

## Morphometric Analysis of The Suryaganga River, Amravati District, Maharashtra Using GIS Techniques

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### Abstract:

*In the present study the morphometric analysis of Suryaganaga river has been done by using the GIS environment. In recent years, the Remote sensing and Geographical Information System (GIS) techniques are used effectively for Morphometric Analysis of river basin. These techniques are accurate and less time consuming. The Suryaganga river is a tributary of Wardha river, which forms the boundary between Amravati and Wardha Districts. The Basin shows dendritic drainage pattern having 6th order. The length of basin is 39.04 Kms and basin has a perimeter of 85.18 Kms. The study shows that basin is structurally less controlled. Overall the study demonstrates the effective use of GIS platform for morphometric studies.*

*Key Words: GIS, Morphometric Analysis, Suryaganga Basin, Amravati.*

### Introduction:

**R**emote Sensing and GIS techniques are the proven efficient tools in the delineation, updating and morphometric analysis of drainage basin. The drainage basin analysis is important in any hydrological investigation like assessment of groundwater potential and groundwater management. In recent year, remote sensing and GIS techniques are used for morphometric analysis of drainage basin areas surrounding the present study area. In India, some recent studies on morphometric analysis by using remote sensing and GIS technique are done by Pareta and Pareta (2011), Magesh et.al (2012), Kumar et al. (2014), Gajbhiye (2015), Umrikar (2016), Gupta and Punwatkar (2017), Manjunatha et al. (2017).

Morphometry is the measurement and mathematical evaluation of earth's surface, form and the dimension of the landforms. The morphometric analysis of the drainage basin and channel network plays a significant role in comprehension of the geo-hydrological nature of drainage basin This paper present detailed study pertaining to morphometric analysis of Suryaganga river basin region.

### Study area:

The Suryaganga River is a tributary of Wardha river which flow in western part of Amravati district. The Wardha river forms a boundary between Amravati and Wardha Districts of Maharashtra. The Suryaganga river basin covers an area 392.65 sq.km. and bounded by latitude 20° 45' and 21° 22' N and longitude 77° 25' and 77° 58'E (Fig.1). The area under study is covered in the Survey of India Toposheet Nos. 55G/16, 55H/13, 55L/1, 55K/4, having scale- 1:50,000.

