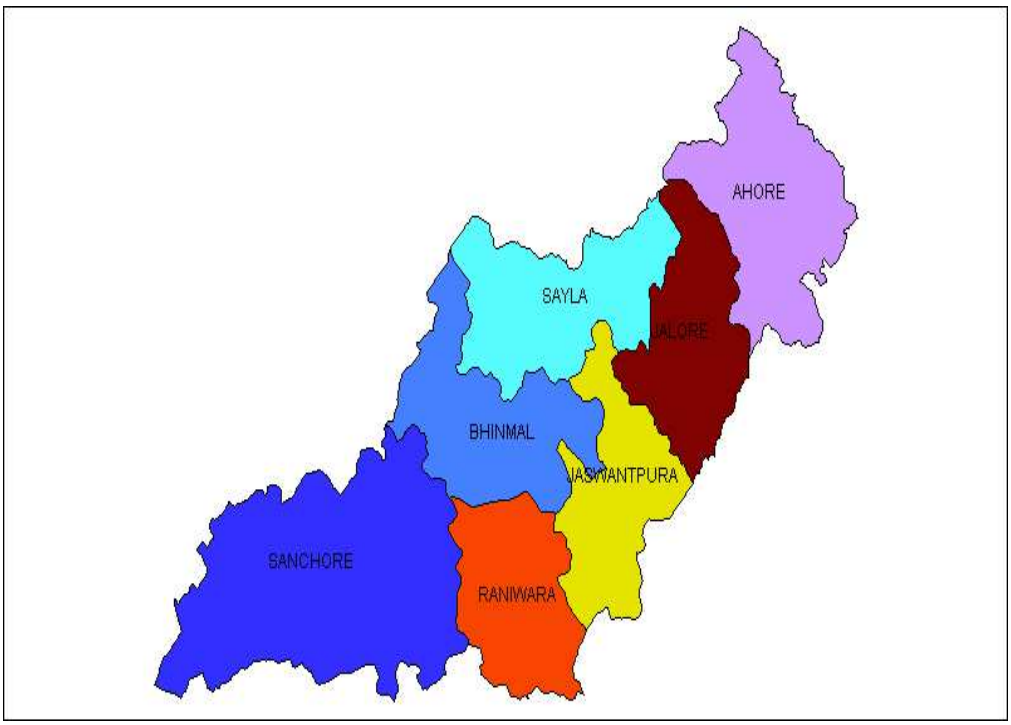
GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES
CENTRAL GROUND WATER BOARD

GROUNDWATER SCENARIO
JALORE DISTRICT
RAJASTHAN



Western Region
Jaipur
2013

DISTRICT AT A GLANCE – JALORE, RAJASTHAN

S.No.	Item	Statistics	
1	GENERAL INFORMATION		
	(i) Geographical area (sq km)	10640	
	(ii) Administrative Division (As on 31.3.2009)		
	Number of Tehsils	07	
	Number of Blocks	07	
	Number of Villages	802	
	Number of Town	03	
	(iii) Population Statistics (As per 2011 Census) Population Density (persons per sq. km.)	 1828730 172	
	(iv) Average Annual Rainfall (1971-2012) in mm	445.4	
2	GEOMORPHOLOGY		
	Major Physiographic Units	Alluvial plain, Flood plain, Buried pediment, pediment, sandy plain, Eolian plain.	
	Major Drainage	Luni, Jawai, Sukri, Khari, Bandi & Sagi.	
3	LAND USE (sq km)(2010-11)		
	(a) Forest Area	235.06	
	(b) Net Sown Area	6993.35	
	(c) Total Cropped Area	11255.25	
4	MAJOR SOIL TYPE	Sand to sandy loam, Loamy alluvium	
5	AREA UNDER PRINCIPAL CROPS (As on 2010-11)	Crops	Area (hectare)
		Bajra	366636
		Wheat	44957
		Jawar	5958
		Barley	520
		Maize	41
		Fruits & vegetables	1554
		Pulses	31304
		Fibre	342
		Condiments & spices	90556
		Oil seeds	383761
6	IRRIGATION BY DIFFERENT SOURCES (2010-11)		
	Source	Area in ha	
	Tube wells/Bore wells	107379	
	Other wells	142638	
	Tanks/Ponds	985	
	Canals	36356	
	Net Irrigated Area (ha)	287358	
	Gross Irrigated Area (ha)	337609	
7	NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on 31.03.2012)		
	Number of Dug wells	07	
	Number of Piezometers	07	

S.No.	Item	Statistics
8	PREDOMINANT GEOLOGICAL FORMATIONS	Older alluvium, Younger alluvium, Jalore Granite, Siwana Granite, Malani Rhyolite (Volcanics) Idar Granite, Erinpura Granite
9	HYDROGEOLOGY	
	Major Water bearing formation	Older and Younger alluvium, Granite, Rhyolite.
	Depth to water level (Pre-monsoon, 2011 (mbgl)	4.74 (Punna-kalan) to 64.60 (Poshana)
	Depth to water level (Post-monsoon, 2011) (mbgl)	2.84 (Punna-kalan) to 75.85 (Poshana)
	Long term decline water level trend (2001-2011) in m/yr	0.16 to 5.3 m/y
10	GROUNDWATER EXPLORATION BY CGWB (As on 31.3.2012)	
	Number of wells drilled	EW-25, OW-02, SH-21, PZ-18, Total-66
	Depth Range (m)	25 – 362.80
	Discharge (liter per minute)	Negligible - 4400
	Transmissivity (m^2/day)	34-370
11	GROUND WATER QUALITY	
	Presence of chemical constituents (EC in µS/cm at 25^0 C, F in1.5 mg/l, Nitrate in 45.0mg/l)	EC - 770-5330 F – 0.09-2.40 Nitrate– 15-155
	Type of water	Potable to Brackish
12	DYNAMIC GROUND WATER RESOURCES (March, 2009) in mcm	
	Annual replenishable ground water resource	435.1818
	Net annual Ground Water Availability	393.2782
	Net Annual Ground Water Draft	775.6949
	Projected Demand for Domestic and Industrial Uses	39.9814
	Stage of Ground Water Development	197.11 %
13	Awareness and training Activity	Date:11.03.2005 Place:Bagora
14	Groundwater control and Regulation	No.of OE blocks:07 No.of blocks notified:05
15	MAJOR GROUND WATER PROBLEMS AND ISSUES	Declining water level, Low Yield of Wells, Quality deterioration.

Ground Water Information
Jalore District
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GROUND WATER SCENARIO
DISTRICT - JALORE, RAJASTHAN

1.0 Introduction

The district derives its name from the town of Jalore, which is the headquarters of the district administration. District is located between latitudes 24º 37' 00" to 25º 49' 00" and longitudes 71º 11'00" to 73º 05'00" with an area of 10,640 Sq. kms (3.11% of the State). The district is part of Jodhpur Division. The district is composed of five sub-divisions viz. Jalore, Ahore, Bhinmal, Sanchore, Raniwara which cover seven tehsils viz: Jalore, Ahore, Bhinmal, Sanchore, Raniwara, Sayala, Bagora and seven blocks viz: Jalore, Ahore, Bhinmal, Sanchore, Raniwara, Sayala & Jaswantpura. Total number of villages in the district is 802 and it also has 3 urban towns. Total population of the district as per Census 2011 is 1828730 with male and female population of 936634 and 892096 respectively. Administrative divisions of Jalore district are depicted in the index map (Fig. 1).

