SURFACE WATER ASSESSMENT BY USING REMOTE SENSING TECHNOLOGY AND GIS - A MODEL STUDY

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ABSTRACT

The hydrological cycle depends heavily on surface water, which is the amount of rainfall that filters bottom through soil till it attains boulder that has been saturated with water. The quality of the water is declining steadily as a result of the increasing industrialization. Hence, It is essential to evaluate the quality of surface water. Surface water prospective zone maps created from satellite images are useful tools for comprehensive ground-based hydrogeological assessments which possibly result in the selection of suitable areas. The ability to extract data on drainage, land use/land cover, geology, and soils from a single image is a unique characteristic of remote sensing and satellite data. The study was carried out by evaluating the quality of the surface water in the Krishna River in Vijayawada, Andhra Pradesh. In different months, a Surface-Water Quality Study was assessed. Understanding the Speed and incidence of surface water requires an understanding of all these aspects. The Geographical Information System 10.1 version software generated a considerable amount of data between various parameters. The toposheets are utilized to generate the study area maps of water prospective zones, which are effective tools for thorough surface-based hydrogeological survey. The Krishna River's surface water quality has been assessed using Arc-GIS software.

Key words: Remote sensing, Base Map, Water, TDS, Environment, Pollution, and GIS.

1. INTRODUCTION

Geographical Information Systems is known to by the acronym GIS. GIS are particularly computer-based decision support systems for acquiring, storing, presenting, and analysing spatial data. An info system is a set of processes carried out on raw information to provide information that can be used in decision-making. The able to process data from massive storage into an analytical format, including processes such reformatting, altering the projection, resampling, and generalisation, as well as assistance for modelling and analysis in the context that form of analysis calibrations of models, forecasting, and prediction all are handled through instructions to the GIS and Post pro, all are handled by the use of GIS. Point, polygon, and line map features are merged to create the geographic features.

In GIS, the term "topology" is used to describe an object's geometrical features, which are untouched to transformations and independent of any specific coordinate system. An object's topological features are unchanged by the scale of measurement. Three factors comprise topology in respect both to spatial and non-spatial data: adjacency, confinement, and connectivity. Topology can be broadly described in two ways. Metric aspects of spatial interactions, such as size, shape, distance, and direction, make up topology.

Adjacency, containment, and overlap are really only some few examples of the topological connections that exist between space objects. For spatial analysis and integration in GIS, It is required that spatial entities and their attributes get a geometric relationship. Different parameter maps are generated during topology creation from linked spatial and attribute data. These map displays that non-spatial information on locations is distributed geographically. Location map is the spatial database that really is relevant to this study.

GIS Applications:

A computer-based information system called a geographic information system (GIS) is used to analyse and digitally depict the geographic features that exist on the surface of the Earth. a planned system of hardware, software, data, and personnel with systems termed as a geographic information systems (GIS) is used to efficiently acquire, store, update, modify, analyse, and display all kinds of geographically referenced data. Because of the promise it offers for the many different area of study to deal with spatial data, it has been called a "enabling technology."

Three basic elements are merged form GIS Components, which are necessary to carry out GIS tasks. The most significant part of a GIS is its users. The procedures and uses of the GIS data must be specified by users. The quality and availability of the information affect the outcomes. A GIS's processing speed, usability, and output all depend on its hardware. In addition to the actual GIS software, this package also includes various databases, images, and statistics. To create precise and repeatable results, procedures analysis needs well-defined, dependable methodologies.

Data Analysis:

A GIS must be able to respond to queries about the interaction of spatial relationships between various datasets. Tools for viewing the geographic features using a variety of symbolises must be used for displaying data here.

2. OBJECTIVES

- ❖ Creation of thematic maps utilizing satellite imagery and topographical data from the Survey of India.
- ❖ Quality assessment of Krishna River water samples collected at various sites testing water samples for physico-chemical characteristics and
- ❖ Using GIS Software 10.1, collect attribute data from the surface water and conduct GIS mapping of the physiochemical data collected from the Krishna River water analysis.

