जल वर्ष 2007 Water Year 2007

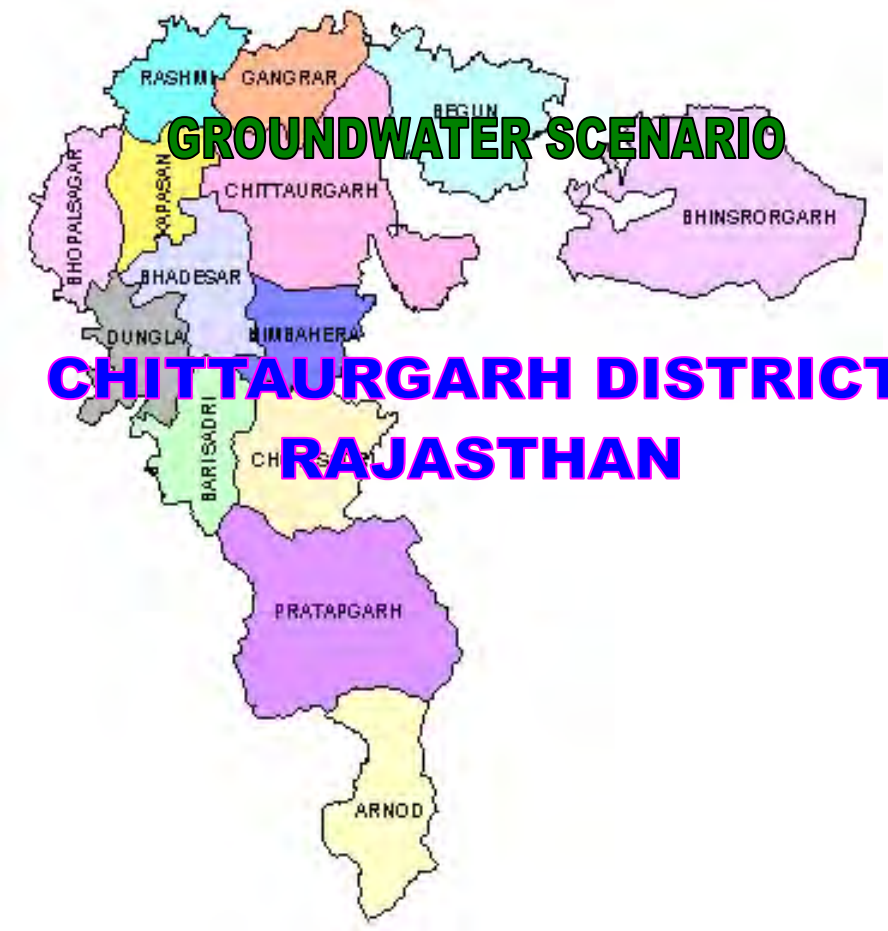
स्वच्छ सुरक्षित जल – सुन्दर खुशहाल कल

CONSERVE WATER - SAVE LIFE

CENTRAL GROUND WATER BOARD

Ministry of Water Resources

Government of India



GROUNDWATER SCENARIO

CHITTAURGARH DISTRICT, RAJASTHAN

Western Region

Jaipur

October, 2007

DISTRICT AT A GLANCE – CHITTAURGARH, RAJASTHAN

S No	Item	Statistics	
1	**GENERAL INFORMATION**		
	(i) Geographical area (sq km)	10,856	
	(ii) Administrative Division (As on 31.3.2007)		
	Number of Tehsils	13	
	Number of Blocks	14	
	Number of Villages	2415	
	(iii) Population (As per 2001 Census)	18,03,524	
	(iv) Average Annual Rainfall (1977-2006) in mm	762.7	
2	**GEOMORPHOLOGY**		
	Major Physiographic Units	Pediment, Buried Pediment, Intermontane Valley	
	Major Drainage	Banas, Gambhiri, Berach, Jakham, Wagon	
3	**LAND USE (sq km)**		
	(a) Forest Area	2800.90	
	(b) Net Sown Area	4110.00	
	(c) Cultivable Area	8960.41	
4	**MAJOR SOIL TYPE**	Yellow brown soil, Black, soil, Red Loam	
5	**AREA UNDER PRINCIPAL CROPS** (As on 2005)	Crops	Area in ha
		Maize	174714
		Oil Seeds	168835
		Pulses	67720
		Wheat	65010
		Jowar	21742
		Barley	2599
		Sugarcane	786
		Chilies	627
		Bajra	41
6	**IRRIGATION BY DIFFERENT SOURCES**		
	Source	No of structure	Area in ha
	Dug wells	111546	107077
	Tube wells/Bore wells	13882	
	Tanks/Ponds	141	3557
	Canals	-	3351
	Other Sources	-	2571
	Net Irrigated Area (ha)	116556	
	Gross Irrigated Area (ha)	126750	

7	**NUMBER OF GROUND WATER MONITORING WELLS OF CGWB** (As on May 2007)	
	Number of Dug wells	31
	Number of Piezometers	8
8	**PREDOMINANT GEOLOGICAL FORMATIONS**	Gneiss (Bhilwara Supergroup), Shale, Schist /phyllite (Aravalli Supergroup), Basalt, Limestone & Sandstone (Vindhyan Supergroup)
9	**HYDROGEOLOGY**	
	Major Water bearing formation	Limestone, Gneiss, Basalt, Schist/phyllite & Shale
	Depth to water level (Pre-monsoon, 2006) (mbgl)	5 - 25
	Depth to water level (Post-monsoon, 2006) (mbgl)	0.5 - 20
	Long term decline water level trend (1997-2006) in m/yr	0.12 – 0.96
10	**GROUNDWATER EXPLORATION BY CGWB** (As on 31.3.2007)	
	Number of wells drilled (EW, OW, Total)	EW-24, OW-9 Total-33
	Depth Range (m)	50 - 150
	Discharge (liter per minute)	Negligible - 300
	Transmissivity (m^2/day)	10
11	**GROUND WATER QUALITY**	
	Presence of chemical constituents more than permissible limit (EC>1500 mmhos/cm at 25^0 C, F>1.5 mg/l, Nitrate>45.0mg/l)	EC - 800 sq km F – 1500 sq km Nitrate– 4200 sq km
	Type of water	Alkaline
12	**DYNAMIC GROUND WATER RESOURCES (March, 2004) in mcm**	
	Annual Replenishable Ground Water Resources	394.3927
	Net Annual Ground Water Draft	561.7714
	Projected Demand for Domestic and Industrial Uses up to 2025	65.6317
	Stage of Ground Water Development	142.44%
13	**MAJOR GROUND WATER PROBLEMS AND ISSUES**	Declining water level Low Yield of Wells Pollution of ground water

GROUND WATER SCENARIO
DISTRICT -CHITTAURGARH, RAJASTHAN

1.0 Introduction

Chittaurgarh district is located between 23^{o} 32$^{'}$ and 25^{o} 13$^{'}$ latitude and 74^{o} 21$^{'}$ and 75^{o} 49$^{'}$ longitude covering an area of 10,856 sq.km. The district is part of Udaipur Division and is divided into five sub-divisions namely Begun, Chittaurgarh, Kapasan, Nimbahera and Pratapgarh. Administratively the district is divided into 13 tehsils and 14 development blocks.

Total number of villages in the district is 2415 and it also has 8 urban towns. Rural and Urban population of the district is 15.15 lakh and 2.89 lakh respectively.