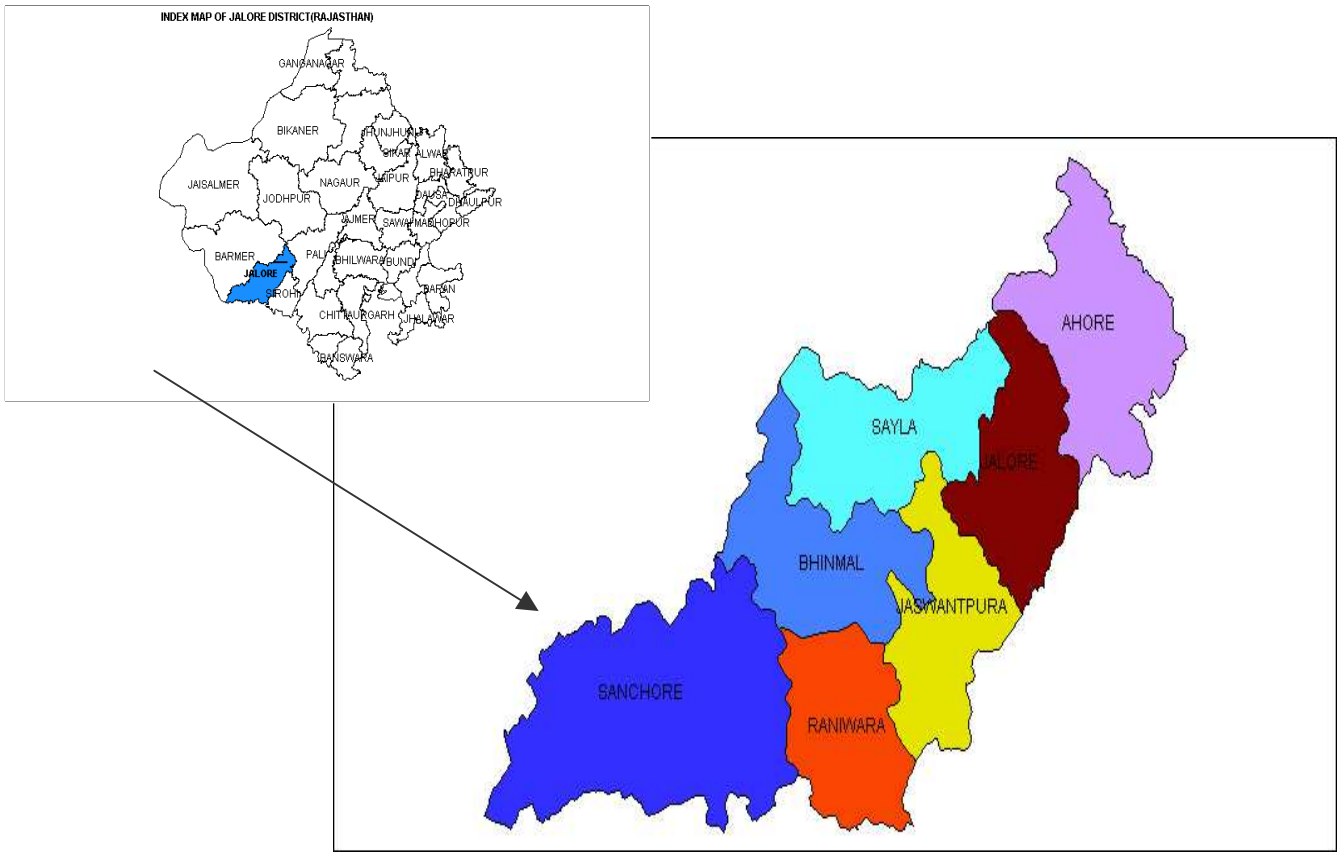

Fig. 1: Administrative Divisions

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.

Table 1: Scientific studies undertaken by Central Ground Water Board

S.No.	Officer/ Project	AAP	Type of Study
1.	UNDP Phase I	1969 - 71	Ground water surveys in Rajasthan
2.	R.K. Tiwari	1974-75	Systematic Hydrogeological Survey in parts of Barmer and Jalore districts
3.	S.K. Gupta	1982-83	Systematic Hydrogeological Survey in parts of Barmer and Jalore districts
4.	B.P.Verma	1975-76	Reappraisal study of ground water resources in part of Jalore area, Jalore district
5.	A.K. Bhatia & S. Datta	1978-79	Reappraisal study of ground water resources in parts of Luni and Sukri basins, districts, Barmer, Jalore and Sirohi
6.	O.P. Poonia	1997-98	Reappraisal Hydrogeological Survey in parts of Jawai sub basin of Luni river catchment (Parts of Jalore and Barmer districts),

The report on Ground Water Potential and Development Potential of Jalore District was brought out by Central Ground Water Board in the year 1981. The updated report on Hydrogeological Framework and Ground Water Potentialities of Jalore District was brought out in 1990. The Central Ground Water Board has also taken up the exploratory drilling program in the district in 1986-87, 1991-92, 1998-99 and Peizometer construction in 1994-95, 1999-2000 and 2011-12.

2.0 Rainfall & Climate

Average annual rainfall (1971-2012) of the district is 445.4 mm. However normal rainfall for the period 1901 to 1970 is 400.6 mm. The annual rainfall gradually decreases from southeastern part to northwestern part.

Climate of the district is dry except during SW monsoon season. The cold season is from December to February and is followed by summer from March to June. Period from mid of September to end of November constitutes post monsoon season.

The district experiences either mild or normal drought once in two years. Severe type of drought has been recorded at Ahore block. Most severe type of drought has been recorded at Bhinmal, Sanchore & Jaswantpura blocks.

3.0 Geomorphology, Drainage & Soil type

The district is characterized by landscape of alluvial plains of hill ranges, and isolated hillocks. Jalore district has almost an even topography in its western section, the lowest point being around 17.0 meter above mean sea level and is marked by sand dunes. The sand dunes trend NE-SW, indicating prevalent wind direction in the area. The eastern section is dominantly hilly, forming the flank of Mount Abu range and the highest point is 991 m above mean sea level (amsl). The elevation of the area ranges from more than 600 m amsl in the east to 75m amsl in the west at the confluence of the Luni and Jawai-Sukri

Rivers. Generally the terrain slopes westwards. The valley floor has an area elevation ranging from 60m amsl to 215m amsl. The hill tops are normally shaped by weathering phenomena, which have caused tors and boulders of various shapes and sizes. These features are well developed in the eastern part of the area. In the mid eastern and western parts, sand dunes are a common topographic feature. Jalore district is often called “Delta of West Rajasthan” and all the principal rivers of western Rajasthan flow through this district.

The review of the geomorphological study carried out by the Central Arid Zone Research Institute (CAZRI) 1966 has shown that the whole of the Luni drainage system can be classified into 7 geomorphological divisions viz. Siwana dissected plateau, Jalor-Israna-Rewara granite rhyolite Inter-fluve with intervening plains, The Khari-Bandi-Sagi river plains, North and North-east alluvial plains, Pachbhadra salt basin, Western plains with dunes, Flood plains of the Luni and Jawai-Sukri drainage systems.

Geomorphologically, the alluvial valley floor belongs to mature landscape system and present landform units are the products of the past meandering courses and wide flood plains. Additionally, there are innumerable old channels buried under wind blown sand.

