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

SIROHI DISTRICT
RAJASTHAN

Sunset at Mt.Abu

Western Region

Jaipur

November, 2008

DISTRICT AT A GLANCE – SIROHI, RAJASTHAN

S No	Item	Statistics	
1	**GENERAL INFORMATION**		
	(i) Geographical area (sq km)	5136	
	(ii) Administrative Division (As on 31.3.2007)		
	Number of Tehsils	05	
	Number of Blocks	05	
	Number of Villages	467	
	(iii) Population (As per 2001 Census)	850756	
	(iv) Average Annual Rainfall (1977-2006) in mm	769.2	
2	**GEOMORPHOLOGY**		
	Major Physiographic Units	Pediment, Buried pediment, alluvial plain, Eolian plain	
	Major Drainage	Luni,west Banas, Jawai,Sukli Bandi,Sagi,Krishanavati,Khari, kapalganga nadi.	
3	**LAND USE (sq km)**		
	(a) Forest Area	1524.95	
	(b) Net Sown Area	1350	
	(c) Cultivable Area	1670	
4	**MAJOR SOIL TYPE**	Loam, sandy clay,saline soil & Kankars	
5	**AREA UNDER PRINCIPAL CROPS** (As on 2001)	Crops	Area in ha
		Maize	25229
		Tilhan	48083
		Pulses	9229
		Wheat	15218
		Jowar	5767
		Bajra	17175
		Barley	1360
6	**IRRIGATION BY DIFFERENT SOURCES**		
	Source	No of structure	Area in ha
	Dug wells	18983	6134589
	Tube wells/Bore wells	45	
	Tanks/Ponds	-	-
	Canals	-	-
	Other Sources	-	-
	Net Irrigated Area (ha)	4907090	
	Gross Irrigated Area (ha)	6134589	
7	**NUMBER OF GROUND WATER MONITORING WELLS OF CGWB** (As on May 2007)		

	Number of Dug wells	26
	Number of Piezometers	06
8	**PREDOMINANT GEOLOGICAL FORMATIONS**	Malani Rhyolite, Erenpura/Sendra/Ambaji granite and gneisses. Kumbhalgarh,Sirohi and Sindreth group of Delhi Super group
9	**HYDROGEOLOGY**	
	Major Water bearing formation	Alluvium,Granite,Gneiss, Rhyolite and Metasediment.
	Depth to water level (Pre-monsoon, 2006) (mbgl)	5-50
	Depth to water level (Post-monsoon, 2006) (mbgl)	0.1-33
	Long term decline water level trend (1996-2006) in m/yr	0.059-1.23
10	**GROUNDWATER EXPLORATION BY CGWB** (As on 31.3.2007)	
	Number of wells drilled (EW, OW, Total)	EW-21, OW-01,Pz-01 Total-23
	Depth Range (m)	93-150
	Discharge (liter per minute)	Meagre -2000
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 - 3237 sq km F –3591 sq km Nitrate– 1263 sq km
	Type of water	Potable
12	**DYNAMIC GROUND WATER RESOURCES (March, 2004) in mcm**	
	Annual Replenishable Ground Water Resources	272.7438
	Net Annual Ground Water Draft	272.6742
	Projected Demand for Domestic and Industrial Uses up to 2025	17.6779
	Stage of Ground Water Development	99.97%
13	**Awareness and training Activity**	Date: 08.03.2006(Training programme on rainwater harvesting) Place: Sirohi
14	**Groundwater control and Regulation**	No.of OE blocks:02 No.of block notified:Nil
15	**MAJOR GROUND WATER PROBLEMS AND ISSUES**	Declining water level, Low Yield of Wells, Quality hazard.

GROUND WATER SCENARIO
DISTRICT -SIROHI, RAJASTHAN

1.0 Introduction

Sirohi district is located between 24° 15' 00"and25° 17' 00"latitude and 72° 16' 00"and73° 11' 00"longitude covering an area of 5136 sq.km. The district is named after Sirohi town and part of Jodhpur Division and is divided into three sub-divisions namely Sirohi,Reodar and Mt.Abu Administratively the district is divided into five tehsils and five development blocks.

Total number of villages in the district is 467 and it also has 05 urban towns. Rural and Urban population of the district is 7 lakhs and 1.5 lakh respectively.

Systematic Hydrogeological survey in the district was carried out by Central Ground Water Board from 1976 to 1977 Reappraisal hydrogeological survey in parts of district was carried out during 1980-81. Under exploratory programme 21 exploratory boreholes have been drilled. Since 1973, monitoring of water level is being carried out four times a year from National Hydrograph Network Stations.

2.0 Rainfall & Climate

Average annual rainfall (1977-06) of the district is 769.2mm. However normal rainfall for the period 1901 to 1970 is 606.3mm. The annual rainfall gradually decreases from southern part to northern part. The maximum average rainfall is 1488.6mm at Mt.Abu and minimum average rainfall is 542.2mm at Sheoganj. .

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 occurred in the district at Pindwara (2000) and Reodar (1987)

3.0 Geomorphology & Drainage

The district is characterized by undulating topography. The district has almost an irregular triangle in shape. A large part of the district is vast semi-desertic plain marked by isolated hillock and chain of hills forming eastern fringe of Thar desert .Abu-Sirohi range divides the district into two parts .Mt.Abu is situated at about 1219m AMSL and is build on an irregular Plateau which is surrounded by several projecting peaks and ridges. Gurusikhar is highest peak in Aravali ranges touches 1722mAmsl.

Drainage:

Sirohi district falls in parts of Luni (41.2 %),W.Banas (35.5 %) Sukli(18.7% Other “nallah” (3.2%) and Sabarmati(1.3%)basins. Tehsil wise distribution of basin area is given below

Sl.No	Name of Tehsil	Area in Sq. Km.				
		Luni	W banas	Sukli	Sabarmati	Other nallah
1	SIROHI	910.9	141.6	63.8	-	-
2	PINDWARA	45.5	781.3	-	-	163
3	REODAR	31.3	223.5	88.3	-	-
4	ABUROAD	0.4	647.4	-	-	-
5	SHEOGANJ	1094.4	1.7	-	-	-

The drainage system is well developed in the district ,Jawai is the main river in north-west part which eventually meets Luni river. West banas is the most important river of the entire district draining almost all the area.Other river which flow in the district are Khari,Sukli,bandi,Kapalganga and Krishnavati.