3. STUDY AREA

After the Ganga, Godavari, and Brahmaputra, the Krishna River is India's fourth-largest river in terms of water inputs and river basin area. The river is 800 meters in length, or nearly 1,288 kilometres. The river also has the name Krishnaveni.

The basin lies between 73°17' - 81°9' E long. and 13°10' - 19°22' N lat., with a max of around 701 km in length and 672 km in width. From its source to where it empties into the Bay of Bengal, the river measures a total of 1,400 kilometres. The Ghatprabha, Malprabha, and Tungabhadra are its main tributaries that enter the river from the right; the Bhima, Musi, and Munneru enter the river from the left. River Network map has been shown in Figure 1. And River water distribution map has been shown in Figure 2.

4. METHODLOGY

Water samples from the Krishna River are collected for three months for a year at a depth of one m in various locations along of the river. Standard techniques used to do a physical and chemical assessment of the lake's water in order to determine the level of pollutants in the Krishna River's waters. Except for pH, E.C., and turbidity, all units are in mg/l. Turbidity units are N.T.U., E.C. units are mhos/cms, and pH has no units. The Flow chart 1. showing Methodology for the present study area.

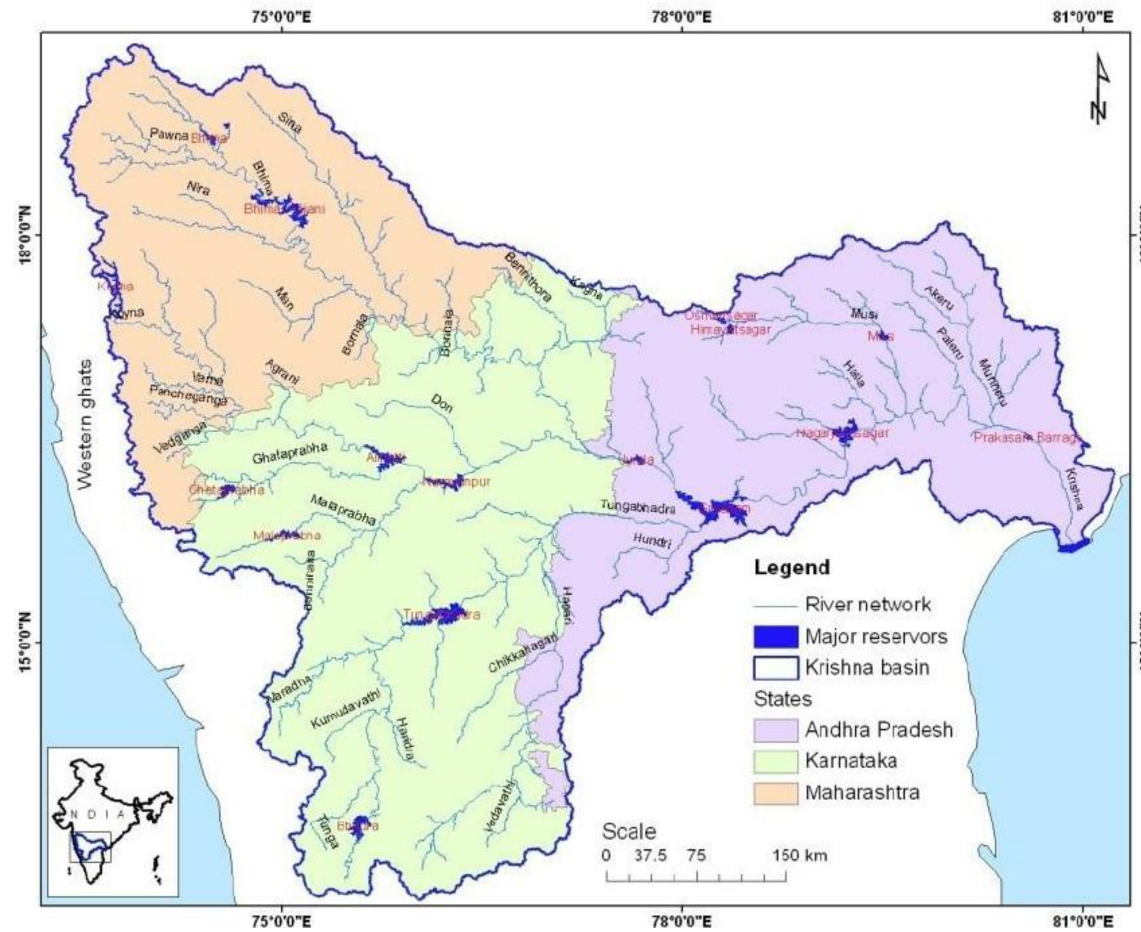


Fig. 1. Showing Study Map of Krishna River Water Network

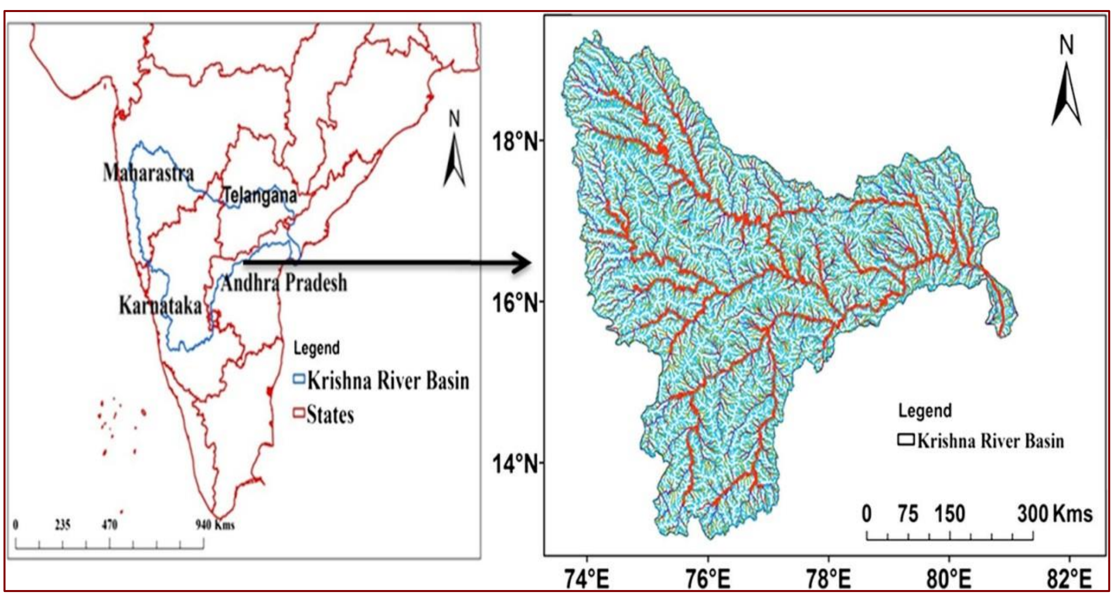
