भूजल सूचना पुस्तिका

देवघर जिला, झारखंड

Ground Water Information Booklet

Deoghar District, Jharkhand State

केन्द्रीय भूमिजल बोर्ड
जल संसाधन मंत्रालय
(भारत सरकार)
राज्य एकक कार्यालय, राँची
मध्य-पूर्वी क्षेत्र
पटना

Central Ground water Board
Ministry of Water Resources
(Govt. of India)
State Unit Office,Ranchi
Mid-Eastern Region
Patna

सितंबर 2013

September 2013

भूजल सूचना पुस्तिका

देवघर जिला, झारखंड

Ground Water Information Booklet

Deoghar District, Jharkhand State

Updated By

के रमेश रेड्डी

(वैज्ञानिक ख)

K. RAMESH REDDY

(Scientist B)

राज्य एकक कार्यालय, राँची

मध्य-पूर्वी क्षेत्र,पटना

State Unit Office, Ranchi

Mid Eastern Region, Patna

DEOGHAR DISTRICT AT A GLANCE

Sl. No.	ITEMS		Statistics	
1.	GENERAL INFORMATION			
	i)	Geographical area (Sq. Km)	2623	
	Administrative Division (As on 2011)			
	i)	Number of Tehsil/ Block	8	
	ii)	Number of Panchayat/Villages	159 / 2704	
	iii)	Population (As on 2011 Census)	14.92 lakhs	
	iv)	Average Annual Rainfall (mm)	1162	
2.	GEOMORPHOLOGY			
	Major physiographic unit:		Hilly tracts with isolated flat topped hills and intermontane valleys	
	Major Drainages:		River Ajay and its tributaries viz Bhagdura, Partho, Dama, and Jayanti	
3.	LAND USE (SqKm)			
	a)	Forest area:	346.3	
	b)	Net area sown:	626.8	
	c)	Cultivable area:	647.2	
4.	MAJOR SOIL TYPE		Clayey, loamy, sandy loam and lateritic	
5.	AREA UNDER PRINCIPAL CROPS			
6.	IRRIGATION BY DIFFERENT SOURCES (Areas in Ha and Number of Structures)		Number of Structures	Area (Ha)
	Dugwell		12641	8198
	Tubewell/Borewell		-	-
	Tank/ponds		697	2744
	Canals		10	74
	Other sources			
	Net irrigated area			
	Gross irrigated area			
7.	NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on 31-3-2012)		09	
	No of Dug wells		09	
	No of Piezometers		Nil	
9.	HYDROGEOLOGY			
	Major Water bearing formation		Chotanagpur Granite Gneiss.	
	(Pre-monsoon Depth to water level during 2006) m bgl.		6.37-10.35	

	(Post-monsoon Depth to water level during 2006) m bgl.	2.55-5.47
	Long term water level trend in 10 yrs (1997-2006) in m/yr	--
10.	GROUND WATER EXPLORATION BY CGWB (As on 31-12-2012)	
	No of wells drilled (EW, OW, PZ, SH, Total)	21 (EW), 08 (OW)
	Depth range (m)	
	Storativity (S)	$2.2*10^{-4}$ to $1.0*10^{-5}$
	Transmissivity (m^2/day)	22-128
11.	GROUND WATER QUALITY	Potable
	Presence of Chemical constituents more than permissible limit (e.g EC, F, As, Fe)	Fe
	Type of water	
12.	DYNAMIC GROUND WATER RESOURCES(2009)- in ham	
	Annual Replenishable Ground water Resources	23960
	Net Annual Ground Water Draft	7155
	Projected Demand for Domestic and industrial Uses up to 2025	2605
	Stage of Ground Water Development	33.18%
13.	AWARENESS AND TRAINING ACTIVITY	
	Mass Awareness Programmes organized	01
	Date:	13/3/06
	Place:	Town Hall, Deoghar
	No of participant :	
	Water Management Training Programmes organized	-
	Date	-
	Place	-
	No of participant	-
14.	**EFFORT OF ARTIFICIAL RECHARGE & RAIN WATER HARVESTING**	
	Project completed by CGWB(No & Amount spent)	-
	Project under technical guidance of CGWB (Numbers)	-
15.	**GROUND WATER CONTROL AND REGULATION**	
	Number of OE Blocks	Nil
	Number of Critical Blocks	Nil
	Number of Blocks notified	Nil
18	**MAJOR GROUND WATER PROBLEMS AND ISSUES**	Iron concentration above permissible limit (1 mg/l) in Palajori and Sarawan block

DEOGHAR DISTRICT INFORMATION BOOKLET

1.0 INTRODUCTION

1.1 **Administrative Details**

Deoghar district spreading over an area of 2623 sq.km, lies between North latitudes 24° 02´ 00´´ : 24° 40´ 00´´ and East longitudes 86° 20´ 00´´ : 87° 05´ 00´´, with its district headquarter at Deoghar. The district is divided into 8 blocks namely i) Deoghar ii)Mohanpur iii)Sarwan iv)Devipur v)Madhupur vi)Karaon vii)Sarath viii)Palajhori. The district is bounded in the north by Jamui and Banka districts of Bihar, in the south and east by Dumka, in the west by Giridih. The total population of Deoghar district as per the 2011 census is 10,42,886 persons.

