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Integrated Approach for Analyze of Physiographic Situation in Part of Gondia District (MS).

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Abstract:-

The present work deals with the assessment of geology, geomorphic and groundwater potential zones in parts of Gondia districts of Maharashtra. In the process of assessment of groundwater in the area, different thematic maps on lithology, lineaments, geomorphology and land use/land cover were prepared and assigned with differential weight age values as per their groundwater recharge and storage characteristics. Major part of the district is underlain by hard rock, where only dugwells are most feasible structures for ground water development. The sites for borewells need to be selected only after proper scientific investigation.

Keyword: - *Geomorphic, Groundwater situation*

Introduction:-

Water is a prime natural resource for human beings and hence a precious national asset. The easy and cheaply available groundwater is the most important resource for domestic, industrial and agricultural uses *etc.* (Lamas and Santos, 2005). However, rapid growth of population, vagaries of rainfall, expansion of irrigation, increased industrialization *etc.* have resulted into enhanced demand for groundwater in various parts of the country (Chalantika Laha and Dr. Sunando Bandyapadhyay, 2013, Bisen D.K and Kudnar N.S., 2013 a, Zode R., at el. 2014). As a result, the groundwater prospecting, exploration and management have become a big task in India in general, and certain drought prone areas in particular ((Kudnar, N. S., 2015, Vijay Paranjpye, 2013). Hence, in the current scenario, it has become crucial not only to find out groundwater potential zones, but also to monitor and conserve this important natural resource.

The district comes under Nagpur division (Vidarbha) in Maharashtra State. It is newly formed district and carved out by the division of Bhandara district in May 1999 (Kudnar, N.S. & Rajasekhar, M, 2019, Day, P.,2007, Anderson, K., & Martin, W., 2008). Gondia district as well as its parent district are unique in Maharashtra and differ from the rest of the State in the following three ways:-

i. The entire area of the district is occupied by crystalline rocks while rest of the State is covered by Deccan Basalt.

ii. Paddy is the staple food crop of the district while wheat is the main agriculture produce in the rest of the State; and

iii. It is endowed with the presence of Malguzari Tanks.

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Study Area:-

Gondia district is situated on north-eastern side of Maharashtra State and share the state borders with Madhya Pradesh on north an Chattisgarh in east. It covers an area of about 5859 sq.km and lies between 20°39 and 21°38 north latitudes and 79° 52' to 80°42 east longitudes. The adjoining districts to Gondia are on northern side Balaghat district of Madhya Pradesh State and on eastern side Rajnandgaon district of Chhatisgarh State. To the south and west are Chandrapur district and Bhandara district respectively of Maharashtra.

