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Mapping of Aquifer For Ground Water Recharge In Shirala Taluka

Dhanshree B.Shinde[1], Prf.Dr.S.S.Kulkarni[2]

[1]M Tech, Dept. of Civil Engineering, RIT, Maharashtra, India
[2]Director, KES Rajarambapu Institute of Technology, Maharashtra, India

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Abstract - *Aquifer mapping is defined as a scientific process of a combination of geologic, geophysical, hydrologic and chemical field and laboratory analysis are applied to find the quantity, quality and sustainability of ground water in aquifers. Groundwater is the water that occurs below the surface of earth, where it occupies all or part of the void spaces in soils or geologic strata. The recharge and discharge of groundwater are control by aquifer characteristics and other factors such as soils, climate, land use, cropping pattern. The Identification of clusters of aquifers will help for preparation of aquifer management plans for sustainable groundwater management. This will help achieving drinking water security, improved irrigation facility and sustainability in water resources development in a rural area. The identification and evaluation aquifer involves GIS applications for demarcation of aquifer boundaries and division into smaller units, various software's has been used for defining preliminary 3D disposition of aquifer systems.*

Key Words: *Aquifer, Groundwater, GIS, Hydrogeology*

1. INTRODUCTION

Water on the earth is in motion through the hydrological cycle. The world oceans cover about three fourth of earth's surface. The total amount of water on the earth is about 1400 million cubic kilometres which is enough to cover the earth with a layer 300 meters depth. However no all of this water is usable.

About 2.7% of this total water available on the earth is fresh water of which about 75.2% is ice in the Polar Regions and remaining 22.6% is groundwater. The remaining 2.2% is available in the form of lakes, river, atmosphere moisture, soil and vegetation. Thus, a large chunk of water available for consumption comes from the groundwater.

Groundwater is recharge naturally by rain and snow melt and to smaller extent by surface water like river and lake. Groundwater is the water beneath earth's surface in soil pore spaces and present in the form of fractures of rock formation. Groundwater is invisible, non-stationary transitory escape resource which does not follow any boundaries set by land-holdings. To understand the essential characteristics of groundwater in any region, we need to know the physical framework within which groundwater occurs, i.e. the aquifers. Aquifer is a void hollow spaces available deep underground which is a main source for groundwater.

An Aquifer is an underground layer of water-bearing permeable rock unconsolidated materials like sand silt and gravel etc. Groundwater can be extracted by tube well or dug well. The study of water in the aquifers and to characterize aquifers is called hydrogeology.

2. Case Study and Data Collection

For current study of aquifer mapping five villages has been selected from Shirala Tal. The selected villages are "Ghagarewadi", "Girajavade", "Dhamavade", "Kondaivadi", "Wakurdebudruk (Bk).The study area lies between latitudes 17º 3' to 17º 6' and longitudes 74º 2'to 74º 6' the area under study is covers about 39km.

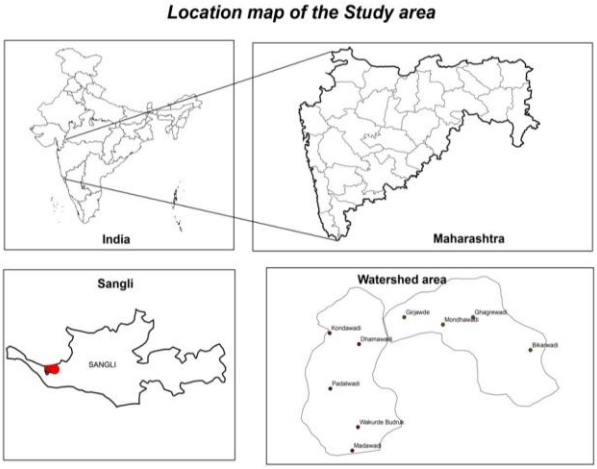


Fig -1: Study Area Map

2.1 Description of the case study

Data of Scheme-

The Morana River is the main river in the area and it flows north to south. The study area is divided into two parts of watershed area. The selected villages are "Dhamavade", "Kondaivadi", "Wakurdebudruk (Bk) in a first part and "Ghagarewadi", "Girajavade" in second part.