Systematic Hydrogeological survey in the district was carried out by Central Ground Water Board from 1972 to 1978. Reappraisal hydroeological survey in parts of district was carried out during 1986-87. Under exploratory programme 29 exploratory boreholes have been drilled. Since 1973, monitoring of water level is being carried out four times a year from 39 National Hydrograph Network Stations.

2.0 Rainfall & Climate

Average annual rainfall (1977-06) of the district is 762.7mm. However normal rainfall for the period 1901 to 1970 is 767.2mm. The annual rainfall gradually decreases from southern part to northern part. The maximum average rainfall is 905mm at Choti Sadri and minimum average rainfall is 595 mm at Bhopalsagar.

The climate of the district is dry except S-W monsoon season. The cold season is from December to February and is followed by summer from March to June. From mid of September to end of November constitute post monsoon season.

The district experiences either mild or normal drought once in two years. Severe type of drought has been recorded very rarely. Most severe type of drought has never occurred in the district.

3.0 Geomorphology & Drainage

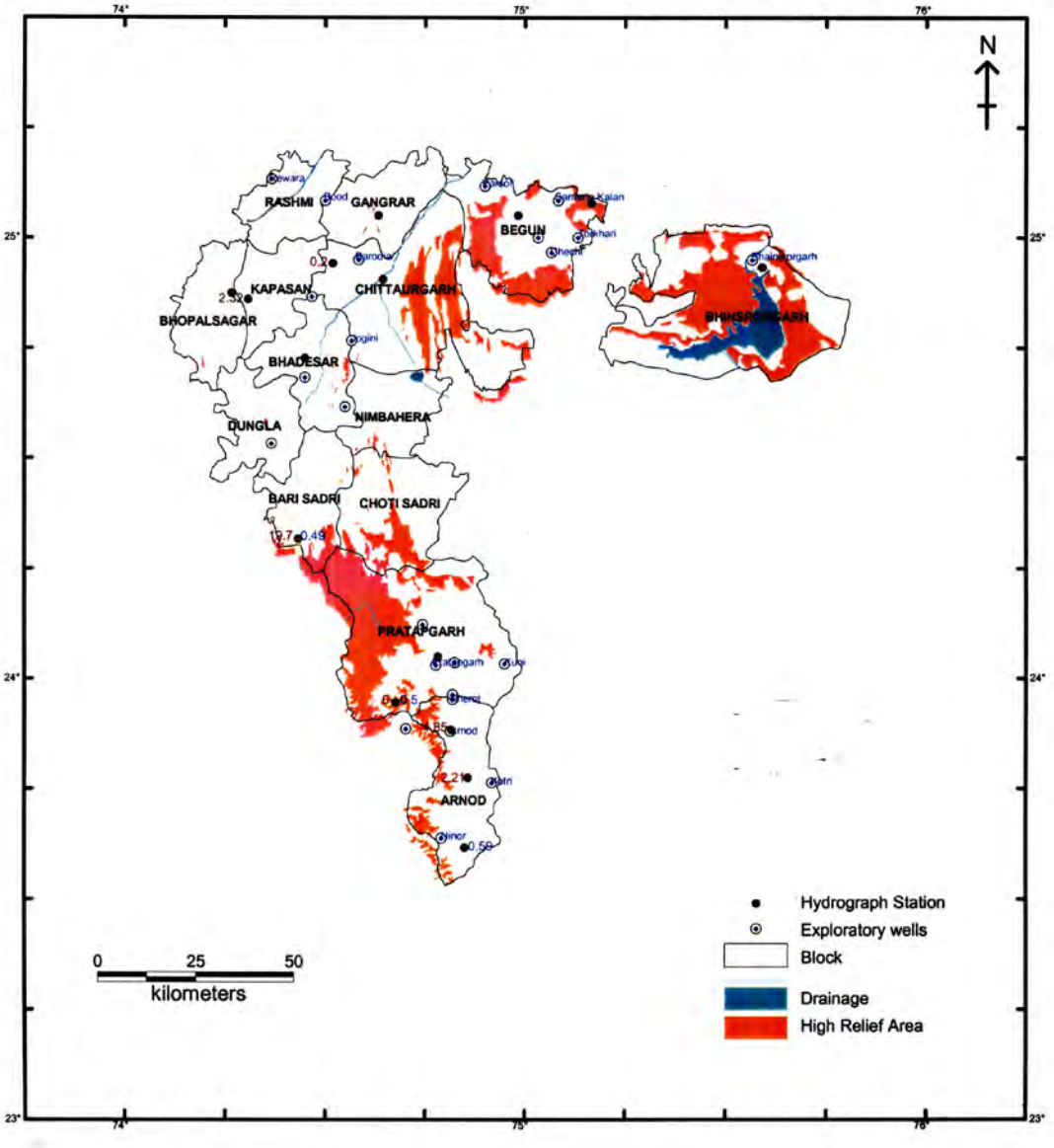
The district is characterized by undulating topography. The western, southern and northern parts are generally plain area. Hills are scattered in Chhoti Sadri, Bari Sadri and Pratapgarh tehsils. Hill ranges towards east of Chittaurgarh town runs north-south with intervening valleys parallel to each other. Chittaurgarh and Pratapgarh tehsils are partly hilly and partly plain.

The district has the regional slope from south to north. The height varies from 317m to 617m,amsl. Pal khera hill is the highest, having height of 617m.

Geomorphologically the district is divided into following units:

Origin	Land Forms	Occurrence in the District
Fluvial	Alluvial Plains	Along west of Banas river and Berach river
	Valley Fills	North of Jhakham dam
	Ravines	East of Begun and Motipura village
Denudation	Pediment	Scattered in entire district
	Burried pediment	Entire district
	Intermountain Valley	Scattered in eastern and northern part of Chittaurgarh
Structural	Plateau	East, North & south –east part of the district
	Dissected Plateau	South –west part around Pratapgarh
Hill	Structural hill	North of Gangrar town

INDEX MAP OF CHITTAURGARH DISTRICT - RAJASTHAN



Drainage:

Chittaurgarh district falls in parts of Chambal (27%), Mahi (21%) and Banas(52%) basins. Tehsil wise distribution of basin area is given below

Sl.No	Name of Tehsil	Area in Sq. Km.		
		Chambal	Mahi	Banas
1	Arnod	335.4	391.7	
2	Bari Sadri		408.3	318.5
3	Begun	2017.8		449.7
4	Bhadesar			460.9
5	Choti sadri		374.4	117
6	Chittaurgarh	146.7		732.7
7	Dungla		29.2	598
8	Gagrar			501.7
9	Kapasan			1252.6
10	Nimbahera		0.1	453.9
11	Rashmi			715.3
12	Pratapgarh	461.2	1031.3	

The drainage system is well developed and drainage density varies from 0.3 to 1 km/sq.km. Chambal is the only perennial river. It enters the district near Gandhi Sagar and flows towards NE for about 50 km and then passes into Kota district. The other main rivers are Banas, Gambhiri, Gujjali, Bamani, Berach, Jakham and Wagon.

The Banas River originates in Udaipur district and enters Chittaurgarh through Rashmi tehsil. It passes through Somi, Sankhli, Pahunia, and Unchkia villages.

The Ghabhir River originating in Madhya Pradesh flowing through Nimbhahera and Chittaurgarh tehsils joins Berach River. It passes through villages of Khor, Myara, Sarthal and Tai.

