Watershed Management of Bindusara River using QGIS

Gadhave Pallav Suresh[1], Dr. Poul D. C[2]
[1, 2] Department of Civil Engineering
[1, 2] Tuljabhavani College of Engineering, Osmanabad

Abstract- *Groundwater is one of the most precious natural resources on the world, since it serves as the foundation for all human activity. Although water shortage has a negative impact on a region's related to social and environmental activities, this issue may be handled to a degree by recognizing groundwater resources and evaluating the quality of the water in those zones throughout their useable time, i.e. post-monsoon to pre-monsoon. This contributes to the uniform distribution of the water demand load, allow for the most effective use of the region's water availability. Due to their ability to identify many ground features indicative of the presence of groundwater, GIS systems and satellite pictures are widely used in groundwater research. The processing and analysis of remote sensing data is a fast and cost-effective technique for identifying and studying groundwater availability in the study area. Additionally, quality checks on ground water ensure that it is suitable for a wide range of uses throughout the course of its useful life.*

Keywords- Watershed Management, QGIS, Ground Water, DEM, Remote sensing.

I. INTRODUCTION

The most essential component of life is freshwater. Water is necessary for human nutrition, hygiene, agriculture, and industry, among other things. While freshwater is the most plentiful element in nature, its distribution on the globe is not uniform. In contrast to the depletion of the supply, global water supply is rising. Human civilization is in urgent need of drinkable water at the moment. Population growth in water-scarce regions will only increase the value of water available. As the population grows, the need for freshwater resources for all purposes of life increases proportionately; from sipping to cleanliness, from industrial to agriculture, water is the main resource that determines a region's economy, growth, and advancement.

The growth of our civilization is conditional on the accessibility and use of adequate water. This irreplaceable resource is scarce at times and abundant at others, yet is distributed unevenly in both time and space. Groundwater is the world's second most abundant source of freshwater, contributing for approximately 30% of total water sources. It is estimated that over 1.5 billion people on the globe depend on freshwater for their drinking water. Precipitation recharges the groundwater table, and groundwater is acquired from surface water. It is the rainwater that has reached the ground directly as a result of rainfall, recharging from stream and other organic water sources, and artificial recharge induced by human activities.

1.2 Necessity

Groundwater is increasingly emerging from the shades of fresh water hydrological, despite its critical role in the systemic hydrological processes. Due to the resource's origin and the relative ease and often comfort of distributed access, groundwater is the bedrock of India's agricultural and drinkable water security. It is a common resource on which agriculturists throughout the country depend. In the number of rural households in India, it is still the only supply of drinking water. Numerous industrial units across the country, especially those located outside authorized industrial zones, are completely dependent on groundwater. India is fast approaching a serious issue with regard to groundwater use and degradation of groundwater quality.

II. AIM

To demarcate the Beed district's Bindusara river watershed and to suggest locations for water systems and groundwater recharge using the district's subsurface stratum map.

III. OBJECTIVES

1. Compilation of data for the given area (DEM, soil strata maps, rainfall data)
2. Delineation of the watershed of the proposed location on the Bindusara river.
3. Superimposing the Bindusara basin on a soil stratum map and identifying potential locations for groundwater recharge given the terrain's slopes.

4. Proposing a site for water infrastructure such as groundwater recharge wells inside the Bindusarariver's catchment.

Theme

The aim of this study is to use GIS technology to integrate spatial and non-spatial data in order to perform a multi-criteria analysis with the goal of finding groundwater potential zones for a watershed in Shirur Taluka, Pune district. The aim of this research is to use remote sensing and GIS to examine different groundwater regulating factors that occur often in the study area.

Collecting and analysing geomorphological, land use, land cover, geological, and hydrological data is important for determining the availability of source water for groundwater assessment, as well as planning and constructing groundwater recharge systems. Groundwater potential zones are discovered via an integrated analysis of these factors in combination with readily available well and ancillary data in a GIS environment. Hydrogeological and geophysical studies on the ground are limited to the study area's target areas in order to identify groundwater potential zones.

IV. THE COLLECTING DATA

The spatial data requirements include a digital elevation model (DEM) of the research area, a satellite image, hydrological data, ground water level data for the study area, water quality standards, and any additional maps provided by the relevant department.

1) Cartosat-1 DEM Tiles
   Bhuvan website Data source: http://bhuvan.nrsc.gov.in
2) Image from the LISS-III satellite – Source: www.bhuvan.nrsc.gov.in
3) Rainfall data may be obtained from the official website of the Maharashtra government at www.maharain.gov.in.
4) Obtain ground water quality standards and ground water level data from the GSDA (Bhujal Bhavan, Pune) and the Central Ground Water Board (CGWB)
5) Soil Maps: - National Bureau of Soil Survey soil maps (NBSS) (NBSS)

1) Creation of a variety of themed maps

Numerous thematic layers such as geomorphology, land use, land cover, soil, slope, drainage density, lineament density, water table fluctuation, and rainfall are used in this type of groundwater study to identify groundwater potential zones using a geographic information system (GIS) such as Arc-GIS. However, the layers used in this study to extract features in order to create themed maps are mentioned below.