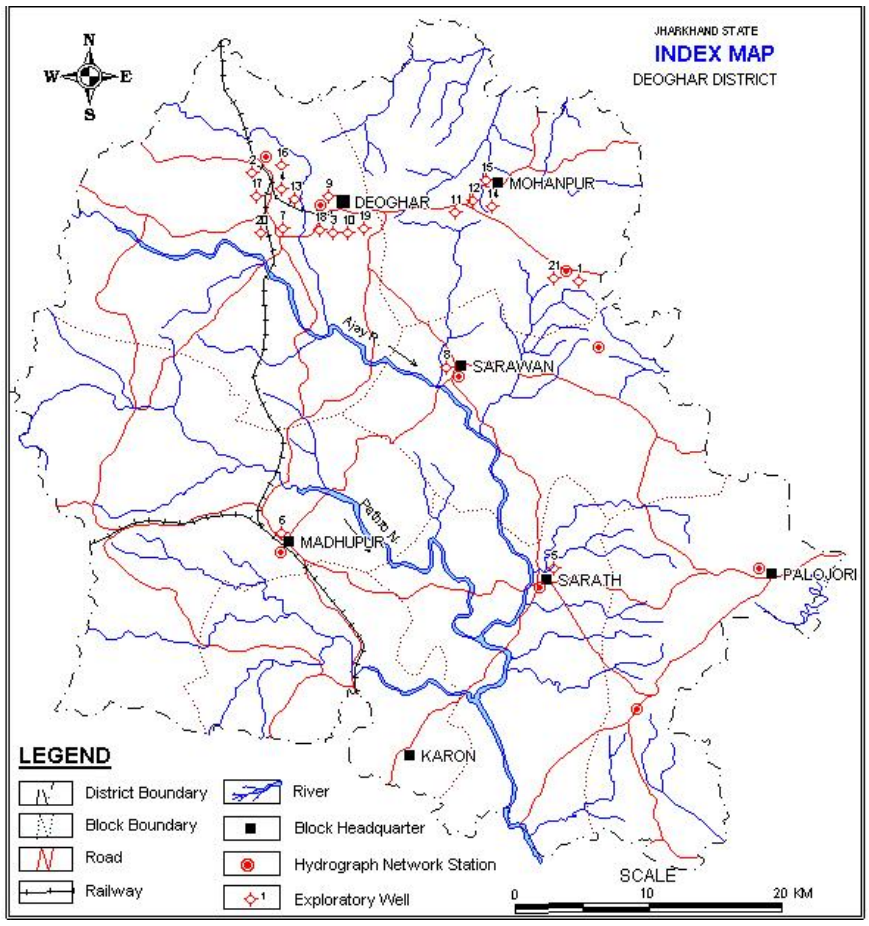
TABLE 1: POPULATION OF DEOGHAR DISTRICT (2011)

Sr. No.	Block	Total	Rural population	Urban population	Male	Female
1	Deoghar	346089	142966	203123	182595	163494
2	Mohanpur	175845	175845	0	91477	84368
3	Sarwan	90757	90757	0	47269	43488
4	Devipur	107015	107015	0	55679	51336
5	Madhupur	190748	135510	55238	98716	92032
6	Karaon	88251	88251	0	45317	42934
7	Sarath	169238	169238	0	87698	81540
8	Palajori	161281	161281	0	82593	78688
	Total	1492073	1233712	258361	775022	717051

1.2 Drainage

The river Ajay and its tributaries control the drainage of the area. River Ajay originates from the hills of the Chotanagpur plateau at an elevation of 346.23m amsl. Prominent among the tributaries are the Bhagdura, Partho, Dama, and Jayanti. These apart, there are several seasonal streams and nallas which ultimately join the river Ajay and its tributaries.(Fig -1)

Fig-1, Index map of Deoghar District



1.3 Studies/Activities carried out by CGWB

Central Ground Water Board has carried out hydrogeological surveys and ground water exploration in the district. Ground water regime monitoring is carried out 4 times annually from 9 HNS wells in the district. Water samples are collected during the month of May to study the changes in water quality along with monitoring of pre-monsoon water level.

2.0 HYDROMETEROLOGY

The climate of the district varies from sub-tropical to sub-humid. May is the hottest month with an average temperature of 35.8°C and December is the coldest month with an average temperature of 12.5°C. August and September are the wettest months. Average annual rainfall of the district is 1162 mm of which about 88% is received between June and October.

3.0 GEOMORPHOLOGY AND SOIL TYPES

In terms of the physiography, the district shows the following three broad categories of landforms

i) Mountainous tracts of Chotanagpur granitic gneisses with isolated flat topped hills, steeper escarpments and intermontane valleys

ii) Plateaus consisting of weathered granite gneiss and Gondwanas

iii) Alluvium found in the immediate vicinity of major rivers as basin fill deposits.