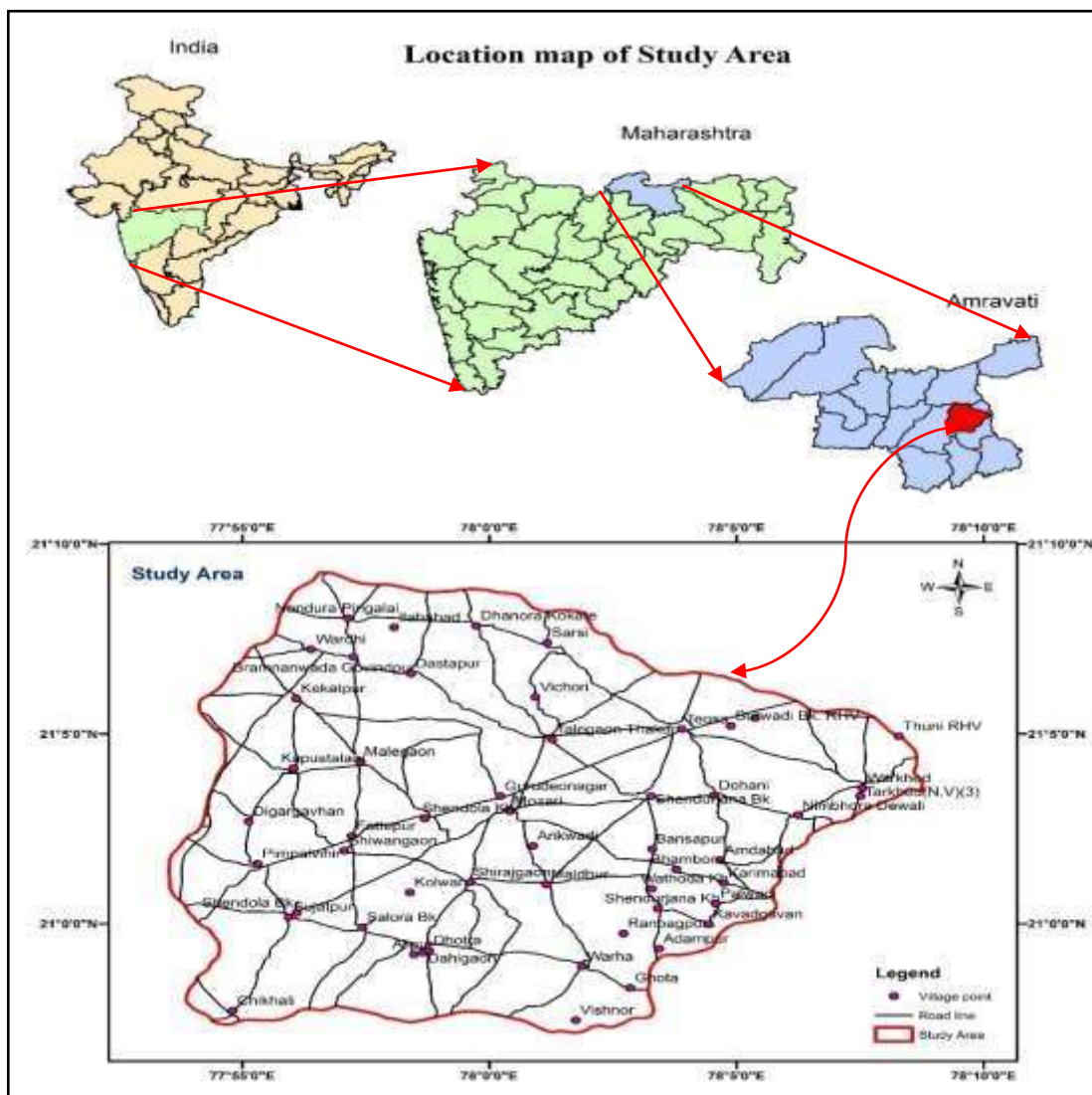


Fig. 1.- Location Map of the study area

**Methodology:**

The morphometric analysis has been carried out from rectified survey of India topographic maps with help of ArcGIS 10.3. software and then digital image processing techniques are used to delineate the drainage network of river basin from the IRS LISS IV satellite imagery downloaded from Bhuvan (NRSC) website.

**Result and discussion:**

In the present study, the morphometric parameters have been evaluated based on the suggested methodology by Horton (1932, 1945), Miller (1953), Melton (1956), Strahler (1952, 1964). The morphometric analysis has been carried out for various parameters grouped under the following heads: *Linear aspects, Areal aspects, Relief aspects.*

