

Presence of abnormal *Pinus* pollen is also quite interesting because it has not so far been reported from Late-Quaternary as well as Recent pollen spectra from Himachal Pradesh (Sharma 1972, 1973; Sharma & Singh, 1974a, 1974b).

The area from which the available solitary clay sample has been investigated appears to be quite promising for detailed investigations, if more samples from different localities are made available for a complete chronological picture of the past vegetation of the area.

References

- ERDTMAN, G., (1943) *An Introduction to Pollen Analysis*. Waltham Mass, U.S.A
- SHARMA, CHHAYA, (1972) Origin of 'Floating Islands' in the Lakes at Khajiar and Rewalsar in Himachal Pradesh. *Palaeobotanist*, v. 19 (3), pp. 270-276.
- (1973) Recent pollen spectra from Himachal Pradesh. *Geophytology*, v. 3 (2), pp. 135-144.
- SHARMA, CHHAYA and SINGH, G., (1974a) Studies in the Late-Quaternary vegetational history in Himachal Pradesh-1, Khajiar Lake. *Palaeobotanist*, v. 21 (2), pp. 144-162.
- (1974b) Studies in the Late-Quaternary vegetational history in Himachal Pradesh-2. Rewalsar Lake. *Palaeobotanist*, v. 21 (3), pp. 321-338.

Address of the Authors

A. P. TEWARI and P. K. SWAIN, 311, Sector 7A. Chandigarh.

CHHAYA SHARMA, Birbal Sahni Institute of Palaeobotany, Lucknow.

(Received: March 23, 1978; Revised form accepted: July 5, 1978)

Jour. Geological Society of India, Vol. 20, Mar. 1979, pp. 134 to 137

Hydrodynamic method of assessing groundwater recharge by precipitation in Deccan Trap terrain—a case study

P. G. ADYALKAR AND S. SRIHARI RAO

Abstract

Amongst the number of methods available for calculating groundwater recharge, the hydrodynamic method is reliable as it takes into consideration the changes in water level, which is a true picture of groundwater regime of the area.

Groundwater recharge is first calculated by multiplying the specific yield obtained by pump test with the actual rise of water level in the well for a given period. From this daily recharge is calculated, which is expressed as a percentage of rainfall.

Introduction

The quantitative assessment of groundwater potential of any area is one of the major objectives in any hydrogeological investigation. The most important parameter required in water balance studies is groundwater recharge by rain. The factor depends upon the volume, frequency and intensity of rainfall, topography, and hydrogeological condition of the area. A number of methods are available, viz., water balance method, empirical method, geochemical method, hydrodynamic method for calculating groundwater recharge

The water balance method is a time consuming long term method; and the percentage of error is often as great as the percentage of groundwater recharge itself. The empirical methods too are approximate and limited in applicability. The geochemical methods are dependent upon the quality of water, whose determination is time consuming and laborious.

The hydrodynamic method which depends on water level fluctuation, is very reliable as the water level change in a basin is the true picture of groundwater regime of the area. The only difficulty in this method is to estimate the specific yield of the formation accurately. This can be overcome by conducting and analysing well-controlled pump tests, keeping in view the hydrogeological conditions of the Deccan Trap terrain.

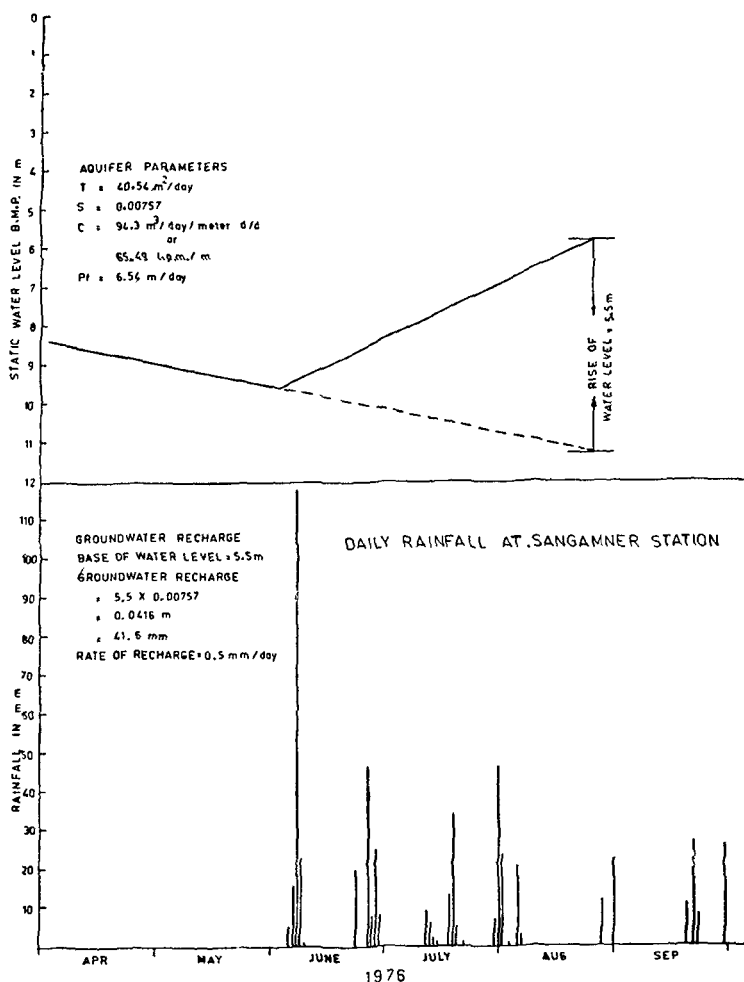


Figure 1. Groundwater recharge to a well in Deccan Trap terrain at Kokangaon. Sangamner Tahsil, Ahmednagar District, Maharashtra.

