GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES
CENTRAL GROUND WATER BOARD

GROUNDWATER SCENARIO
SIKAR DISTRICT
RAJASTHAN

Western Region
Jaipur
2013

DISTRICT AT A GLANCE – SIKAR DISTRICT, RAJASTHAN

S. No.	Item	Statistics
1	**GENERAL INFORMATION**	
	(i) Geographical area (sq km)	7732
	(ii) Administrative Division	
	Number of Tehsils (6)	• Sikar • Fatehpur • Lachhmangarh • Danta Ramgarh • Shri Madhopur • Neem Ka Thana
	Number of Blocks (8)	• Fatehpur • Lachhmangarh • Dhod • Neem Ka Thana • Sri Madhopur • Danta Ramgarh • Piprali • Khandar
	Number of Villages	Total- 1017 (Inhabited 1004+ uninhabited-13)
	(iii) Population (As per 2011 Census)	Male 1374990 Female 1302343 Total 2677333
	(iv) Average Annual Rainfall (1971-2011) in mm	463.0
2	**GEOMORPHOLOGY**	
	Major Physiographic Units	• The hilly area in the east • The undulating area in the centre with hillocks • The western desertic plain (major part of the villages and plains are sandy with development of dunes to the north of Sikar).
	Major Drainage	Mendha, Kantli, Dohan, Krishnawati and Sabi
3	**LAND USE (sq km) (2011-2012)**	
	(a) Forest Area	703.79
	(b) Net Sown Area	5261.08
4	**MAJOR SOIL TYPE**	• Desertic soil • Red desertic soil • Serozems • Saline soil • Lithosols

S. No.	Item	Statistics	
		• Regosols • Old alluvium	
5	**AREA UNDER PRINCIPAL CROPS** (AS ON 2010-2011)		
		Crops	**Area in ha**
		Fruits & Vegetables	121.12
		Oil Seeds	1183.88
		Bajra	3289.46
		Wheat	1004.83
		Barley	357.43
		Pulses	1643.46
		Condiments & spices	131.84
6	**IRRIGATION BY DIFFERENT SOURCES** (2010-2011)		
	Source	No. of structures	Gross Irrigated Area in km^2
	Dugwells	60623	796.99
	Tube wells/Bore wells	23327	2153.07
	Tanks/Ponds	-	-
	Canals	-	-
	Others	-	-
	Net Irrigated Area (km^2)	2950.06	
	Gross Irrigated Area (km^2)	3447.68	
7	**NUMBER OF GROUND WATER MONITORING WELLS OF CGWB** (As on May 2013)		
	Number of Dug wells	30	
	Number of Piezometers	4	
8	**PREDOMINANT GEOLOGICAL FORMATIONS**	Alluvium, Gneiss, Schist	
9	**HYDROGEOLOGY**		
	Major Water bearing formation	Quaternary alluvium and Consolidated formations (quartzite, schist, phyllite, gneiss and amphibolite) of Delhi super group	
	Depth to water level (Pre-monsoon, 2012) (mbgl)	3.13 – 30.80	
	Depth to water level (Post-monsoon, 2012) (mbgl)	1.45 – 28.89	
	Long term water level decline trend (1997-2006) in cm/yr	51 cm/yr (Pre Monsoon) 86 cm/yr (Post Monsoon)	
10	**GROUNDWATER EXPLORATION BY CGWB** (As on 31.1.2013)		

<table>
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<tr><td></td><td>Number of wells drilled (EW, OW, PZ, SH, Total)</td><td>
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<tr><td>Type</td><td>Allu</td><td>Hard rock</td><td>Total</td></tr>
<tr><td>EW</td><td>80</td><td>14</td><td>94</td></tr>
<tr><td>OW</td><td>23</td><td>4</td><td>27</td></tr>
<tr><td>SH</td><td>2</td><td>0</td><td>2</td></tr>
<tr><td>PZ</td><td>37</td><td>1</td><td>38</td></tr>
<tr><td>Total</td><td>142</td><td>19</td><td>161</td></tr>
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</td></tr>
<tr><td></td><td>Discharge (m^3/day)</td><td>64 - 90 Alluvium
10 - 30 m^3/day in consolidated formation</td></tr>
<tr><td></td><td>Storativity</td><td>5.62×10^{-4} to 4×10^{-2} (Alluvium)</td></tr>
<tr><td></td><td>Transmissivity (m^2/day)</td><td>495 (Average)</td></tr>
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F – 5226 sq km
Fe – 2240 sq km</td></tr>
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<tr><td></td><td>Annual Replenishable Ground Water Resources</td><td>334.2306</td></tr>
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<tr><td></td><td colspan="2">Water Management Training Programme Organized
<table>
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<tr><td>20 & 21/12/2006</td><td>Sikar</td></tr>
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<tr><td></td><td>Number of Semi-critical Blocks</td><td>1</td></tr>
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Sikar District
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GROUND WATER SCENARIO
SIKAR DISTRICT, RAJASTHAN

1.0 Introduction

Sikar district is located in the north eastern part of Rajasthan State and extends between north latitudes 27°07′ & 28°12′ and east longitudes 74°41′ and 76°05′ . It encompasses an area of 7732 sq. km. (forming about 2.25% of total area of the entire state and forms roughly the crescent shape) and is covered in the Survey of India degree sheet nos. 45I, 45M, 54A, 44P and 44L. It is bounded on the north by Churu and Jhunjhunu districts of Rajasthan state and Mahendergarh district of Haryana state, on the west by Churu and Nagaur districts and on the south by Jaipur district of Rajasthan state.

Central Ground Water Board has taken up various scientific studies in the district. A list of studies carried out in the district is given in Table 1.