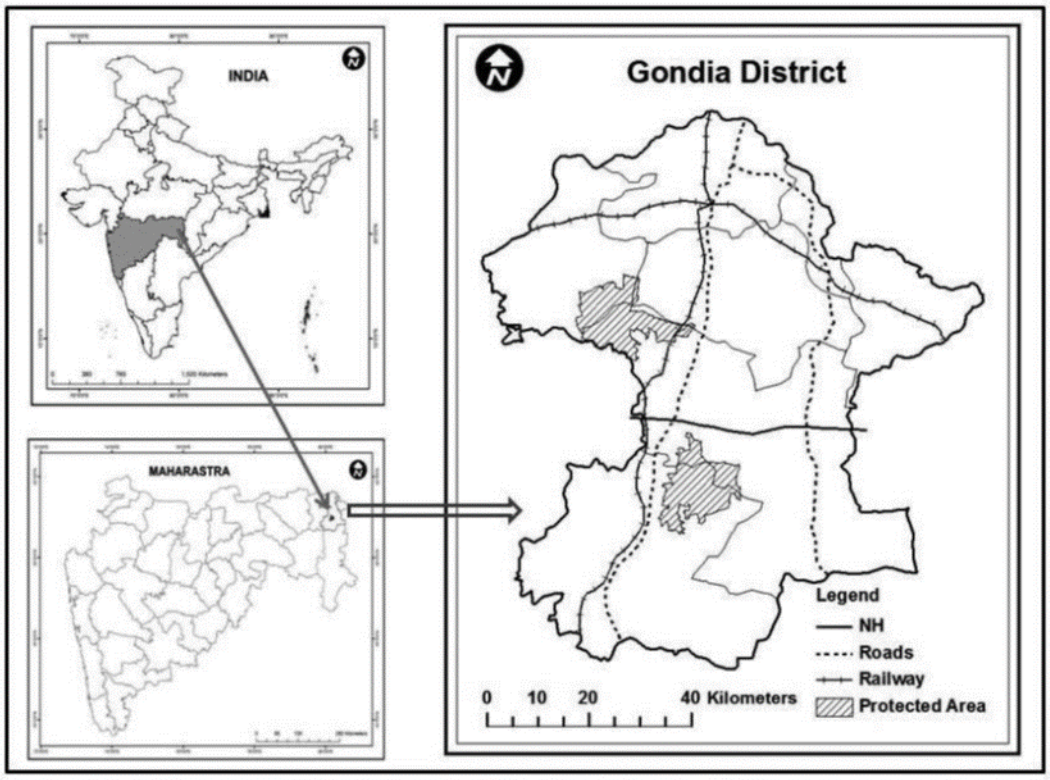

Fig: I. Study Area

Objectives:-

1) To understand ground water condition of Gondia district.
2) To analyze the geological, geomorphologic & climatic situation of Gondia district.

Used Data & Methodology:-

Three types of data sets were used for the groundwater assessment studies;

a) Topographical map of Survey of India on 1:50,000 scale

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b) Secondary data on hydrology collected in the field itself *i.e.* well inventory details.

It is essentially based on two techniques - semi structured interview of resource persons and focus group discussion. In addition to these interactive techniques, some village tanks were visited with the community members. Secondary data are collected from the sources like district gazetteers and district socio economic review.

Case studies on irrigation aspect of the tank management by some earlier researchers have been used to substantiate the limited coverage of irrigation aspect in the present study. These case studies conducted in 2010 essentially cover self-initiated community based irrigation management in two villages in adjoining Bhandara district. Gondia district shares a lot of similarity with Bhandara district. In fact it was carved out of Bhandara district in 1999.

Subject Matter:-

Geological Structure:

Gondia district is unique in Maharashtra in sense that the entire area of the district is occupied by metamorphic rock and alluvium. ducks (Kudnar, N. S., 2018, Vijay Paranjpye,2011).

The brief description of various lithorites is given below

Table I: Geological Structure:

Age	Formation	Lithology
Pleistocene to Recent	Alluvium and Lalerite	Silt, Sand, Gravel, Laterite
Protozoic	Vindhyan Super Group	Quartzite and Shale
	Doongargarh Super Group	Andesite, Sandstone granite, Ehyolite
	Sausar Group	Muscovite-boitite-schist, Granite, Tirodi Gneiss
	Sakoli Group	Schist, Phyllites, Quartzite
Archaean	Amagon Group	Granite & Gneisses

- Alluvium is developed all along major river courses such as Bagh, Chulbandh and Gadavi.

- Laterites are distributed all over the district but observed prominently in S.Arjuni and Arjuni Moregaon.

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- Metamorphic rocks like various granites, Gneiss, Schists, Phylites etc. are exposed throughout district. - Gondia district is rich in economic minerals like manganese, kyonite, sillimanite corundum and pyrophyllite (Raghunandan A. Velankar, 2011, Zode R., at el. 2015, Kudnar, N. S., 2019).

Geomorphology

Geomorphologically the district can be divided into two parts

1) The north-Western, north eastern, south-eastern and central parts which have structural units like hills and ridges.

2) The northen, north-central, west central, south and south-west portions having undulating topography over denudational units like pediments and fluvial units (Kudnar, N.S. & Rajasekhar, M, 2019)

The important geomophological units identified in the are are below

Nature of Unit	Land form
1. Structral origin	Structral hills and structral ridges
2. Denudational Origin	Pediments/Pediplains, denudational
3. Fluvial Origin	Older and younger alluvium.

Climate

Gondia District experiences extreme variations in temperature with very hot Summers and very cold Winters and an average relative humidity of 62 percent. Minimum temperature of 7.4 D.C. and Maximum temperature of 47.5 D.C. recorded in the year 2011.

Rainfall

Gondia district receives rainfall from South- Western winds mainly in the months of June, July, August and September. July and August are the months during which the maximum rainfall as well as maximum continuous rainfall occurs.

The following table shows , taluka-wise average rainfall statement for the last 4 years.

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Table II: Rainfall

Sr. No.	Name of Taluka	Average Rainfall During Last 4 Years (in mm)			
		2008	2009	2010	2011
1	Gondia	1551.6	933.1	1227.6	1049.0
2	Goregaon	1107.6	905.0	1299.4	1106.9
3	Tirora	1263.6	867.6	1320.8	1003.4
4	Arjuni Moregaon	1203.2	890.4	1954.2	1653.1
5	Deori	1051.9	870.0	1213.0	917.3
6	Amgaon	1352.3	845.0	1371.0	1274.0
7	Salekasa	1412.8	947.6	1384.5	1375.6
8	Sadak Arjuni	1373.4	1108.2	1819.3	1142.5
Total		10316.5	7366.9	11589.8	9521.8
Average		*1289.5*	*920.8*	*1448.7*	*1190.2*

Water Level Trend (2001-2011)

Trend of water levels for premonsoon and postmonsoon period for last ten years (2001-2011) have been computed for 21 GWMS. Analysis of trend indicates that during premonsoon period, rise in water level has been recorded at 9 stations and it ranges between negligible (Ghonari) and 0.56 m/year (Sondad). (R. Bhavani, 2013).

