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GIS BASED ANALYSIS OF GROUNDWATER VARIATION IN MAHESH RIVER BASIN, AKOLA AND BULDHANA DISTRICTS, MAHARASHTRA, INDIA

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Abstract: Groundwater is an important and vital factor of any life support system. It is crucial for agriculture,industry and human reality.During last two decades, in the absence of regulatory guidelines, uncontrolled and inconsistent exploitation of groundwater had adversely affected its potentiality unevenly. The reserves of water on Earth are immense, but this is mostly salt water which is unsuitable for drinking and irrigation purpose.In this study focuses on the GIS based analysis of ground water variation study, maximum and minimum ground water level of ground water table present in area. In this study ground water level data was collected from35bore and open wells in villages locatednearby Mahesh river basin inAkola and Buldhana district with the help Garmin GPS.The locations of the observation wells were converted on the base map in GIS software. In present study area survivals for last five years is not sufficient rainfall unregularly and day by day decreaseground water level.The analysis of result also monitors ground water fluctuation using GIS techniques in Mahesh river basin.

Keywords:GIS, Water fluctuation, GPS and Spatial Interpolation.

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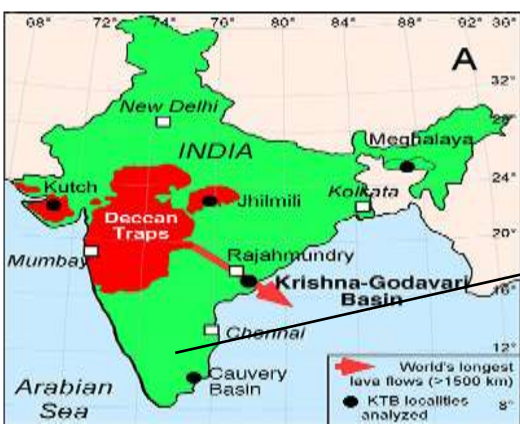
INTRODUCTION

Water is one of main resources essential for the overall socio-economic development of any region and it requires careful planning and appreciates exploration. Groundwater resources assessment in many areas of the country is critical for the developmental strategies of integrated water management. Wide spatial-temporal variation in the occurrence of ground water resources warrants scientific exploration to locate best sites for tapping this valuable resource. It has many other advantages over surface water. Fast industrial growth, urbanization and rise inagricultural manufacture have led to freshwater lacks inmany parts of the world. To suitable supply of water forvarious purposes like agronomic, domestic and industrial, agreater importance is being laid for a planned and optimalutilization of water resources. The water condition foragriculture, municipal and industries is higher than the yearlyrecharge. This may principal to reduction of ground water. Onother hand, continuous withdrawals from groundwaterreservoir in excess of replenish able recharge may result inlowering of water table. Surface hydrological indications areone of the promising scientific tools for assessment andmanagement of water resources. Drainage morphometricanalyses are a prerequisite for selection of water recharge site,watershed modeling, runoff modeling, watershed delineation,groundwater prospect mapping and geotechnical investigation. (Magesh et al., 2011; Thomas et al., 2012;Khadri, Chaitanya Pande, Moharir K (2013) and Khadri, S. F.R. and Kanak N. Moharir 2014) In this study area of thedata gathered from GPS surveys and from environmentalremote sensing systems can be fused within a GIS for asuccessful characterization and assessment of watershedfunctions and conditions.Better interpretation of hydrogeological data often requires that their spatial location be in corporate into the analysis. Geographic information system can be used for storing hydrogeological data as well as their spatial locations in a relational database. It also provides the facility to analyze the spatial data objectively using various logical conditions. As a result, nowadays, GIS is widely used for spatial modeling of hydrogeological prospect of a large area with more reliability. Examples from recent literature spotlight several uses of GIS as applied to ground water exploration. Gustafsson (1993) is used a GIS for the analysis of lineament data derived from SPOT imagery for ground water potential mapping. Minor et. al. (1994)has developed an integrated interpretation strategy to characterize ground water resources for identification of well locations in Ghana using a GIS as the unifying element. For the assessment of ground water resources of Northwest Florida Water Management District, Richards et. al. (1996) has taken the advantage of GIS for spatial analysis and data visualization. Krishnamurthy et. al. (1996) have developed a GIS based model for delineating ground water potential zones of Mahesh River basin, Maharashtra, India by integrating different thematic layers derived from remote sensing data. The present study understanding of ground water is essential for the reality of people survives inrural areas.