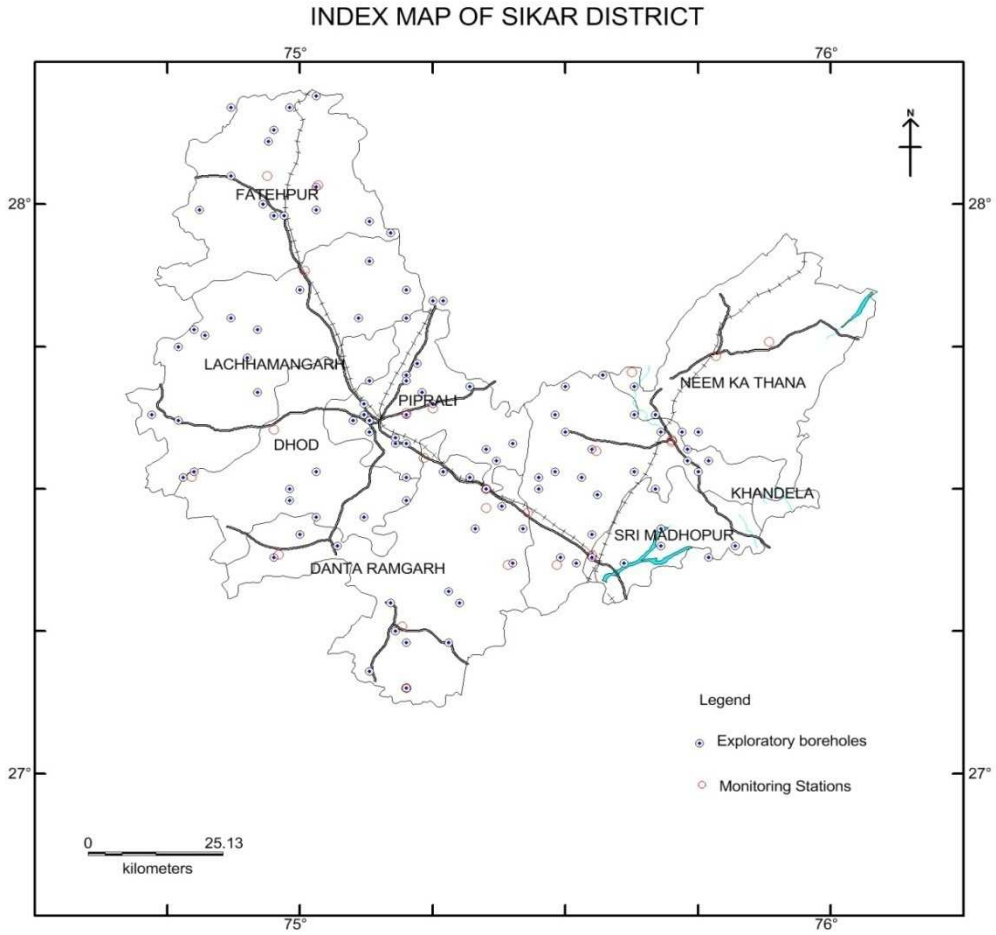

Fig. 1: Administrative divisions

Table 1: Scientific studies undertaken by Central Ground Water Board in Sikar district, Rajasthan

S.No.	Officer/ Project	AAP	Type of Study
1.	Geological Survey of India	1961 – 66	Systematic Hydrogeological Survey
2.	UNDP Project Phase II	1971 – 74	Ground Water Surveys in Rajasthan and Gujarat
3.	G.S. Mittal	1979 – 80	Reappraisal Hydrogeological Investigation in part of Sikar basin, Sikar district

The report on Ground Water Resources and Development Potential of Sikar District was brought out by Central Ground Water Board in the year 1988. The revised District Report was issued in 1999. In the years 1969 and 1971, ground water exploration was carried out by Geological Survey of India for water supply to Khetri Copper Project and for the proposed Saladipura Fertilizer Complex. Exploratory drilling was carried out by the Central Ground Water Board (erstwhile Exploratory Tubewell Organization) under the Ground Water Exploration Programme in early sixties and seventies. Thereafter quite a good number of exploratory wells were drilled in Sikar district by CGWB during the years 1985-86, 1986-87 and from 1990-91 to 1994-95.

In addition to above mentioned work, ground water regime is being regularly monitored on a regional scale by Central Ground Water Board since 1969. Water levels are monitored four times in a year during the months of January, May, August and November. Water samples for quality monitoring are collected during the month of May.

2.0 Rainfall & Climate

Mean annual rainfall (1971-2011) of the district is 463.0 mm whereas normal rainfall (1901-70) is lower than average rainfall and placed at 459.8. Almost 95% of the total annual rainfall is received during the southwest monsoon, which enters the district in the last week of June and withdraws in the middle of September.

The mean annual rainfall is highest (536.6 mm) at Neem Ka Thana, which is located in the south eastern part of the district. It is lowest at Fatehpur (407.8 mm), which lies near north western boundary of the district. Climate is generally dry except during the monsoon period. Humidity is the highest in August with mean daily relative humidity of 80%.

3.0 Geomorphology, Drainage, Soils, Land Use & Irrigation Practices

Geomorphologically, the district comprises the following geomorphological units (Fig. 2):

- The hilly area in the east
- The undulating area in the centre with hillocks

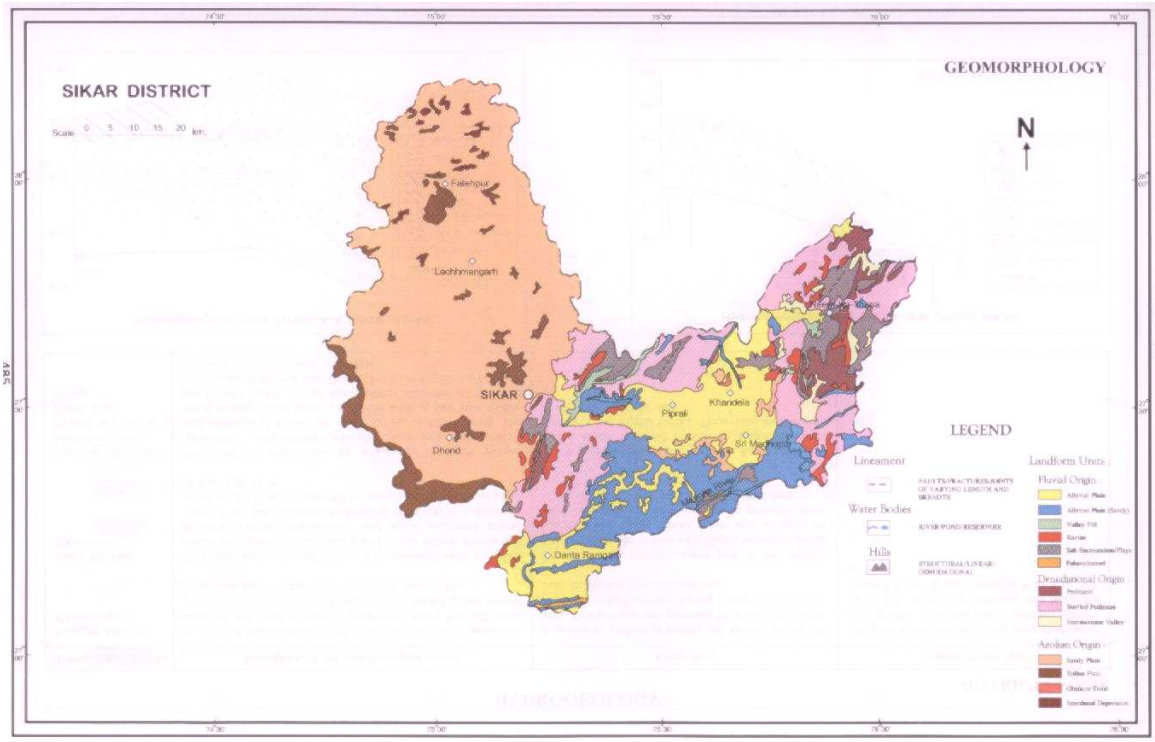

Fig. 2: Geomorphology

The western desertic plain (major part of the villages and plains are sandy with development of dunes to the north of Sikar).

