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Hydro geological and Geomarphological Assessment of Groundwater Recharge of The Girsawli-Village, Warora- Tahsil, Chandrapur-District, Maharashtra State using Remote Sensing and GSI Technique

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***Abstract*:**
The study of hydro geological and geomarphological with rainfall surface recharge investigation of the small watershed and village.itisartificially groundwater recharge techniqueaugmented the rate of exceeding the infiltration rate under natural condition. Geomarphologicalanalysis was carried out to illustrate the drainage characteristics andhydrogeo morphology of Girsawali watershed. The basic studyofsmallwatershedmorph metric parameters (linear, areal and relief aspects of drainage network) for the basin were determined using Reemote sensing and Geographic Information System (GIS). Thesetechniqueare describe the basin and drainage network, geometry, texture, soil , crop, structure and relief characteristics. where also using topographic maps of 1:50,000 scale. There wasfindings related that is in the youth-age stage of geomorphic evolution.Marphometric analysis shows that the maximum stream is of 3rd order nalanature with dendrite drainage pattern. Groundwater scarcity zone map shows poor, low moderate and high fluctuate.

Keyword: Hydrogeomarphological, hydrogeological, rain fall surface, artificial groundwater rechargetechnique.

Introduction

The term hydrogeomarphology design the study of landforms caused by the action of water [3].Hydrogeomorphologydescribe and evalutes the environment in which water circulate, thus providing the information to understand the situation and to make the proper decision [4] .

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The quantitative study of drainage basin provides the theoretical base for the hydrogeomarphicalapproach , suggesting that certain unvarying drainage basin characters can be correlated to the hydrologic response of basin [1]. The marphometric analysis has been carried out by following [2],[4]. The applicationof remote sensing and GSI is more effective and convenient tool forhydrogeoloical mapping. Water is a prime natural resource for the mankind. Ground water is the more reliable and economically affordable source for the population in the area. Excessive use of ground water for water supply has led to a situation where natural replenishment cannot match exploitationrates ,leadingto falling groundwaterlevels[11]. Extraction rate of ground water in this mini watershed is higher as compared to recharge under natural condition of basaltic rock . thewater tablehas goes down day by day due to over exploitation which creates scarcity condition during summit(raj,2001) . Surface water is water in river, lake or fresh water wetland ,whichis naturally replenished by precipitation and naturally lost through discharge to the ocean , evaporation and subsurface ,although the only natural input to any surface water system precipitation within its watershed. The total quantity of water in that system at any given time is also dependent on many other factor includes storage capacity oflakes,wet lands and artificial reservoir . The permeability oftherun off characteristic of land in the watershed, the timing of the precipitation and local evaporation rates. All these factors also affect the properties of water lost .Ground water is fresh water located in the pore spaces of soil and rock it is also water table[6] , [9]. Collected the data of rain fall in this village near 10 years about 2008 to 2017.

The objective of the study to target ground water zone of Village -Girsawali mini watershed of Taluka-WaroraofDistrict-Chandrapur , and to investigate groundwater condition of that area to find out suitable site for ground water recharging and to protect enhance water resource for the integrated socio-economic development of this watershed.

Location:

Fig1: Location of Village- Girsawali, Tahsil -Warora , District Chandrapur (MH)

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The Village ofGirsawali is situated at N 52° W from the district Chandrapur and N 60° W from the Taluka-Warora. It is about 57 km from district place and 12 km from taluka place. It can be approached from the Warora by tar road to Wandhali and to Girsawali by un-medaled road from Wandhali. The village is approachable in all seasons.

Study area

The study area lies between the latitude and longitude **N 20° 18’ 49.9”; to E 78°53’ 03”** and falls in geological survey of India,Toposheet number **55L/15** and covering about 507.37 hectares area.

