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Study of Hydrogeological Properties of Durg Block, Durg District, Chhattisgarh, India

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Abstract: *A hydrogeological study of any area is essential to know about the ground water condition, ground water resource , ground water quality and it is also essential to find out the suitable area for ground water recharge, discharge and ground water development. Durg blocks comes under the Durg district which is located almost in the central part of the Chhattisgarh state. Durg block falls between Latitude 21° 02' 00" N and 21°22' 00" N and Longitude "81°08' 00" E and 81° 28' 00" E and most of the area covered in toposheet no. 64G/8. Its Covering an area of 675.17 sq.km. Geologically, the block comprises of rocks of Chhattisgarh Supergroup ranging in age from Meso to Neo-Proterozoic. Hydro geologically the Durg district can be categorized into pre Cambrian sedimentary province. (C.G.W.B,Report,Durg Brochure 2013,District statistical booklet 2013-14)*

Key words*: water level fluctuation, water level trend, depth to water level, water resources, pre-monsoon, post –monsoon.*

I. Introduction

Hydrogeological studies of any area reveals the geological condition and groundwater condition of the area. Ground water condition of any area is directly proportional to geology of the area. In this paper the geology of the area, water level fluctuation, water level trend and water resources of Durg are discussed.

Geology of the area : The area of Durg block containing rocks of Raipur group of Chhattisgarh supergroup of proterozoic age. The rocks of Raipur group mainly represented by gunderdehi formation , Chandi formation and Tarenga formation. But Durg block consist rocks of chandi formation and gunderdehi formation.

Generalized geological succession of Durg block shown in table no.

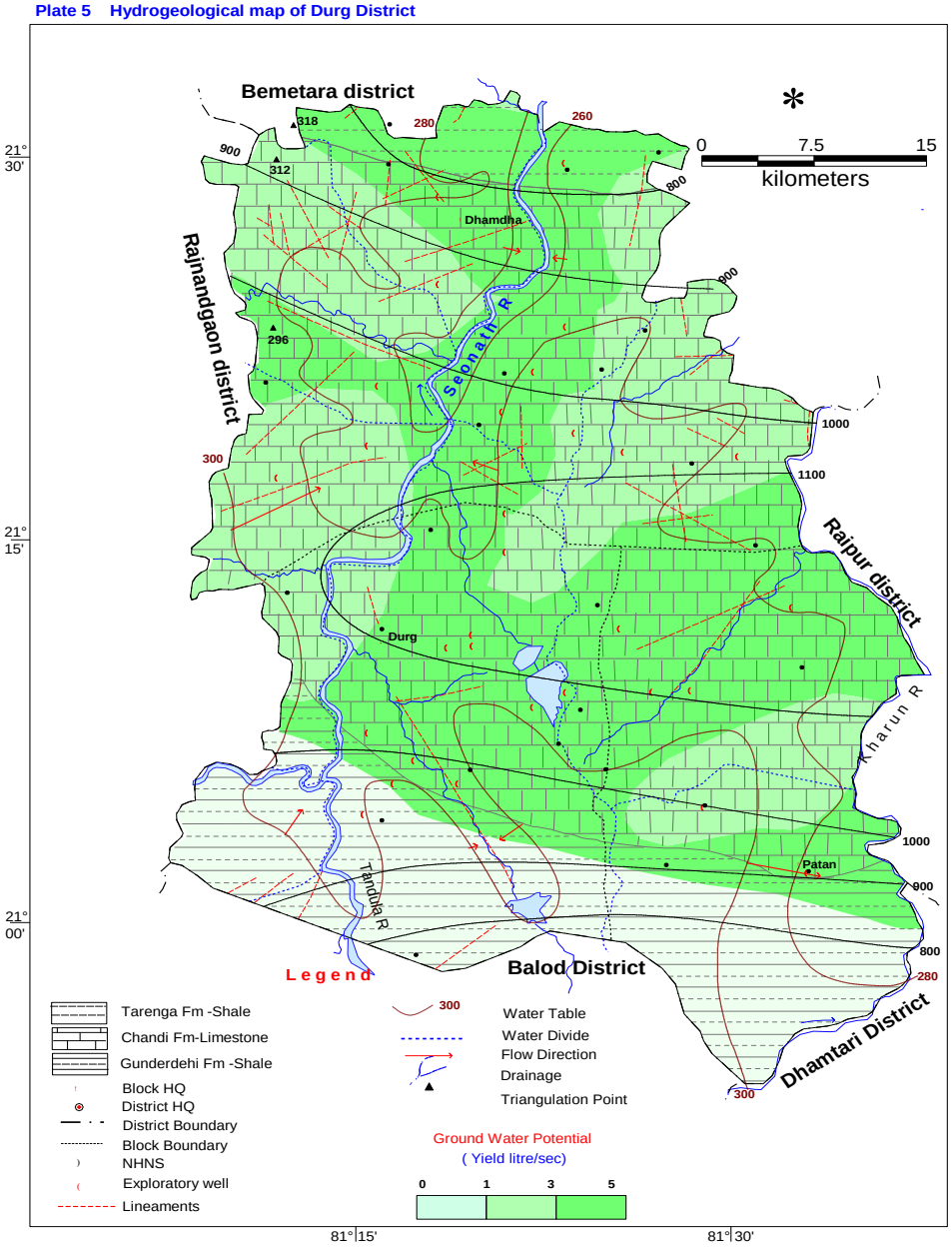
SUPER GROUP	GROUP	FORMATION	MEMBER	LITHOLOGY	CHARACTERI-STICS	AGE
				LATERITE	RED, DARK BROWN, PISOLITIC, MASSIVE, CAVERNOUS, HARD, COMPACT, FERRUGENOUS	QUATERNARY
CHHATTISGARH	RAIPUR	CHANDI	NEWARI	FERRUGINOUS SANDSTONE	REDDISH BROWN, FINE TO COARSE GRAINED, HARD, COMPACT ROCK. OCCURES AS INTERCALATIONS IN CHANDI FORMATION (DEODONGAR MEMBER) PURPLE TO GREY, FINE GRAINED, HARD AND COMPACT, CALCAREOUS ROCK SHOWING STROMATOLITIC STRUCTURE	NEO TO MESO PROTEROZOIC
			PENDRI			
			DEO-DONGAR	STROMATOLITIC LIMESTONE		
			NIPANIA			
		GUNDERDEHI	DOTOPARH	PURPLE CALCARIOUSE SHALE	PURPLE TO WHITE, FINE GRAINED, FRIABLE,CALCA-REOUS WITH INTERCALATIONSOF STROMATOLITIC LIMESTONE	

