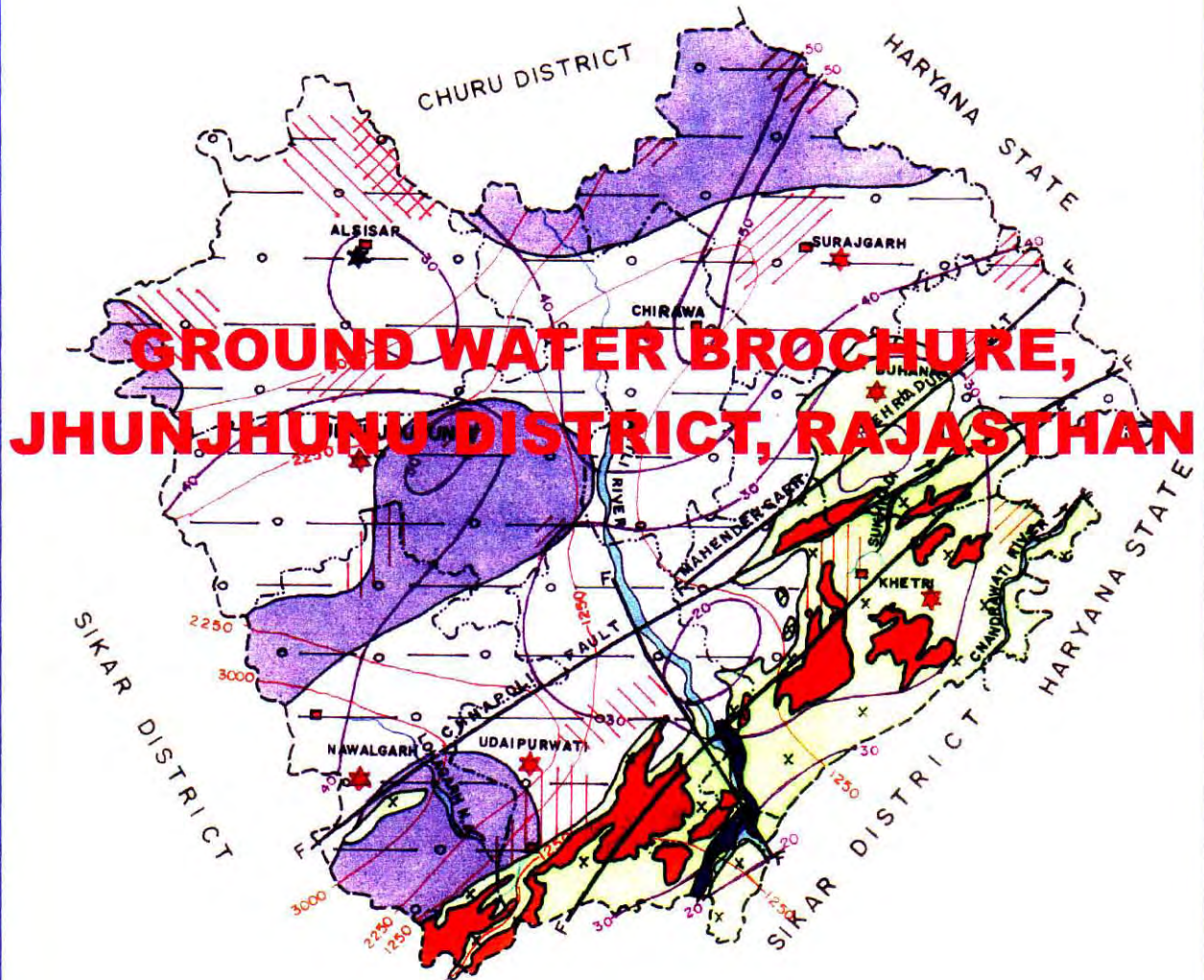




CENTRAL GROUND WATER BOARD
MINISTRY OF WATER RESOURCES
GOVERNMENT OF INDIA



WESTERN REGION
JAI PUR
NOVEMBER, 2008

JHUNJHUNU DISTRICT AT A GLANCE

1	GENERAL INFORMATION	
i	Geographical area (sq.km.)	5928
ii	Administrative Divisions	5
	No.of Tehsils/Blocks	6/8
	No.of Villages	1063 (inhabited 867+uninhabited 2)
	No. of Towns	13
	Number of Municipalities	12
iii	Population(as per 2001 census)	19,13,689
iv	Average annual rainfall(mm) (1971-2006)	485.6
2	GEOMORPHOLOGY	
i	Major physiographical units	i The hilly area in the south eastern part
		ii The undulating area with small isolated hills in the south western part and
		iii The desertic plain in the northern part
ii	Major Drainage	Non-perennial Kantli river and other streams viz. Dohan, Chanderwati, Budhi nala, Sukh nadi.
3	LAND USE (sq.km.)	
i	Forest area	395.27
ii	Net area sown	4273.46
iii	Cultivable area	6463.23
4	MAJOR SOIL TYPES	i Desertic (45% of district area)
		ii Sand dunes (36%)
		iii Red desertic (8%)
		iv Lithosols and regosols of hills (6%)
		v Older alluvium (5%)
5	AREA UNDER PRINCIPAL CROPS. (sq.km.) (2003-04)	
i	Food grains	
	Bajra	2919.74
	Wheat	634.56
	Barley	62.06
	Jawar	0.06
	Maize	Nil
ii	Oil seeds	949.32
iii	Cereals	1241.38
iv	Non food grains	5813.06
v	Others	3.64
6	IRRIGATION BY DIFFERENT SOURCES (sq.km.)(2003-04)	
i	Dug wells/Tube wells/Bore wells	2267.38

ii	Tanks/Ponds	0.36			
iii	Canals	0.17			
iv	Other Sources	-			
v	Net Irrigated Area	2159.11			
vi	Gross Irrigated Area	2267.91			
