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AN APPROACH FOR IMPLEMENTATION OF GROUNDWATER RECHARGES POTENTIAL SITES(DEEPENING AND WIDENING) IN KAYADHU RIVER, SENGAON TOWN, HINGOLI DISTRICT, INDIA

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ABSTRACT :

Determinations of rainfall, run-off and water loss from evaporation and transpiration by vegetation are essential factors which indicating the hydrologic characteristics of river basins. The main factors are responsible for the decline of groundwater table in the catchmentsofKayadhu River System located at Sengaon to clarify the feasible causes of groundwater exploitation, demographic growth, climate changes and lack of water management. If prolong next to our present path, the groundwater resources run dry, then only society knows the significance of water.Kayadhu River is the main tributary of the Penganga, which flows direction of West-East trending towards Sengaon to Hingoli. A catchment is bounded by natural features such as hills or mountains from which surface and subsurface water flow into streams, rivers,andwetlands into the low lying area of the catchment. The upstream part of river catchment area extended in North West direction and comprising an area of 222.04km^2. The recommendation of widening and deepening inKayadhu river bed with using technical surveyed and a collection of well observatory data from the study area. ASTER DEM is powerful data to extract raster layers i.e. elevation, aspects, contour and slope map can be computed by using the powerful analysis tools GIS and its extensions in ArcGIS environment. After that implementation experience shows that are ubiquitous recharge sites (widening and deepening) impact for long term sustainability of groundwater intensity conditions are maintained.

KEYWORDS : *Kayadhu River, GIS, Catchment,deepening andwidening, Groundwater*

INTRODUCTION

The exchange of water between groundwater and rivers assessments and analysis at various scales in a range of different hydrologic and geologic settings, the process is a key component influencing river quantity and water quality, geomorphic evolution, riparian zone character, preservation, and restoration (River Science, USGS,2007)**.** Adequateinformation of the impact of channel dimension in relation to the high ranges streamflow discharges possibly will be the source for the estimate of discharge from channel geometry at ungauged sites (Hedman,1970). In order to identify river channel parameters size, shape and depth interrelated with channel erosion and terrain undulation.

Sengaon town is located on the bank of Kayadhu River. As per the census 2011, about 1,708 families residing and nearly 8,455 total people live in the Sengaon town. The town also supports a largely agricultural economy and growing urban base. This growth is expected to place a continually increasing demand for water resources in the Sengaon town.The specific characteristics of the groundwater flow systems concerned with the various features, a judgment of the understandingof groundwater movement, the area and scope of recharge and discharge, the flow direction and velocity of particular point given in the area and infiltration of water depth, yield, estimating base flow of river and groundwater budgets (Toth, 1963).The groundwater exploitation has become an essential part of the water management in the rural areato understand the potential use of water. In hard rock terrain occurrence of groundwater is inadequate and

itsmainly confined to fractured and weathered strata.In many areas,river flow isan importanttosource of water supply.The semi-arid region rivers are subjected to perceptiblevariation in water and sedimentation discharge (Baker and Kochel, 1988, Rajguruet.al, 1993; Kale et.al; 1994).The groundwater principally for regional flow systems, but the emplacement of local flow systems, which makes the interface between surface and groundwater more complex (Winter, 1999).In Sengaon area thegroundwater resources were (37.76%) used for drinking and agricultural purpose (GCWB, 2013).Accessibility of groundwater that occurs in geological strata is totally dependent on recharge and discharge based on terrain slopes, water table fluctuation hydrogeological conditions (Freeze & Chery, 1979, Sophocleous, 2002). Geologically, the area comprises hard rock (Deccan trap) Basalt flow upper Cretaceous to Eocene period originated and recent unconsolidated alluvial deposition (CGWB, 2013).It is generally put on groundwater recharge results in higher terrains and groundwater discharge in lower terrains.

This study is mainly focused on the GIS data analysis, well observatory data, slope, catchment, flow direction, flow accumulationand recharge sites (Deeping &Widening) in Kayadhu River bed.The main objective of this study is to establish the deepening & widening techniques in the improvement of groundwater recharge and storage.