No natural lakes in the district. Artificial Lake named Nakki lake in Mt.Abu is so picturesque and has become place of pride.

4.0 Soils & Irrigation Practices

The soils of the district falls under the following broad categories

- Mattiyar (Stiff Clay):- Black colour found in Pindwara and parts of Sheoganj block.This soil is more suitable for Wheat,Barley and Cotton.
- Gorat or Bhuri (Sandy):-Light brown colour,found in Reodar ,some parts of Sirohi and Sheoganj tehsil.It is fertile and suitable for Bajra.
- Reti(sand);-It is found in riverbeds,suitable for growing Tomatos and watermelon.
- Kankari(hard and stony mixed with sand):-It is found around the bases of the hills.
- Khari(saline soil):-Unsuitable for crops found in western parts of the district,

Irrigation:

The principal means of irrigation in the district are wells/tube wells. Groundwater is the main source of irrigation and is utilized through dug wells, DCB's, and tube wells. Canal irrigates only a small area. Important irrigation projects are West Banas,Sukli Selwar,Angore,Kameri,Swaroopsagar,Kailashnagar,Mandar Nallah etc. 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	SIROHI	13714	13714	---	----	----	3638	23	---
2	PINDWARA	8017	8017	----	--	--------	3550	01	---
3	REODAR	20759	20759	---	---	----	6702	06	---
4	ABUROAD	5375	5375	---	----	----	2560	01	----
5	SHEOGANJ	11536	11536	----	----	----	2533	14	---

5.0 GROUNDWATER SCENARIO

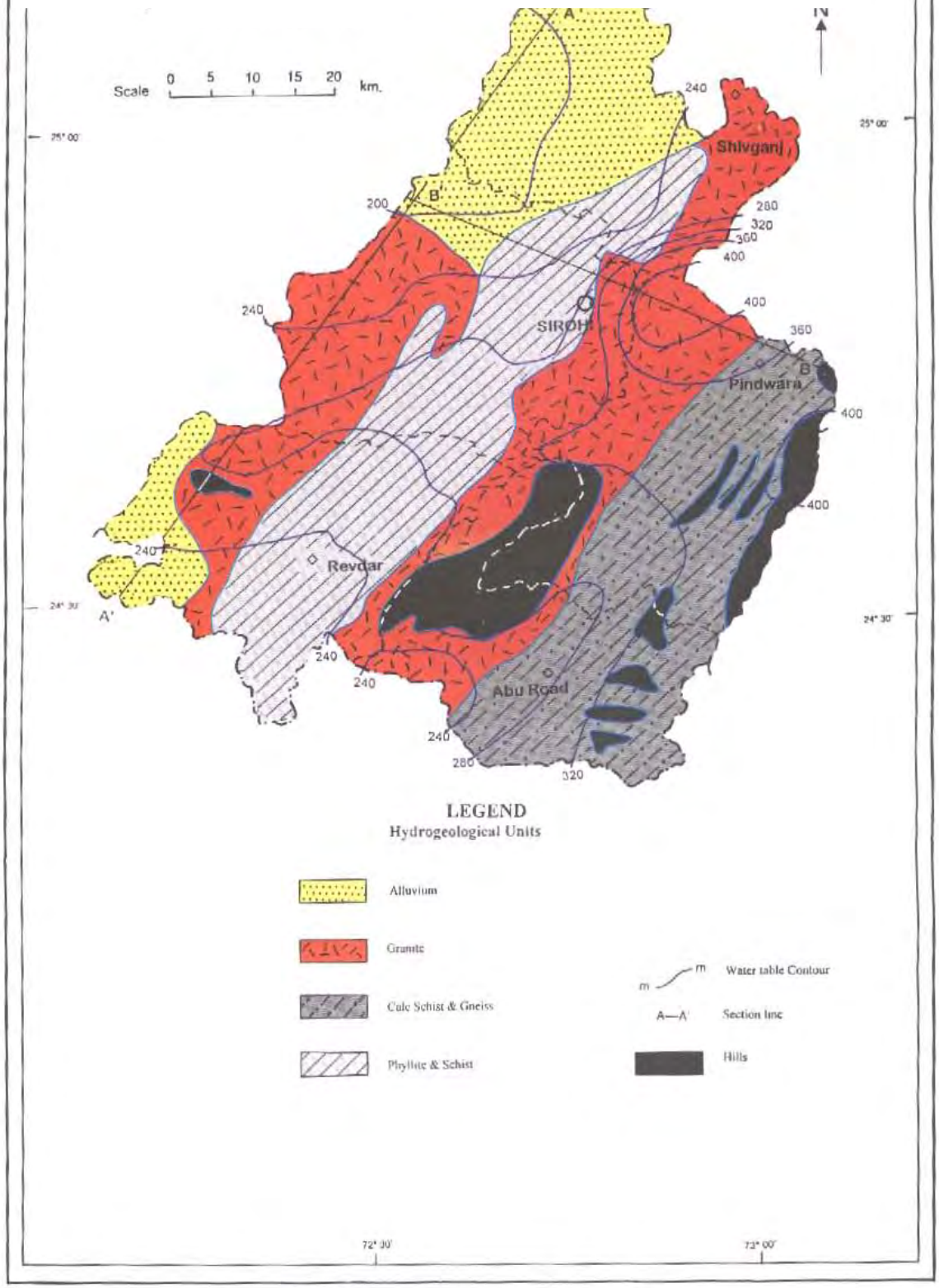
Geological Framework

Geological formation exposed in the district range in age from Proterozoic to Recent. Oldest rock is Calc.Schist,Calc.Gneiss which belong to Kumbhalgarh group of Delhi Super Group, While youngest formation is Alluvium belongs to Quaternary group. Delhi Super group rocks are exposed in the southeastern and central part of the district. Post Delhi granite and granitic gneiss are Erenpura,Sendra,Ambaji granite and graniticgneiss are exposed in the northeastern, southwestern and southeastern part on entire district.Malani rhyolite are exposed in the southern and northern part of the district around Aburoad and sheoganj block, Northwestern and southwestern parts of district are covered by unconsolidated sediments comprising of Alluvium and windblown sand.