Study Area

The Mahesh River basin is situated in Akola and Buldhana districts of Maharashtra which is located between 76° 46’11’’ E and longitude 20°40’ 36” N latitude covered by survey of India Toposheets no. 55 D/9, 55 D/7, 55D/11,55D/13,55D/14and 55 D/15on 1:50,000 scale. It can be approached from Amravati by road transport which is about 120 Km. The Mahesh River basin which is a major tributary of Mun River lies towards the western and southern part of Akola and Buldhana districts. The total area covered by Mahesh River Basin is 328.25 Sq. Kms. the study area is occupied by alluvium and Deccan basalts which are horizontally disposed and is traversed by well-developed sets of joints. The Ajanta hill ranges are bordering the district in the Southern with their slope towards Western. The starting part of Akola district is plain whereas the western part is again elevated with its general slope towards Sothern. The Mahesh River Basin flows in the Southern to Western direction having western slope and meets the Mun River near Balapur village in Akola district. Purna is the major river of the Akola and Buldhana district. The important tributaries of Purna River are Katepurna, Morna, Man, Vidrupa, Shahanur, Van and Nirguna. Most of the watershed area was covered by unconsolidated sediments, black cotton soil, Red soils and basaltic rocks of Deccan Traps. The study area was drained by Mahesh River flowing south to western with almost dendritic to sub-dendritic pattern (Fig.1).



Deccan Trap of Maharashtra Map

Akola and Buldhana District Map

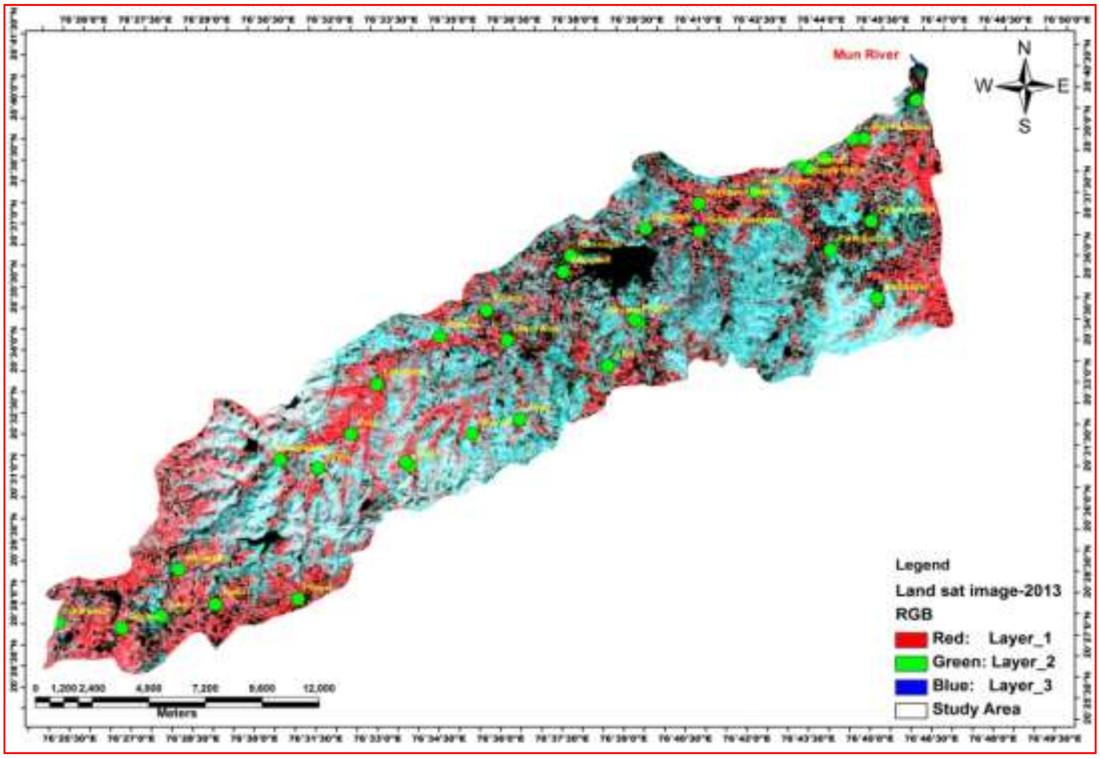


Fig. 1: Location map of Mahesh River Basin

Deccan Traps:

The occurrences and distribution of groundwater is mainly controlled by litho logical, structural, geomorphologic on climatic condition in basaltic terrain, under the water table, semi-confined and unconfined condition, it is interesting to note that basaltic lava flows develop peculiar characteristics, especially on the top layer which makes the basaltic rock capable of holding and transmitting groundwater. Secondary features like degree of weathering, spheroidal weathering, jointing, fissuring and fracturing develop the secondary storage space for groundwater. The Deccan trap has three different water bearing horizons viz. massive basalt (Jointed, fractured),vesicular basalt and weathered basalt. The permeable zone includes the flows, themselves. The basic properties such as ability to receive recharge, hold water in storage and transmit it by gravity are different for different litho logical units of the trappean flows. In basalt formation groundwater occurs generally in unconfined condition. In general the physical characters of basalt control the groundwater potential its degree of weathering and weathered products.