3. Methodology

A topographic map is detailed and accurate two-dimensional representation of natural and human made features on the earth's surface. The study area belongs to the number 43/E4. The top sheet is useful in understanding the

geomorphologic feature of the area. The field work has been done to understand the layout, geology and other aspects of the area. The geological mapping mainly included marking of the flow units with help of the red layer and marking out of the major zones of seepage. Rock samples were collected for petrographic analysis. In the fourth field visit the hydrological study was carried out, which included monitoring of selected dug-wells i.e. water level and in-situ water quality analysis. Morphologic features of the area.

With the help of topographical sheet of a particular region following features are achieved:

1. Drainage pattern of basin
2. Delineation of watershed boundary

Tools used for data interpretation and analysis:-

Geological map, drainage map, hydrological map, lithological section has been completed based on collected data.

Water quality analysis of area has been completed by water quality testing and contour map of water table is prepared by using 'Surfer' software.

Arc GIS, Google earth, Surfer these are the various software's used for analysis of Aquifers**.**

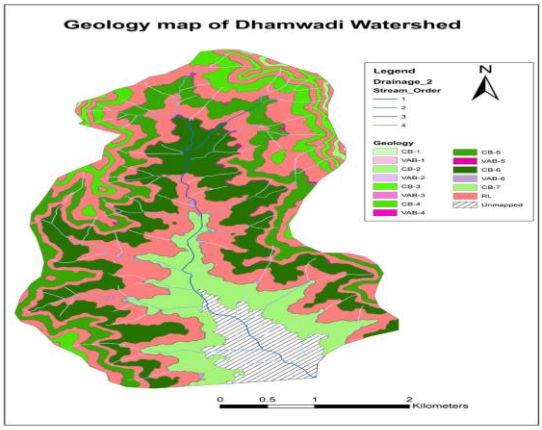
Geology of the area

The study area is occupied by the Deccan Basalt. There are two types of basalt flows in the study area. The compact basalt in the area is dense and massive, the vertical joints seen in the wells of Ghagarewade and Kondaiwade villages.

The study area is divided into two watersheds. Both the watersheds show the thirteen units of lava flows. These flows are found between elevation of 600m to 820m above msl, these flows grouped into 'compact basalt flows (CB)' and 'vesicular amygdaloidal basalt flow' (VAB). The seven flows are compact basalt flows, while six flows are vesicular amygdaloidal flows. The minimum thickness of flow is 4m which is demarcated in simple flows, and maximum thickness flow is 13m which is demarcated in the compact basalt flow.

The regional trend of the fractures is NE-SW. The study area divided into two water sheds namely Ghagarewade and Dhamwade.

The geological cross section of the area in the SSW-NNE direction shows that the slopes are higher in the SW direction grading down towards NE. The cross section is from Kondaiwadi to Girajwade. The horizontal flows have been cut by the morana river in the central part of the section, it forms a trench in the central part in the Wakurde bk.



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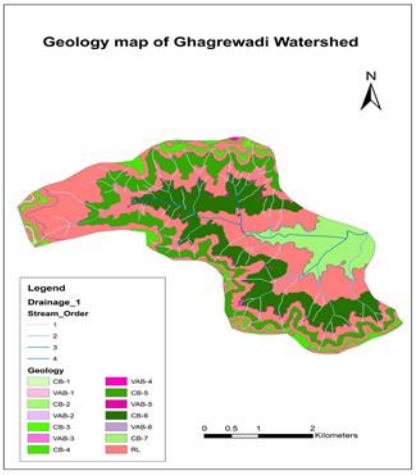

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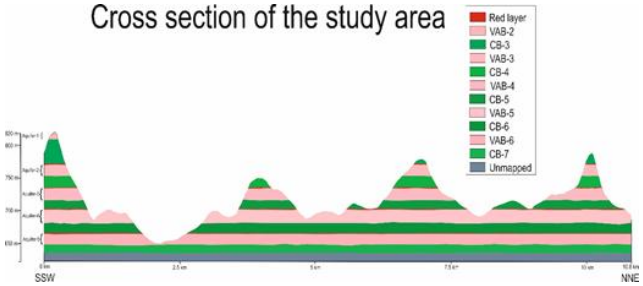


