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Assessment of Groundwater Potential in Hosur Union in Krishnagiri District, Tamil Nadu, India

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ABSTRACT

Groundwater abstraction is increasing day by day due to its increasing demand for various uses. Hosur Union of Krishnagiri district completely depends on groundwater for drinking purpose, since the surface water from Penniyar river is very limited. In the present study the assessment of groundwater quantity of this region is taken up, to ascertain the safe yield. The study reveals that the magnitude of annual rainfall and groundwater potential has a decreasing trend. The discharge rate is more than the recharge rate, leading to depletion of the groundwater level. The critical drawdown and safe yield have also been determined.

INTRODUCTION

Groundwater abstraction is increasing day by day due to its increasing demand for various purposes. Even though the availability of subsurface water is more when compared to the surface water, the entire quantity of groundwater can not be used, without causing detrimental effects of aquifers (Eheart & Barclay 1990). For efficient groundwater management, it is essential to asses the groundwater resources using advanced techniques in the field of groundwater engineering. People of Hosur Union of Krishnagiri district, completely depends on groundwater resources for drinking purposes. With increase in population leading to increase in water requirements, the rate of abstraction of groundwater in that area is increasing, which may ultimately affect the aquifers in that area, both in quantity and quality. In this study, the assessment of groundwater potential is done by groundwater fluctuation method (GEC Committee 1990) and the safe yield from the aquifer is determined.

THE STUDY AREA

Hosur union of Krishnagiri district in Tamilnadu is located about 45 km from of Bangalore city. It lies between latitude of 12°7'-12°44' north and longitude of 77°30'-78°27' east, and has a total area of 249 km^2. Hosur union is comprises of 30 panchayats consisting of 193 villages having a total population of 1,38,706 as per 2001 census. The topography of the study area has a minimum elevation 635 m above m.s.l. and a maximum elevation of 1295m above m.s.l. The maximum rainfall is around 900mm, and minimum is around 700 mm. The geography of the study area is an undulating terrain with low altitude hills. The geological formations consist of hard rocks of granite or gneiss formation. The aquifers in this region are unconfined.

MATERIALS AND METHODS

For the assessment of the safe yield of the study area, network of 5 observation wells located in and around the study area were selected along with two rain gauge stations influencing these observation

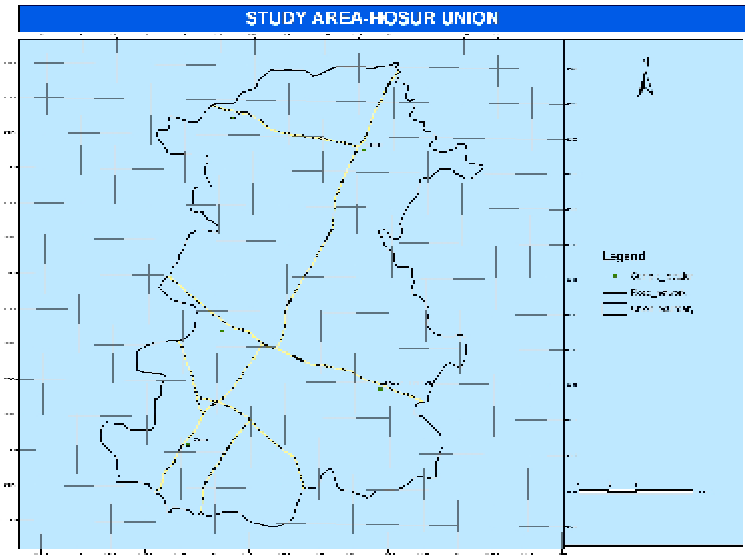

Fig.1: Map showing the locations of area.

wells. The location of observation wells is shown in Fig. 1 and the details of these observation wells are given in Table 1. Table 2 shows the variations of water level in observations wells for fifteen years. These data were collected from the Groundwater Board Division, District Collectorate and Tamil Nadu Public Works Department. Based on net results of the observed field data, the quantity of discharge and recharge rate was calculated (GEC Committee 1990). The total safe yield in the study area was calculated based on the equation given below (Raghunath 1998).

Total safe yield = Total area × specific capacity (weighted average) × critical drawdown

The critical drawdown of the aquifer was determined by considering the factors such as rainfall influencing the water level, the specific yield and area represented by each water table slope of the study area (Ramesh & Mahendran 1990). The net safe yield of the aquifer was determined by subtracting the quantity extracted so far in excess over recharge and evaporation loss at 15% from the total safe yield.

RESULTS AND DISCUSSION

Based on the field data, the trend analysis of static water levels observed for a period of 15 years in the network of the observation wells was carried out. The variation of water level fluctuations with the amount of rainfall in each observation well are shown in Figs. 2 to 6. The results showed that there was a gradual rise in the water level with the increase in rainfall from year 1992-2003. However, there was a decrease in water level in most of the observation wells even though an increase in rainfall from the year 2004 to 2006. The net results of the study clearly indicate that there was depletion in the groundwater potential. This is mainly due to unexpected demographical explosion, industrialization and urbanization. It was also observed that the quantity of water

Table1: Details of observation wells with well numbers

S.No.	Well number	Location
1	53029	Perandapalli
2	53030	Bagalur
3	53045	Mathigiri
4	53076	Kaganur
5	53077	Mookandapalli