Study Area

The Kayadhu is the main river of the It flows through Sengaon, Hingoli, Aundha Nagnath,and Kalamnuri. It meets the Penganga River in the Nanded district, Hadgaontalukas.The study area is bounded by 76^0 52' to 76^0 55' E latitude and $19^0$49' to $19^0$46' N latitude at situated at the left bank of Kayadhu River (Fig.1). The drainage system of the catchment area is characterized as dendritic to the parallel pattern. The catchment area of Kayadhu river from Sengaon town aerially extended 222.04km^2northwestdirection of the upstream.The total relief surface is from 527m (amsl) highest point and 444m (amsl) lowest point elevation, an average relief of the 83m (amsl). The geology of the Kayadhu River bedrock permeable weathered fractured and jointed basalt. The unconsolidated material also covered nearly 60% to 70% of the fluvial agent in the river bed. The main central focus of the study ishow to sustainthe rainfall effect on the catchment flow that can support to augmentation of groundwater through artificial recharge structures (Deeping & Widening).The target of the Sengaon town Kayadhu river area created the three (03) structures is variable in size and depths. It is also directly percolating and raises the depth to the water table.

The Sengaon Taluka falls under the semi-arid region which has a dry and tropical climate with hot summer and mild winter and average annual rainfall around 838.06 mm which receives from SW monsoonal winds (June-September). The temperature ranges from 12.7 to 41.7^{0}C in winter and summer season. The humidity is high during the south-west monsoon season ranging between 60% and 80%. After September, the humidity's decrease gradually and in the cold season and summer, the air is generally dry. The air is generally dry over the district except during the southwest monsoon when the relative humidity is high. The summer months are the driest when the relative humidity is generally between 30 percent in the afternoon.

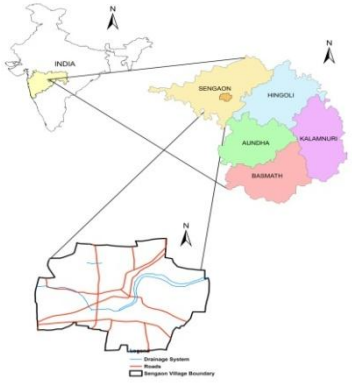


Fig. 1 Location Map of Study Area

Methodology:-

The generation of various thematic layers from (SOI) topographic map 46E/2 on 1:50,000scale and remote sensing satellite image. Using ASTER DEM in terrain parameters such as digital elevation model (DEM), aspects, flow direction, and slope gradient. The hydrologic features such as flow accumulation, flow direction,and slope are derived from DEM using ArcHydro toolbox in ArcGIS.

Results and Discussion:-

Table. 1 Rainfall Data (Source GSDA)

Taluk	Rainfall Years wise														
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Ave. Rain-fall (mm)
Sengaon	601	1155	888	705	322	407	1078	712.6	636	1170	521.68	677.33	774.66	652.00	

Catchment and Drainage System

The catchment area is a representation to covering the area to the catchment outlet where the streams flow is measured. Slope and aspects data are also useful for linear parameters and runoff parameters in the catchment.The catchment boundaries are extracting from Survey of India (SOI) topographical map or ASTER satellite data generating the catchment of DEM. The Kayadhu River originated fromRisodataluk576m and 482m (amsl)) at Sengaon town. Its flowing pathway is west to south and the main channel length is 28.80 km traveled up to the study area. In this catchment area, 31 villages fall under and well drainage network system occurred. The relief of the catchment area is 90m (amsl). Catchment length is 24.26m and width of the 18.70m. The drainage network system is dendritic to sub dendritic pattern (fig.2)

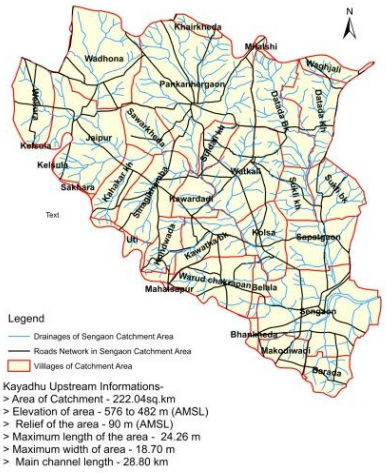
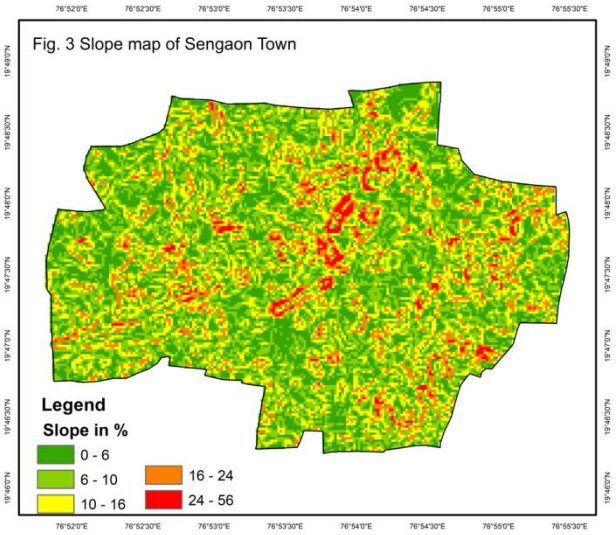