Hydro-geological Condition:

Groundwater occurs under water table condition both in unconsolidated and consolidated saturated zone of 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, ground water movement takes place through pore space between grains. Water bearing properties of different aquifers are described below

HYDROGEOLOGICAL MAP OF SIROHI DISTRICT, RAJASTHAN



Groundwater in Delhi Super Group

- **Phylite and Schist**:- These aquifers occur predominantly in Aburoad,Pindwara nad central part of Sirohi 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 25 to 40 m. Yield of wells varies from 30 to 250 m^3/day. The depth to water level in the area tapping this aquifer ranges from 20 m to 40m in the northern part and 10m to 20m at westernparts.

Groundwater in Post Delhi groups of formation.

- **Rhyolite and granite (Malani)and Erenpura granite & gneiss;-** In the large part of the area Erenpura granite forms the principal aquifer but to a small extent Malani rhyolite and granite forms aquifer especially in the northern and western part of the district. Idar granite also exist in the central part of the district.. This aquifer is tapped by open wells ranging in depth from 20 m to 50m. The depth to water level varies from 20 to 40 m bgl in the northern part and 10m to 20m in the western part of the district. Yield of wells ranges from meagre to 250 m^3/day.

Groundwater in Unconsolidated Sediments

- **Alluvium**: Alluvium occurs overlying the weathered hard rock formation found in the northern and western part of the district. It has limited thickness and aerial extension. It is confined to catchments of Jawai,Sukli and Khari river. The depth to water level is less than 10mbgl near river courses but exceeds 35m in other areas. Depth of well ranges from 25m to 40m.Yield of wells ranges from 150 to 1000 m^3/day.

Deep Aquifer System:

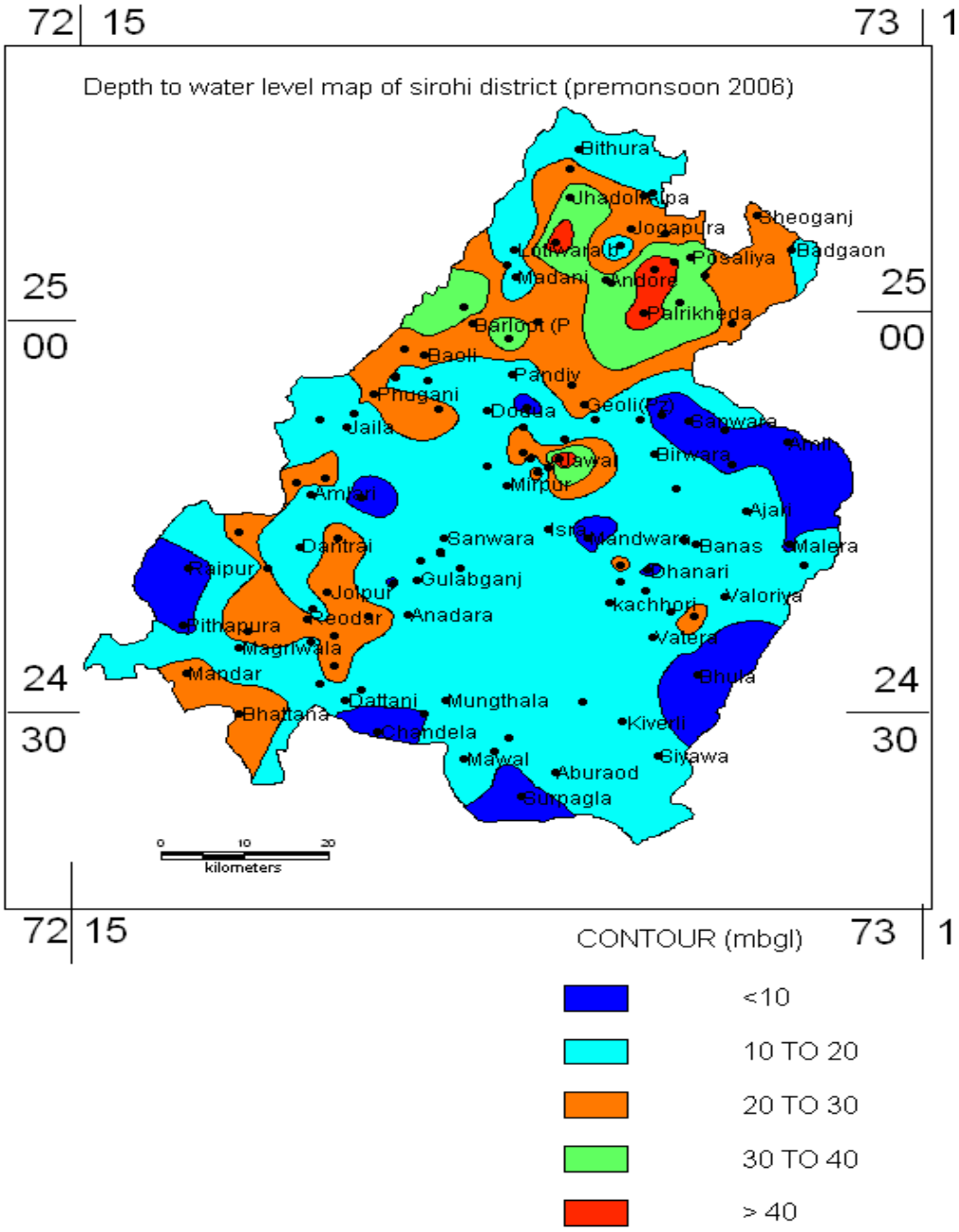
Exploratory drilling in the district reveals that the hard rock forms the main aquifer in the large parts of the district. Depth of tubewell ranges from 20m to 150m.Yield of tube well ranges from meagre to 2000lpm.

