Investigation of Physico-Chemical Characteristics of Bennethora River and Mapping using GIS Application

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Abstract

BENNETHORA is a major irrigation project at Heroor.K village designed to irrigate 20,234 hectares of land in drought –prone Chittapur and Sedam taluk of Kalaburagi district. The study area of BENNETHORA reservoir is located at 28km away from Kalaburagi city. BENNETHORA River (Krishna Basin) this reservoir spreads over area of 45sq.miles. The sampling points were collected from the reservoir and mappings were carried out using GIS application. GIS software provides the functions and needed to store, analyze and display geographic information. GIS softwares in use tools are ARC/ AutoCAD Map etc. The water samples were collected and brought to laboratory for further analysis and analyzed for physico-chemical parameters such as pH, Turbidity, Fluoride, Chloride and Hardness.

Keywords: Arc AutoCAD, Bennethora, GIS, NTU, River surface water

I. INTRODUCTION

Water is a common chemical substance that is essential for the survival of all known forms of life. The major proportion of all water quality degradation worldwide is due to anthropogenic causes [1].Water resources are the main areas which are very closely associated with the daily life of masses. Impact of the science and technology has made our water resources polluted. The municipal and industrial wastewater discharge constitutes the constant polluting source, on the concentration of pollutants in river water. So there is a need to develop a systematic program to clean the above set pollution present almost in every river water. It is imperative to prevent and control the rivers pollution and to have reliable information on the quality of water for effective management. The world is facing the challenge of purification of water and air resources. In spite of many uses the organic compounds are toxic in nature and environmental contamination by these toxic chemicals is emerging as a serious global problem. Water is essential elements for all living being is invariably polluted in all countries. India is no exception to this phenomenon [2]. Rivers are the life line of the country. When they are affected, the consequences are detrimental to humanity at large. A Geographic Information System (GIS) is an integrated set of hardware and software tools used for the manipulation and management of spatial (geographic) and related attribute data to digitally represent and analyze the geographic features present on the earth's surface and the events taking place on it. GIS technology integrates common database operations such as query and statistical analysis with the unique visualization and geographic analysis benefits offered by maps. These abilities distinguish GIS from other information systems and make it valuable to a wide range of public and private enterprises for explaining events, predicting outcomes, and planning strategies. A Geographic Information System is a computer-based system, which is used to digitally reproduce and analyze the feature present on the earth's surface and the events that take place on it. In the light of the fact that almost 70% of the data has geographical reference as its denominator, it becomes imperative to underline the importance of a system which can represent the given data geographically.

II. LITERATURE REVIEW

A. *Water quality analysis of Bhadravathi taluk using GIS – A case study:*

This paper presents a case study on the water quality analysis carried out at the Bhadravathi Taluk, Karnataka, India. Twelve physico-chemical parameters were considered in the analysis. The surface and ground water quality analysis of the Bhadravathi taluk during the year 2010-11 is presented in the paper. The IDW maps showing the spatial distribution of various physico-chemical parameters are developed using GIS facilitated in identifying the potential zones of drinking water quality. Water Quality Index (WQI) shows a wide variation among all the water samples. For example: the water sample at New Bridge site has very high WQI during both the seasons making it unfit for usage. This necessitates the undertaking of certain measures in this area to improve the water quality. WQI is also very high at Haladamma Temple, which is above 100 indicating its non-pot ability. Therefore, it necessitates proper waste disposal technique and fertilizer usage [3].

B. *Assessment of Water Quality of Bennethora River in Karnataka through Multivariate Analysis:*

The evaluation of river water quality is a critical element in the assessment of water resources. The objective was to identify physico-chemical parameters that are less important in assessing annual variations of river water quality. Eight physico-chemical parameters were used for monitoring river water quality from June (2005) to May (2006) for BENNETHORA River (Krishna Basin) near kalaburagi city of Karnataka state in India and they were selected for the purpose of the study. Significant variations among the parameters and interesting correlations were observed throughout the period of study. Multivariate technique, Principal component analysis was applied to evaluate the annual correlation of water quality parameters. Results show that 5 physico-chemical parameters are identified as less important in explaining the annual variance of the data set, and therefore could be the non-principal parameters (Water temperature, pH, total alkalinity, hardness [4].