3.1 Drainage

Jalore district falls in parts of Luni basin (82.8%), Other Nallahs (16.9%) and Outside Basin(0.3%). Tehsil wise distribution of basin area is given in Table 2.

Table 2: Tehsil wise distribution of basins

Sl.No	Name of Tehsil	Area in Sq. Km.		
		Luni	Other Nallahs	Out side Basin
1	Ahore	1536.4	-	-
2	Bhinmal	2653.6	-	4.1
3	Jalore	2277.2	-	-
4	Raniwara	494.9	-	513.8
5	Sanchore	1857.9	33.9	1286.8

The Jalore district forms a part of the Central Luni Basin and is drained by the Luni drainage system, which passes only through the southwestern tip of the district near Sanchore before shedding its load into Runn of Kutch, originating from the Aravalli hill ranges. The main rivers in the district are Jawai, Sukri, Khari, Bandi and Sagi, which are tributaries of the Luni River and form a trellis pattern of drainage flowing due northwest. All rivers are ephemeral with graded and meandering courses and wide flood plains.

3.2 Soils & Irrigation Practices

Soils are shallow with deep gravel encrusted with CaCO3. The texture of the soils in general varies from sandy to sandy loam but in deltaic areas of the Luni River south to southwest of Sanchore, the soils are loamy alluvium. The pH value ranges from 7.0 to 9.0 and in general, the soils have a higher pH. The nature of the soils can be broadly described as fine-sorted sand on the dunes and coarse to medium textured soils on the plains with a tendency for increase in fine particles. The soils in the eastern part of the district are

shallow, covering partly weathered rocks and calcareous gravelly material. Soils along the hill slopes are also mostly shallow consisting of weathered rock and calcareous gravelly materials. The fertility status of the soils in general is low and the proportion of organic matter varies from 0.2 to 1.0 per cent. The soils of the district can be broadly divided into three types.

1.Aridisols: (a) Camborthids

(b) Calciorthids

2.Entisols: Torripsamments

3.Aridisols and Entisols: (a) Torripsamments

(b) Calciorthids

(c) Paleorthids.

3.3 Irrigation

The principal means of irrigation in the district are wells/tube wells, though some areas are irrigated by canals. 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 Narmada canal project, Bandhi sandhara irrigation project, Bhetala irrigation project, Dantwara irrigation project, Dhumada mata bund and Gudanal II irrigation project.

Details of the Net irrigated area and gross irrigated area (as on 2010-11)by different sources are given in Table 3.

Table 3: Details of irrigated area by different sources

(Area in Ha)

Source / Area	Canal	Tanks	Tubewells	Other wells	Total
Net irrigated	36356	985	107379	142638	287358
Gross irrigated	36725	1058	130169	169657	337609

4.0 Groundwater Scenario

4.1 Geological Framework

Geological set-up of the district is represented by Quaternary alluvium and various igneous and meta-sedimentary rocks. Vast area is covered by Quaternary alluvium and wind blown sand. In the southeastern part of the district around Jaswantpura, Delhi supergroup rocks comprising of phyllite, schist and Erinpura granite and gneisses are exposed. Erinpura granite and gneisses are also exposed near Jalore town. Younger Alluvium mainly occurs along river courses and stream channels.

4.2 Hydrogeology

Ground water 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 ground water in hard rock areas is governed by size, openness, interconnection and continuity of structurally weak planes while in unconsolidated rocks, ground water movement takes places through pore space between grains. Hydrogeological map of Jalore district is presented in Fig. 2.

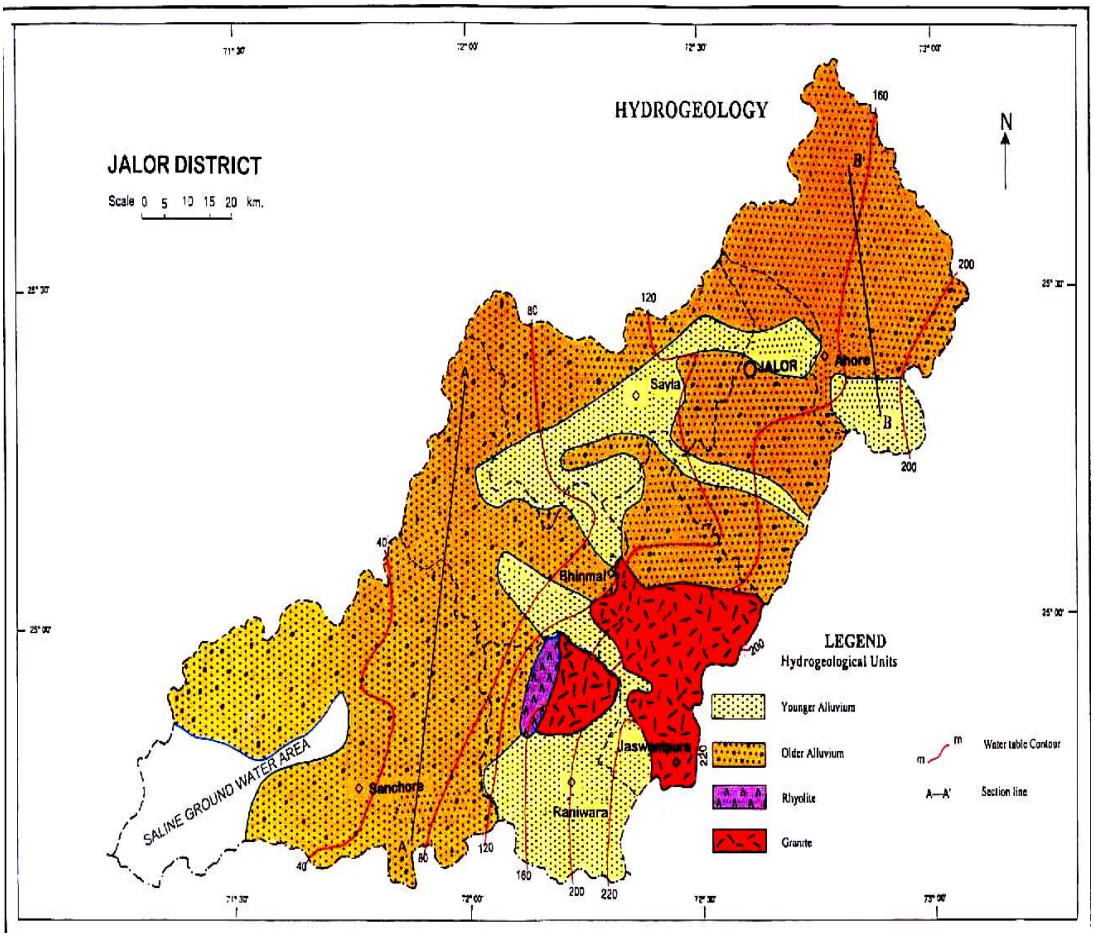

Fig. 2: Hydrogeological Map

Water bearing properties of different aquifers in the district are described below.

4.2.1 Ground water in Delhi Super Group

Granite: These aquifers occur predominantly in Jaswantpura tehsil. Few intrusives are also found which have low permeability. Ground water is retained in weathered zones, fractures, joints etc. Depth of open wells tapping these aquifer ranges from 20 to 50m. Yield of wells varies from 20m^3/day to 188m^3/day. The depth to water level in the area tapping this aquifer ranges from 11m to 31m.