(*District Resource Map 2003,C.G.W.B, Report, Durg Brochure 2013*)

Structures: The rock of Chhattisgarh super group display sub-horizontal dips. The overlaying formation are nearly flat dipping. In the area of Durg district minor lineaments are present which are predominant and most of the drainages are controlled by lineaments which indicates that these drainage are probably developed due to structural disturbance.

Hydrogeology: Hydrogeologically the durg district can be assorted into pre Cambrian sedimentary province. It includes Chhattisgarh super groups of rock of upper proterozoic age of marine origin. This province occupies whole district area incorporating durg block. It mainly consist of arenaceous , argillaceous, calcareous rocks and are lead by lime stone/dolomite and calcareous shale. In this formation ground water appears under water table, semi-confined and confined condition. .The weathered, cavernous and fractured part of the formation establish the aquifers in the area. These formations are the most latent in regards to the ground water yield and Development. The weathered zone is confined to upper 30 m. depth and exceptional cases it is observed up to 58m. Most of the cavernous zones occur between 10 and 70m. depth and fractures are gainful down to 150 to200m. In this province, cavernous zones sometimes initiate just after soil horizon, particularly in the stratified calcareous rocks along the bedding. These caverns implement good channel for ground water movement when free from residual clays but many times the solution channels are replete with residual clay and cause hindrance to ground water moment. All the formations in the district/area are productive.

