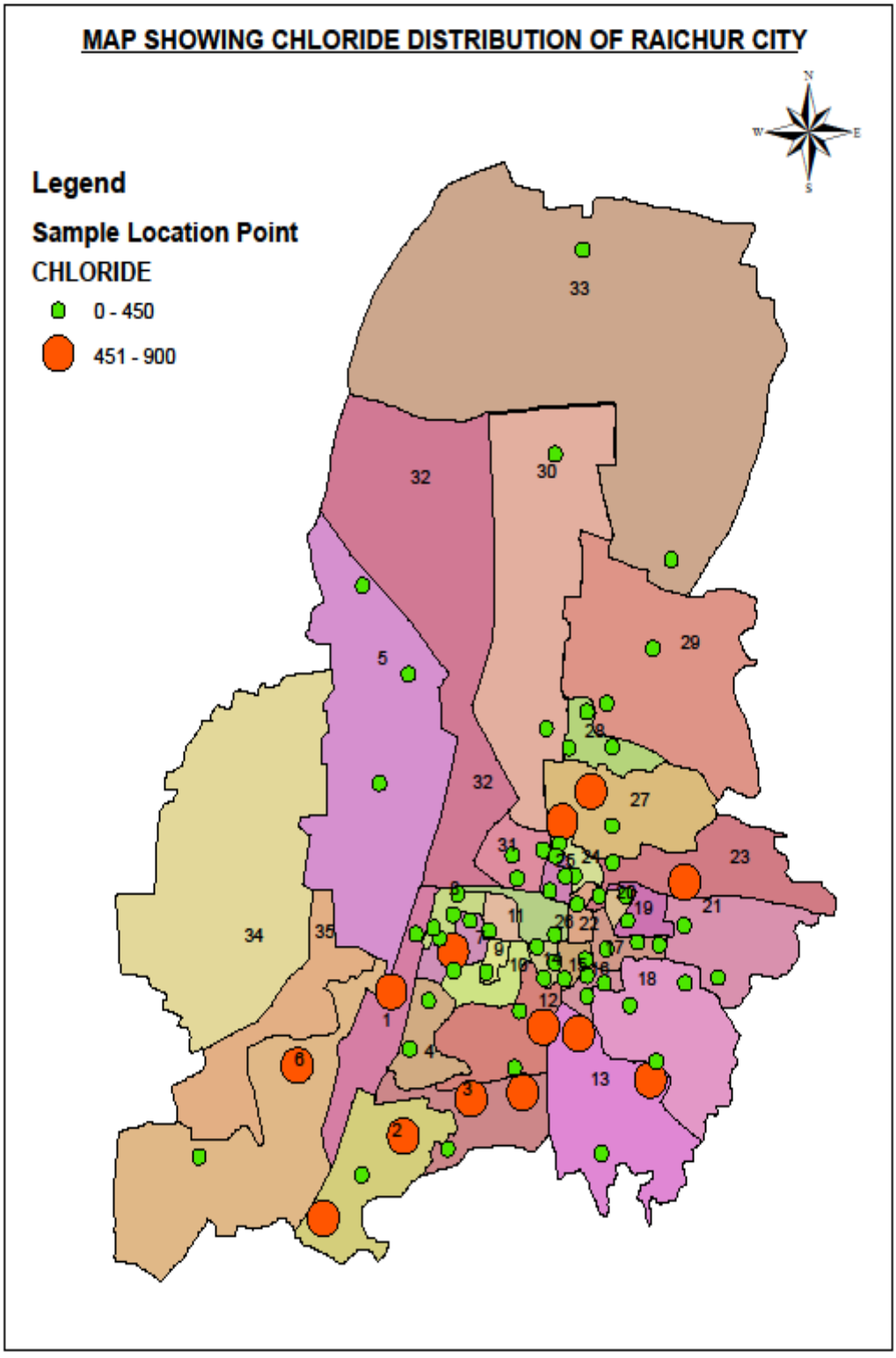

Fig.13 Map showing Chloride distribution of Raichur City

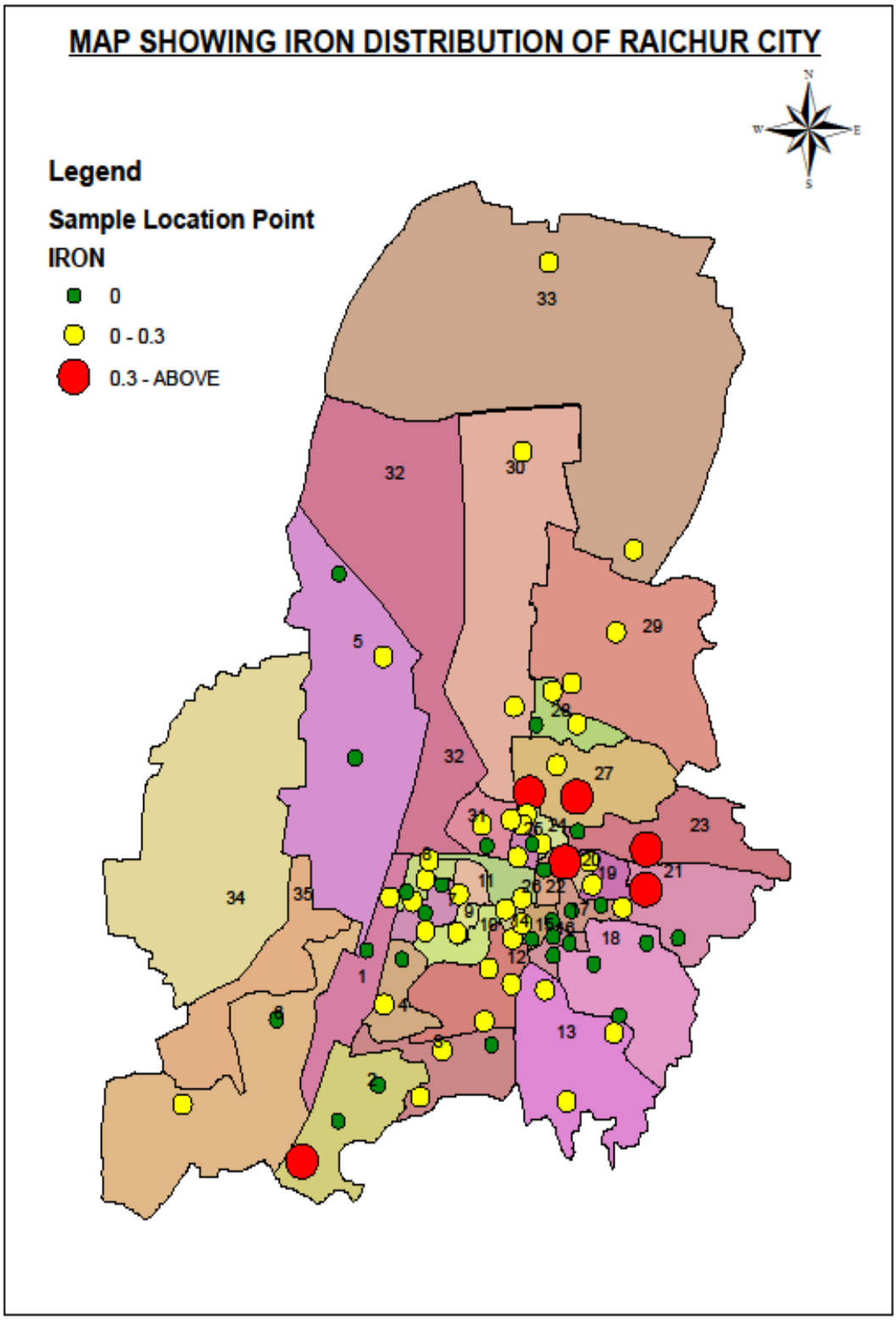

Fig.14 Map showing Iron distribution of Raichur City

Field Kit for Testing Water Quality

Conclusion

The analysis reveals that the majority of the area is having pH concentration more than 8.5 mg/l, in the wards no: 3, 4, 5, 9, 10, 20, 21, 22, 23, 27, 28, 30, and 33. While the maximum permissible limit being 6.5 to 8.5 mg/l. And the total hardness concentration exceeds the permissible limit of 600 mg/l in the wards no: 1, 6, 12, 29, and 31. The calcium hardness concentration is almost within the permissible limit of 200 mg/l but except the ward no 12. The fluoride concentration is also within the range of permissible limit of 1.5 mg/l throughout the study area except ward no 31. Total alkalinity and Chloride concentration is within the permissible limit.

The iron concentration is exceeding the permissible limit of 0.3 to 1.0 mg/l in the wards no: 20, 21, 23, and 27.

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