Rhyolite: These aquifers occur predominantly towards Jaswantpura tehsil. Ground water occurs under water table condition and is mostly tapped by dug wells. Depth of wells ranges from 20m to 30m. The depth to water level ranges from 11m to 18m bgl. Yield of wells ranges from 30 to 80m^3/day.

4.2.2 Groundwater in Unconsolidated Sediments

Younger Alluvium: Alluvium occurs predominantly in the entire district. It is confined to riverbeds and riverbanks. The depth to water level is less than 10m bgl near river courses but exceeds 40m in other areas. Yield of dug wells ranges from 60-150m^3/day and that of tubewells from 80-560m^3/day

Deep Aquifer System: Exploratory drilling in the district reveals that Alluvium covers the maximum part of the district. Depth of tubewells ranges from 10-40m^3/day with a drawdown of 1.28-16.28m.Transmissivity varies from 370-5696m^2/day.

4.2.3 Water level scenario

Depth to Water Level (Pre Monsoon 2011)

The depth to water level varies widely depending upon topography, drainage, bedrock geology etc. During May, 2011 (Pre monsoon period), depth to water level has been observed to vary from less than 5 m to more than 50m bgl. Water level is shallower in hard rock aquifers mainly in Bhinmal block. Depth to water level varies from 20 to 40m in greater part of the district. Deeper water levels (>50m) have been observed in parts of Bhinmal, Raniwara, Soyala blocks. Depth to water level map of May, 2011 is presented in Fig. 3.

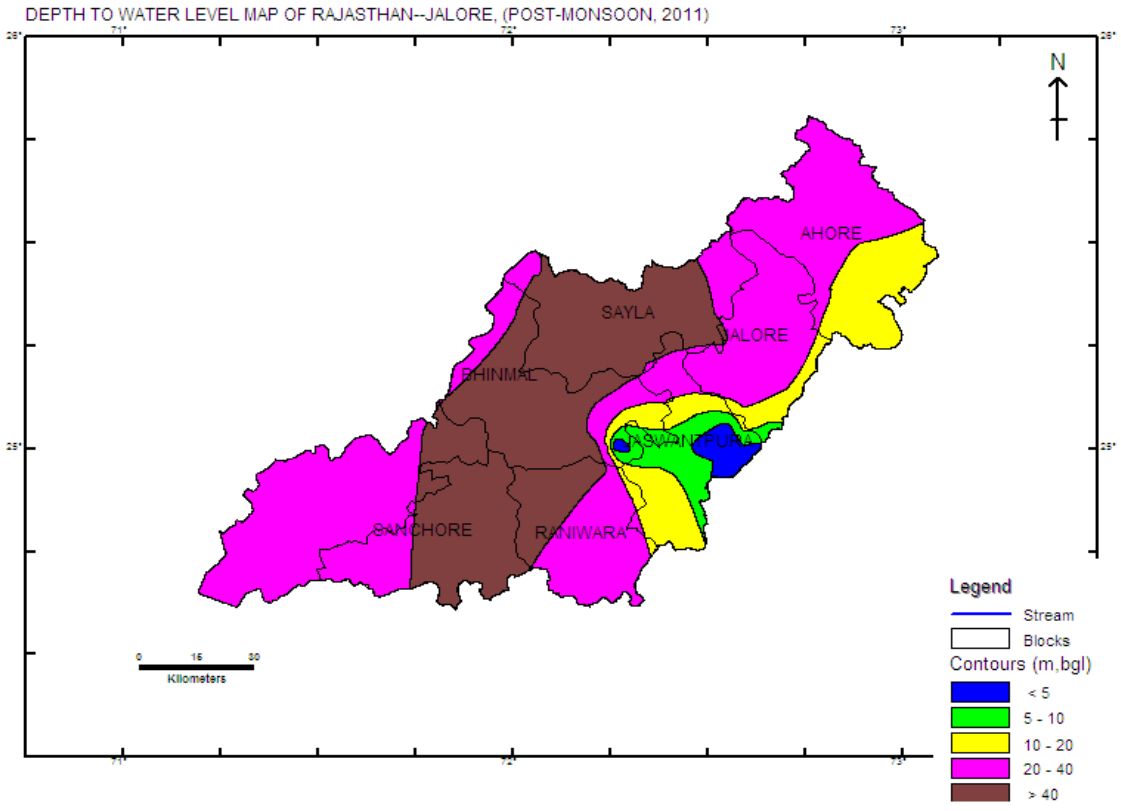

Fig. 3: Depth to water level - May, 2011

Depth to Water Level (Post Monsoon 2011)

During November, 2011 (post monsoon period), water levels have been found to range widely from less than 3m to more than 50m bgl. Water level is shallower in eastern parts of the district. In general, depth to water level varies from 2m to 10m in Jaswantpura tehsil and between 10m to 20 m in

the eastern parts of the district. In rest of the district post-monsoon water-level ranges from 20 m to more than 40m. Depth to water level map of November, 2011 is presented in Fig. 4.

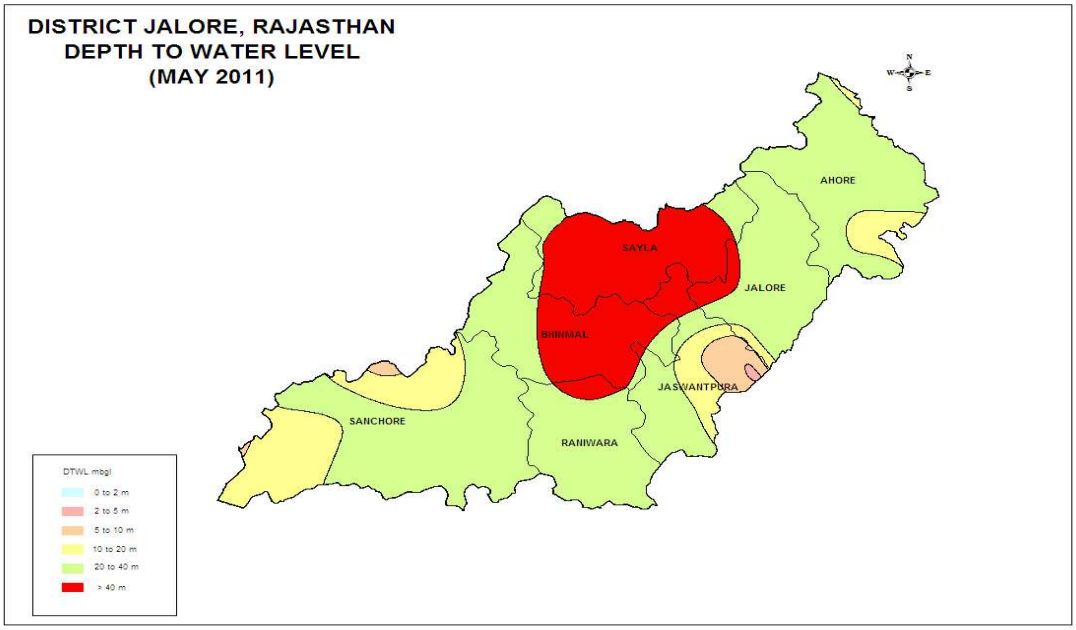

Fig. 4 Depth to water level map - November 2011

Seasonal fluctuation map (Fig. 5) based on Pre and Post-monsoon 2011 water level data indicates that there has been rise in water level in major part of the district. A perusal of the fluctuation data indicates that major part of the district has recorded rise in water level of upto 4.00 m. Decline upto 4.00 m in water level has been observed at Sayla block (Table 4).