Massive Basalt:

Majority of the Deccan trap is composed of massive basalt and is the major water bearing formation of the area, massive basalt is devoid of primary porosity and permeability except some fractures and joints, which are later enlarged by weathering along the joint planes and are acts as a major. The major part of study area is consisting Deccan trap which is composed of massive basalt. It is the main water bearing formation of the area. Massive basalt as such doesn't have primary porosity and permeability except some fractures and joints. The joints, which are later, enhanced by weathering along the joint plains, are the major conduits for water storage and transmission. Occasionally, the closely spaced interconnecting joints present in between the massive horizons may contribute towards the formational porosity and can form productive zones. The size and number of vesicles, degree of weathering and jointing pattern mainly control the water productivity and yielding strength of aquifer in basaltic terrain.

Alluvium:

The sand and gravel beds have high degree of porosity and permeability. In the Mahesh River basin it is the major water bearing formation as it is found in patches along nala cuttings. As these formations have higher porosity and permeability these formations have appreciable yield. The yield of dug wells in the alluvium depends upon the thickness of granular zone (which is near about 5 to7 meters) as well as sand /clay ratio, composition and nature of packing. The Eastern part of the basin is occupied by the older and younger alluvium.

Methodology:

In this study bore and open wells are dominant in the hard rock terrain of the Mahesh River basin. The selections of 35 observation wells have established to monitor variation in groundwater levels in area. The wells are open dug well and bore well type mostly used for drinking and irrigation purposes. The groundwater levels were record on seasonal basis from 35 observation wells were observed for groundwater fluctuation for two seasons of the area.Whilecollecting ground water level data some neededsupport has been taken from GSDA Amravati.

Results and Discussion

Geo-hydrology and groundwater exploration means to identify and to locate the zone of recharge of groundwater in a particular river basin or a catchment. These particular zones are present in various terrains. The identification of such places from the entire area, are thus selected for groundwater exploration. The Geological set up is established for knowing about surface and subsurface nature of terrain. It is well established that geology plays a vital role in the distribution and occurrence of ground water. Krishnamurthy and Srinivas (1996) have carried out various geological studies in different terrains and proved that IRS data can be effectively used for geological mapping.In order to understand the groundwater conditions of the study area, a general lithological map hasused (Fig.2). Topographic and surface features are mapped in order to determine from highest to lowest area. This may provide some information about the movement and storage of ground water, where water from different higher places can move and accumulate. In this present area records of 35 wells were identified. The groundwater level depth and diameter in basalt ranges was recorded such as 6.1 to 16.36 m 4 to 7 m.bgl respectively.The main water bearing properties of the formations of the area are summarised as follows(Table 1).

Table 1: Showing well inventory data established in Mahesh River Basin

S. N.	Village Name	Geology	Nature of Water Bearing Horizon	Diameter	Depth
1	Balapur	Alluvium	Alluvium	4	11.2
2	Umra Lasura	Alluvium	Alluvium	2.72	9.2
3	Sambhapur	Deccan Basalt	F.M.B.	2.9	6.1
4	Shendri	Deccan Basalt	W.V.B.	1.7	7.4
5	Hingna Umra	Deccan Basalt	W.V.B.	2.2	8.9
6	Ambikapur	Deccan Basalt	V.B.	6	12.1
7	Koregaon BK.	Deccan Basalt	F.M.B.	3	11.2
8	Hingna	Deccan Basalt	F.M.B.	1.78	7.5
9	Nilegaon	Deccan Basalt	F.M.B.	4.24	14.2
10	Ramnagar	Deccan Basalt	F.M.B.	4.5	11.4
11	Wihigaon	Deccan Basalt	J.M.B.	5.16	8.4
12	Kherdi	Deccan Basalt	F.M.B.	3.63	9.7
13	Umra	Deccan	W.V.B.	4.5	11.2