Village – Girsawli,Tahsil- Warora,District-Chandrpur

Toposheet no. - 55L/15,

Quadrant B/3, Watershed no.-WRD

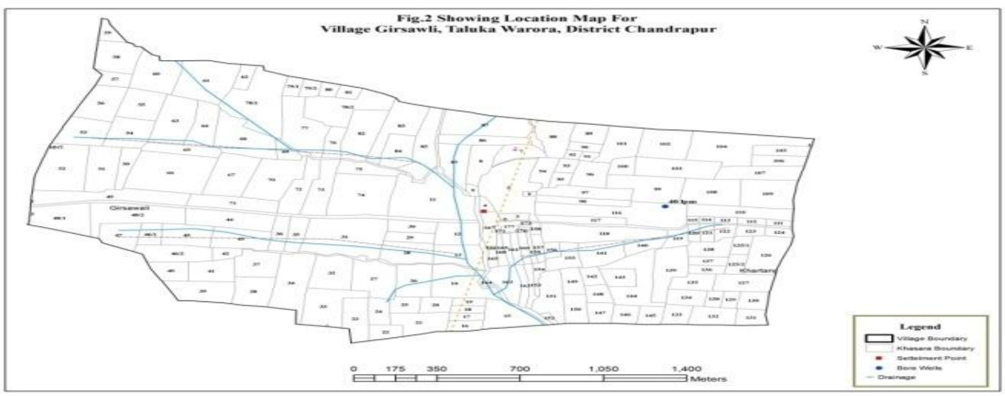

Fig 2 : Location map of study area District –Chandrapur (MH)

Toposheet no. 55L/15, of Village- Girsawali

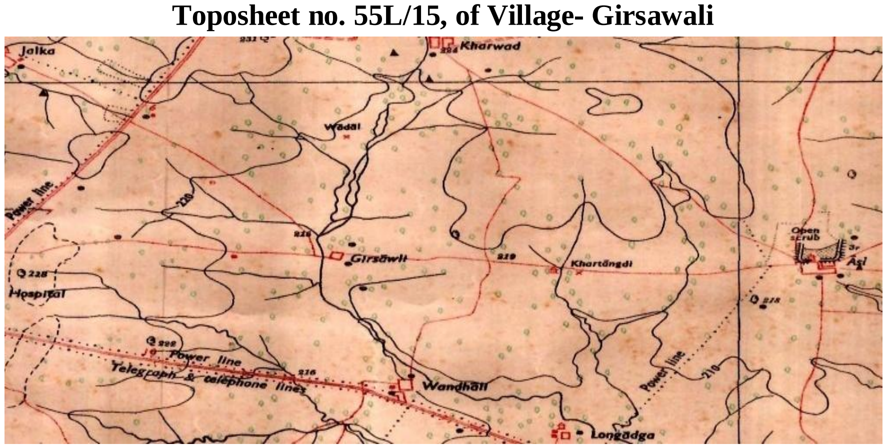

Fig 3: Study Area of Village- Girsawali, ,Tahsil- Warora, District-Chandrapur

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Methodology

The present study is baseongeomarphologicalandhydrogeologicalstudy of the area.

Climate and Rainfall: The area falls under sub arid climatic condition. In the project area the day time temperature varies from 22^{0}c to 47^{0}c during all seasons and the temperature range during night time is having variation from 10^{0}c to 27^{0}c in all seasons. The study area falls under the assured rainfall zone and the intensity of rainfall during the period July to October is high accounting for the two thirds of the annual precipitation. The rainfall data thus obtained was arranged according to the decending order of rainfall [6] and [9]. Then as per the the guide lines given 75% dependability criteria, it came to notice that the rainfall for year 2012 i.e. 1426.20 is the dependable rainfall. The details for rainfall analysis are as given below in the form of table.