The hilly tract is part of the Aravalli range. A chain of hills passing through Sakarai Mata Ji lying east of Sikar divides the district almost into two east-west halves. The western part represents typical desertic topography. The altitude of the highest peak is about 1052 mamsl and that of other hills generally range between 350 and 700 mamsl. The plain area generally lies at altitude between 380 and 530 mamsl. The terrain in the north-west slopes towards west. The hill peaks which have attained considerable height in the hill system of the district are at Raghunathgarh, Harsh, Deogarh and Shyamgarh, all falling in Sikar tehsil. The central portion of the district can be called as watershed with the rivers and streams in the north flowing towards north, those in the south towards south and those in the east towards east.

There is no perennial river in the district. The most important rivers in the district are Mendha, Kantli, Dohan, Krishnawati and Sabi. Mendha river flowing in Danta Ramgarh and Sri Madhopur tehsils merges with the Sambhar lake. Kantli originates near Khandela in Sri Madhopur tehsil and flows out of the district in the northeasterly direction to district Jhunjhunu. Dohan River flows in the uppermost northeastern region of the district and covers a small portion of it. Krishnawati River originates from the hills in the southeast of Neem Ka Thana and flows out of the district in the northeastern direction. Sabi River flows only in Neem Ka Thana tehsil. In the western desertic plain, there is practically no surface drainage system. Apart from these, there are several minor streams or nallahs originating from the hills which flow for short distances and disappear in the sandy tract. There is natural lake near Pritampuri in the eastern part of the district. It is a small depression where rainwater accumulates and lasts for a few months. Similarly, there are no big tanks in the district. However, small tanks or pits are numerous in the area.

3.1 Soils

The soils of the district have been broadly classified by Agriculture Department, Govt. of Rajasthan as given below:

- Desertic soil
- Red desertic soil
- Serozems
- Saline soil
- Lithosols
- Regosols
- Old alluvium

3.2 Land use

The socio-economic factors have significant influence on land use both in rural and urban areas. Land form, slope, soils and natural resources are some of the important factors which control the land use pattern of the district. About 67.95% of the total area of district was under cultivation during the year 2011-12 (Table 2). The uncultivable area comprises of forest land (9.09%), uncultivable land (5.77%), pasture land (5.20%), cultivable waste (0.49%), Barren land (1.15%) and fallow land (10.12%). Trees, groves, orchards etc. constitute only 0.0018% of the total area.

Table 2: Land use pattern

Tehsil	Geographical area (ha)	% of Study area	Forest & Hills	Barren land	Non agriculture use	Pasture & grass land	Cultrable waste-land	Trees & grooves	Fellow land	Net sown area
Fatehpur	107070	9.13	4616	1	4062	5289	0	0	26212	66747
Lachhmangarh	121893	36.77	1700	0	4716	7401	27	0	18213	89819
Sikar	151534	10.24	10235	775	7778	6665	671	0	10686	113736
Danta Ramgarh	137117	0.00	5262	1731	6673	6590	44	0	15065	100642
Sri Madhopur	137807	0.00	9957	3266	7413	7999	1197	14	5865	99411
Neem Ka Thana	118822	2.57	38609	3142	5183	6341	1907	0	2342	55753
Total	774243	9.45	70379	8915	35825	40285	3846	14	78383	526108
Area in ha as per village records (2011-12)										

The major Kharif crops are bajra, jowar, pulses, maize and groundnut. Main Rabi crops are wheat, barley, gram and oilseeds. Cotton is an important cash crop that is grown in the district.

3.3 Irrigation

Net area under irrigation is 37.98% of the total geographical area. There is no major irrigation project. Dug wells & tube wells are the main source of irrigation. Irrigated area and number of structures according to source are given in Table 3.

Table 3: Areas Irrigated by various sources

S. No.	Tehsil	Area as per village records	Tube wells	Wells	Total irrigated area
1	Fatehpur	107070	2157	1590	3747
2	Lachhmangarh	121893	19098	12705	31803
3	Sikar	151534	76716	15858	92574
4	Danta Ramgarh	137117	57338	14086	71424
5	Sri Madhopur	137807	50183	19902	70085
6	Neem Ka Thana	118822	9815	15558	25373

4.0 Ground Water Scenario

4.1 Hydrogeology

The availability, occurrence and movement of ground water is mainly controlled by the topographic features, physical characteristics and structural features present in the geological formations. Ground water occurs under unconfined to semi-confined condition. The principal aquifer in the area is Quaternary sediments covering major part of the district (resting in western and central parts of the district) whereas quartzite, schist, phyllite, limestone and dolomitic limestone of Delhi Super Group also constitute important aquifers (resting in the eastern and north central parts of the district mainly in Neem ka Thana, Khandela, Danta Ramgarh and part of Piprali blocks).

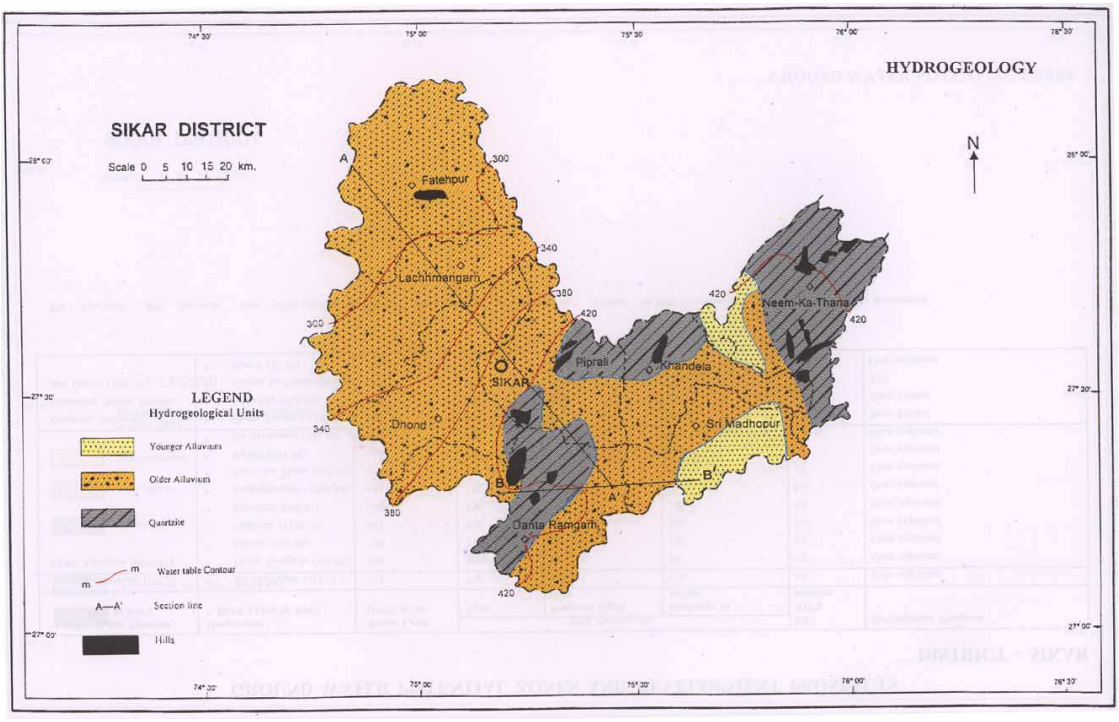

Fig. 3: Hydrogeology

Ground water occurs in the pore spaces and interstitial openings of Quaternary alluvium while in hard rock formations, occurrence and movement of ground water is controlled by secondary porosity i.e. through the bedding planes, fissures, joints, fractures, solution cavities and other structurally weaker planes. Hydrogeological map of the area is depicted in figure 3.