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 05m to more than 50 m bgl.

In general DTW varies from 10m to 20 m in greater part of the district. In the northern part DTW varies from 20 m to 30 m,bgl. Deep water levels (>40 m) are observed in small pocket Sheoganj tehsils.

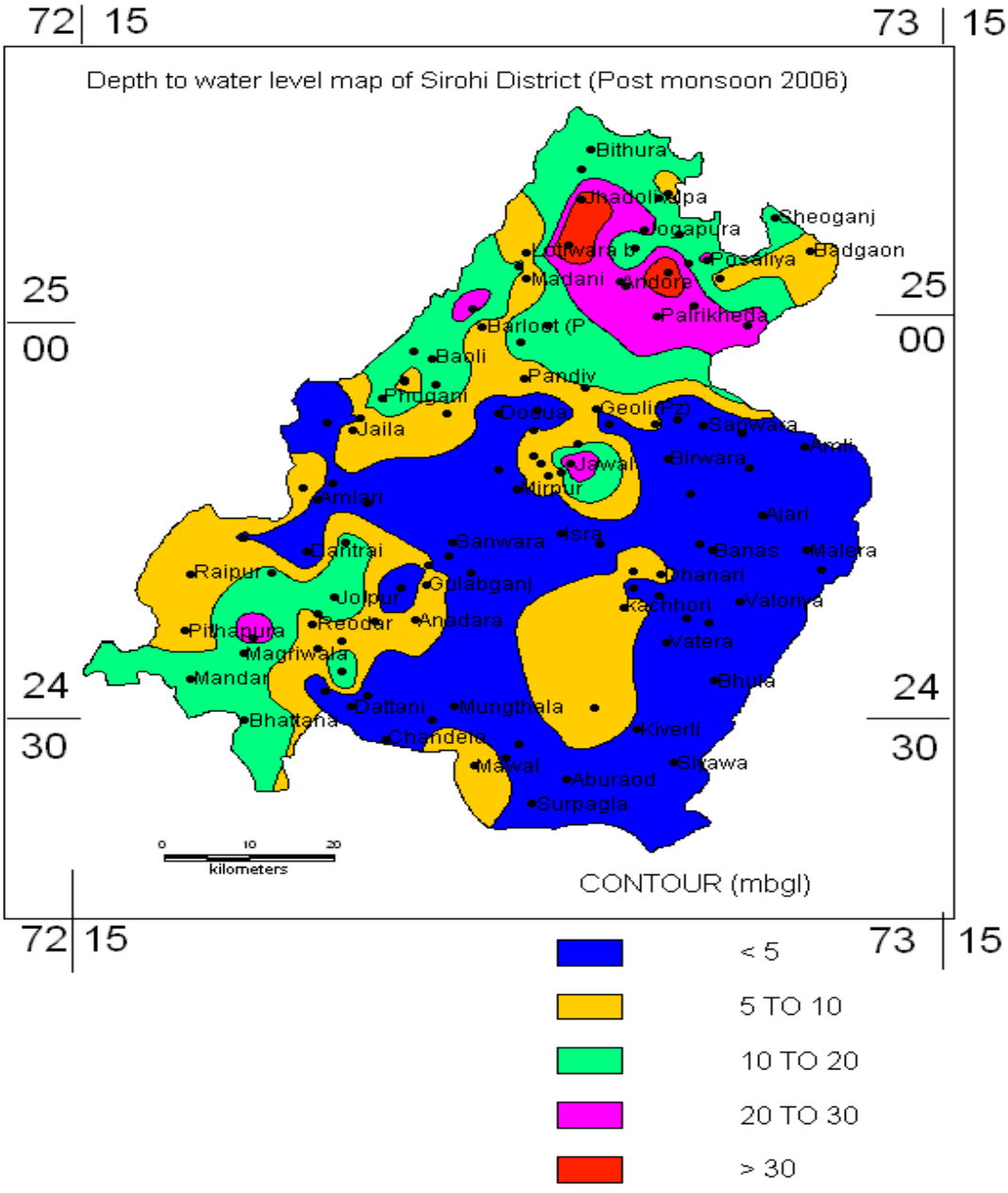
Map of Depth to Water Level (Pre Monsoon 2006)



Depth to Water Level (Post Monsoon 2006)