Table1: Rainfall analysis of last 10 year (2008 -2017)

Sr. No.	District	Taluka	Year	Rainfall in mm
1	Chandrapur	Warora	2017	1168.70
2	Chandrapur	Warora	2016	887.20
3	Chandrapur	Warora	2015	1281.80
4	Chandrapur	Warora	2014	540.00
5	Chandrapur	Warora	2013	1364.40
6	Chandrapur	Warora	2012	1426.20
7	Chandrapur	Warora	2011	1625.90
8	Chandrapur	Warora	2010	1640.90
9	Chandrapur	Warora	2009	585.60
10	Chandrapur	Warora	2008	1386.60

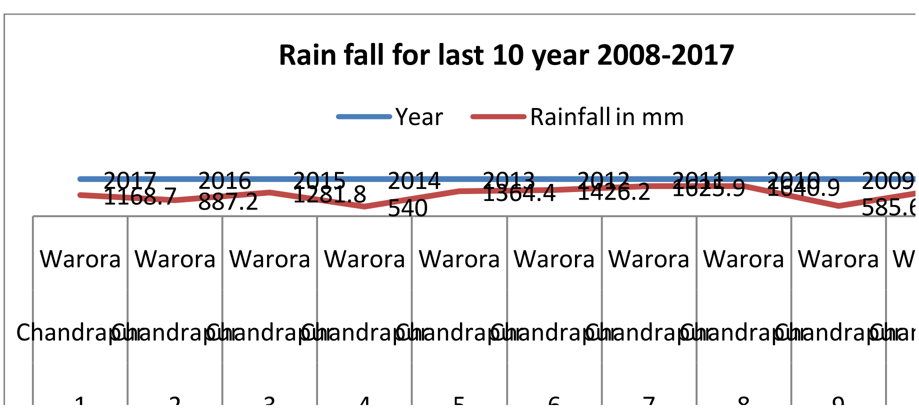

Fig 4: Histogram of rain fall for last 10 years 2008-2017,in Tahsil –Warora, District-Chandrapur

Table 2: Rain fall analysis for 75% Dependability ofTahsil-Warora , District –Chandrpur of last 10 year (2008 to 2017)

Sr. No.	District	Taluka	Year	Rainfall in mm
1	Chandrapur	Warora	2010	1640.90
2	Chandrapur	Warora	2011	1625.90
3	Chandrapur	Warora	2012	1426.20
4	Chandrapur	Warora	2008	1386.60
5	Chandrapur	Warora	2013	1364.40
6	Chandrapur	Warora	2015	1281.80
7	Chandrapur	Warora	2017	1168.70
8	Chandrapur	Warora	2016	887.20
9	Chandrapur	Warora	2009	585.60
10	Chandrapur	Warora	2014	540.00