7	NUMBER OF GROUND WATER MONITORING WELLS OF CGWB				
i	No. of dug wells	5			
ii	No. of piezometers	19			
8	PREDOMINANT GEOLOGICAL FORMATIONS	<ul style="list-style-type: none"> Alluvium Formations of Delhi Super Group 			
9	HYDROGEOLOGY				
i	Principal Water Bearing Formations	Quaternary alluvium and talus & scree. (covering 78.70 % of district area)			
		Quartzites, phyllite/schist, gneisses & limestone of Delhi Super Group and granites, pegmatites and amphibolite of Post Delhi Intrusives (covering 21.3% of district area)			
ii	Pre-monsoon depth to water level during 2006 (mbgl)	16.45 – 73.29 (More than 40m depth to water level is constituted by 70.84% of stations; 20 to 40 m by 20.83% of stations and; less than 20 m by only 8.33% of stations)			
iii	Post-monsoon depth to water level during 2006 (mbgl)	15.23 – 75.67 (More than 40m depth to water level is constituted by 63.64% of stations; 20 to 40 m by 31.82% of stations and; less than 20 m by only 4.54% of stations)			
iv	Long term water level trend in last 10 years (1997-2006) m/year	0.0222 to 0.2010			
10	GROUND WATER EXPLORATION BY CGWB (as on 31.03.2007)				
i	No. of wells drilled	Type of wells	Formation		Total
			Alluvium	Hard rock	
		EW	78	11	89
		OW	10	Nil	10
		SH	Nil	Nil	Nil
	PZ	32	Nil	32	
ii	Depth Range (m)	Uncon.		Con.	
		30 - 115		106 – 172.50	
iii	Discharge (lps)	2.6 - 45.50		1.20 – 12.00	
iv	Transmissivity (m ² /day)	100 - 1915		26.35 – 465.35	
v	Storativity	5.48x10 ⁻⁵ – 1.05x10 ⁻²		--	
11	GROUND WATER QUALITY				
i	Presence of chemical constituents more than	EC	% of samples		