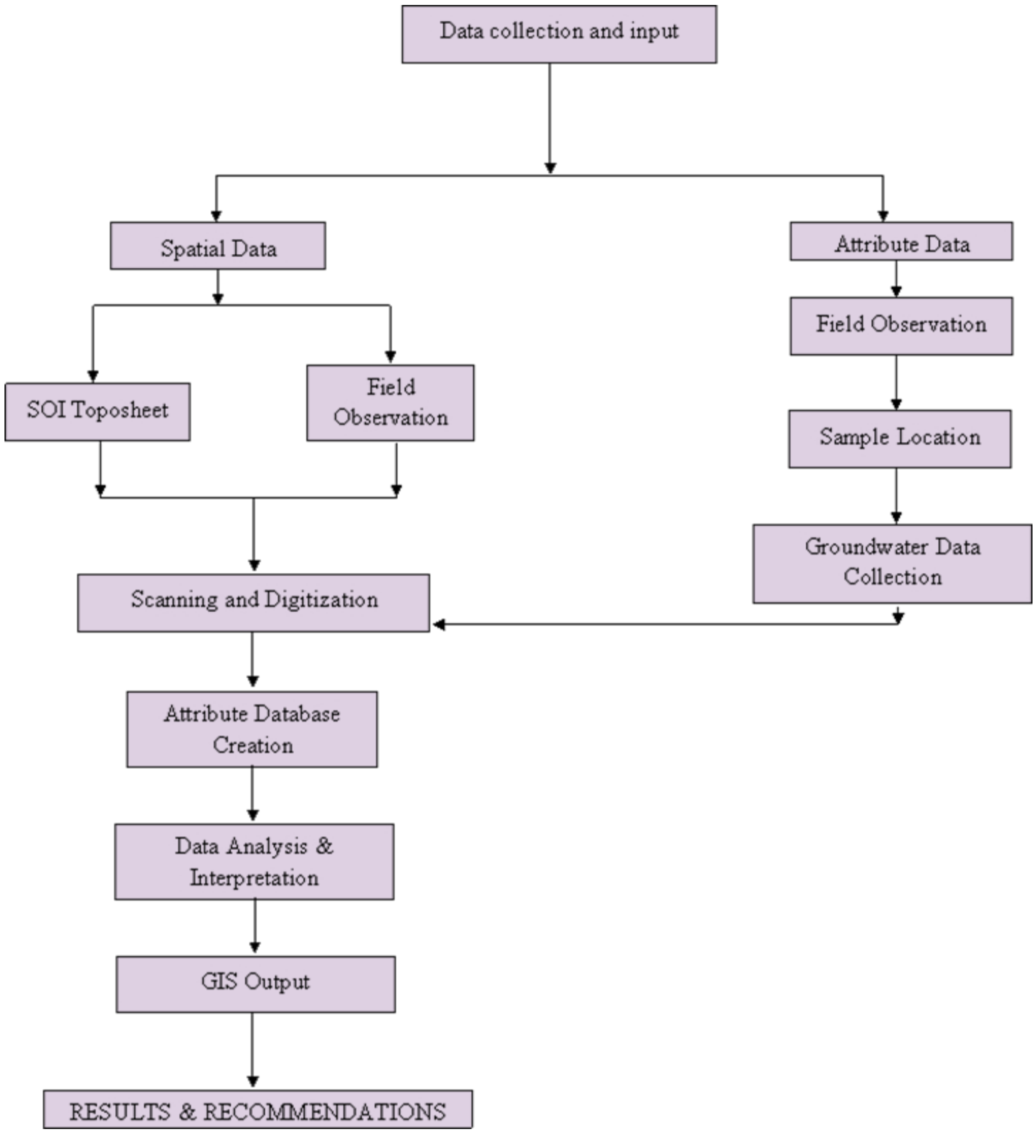


Fig.

2. Map of Krishna River Water Distribution



Flow chart 1. Methodology for the assessment of water at study area.

5. RESULTS AND DISCUSSIONS

The pH, Turbidity, Total Solids, Hardness, Alkanity, Chlorides, and TDS readings of the Krishna River water samples, according to the analysis, are good, signifying that there will be no water pollution in the Krishna River assessment conducted during all 3 months of May, June and July 2022. The assessment shows that the quality of the Krishna River was satisfactory at all of the sampling locations and all parameters were within accepted limits and results of water assessment has been shown in Table 1, 2, and 3.