Hydrogeology

The Deccan Trap basalts represent vast spreads of lava with an aerial extent of about 500,000 sq km, covering major portions of Maharashtra, Madhya Pradesh, Gujarat and parts of Andhra Pradesh and Karnataka. They are Upper Cretaceous to Lower Eocene in age.

Groundwater availability in the Deccan Trap is controlled by the contrasting water-bearing properties of different lithological units of the traps. The weathered zones, jointed and fractured units and the vesicular varieties form important water-bearing horizons in the Deccan Trap. Groundwater occurs under both water table

TABLE I

Well No. : 47-1/6-2A-15

Village : Kokangaon

Location : 19°35' : 74°19'

Aquifer : Fractured and jointed basalt

Date of test : 24-3-1977

Depth : 15.5

Dia. : 6.15 m

Initial depth of water : 8.36 m

Static water level : 7.14 m

Rate of pumping : 490.6 lpm.

Time of Pumping (mts)	Drawdown (m)	Drawdown expressed as % of *I.D.W.	Rate of infiltration (lpm)	Specific Capacity (lpm/m) Kumaraswamy	Coef. of permeability (m/day)	Transmissivity (m ² /day)			Specific yield (Fraction)		Radius of influence (m)	Averages		
						Pf x *D ¹	Adyalkar & Mani	Theis recovery	Papadopoulos & Cooper	Empirical method		T (m ² /day)	S Fraction	C (lpm/m)
30	0.36	5		74.25		52.20				0.00058				
60	0.745	8.9		72.50		49.72				0.00128				
100	1.21	14.5		70.39		47.15				0.00230				
140	1.615	19.2		68.58		44.96				0.00353				
180	1.955	23.3		67.03		43.27				0.00477				
200	2.09	25	136.9	66.30/ £64.68	6.54	42.67	33.15/ @48.27	29.0/ 34.0/ +56.23	0.0114/ %0.006	0.00530	183.8	40.54	0.00757	65.49
—	8.36	100	317.2	37.94		27.06								

*D¹=Corrected initial depth of water saturated thickness

*I.D.W.=Initial depth of water

£ Specific capacity by Slichter's method

@ Transmissivity by Cooper and Jacob's method

' Transmissivity by Jacob's recovery method

+ Transmissivity by Papadopoulos and Cooper method

% Specific yield (Fraction) by Walton's method

and confined conditions. The topography, nature and extent of weathering, jointing and fracture pattern, thickness and depth or occurrence of vesicular basalts are the important factors which play a great role in the occurrence and movement of groundwater in these rocks.

Analysis and Results

The quantitative appraisal of groundwater potential in the Deccan Trap is beset on the one hand with the understanding of hydrogeological conditions of the area and on the other with the assessment of hydraulic properties of the aquifers, as they are patently anisotropic and heterogeneous. However, the changes in water level over a long period will give the true hydrogeological picture of the area.

The Central Groundwater Board have set up hydrograph network observation wells throughout India to monitor the water levels periodically. One such well is located near Kokangaon, Sangamner *taluka*, Ahmednagar district, Maharashtra. Periodic water level measurements have been taken on this well since 1970. The hydrograph of the well for the year 1976, along with the daily rainfall for the year 1976, is shown in Fig. 1.

A pump test was conducted on this well on 24th March 1977. The data has been analysed by various methods, viz., Papadopulos and Cooper, Cooper and Jacob, Jacob's recovery, Theis recovery, Adyalkar and Mani and other methods. The results have been tabulated and shown in Table I.

It can be seen from Fig. 1 and Table I, that the rise of water level from June 2nd to August 24th, 1976 (83 days) was 5.5 m and the average specific yield is 0.00757.

Groundwater recharge = Specific yield \times Rise of water level

$$= 0.00757 \times 5.5$$

$$= 0.0416 \text{ m}$$

$$= 41.6 \text{ mm}$$

The rainfall during this period = 483 mm.

Groundwater recharge expressed as percentage of rainfall during this period.

$$\frac{41.6 \times 100}{483} = 8.6\%$$

$$= 483$$

The groundwater recharge to this well during the monsoon period of 1976 can be expressed as follows:

The total rainfall from June to September (4 months) = 589 mm. Rate of groundwater recharge = 0.5 mm per day. Groundwater recharge for 4 months = $0.5 \times 120 = 60$ mm. Groundwater recharge as expressed in percentage of rainfall

$$\frac{60 \times 100}{589} = 10\%$$

Address of the Authors

P. G. ADYALKAR and S. SRIHARI RAO, Central Groundwater Board, Nagpur.

(Received: Feb. 23, 1978; Revised form accepted: April 7, 1978)