Exploratory drilling done in the district by GSI and CGWB under UNDP Project has revealed the extension of aquifer both in lateral and vertical directions.

4.2 Ground water in Quaternary sediments

Quaternary sediments, generally unconsolidated, form the principal and most promising aquifer system. These are wind blown sand and are comprised of sand, gravel, pebbles and clay with 'Kankar'. The Quaternary sediments form aquifer in the western and central parts of the district mainly in Fatehpur, part of Lachhmangarh, Dhod and part of Piprali and Sikar blocks and occupy about 75% of the district area. Ground water occurs under unconfined condition. In Sikar basin, silt and fine sand form the main aquifer. The coarse sediments mostly occur in the eastern part of the district in the proximity of rivers and streams originating from the hilly areas. Semi-confined conditions have developed locally due to occurrence of silty clay layer or clayey lenses. However, different water bearing lithological units of the Quaternary deposits are inter-connected and behave like a single hydrogeological unit.

In the western part of the district in Sikar basin area, the aquifer is quite extensive and fairly thick. Generally, its thickness lies between 30 and 80 m. In the central and eastern parts, the thickness of aquifer is controlled by bed rock topography and is highly variable. Thickness of saturated zone generally varies from 10 to 50m. Aquifers are mainly under unconfined and semi-confined conditions but at some places, confined conditions have also been observed. Average discharge of wells in alluvium ranges from 40m^3/day to 90m^3/day. Water is generally fresh and potable in all the blocks except in Fatehpur and parts of Lachhmangarh block where it is saline.

4.3 Ground water in hard rock formations

In hard rock formations, ground water occurs under unconfined condition in weathered mantle and in joints and fractures etc. However, semi-confined conditions may occur in deep seated fracture zones. These form aquifer in eastern part of the district in Neem Ka Thana, Khandela blocks, parts of Danta Ramgarh and Piprali blocks (figure 3). The hard rock aquifer is constituted by quartzite, schist, phyllite, gneiss and amphibolite of Delhi Super Group. These rocks have poor water yielding capacity as compared to the alluvium. The yield of open wells tapping hard rocks varies individually depending upon the extent of weathering. Higher discharge is observed when the well is located along the lineament. Moderate yield is also observed wherever the weathered mantle is overlain by considerable thickness of blown sand.

Exploratory drilling has been carried out in hard rock formations up to 143 mbgl depth. Wells tapping quartzites have generally good discharge compared to the other formations. Schist wherever traversed by quartz vein also yields fairly good discharge. Overall in hard rock especially in quartzite, the depth to water level ranges from 7.5 mbgl (Dariba in Neem ka Thana block) to 48.50 mbgl (Thet in Danta Ramgarh block). The average yield of this formation varies from 10 m^3/day to 30 m^3/day.

4.4 Depth to water level

In order to study the behaviour of water level, National Hydrograph Stations of CGWB and key wells inventoried during the survey have been considered. It also includes the piezometers of Ground Water Department, Rajasthan State and CGWB.

Based on the data of these net work stations and inventoried wells, a regional depth to water level map has been prepared.

A perusal of depth to water level maps (Fig.4&5) shows that the water level ranges in the area from less than 2m to more than 75m. The depth to water level in general is less than 35m in eastern and central parts of the district falling in Neem Ka Thana, Khandela, Sri Madhopur and Danta Ramgarh blocks. In the western part of the district, it generally varies from 25 m to more than 45m. Depth to water level less than 10 m has been observed in central and eastern parts of the district, viz Khandela, Kanwat etc. Depth to water level as recorded in 156 key wells of GWD & NHS (2012) ranges from 1.80 to 77.20 and 0.80 to 78.25 mbgl during pre-monsoon and post monsoon respectively. Block-wise details of depth to water level during Pre-monsoon and Post-monsoon periods and seasonal water level fluctuations are given in Table 4.

Table 4: Depth to water level during and water level fluctuation (2012)

Block	Pre Monsoon		Post Monsoon		Water level fluctuation (Pre– Post)	
	Min	Max	Min	Max	Min	Max
Danta Ramgarh	14.10	72.64	13.55	71.55	-11.45	4.95
Dhod	37.88	77.20	38.10	78.25	-1.30	0.05
Fatehpur	30.15	51.60	29.99	50.90	0.04	1.15
Khandela	7.30	43.90	6.10	44.20	-4.05	9.11
Lachhmangarh	33.30	64.60	31.43	64.80	-0.83	1.87
Neem Ka Thana	1.80	53.75	0.80	46.99	-4.55	11.40
Piprali	13.05	74.73	7.95	75.25	-1.39	5.24
Sri Madhopur	27.72	58.95	27.80	58.20	-2.04	0.75
District	1.80	77.20	0.80	78.25	-11.45	11.40
(-) shows decline						

4.5 Water level fluctuation

The study of fluctuation data indicates that rise in water level varies from 0.04m to 11.40 m. The decline in water level ranges from 0.83m to 11.45m.

4.6 Water level trend

The district shows declining trend of ground water during the period 2001-2012. Average trend of each block is in Table 5.