Fig -1: Study Area Map

Table2. Active outlets and rotation period

Aquifer	Area (Sq.km)	Thickness (m)
Aquifer 1	0.005216	13
Aquifer 2	0.02205	9
Aquifer 3	0.083483	10
Aquifer 4	0.199778	15
Aquifer 5	0.332756	19
Aquifer 6	0.228984	18

4. Hydrogeology

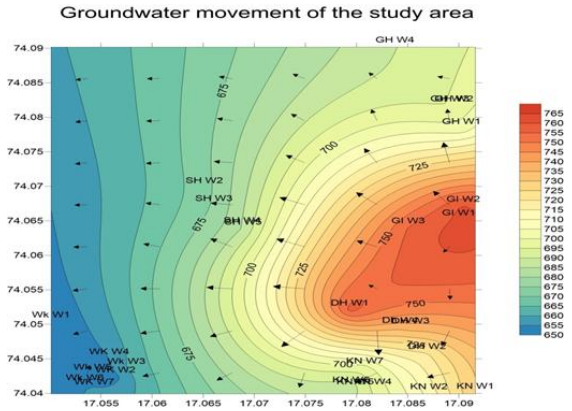
Well Inventory

Well inventory is done basically to get an overall understanding of the spread of the total wells in the study area. Also, the wells show the geology of the area which helps in the geological mapping of the area to be carried out.

The water level data of 31 well was collected twice, First time in September and second time in February. The static water level was taken with the help of normal tape with a plumb bob attached at lower end. The elevations of the wells were obtained with a GPS. The reduced water level (R.W.L) was calculated by subtracting the elevation of well from mean sea level from the static water level. Using these data water table contour map was plotted using surfer.

Based on water table contour map, we can identify the direction of water flow and locate the probable recharge-discharge areas.

Based on the water table contour maps, we can identify the direction of the groundwater flow and locate the probable recharge-discharge areas the above contour map shows that groundwater flow is to be towards west. The recharge area in the study area can be observed towards east.



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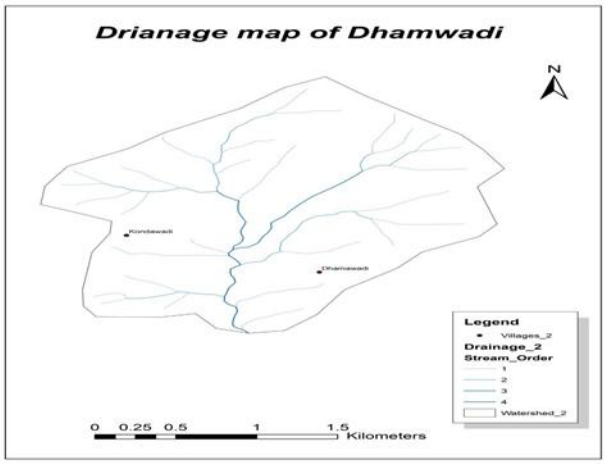
Drainage Network

The study the geometry of drainage network of an area gives information about the relationship between the surface runoff, the infiltration of rain water and relative permeability of rocks exposed in watershed.



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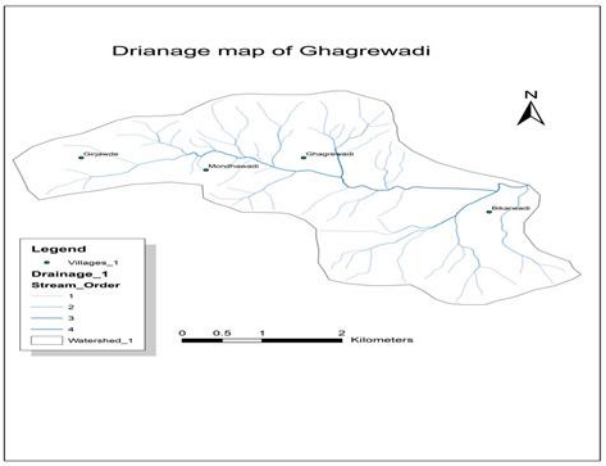