Fig. 2 Location for Catchment Area and Recharge Structure of Kayadhu River Bed at SENGAON, Hingoli District, Maharashtra

Slope

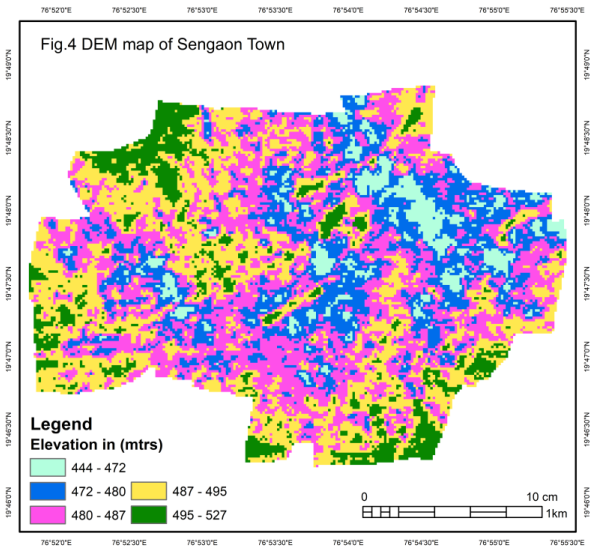
They conclude that area ratio operates most independently of scale; therefore being more suitable when coarser resolution DEMs are applied.The slope represents the loss or gains in altitude per horizontal distance in a direction. Slope map was prepared from ASTER DEM data as shown in the figure. This was completed for different DEM resolutions to extract topographic information. Slope inclination and slope aspect; these are the basic flow attributes of the Earth's surface that are used to derive more complex features (Florinsky, 2012). However, However, the slope category of 0 – 6% and 6% - 10% (complete flat) area are cover maximumpercentage, 10% - 16% as well as 16% - 24% slopes are (flat area) whereas, the

average slope was 24% - 56% undulating slope area mainly occurred in a west-east part of the study area. Some tracts were also persisted in southeast and central region (fig.3).



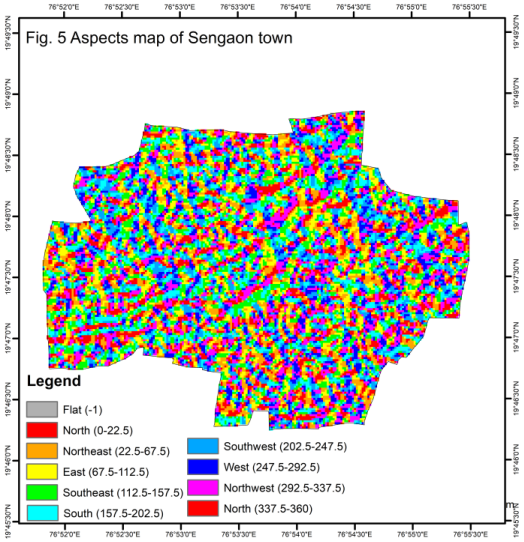
DEM

In the digitalera,the advanced technique and tools similar tothe Digital Elevation Model (DEM) are commonly used for extraction and analysis of various features and especially has implemented for river basin features. Digital Elevation Model (DEM) is an important factor in assessing in any process using digital topography analysis, including slope, curvature, roughness and local relief that are its derivative attributes. The parameters are normally utilized in several applications such as flood simulation (Pakoksung and Takagi 2015).Aster DEM is used to prepare slope, aspect and contour maps.



Aspects

In generally aspects map used for the direction to mountain slope faces. The aspect of a slope can apply for the local climate because the sun's rays are in the west at the hottest time of day in the afternoon, and so in most cases, a west-facing slope will be warmer than sheltered east-facing slope. The value of the output raster data set represents the compass direction of the aspect. It is clearly shown that north-facing slopes mainly occur in the study area. Therefore, it would be said that larger values of the Sengaon town aspect ratio probably lead to low relief and short DEM spacing relative to the vertical resolution. Fig.5