III. METHODOLOGY

Methodology includes the collection of samples from different sampling points of the BENNETHORA river .After studying the area of the project and length of the river selected is 15km and samples were collected as per the standard procedure .The grab samplings of river water were collected in sterilized glass bottles and closed with sterilized glass stopper and taken for further analysis .At every 1km distance 5000ml samples were collected .The latitude and longitude of every sample point was noted down and bottles were given a serial numbers .The procedure was continued to full 15km length of river. The collected samples were analyzed for major physical and chemical water quality parameters like pH, Turbidity, Fluoride, Chloride and Hardness as per the method Assessment of Water Quality described in "Standard methods for the examination of water and wastewater" The results obtained were correlated with the normal values and with using ArcGIS and the each parameters were plotted using GIS software. The study is based on Survey of India toposheets and GPS point of study area (water samples collected locations). The main sources of secondary data were water tested parameters in laboratory for generate the water quality mapping using ArcGIS 9.2 software.

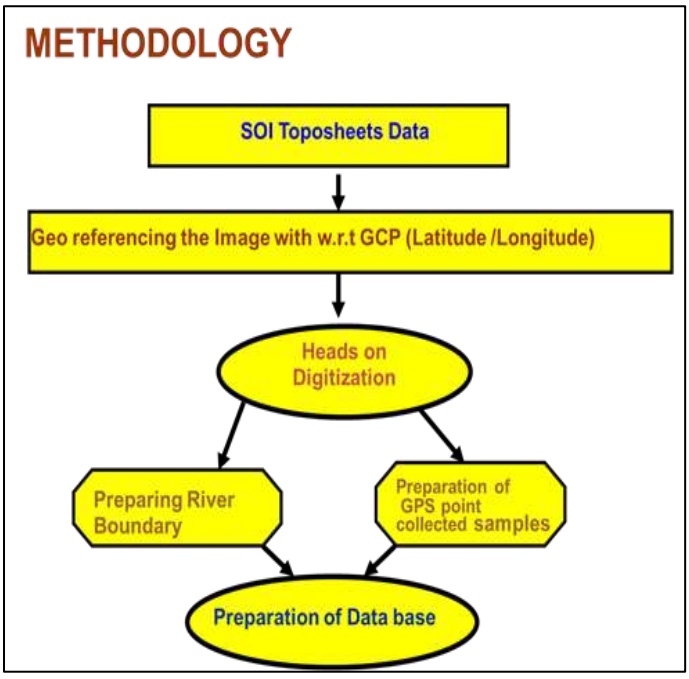

Fig. 1: Flow chart of Data base preparation

IV. RESULTS AND DISCUSSION

A. pH:

The pH value of water indicates the logarithm of reciprocal of hydrogen ion concentration present in water. The pH content in the study area varied from 6.5 to 8.5mg/L with an average of 7.6 mg/L. In sample number 2,3,4,5 almost reaching to maximum limit.

