Delineating Groundwater Potential Areas Based on Bore Well Characters in Kodoli Basin, Panhala Taluka, Kolhapur District, Maharashtra

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Abstract

The Kodoli basin is of 5th order basin, Kolhapur Taluka, Maharashtra. The Cretaceous flow basalts are the litho units. The groundwater occurs under water table and semi-confined to confined conditions Based on the hydrogeology and the characters of the existing bore wells (depth-yield-casing), groundwater potential zones have been delineated. It has been found that the central part of the basin is more suitable area for future development.

Key Words

Groundwater Potential Zones, Deccan Basalts, Kodoli River Basin, Maharashtra.

Introduction

The uneven distribution of rainfall and limited availability of surface water made water scarce. This has given the geologists, especially for hydrogeologists an opportunity to search for groundwater as an alternative source. The depletion of rainfall in recent years has caused significant lowering of water table. Hence, the dug wells are dry and sinking of bore wells has become common. A well has to be designed to get optimum quantity of water economically from a geological formation (Raghunath, 1974). The depth of fracturing and weathering as well as the nature of weathering products determine the availability of groundwater and supply to the well (Karanth, 1987). There may or may not be any relation between depth of drilling and yield of bore wells. An analysis of a large number of bore well data of an area provides information about the conditions of groundwater occurrence. In the present work, authors have studied the occurrence of groundwater and the characters of bore wells sunk in the Kodoli basin, Panhala Taluka, Kolhapur District, Maharashtra and suggested potential areas in the basin.

The basin is found in the survey of India toposheet no. 47 L/l and lies between latitudes 16° 48' 8" to 16° 54' 30" north and longitudes 74° 9' to 74° 13" 50' east. The Kodoli river is a tributary of Krishna river flowing from south-to north direction. It is a fifth order basin, covering an area of 115 sq. Kms.

Geology

The basin is on the flow basalts (Deccan traps) of Cretaceous age and mostly covered by black soil. The detailed study reveals that there are two types of lava flows viz;

- The older flow (Flow I) is with amygdales, jointed and fractured basalts and exhibit spheroidal structure.
- The younger flow (Flow II) is with occasional amygdales but the flow tops are with numerous vesicles and are jointed, fractured and exhibit spheroidal structures.

The southern hill tops are covered by laterites (lateritic bauxite) and rest of the basin is covered by basalts with / without amygdales. Two red bole beds are identified one below the older flow and other between older and younger flows.

Hydrogeology

Normally the groundwater in basalts occur under water table conditions and also under pressure conditions. The groundwater occurrence horizons in the present basin could be classified as:

> Within fractured/jointed section (Phreatic aquifer)

> Within the flow contact (artician aquifer)

> Within the vesicular/amygdaloidal section (Phreatic aquifer)

Thus the groundwater occurs under water table conditions at shallower levels and at deeper levels under semi-confined to confined conditions. The groundwater in the basin is developed by both dug as well as bore wells. However, the bore wells are more popular these days because of sharp depletion in the water table.

Characters of Static Water Levels

Static water levels from bore wells at 41 locations spread over eleven villages (post monsoon data) were collected. The data is utilized to draw contour map showing static water levels (Fig.l). The depth to static water levels is 22 to 26 meters below ground level (bgl) in the southern side of the basin and depth gradually decreases steadily towards north (14 mts bgl). The static water level data is again used to draw water table map (Fig.2). The depth to water table is