4.0 Soils & Irrigation Practices

Two third area of the district is covered by hilly terrain. The soils of the district falls under the following broad categories

- Black Soils
- Yellowish brown soils
- Grayish brown alluvial soils
- Hilly soils

Black soils are found in Pratapgarh, Arnod, Dungla, Kapasan, Begun and parts od Rashmi tehsils. Yellowish brown soils are predominant in Chittaurgarh, Nimbahera, Bhopalsagar, Bhainsorgah and Bhadesar panchyat samities. The hilly soils occur in Bhainsorgarh, Begun, Chittaurgarh, Dungla, Chotti Sadri, and Nimbahera Panchayat samities. There are broad stretches of light sandy loam soils along banks of river.

Irrigation:

The principal means of irrigation in the district are wells/tube wells, though some areas are irrigated by canals, tanks etc. Groundwater is the main source of irrigation and is utilized through dug wells, DCB's, and tube wells. Tanks form the second most important source of irrigation in the district. Canal irrigates only a small area. Important irrigation projects are Gambhiri (Nimbahera), Bankiy & Bassi (Chittaurgarh), Wagon (Dungla), Dorai & Orai (Begun), Bhoplasagar (Kapasan). Details of the gross irrigated area by different sources and number of structures have been given below:

(Area in Ha)

Sl. No	Tehsil	Total Irrigated Area	Irrigated Area				Number of structures		
			Tube wells / wells	Ponds / Tanks	Canals	Others	Dug Well	Tube Well	Pond
1	Arnod	11177	11129	48			6556	810	5
2	Bar Sadri	3235	3235				6602	1222	2
3	Begun	17699	14548	85	2648	218	7639	1986	8
4	Bhadesar	7198	7198				13313	773	5
5	Chhotisadri	8039	7986	53			11289	2030	10
6	Chittaurgarh	18611	16098	2430		83	8530	1684	4
7	Dungla	2587	2587				7447	993	11
8	Gangrar	6774	6371	66		337	11675	367	43
9	Kapasan	3732	3623		58	51	13782	468	6
10	Nimbahaera	23709	23672		37		5795	164	21
11	Pratapgarh	10330	9751	562		27	8686	2872	5
12	Rashmi	3217	2521	10	195	491	6523	414	8
13	Rawatbhata	10442	8358	303	413	1368	3709	99	13

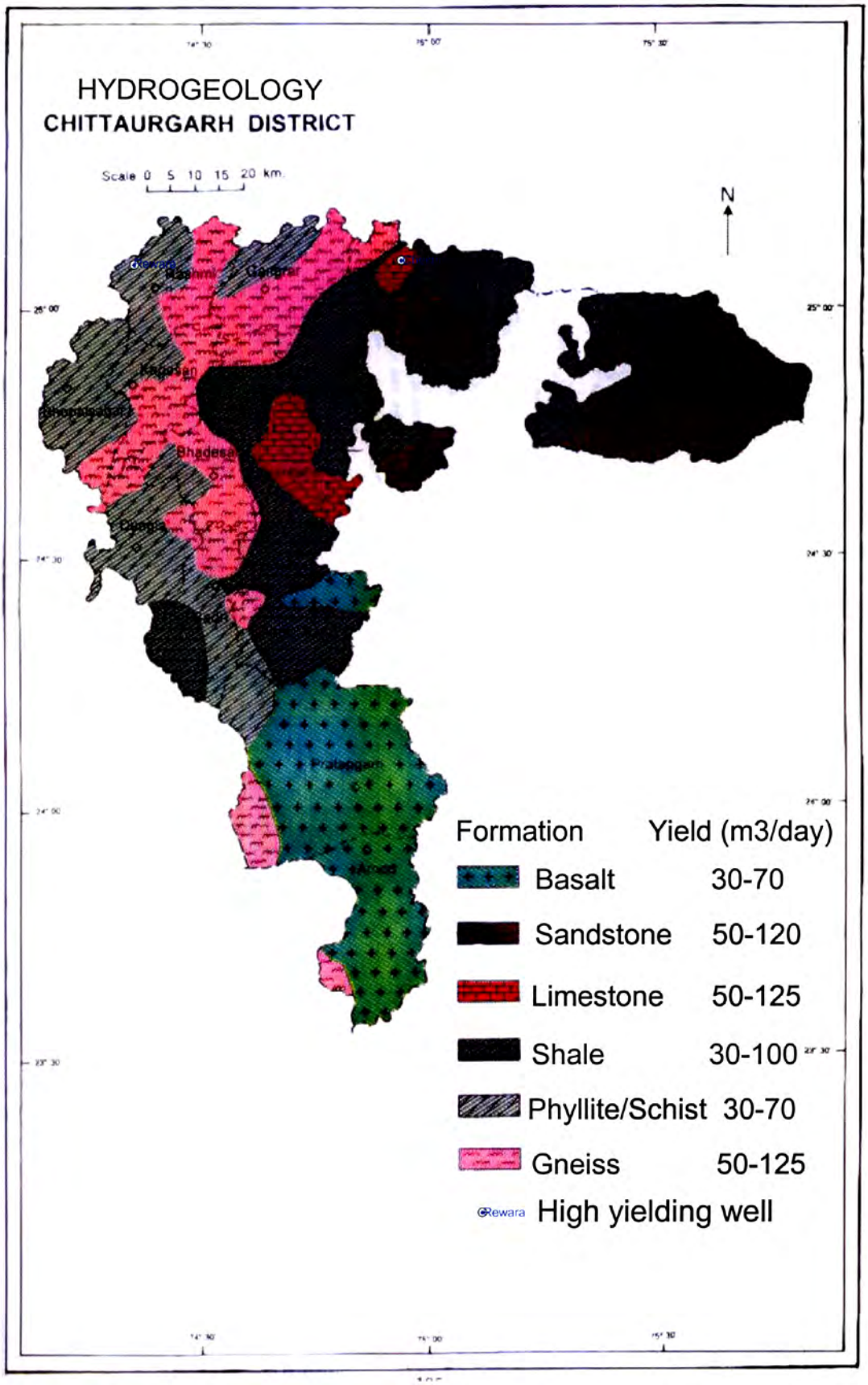
5.0 GROUNDWATER SCENARIO

Geological Framework

The geological set-up of the district is represented by various igneous and meta-sedimentary rocks. Bhilwara super group of Archean age comprising of Shale, Phyllite, Slate, Limestone, Marble, Schist, Quartzite etc prevail in north - eastern part of the district. Meta-sedimentary rocks belonging to Vindhyan super group are exposed in central and northeastern part. Deccan Traps are exposed in southern part while thin mantle of alluvium occurs along river courses and stream channels.

Hydro-geological Condition:

Groundwater occurs under unconfined condition in saturated zone of rock formation. Its occurrence is controlled by topography, physiography and structural features of the geological formations. The movement of the groundwater in hard rock areas is governed by size, openness, interconnection and continuity of structural weak planes while in unconsolidated rocks,


HYDROGEOLOGY
CHITTAURGARH DISTRICT
Scale 0 5 10 15 20 km.
N
Rashmi
Gangrar
Kapasan
Bhadesar
Pratapgarh
Arnod
Formation
Yield (m3/day)
Basalt 30-70
Sandstone 50-120
Limestone 50-125
Shale 30-100
Phyllite/Schist 30-70
Gneiss 50-125
Rewara High yielding well

ground water movement takes places through pore space between grains. Water bearing properties of different aquifers are described below

Groundwater in Bhilwara Super Group

- **Granite-Gneiss and Schist**: These aquifers occur predominantly in Pratapgarh tehsil. Few intrusives are also found which have low permeability. Groundwater is retained in weathered zones, fractures joints etc.