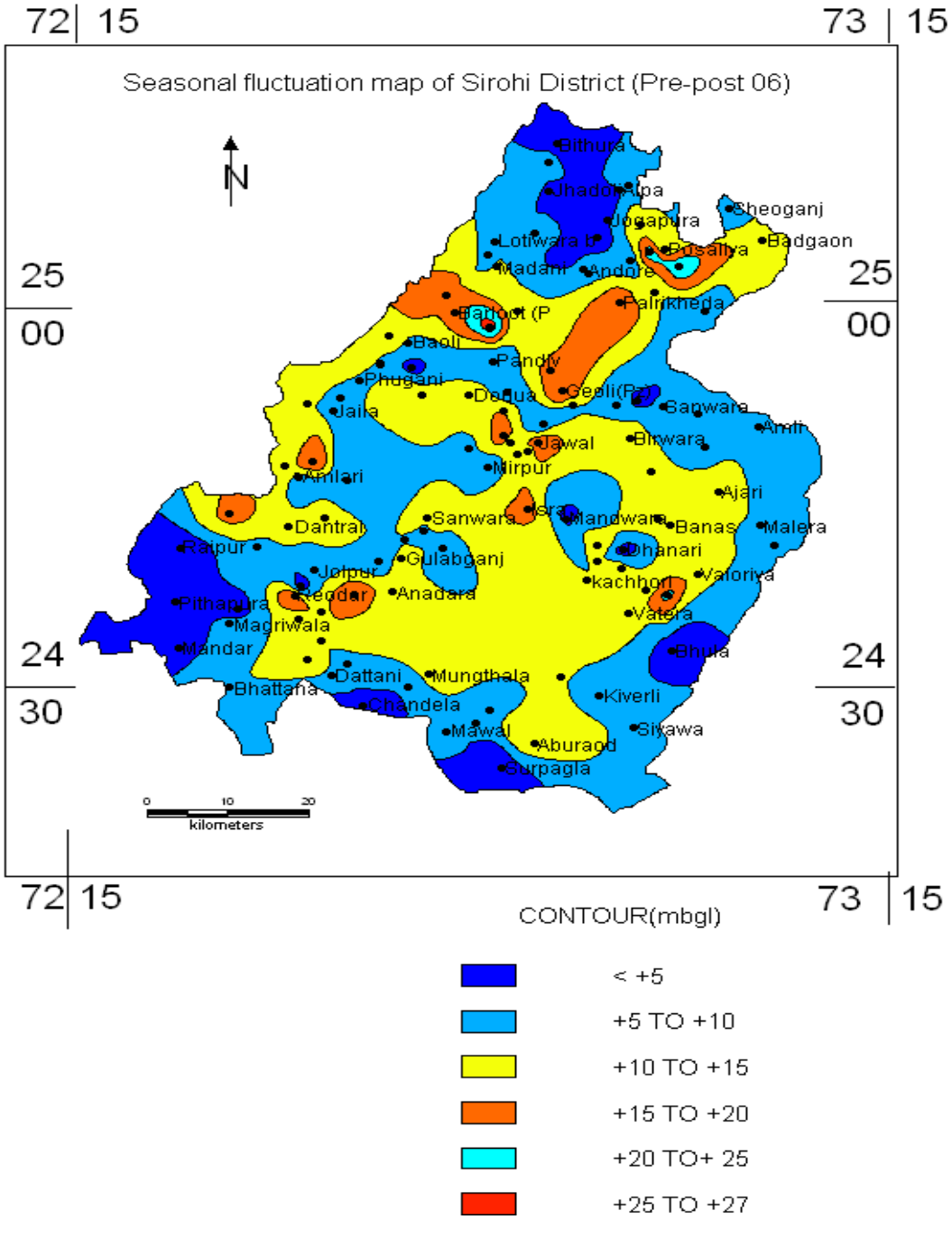
During Nov.06 water level ranges widely from less than 1m to more than 30m,bgl. Water level is shallower in central and southern part of the district. In general DTW varies from 5m to 10m in major part of the district. Water level between 10m to 30m is observed in parts of Sirohi and Sheoganj tehsils.

Block	Pre Monsoon		Post Monsoon	
	Min	Max	Min	Max
SIROHI	8.14	46.60	0.36	28.90
PINDWARA	5.90	23	0.10	12.70
REODAR	8	28	1.27	21
ABUROAD	6.1	19.30	0.40	12.27
SHEOGANJ	11.41	50	3.25	37.70



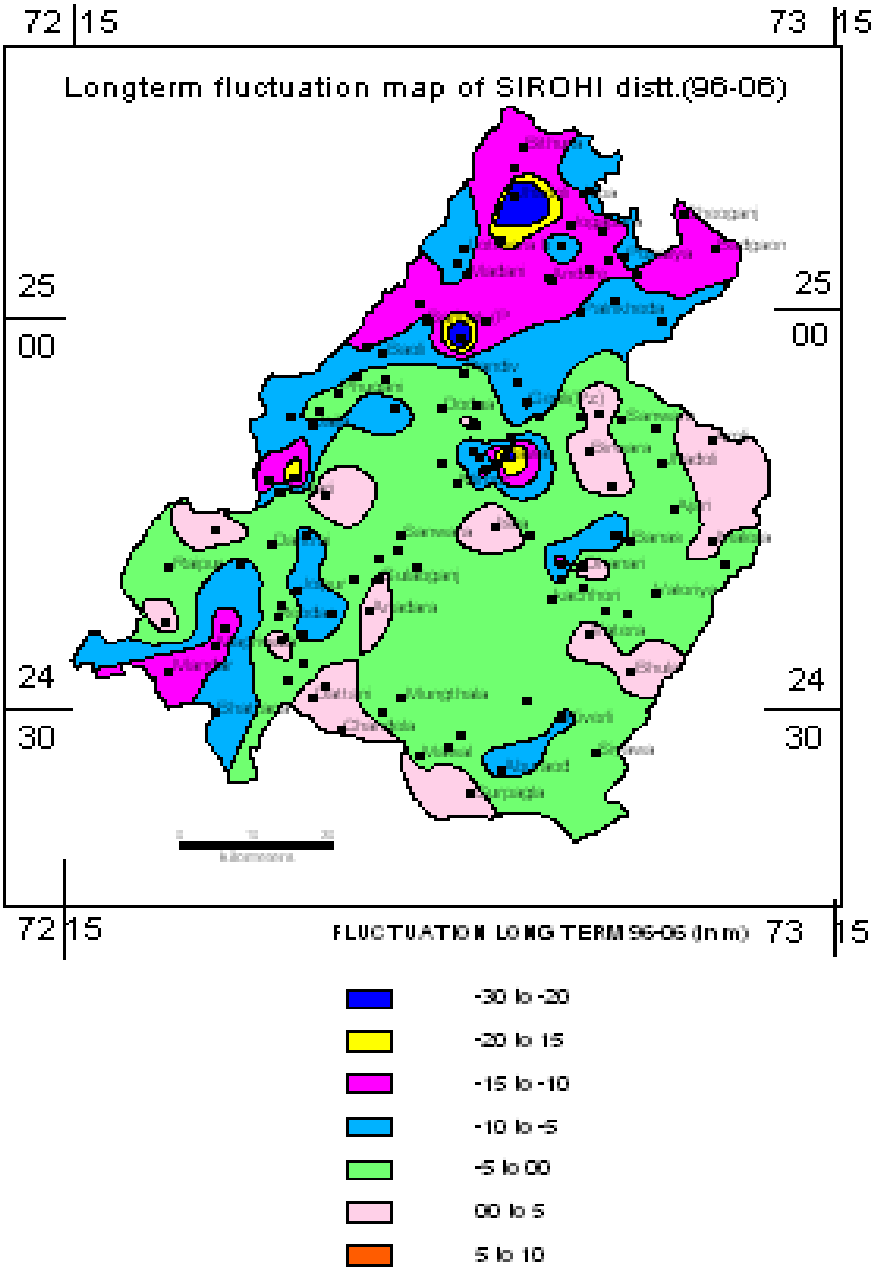
Water Level Fluctuation; Seasonal fluctuation in water level based on Pre and Post-monsoon 06 indicate that there has been exceptionally rise in water level in entire district. Perusal of the fluctuation data indicate that major part of the district has recorded rise in water level of more than 10m at the decline in water has not been observed due to high rainfall.