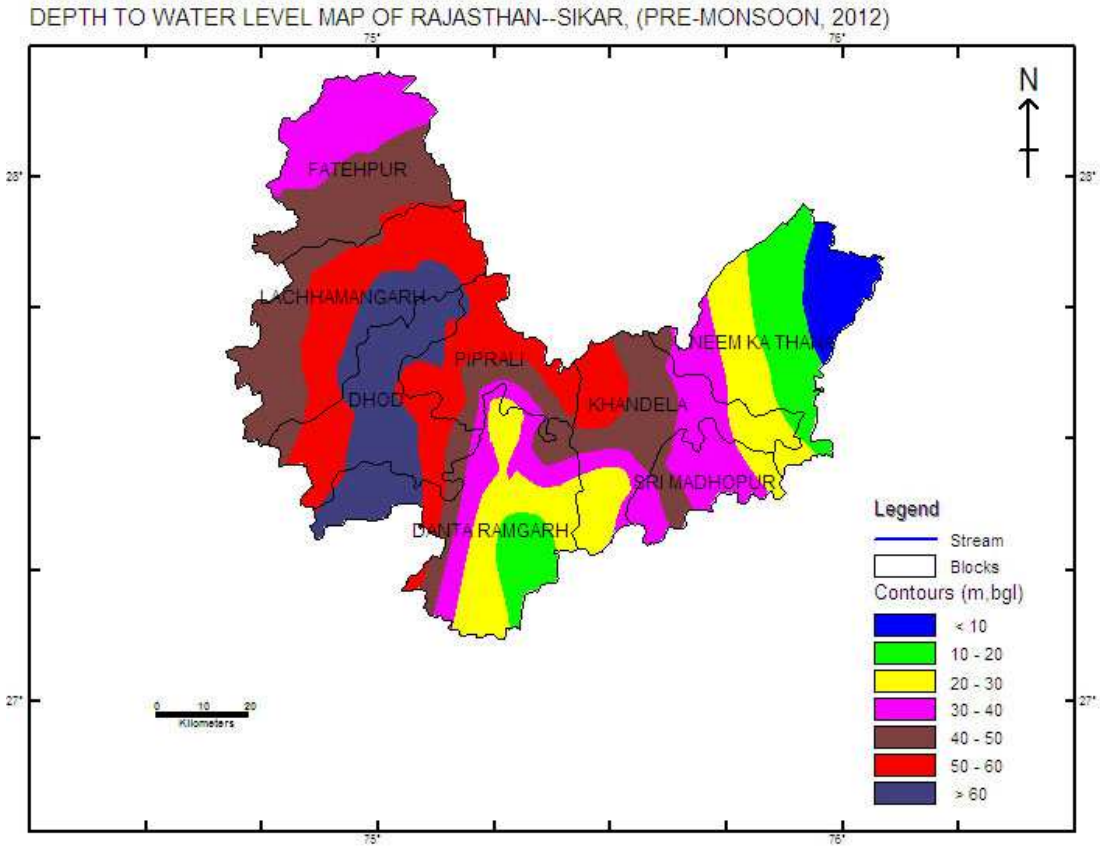

Fig 4: Depth to water level (May 2012)

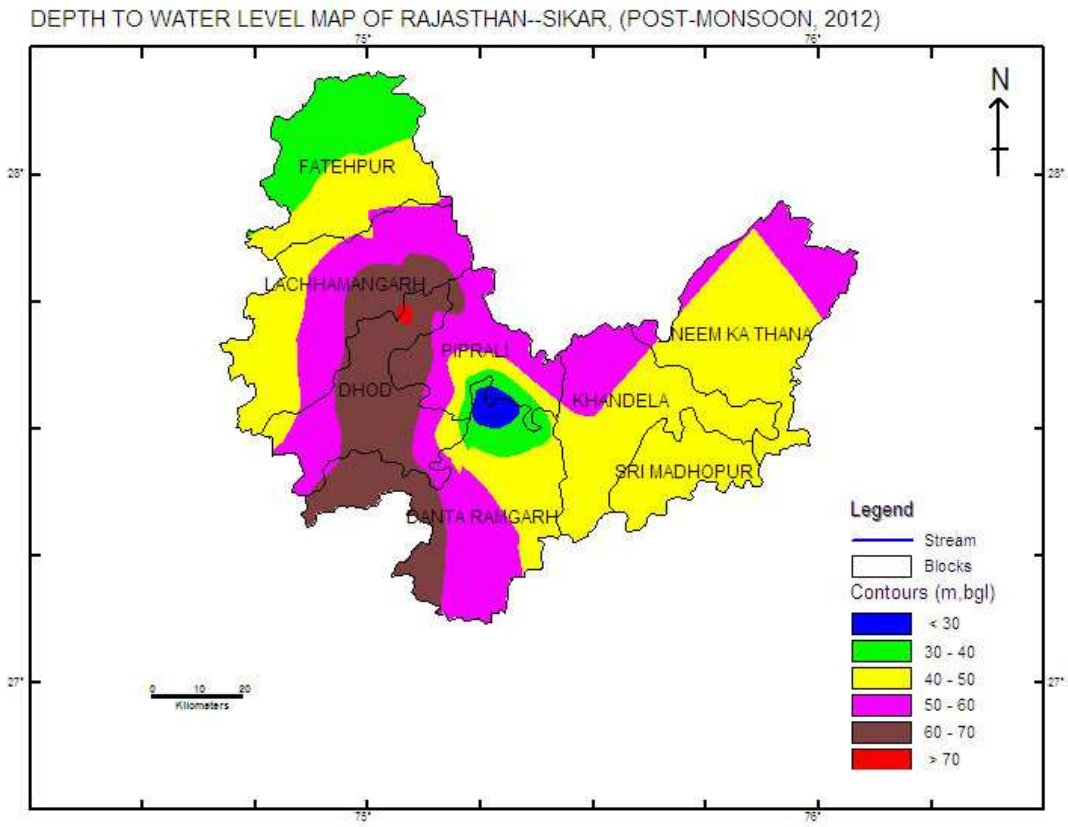

Fig 5: Depth to water level (November 2012)

Table 5: Block wise average water level trend (2001 – 2012)

Block	Trend (m/yr)
Danta Ramgarh	0.70
Dhod	1.12
Fatehpur	0.15
Khandella	0.76
Lachhmangarh	0.37
Neem Ka Thana	0.48
Piprali	0.57
Sri Madhopur	1.04

4.7 Water table gradient

The general direction of ground water flow is from south-west to north- east, however, in the north eastern part of the district viz. Neem ka Thana, Patan, it is towards north eastern direction. As far as, regional flow direction is concerned, the water table follows the slope of basement topography. In the alluvial tract, the gradient of water table is of the order of 1 to 1.5 m/km but in hard rock areas, it is steeper and is 3 to 5 m/km.

5.0 Ground Water Resources

Ground water resources have been reassessed jointly by Central Ground Water Board and State Ground Water Department as on 31.3.2009 based on Ground Water Estimation Committee (1997) are given in Table 7.

Table 6: Ground Water Resources

Block	Area of Block (Sq.Km.)	Annual Ground Water Recharge (mcm)	Net Annual Ground Water Availability (mcm)	Existing Gross Ground Water Draft for Irrigation (mcm)	Existing Gross Ground Water Draft for Dom.& Industrial Use (mcm)	Existing Gross Ground Water Draft for All Uses (mcm)	Stage of Ground Water Development (%)	Category
Danta Ramgarh	1210.51	50.8650	45.7785	73.7495	9.6293	83.3788	182.14	Over exploited
Dhod	911.15	44.4076	39.9668	53.5787	9.5137	63.0924	157.86	Over exploited
Fatehpur	1291.23	46.5965	41.9368	25.7262	11.3684	37.0946	88.45	Safe
Khandella	743.46	32.7222	30.7581	37.4070	4.3452	41.7522	135.74	Over exploited
Lachhmangarh	1051.62	49.3942	44.4548	42.9048	9.3900	52.2948	117.64	Over exploited
Neem Ka Thana	1197.12	36.2523	32.6270	37.2849	7.9177	45.2026	138.54	Over exploited
Piprali	807.66	34.8759	31.3883	51.0899	10.6890	61.7789	196.82	Over exploited
Sri Madhopur	668.1	39.1169	35.2052	71.0548	6.6653	77.7201	220.76	Over exploited
Total	7880.85	334.2306	302.1155	392.7958	69.5186	462.3144	153.03	Over exploited

6.0 Ground Water Quality

6.1 Quality of shallow ground water

The study of quality data indicates that in general, the ground water quality is suitable for domestic, irrigation and industrial purposes except at a few localized small patches.