Table 2. Physical and Chemical Analysis of water samples – May 2022

Sl.No.	pH	Turbidity	Alkalinity	TDS	Chlorides	Total Solids	Total Hardness
1	7.3	4.0	142	350	120	420	220
2	7.4	2.0	185	280	150	460	200
3	7.3	3.2	170	220	140	455	168
4	7.2	4.2	190	250	160	420	208
5	7.6	4.0	185	280	130	438	208
6	7.4	4.5	112	320	184	496	234
7	7.9	3.9	124	398	195	494	244

Table 3. Physical and Chemical Analysis of water samples – June 2022

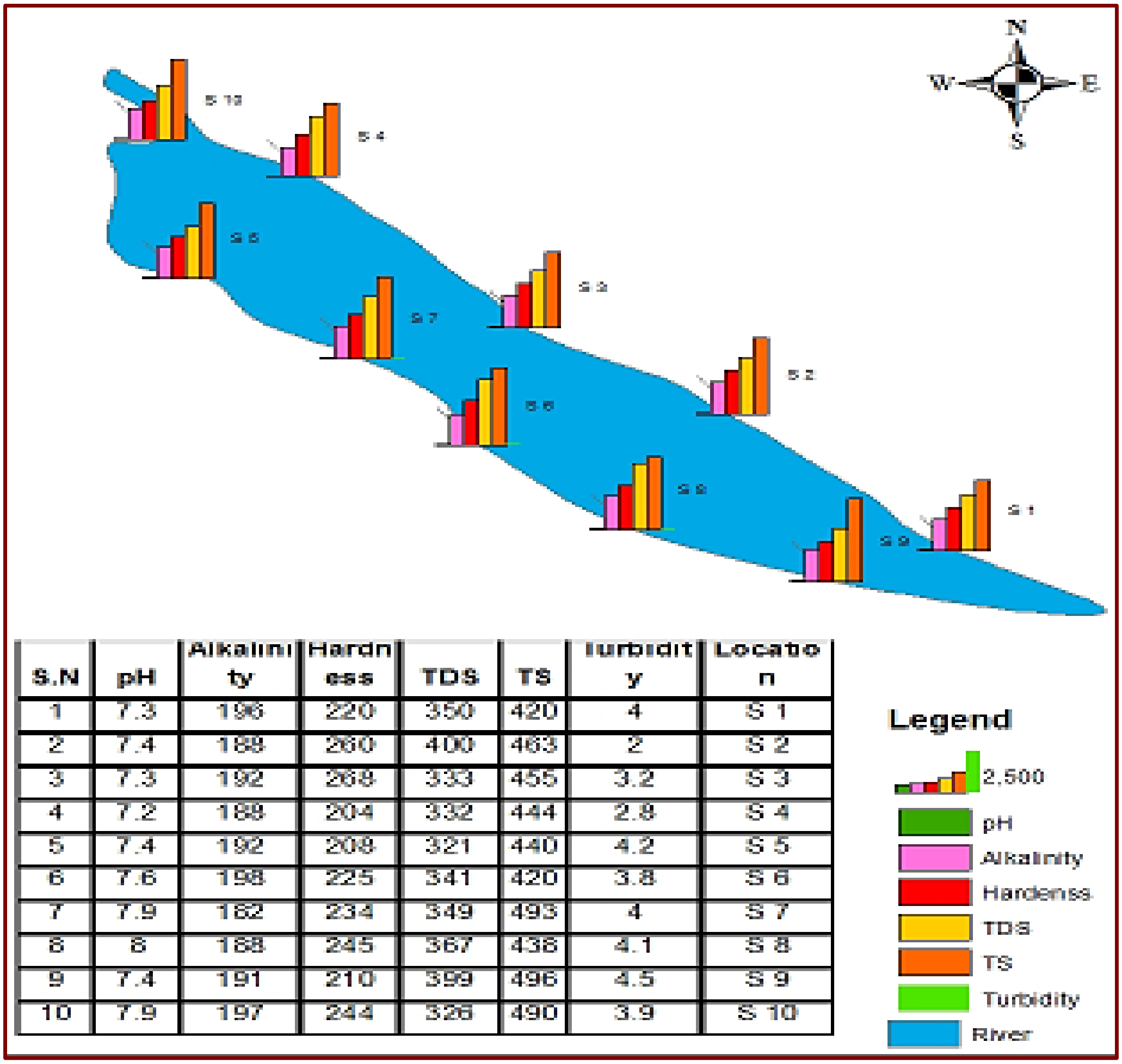
Sl.No.	pH	Turbidity	Alkalinity	TDS	Chlorides	Total Solids	Total Hardness
1	7.3	4.0	114	224	180	462	160
2	7.4	2.0	102	324	114	420	144
3	7.2	3.0	154	340	106	464	156
4	7.8	3.0	178	242	120	320	172
5	7.4	3.0	156	456	196	454	153
6	8.1	2.0	188	284	146	452	143
7	8.2	4.0	146	385	158	495	250