	Water level fluctuation (Pre– Post)			
	Rise		Fall	
Block	Min	Max	Max	Max
SIROHI	3.69	17.86	-------	-----
PINDWARA	3.50	22.28	------	------
REODAR	0.90	16.16	-------	------
ABUROAD	1.35	14.25	-------	-----
SHEOGANJ	2.40	27.50	-------	-----



Decadal (1996-06) water level trend has been worked out for Pre and Post Monsoon and has been given in the table below. On comparing water level data majority of monitoring stations show declining trend ranging from 0.21m/yr to 0.94m/yr during pre-monsoon. Rise in water level is observed in small pockets in Aburoad,Sirohi and Pindwara tehsils. During post-monsoon decadal trend show rise and decline of 0.14m and 0.56 m/yr respectively.

Block	Pre Monsoon Trend (m/yr)		Post Monsoon Trend (m/yr)	
	Rise	Fall	Rise	Fall
SIROHI	------	0.43	-------	0.05
PINDWARA	------	0.21	0.14	------
REODAR	-------	0.46	----	0.14
ABUROAD	----	0.31	0.07	-----
SHEOGANJ	-----	0.94	-----	0.56



Groundwater Quality

Water Quality in Shallow Aquifer

The range of chemical constituents of groundwater in Sirohi district.

S.No.	Chemical constituent	Range
1	PH	7.5 to 7.98
2	Chloride	21 - 2978 ppm
3	Specific conductivity at 25°C	370-9900 **m. mhos/cm at 25^0C**
4	Total hardness as $CaCo_3$	170 - 2340 ppm
5	Calcium	28 - 688 ppm
6	Magnesium	4.8 - 156 ppm
7	Bicarbonate	183 - 830 ppm
8	No_3	0.16 - 146 ppm
9	F	0.47 - 6.6 mg/lit

Shallow groundwater of dug well zone is alkaline in nature with pH ranging from 7.5 to 7.98 The sp. Conductance is within 4500 mmhos/cm at 25^oC but higher values are recorded in very small pocket.

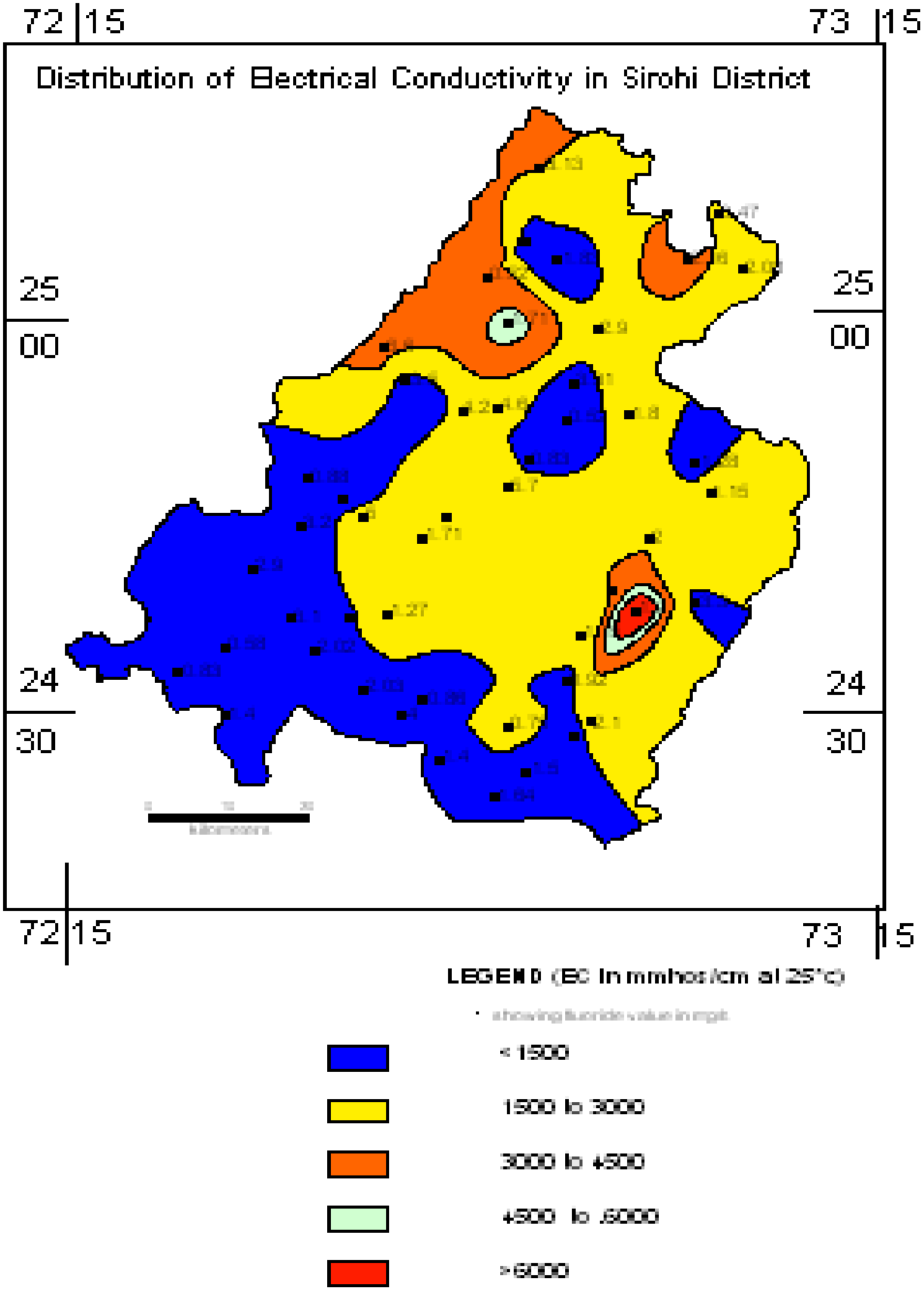
The Chloride content varies from 21ppm to 2978ppm. High Chloride content (>250ppm) has been observed at north western part of the district.