4.2.1 Digital elevation map clipping (DEM)

The term "digital elevation model," or DEM, refers to any digital representation of a topographic surface. Cartosat-1 DEM tiles with a resolution of 30m were used to cover the study area (Source: http://bhuvan.nrsc.gov.in/). The region of interest was extracted from the DEM data and then loaded into Arc GIS. To overlay, the previously generated border map was utilised. The required study area is subsequently extracted using Arc-data GIS's management tool's clip tool. The final DEM clip is being obtained.

Selection of the Site:

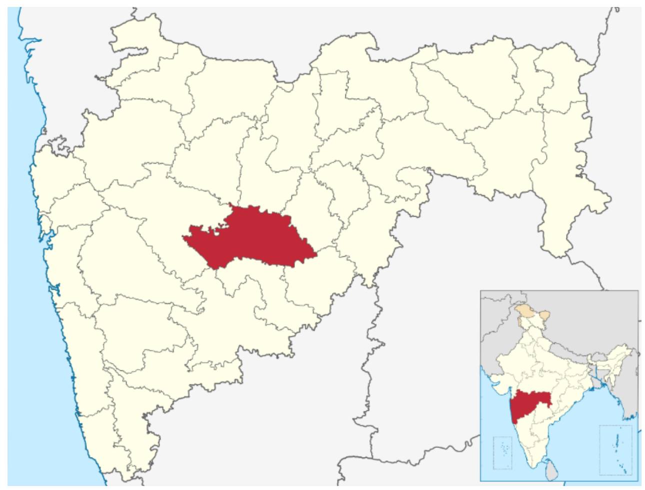

Fig No. 1:-Importing DEM

Variation in Ground Water Quality

Geomorphological landform of Geomorphological landform of Bindusara river watershed:

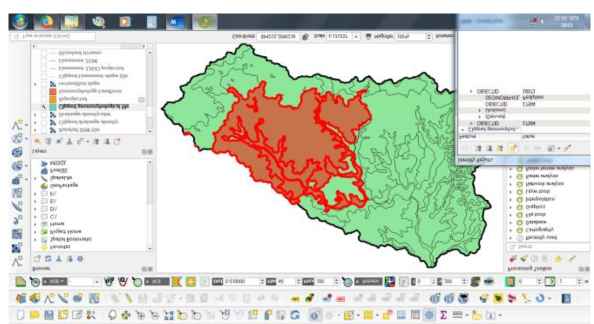

Fig No.2

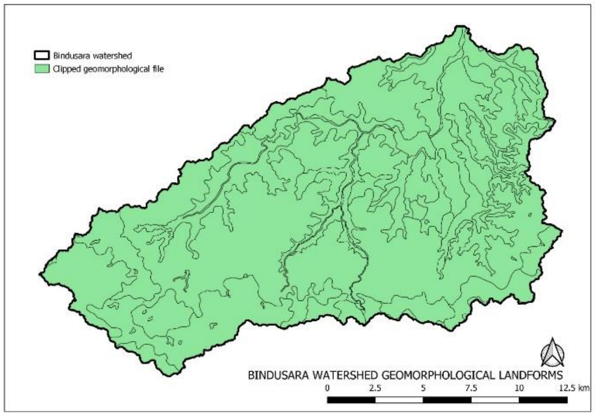

Fig No. 3

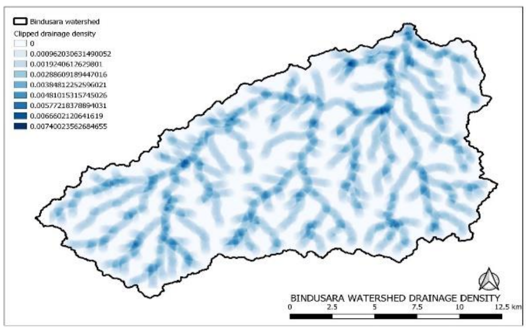

Fig No. 4:-Drainage density map:

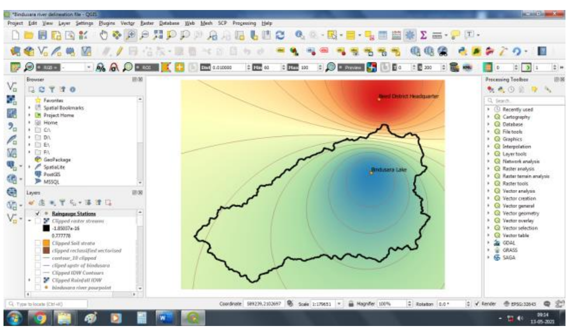

Fig No. 5:-IDW and Raigauge Stations:

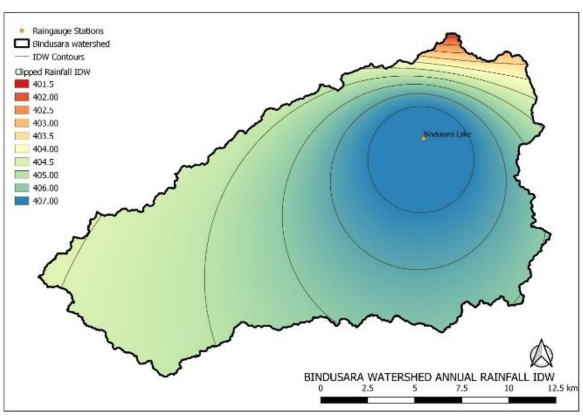

Fig No. 6:-IDW Clipped

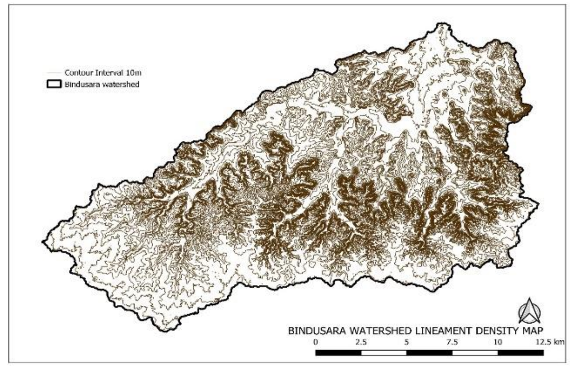

Fig No. 7:-Bindusara river watershed contour

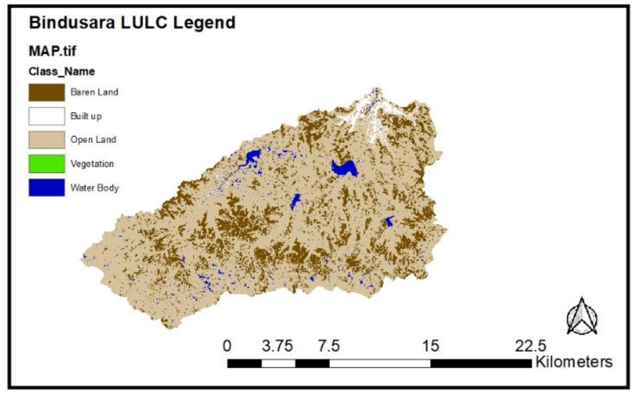

Fig No. 8:-Classification map

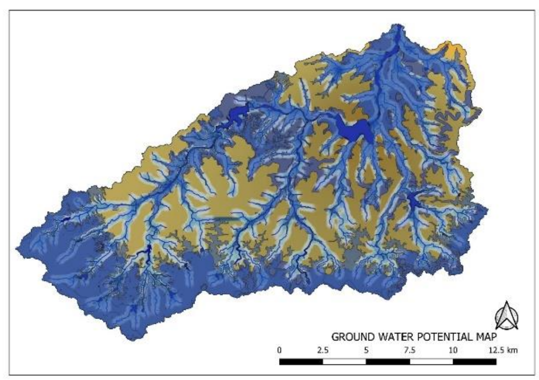

Fig No. 9:-Ground Water Potential Map:

The following is a description of the ground water potential map:

The map of ground water potential was created by superimposing multiple layers, including the terrain slope layer, the drainage density layer, the annual rainfall IDW raster layer, the geomorphological landforms layer, the soil strata layer, the Landsat Image Classification layer, and the lineament density layer. The blue shaded region denotes locations with elevated groundwater levels. The deeper blue hues indicate areas with a lower slope value. All the layers were stacked one on top of the other and their opacity levels modified to determine the most viable places for the borewell to serve as a ground water recharge structure. All blue and blue-toned locations are ideal for ground water recharging. The brown region indicates very steep slopes and hilly places, which is why we are unable to offer groundwater recharge structures, since water flows at a faster rate on hills. Bunds and bandharas may be utilised to slow down tiny streams in brown shaded areas, thus improving contact time and infiltration.

V. CONCLUSION

1. From the first objective of this study, it can be deduced that geomorphological variables have a considerable effect on the determination of the investigated region's basic geophysical characteristics. Additionally, these variables contribute to the determination of surface drainage, topography, soil types, and texture, which all throw light on subsurface features.

2. As shown by the GIS analysis, the existence of groundwater in the study area is primarily governed by geomorphology and soil type, with lineament density, drainage density, and slope following closely behind

3. Geoinformatics shows its use in determining the presence and flow of groundwater in order to map and design a scientifically sound groundwater management plan.

VI. FUTURE PERSPECTIVES

Additional study focused on the location of artificial recharge structures to improve groundwater recharge in order to add value to the region's surface and subsurface water resources may be pursued in the future. Additional study focused on the location of artificial recharge structures to improve groundwater recharge in order to add value to the region's surface and subsurface water resources may be pursued in the future. Groundwater flow and transport modelling may also be conducted for the study area. Additional resistivity studies should be conducted to save money and time by accurately defining the groundwater potential zone, allowing for precision drilling. Continuously growing ground water potential zones over a three-year region enables the identification of ground level depletion zones requiring suitable groundwater management.e.

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