Table 4. Physical and Chemical Analysis of water samples – July 2022

Sl.No.	pH	Turbidity	Alkalinity	TDS	Chlorides	Total Solids	Total Hardness
1	6.8	3.8	152	183	336	470	132
2	7.6	4.5	196	196	348	468	152
3	7.2	3.3	182	160	340	412	146
4	7.8	4.2	196	142	282	493	172
5	7.4	3.8	192	120	395	408	142
6	7.6	4.1	116	152	259	455	198
7	7.6	4.2	120	112	338	490	112

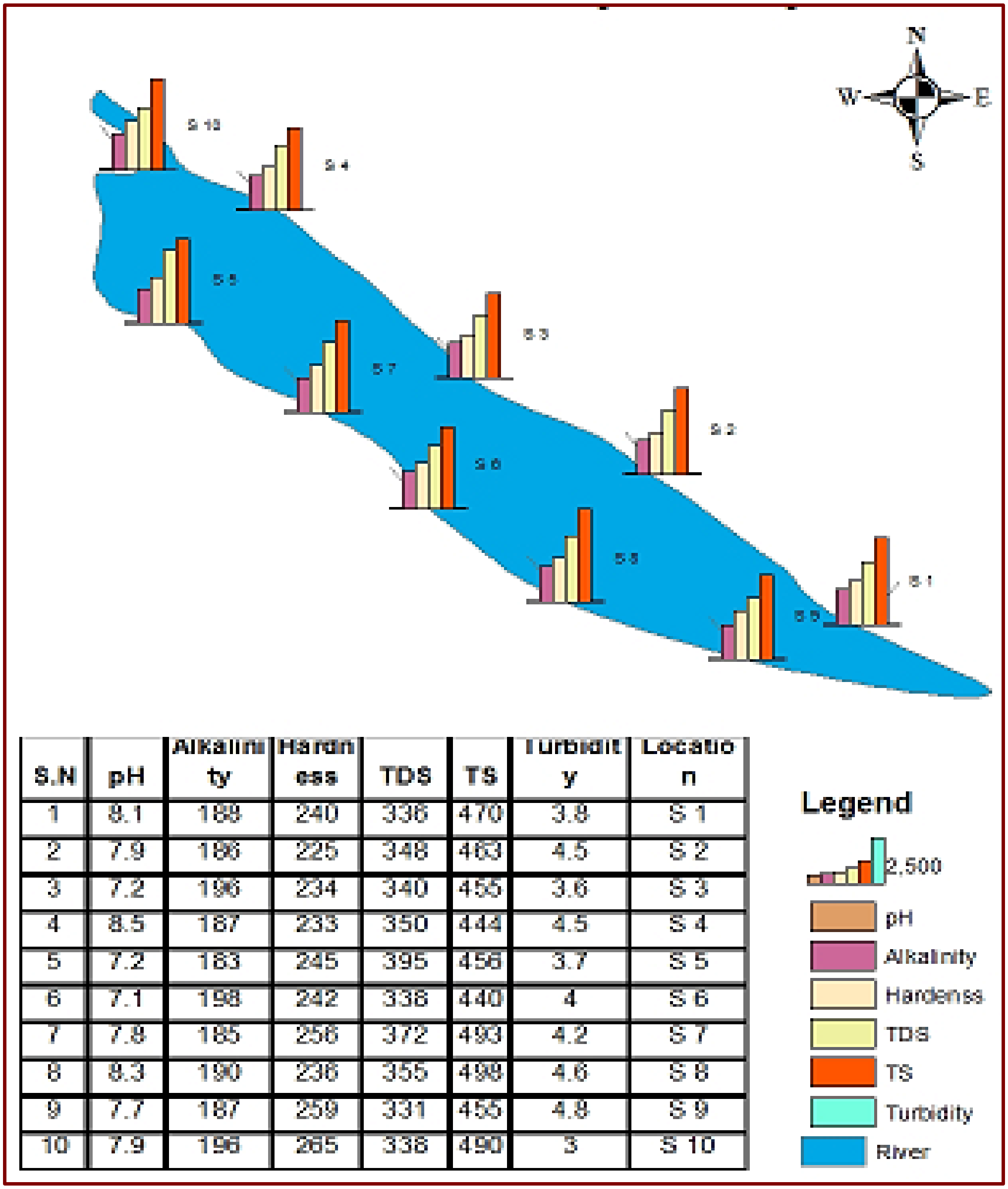
6. CONCLUSIONS:

The study will help in effectively developing the location with good water quality. GIS should be used to record environmental changes occurring in the Krishna River water, and for environmental mapping and recording of the Krishna River water environment, satellite base image maps should be used as the primary input parameters. The analysis of the water in the Krishna River has shown the importance of using GIS to assess the quality of surface water. By incorporating water quality data from Krishna River from different months with spatial data sources to generate maps that can be utilized as reference purposes in and around the study area, GIS technology plays an important role in decision-making for policy makers to promote environmentally sustainable conditions. It is essential to monitor river Krishna River's surface water. Figures 3, 4, and 5 show the maps for 3 months' assessment of the water samples analysis of study area. The geographical distribution maps of pH, TDS, TS, conductivity, hardness, and chlorides show that these parameters are within the research area's allowed limit.



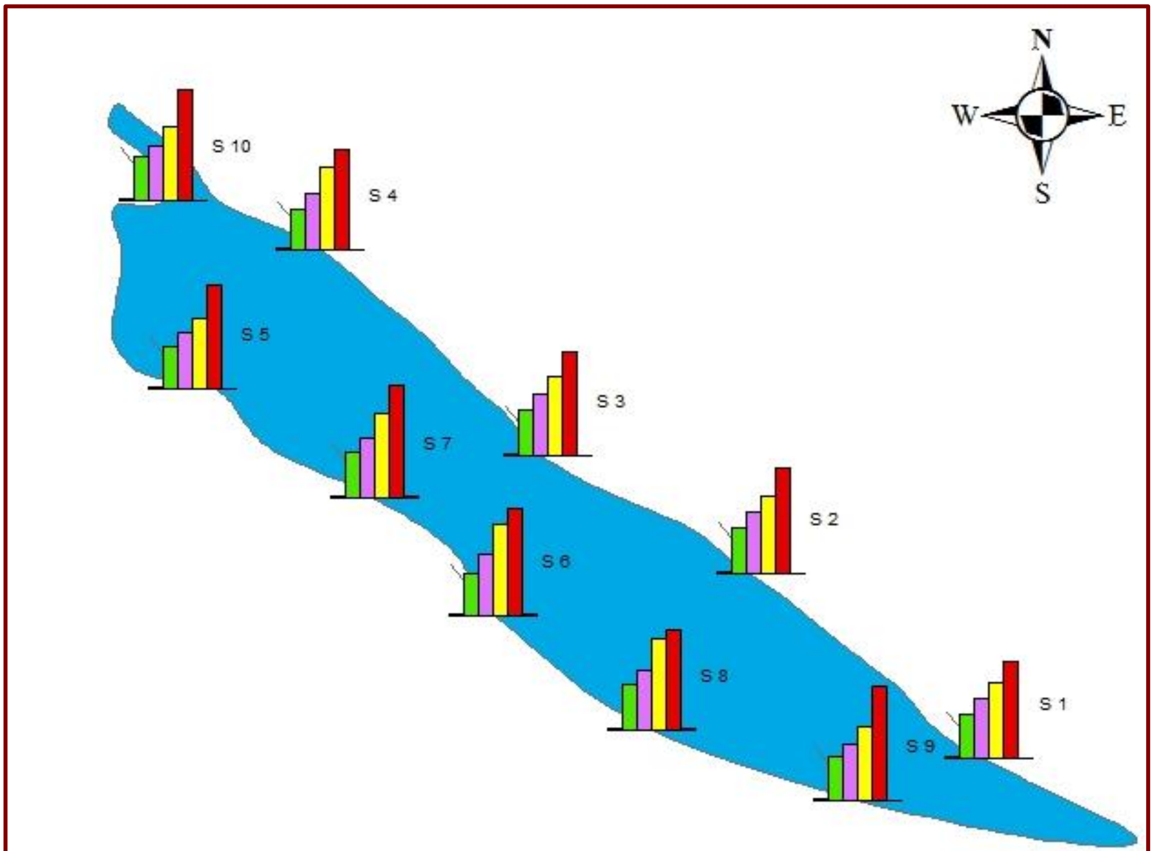
S.N	pH	Alkalinity	Hardness	TDS	TS	Turbidity	Location
1	7.3	196	220	350	420	4	S 1