The concentration of bi-carbonate varies from 183 ppm to 830 ppm.

The fluoride content is generally within 1.5 mg/lit in major part of the district. Higher concentration (>1.5mg/lit) is found at northwestern part of the district.

The concentration of Nitrate ranges from 0.16 ppm to 146 ppm. Nitrate values in major part of the district are within 45 ppm. Higher values of nitrate occur at .central part of the district.

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


72 15
73 15
Distribution of Electrical Conductivity in Sirohi District
25 00
24 30
72 15
73 15
LEGEND (EC in mmhos/cm at 25°C)
showing fluoride value in mg/l
< 1500
1500 to 3000
3000 to 4500
4500 to 6000
>6000

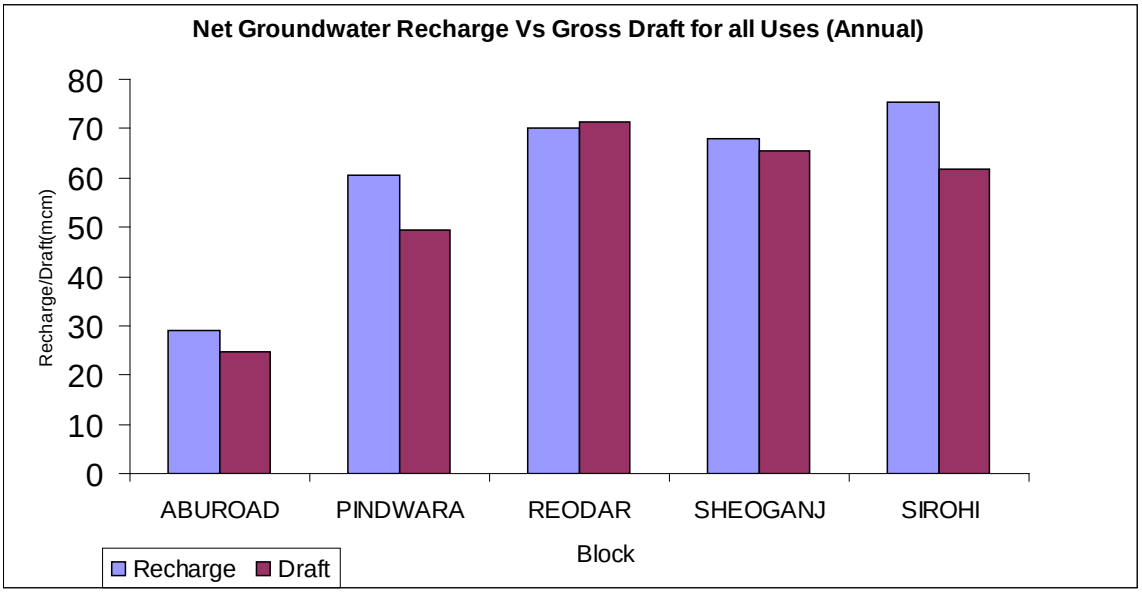
Water quality in Deep Aquifer

Chemical analysis of water samples collected from tubewells show that quality is fresh and potable. The sp. Conductance is generally less than 600m mhos/cm at 25^{o}C to 3500mmhos/cm at 25 ^{o}C

The concentration of Chloride varies from 28ppm to 1000 ppm except at The concentration of Fluoride is ranges from 0.40mg/l at Nichlagarh (southern part) to 10.8mg/l at Sugalia(northern part). In the alluvial tract of the district (Sheoganj block) fluoride concentration is observed to be high.

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 is estimated to be 272.7438mcm. Draft for all use is 272.6742mcm and over all stage of development is 99.97 %.



Summarized block wise estimate of dynamic groundwater resources is given below (as on 31.03.2004):

Sl. No.	Assessment Unit	Net Annual Ground Water Availability	Gross Ground Water Draft for All uses	Stage of Ground Water Development	Category
1	SIROHI	67.8143	61.8848	91.26	Critical
2	PINDWARA	54.5018	49.2728	90.41	Critical
3	REODAR	63.1431	71.4637	113.18	OE
4	ABUROAD	26.2732	24.7123	94.19	Critical
5	SHEOGANJ	61.0473	65.3406	107.03	OE