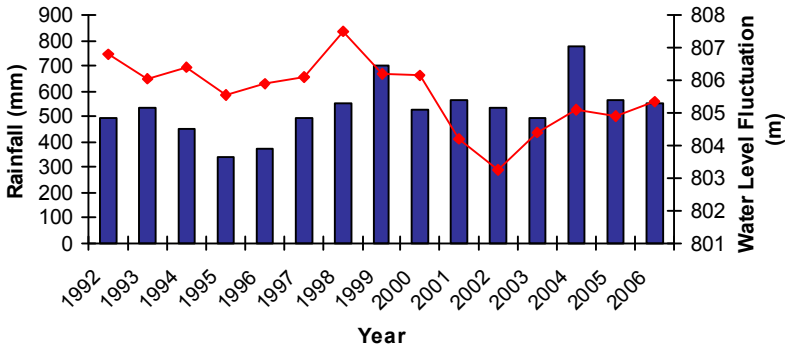

Fig. 2:

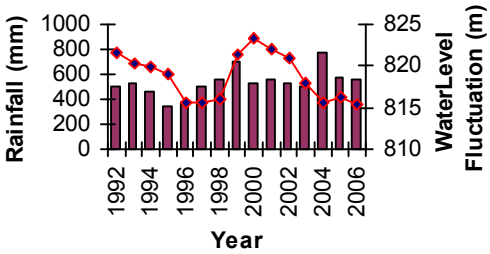

Fig. 3:

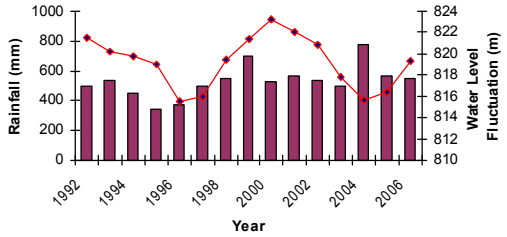

Fig. 4:

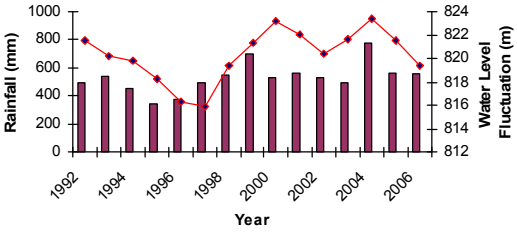

Fig. 5:

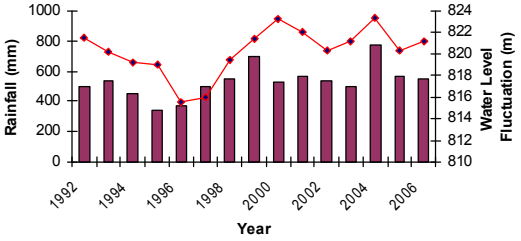

Fig. 6:

Figs. 2-5: The water level fluctuations with the amount of rainfall in each observation well.

pumped out in the aquifer was 3.89 Mcum and the recharge estimated was 1.614 Mcum. Hence, it indicates that in the study area as a whole, the groundwater discharge rate was more than the recharge, which leads to groundwater depletion. The critical drawdown determined for the safe yield consideration in the study area was 1.9 m below average static water level for the last 15 years. The estimated safe groundwater potential is 36.5 Mcum and the net safe yield after subtracting the overdraft and evaporation loss is 31.025 Mcum.

CONCLUSIONS

Based on the results and discussion, following conclusions were drawn.

1. In the study area the groundwater discharge rate was found to be 3.89 Mcum, which is higher than the recharge rate. This is mainly due to increase in population, urbanization and industrialization.

Table 2: Variations of water level in observations wells.

	Well No.				
Year	53029	53030	53045	53076	53077
1992	-1.94	-0.62	-1.77	-5.40	-4.00
1993	-0.02	0.16	-0.77	-0.43	-1.22
1994	-1.24	-1.05	-0.40	2.03	0.27
1995	-1.00	-1.95	-3.30	-1.10	-
1996	1.40	0.15	-0.05	1.35	-
1997	2.40	-0.95	5.53	1.65	4.40
1998	-0.75	0.90	-0.55	0.20	-1.55
1999	1.75	-0.5	-0.76	2.30	3.40
2000	-2.30	1.00	-1.32	-0.45	-0.8
2001	-3.95	0.05	0.30	1.30	0.40
2002	0.5	-0.65	-3.30	-	-
2003	3.50	5.25	-2.90	-	-
2004	2.40	1.00	1.25	-	-
2005	1.12	1.20	5.25	4.75	6.40
2006	-2.98	-2.35	-2.85	-4.20	-5.90
Net	-1.11	1.64	-5.64	12.80	1.82
Specific Yield	0.03	0.03	0.03	0.03	0.03
Discharge, Mcum	-	0.39	-	3.07	0.4368
Recharge, Mcum	0.264	-	1.35	-	-

2. It can also be concluded that the estimated recharge rate in the study area is 1.614 Mcum, which is much lesser than the discharge rate. This is mainly due to moderate permeability of the soil and hard rock terrain.
3. The results of trend analysis of water level variation with the rainfall indicate that there was a gradual rise in water level with increase in rainfall from the year 1992-2003. However, there was a decrease in water levels in most of the observation wells even though there was increase in rainfall from the year 2004 to 2006. This clearly indicates that there was groundwater depletion due to over-exploitation.
4. The estimated safe groundwater potential for the study area is 36.5 Mcum and the net safe yield after subtracting the overdraft and evaporation loss is 31.025 Mcum.

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