2	7.4	188	260	400	463	2	S 2
3	7.3	192	268	333	455	3.2	S 3
4	7.2	188	204	332	444	2.8	S 4
5	7.4	192	208	321	440	4.2	S 5
6	7.6	198	225	341	420	3.8	S 6
7	7.9	182	234	349	493	4	S 7
8	8	188	245	367	438	4.1	S 8
9	7.4	191	210	399	496	4.5	S 9
10	7.9	197	244	326	490	3.9	S 10

Fig. 3. Showing the water samples analysis of study area during May 2022



S.N	pH	Alkalinity	Hardness	TDS	TS	Turbidity	Location
1	8.1	188	240	336	470	3.8	S 1
2	7.9	186	225	348	463	4.5	S 2
3	7.2	196	234	340	455	3.6	S 3
4	8.5	187	233	350	444	4.5	S 4
5	7.2	183	245	395	456	3.7	S 5
6	7.1	198	242	338	440	4	S 6
7	7.8	185	256	372	493	4.2	S 7
8	8.3	190	236	355	498	4.6	S 8
9	7.7	187	259	331	455	4.8	S 9
10	7.9	196	265	338	490	3	S 10

Fig. 4. Showing the water samples Analysis of study area during June 2022



ID	pH	Alkalinity	Hardness	TDS	TS	Turbidity	Location
1	7.8	189	260	334	420	3	S 1
2	7.9	196	265	339	463	2.3	S 2
3	7.8	198	270	345	455	4	S 3
4	7.4	179	252	365	444	3	S 4
5	7.9	185	248	310	456	2.8	S 5
6	7.4	184	269	398	465	2.4	S 6
7	7.6	196	263	370	493	3	S 7
8	8	198	260	396	438	3	S 8
9	8.4	193	245	323	500	2.9	S 9
10	8.2	194	239	329	490	4.2	S 10

Fig. 5. Showing the water samples Analysis of study area during July 2022

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