Table 4: Water level fluctuation for the year 2011

Block	No. of wells analysed	Depth to water level (mbgl)		No. of wells showing depth to water level in the range of					
		Min	Max	0 – 2	2 – 5	5 – 10	10 – 20	20 – 40	>40
Ahore	2	15.00	23.00	0	0	0	1	1	0
Bhinmal	3	2.87	46.15	0	1	0	0	1	1
Jalore	1	38.5	38.5	0	0	0	0	1	0
Jaswan-tpura	2	2.84	3.55	0	2	0	0	0	0
Raniwara	1	20.25	20.25	0	0	0	0	1	0
Sanchore	1	24.18	24.18	0	0	0	0	1	0
Sayla	3	39.35	75.85	0	0	0	0	1	2

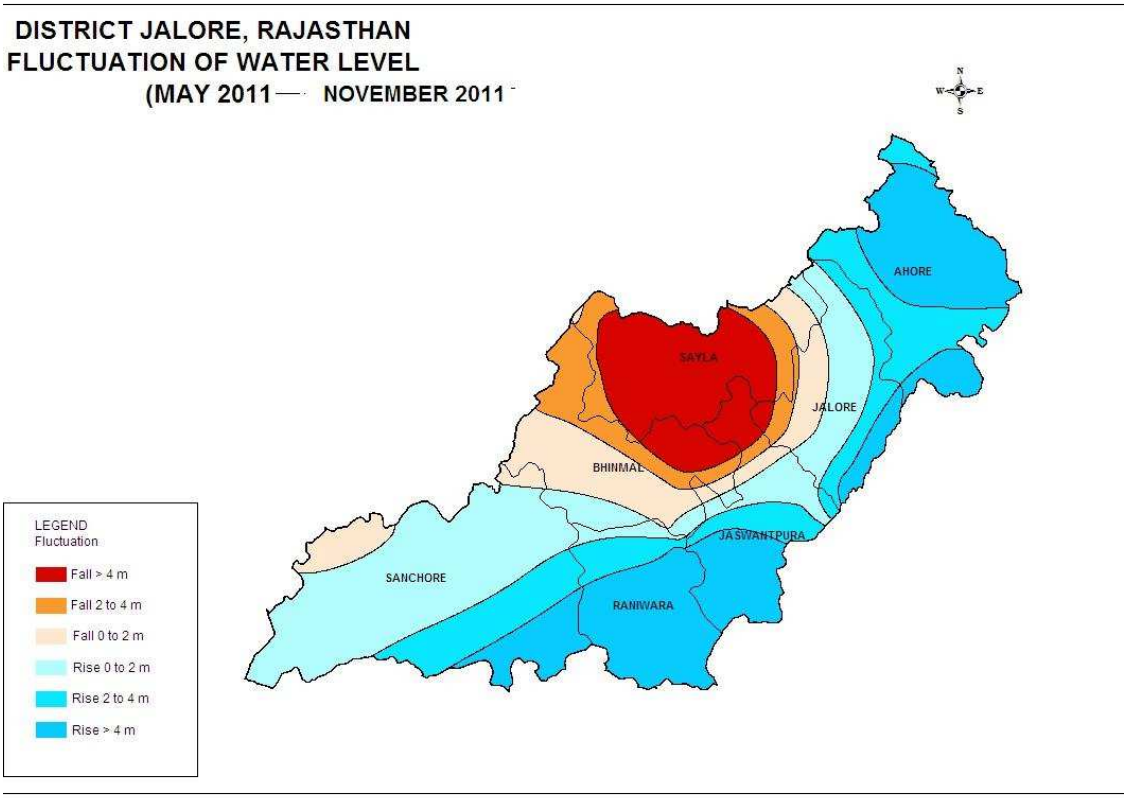

Fig.5: Seasonal water level fluctuation (May 2011 – November 2011)

Decadal mean (2001-2010) has been compared with 2011 water level data to work out water level trend for Pre Monsoon and has been given in the table 5 and depicted in map (Fig. 6). Majority of monitoring stations have shown declining trend ranging from 0.00661m/yr to 4.3604m/yr during pre-monsoon. Rising trend has been observed in small pockets in Raniwara, Jaswantpura and Sanchore tehsils.

Table 5: Decadal Pre-monsoon water level trend (2001- 2011)

Block	Rise			Fall		
	No. of wells	Minimum	Maximum	No. of wells	Minimum	Maximum
Ahore	2	-	-	2	1.60	1.90
Bhinmal	2	-	-	2	8.28	15.59
Jalore	1	-	-	1	8.78	8.78
Jaswantpura	2	5.26	4.92	2	-	-
Raniwara	1	0.17	0.17	1	-	-
Sanchore	2	0.53	0.53	2	-	-
Sayla	2	-	-	2	8.99	25.48

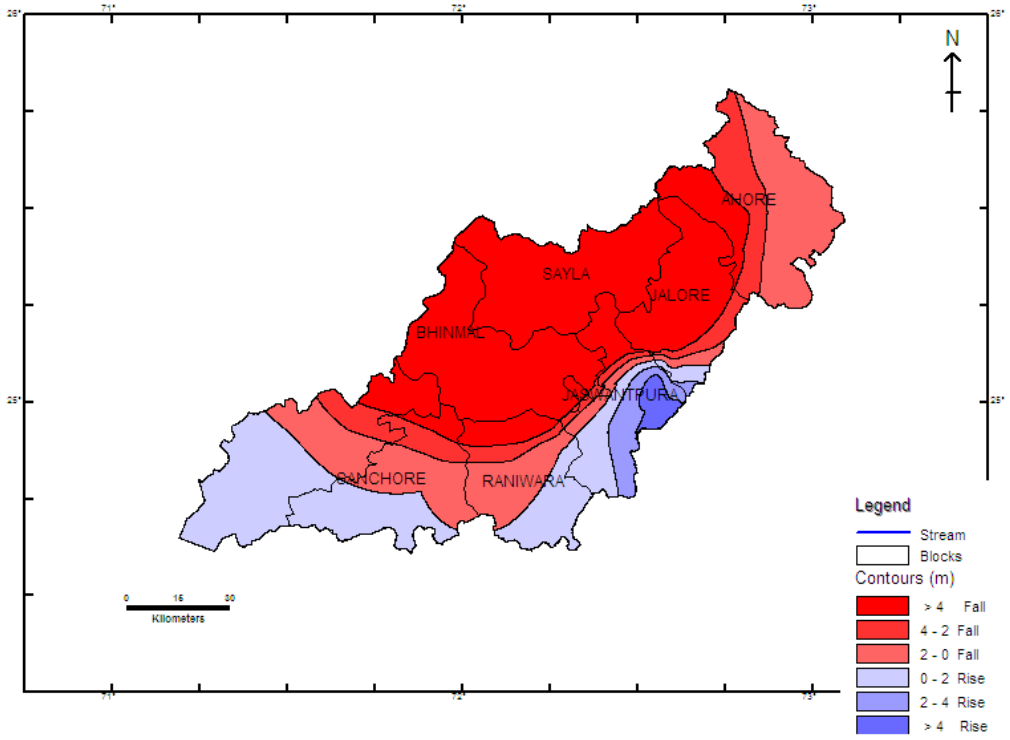

Fig. 6: Decadal Pre-monsoon water level fluctuation (2001 – 2011)

4.3 Groundwater Resources

Groundwater resources have been estimated by jointly by CGWB and State Ground Water Department as per the norms recommended by GEC' 97. While assessing the ground water resources saline and hilly areas have not been considered. Net Annual Ground Water availability in the district is estimated as **393.2782** mcm. Annual Ground Water Withdrawal for all uses is **775.6949**mcm and overall stage of groundwater development is **197.24%.** Summarised block wise estimate of dynamic groundwater resources is given in Table 6. Block wise Annual ground water recharge vis-a-vis ground water draft are represented in Fig. 7.