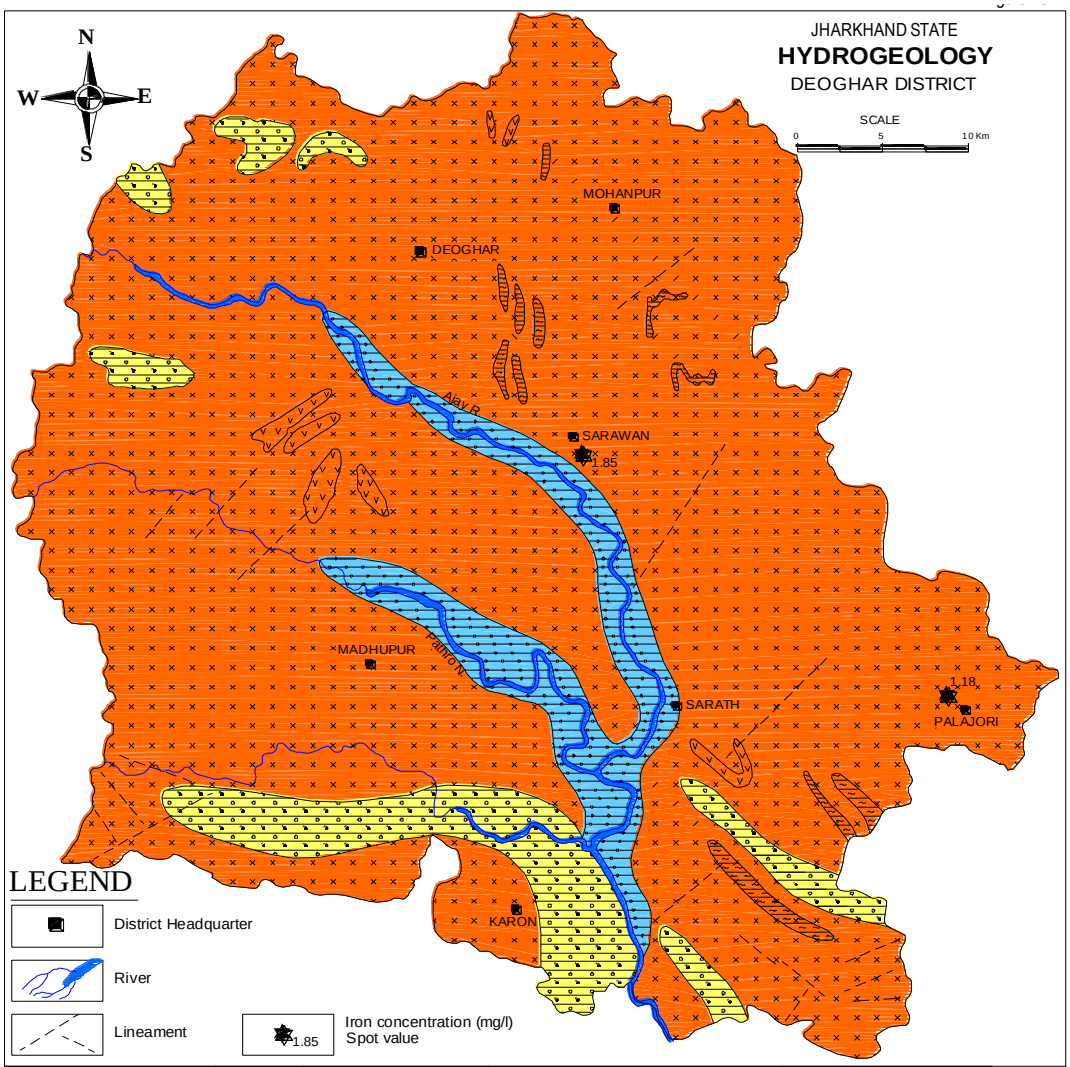
In general the area shows a general slope from north to south. The land surface is rugged and uneven ranging from flat lands to almost steep slopes. However, in general the slopes are gradual and these have been worked into terraced paddy fields at several places.

The surface lithology has exercised profound impact on the development of soil types. The district is characterized by a wide variety of soils, which can be classified as clayey, loamy, sandy loam and lateritic. Sandy loams to loamy sands are common in uplands whereas loam to sandy loam is common in lowlands.

4.0 GROUND WATER SCENARIO

4.1 Hydrogeology

Deoghar district is largely covered by Chotanagpur granites and gneissic complex associated with some metasediments and metabasic rocks. The Gondwanas have been developed in tectonic basin fill deposits and are resting on Archaean basements. The Gondwanas mainly consist of sandstones, shales, coal seams and are exposed in Karon and Madhupur blocks of the district. Alluvium occurring along the river channels and adjoining areas and are mainly composed of fine to coarse sand and clays. Laterites occur in isolated patches. About 70% of the district area is underlain by hard and compact granitic rocks, known as Chotanagpur granite gneiss. Weathering, fracturing and jointing have introduced secondary porosities in these hard rocks and these govern the occurrence and movement of groundwater in these rocks. In these formations groundwater occurs under unconfined condition in the weathered mantle and under semi-confined to confined conditions in the fractures underneath. Groundwater also occurs under unconfined condition in the narrow stretches of alluvium along stream courses; however, groundwater potentiality in the alluvium is not promising.(Fig-2)