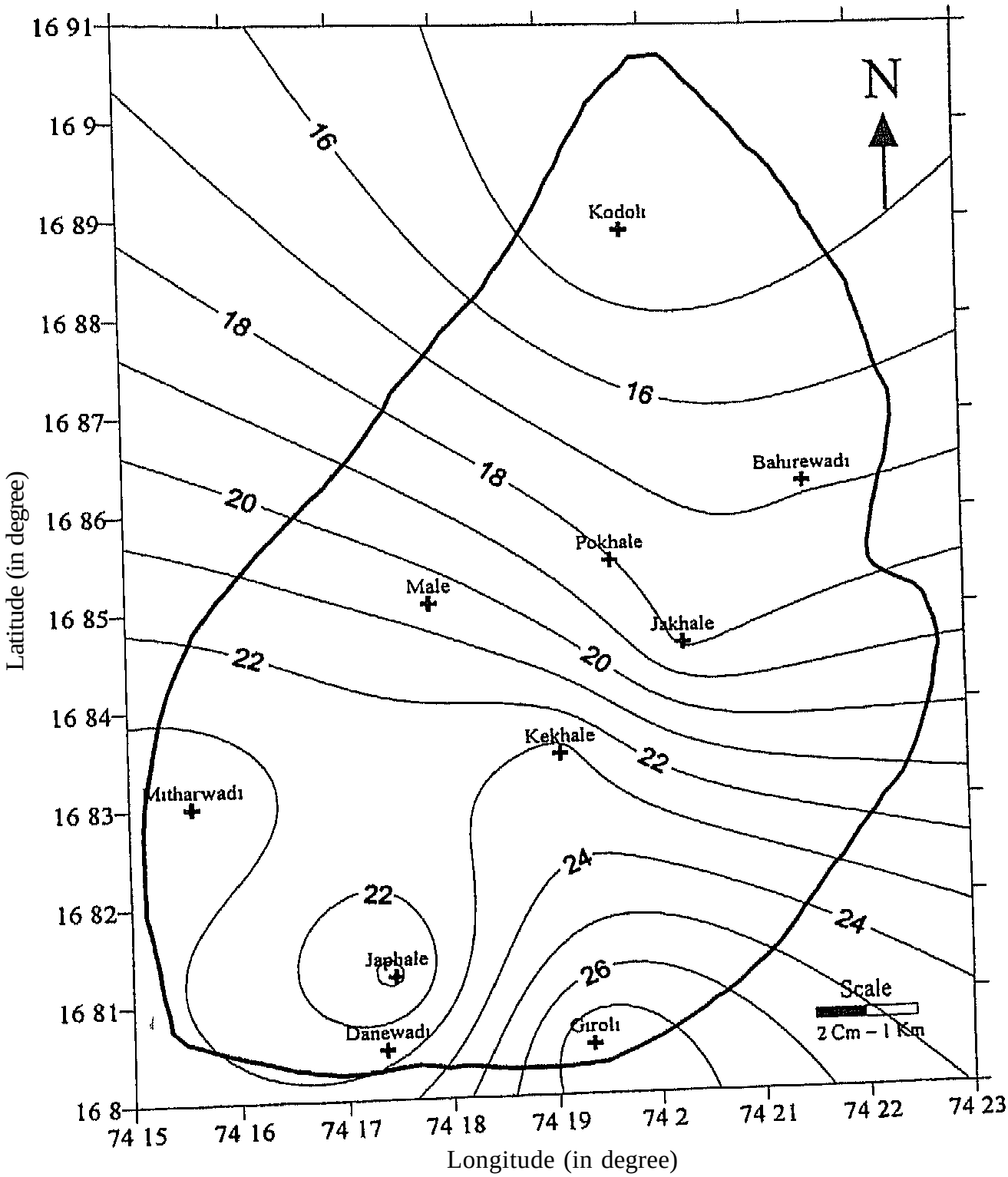


Fig. 1. *Areal Distribution of Static Water Level*

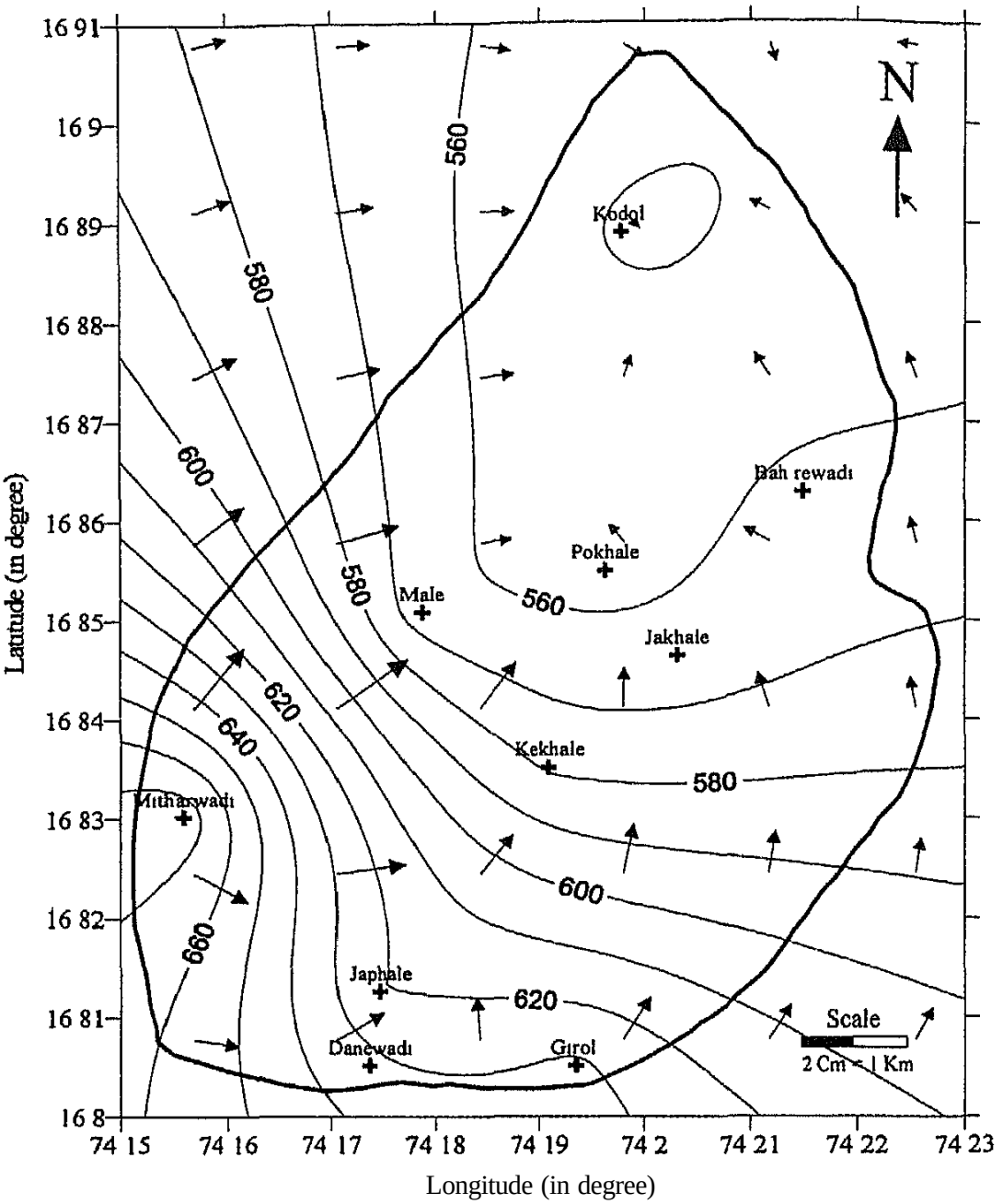


Fig. 2. *Areal Distribution of Water Table (above mean sea level in meters).*

around 660 mts amsl in the southwestern side and is around 550 mts amsl towards north .The flow lines (Fig 2) shows that the hydraulic gradient is steeper in the western part of the basin and gentle in the southern part .The flow is towards the center of the basin. Thus, the southern part is the area of recharge while the northern part is area of discharge.

Characters of Bore Wells

The bore well characters can be studied by collecting the data regarding their depth, yield and casing. The relation between depth, yield and casing in different lithologies were studied by various workers viz, Davis and Turk

(1964), Raghunath (1974), Radhakrishna et al (1974) Houstan and Lewis (1988), Patil and Puranik (1990), Hegde and Puranik (1990), Subba Rao (1992) and Gourshetty and Puranik (1997) In the present study, depth, yield and casing data of 32 bore wells has been collected from Groundwater Survey and Development Agency (GSDA), Kolhapur This data is utilized to interpret the depth and yield relation.

The relation between depth yield and number of bore wells is presented in Fig. 3 .This reveals that 47% of bore wells yield less than 1000 liters per hour (lph), 31% of bore wells yield between 1000 3000 lph Further, it also reveals that 84 %of bore wells have depth range between 50 80 meters and only 2 bore wells have depth above 80 meters while 3 bore wells have depth below 60 meters.