	Atali	Basalt			1
14	Naidevi	Deccan Basalt	weathered jointed M.B.	4.2	16.6
15	Lokhanda	Deccan Basalt	Sheroidal W.M.B.	5.5	9.4
16	Pala	Deccan Basalt	Weathered jointed M.B.	3.13	7.5
17	Sirala	Deccan Basalt	W.V.B.	4	11.8
18	Ganeshpu ra	Deccan Basalt	M.B.	7.3	10.2
19	Wairagad	Deccan Basalt	W.V.B.	3.6	8.2
20	Undri	Deccan Basalt	Slightly jointed M.B.	2.1	9.4
21	Dasala	Deccan Basalt	F.M.B.	4.2	11.4
22	Kinhi	Deccan Basalt	F.M.B.	6.85	12.4
23	Pimpri	Deccan Basalt	F.W.B.	4.58	8.7
24	Nirod	Deccan Basalt	F.W.B.	2.35	8.4
25	Gharod	Deccan Basalt	F.M.B.	2.92	10.4
26	Akoli	Deccan Basalt	Slightly jointed M.B.	2.8	12.4
27	Atali	Deccan Basalt	weathered jointed M.B.	5.78	9.1
28	Patunda	Deccan Basalt	weathered jointed M.B.	3.12	12.4
29	Pedka	Deccan Basalt	W.V.B.	3.67	14.5
30	Kadmapur	Deccan Basalt	spheroidal W.M.B	2.1	8.6
31	Palshi Kh.	Deccan Basalt	F.M.B.	3.24	9.7
32	Palsi Bk.	Deccan Basalt	F.M.B.	5.74	8.5
33	Umra Lasura	Deccan Basalt	F.M.B.	4.85	7.6

34	Takarkhed-1	Deccan Basalt	F.M.B.	3.57	13.2
35	Takarkhed-2	Deccan Basalt	Slightly jointed M.B.	3.07	12.4

J-Jointed F Fractured W-Weathered V-Vesicular

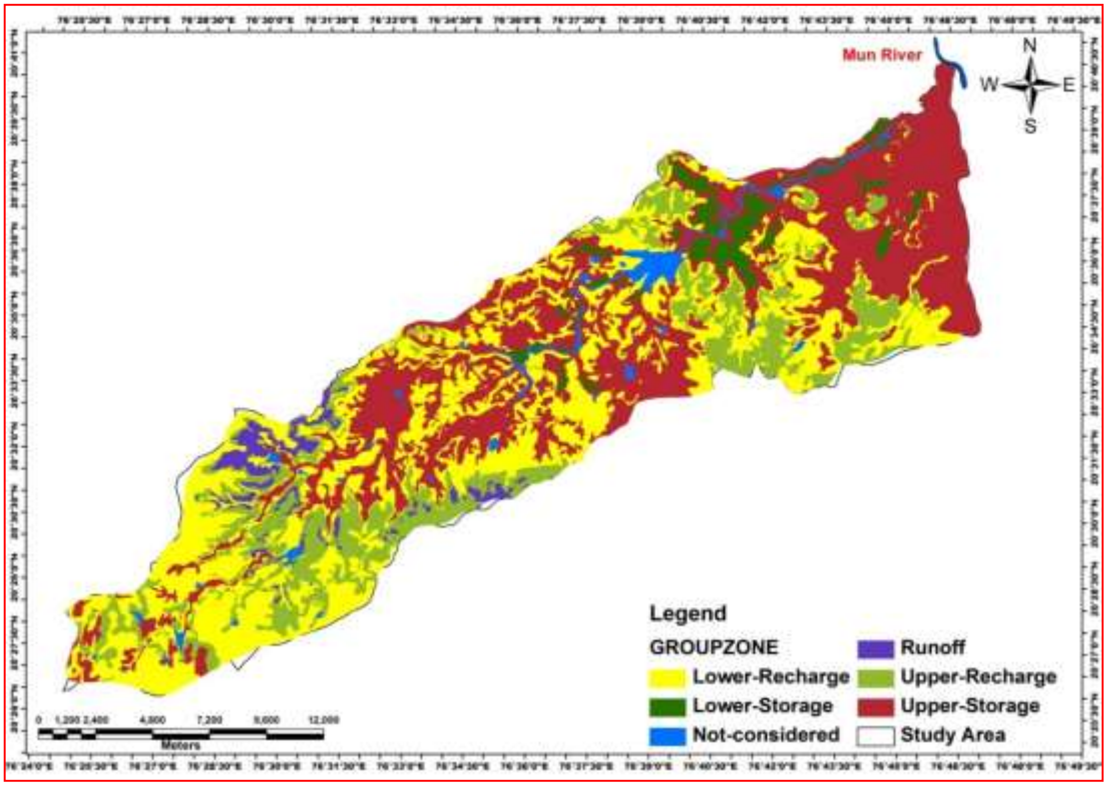


Fig. 2: Showing favorable water bearing zones mapping of the Mahesh River Basin

Depth of Water Level

In present study area detailed study of 35 observation wells was recognized, theirsite and groundwater depth were observed during season period of yearly (Table1). The depth of ground water table ranges from 3.5 to 16 m. bgl. For pre monsoonperiod ground water level 6 to 16.3 m. bgl. Were measured in area with help of interpolation techniques. If these factors are favourable then the aquifercondition holds good for good groundwater potentiality. Agood aquifer is one which has been recharged during theperiod of monsoon when rain water gets infiltrated andrecharged. The Kadmapur and Lokhanda villages were recorded 14-17mground waterlevel and Ambikapur, Dasala, Sirala and Takarkhed were recorded 6.1-7.2m depth ranges in Mahesh river basin (Fig.3).