AGE GROUP	SYMBOL	LITOHOLOGY	HYDROGEOLOGICAL CONDITION	GROUND WATER POTENTIAL
RECENT TO QUATERNARY		ALLUVIUM, SAND, CLAY, SILT ETC.	MODERATELY THICK AND LIMITE ALONG RIVER BANKSMAINLY UNCONFINED / SEMICONFINED AQUIFERS.	MODERATE YIELD PROSPECTS 10 TO 20 m ³/ hr.
UPPER TRIASSIC TO LOWER CORBONIFEROUS		SANDSTONE AND SHALES	MODERATELY THICK AND LIMITE IN EXTENT CONFINED TO SEMI CONFINED AQUIFERS.	MODERATE YIELD PROSPECTS FOR DEEP TUBEWELL UP 10 m ³/ hr.
		QUARTZITE	MOSTLY OCCURS AS PATCHES, POOR FOR GROUND WATER POTENTIAL	
PRE CAMBRIAN TO ARCHAEAN		AMPHIDOLITE AND BASIC ROCKS	MOSTLY OCCURS AS DYKES, POOR FOR GROUND WATER POTENTIAL	
		GRANITE AND GNEISSES	GROUND WATER RESTRICTED IN WEATHERED ZONE AND INTER - CONNECTED FRACTURES	LIMITED YIELD PROSPECTS UP TO 10 m ³/ hr. FOR DUG WELL AND UP TO 50 m ³/ hr FOR DEEP BORE WELLS

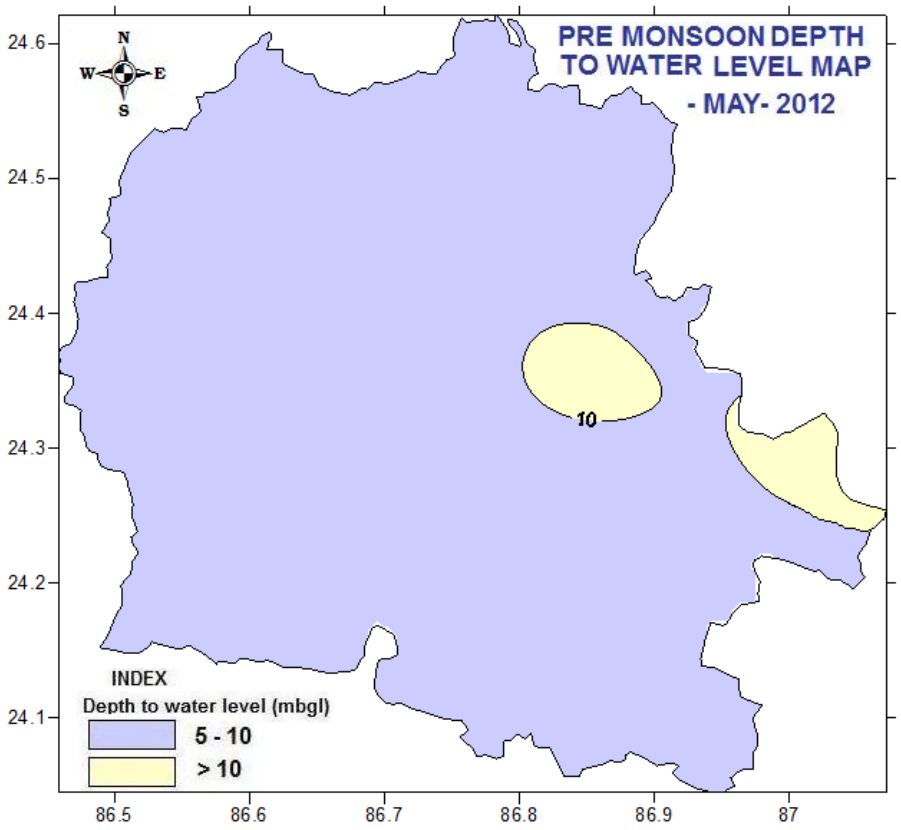
4.1.1 Depth to Water level

During May 2011, the depth to water levels in HNS wells(Fig-1) tapping shallow aquifer ranged from 5.63 to 12.00 mbgl. Depth to ground water levels during the post monsoon (November 2011) varied between 2.61 mbgl and 12.00 m bgl. Categorization of depth to water level of pre-monsoon period (May 2011) for HNS in Deoghar district is presented below in **table -1**.Depth to water level map has been prepared and presented in**Fig-3.**

Table-1 Categorization of depth to water level of pre-monsoon period (May 2011)

No. of wells measured	**Depth to water level (m bgl)**		0-2 (m)		2-5 (m)		5-10 (m)		10-20(m)	
	Min	**Max**	No.	%	No.	%	No.	%	No.	%
8	5.63	12.00	0	0	0	0	6	75	2	25