Depth to open wells tapping these aquifer ranges from 3 to 24m. Yield of wells varies from 6m^3/day to 48m^3/day. The depth to water level in the area tapping this aquifer ranges from 2m to 12m. Saturated thickness tapped in most wells ranges from less than 1m to 6m.

- **Slates Phyllite and Schist:** These aquifer occur predominantly towards north of Pratapgarh tehsil. Groundwater occurs under water table condition and is mostly tapped by dug wells. Depth of wells ranges from 8m to 15m. The depth to water level ranges from 3m to 8m,bgl. Yield of wells ranges from 6 to 12m^3/day. Thickness of water column in most of the wells ranges from 0.50m to 6.0m
- **Quartzite:** The water-bearing unit of quartzite is highly ftractured and jointed. Intercalation of slates and phyllites is common. The depth of wells ranges from 7m to 16m. The depth to water level ranges from 4m to 14m,bgl. Yield of wells varies from 30m^3/day to 150m^3/day. Saturated thickness in wells varies from 4m to 6m.

Groundwater in Vindhyans

- **Sandstone:** The vindhyan sandstone, which is jointed and fractured, occurs in small pockets around Madhura Tala village. This aquifer is tapped by open wells ranging in depth from 6m to 12m. The depth to water level varies from 4 to 9m,bgl. Yield of wells ranges from 10 to 150m^3/day. Thickness of the water column ranges from 1m to5m.
- **Shales:** Shales intercalated with calcareous material generally forms poor aquifer. Depth of open wells ranges from 6m to 18m. Depth to water level range from 5m to 10m,bgl. Deep water level condition occurs towards north of Pratapgarh. Thickness of water column ranges from 0.80 to 5.50m. Yield test show specific capacity of wells is of the order of 0.181m^3/min/m and optimum yield is 0.06m^3/min.

Groundwater in Deccan Traps

Basalts as aquifer occur in southern part of the district. The groundwater occurs under water table condition and is exploited by open wells.

- **Compact Basalt**: The wells tapping this aquifer occur near Gyaspur, Nikor, Kunnaiy and Jokhera villages. Depth of wells ranges from 3 to 18m. Depth to water level ranges from 2m to 15m,bgl. Yield of wells ranges from 6 to 200m^3/day. Thickness of water column ranges from 0.50m to 8.0m. Sp capacity of wells ranges from 0.015m^3/min/m to 0.051m^3/min/m. Optimum yield of wells ranges from 0.1.m^3/min to 0.015m^3/min.
- **Weathered Basalt**: Groundwater in weathered zone of basalts occur under unconfined condition. The aquifer occurs near Pilu, Pratapgarh, Dalot and Ambirana villages. It is tapped by open wells ranging in depth from 3 to 22m. Yield of wells ranges from 6 to 250 m^3/day. The thickness of water column

ranges from 1m to 10m. Sp capacity of wells ranges from 0.08 to 0.14m^3/min/m and optimum yield ranges from 0.018 to 0.081m^3/min.

- **Vesicular Basalt:** Groundwater in vesicular zone of basalt occurs near Rampur, Thikriya, Arnod, and Chota semlia villahes. Depth of wells ranges from 4m to 18m. The depth to water level ranges from 5m to 20m,bgl. Yield of wells ranges from 6 to 200m^3/day. Thickness of water column ranges from 0.50m to 9,0m. Sp capacity of dug wells ranges from 0.074 to 0.138m^3/min/m and optimum yield varies from 0.026 to 0.073 m^3/min
- **Amygdoloidal Basalt**: Groundwater in amygdoloidal Basalt occur near Gandher, Nagdela and Chokhi pipli villages. Depth of wells ranges from 7m to 20m. The depth to water level ranges from 2.5m to 17m,bgl. Yield of wells ranges from 23 to 300m^3/day. Thickness of water column ranges from 1m to 3.5m. Sp capacity of dug wells is of the order of 0.089m^3/min/m and optimum yield is 0.027 m^3/min

Groundwater in Unconsolidated Sediments

- **Alluvium**: Alluvium occurs overlying the weathered hard rock formation. It has limited thickness and aerial extension. It is confined to riverbeds and riverbanks. The depth to water level is less than 10m,bgl near river courses but exceeds 25m in other areas.

Deep Aquifer System:

Exploratory drilling ion the district reveals that basalt, sandstone, quartzite, granite/gneiss, phyllite etc. forms the hard rock aquifer.

Multiple aquifer system is found in basaltic terrain. Among all the flows, 3, 5, and 6th flow are potential. Moderate groundwater potentialities are within contact zone of basalt and others lithological units.

Shallow aquifer up to 30m depth is encountered in all bore wells except at Kotra, Sohagpura, and Arnod. Its yield is 2 to 15 lpm.

First deep aquifer was encountered in depth range of 26m and 90m. Its yield varies from 6 lpm to 105 lpm. Yield less than 3 lpm is found at Pratapgarh and Sohagpura.

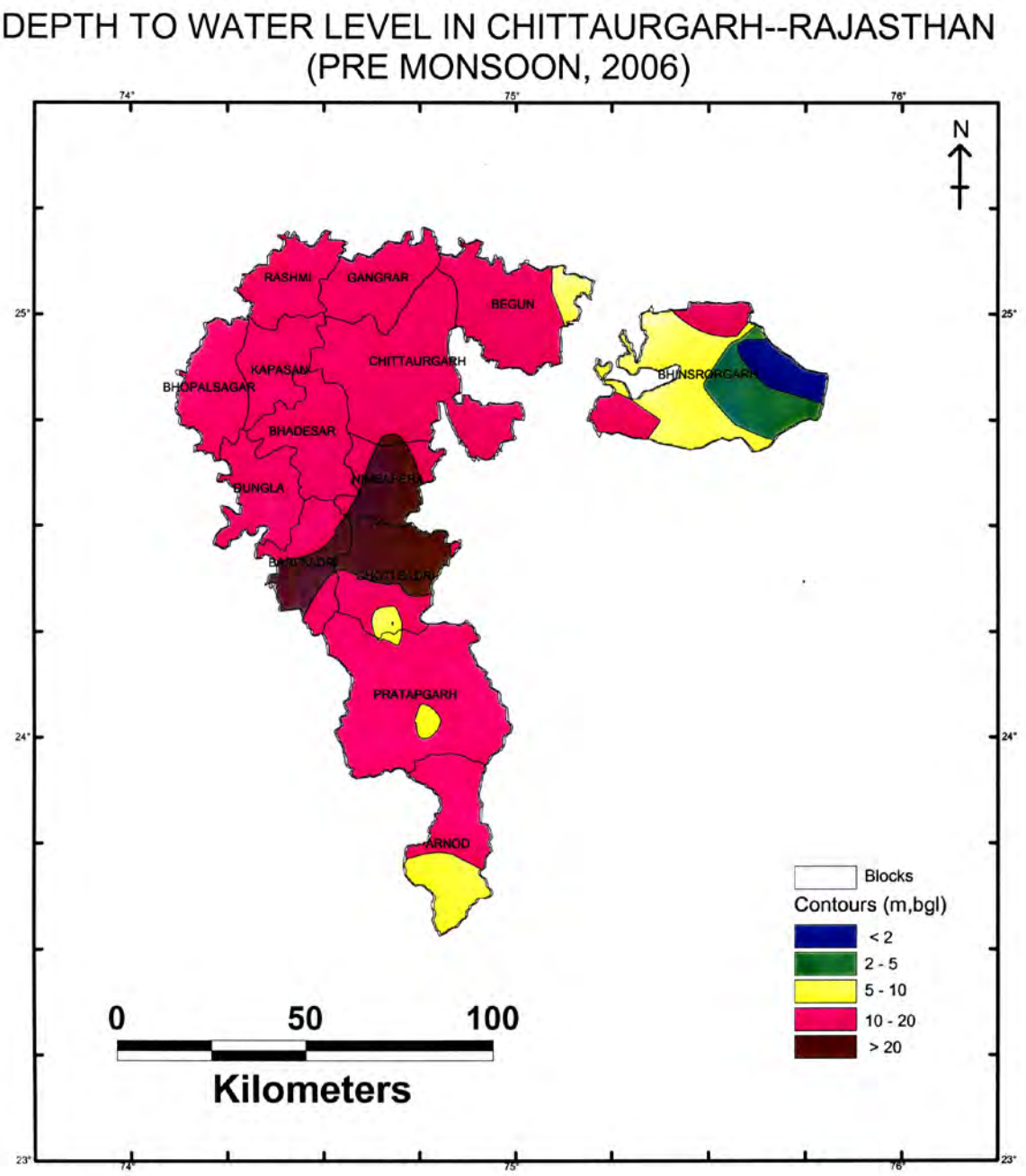
Second deep aquifer is encountered in depth range of 40m to 92m, which yields 20 to 100 lpm.