Figs. 4 ,5 and 6 show the spatial distribution of depth, yield and casing of bore wells in the Kodoli basin Fig 4 reveals that the bore wells are less deep (60 mts) in the southern part of the basin and are more deep (75 mts) in the northern part of the basin Fig 5 reveals that yield is more (above 3500 lph) in the central and northern part of the basin Fig 6 reveals that casing required is more in the southern and northern part of the basin while the casing required is less in the central part.

0	1000	Yield(inU 2000	PH) 3000	4000	5000	6000	7000	8000	Total No of wells
OtolO									0
10 to 20									0
20 to 30	1							1	2
30 to 40		1							1
40 to 50									0
50 to 60	1	2	1	2					6
60 to 70	7	2	3			1	1	1	15
70 to 80	4		1					1	6
80 to 90	2								2
90 to 100									0
Total No wells	15	5	5	2	0	1	1	3	32

Fig.3. *Classification of 32 Bore wells w.r.t their depth and yield*

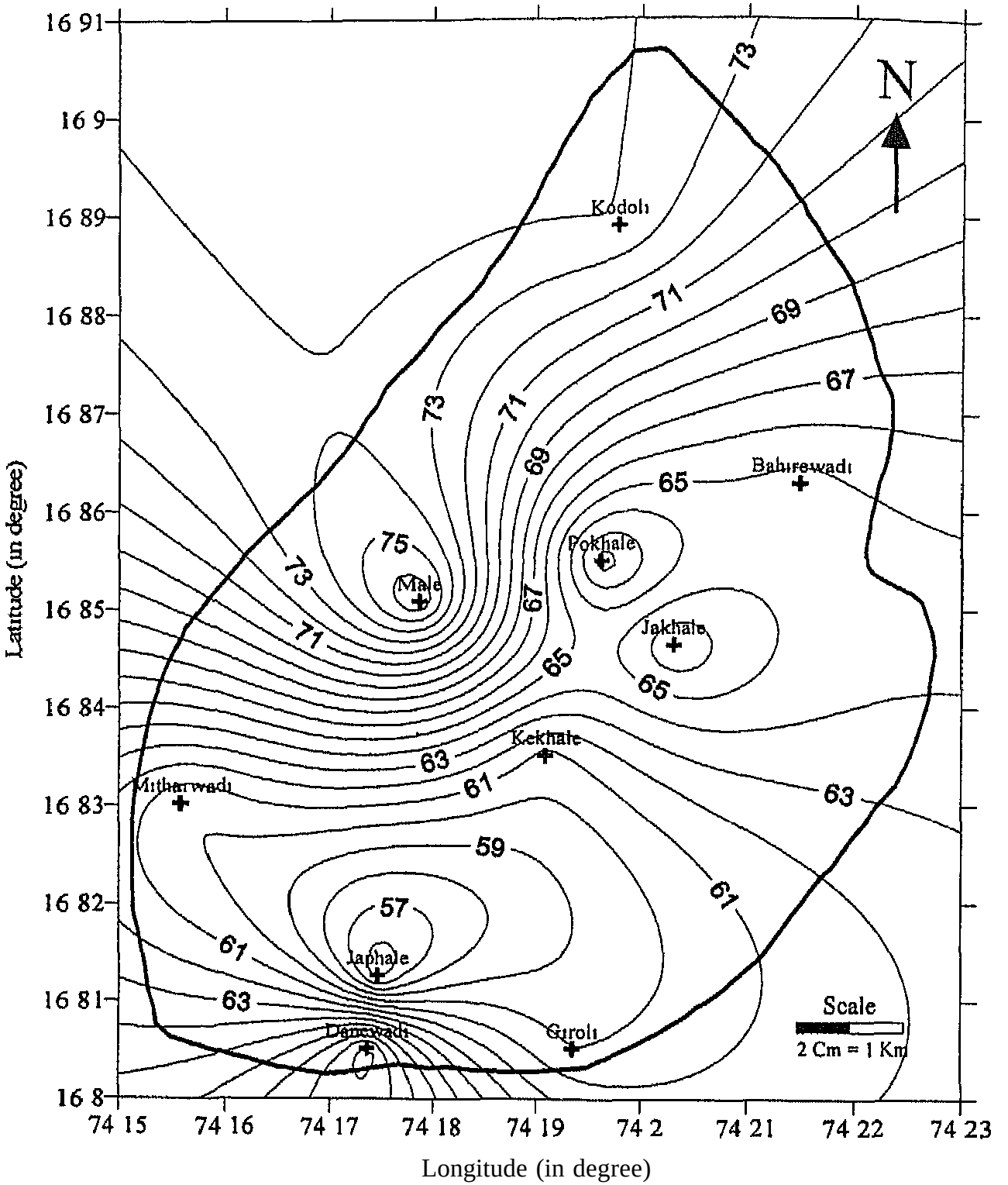


Fig. 4. *Variation in Depth of Bore Wells (in meters)*

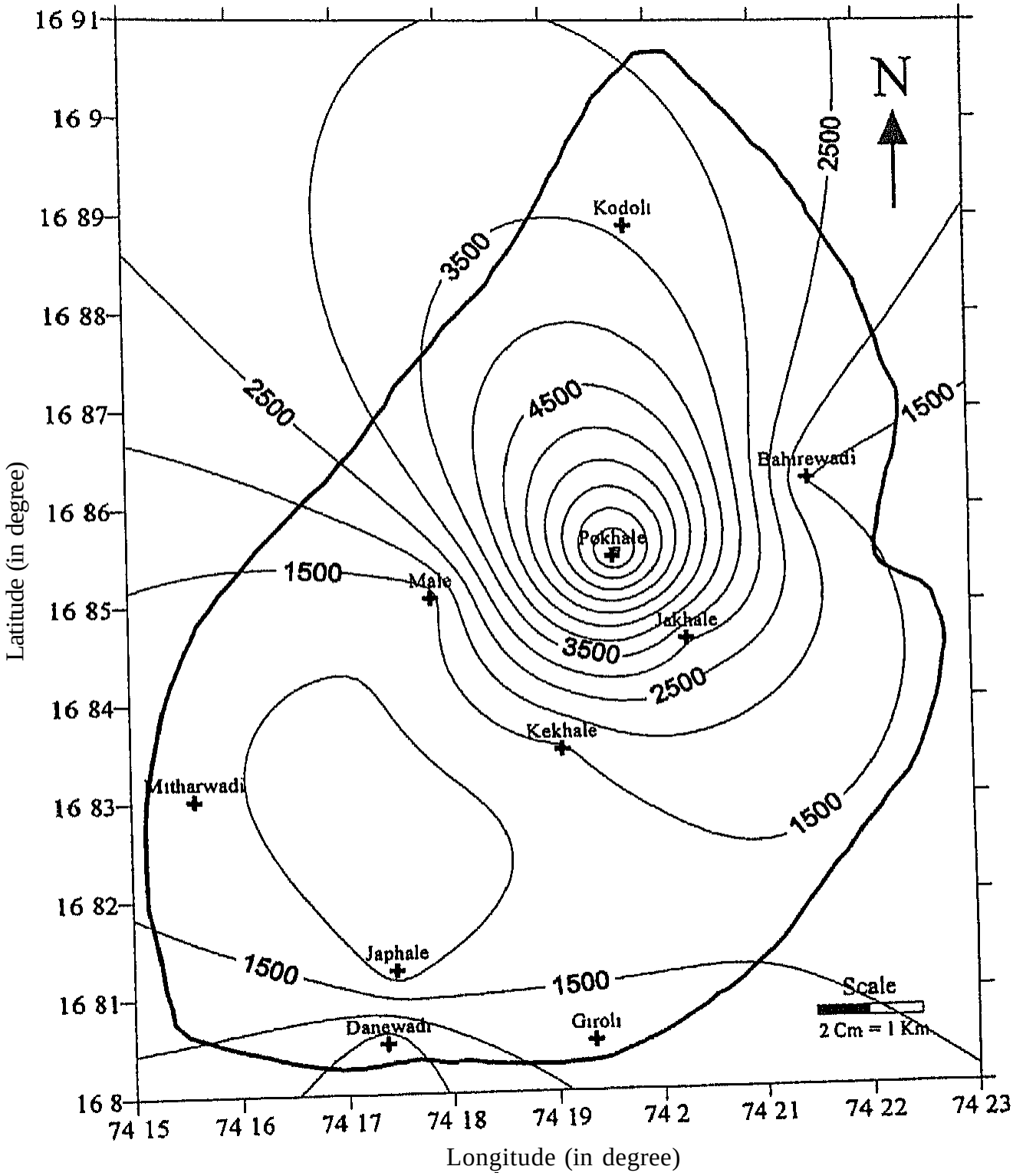


Fig .5. *Variation in Yield of Bore Wells (in liters per hour)*

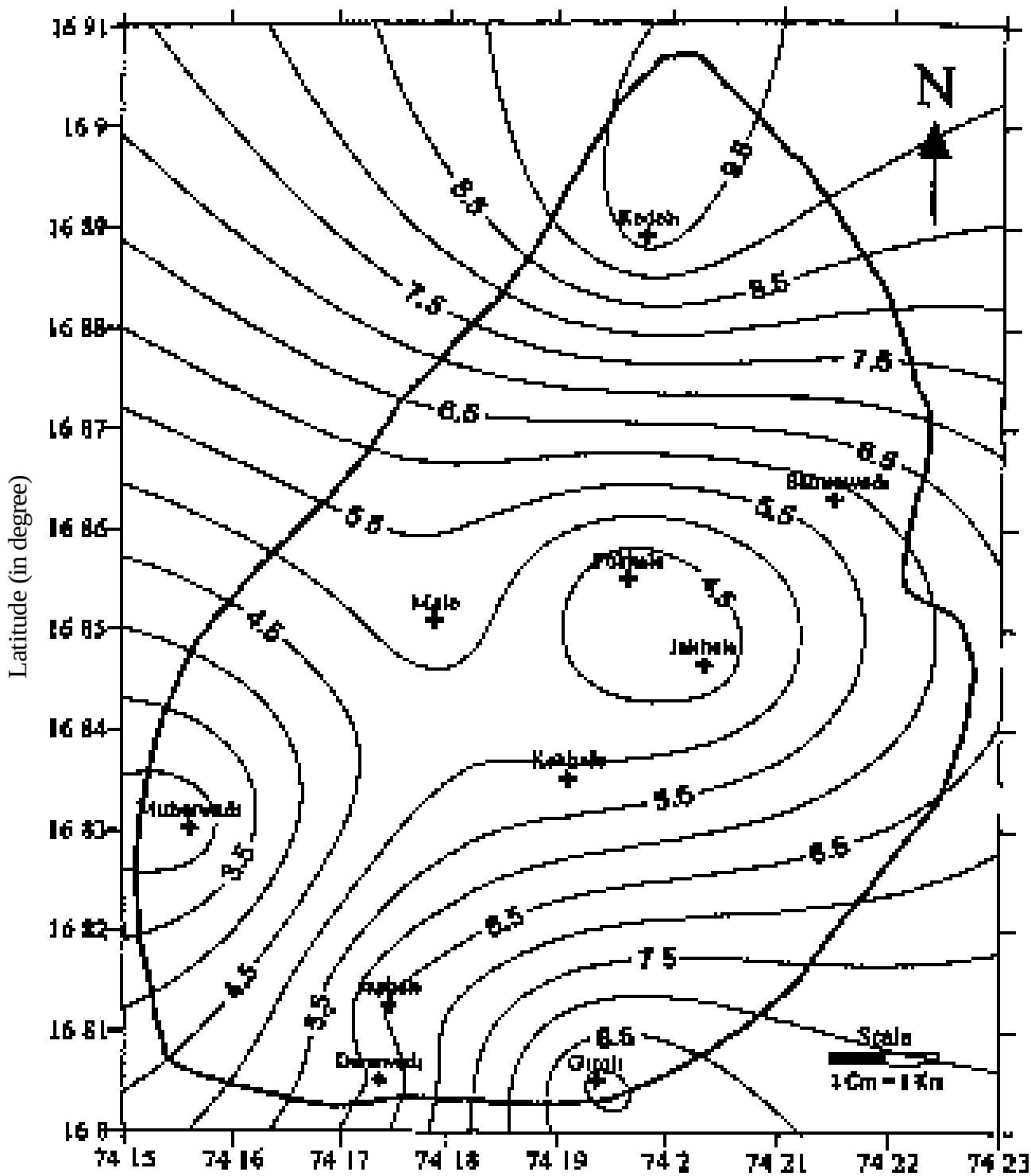


Fig. 6. *Variation in Casing of Bore Wells (in meters)*

In older to know the relation between depth and yield of bore wells, graphs showing depth vs yield relation are plotted. The bore well