Fig-3- Pre Monsoon Depth to Water Level Map

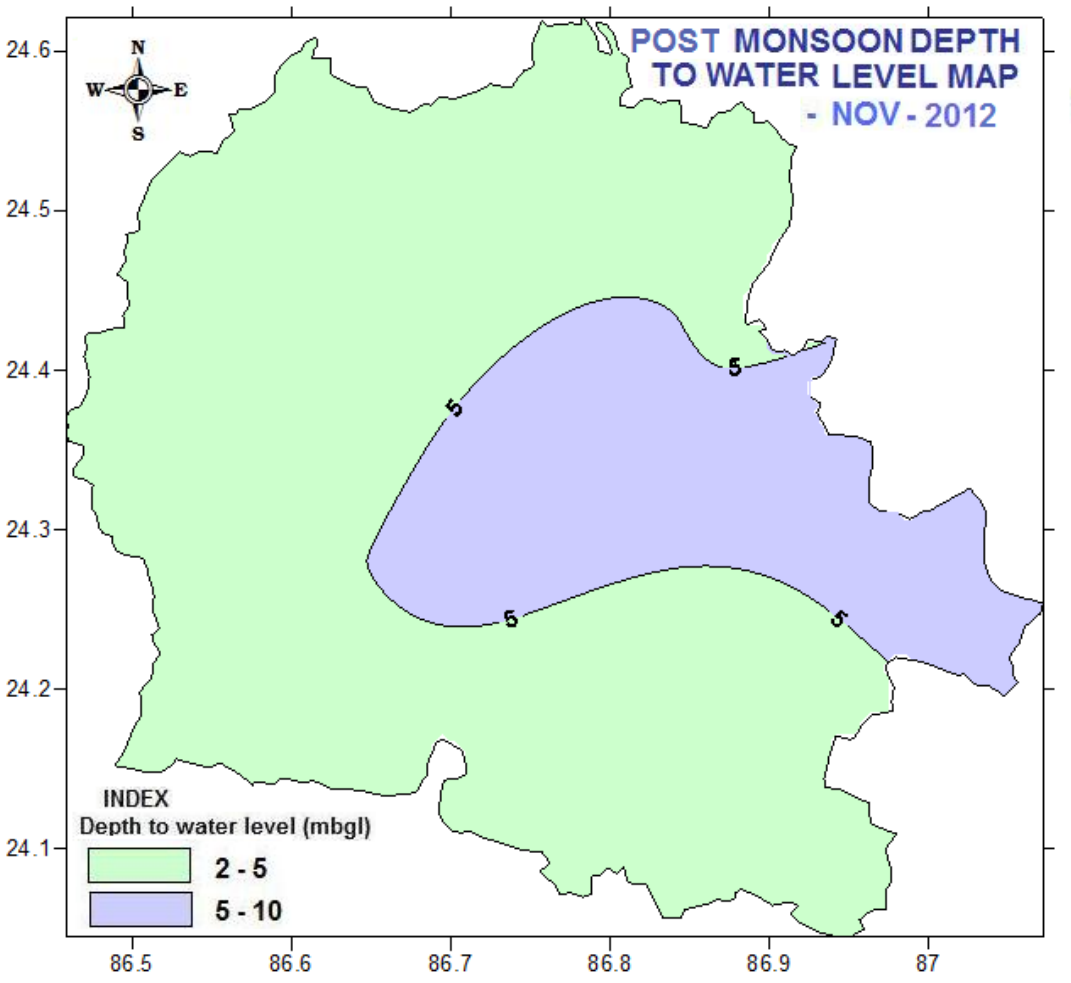


Categorization of depth to water level of post-monsoon period (November 2011) for HNS in Deoghar district is presented below in **table- 2.** Depth to water level map has been prepared and presented in **Fig -4.**

Table-2 Categorization of depth to water level of post-monsoon period

No. of wells measured	**Depth to water level (m bgl)**		0-2 (m)		2-5 (m)		5-10 (m)		10-20(m)	
	Min	**Max**	No.	%	No.	%	No.	%	No.	%
7	2.61	12.00	0	0	5	71.4	1	14.3	1	14.3

Fig-4- Post Monsoon Depth to Water Level Map



4.1.2 Aquifer Parameters

A total of 21 exploratory wells and 08 (Fig-1)observation wells have been drilled down to a depth of 199 m in hard rock formation to decipher the potential fracture zones. The exploratory data reveals presence of maximum of 4 sets of potential fractures between 50 and 167 mbgl. The yield of the wells varies from 0.6 m^3/hr to 151 m^3/hr. Transmissivity values have been found to range between 22 and 128 m^2/day and Storativity value ranges between 1.1X 10^{-5} and 2.2X 10^{-4}.

Summarized hydrogeological data of exploratory drilling in the district has been provided in table-3.

Table-3 Summarized hydrogeological data of exploratory drilling in Deoghar district.

Rock Type	Depth range (m bgl)	No. of fractures tapped	Depth zone within which fractures confined	Water level (m bgl)	Yield (m^3/hr)	Drawdown (m)	T (m^2/day)	S
Granite gneiss	103-199.2	1-4	50-167	1.5-7.8	0.6-151	3.61-30	21.90-128	1.1* 10^{-5} - 2.2* 10^{-4}