The minimum and maximum values and general range of various chemical constituents in ground water is furnished below in Table-6.

Table 6: Ranges of chemical constituents in shallow ground water

Chemical constituents	Range		BIS 10500 Limits	
	Minimum	Maximum	Desirable	Permissible
pH	7.02	9.00	6.5	8.5
EC (µS/cm at 25^0 C)	405	10860	500	2000
CO_3 ppm	0	192	-	-
HCO_3 ppm	171	1330	-	-
Cl ppm	14	1985	250	1000
Total Hardness ppm	50	2200	300	600
SO_4 ppm	5	2325	200	400
NO_3 ppm	1	1135	45	45
Ca ppm	16	436	75	200
Mg ppm	5	304	30	100
Na ppm	60	1074	-	-
K ppm	1	463	-	-
F mg/l	0.10	994	1.00	1.50

6.1.1 pH

The pH value of ground water in the district ranges from 7.02 to 9.00 indicating alkaline nature of ground water.

6.1.2 Electrical conductivity

Electrical conductivity ranges from 405 to 10860 mmhos/cm at 25^0C. However, in greater part of the District, it varies from 750 mmhos/cm 25^0C to 2500 mmhos/cm 25^0C. The electrical conductivity map prepared using pre-monsoon, 2011 data is depicted in Fig.6. The perusal of map indicates that in small areas around Fatehpur, Nechwa (in the western part of district), it is between 2000 and 3000 mmhos/cm 25^0C. More than 3000 mmhos/cm 25^0C is noticed around central part such as Samer, Kochhor, Gowati etc. Electrical conductivity more than 5000 mmhos/cm 25^0C has been found around Samer, Motlawas, Rewasa etc.

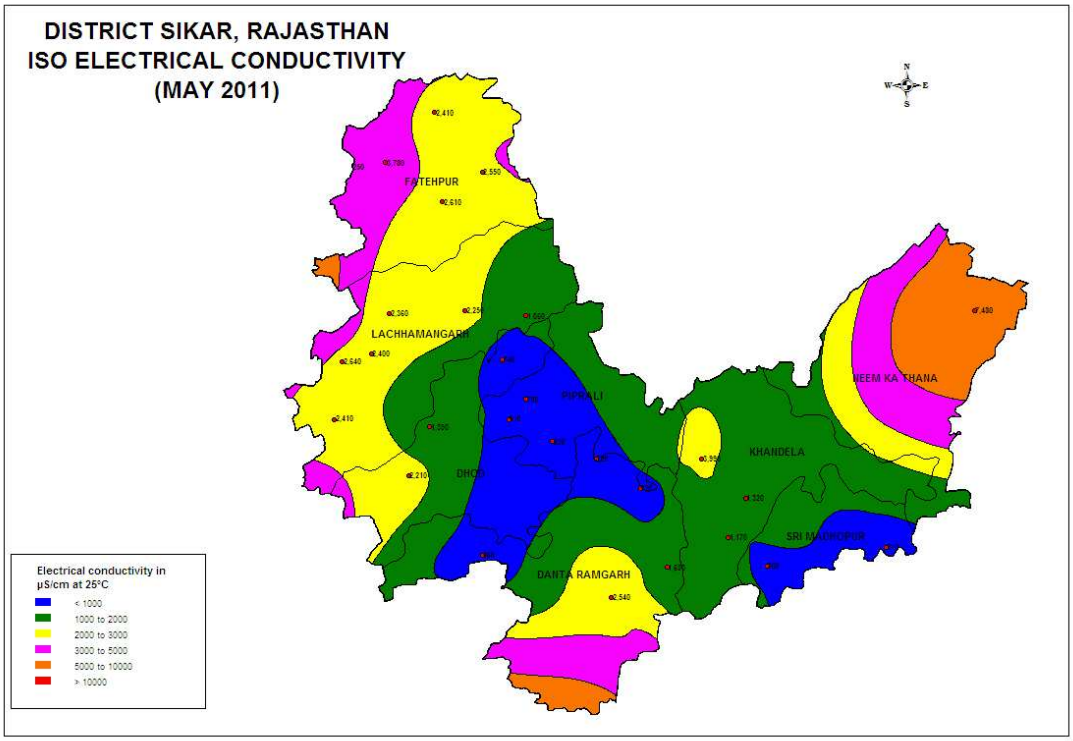

Fig. 6: Iso- Electrical Conductivity (May 2011)

6.1.3 Chloride

Chloride concentration ranges from 14 to 1985 ppm. In greater part of the district, it lies within 300 ppm. The perusal of map indicates that in small patches around northern part of the District viz. Saladipura, Kotri etc., it is between 300 and 500 ppm. More than 500 ppm chloride concentration is noticed around central part such as around villages viz. Motlawas, Sama, Sikar, Rewasa. In general, chloride concentration increases towards central part of the district.

6.1.4 Fluoride

Fluoride concentration in ground water ranges from 0.10 mg/l to 7.25 mg/l. Higher fluoride concentration (14.28 mg/l) has been observed at Dukia village. In northern part around Khandela & Guhala concentration of fluoride varies from 2.67 to 7.08 mg/l. Fluoride in excess of maximum permissible limit has been observed in parts of Fatehpur, Lachhmangarh, Dhod, Danta Ramgarh and Khandela blocks (Fig. 7).

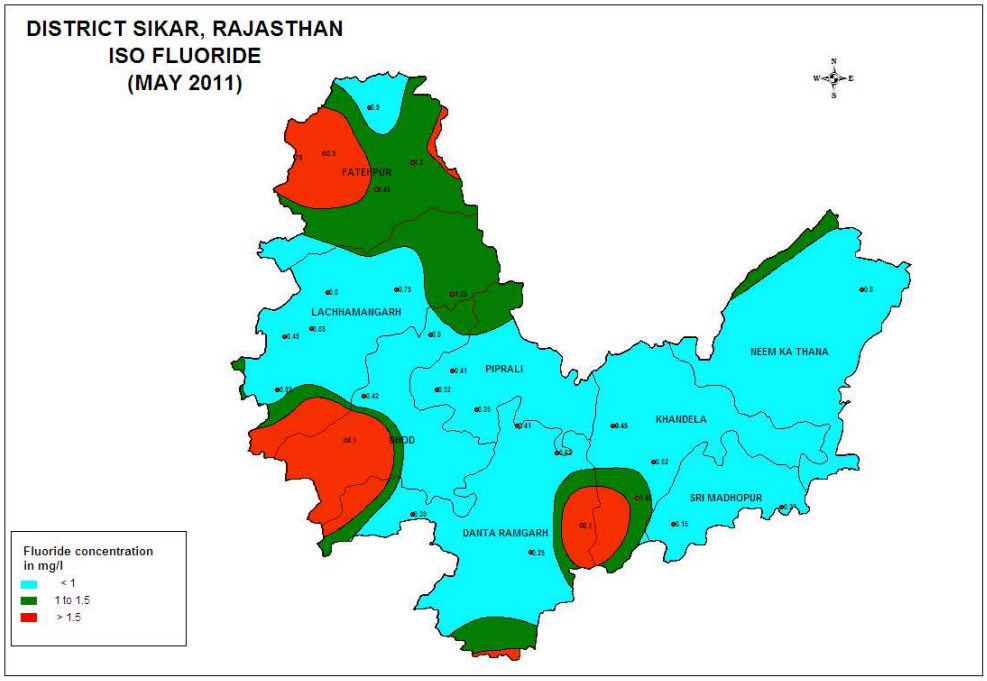

Fig. 7: Iso-Fluoride (May 2011)