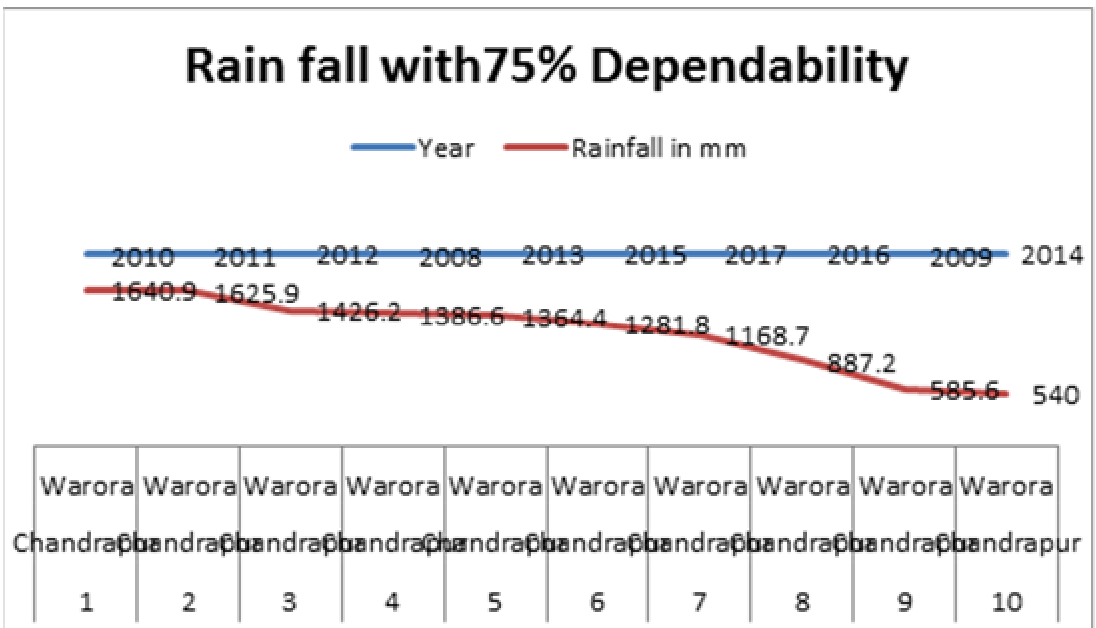

Fig 5: Histogram of Rain fall analysis with 75% Dependability inTahsil-Warora,District-Chandrapur

Soil

The village Girsawli is occupied by very fine montmorillonitic hyperthermic soil cover. This soil very less permiability leading to less underground recharge and more surface runoff. It has good capability of holding surface water.

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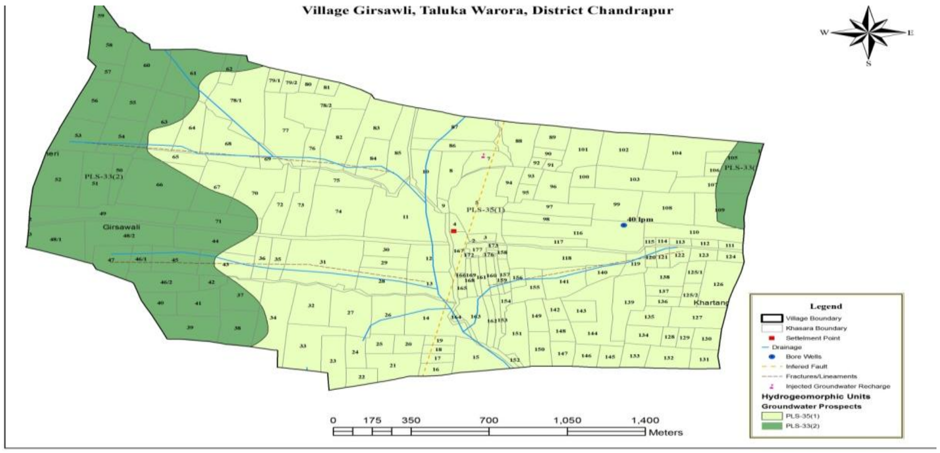

Fig 5: Showing Hydrogeomarphic units in ground water prospects

The remote sensing study is carried out and information collected related to the study area . Details field work has been carried out for collecting data and required geological and geomarphological, hydrogeological and rain fall information by using remote sensing and GSI technique.

Result and Discussion

The village is having more or less flat topography. The entire area of the village is represented by a moderately plain terrain with the different of elevation is 5m. The maximum elevation value is218GDm its noticed on NE corner of the village and the minimum value is 214 m towards southern portion of Gaothan. All the streams flowing through the village are draining southern corner indicating of slope direction towards south. The general slope of the area is gentle i.e. 1° to 2°. The village is drained by the nala which is the 3rd order stream flows towards south. The drainage is Dendritic, which is typical for the basaltic terrain and right angle which is underlying sedimentary formation.

Geological succession

The main rock types are primitive basaltic rocks belonging to Chikhali Formation of Sahyadri Group from Deccan Trap Super Group (Resource Map, GSI). The basaltic lava flows are of simple in nature. Limestone's and shale belonging to Lameta Formation occurs unconformably below these basaltic rocks. Limestones are clasticin nature and at some area silicification is noticed. The Cherty Limestone is overlain unconformably by weathered basaltic.