Plate 5 Hydrogeological map of Durg District



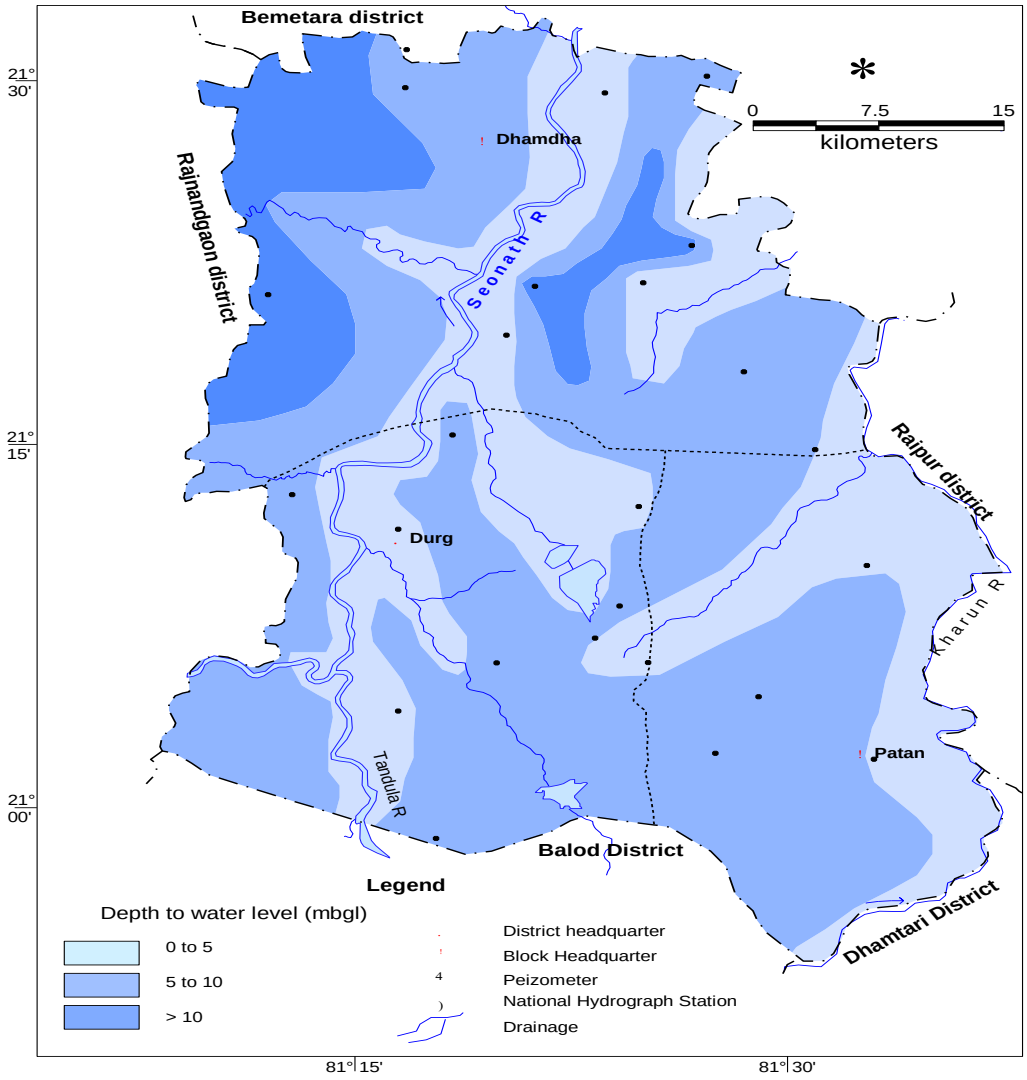
Ground water regime monitoring: Central ground water board monitors the ground water regime of durg district/block through the national hydrograph network station [NHS], 32 no. of dug wells and 5 no. of piezometers are endowed in the district to monitor water level four times in a year i.e. January- may [pre-monsoon] August and in November [post-monsoon] these monitoring wells are bestowed throughout the district covering all the lithological formation.

Depth to water level: Ground water is dynamic system. It always remains under the influence of time depend recharging and discharging factor due to this contains influence, water level of the aquifer system fluctuates and the range depend on the period of influence.

Pre-monsoon may 2013: The depth to water level in the district during the month of may is ranges between 1.78 to 9.57 mbgl while in the durg block the depth to water level lies between 0-10 mbgl . The shallow water level 0-5 mbgl are observed along river coarse. While the depth to water level more than 10 mbgl is observed in NW and NE part of the district.