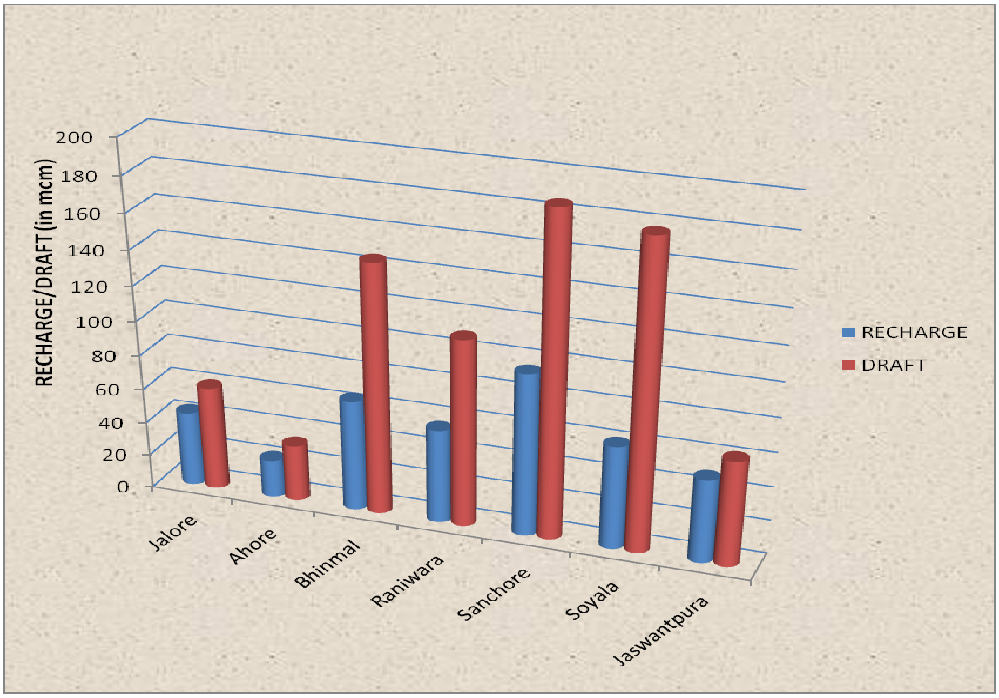

Fig.7: Annual Ground Water Recharge vis-à-vis draft

Table 6: Block wise details of Ground Water Recharge, Draft and Category

Block	Type of Area	Annual Replenishable Ground Water Resource	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for Irrigation	Existing Gross G.W. Draft for Dom. & Ind. Use	Existing Gross Ground Water Draft for all uses	Stage of G.W. Develop-ment.	Category
		(mcm)	(mcm)	(mcm)	(mcm)	(mcm)	(%)	
AHORE	NC	24.2540	22.3366825	28.6832	4.7376	33.4208	149.62	Over-exploited
BHINMAL	NC	72.2800	65.2697344	139.74545	5.8728	145.61825	223.1	Over-exploited
JALORE	NC	49.0180	44.1162138	56.4195	4.6572	61.0767	138.45	Over-exploited
JASWANT-PURA	NC	54.6009	49.4159675	59.1154	3.3708	62.4862	126.45	Over-exploited
RANIWARA	NC	61.4402	55.630345	105.021	4.6296	109.6506	197.11	Over-exploited
SANCHORE	NC	105.6835	95.4037113	178.5945	7.4256	186.0201	194.98	Over-exploited
SAYLA	NC	67.8952	61.1055525	169.6462	7.776	177.4222	290.35	Over-exploited
TOTAL OF DISTRICT (Excluding Saline)		**435.1818**	**393.278207**	**737.22525**	**38.4696**	**775.69485**	**197.24**	**Over-exploited**

4.4 Groundwater Quality

4.4.1 Water Quality in Shallow Aquifer

The range of chemical constituents of groundwater in Jalore district is sown in Table 7.

Table 7: Ranges of various chemical constituents in ground water

S. No.	Chemical constituent	Range
1	PH	7.3 to 8.15
2	Chloride	99 - 1633 ppm
3	Specific conductivity at 25°C	770-5330 µS/cm at 25^0C
4	Total hardness as $CaCo_3$	110 - 700 ppm
5	Calcium	16 - 92 ppm
6	Magnesium	09 - 120 ppm
7	*Iron*	0.05 - 0.66ppm
8	Bicarbonate	18 - 1732 ppm
9	No_3	15 - 155 ppm
10	F	0.09 - 2.40 mg/lit

Distribution of Electrical conductivity in the district is shown in Fig. 8. EC varies from 770 µS/cm at 25^oC to 5330 µS/cm at 25^oC in the district. EC in most part of the district is below 3000 µS/cm at 25^oC except western part of Sanchore, northern parts of Jaswantpura and Jalore, eastern part of Bhinmal and majority of Sayla and Ahore blocks.

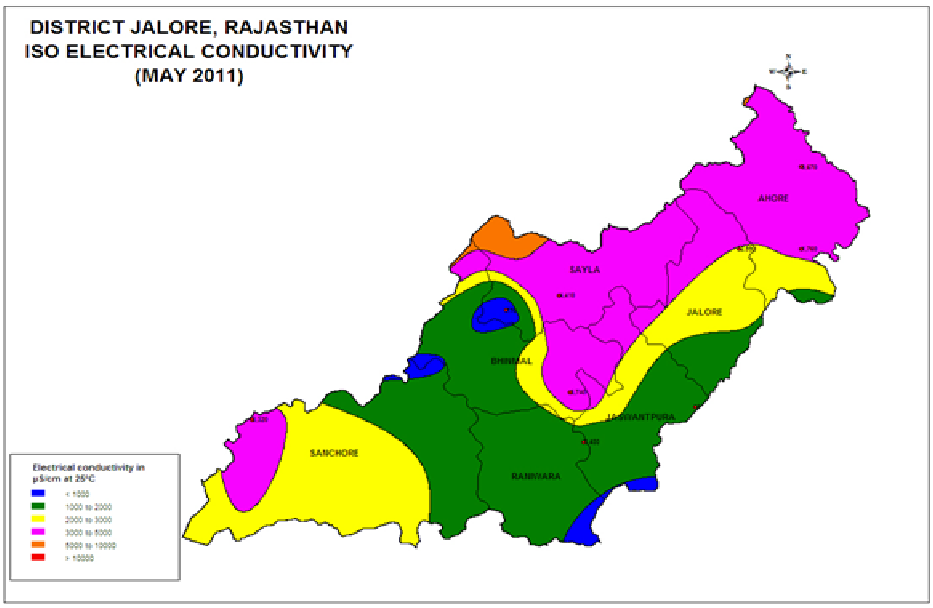

Fig 8: Distribution of Electrical Conductivity

Fluoride concentration has been found to range from 0.9 to 2.4 mg/l. High fluoride contents (>1.5 mg/l) are found in Sanchore, Raniwara and Bhinmal blocks and parts of Sayla and Jaswantpura blocks. Fluoride concentration in the rest of the district is within the permissible limit (1.5 mg/l). Distribution of fluoride in the district is shown in Fig. 9.