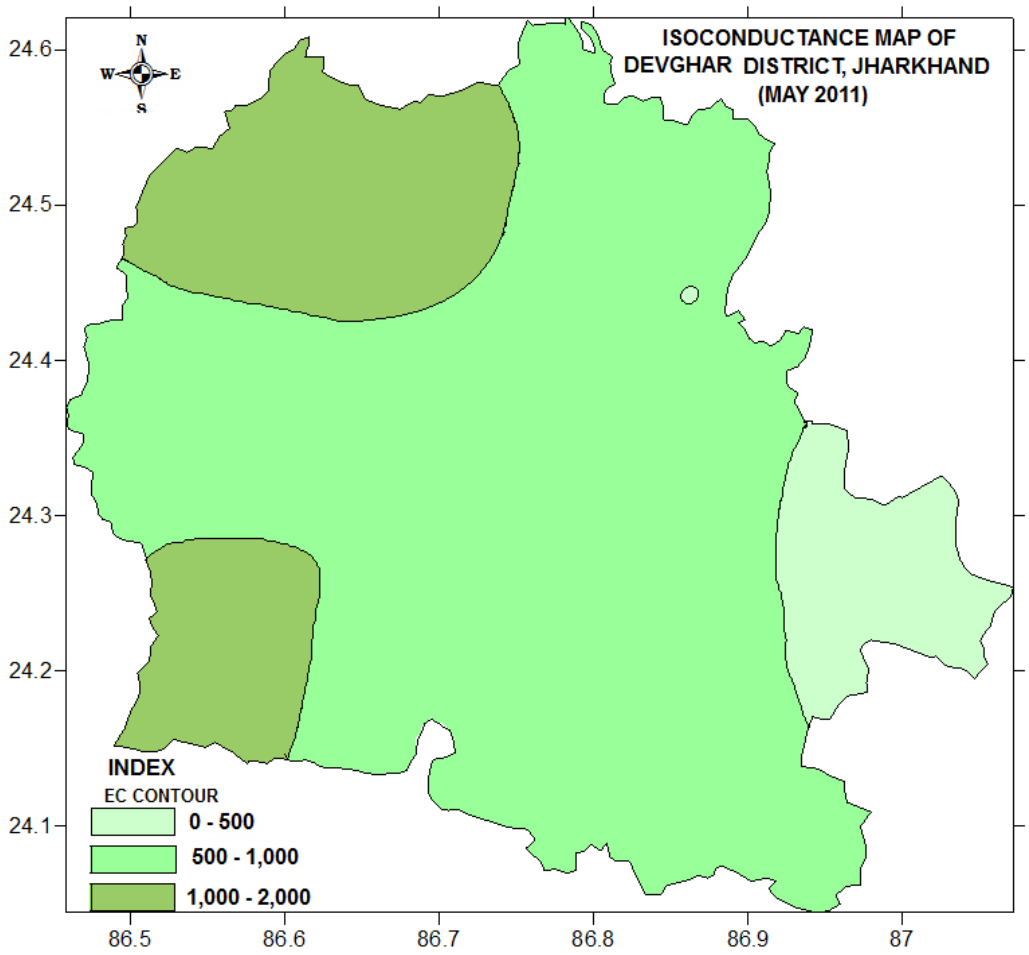
4.2 Ground Water Quality

Ground water in the phreatic aquifers in Deoghar district has been found to be slightly alkaline in nature. The specific electrical conductance of ground water in phreatic zone during May 2011 was in the range of 480 to 1130 µS/cm at 25ºC. The suitability of ground water for drinking purpose has been evaluated on the basis of pH, Total hardness (T.H), Ca, Cl, F and NO_3. The chemical concentration of these constituents, when compared with the drinking water specification recommended by IS:10500, 1991 as presented below in **table-4,** indicates that none of the samples exceed the permissible limit set for drinking use. However, Iron concentration above 1 mg/l has been found at Palajori (1.18 mg/l) and Sarawan (1.85 mg/l). Based on May 2011 data isoconductance map is prepared and presented in **Fig-5.**

Table-4 Number of samples exceeding permissible limit in the district.

Quality	IS:10500, 1991		No. of samples in the district exceeding permissible limit
	Desirable limit	Permissible limit	
pH	6.5-8.5	No relaxation	0
T.H	300	600	0
Ca	75	200	0
Cl	250	1000	0
F	1.0	1.5	0
NO_3	45	100	0

Fig-5- Isoconductance map of Deoghar district



4.2.1 Status of Ground Water Development

In the rural areas of the district, the entire water supply is dependent on ground water. Ground water development is mainly through dug wells and hand pumps. In general dug wells are of 2 m diameter and the depth ranges between 8 and 15 m depending on the thickness of the weathered zone, tapping the shallow aquifer in the weathered zone and uppermost slice of the basement. Large numbers of dug wells used for drinking purpose

are under private ownership for which there is no reliable data. Over the years Mark II/ Mark III hand pumps are being installed in large numbers for ground water development. These hand pumps have the two major advantages i.e. i) Less susceptible to contamination from surface sources and ii) Tap fractures between 20-60m depth which have been found to be less affected by seasonal water level fluctuation and thus have lesser chances of failure even during extreme summer. In rural areas of the district, PHED has drilled 13515 wells fitted with hand pumps, out of which 10906 nos. are under working condition at present.

In the urban areas ground water plays a supplementary role in water supply sector, as the major volume of supply being made from dams, reservoirs or weirs across rivers or streams. No authentic data is available for the existing number of ground water structures catering to urban water supply. For Deoghar urban area, the dependence on ground water for drinking purpose has been considered as 25%.

As per the latest ground water resource estimation carried out following GEC 97 methodology, the overall stage of ground water development in Deoghar district(**Fig-6 &7**) is 33.18% indicating sufficient scope of future development. The ground water resource of Deoghar district is shown in the **table-5** below-

Table:-5 Dynamic Ground Water Resources of Deoghar district as on 31st March 2009 as per GEC 97 (ham)