Third deep aquifer was observed between 95m to 105m, which forms a negative zone.

Depth to Water Level (Pre Monsoon 2006)

The depth to water level varies widely depending upon topography, drainage, bedrock geology etc. Depth to water varies from less than 2m to more than 50m bgl. Water level is shallower in eastern part (Bhaisrorgarh) of the district.

In general DTW varies from 10 to 20m in greater part of the district. In the southern part DTW varies from 5m to 10m,bgl. Deep water levels (>20m) are observed in parts of Bari Sadri and Nimbahera tehsils.

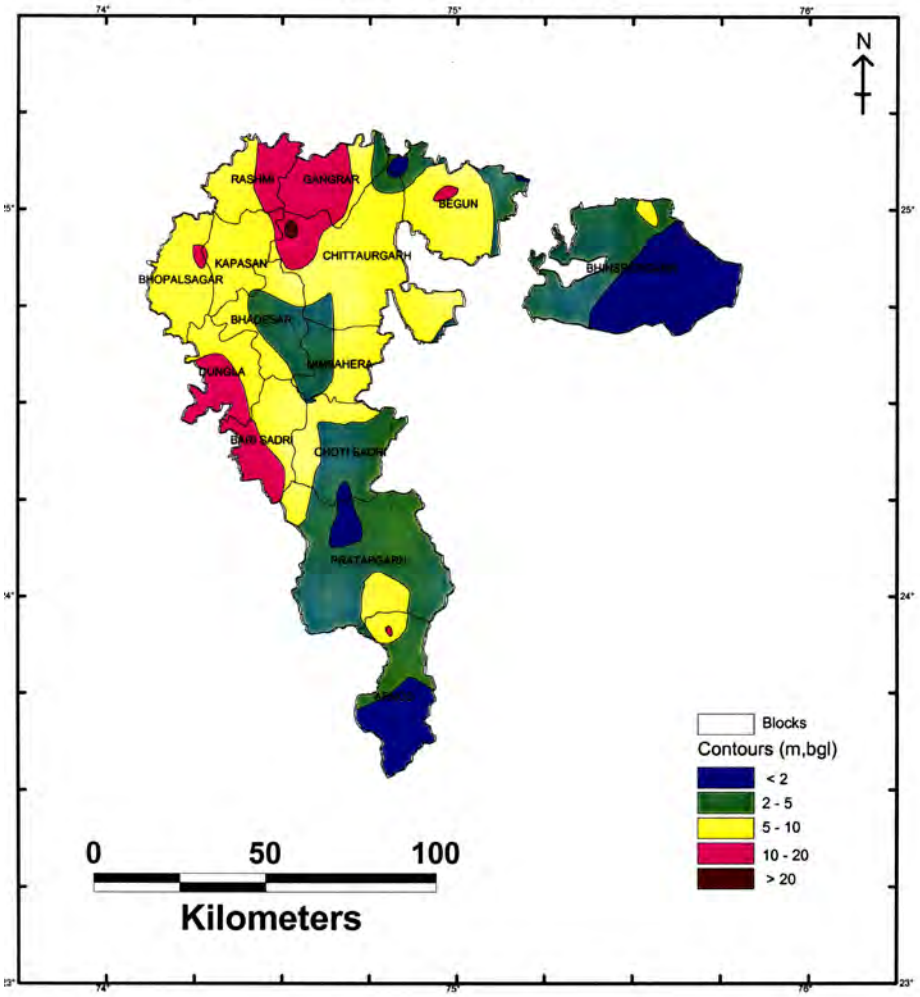


Depth to Water Level (Post Monsoon 2006)

During Nov.06 water level ranges widely from less than 2M to more than 20m,bgl. Water level is shallower in eastern and southern part of the district. In general DTW varies from 2m to 5m in Bhaisrorgarh, Pratapgarh and Chotti Sadri tehsils, between 5m to 10m in Chittaurgarh, Kapasan, Bhopalsagar and Begun rehsils. Water level between 10m to 20m is observed in parts of BariSadri, Rashmi and Gangrar tehsils.

Block	Pre Monsoon		Post Monsoon	
	Min	Max	Min	Max
Arnod	4.71	12.18	0.90	10.74
Barisadri	20.75	20.75	5.43	14.08
Begun	5.45	18.96	0.64	10.72
Bhadesar	15.70	15.70	3.88	9.48
Bhaisrorgarh	0.70	15.10	0.53	5.44
Bhopalsagar	14.77	16.72	5.78	11.71
Chittaurgarh	11.17	19.65	4.85	22.03
Chottisadri	4.74	22.62	1.42	5.13
Gangrar	15.40	15.40	14.03	16.17
Kapasan	12.65	12.65	5.78	6.97
Rashmi	11.10	11.10	6.30	6.30

DEPTH TO WATER LEVEL IN CHITTAURGARH DISTRICT-RAJASTHAN
(POST MONSOON 2006)



Water Level Fluctuation

Seasonal fluctuation in water level based on Pre and Post-monsoon 06' indicate that there has been rise in water level in major part of the district. Perusal of the fluctuation data indicate that major part of the district has recorded rise in water level of more than 4m except in parts of Chittaurgarh where decline in water has been observed.

Block	Water level fluctuation (Pre– Post)			
	Rise		Fall	
	Min	Max	Max	Max
Arnod	3.81	10.49		
Barisadri	6.67	6.67		
Begun	3.53	8.24		
Bhadesar	11.82	11.82		
Bhaisrorgarh	0.17	9.76		
Bhopalsagar	5.01	8.99		
Chittaurgarh	4.86	14.80	7.25	7.25
Chottisadri	3.32	17.83		
Gangrar	1.37	1.37		
Kapasan	5.68	5.68		
Pratapgarh	3.20	13.84		
Rashmi	4.80	4.80		

Decadal (1997-06) water level trend has been worked out for Pre and Post Monsoon and has been given in the table. On comparing water level data majority of monitoring stations show declining trend ranging from 0.12m/yr to 0.96m/yr during pre-monsoon. Rise in water level is observed in small pockets in Pratapgarh, Bari Sadri and Chttaurgarh tehsils. During post-monsoon decadal trend show rise and decline of 0.03 and 0.25m/yr respectively.