7.0 *Status of Groundwater Development*

Phyllite, Granite, schist 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 15 to30 m and 50 to 120m 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
SIROHI	Alluvium	60	160	---	>30	50	3-5	200
	Granite	80	90	---	15-30	100	4-5	200
	Phyllite/ Schist	40	70	---	15-30	100	3-5	200
ABUROAD	Alluvium	40	120	---	25-30	100-120	4-5	200
	Granite	40	90	---	25-30	100-120	3-5	200
	Phyllite/ Schist	40	70	---	25-30	100-120	3-5	200
REODAR	Alluvium	60	150	----	30-35	100-120	3-5	200
	Granite	40	90	----	30-35	100-120	4-5	200
	Phyllite/ Schist	50	90	----	30-35	100-120	3-5	200
SHEOGANJ	Alluvium	60	150	---	30-40	100-120	4-5	200
	Granite	40	90	----	30-40	100-120	3-5	200
	Phyllite/ Schist	40	90	---	30-40	100-120	3-5	200
PINDWARA	Schist	40	90	----	25-30	100-120	3-5	200
	Granite	40	90	---	25-30	100-120	3-5	200

Urban and Rural Water supply

Sirohi district comprises 6 urban areas and each of them is facilitated by piped water supply. All the 467 villages and 375 marked hamlets are benefited by water supply for drinking and domestic purposes. Status of urban and rural water supply is given bellow:

URBAN WATER SUPPLY:

Town	Population As 2001	Present Population	Source of Drinking water			Demand KLD	Supply KLD	Difference KLD	Service Level KLD	Water Supply Interval
			Tube well	Dug well	Dam					
Sirohi	35521	40000	12	11	--	4000	3400	600	85	1day
Sheoganj	24789	30000	2	10	--	3000	2400	600	80	1day
Pindwara	20798	24000	9	-	-	1680	1680	--	70	1day
swarupganj	12440	15000	3	3	--	1050	1050	--	70	1day
Aburoad	47320	54000	10	16	--	5400	4300	1100	80	Daily
Mount Abu	22045	37000	--	--	2	5000	3400	1600	90	1day

Block	Village	Types of Scheme					Hamlets	
		Piped	Dug well	JJY	Reginal	HP	Total	Benefited
SIROHI	83	17	2	15	24	25	11	11
PINDWARA	99	8	5	11	6	69	18	18
REODAR	126	10	5	24	10	77	98	98
ABUROAD	87	7	7	7	13	53	235	235
SHEOGANJ	72	14	6	6	24	22	13	13

7.0 Awareness & Training Activity:

Training programme on Rainwater Harvesting organized;

Date; 08.03.2006

Place; Sirohi

Block; Sirohi

8.0 Area notified by CGWA/SGWA

No are notified

9.0 Ground Water Development Strategy

Ground Water Development

Stage of ground water development in the district is 99.97 %, which indicate that the scope of ground water development is almost exhausted in 2 blocks where groundwater development has already exceeded 100% and categorized as "Over-exploited". 4 blocks falls under "Critical" category where ground water development is approaching 100%. There is little scope for further development in these blocks for irrigation or industrial use. However, exploratory drilling can be taken up in unexplored area for estimation of aquifer parameters.

Recommendation for future Groundwater development in Sirohi districtis as below:

Block	Aquifer	Type of recommendation	Proposed depth (m)	Anticipated discharge in lpm	Chemical quality (EC)
SIROHI	Alluvium Phyllite Granite(G1) Granite(G2)	i.)Large dia. dug well. ii)Dug cum bore well. iii)Tube well.	30-40 40-60 100-120	1300-2000 1000-1300 1000-1300 1000-1300	Below 4000
ABUROAD	Alluvium Phyllite/ Schist Granite	i.)Large dia. dug well. ii)DCB iii)Tube well.	25-30 30+HB 100-120	1500-2000 1000-1300 650-1000	Below 2000
PINDWARA	Schist/gneis Granite G1 Granite G2	i.)Large dia. dug well. ii)Deepening of existing well. iii)Tube well.	25-30 30+HB 100-120	1500-2000 1000-1300 650-1000	Below 2000

REODAR	Alluvium Phyllite Granite(G)	i.)Large dia. dug well. ii)Dug cum bore well. iii)Tube well.	30-35 30+HB 100-120	1300-2000 1000-1300 650-1200	Below 2000
SHEOGANJ	Alluvium Phyllite Granite(G)	i.)Large dia. dug well. ii)Dug cum bore well. iii)Tube well.	30-40 30+HB 100-120	1000-2000 650-1200 650-1200	Below 4000

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 is rapidly reaching 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 large number of WHS have been constructed in the district

In the year 2006-2007 National Rural Employment Guarantee Scheme (NREGS) has proposed to construct following WHS.

Block	Structure propose for Construction	
	Sub-Surface Barrier	Annicut
SIROHI	01	37
PINDWARA	nil	19
REODAR	19	63
ABUROAD	nil	Nil
SHEOGANJ	2	13

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.

11.0 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 1996 & 2006 shows that 70% of wells (total wells 107) registered decline in water level. In the decade, decline of more than 50cm/yr was observed in 50% wells. The long term depleting nature of water level causes reduction in storage, which leads to water scarcity.

Water Quality Hazard

In the block, fluoride (>1.5 mg/lit) is found in more than 65% villages and habitation. Fluoride hazard is mainly in Sheoganj block. The electrical conductance more than 1500 micro-mhos/cm is observed in 60% villages. Water salinity is scattered in entire district but more attention has to be given in the alluvium part of the district localized in Geoli, Gol, Merakishanganj area. The nitrate hazard more than 45 mg/lit is found in 25% of villages falling in the district.

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.

12.0 Recommendations

1. Ground water draft is very high in the entire district. Stage of ground water development in the block has reached 99.97% due to indiscriminate use. It is high time to be controlled by preventing further development.
2. Water scarcity is a perpetual phenomenon in Sirohi. Permanent solution to drinking water problem should be devised using Narmada canal project.

3. The yield of well in the district can be improved by connecting an adit in the fracture zone or by constructing infiltration galleries or even by adopting latest fracturing techniques.
4. 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.
5. Awareness programme and training on rainwater harvesting will be beneficial to check decline in water level and justified use.
6. 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.
7. 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.
8. Alluvial tracts along river channels of Krishanavati, Khari, kapalganga nadi 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.
9. 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.

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