	permissible limit	F	% of samples
		Fe	% of samples
ii	Type of water		Alkaline
12	DYNAMIC GROUND WATER RESOURCES (as on 31.03.2004) (EXCLUDING SALINE) (Figures in mcm)		
i	Annual replenishable ground water resources		235.1238
li	Net annual ground water draft		470.3565
lii	Projected demand for domestic and industrial uses up to 2025		130.1400
iv	Stage of ground water development (%)		200.05
13	AWARENESS AND TRAINING ACTIVITIES		
	Mass awareness programme organized		Nil
ii	Water management training programmes organized		Nil
14	EFFORTS OF ARTIFICIAL RECHARGE AND RAINWATER HARVESTING		
iii	Projects completed by CGWB (numbers and amount spent)		Nil
iv	Projects under technical guidance of CGWB (numbers)		Nil
15	GROUND WATER CONTROL AND REGULATION		
i	Number of OE blocks		7(Chirawa, Buhana, Surajgarh, Jhunjhunu, Nawalgarh, Udaipurwati and Khetri blocks)
li	Number of critical blocks		Nil
lii	Number of blocks notified		3(Chirawa, Buhana and Surajgarh blocks)
16	MAJOR GROUND WATER PROBLEMS AND ISSUES		
i	Declining water level		Reduction in yields of wells and deterioration in quality
ii	Over-draft of ground water		

GROUND WATER BROCHURE

JHUNJHUNU DISTRICT

1.0 INTRODUCTION

Jhunjhunu district is located in the extreme north eastern part (bordering Haryana state) of Rajasthan State and lies between 27°38' & 28°31' north latitudes and 75°02' & 76°06' east longitudes. It covers 5928 sq.km. of geographical area (Figure 1). The administrative set up of the district is given below.

Sl.No.	Sub-division	Sl.No.	Tehsil	Sl.No.	Block	Area (sq.km.)
1	Chirawa	1	Chirawa	1	Chirawa	493.04
				2	Surajgarh	779.09
2	Jhunjhunu	2	Jhunjhunu	3	Alsisar	827.15
				4	Jhunjhunu	751.90
3	Khetri	3	Buhana	5	Buhana	651.14
		4	Khetri	6	Khetri	819.44
4	Nawalgarh	5	Nawalgarh	7	Nawalgarh	696.80
5	Udaipurwati	6	Udaipurwati	8	Udaipurwati	867.28

The population of district is 19,13,689 based on Census,2001 including 1518573(79.35%) rural and 395116 (20.65%) urban. The density of population is 323 persons/ sq.km.

Jhunjhunu district is covered under mainly Sekhawati basin and north western part falls under the outside the basin i.e. having inland drainage. The area is drained mainly by Kantli river. The area in the south eastern part is drained by Singhana river and a small area in south western corner of district is drained by Budhi nala. The south and east of hill ranges in Khetri area is drained by Dohana river. All the rivers/nalas are ephemeral in nature and flows in response to heavy precipitation during monsoon. Being a desertic terrain particularly in north eastern and north western part of district has inland drainage (Figure 2).

The land use statistics of the district is furnished below.

Sl.No.	Particulars	(figures in sq.km.)
1	Area not suitable for cultivation	355.92
2	Hills & hilly forest	396.14
3	Pasture land	401.74
4	Barren land	65.91
5	Others	79.00
6	Area suitable for cultivation but not cultivated	422.87
7	Area under cultivation	6463.23
i	Area irrigated by wells	2267.38
ii	Area irrigated by canals	0.17
iii	Area irrigated by tanks/ponds	0.36
iv	Area irrigated by other sources	Nil
v	Unirrigated area	4195.32