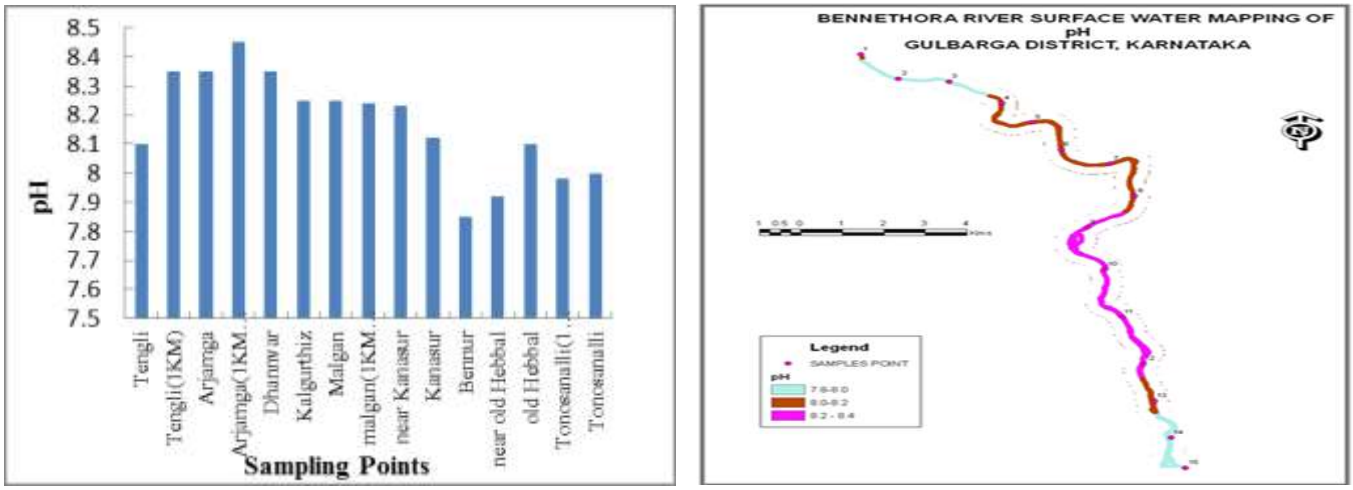

Fig. 2: Bar chart and surface water mapping of pH using GIS

B. Turbidity:

The turbidity in the study area varied from 2 to 5.9 NTU. Turbidity is an indicator of the quantity of matter suspended within a water sample. This can be organic and inorganic [5]. It was traditionally measured using Formazine Turbidity Units (FTU), but is now commonly measured Nephlometric Turbidity Units (NTU).

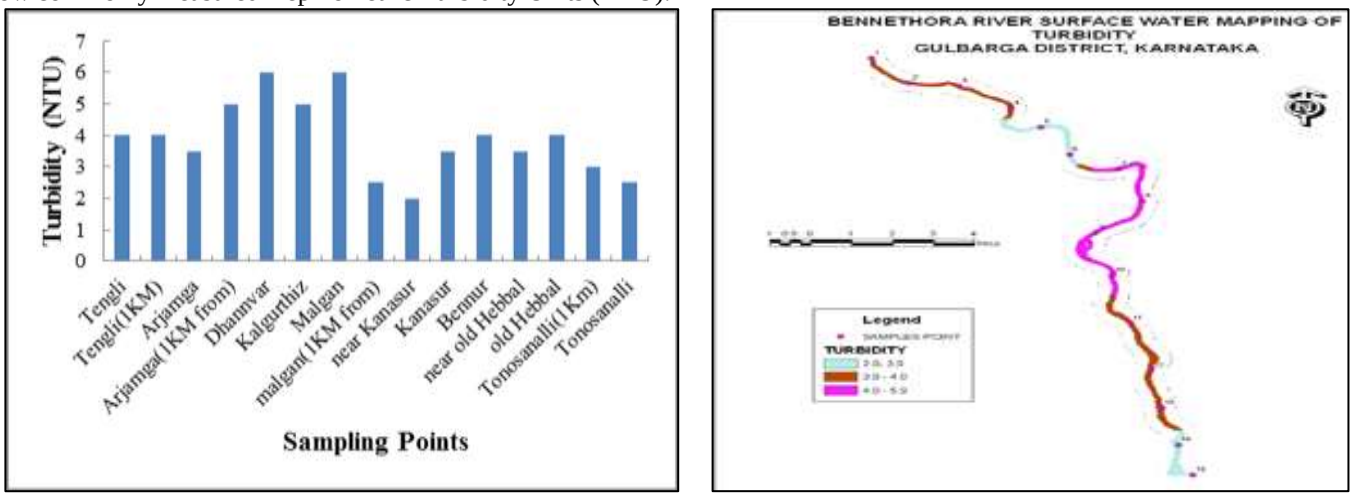

Fig. 3: Bar chart and surface water mapping of Turbidity using GIS

C. Fluoride:

The fluoride content in the study area varies from 0.4 to 0.8 mg/L with an average of 0.55 mg/L.High levels can cause structural tooth damage and at a high enough level can cause skeletal damage.