data (i.e., depth and yield) around 7 villages are used in the plotting (Fig.7 to 13). Following are relation with lespect to depth vs yield, mound different villages

Fig.7. Relation between Depth and Yield of Bore wells around Bahir

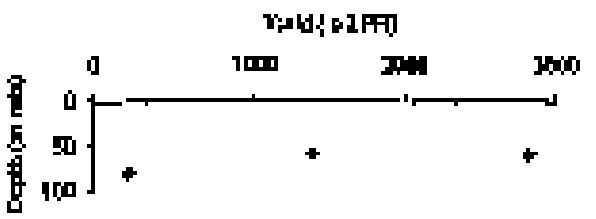
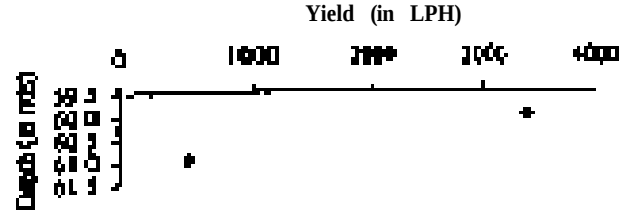
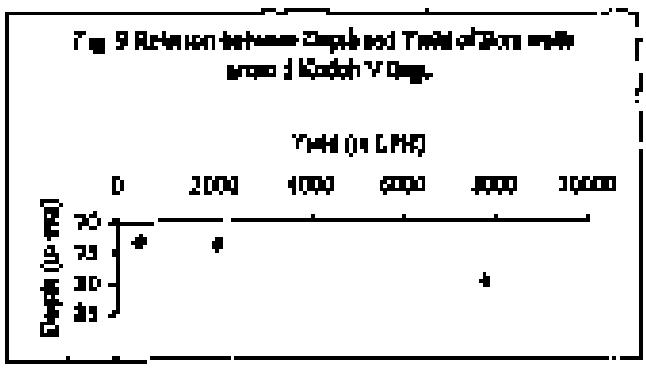
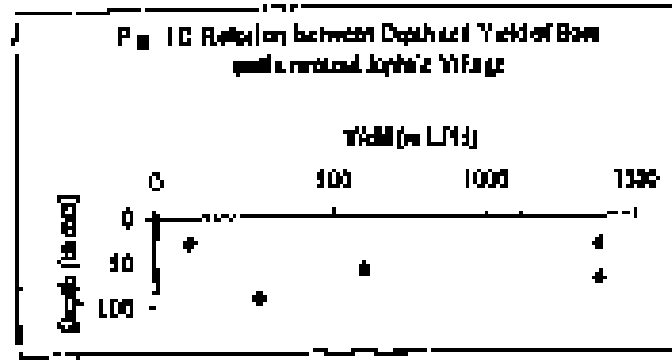
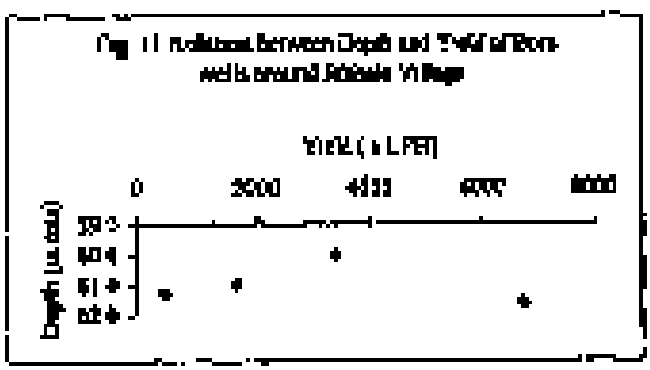