6.1.5 Nitrate

Nitrate concentration in excess of maximum permissible limit of 45 mg/l has been observed from isolated pockets in all the blocks except Khandela and Sri Madhopur blocks (Fig. 8).

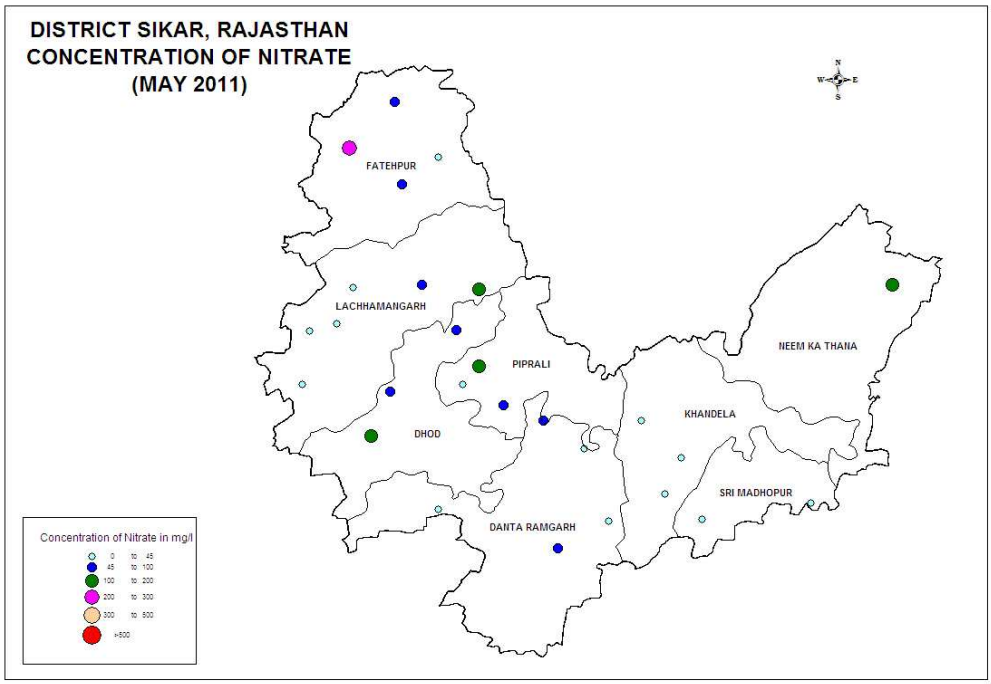

Fig. 8: Distribution of Nitrate

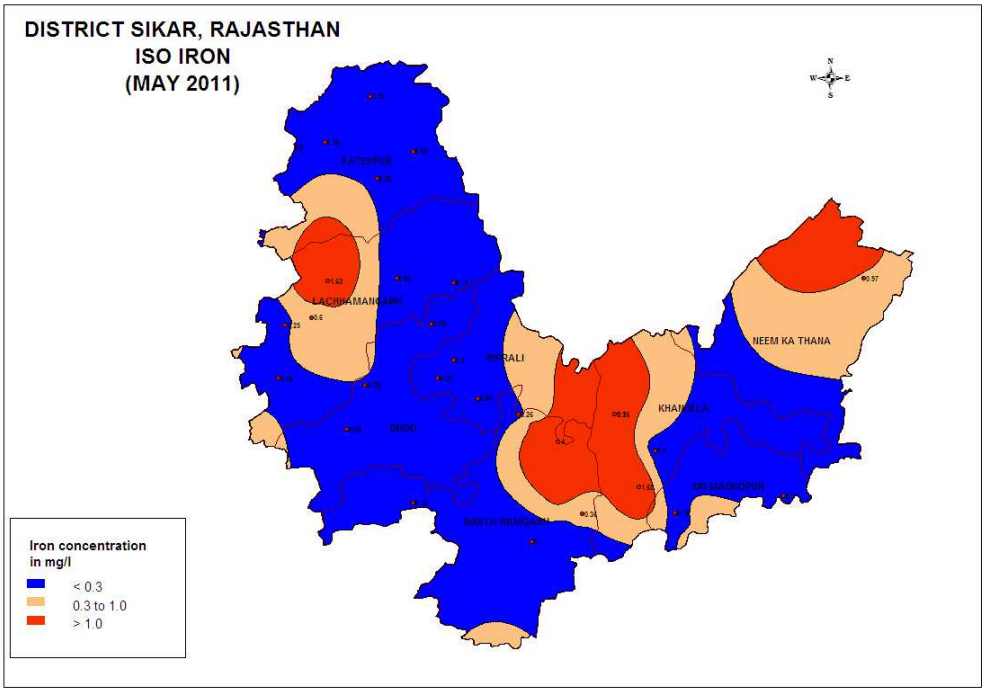

Fig. 9:Iso-Iron

6.1.6 Iron

Iron concentration in major part of the district is within the maximum permissible limit of 1 mg/l. Excess iron concentration has been observed in isolated pockets in almost all the blocks (Fig. 9).

6.2 Ground water quality in deeper aquifers

Study of ground water quality in deeper aquifers is based on water samples collected during survey from tube wells and exploratory wells drilled by Central Ground Water Board. Ground water quality in deeper aquifer is more or less similar to that of shallow aquifer, as the aquifers are interconnected and form single litho-unit. A perusal of chemical data indicates that electrical conductivity of ground water ranges from 595 µS/cm 25°C (at Motlawas in Lachhmangarh block) to 2880 µS/cm 25°C (at Ramgarh in Fatehpur block). The fluoride concentration varies from 0.73 mg/l to 9.94 mg/l and chloride concentration varies from 21 ppm to 362 ppm. Ground water in deeper aquifers in the district is by and large suitable for drinking purpose.

6.3 Depth wise salinity variation

The depth wise salinity variation is indicated by the results of chemical data of water samples. Around areas such as Dukia, Samer, Motlawas, Dudwa, Bajyawas, Gowati etc., vertical salinity variation has been noticed. As a whole, some patches of salinity and fluoride hazards are emerging due to heavy exploitation of ground water.