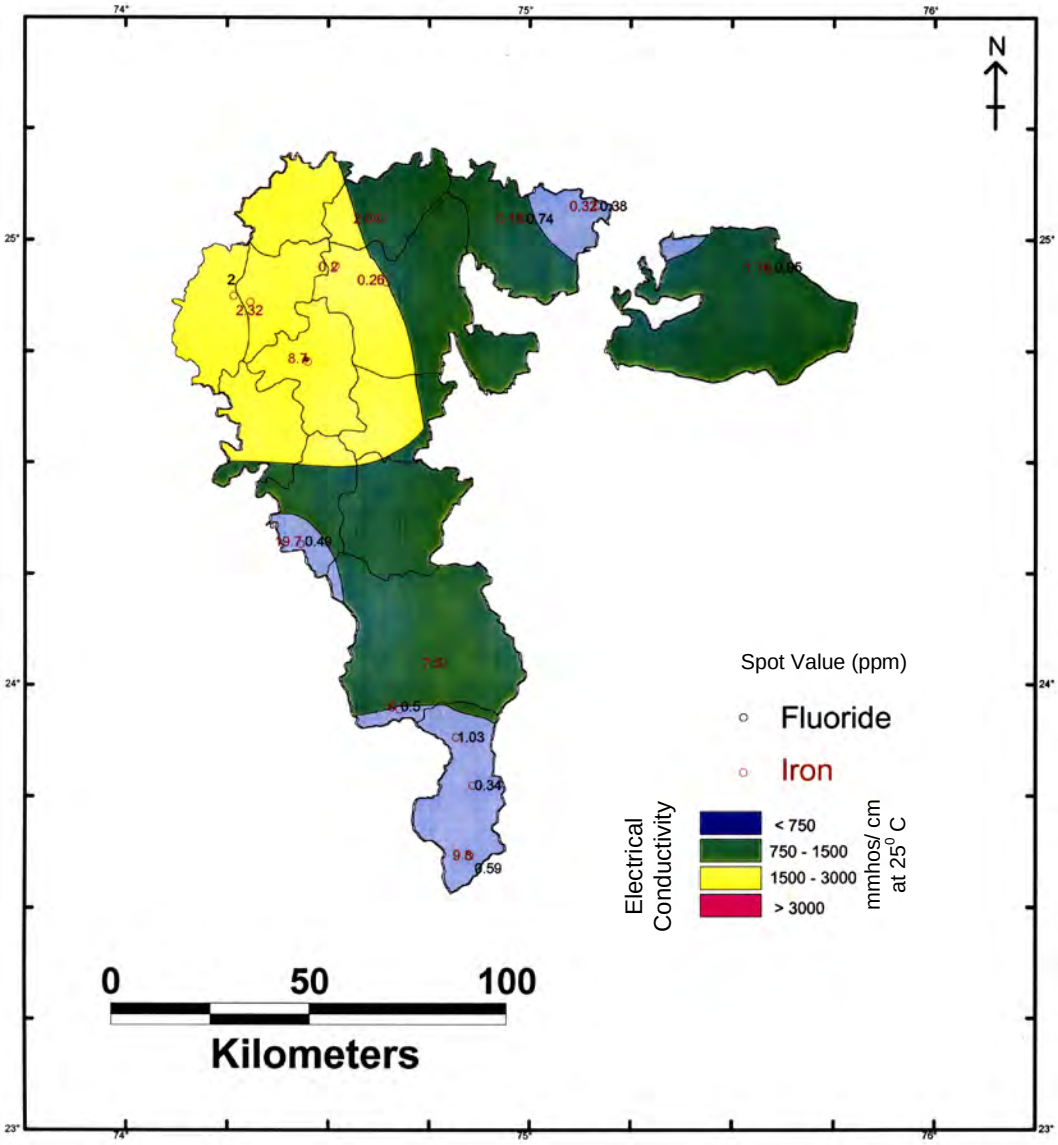
Block	Pre Monsoon Trend (m/yr)		Post Monsoon Trend (m/yr)	
	Rise	Fall	Rise	Fall
Arnod		0.24	0.02	0.020
Barisadri	0.52	0.36	0.0006	0.80
Begun		0.12	0.0139	0.28
Bhadesar		0.89	0.0369	0.02
Bhaisrorgarh	2.02	0.12	0.0244	0.13
Bhopalsagar		0.90		0.023
Chittaurgarh	0.18	0.73	0.0.0789	0.055
Chottisadri		0.019		0.761
Gangrar		0.70		0.57
Kapasan		0.96		0.03
Pratapgarh	0.17	0.17	0.0172	0.023
Rashmi		0.46		0.26
Nimbahera		0.28		0.21
Dungla		0.53		0.51

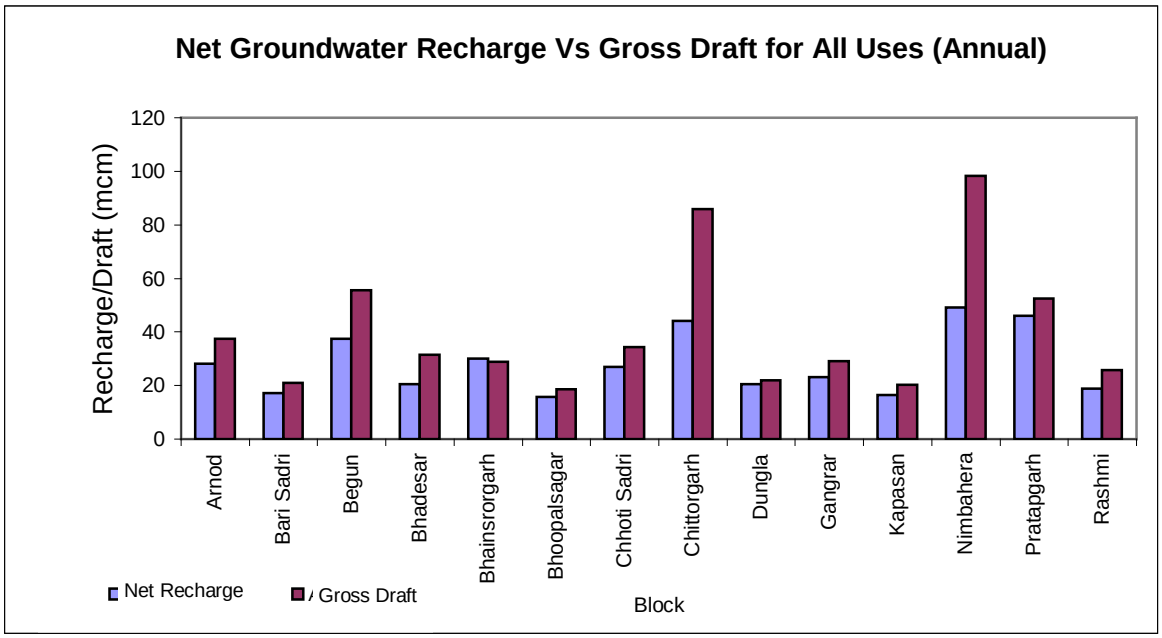
Groundwater Quality
Water Quality in Shallow Aquifer

Shallow groundwater of dug well zone is alkaline in nature with pH ranging from 7.5 to 8.7. The sp. Conductance is within 1500mmhos/cm at 25^{o}C but higher values are recorded in southern and northwestern part of the district.

The Chloride content varies from 43 ppm to 376ppm. High Chloride content (>250ppm) has been observed at Kapasan and Arnoud. The concentration of carbonate varies from negligible to 48ppm and bi-carbonate varies from 122ppm to 866ppm.