Fall in water level has been observed at 12 stations and it ranges between 0.02 at Goregaon and 0.42 m/year at Amgaon. During post-monsoon period, rise in water levels has been recorded at 3 stations and it ranges from negligible m/year(Karandli) to 0.54 m/year (Sindkheda), whereas at 18 stations, fall in water level ranging between 0.02 m/year (Kohmera) and 0.16 m/year (Sejgaon) is observed. Thus in major part of the district, both during pre and postmonsoon periods declining trends of water levels have been observed (Kudnar, N. S., 2018, Vijay Paranjpye, 2011).

Suitability of Ground Water for Irrigation Purpose

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The water used for irrigation is an important factor in productivity of crop, its yield and quality of irrigated crops (Bisen D.K and Kudnar N.S., 2013 c). The quality of irrigation water depends primarily on the presence of dissolved salts and their concentrations. Sodium Absorption Ratio (SAR) and Residual Sodium Carbonate (RSC) are the most important quality criteria, which influence the water quality and its suitability for irrigation. (Kudnar, N. S., 2015).

Ground Water Development

A major part of the Gondia district is underlain by crystalline rocks comprising of granitic gneisses, schist's, volcanics etc. These formations act as good aquifers only where the thickness of the weathered mantle is high and they are affected by sets of open joints and fractures. Ground water development in the area is on moderate scale. There are three type of ground water structures i.e. dugwells, borewells and tubewells in the area. Dugwells one normally able to sustain 3 to 6 hours of pumping per day and the duration of recuperation vary from 3 to 9 hours. A large number of dug-cum-borewells are present in this district, the depth of the bores ranging from 15 to 30 meters from the bottom of the well. Topographic lows and the areas where the thickness of weathered mantle is high are usually the favourable zones for such wells. The study of litholog of exploratory wells indicates the presence of weathered formations down to 30 m bgl followed by jointed/fractured formations extending up to another 30 to 40 m bgl. Due to this fact, the depth of dugwells should not exceed more than 25 m and depth of borewells by more than 70 m. , (Bisen D.K and Kudnar N.S., 2013 b, Zode R., Chaturvedi, 2014)

Water Conservation and Artificial Recharge

Percolation Tanks and Cement Bandharas are the feasible artificial recharge structures in the district. The existing dugwells can also be used for artificial recharge; however, the source water should be properly filtered before being put in the wells. As the post-monsoon water levels are shallow in major part of the district, extreme care should be taken while selecting the sites for artificial recharge structures. The sites need to be located where the hydrogeological conditions are favourable, i.e., where sufficient thickness of desaturated/ unsaturated aquifer exists and water levels are more than 5 m deep in postmonsoon season. Such areas are restricted and occur in central and southern part of the district, occupying parts of Deori and Arjuni Morgaon talukas. However roof top rainwater harvesting by storing the water in storage tanks during rainy season for use during non-monsoon season should be encouraged in scarcity affected areas as well as in urban area (Bisen D.K and Kudnar N.S., 2013).

Conclusion:-

1) As the post-monsoon water levels are shallow in major part of the district, extreme care should be taken while selecting the sites for artificial recharge structures. The sites need to be located where the hydrogeological conditions are favourable, i.e., where sufficient thickness of

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de-saturated/unsaturated aquifer exists and water levels are more than 5 m deep. Such areas are restricted and occur in central and southern part of the district, occupying parts of Deori and Arjuni Morgaon talukas

2) The major part of the district is underlain by crystalline rocks comprising of granitic gneisses, schist's, volcanics, etc. These formations act as good aquifers only where the thickness of the weathered mantle is high and they are affected by sets of open joints and fractures. Therefore, the topographic lows and the areas where the thickness of weathered mantle is high are usually the favourable zones for dugwells and dug-cumborewells.

3). Major part of the district is underlain by hard rock, where only dugwells are most feasible structures for ground water development. The sites for borewells need to be selected only after proper scientific investigation.

4). Abandoned Malguzari tanks should be revived and proper care should be taken of the existing tanks by regularly de-silting them and reclamation of tanks should be stopped.

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