	Annual Replenishable Ground Water Resource					Natural Discharge during non-monsoon season	Net Annual Ground Water Availability	Annual Ground Water Draft			Projected Demand for Domestic and Industrial uses up to 2025	Ground Water Availability for future irrigation	Stage of Ground Water Development (%)
	Monsoon Season		Non-monsoon		Total			Irrigation	Domestic and Industrial uses	Total			
Block	Recharge from rainfall	Recharge from other sources	Recharge from rainfall	Recharge from other sources									
Deoghar	2342.73	4.39	866.01	131.28	3344	334	3009.97	490.09	882.282	1372.4	552.53	1967.34	45.59
Mohanpur	2124.99	4.70	834.28	193.29	3157	316	2841.53	735.67	241.900	977.6	332.45	1773.41	34.40
Sarwan	2519.52	26.90	989.17	251.10	3787	379	3408.04	970.92	217.385	1188.3	298.76	2138.36	34.87
Devipur	1777.65	3.26	697.91	104.37	2583	258	2324.87	391.50	142.730	534.2	196.16	1737.22	22.98
Madhupur	2192.64	3.58	842.94	126.75	3166	317	2849.32	478.50	472.360	950.9	334.60	2036.22	33.37
Karaon	1218.94	2.87	474.67	131.09	1828	183	1644.81	501.47	201.468	702.9	276.88	866.46	42.74
Sarath	2327.14	3.86	913.64	127.92	3373	337	3035.30	480.94	230.893	711.8	317.22	2237.04	23.45
Palajori	1857.42	3.51	729.13	132.27	2722	272	2450.18	501.12	215.857	717.0	296.66	1652.40	29.26
Total	**16361.04**	**53.08**	**6347.85**	**1198.06**	**23960**	**2396**	**21564.03**	**4550.208**	**2604.9**	**7155.1**	**2605.37**	**14408.45**	**33.18**

Figure-6

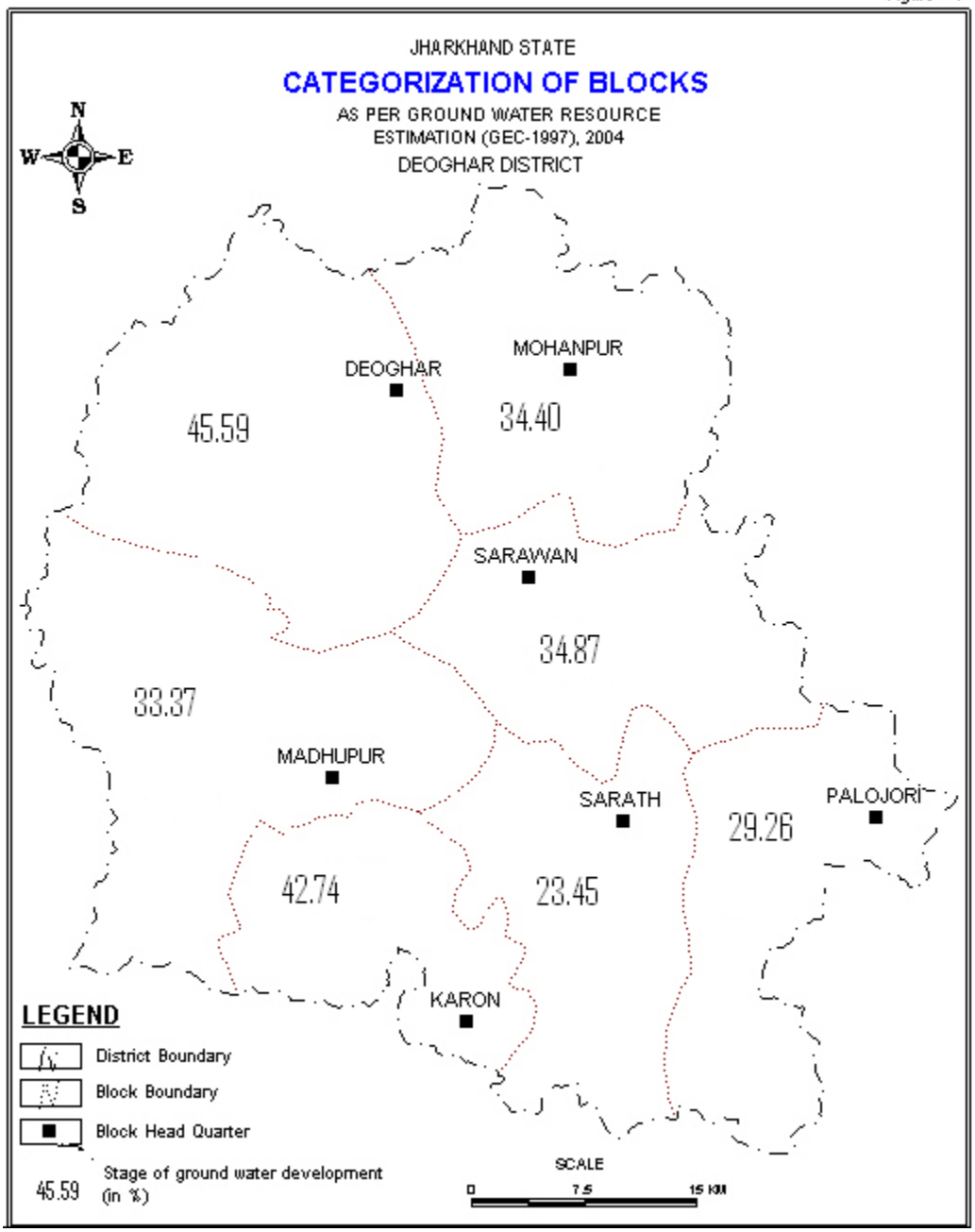
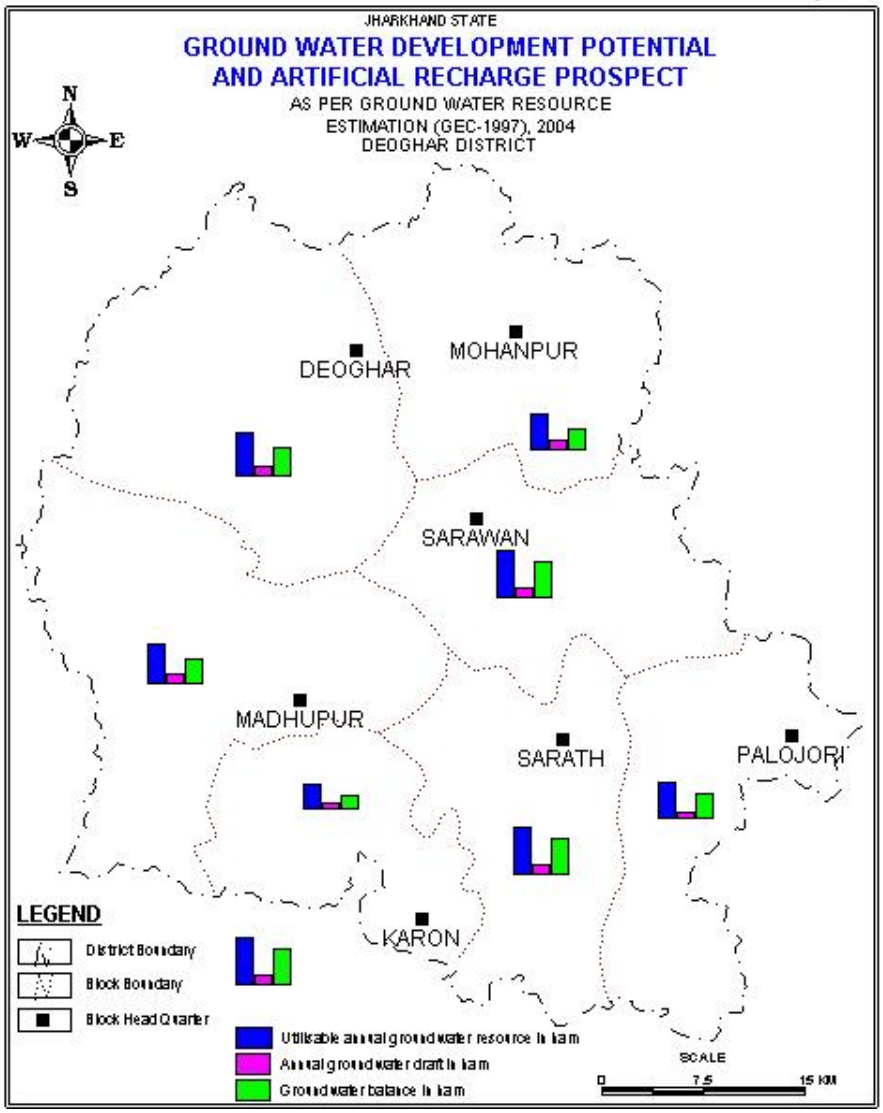