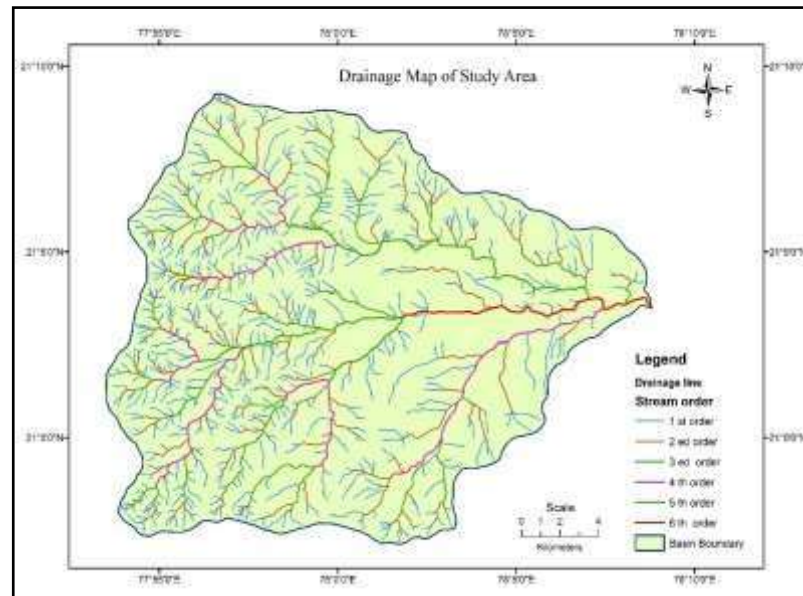


Fig. 2.- Drainage Map of the Suryaganga River

**Linear Aspect:**

It is found that the Suryaganga river is basin is VI<sup>th</sup> stream order. The total number of streams comes out to be 864, out of which 658 are of I<sup>st</sup> order, 158 of II<sup>nd</sup> order, 35 of III<sup>rd</sup> order, 9 of IV<sup>th</sup> order, 3 of V<sup>th</sup> order and 1 of VI<sup>th</sup> order. The mean stream length of sixth order-stream is 13.76 Kms. In the study area, mean Rb varies from 3 to 4.51; the mean bifurcation ratio (Rb) is 3.71 which indicate the basin is less affected by structural disturbances. Basin length of suryaganga basin is 39.04 sq. km and the perimeter of river basin is 85.15 sq. km. The linear parameter computed as shown in table 1.

5 <sup>th</sup>	3	3.00	34.42	11.47	21.32	1.20		
6 <sup>th</sup>	1		13.79	13.79	35.11			

Table 1: Linear parameter computed for Suryaganga river basin.

**Areal Aspect:**

In the present study the area of basin is calculated as 392.65 sq. km. The Drainage density (Dd) for the study area is 1.96 which indicate low drainage density generally results in area of resistant rock or permeable surface material, low relief and vegetation. The Stream frequency (Fs) for the study area is 2.20. The Circularity ratio (Rc) value for the present study is 0.68, suggesting more or less circular shape, high to moderate relief and drainage is structurally controlled.

Drainage Texture (Dt) of Surya ganga basin is found to be 10.14 which is indicating very fine drainage textures. The elongation ratio (Re) of is 0.57 which is represent the basin is elongated nature. The value of length of overland flow (Lg) is 0.98. The Texture ratio (Rt) of Study area is 7.72 has indicate that intermediate texture. Constant of channel maintenance (Cm) is 0.51 in the study area. The areal parameter computed for basin are shown in table 2.

Stream Order (Su)	No. of Stream (Nu)	Bifurcation Ratio (Rb)	Total Length (Lu) Kms.	Mean Length (Lm) Kms.	Cumulative Stream Length	Stream length ratio	Basin Length (Lb) Kms.	Basin perimeter (P) Km s.
1 <sup>st</sup>	658	4.16	441.97	0.67	0.67	1.39	39.04	85.18
2 <sup>nd</sup>	158	4.51	146.95	0.93	1.6	2.43		
3 <sup>rd</sup>	35	3.89	78.99	2.26	3.86	2.65		
4 <sup>th</sup>	9	3.00	53.90	5.99	9.85	1.91		

Basin Area (Sq. Kms.)	Drainage Density	Stream Frequency	Circularity Ratio	Drainage Texture	Elongation Ratio	Length of Overland Flow	Texture Ratio	Constant of Channel maintenance
392.65	1.96	2.20	0.68	10.14	0.57	0.98	7.72	0.51

**Table 2: Areal parameter computed for Suryaganga river basin.**

**Relief Aspect:**

The highest point of basin is 480 mts. and the lowest point 270 mts. and the relief of the basin is 210 m. In the study area, the value of relief ratio (Rh) is 0.002 indicating the basin has gentle slope and high infiltration capacity. The relative relief (Rhp) of basin is 103 which show that moderate relief nature. The relief parameter computed for basin as shown in table 3.

Parameter	Results
<b>Height of basin mouth (z)</b>	270 mts.
<b>Height point on basin (Z)</b>	480 mts
<b>Basin Relief (H) =Z-z</b>	210 mts.
<b>Relief Ratio (Rh)</b>	0.002
<b>Relative Relief (Rhp)=H/P</b>	103

Table 3: Relief parameter computed for Suryaganga river basin.

**Conclusions:**

For present study number of morphometric parameter has evaluated and results are calculated effectively in GIS environment. It has found that the maximum order of Suryaganga basin is 6th order basin and show dendritic drainage pattern. The mean bifurcation ratio (Rb) has lower values indicating that the basin is structurally less distributed. In the study area has low drainage density. The Drainage Texture (Dt) values shows the basin has very fine drainage textures. The Circularity ratio (Rc), signifying more or less circular shape, high to moderate relief and drainage is structurally controlled. The Texture ratio (Rt) has show that moderate texture. Elongation ratio (Re) indicates that the basin is elongate nature. In The present study demonstrate the value of GIS technique in study of morphometric analysis.

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