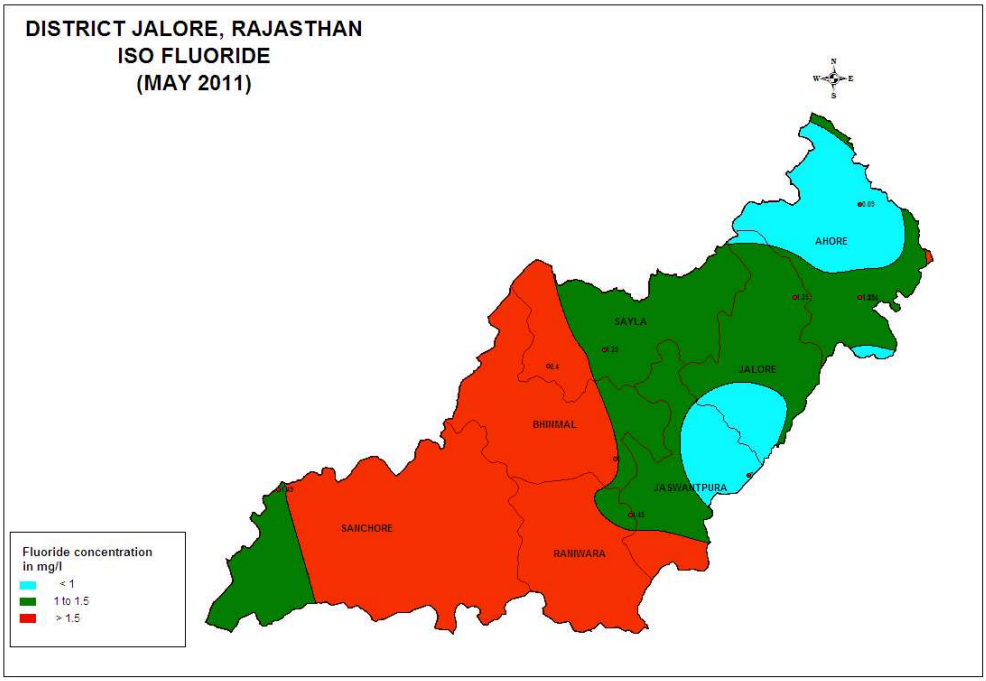

Fig. 9: Distribution of fluoride

Iron content in ground water in the district varies from 0.05 to 0.66 mg/l. Iron concentration in major parts of district has been found to be less than permissible limit of 1 mg/l. Iron distribution in ground water is shown in Fig. 10.

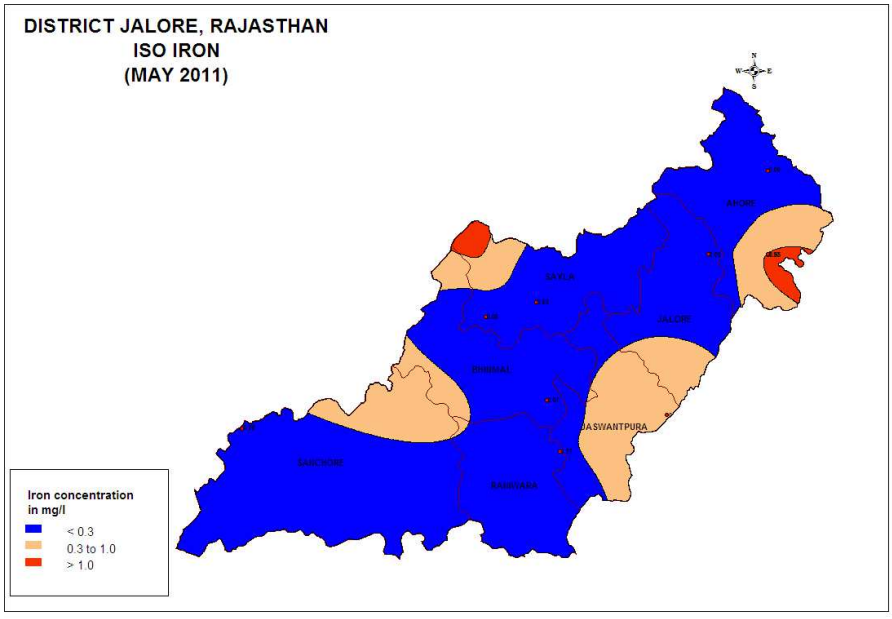

Fig. 10: Distribution of Iron

Nitrate distribution in the district varies from 15 to 155 mg/l. It is mostly within permissible limit (<45 mg/l). Higher values of nitrate have been observed in Raniwara, Ahore and Bhinmal blocks. Distribution of Nitrate in the district is shown in Fig. 11.

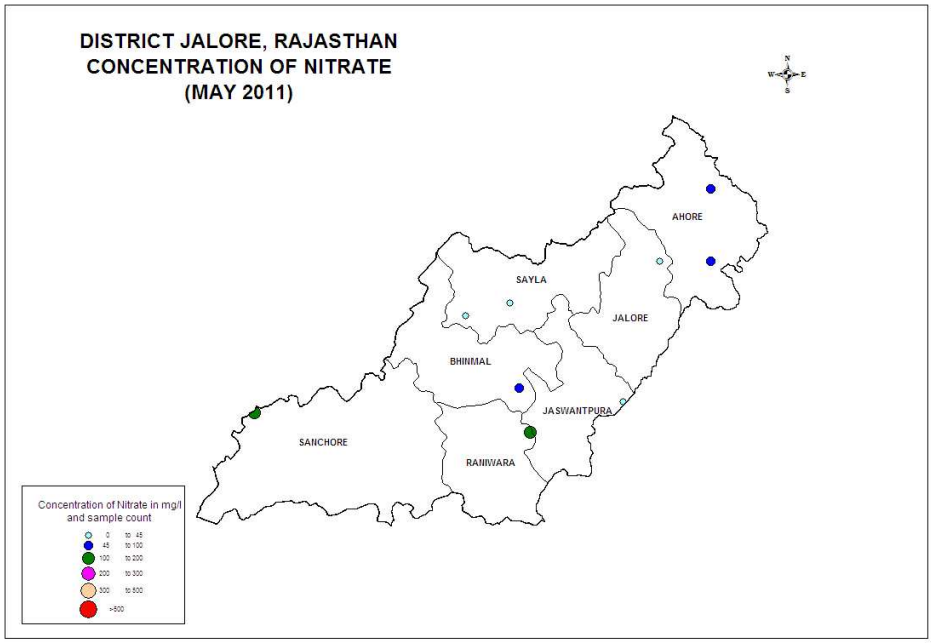

Fig. 11: Distribution of Nitrate

4.4.2 Quality of water from deeper aquifer

Ground water exploration data indicates that the quality of ground water in the district is generally brackish to saline with very limited and small pockets having fresh ground water. The lowest electrical conductivity value of 497 M.mhos/cm at 25^{o}C at Sanchore. Depth wise quality deterioration has been observed at Ahore, Dangra, and Posana. Fluoride concentration in ground water in general is from 1.00- 4.0 mg/l whereas it ranges from 0.3 mg/l to 8.0 mg/l.