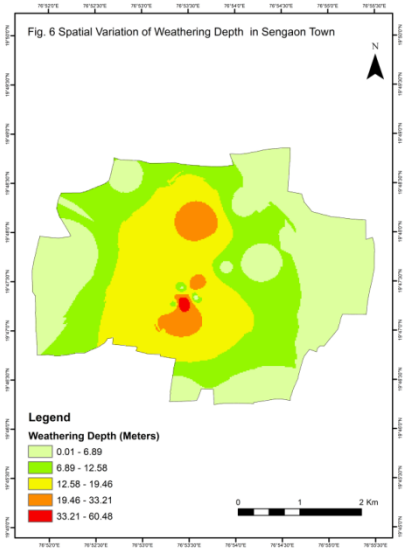


Geology

The surface geology in the study area is characterized by (Deccan trap) basalt and recent alluvial deposits of the Kayadhu River. Alluvial deposits are underlain by bedrock of the (Deccan trap) Basalt of Ajanta group formation. The alluvial deposits strata's occur as gravels, sand, silts,and clays along river banks as well as the bed. The depth of the alluvium (between 1 and 4ft) is generally controlled by the topography of the underlying basalt hard bedrock.It comprises beds and lenses of sands, gravels,and boulders in a matrix of clays. The porosity of these granular zones ranges from 10 to 15 %.The Kayadhu River, which consists of (Deccan trap) basalt that erupted in the period of Upper Cretaceous-Lower Eocene. However, the formation generally has secondary porosity and permeability acquired due to weathering, jointing, shearing, fracturing etc. When the thickness of these zones are appreciable (30% to 60% of flow), the flow forms an aquifer of moderate potential. The structural and composite characteristics described above are repeated in all the lava flows of an area and they thus form multiple aquifer systems which generally extend to depths of 150 to 250 meters. The basalts are characterized by secondary pores as fractured and jointed on the surface of the river (CGWB, 2013). The catchment of the study area mainly concentrated to rechargesurface water on the basis of terrain characters likeslope, decrease the surface flow and increase recharge groundwater in aquifer recharge zoneby deepening and widening ofthe river directly.

The basaltic flows contain different types of occurrences of groundwater in vesicles, joints,and weathered layers, structural and hydrological characteristicsof the Deccan basalts classified into five classes. The storativity and transmissivityare the characteristics to determine their condition to play as aquifers (Deolankar, et.al, 1980).The mainly in hard rock of Deccan basalt the groundwater associated in the weathered zone above the hard rock, semi-confined fissures, fractures, joints, cooling cracks, lava flow junctions,and inter-trapping beds. The weathering condition of study area observed and collection of field observatoryinformation range from 0 to 60 m below the surface. The northeast and west side of the town exhibits the shallow weathered basalt thickness of 0 - 13 m, moderate weathering

occurredcenter part with there thickness of strata is 13 – 33 m and deep weathered small patch encounter same as the center with depth ranges from 33 – 60 m.



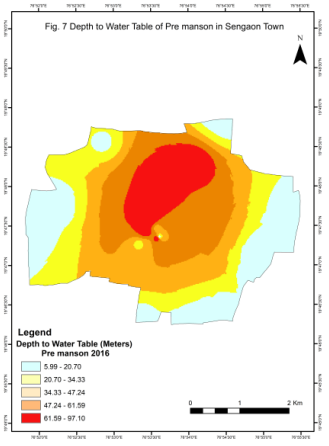
Recharge Structures

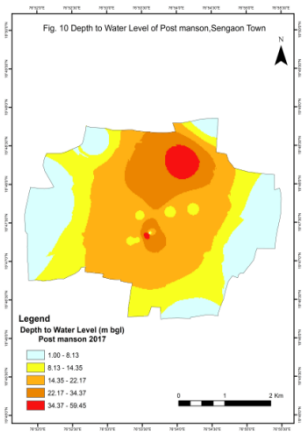
However, there are many pathways Rivers can be revived and rejuvenated, which will also lead to increased water availability. Some of the steps to rejuvenate parched and polluted rivers in Maharashtra include (We are not including governance steps like equitable water distribution etc. To harvest water where it falls, slow down the surface flow and increase recharge in aquifers in aquifer recharge zone. The catchment area to protect aquifers, improve water availability for all and improve base flows in the river. It is the base flows that significant contribution of surface or subsurface river flows in drought. The study area of Kayadhu river at Sengaon town 03-structures has implemented, which has been on deepening and widening of river bed for well groundwater recharge in around areas.The length of the deepening and widening should be decided based on surface runoff calculations and technical measurement of the size of the structures are 100 fit in length and wide size in 3 meters away from both banks. As per the guidelines of GSDA natural depth of river or drainages are more than 3 meters and deepening is not proposed in alluvium.