Total Water gained from all sources.

1) Public Utility Wells: 16.88 cum/day but it is not potable

2) Bore wells with hand Pumps: Nil (No HP is present in the village)

3) PWS Scheme: 71.50 cu. m/day

Availability of surface Rain off

Thus water are available from all drinking water sources is 71.50 cu.m/day.

The availability of surface water for artificial groundwater recharge is calculated by using Strange table. As per the discussion given the rainfall with 75% dependability for tehsil Warora is 1426.20 mm. according to strange table,

1) Runoff will be 20.40%
2) The depth of runoff is 219.8250mm.
3) The Yield in TCM/sq.km is 223.4422 sq.km.
4) Yield in TCM/Ha is 2.2134/ha.

Therefore, the total availability of Runoff for village Girsawali is

= Total Area of village X Yield in TCM

= 510.23 ha X 2.2134

= 1129.34 TCM.

Thus in the village-Girsawali, the total available runoff for the purpose of groundwater recharge is 1129.34 TCM.

Table 3: Estimation of aquifer storage capacity

Sr. No.	**Watershad No**	**Geographical Area (Ha)**	**Assessment (Worthy) area (Ha.)**	**Depth to water level (Post Monsoon) below cut off level (m)**	**Volume of unsaturated zone (Ham)**	**Average Specific yield (%)**	**Total aquifer storage potential as volume of water (Ham)**
1	***2***	***3***	***4***	***5***	***6 = (4*5)***	***7***	***8 =(6*7)***
1	WRD	492.13	460.00	3.00	1380.00	0.037	51.06

Problems Identified

The village-Girsawaliare sources of contamination of Fluoride above permissible limit (from 2.00 ppm to 2.65 ppm). The PWS source is recently started working and is located 1 km north of the village. There are no any source of potable water quality is present.

Thereareincrease groundwater level by process of recharge in the aquifer. There by increasing groundwater resource for drinking and irrigation purposes. The Storage capacity of the aquifer is approximately 51.06ham(hectare-metre) and to fulfill the requirements for aquifer recharge, quantity of surface water shown in **Table 3**. The best way to recharge to groundwater will be increase maximum rainfall in to ground trough suitable water conservation structures.

On the another side the quality of groundwater may be improved through artificial recharge. Groundwater means various surface water conservation measures like Direct Injection of surface water to aquifer. i.e recharge shafts, recharge trenches, roof top rainwater harvesting.

Solutions Given:

1] Rainwater harvesting structures: A point source recharge for improving groundwater quality, the roof top rainwater harvesting touse the public utility wells is implemented.

2] Recharge Shafts: The village is drained by a 3rd order stream having catchment of about 2500 ha and slop is moderate. It is identified thatdirect injection of surface running water through this drainage. if injected along the upper reaches of the mini watershed will be helpful in improving the groundwater quality. Therefore recharge shafts are essential to be constructing upstream of the village [6] and [9].

3] Recharge Trench: The existing nala is silted due to silt deposition from past. There are runoff percentage isvery high and only construction of recharge.shaft will not serve the issue that is the reason. Recharge trench to augment surface runoff Needs to be constructed for increasing the efficiency of recharge[9].

Conclusion

The study ofgeomarphometric analysis shows that the maximum stream is of 3rd order nature with dendrite drainage pattern. Groundwater scarcity zone map shows poor, low moderate and high fluctuate hydrogeological and geomarphological with rain fall of surface to identify the causes of contamination and its origin with specific remedial measures through dilution and preventivemeasurement for contamination. Rainfall availability for artificial groundwater recharge. There are need to implement of rain water harvesting measures so as to bring contamination concentration with permissible and desirable limits. To create awareness community with the affected villages about causes of contamination and preventive measure from long term availability of safe drink water.categorized in to older alluvial plain , residual hill and Quaternary ages covers about 75% of the total area.

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