JHARKHAND STATE
CATEGORIZATION OF BLOCKS
AS PER GROUND WATER RESOURCE
ESTIMATION (GEC-1997), 2004
DEOGHAR DISTRICT
N
W
E
S
DEOGHAR
MOHANPUR
SARAWAN
MADHUPUR
SARATH
PALOJORI
KARON
45.59
34.40
34.87
33.37
42.74
23.45
29.26
LEGEND
District Boundary
Block Boundary
Block Head Quarter
45.59 Stage of ground water development (in %)
SCALE
0
7.5
15 KM

Fig-7



5.0 GROUND WATER RELATED ISSUES & PROBLEMS

Some of key ground water related issues are

a) Locating suitable sites for bore wells

b) Suitable design of dug wells and hand pumps

c) Taking up artificial recharge projects to augment the ground water resource availability in Deoghar urban area

d) Optimal development of irrigation potential by developing ground water available for future uses:

e) Creating public awareness for conserving ground water through awareness camps, NGO's and mass media.

6.0 Awareness & Training activity

6.1 Mass Awareness Campaign (MAP) & Water Management Training Programme (WMTP) by CGWB

One mass awareness campaign was organized at Town Hall, Deoghar on 13/3/06 in which over 100 persons participated.

7.0 AREA NOTIFIED BY CGWB/SGWA

None

8.0 RECOMMENDATIONS

In the hard rock areas, pin pointing suitable sites for bore wells is always a challenge. Considering the anisotropy in distribution of fractures at deeper level, suitable sites may be selected using remote sensing techniques in association with geophysical and hydro-geological investigations.

For deriving optimal benefit from aquifers in areas under fissured formation, the dug wells should be designed to penetrate the weathered zone as well as top part (1-2 m) of the underlying bed rock, so as to get the full benefit, from the total thickness of the shallow aquifer. For hand pumps and shallow tube wells the casing provided against the weathered zone should be slotted at the bottom so that the well can extract shallow ground water also. In urban areas use of shallow aquifers should be encouraged.

The surface run off in urban areas and its peripheral parts should be harnessed to augment the ground water resource through appropriate recharge techniques. For urban areas roof top rain water harvesting and artificial recharge is most suitable. Location and design of the structures should be guided by findings from hydrogeological and geophysical surveys. Sites for artificial recharge should be taken up at places where sufficient thickness of weathered zone as well as fracture/fracture zones are available. The depth of the recharge well should be governed by the depth of occurrence of the fractures.