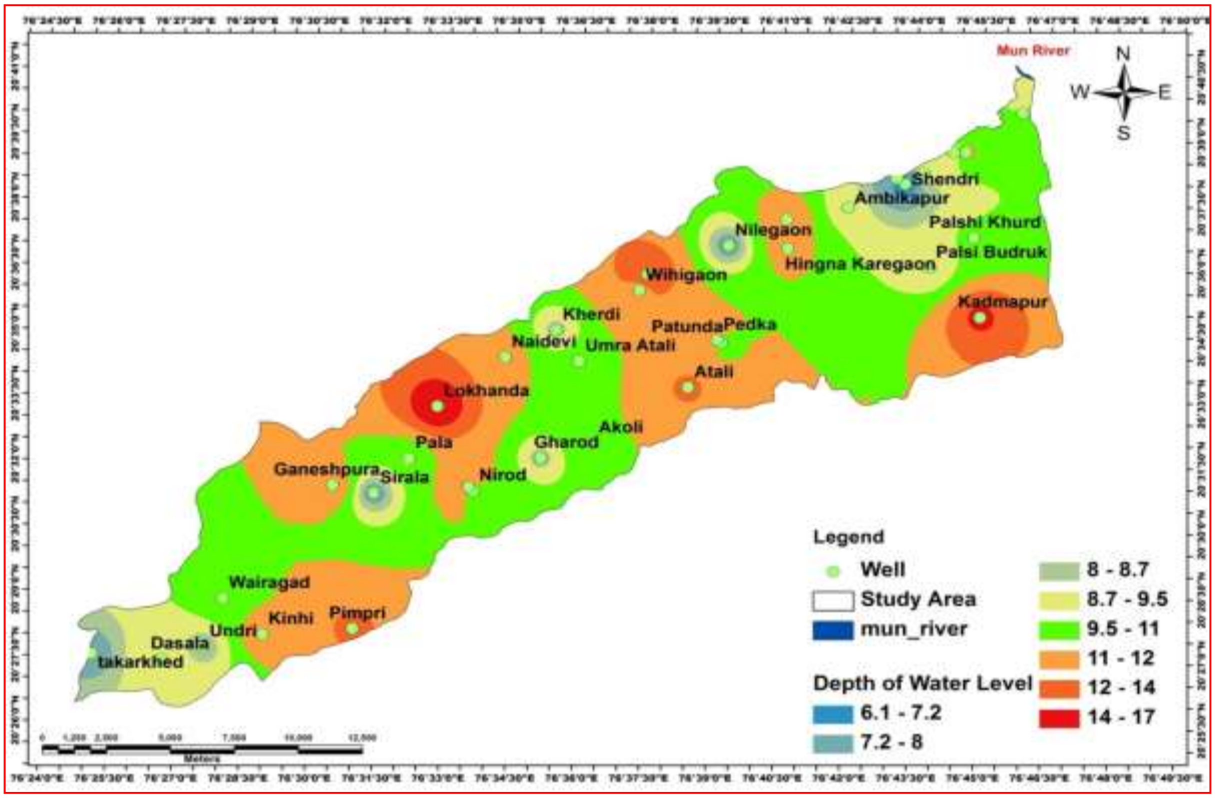


Fig. 3: Water Level Depth of Mahesh River Basin

Conclusion

The groundwater table and spatial interpolation of groundwater level map is used in defining the situation, range andnature of aquifer in area. These water level maps also give the information about ground water flow bearing and soil and water conservation site and discharge areaGroundwater is most important precious resource ofecological system. Recently there has been overalldevelopment in various fields such as agriculture, industryand urbanization in India. This has led to increase in thedement of water supply which is met mostly fromexploitation of groundwater creating a water stress condition.Groundwater identification program needs a large volume ofdata from various sources. The above ground water level map shows that highest water shows western side and central part of the area around Undari and Dasala villages in area. The water level data displays that ranges of water always decrease using Arc GIS software 10.3.

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