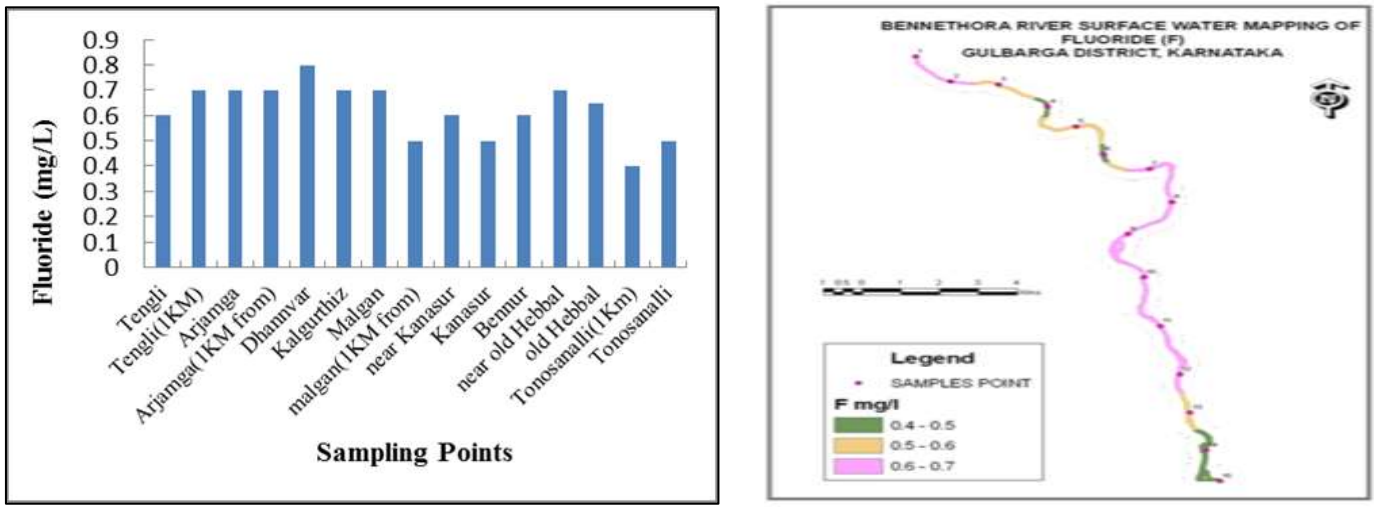

Fig. 4: Bar chart and surface water mapping of Fluoride using GIS

D. Chloride:

The chloride content in the study area varied from 30 to 45 mg/L with an average of 40.44 mg/L. High concentration of chloride gives the salty taste to water Chlorides are generally present in water in the form of sodium chloride and may be due to leaching of marine sedimentary deposits, pollution from sea water, brine or industrial or domestic wastes. Their concentration above 250mg/L produces a noticeable salty taste in drinking water and is thus objectionable.