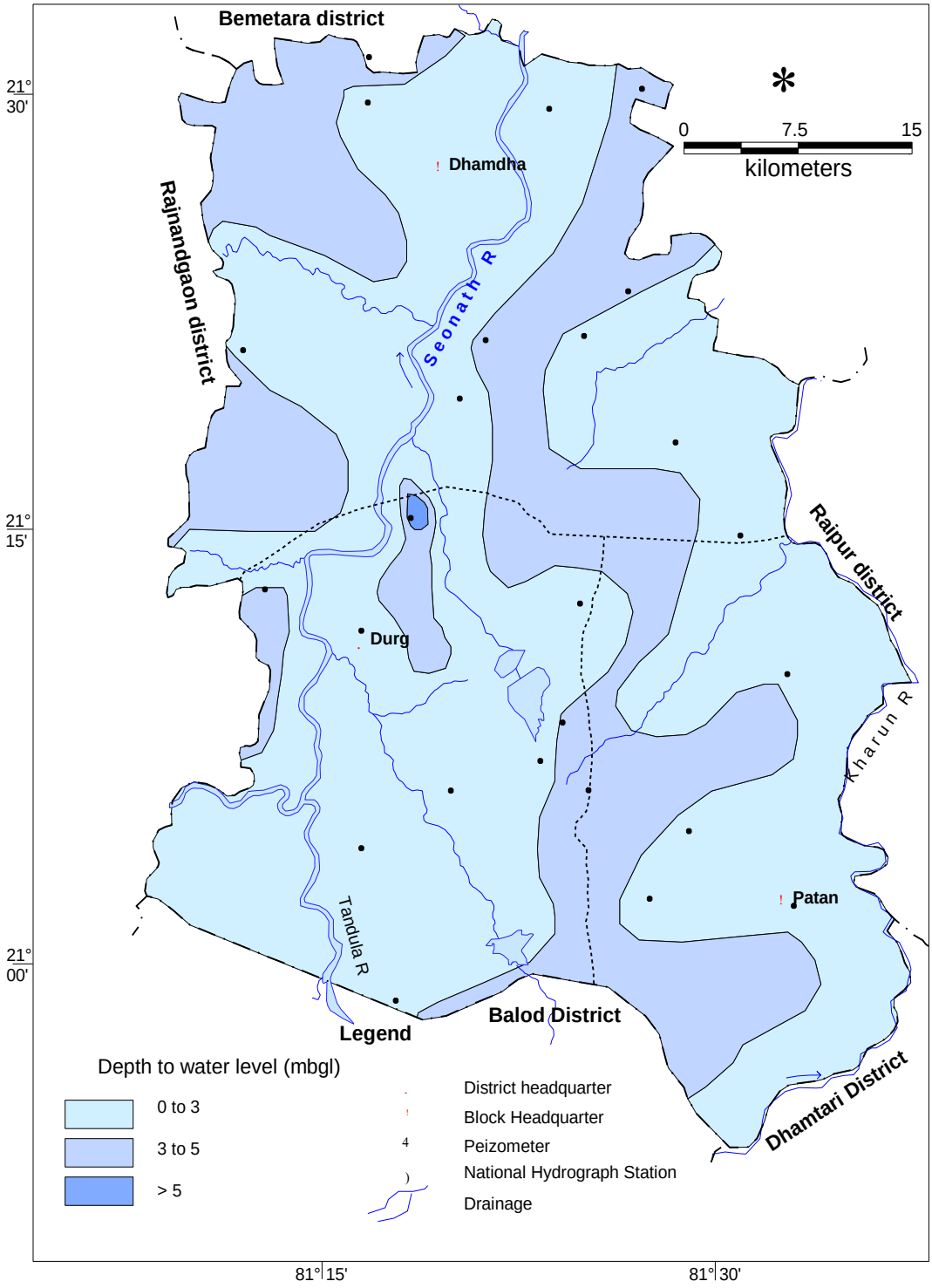
Post monsoon November 2013: The depth to water level in the district during the month of november is ranges between 0-3 or 3-5 mbgl while in durg block the depth to water level ranges between 0- >5 mbgl. In the maximum area depth to water level is 0-3 mbgl but in the northern part of the block water level between 3-5 or >5 mbgl means during the post monsoon period in the whole district water level ranges from 1.25 mbgl to 5.75 mbgl. *(C.G.W.B,Report,Durg Brochure 2013)*

Plate 2 Premonsoon (May 2013) Depth to Water Level map



(source: C.G.W.B, Report ,Durg Brochure 2013)