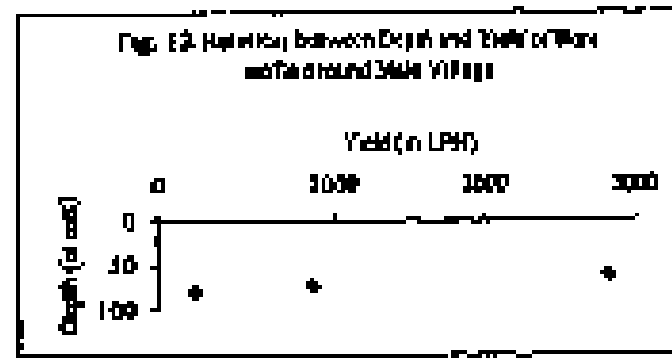
Fig.8. Relation between depth and yield of bore wells around Kekhale Village

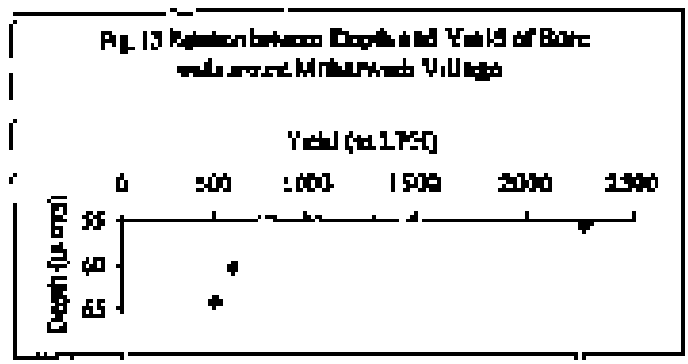












Villages	Relation
Bahirewadi	Yield decreases with depth.
Kakhale	Yield decreases with depth.
Kodoli	Yield decreases with depth.
Japhale	Yield increases with depth and also Yield remains same with depth.
Jakhale	Yield decreases with depth.
Mitharwadi	Yield decreases with depth.

Discussion and Conclusions

The Kodoli basin is of 5th order with monotonous lithology i.e., basalts. Two flows of basalts are identified in the basin. The older flow is with amygdales and the younger flow is with numerous vesicles. Both the flows are highly jointed, fractured and weathered. The groundwater occurs under water table (phreatic) conditions at shallower levels and at deeper levels under semi-confined to confined conditions. The depth to static water level varies from 14 mts bgl to 26 mts bgl. The flow of groundwater is towards north. The closeness of the contour in the western part of the Fig.2 indicates that the flow of groundwater is faster compared to other part of the area. More number of bore wells yield less than 1000 lph and have depth range between 50 -80 mts. On comparing Fig.. 4 and 5 it could be said that there is more yield in the central part of basin where the depth of bore wells is around 65-70 mts. This in concurrence with Fig.3 showing maximum number of bore wells have depth range between 60-70 mts. More casing in the northern and southern sides of the basin reveals more weathered formation. Less casing in the central part indicates less weathered formation.

In this basin three types of relation between depth and yield are noticed viz;

1. Yield decreases with depth around Bahirewadi, Kakhale, Kodoli, Jakhale, Male, Mitharwadi villages indicating that opening (fractures) in the rock formations decreases at depth i.e., lowering in the storage capacity of water.

2. Yield increases with depth around villages Japhale indicating increase in the opening (fractures) at depth in the rock formation.

3. Yield remains same with depth at places near village Japhale. This indicates consistency in the openings (fractures) in the rock formation even at deeper levels and the area has good storage capacity.

Finally it could be said that drilling beyond 70-75 mts in uneconomical. The central part of the basin i. e., the areas around Male, Pokhale, Jakhale and Kekhale villages is more suitable area for future development This part of the basin shows more yield, less depth of bore wells and casing required is also less. The flow lines in Fig. 2 support this .There is vast variation in the depth and yield relation. This may be related to the variation in fracturing and weathering pattern of the rock formation horizontally as well as vertically.

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