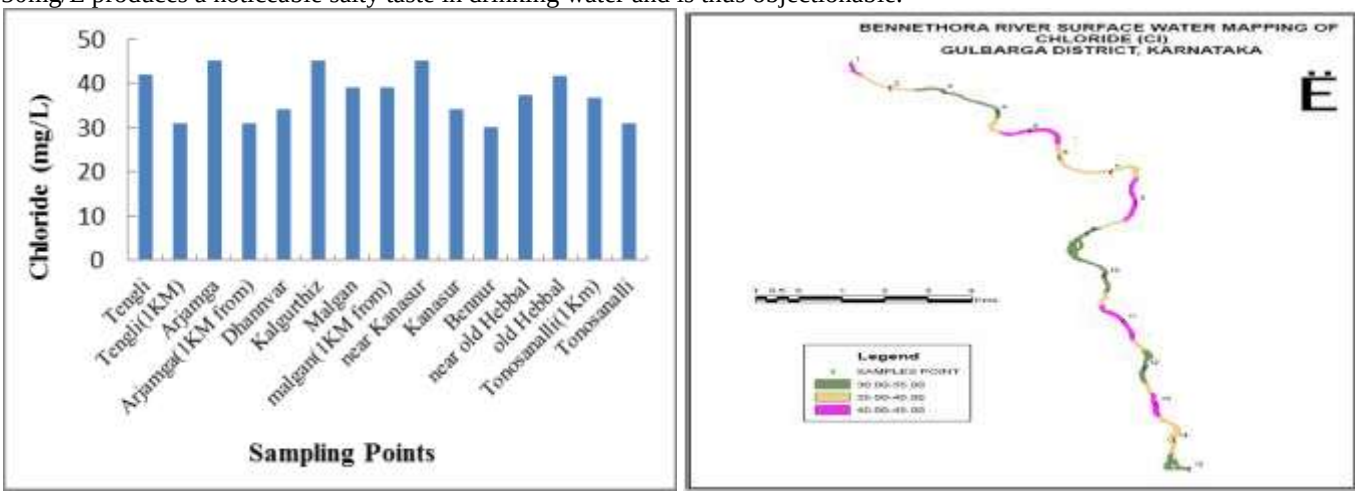

Fig. 5: Bar chart and surface water mapping of Chloride using GIS

E. Hardness:

The hardness content in the study area varied from 124 to 280 mg/L with an average of 168.2 mg/L. Which is within permissible limit so it can be used for domestic and industrial purposes Calcium and magnesium are common constituents of natural water and the important contributors to the hardness of water, the calcium and magnesium content may range from zero to several hundred mg/L, depending on source and treatment of water, these salt break down on heating to form harmful scale in boilers, pipes and cooking utensils.

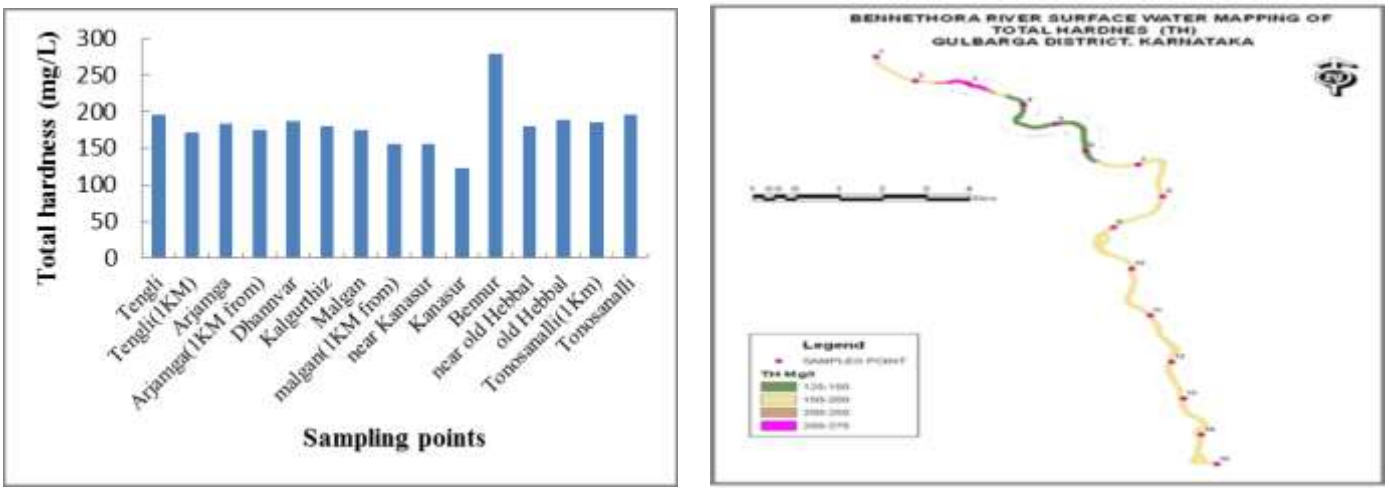

Fig. 6: Bar chart and surface water mapping of Chloride using GIS

V. CONCLUSION

1) The pH content in the study area varied from 6.5 to 8.5mg/L with an average of 7.6 mg/L. In sample number 2,3,4,5 almost reaching to maximum limit.
2) The fluoride content in the study area varied from 0.4 to 0.8 mg/L with an average of 0.55 mg/L. In the study area the fluoride content is very high and non-permissible for drinking purpose so it has to be reduced by treatment.
3) The chloride content in the study area varied from 30 to 45 mg/L with an average of 40.44 mg/L. Chloride is the minor constituent of the earth's crust. Chloride is found in almost all types of natural waters. High concentration of chloride gives the salty taste to water.
4) The Hardness content in the study area varied from 124 to 280 mg/L with an average of 168.2 mg/L. This is within permissible limit so it can be used for domestic and industrial purposes.
5) The GIS map clearly brings out the aerial extent of each parameter in the study area. It has brought a new perspective dimensions for database management with reference to geographical location.

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