Groundwater condition

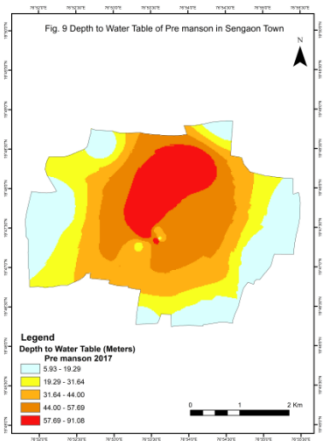
Depth to Water Table

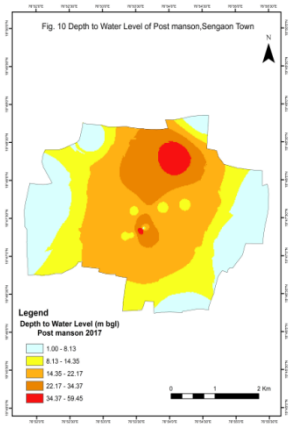
The configuration of the water table is dependent on and controlled by many factors of which topography, geomorphology,and structural features are important. Hydraulically, the surface discontinuities can act as barriers, channels or a complex combination of both during groundwater flow and potential recharge (Bredehoeft et al. 1992; Caine et al. 1996).Although the water table configuration, in general, mimics the pre and post-monsoonperiods there is a variation in the depth-to-water table among the study area. In the pre-monsoon water table occurring at ranges from lower depth 5.99 m to at the higher level depth 97 m bgl.The period of post-monsoon the same observational well data interpreted and analyses the depth to water table from 2.29 m to 81.25 m bgl.



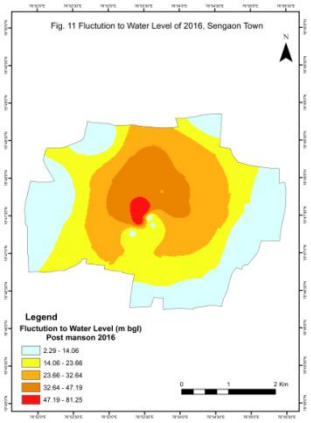


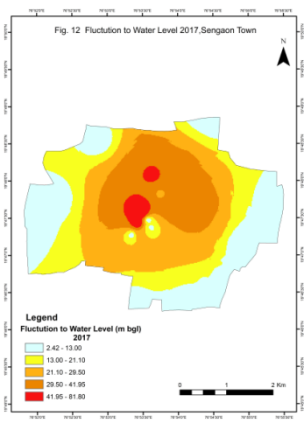
There is a good correspondence between the areas recording the rise in the water table during pre-post-monsoon period of 2017 and the areas of highly jointed rocks and weathered. For example, the rise of the table 5m to 91m of the water table in pre-monsoon. Similarly, in the rise from 1 m to 59.45 m area corresponds with the zone of rising of the water table in the post-monsoon period.





Groundwater Fluctuations





Conclusion

Kayadhu River is the main tributary of the Penganga, which flowing direction W-E trending (Sengaon to Hingoli). The upstream part of river catchment area extended in North West direction 222.04sq.km. The recommendation of widening and deepening in the study area has been carried by technical surveyed and collection of well observatory data from Kayadhu river channel and the adjacent part of Sengaon town. The minimum temperature is 12.7^{0}C and the maximum temperature is 41.7^{0}C of the Sengaon talukas. The rainfall recorded in the study area shows that the average annual rainfall is 838.06 mm. During the year 2005, the highest rainfall recorded is1155 mm. About 81% of the rainfall occurs from June to September and July is the rainiest month.The surface geology in the study area is characterized by (Deccan trap) basalt and recent alluvial deposits of the Kayadhu River. Alluvial deposits are underlain by bedrock of the (Deccan trap) Basalt of Ajanta group formation.The Kayadhu River originated from Risodataluk 576m and 482m (amsl)) at Sengaon town and Its flowing pathway is west to south and the main channel length is 28.80 km traveled. Catchment length is 24.26m and width of the 18.70m. Drainage network is dendritic to sub dendritic pattern.The maximum slope of the study area is 24-56%, whereas, the average slope was 24.02%. Steep slope mainly occurred in a west-east part of the area, some tracts were also persisted in southeast and central region. In the north-west upper part, area has flat terrain. In the study area of the Kayadhu river at Sengaon town 03-structures has to be implemented, which has been on deepening and widening of the river for well groundwater recharge in around areas.

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