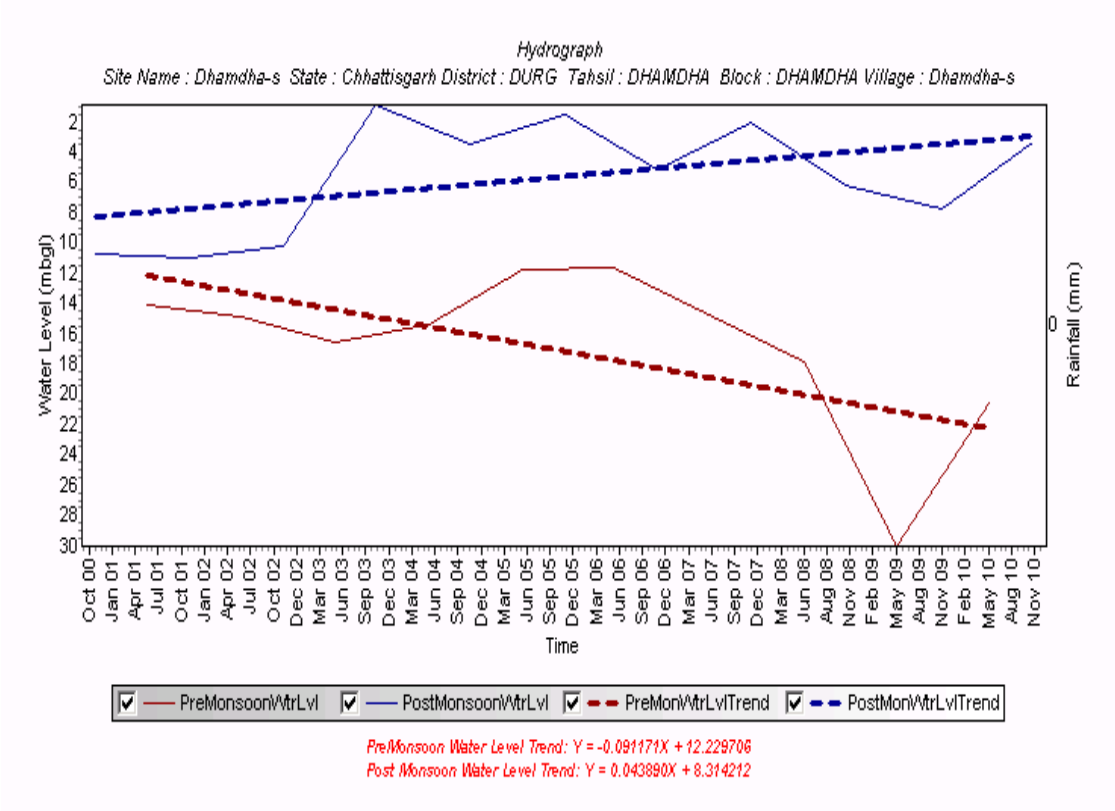
Plate 3 Postmonsoon (Nov. 2013) Depth to Water Level map



(source: C.G.W.B, Report, Durg Brochure 2013)

Water level fluctuation : The seasonal water level fluctuation in a year is determined is based on the depth to water level data gathered during the month of May 2013 and November 2013 in order to see the seasonal water level fluctuation in the district. Maximum water level fluctuation of 6.83 m. was observed at Marra observation station .The minimum fluctuation of the water level of 0.55 m. was observed at Ahiwara. It is observed that in around 75% of the area, the fluctuation is less than 5m. and 25% area show fluctuation is more than 5m.

Water level trend : The water level trend for pre monsoon (May)and post monsoon (November) period since the year 2000 t0 2009 is presented in fig.(1).In case of durg observation station both pre monsoon and post monsoon water levels are sowing rising trend. in long term trend 2000-2009 the durg block showing -0.804 (m./year) in pre-monsoon while in post monsoon it is -0.6525(m/year). **Fig. (1)**



(Source: C.G.W.B, Report, Durg, 2011)

Ground water resources: The total ground water recharge from all the sources in the district is 25197.74 ham. The net available resource is 22939.2 ham. Existing gross ground water draft for all purposes is 13185.27 ham. Out of which 17302.52 ham is for domestic and industrial water supply .the net ground water availability for future irrigation development is 4995.76 ham. The overall stage of the ground water development in the district is 75-93%.

Ground Water Resources Durg block (as on March 2011)							
Assessment Unit / Block	**Total Annual Recharge (Ham)**	**Net ground water availability (Ham)**	**Existing Gross Ground Water Draft for Irrigation (Ham)**	**Existing Gross Ground Water Draft for Domestic & Industrial Water Supply (Ham)**	**Existing Gross Ground Water Draft for All Uses (Ham)**	**Net Ground Water Availability for Future Irrigation Development (Ham)**	**Stage of Ground Water Development (%)**
Durg block	6144.34	5630.86	2222.01	2493.40	4715.41	370.75	83.74

(C.G.W.B, Report, Durg 2013)

II. Conclusion

Durg district is developed from ground water development point of view but the ground water development in the block as well as in district is also not uniform and steady. The area of Durg is suitable for artificial recharge and requires immediate attention. .The ground water flow in the area is towards the rivers which indicate that during lean period the ground water contributes the base flow to the river. In areas of shallow water table lying within 0 to 5 mbgl during post-monsoon period, surface water bodies like local ponds, farm ponds and small earthen dam along small streams may be constructed to hold water for long duration and for replenishment of soil moisture. Being the populous & growing centre, urban hydrogeological study can be taken in Durg town to avoid future problems regarding ground water development and management.

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