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	Location		Stream order	No of streams	Length of streams (km)	Basin area (sq.km)	Bifurcation ratio (no of streams n/n+1)	Drainage density (sum of streams lengths /basin area) (km/sq.km)	Stream frequency (sum of no of streams/basin area) /sq.km
Shirala	Dhamwadi		1	28	11.57	5.43	4.66	3.51	6.8
			2	6	4.32		3		
			3	2	2.07		2		
			4	1	1.15		N.A		
				∑ 37	∑ 19.12				
	Ghagrewadi		1	58	32.82	17.50	4.14	2.97	4.34
			2	14	12.11		4.66		
			3	3	4.12		3		
			4	1	2.86		N.A		
				∑ 76	∑ 51.93				

Fig -1: Study Area Map

From table

Bifurcation ratio - If the bifurcation ratio falls between2–5 this generally implies that the drainage is slope controlled. A bifurcation ratio greater than 5 implies that there is some structural element such as a fracture, fault, dyke, etc. which is governing the drainage pattern.

Table2. Active outlets and rotation period

Bifurcation Ratio	Interpretation
<=2	Flat terrain
2-5	Mountainous terrain
>=5	Structurally controlled terrain

This shows that both Ghargrewadi and Dhamwadi have mountainous terrains.

Drainage density - The drainage density gives an indication of the texture of the drainage and permeability of the underlying rock strata.

Table2. Active outlets and rotation period

Drainage Density value	Interpretation
0-2	Low
2-4	Moderate
4-6	High
>6	Very High

The both watersheds show moderate drainage density

Stream Frequency

It is a ratio between the total numbers of streams of all orders to the area of the watershed. It is a pure indictor of the permeability of the underlying rock strata.

Table2. Active outlets and rotation period

Stream Frequency value	Interpretation
0-2	Very Poor
2-4	Poor
4-6	Moderate
>6	Very High

In Dhamwade the stream frequency is very high which tells us that the rock strata are very poorly permeable. While in Ghagrewadi the stream frequency is Moderate which shows that the rock strata is less permeable.

5. RESULT

According to the aquifer mapping of the selected villages following results are obtained-

1. Bifurcation ratio shows that both Ghagarewadi and Dhamwadi have mountasnious terrains.

2. All the five aquifers have been demarcated in vesicular basalt.

6. CONCLUSIONS

As per the study we have demarcated the recharge areas. In these recharge areas we have some recommendations for recharge as follows:

1. Continuous contour trenches

2. Staggered contour trenches

3. Recharge ponds

All the five aquifers have been demarcated in Vesicular basalt.

Based on the water table contour maps, we can identify the direction of the groundwater flow is to be towards west and locate the probable recharge-discharge areas the above contour map shows that groundwater flow is to be towards west. The recharge area in the study area can be observed towards east.

REFERENCES

[1] Da Ha, Gang Zheng(2019) "Estimation of hydraulic parameters from pumping tests in a multiaquifer system."Journal of hydrologic Engineering,Vol.1/No.5,877-886

[2] Elise Bekele, joanne Vanderzalm (2017) "Managed aquifer recharge (MAR) in sustainable urban water management." Journal of water Engineering, Vol.10/No.3,239-245

[3] Kanak Moharir, Chaitanya Pande (2017) "Inverse modelling of aquifer parameters in basaltic rock with the help of pumping test method." GeoscienceFrontiers, ,Vol.8/No.6,1385-1395

[4] O.A.Adeyeye, E.A.Ikpokonte (2017) "GIS-based groundwater potential within Dengi area, North Central Nigeria."The Egyptian Journal of Remote Sensing and Space Science,Vol.22/No.2,175-181

[5] Rafael Goncalves Santos, Mara Lucia Marques: "GIS Applied to the Mapping of LU, LC and Vulnerability of the Guarani Aquifer System"