6.4 Long term ground water quality variation

Long-term changes in ground water quality have been studied based on the chemical data of NHS. In general, there are no marked changes in the ground water quality. In the western part of the district i.e. in Fatehpur and Dhod blocks, some part of central area of Lachhmangarh block and part of Piprali block are affected with

salinity hazard. This may be the case of inland salinity caused due to inland drainage.

7.0 Ground Water Management Strategy

7.1 Ground Water Development

Ground water is an important source of water for agriculture, domestic and industrial needs. Ground water, a renewable source of water has the remarkable distinction of being highly dependable and safe source of water supply. Due to urbanization and population explosion, large-scale exploitation and deterioration of ground water quality has occurred. Therefore, greater emphasis is being laid on conservation and management of ground water resources.

Ground water development has been more in areas underlain by potential aquifers. Assessment of ground water availability and development of ground water through various pumping technologies such as deep tube wells, shallow tube wells, hand pumps and manually operated shallow tube wells for irrigation have been practiced without detailed investigation of the resources. Little attention has been given to after effects of over-exploitation of ground water. In many cases, inefficient and poor ground water development systems have resulted in decline in water level, ground water pollution and water logging and salinity hazard.

7.2 Water Conservation & Artificial Recharge

Since the stage of ground water development has already crossed 100%, artificial recharge is the need of the hour. Rain water harvesting should be encouraged by constructing anicuts, bunds, check dams etc. in rural areas and by means of roof top rain water harvesting structures in urban areas which should be selected carefully considering the local geological conditions of the area.

Rajasthan Ground Water Department has selected a few sites for construction of sub-surface dykes cum check dams in the following areas by which the ground water resource can be augmented and recharged.

- ½ km. north east of Kanwat village on nallah of Kantli river, Khandela block.
- ½ km. east of Hathideh village, Khandela on local nallah, Khandela block.
- 1.5 km. east of village Mehroli on Mendha river, Sri Madhopur block.
- 1 km. west of Jhalara village on nallah of Dohan river, Neem ka Thana block.
- ½ km. south of Bhagwanpura-Saidala village on local nallah, Neem ka Thana block.

Depending upon need and local conditions, Watershed Development and Soil Conservation Department is constructing permanent check dams under integrated watershed development projects in each block. The main objective of the projects is to make utilization of available land, soil water, labour and animals in the watershed. Check dam is constructed to harvest rainwater, reduce soil erosion and check run off velocity in the watershed.

8.0 Ground Water Related Issues & Problems

Almost the entire district faces the problem of ground water scarcity. However, there are some areas which are vulnerable to pollution and depleted water table.

8.1 Ground water quality hazards

Chemical analysis results of water samples from phreatic aquifer indicate that nitrate, chloride, fluoride etc. occur beyond prescribed limit in isolated pockets in various parts of the district. Ground water from deeper aquifer does not contain any such chemical constituents in excess concentration, which may be harmful to local population. Electrical conductivity more than 5000 ms/cm at 25^0C is found in and around northern and western part of the district falling in Fatehpur and Lachhmangarh blocks. In and around the village Rewasa (in Piprali block), EC is more than 6000 μS/cm at 25^0C due to inland saline lake.

Chloride content in ground water in excess of the prescribed limit occurs in Biramsar, Fatehpur, Shekhawas, Ramsisar, Udansar, Juliasar villages in the northern and western parts of the district falling in Fatehpur and Lachhmangarh blocks. High fluoride concentration in ground water has been observed at Rookansar, Tejsar, Bikamsar, Dukia, Kochar and Bibipur villages in south central, northern and some pockets in western parts of the district. Overall, the northern and western parts of the district are affected with ground water quality problem especially salinity hazard.

The district does not have any major industrial establishment and there are no large-scale mining activities in the area. Hence, the chances of pollution are very limited. Till now, no report has been received either from State Govt. or from any other sources regarding large scale ground water pollution in the area. Central Ground Water Board is continuously monitoring the chemical quality in the area to keep vigil over the quality of ground water.

8.2 Water table depleted area

As mentioned earlier, ground water development in the district is more than 100%. Long term trends of hydrographs indicate that there has been some decline in western part, south central part and small area lying in eastern part of the district. Due to decline in water level, alluvium is no more yielding aquifer. Around 85% of monitored stations show decline in water level while only 15% stations indicate marginal rise in water level. In more than a decade, 6 to 8 m of decline in water level has been observed.

9.0 Awareness & Training Activity

9.1 Mass awareness Programme (MAP)

Three Mass Awareness Programme were organized on 26th July 2003, 28th March 2004 & 23rd August 2005 at Piprali, Sri Madhopur & Dhod respectively.

9.2 Water Management Training Programme (WMTP)

A two day Training Programme on “Rainwater Harvesting for Artificial Recharge to Ground water” was organized at Sikar on 20th & 21st December 2006.

10.0 Areas Notified by CGWA

Dhod & Sri Madhopur were Notified on 2nd December 2006 by the Central Ground Water Authority for ground water regulation and management making it mandatory to seek permission for any structure proposed to be drilled for groundwater abstraction. District Collector has been authorized to take necessary measures for implementation of regulatory measures. An Advisory Committee under the Chairmanship of District Collector has been constituted to take up all the issues related to Notified areas.

11.0 Recommendations

- As the stage of ground water development in the district as a whole is 153%, practically no scope is left for construction of new ground water abstraction structures for irrigation purposes except for drinking water supply. However, out of eight blocks, only one block viz. Fatehpur block falls under safe category where a very limited scope of future ground water development exists owing to salinity hazard.
- Artificial recharge measures like small check dams, anicuts, earthen dams; nala bunds etc. may be constructed at feasible sites to store rainwater and excess runoff from the area. This will increase the recharge to ground water body and as a result of which the yield of wells located in the vicinity will be increased.
- Watershed development and control of soil erosion activities should be encouraged in the area under different programmes.
- Surface run off can be harnessed by constructing tanks at feasible sites in the eastern part of the district for supplementing irrigation potential to increase the agricultural production.
- Modern agriculture management techniques have to be adopted for effective and optimum utilization of water resources. This can be achived by maintaining minimum hours of pumping and selecting most suitable cost effective cropping pattern with proper soil and water management.
- In areas affected with salinity hazard, salt tolerant crops should be encouraged for cultivation.
- As the western and some northern parts of the district suffer from salinity problem, it is essential to precisely identify the fresh water aquifers through borehole logging to avoid failure of tubewells in saline belt. Cement sealing should also be invariably done precisely to seal off the saline aquifer.
- Over-exploitation may disturb the hydrochemical balance of fresh and saline water interface leading to contamination of saline water ingress. Therefore, proper care should be taken to avoid over-exploitation. Clustering of tube wells should also be avoided.
- There is need to educate people to make them aware of importance of ground water, better practices of water use available in domestic, irrigation and industrial sectors, present ground water scenario, need and means of water conservation, artificial recharge techniques etc.