5.0 Status of Groundwater Development

Alluvium, Granite and Rhyolite form the aquifer in different parts of the district. Ground water occurs under unconfined to semi-confined condition. Depth and diameter of the dug well and bore well depend on formation and geomorphology. Formation wise details of yield of groundwater abstraction structures in each block are given in Table 8.

Table 8: Formation wise details of yield of ground water abstraction structures

Block	Formation	Avg. Yield m^3/day	
		Dug well+DCB	TW
Ahore	Younger Alluvium	120	150
	Older Alluvium	140	170
Bhinmal	Younger Alluvium	150	140
	Older Alluvium	150	150
Jalore	Younger Alluvium	135	150
	Older Alluvium	135	150
Jaswantpura	Younger Alluvium	90	150
	Older Alluvium	90	135

Block	Formation	Avg. Yield m^3/day	
		Dug well+DCB	TW
	Granite	90	120
Raniwara	Younger Alluvium	100	135
	Older Alluvium	120	150
	Granite	120	120
	Rhyolite	90	-
Sanchore	Older Alluvium	135	150
Sayala	Younger Alluvium	120	150
	Older Alluvium	135	150

As the stage of GW development in district in 197.24%, there is no scope for further ground water development. Quality of ground water in general is good for drinking purposes as well as for irrigation purpose. The main source of water for irrigation is ground water. The dug wells in the alluvium aquifer system have been converted into dug cum bore wells (100 m bgl) and tube wells (150 m bgl). Dug cum bore wells and tube wells are feasible in alluvium aquifer system, which may yield 10 to 20 m^3/hr & 50 m^3/hr respectively. Dug wells of 30 to 40 m depth and dug cum bore wells upto 60 m depth are feasible in granite and may yield 10 to 15 in m^3/hr. However the most economic and viable ground water structures for farmers are dug cum bore wells (cavity type), which are economic in construction and also in maintenance of energy as the pump set can be placed at the bottom of the dug well zone i.e. just near the water table.

6.0 Groundwater Related Issues & Problems

Almost entire district is facing problem of groundwater scarcity. There are large areas vulnerable to quality deterioration and depleted water table. Major issues in the district are as follows:

6.1 Groundwater Depletion

Comparison of pre monsoon water level between 2001 & 2011 shows that 90% of wells analysed (total wells 16) registered decline in water level. In the past decade, decline ranging from 0.00661m/yr to 4.3604m/yr has been observed in majority of wells. Depleting nature of water levels in the long term causes reduction in storage, which leads to water scarcity.

6.2 Water Quality Hazard

High fluoride: Groundwater in Central and eastern parts of the district have high fluoride values exceeding permissible limit of 1.5 mg/lit. The fluoride value ranges in district for 0.21 mg/lit (Choudhariyo Ki Dhani) to 9.07 mg/lit at Bagora.

Salinity: In the eastern and western parts of the district where Bandi and Sukri streams discharge their load in the Luni river, groundwater is found to be saline to highly saline as around Sanchore having total dissolved salts ranging from 3000 to 7000ppm.

Vertical groundwater quality zonation: Vertical groundwater quality zonation has been noticed at depth in Jawai-Sukri valley at Ahore, Dangra, Posana and Dhadhal locations. Non-judicious pumping of wells may cause ingress of salinity in fresh water bearing formations. Geophysical logging of

boreholes in the area has clearly indicated the vertical groundwater quality zonation, which has also been ascertained by exploratory drilling.

7.0 Groundwater Management Strategy

Stage of groundwater development in the district is 197.24% and all the blocks fall under “Over-exploited” category. Therefore, 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.

7.1 Water Conservation

As the entire district comes under the category of 'Over-exploited', ground water should be used judiciously taking into account modern agriculture water management techniques by cultivating crops needing less watering and use of sprinkler system & drip irrigation should be encouraged. The non-conventional sources of energy like windmills fitted with pump be utilised in dug cum bore wells because the area is under the grip of high velocity winds.

Small farmers in the area should be encouraged to use common groundwater structures for optimum use of groundwater resources for irrigation purpose.

If the situation of over-exploitation of groundwater continues for some more years, the district may face acute problem of availability of groundwater even for drinking water supply. Therefore, early implementation of regulation on groundwater use in the area is necessary. Cultivators should also be made aware and encouraged to adopt suitable cropping pattern using modern techniques by extension services for getting maximum agriculture production through minimum groundwater withdrawal.

7.2 Artificial Recharge

Jalore district is covered by extensive alluvial plains with some scattered rocky terrain. Topographically all the rivers flowing in the district originate in Sirohi & Pali districts. Hydrogeologically, alluvial formation has good water storage and transmission capacity in comparison to hard rocks. Alluvium being the major aquifer in the district, different techniques of artificial augmentation of ground water resources can be adopted such as :-

- Rain Water Harvesting and Construction of subsurface barriers, check dams, percolation tanks etc. in the district may increase recharge of ground water reservoirs.
- Existing dams situated in Sirohi and Pali district should release some water in downstream so that the alluvial aquifers of the district may be recharged.

A provision for surplus water of Narmada Canal project for artificial recharge in the district may also be taken into consideration. Maximum emphasis should be laid on preparation of regional water supply scheme from Narmada canal water & maximum irrigation should be facilitated by surface water available through Narmada Canal project so that the stress on ground water resources can be reduced.

7.3 Awareness & Training Activity

Central Ground Water Board regularly organizes mass awareness programmes in different parts of the country to create awareness on the need for rain water harvesting, artificial recharge and conservation of water. One mass awareness programme was organised on 11.03.2005 at Bagora village.

7.4 Area notified by CGWA/SGWA

Central Ground Water Authority (CGWA) has notified five (05) blocks viz. Jalore, Raniwara, Bhinmal, Sanchore and Sayla for regulation of ground water withdrawal. In such areas, construction of new ground water abstraction structures is banned without prior permission of the District Advisory Committee formed by CGWA. The District Collector is authorised for implementation of regulatory measures. NOC for drilling of tubewells by Industries/infra structure projects is not granted in the notified areas.

8.0 Recommendations

- Groundwater should be used judiciously taking into account modern agriculture water management techniques by cultivating crops needing less watering such as wheat (Raj 911), barley (RD 2508), Makka- Mahi kanchan, Jowar (CSH 1,6&14) Bajara (HHB 67260), Moong (K 581), Soyabeen (Pusa 16), Til (RT 46) Ground nuts (RG 141), Mustard (Pus Bold) and use of sprinkler & drip irrigation systems should be encouraged.
- The small-scale farmers in the area should be encouraged to use common ground water structures for optimum use of ground water resources for irrigation purposes.
- Cultivators should also be made aware and encouraged to adopt suitable cropping pattern using modern techniques by extension services for getting maximum agriculture production through minimum withdrawal.
- Suitable artificial recharge structures like subsurface barriers across the river bed should be constructed to arrest and impound the ground water run off for meeting various sectoral needs.
- Mass awareness programmes should be taken up in almost all the areas of the district to educate public in adopting water saving practices & conservation of water.
- A provision for surplus water of Narmada Canal project for artificially recharge in the district may be taken into consideration. Emphasis should be laid on preparation of regional water supply scheme from Narmada canal water & irrigation should also be facilitated by surface water available through Narmada Canal project so as to reduce the stress on ground water resources.