Distribution of Electrical Conductivity, Fluoride & Iron





The fluoride content is generally within 1mg/lit in major part of the district. Higher concentration (>1.5mg/lit) is found at Kapasan, Singhpur, Napania and Akola.

The concentration of Nitrate ranges from 2ppm to 220 ppm. Nitrate values in major part of the district are within 90ppm. Higher values of nitrate occur at kapasn, Akola and Napania.

The groundwater is moderately hard to very hard in major part of the district.

Water quality in Deep Aquifer

Chemical analysis of water samples collected from tubewells show that quality is fresh and potable except at Pratapgarh. The sp. Conductance is generally less than 200m mhos/cm at 25^{o}C except at Pratapgarh (2940 m mhos/cm at 25^{o}C) and Kherot (3760 mhos/cm at 25^{o}C).

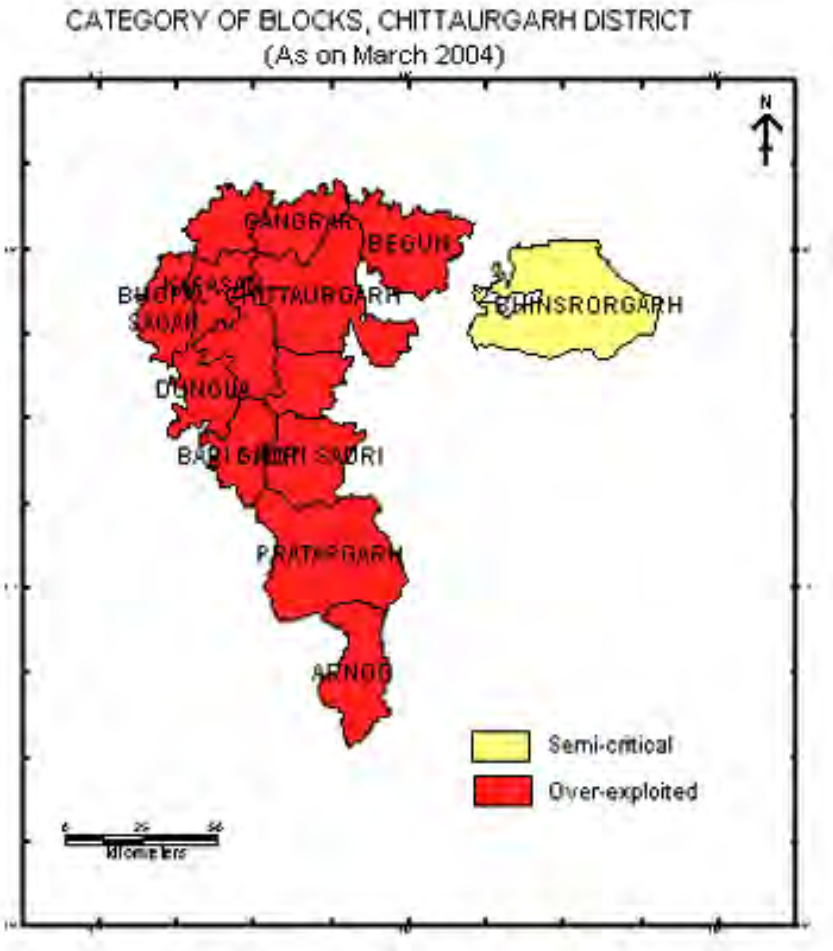
The concentration of Chloride varies from 14 to 234ppm except at Kherto and Pratapgarh(902ppm). The concentration of Fluoride is less than 1.0mg/lit and is well within permissible limit.

6.0 Groundwater Resources

Groundwater resources have been estimated as per the norms recommended by GEC 97. While assessing the ground water resources saline and hilly areas have not been considered. Total groundwater resources based on water level fluctuation method is estimated to be 4920 ham. Draft for all use is 9839 ham and over all stage of development is 142.44%.

Summarized block wise estimate of dynamic groundwater resources is given below:

Sl. No.	Assessment Unit	Net Annual Ground Water Availability	Gross Ground Water Draft for All uses	Stage of Ground Water Development	Category
1	ARNOD	2818	3757	133.32	O.E
2	BARI SADRI	1720	2097	121.92	O.E
3	BEGUN	3741	5563	148.70	O.E
4	BHADESAR	2057	3149	153.09	O.E
5	BHAINSRORGARH	3005	2892	96.24	S. Cr.
6	BHOOPALSAGAR	1575	1860	118.10	O.E
7	CHHOTI SADRI	2685	3440	128.12	O.E
8	CHHITORGARH	4407	8600	195.14	O.E
9	DUNGLA	2057	2193	106.61	O.E
10	GANGRAR	2312	2919	126.25	O.E
11	KAPASAN	1645	2031	123.47	O.E
12	NIMBAHERA	4920	9839	199.98	O.E
13	PRATAP GARH	4605	5252	114.05	O.E
14	RASHMI	1892	2585	136.63	O.E
DISTRICT TOTAL		**39439**	**56177**	**142.44**	O.E



7.0 *Status of Groundwater Development*

Gneiss, schist, phyllite, slate, Basalt, Sandstone, shale and alluvium form the aquifer in different parts of the district. Alluvium area is restricted to riverbeds. Ground water occurs under unconfined to semi-confined condition. Depth and diameter of the dug well and bore well depends on formation and geomorphology. However, general depth of dug well and bore well ranges from 10 to 20m and 100m respectively.

Details of groundwater structures is as follows:

Tehsil	Formation	Avg. Yield m^3/day			Depth in m		Diameter	
		Dug well	DCB	TW	Dug well	Tube well	Dug well, m	Tube well, mm
Arnod	Basalt	30	40	64	5-20	50-125	4-5	200
Bari Sadri	Sc& Ph	38	50	64	8-20	125	3-5	200
	Gn	32	45	64	5-25	125	4-5	200
Begun	Sst	40	55	80	10-20	125	4-5	200
	Lst	60	70	120	15-25	150	4-5	200
	Sh	50	60	96	3-30	125	4-5	200
Bhadesar	Sh	45	60	96	3-30	125	4-5	200
	Sc&Ph	38	50	64	8-20	125	3-5	200
	Gn	32	45	64	5-25	125	4-5	200
Bhaisorgarh	Sst	40	50	-	10-20	-	4-5	-
	Sh	45	55	-	3-30	-	4-5	-
Bhopalsagar	Sc&Ph	38	50	64	8-20	125	3-5	200
Chittaurgarh	Ls	60	70	120	15-25	150	4-5	200
	Sh	50	60	96	3-30	125	4-5	200
	Gn	32	45	-	5-25	-	4-5	-
Gangrar	Sc&Ph	38	50	64	8-20	125	3-5	200
	Gn	32	45	64	5-25	125	4-5	200
Kapasan	Sc&Ph	38	50	-	8-20	-	3-5	-
	Gn	32	45	-	5-25	-	4-5	-
Nimbahera	Ls	60	70	120	15-25	150	4-5	200
	Sh	45	55	96	3-30	125	4-5	200
Pratapgarh	Basalt	30	40	64	5-20	50-125	4-5	200
	Gn	32	45	-	5-25	-	4-5	-
Rashmi	Sc&Ph	38	50	64	8-20	125	3-5	200
	Gn	32	45	64	5-25	125	4-5	200
Dungla	Sc&Ph	38	50	64	8-20	125	3-5	200
	Gn	32	45	-	5-25	-	4-5	-

Urban and Rural Water supply

Chittaurgarh district comprises 8 urban areas and each of them is facilitated by piped water supply. All the 2209 villages are benefited by water supply for drinking and domestic purposes. Status of urban and rural water supply is given bellow:

Town	*Population*	*Source of Drinking water*				*Service Level LPCD*	*Water Supply Interval*
		Surface water	*Bore well*	*Dug well*	*Hand pump*		
Bari Sadri	*15001*	*-*	*5*	*7*	*38*	*30*	*3 days*
Begun	*19333*	*-*	*18*	*1*	*68*	*40*	*Daily*
Chooti Sadri	*16602*	*1*	*1*	*-*	*44*	*50*	*1 Day*
Chittaurgarh	*96028*	*1*	*108*	*7*	*220*	*60*	*1Day*
Kapasan	*18705*	*-*	*10*	*2*	*74*	*40*	*1 Day*
Nimbahera	*53323*	*-*	*20*	*-*	*14*	*40*	*1 Day*
Pratapgarh	*36414*	*1*	*5*	*2*	*125*	*55*	*1Day*
Rawatbhata	*34677*	*1*	*-*	*-*	*24*	*60*	*Daily*

Tehsil	Population	Number of Structures		
		Dug Well	Tube well	Hand pump
Arnod	119818	190	324	183
Barisadri	88817	145	205	144
Begun	99675	215	310	216
Bhadesar	107382	166	226	165
Chittaurgarh	167842	223	303	220
Chottisadri	100002	148	181	147
Gangrar	88622	128	187	128
Kapasan	157162	205	289	191
Pratapgarh	201086	331	603	339
Rashmi	75312	82	126	83
Nimbahera	135305	154	164	155
Dungla	89957	104	150	104
Rawatbhata	82593	175	285	171

Major part of the district (about 95%) is covered by hard rock formations where success failure ratio is 80:20 High yield i.e. more than 800 lpm was recorded in 5% of the wells, yield between 100 – 500 lpm in 50% where as yield less than 100 lpm was registered in 25% of wells. About 20% wells have yielded negligible quantity of water.

8.0 Ground Water Development Strategy

Ground Water Development

Stage of ground water development in the district is 142.44%, which indicate that the scope of ground water development is already exhausted in 13 blocks where groundwater development has already exceeded 100% and categorized as “Over-exploited”. Only 1 blocks falls under “Semi-Critical” category where ground water development is approaching 100%. Most the boreholes have been drilled in the southern part of district falling in Arnod and Pratapgarh blocks. There is no scope for further development in the district for irrigation or

industrial use. However, exploratory drilling can be taken up in unexplored area for estimation of aquifer parameters.

Water Conservation and Artificial Recharge

Ground Water Management

Due to over development of groundwater further exploitation of this precious resource must be checked. Artificial recharge is a difficult task in the district as the country rock is composed exclusively of hard rocks, water level gradient is steep and storage capacity is low. Under such condition there is likelihood that recharged water will reappear as base flow. Any induced water application will create localized mound with no change in trend of declining water level in adjacent areas.

Since the stage of ground water development has already crossed 100%, for sustainable utilization of water resources conjunctive use of surface and groundwater is inevitable. Water Harvesting is the only solution through construction of bunds, anicuts, and rooftop harvesting structures. The area has undergone polyphase deformation in geological past, which has resulted in a complex structure (folded, faulted and jointed) that may not be conducive for such structures. Therefore, site of these structures should be selected carefully.

Irrigation, Watershed Development & Soil Conservation Department has constructed sub-surface barriers and anicuts under Irrigated Watershed Development Project to harvest rainwater, reduce soil erosion and check runoff velocity. So far 902 WHS have been constructed in the district.

Tehsil	Structure Constructed		Structures to be constructed	
	Sub-Surface Barrier	Annicut	Sub-Surface Barrier	Anicut
Arnod	5	25	1	121
Barisadri	18	18	264	218
Begun	0	56	0	24
Bhadesar	4	57	0	78
Chittaurgarh	6	58	6	139
Chottisadri	44	12	46	227
Gangrar	0	73	9	146
Kapasan	0	39	0	58
Pratapgarh	0	32	0	162
Rashmi	29	28	21	116
Nimbahera	60	36	63	138
Dungla	258	21	258	80
Rawatbhata	0	23	0	88
	424	478	668	1595

Impact assessment of water harvesting structures (WHS) reveals that there is increase in cropping area, cropping intensity, crop production and labor employment observed in the project area. Erosion from nalah bank minimizes. Cropping pattern and cropping intensity changed. Harvested water provides supplementary irrigation during long dry spell. In view of the above, such WHS programmes may be taken up in the district for further development of surface water and ground water resources to enhance agricultural production.

9.0 GROUND WATER RELATED ISSUES & PROBLEMS

Almost entire district is facing problem of ground water scarcity. However, there are some areas vulnerable for pollution and depleted water table. Major issues in the district are as follows:

Groundwater Depletion Hazard

Comparison of pre monsoon water level between 1997 & 2006 shows that 60% of wells (total wells 26) registered decline in water level. In the decade, decline of more than 50cm/yr was observed in 25% wells. The long term depleting nature of water level causes reduction in storage, which leads to water scarcity.

Water Quality Hazard

In the district, fluoride (>1.5 mg/lit) is found in more than 15% villages and habitation. Fluoride hazard is mainly in Kapasan sub-division. The total salt concentration more than 1500 mg/lit is observed in 8% villages. Water salinity is localized in Kapasan-Bhopalsagar zone and Rashmi block. The nitrate hazard more than 45 mb/lit is found in 42% of villages falling in Gangrar, Rashmi, Kapasan, Bhopalsagar and Bari sadri blocks

Occurrence of Drought

The rainfall variation during last decade has been a critical water sector hazard. During 1997–06 the rainfall deficit years were 97,98,00,01 and 02 and are classified as serious drought years. The constant rise in population, urbanization, industrialization and agricultural growth has caused decrease in per capita availability of water.

10.0 Recommendations

1. Ground water draft is very high in all the blocks. Stage of ground water development in the district has reached 144.42% due to indiscriminate use. It has to be controlled by preventing further development.
2. Water scarcity is a perpetual phenomenon in Chittaurgarh. Permanent solution to drinking water problem should be devised using Ghosunda dam water.
3. Manpura mines can be additional potential source of water supply in October to December and partly from January to June.
4. A gated barrage on Berach River near Damdama annicut should be considered for improved water supply to Chittaurgarh.

5. Revival of traditional ground water storage system i.e. *Baori*, open wells, *Tanka* etc for rainwater conservation for use in day to day life will reduce ground water draft.
6. Awareness programme and training on rainwater harvesting will be beneficial to check decline in water level and justified use.
7. Taking advantage of uneven topography of the area, small WHS or earthen dams, upstream of irrigation commands, at suitable sites, may be constructed to store rainwater. This will increase recharge to ground water which ultimately result in increase of yield of wells.
8. Modern agricultural management techniques have to be adopted for effective and optimum utilization of the water resources. Maintaining irrigation through minimum pumping hours as per minimum requirement of water by the crop and also selecting most suitable cost effective cropping pattern can achieve this.
9. Alluvial tracts along river channels of Banas, Gambhir, Berach, Jakham and Wagon most feasible locations where shallow wells can be constructed to harness the shallow water table aquifers being potentially recharged by the flash flood and surface runoff. These wells can be used for water supply, wherever feasible.
10. Surface runoff can be harnessed by constructing tanks at feasible sites in the area occupied by the hard rock terrain for supplementing irrigation potential to increase the agricultural production.
11. High water requirement crops be discouraged. Proper agriculture extension services should be provided to the farmers so that they can go for alternate low water requirement economical crops.