Fig. 1

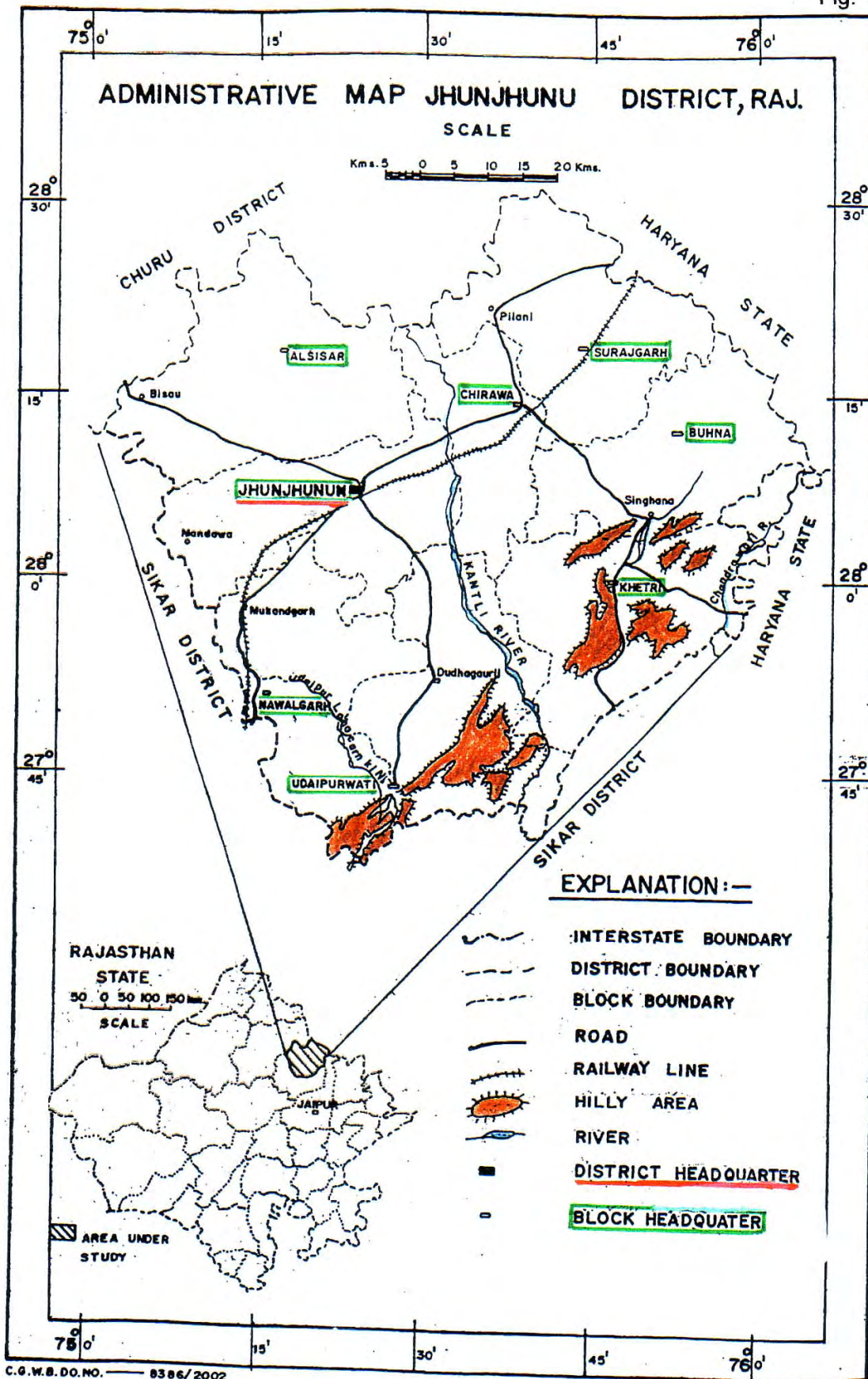
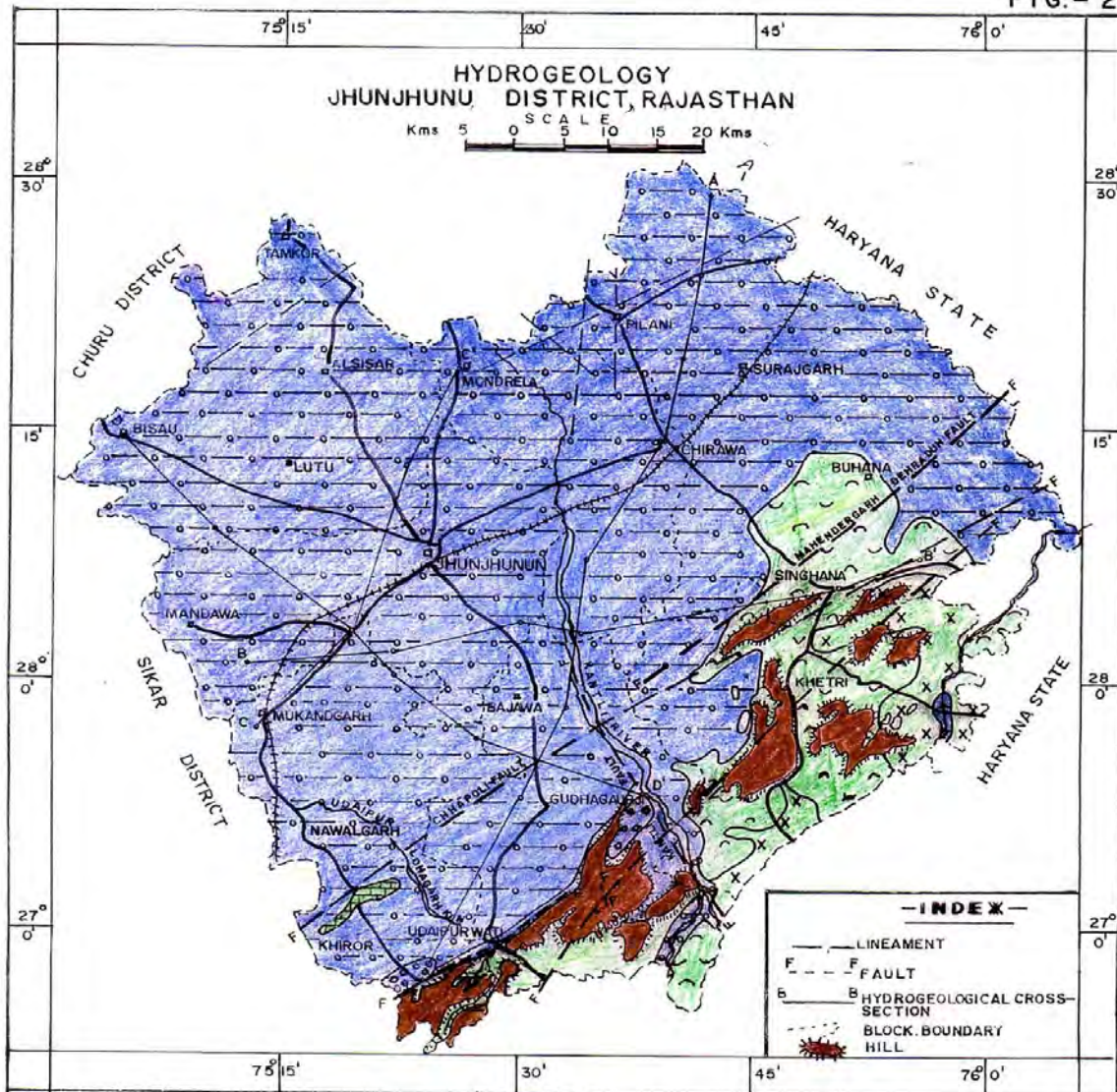


FIG.- 2



- INDEX -

- LINEAMENT
- F - - - F FAULT
- B - - - B HYDROGEOLOGICAL CROSS-SECTION
- - - - - BLOCK BOUNDARY
- ▲ HILL

FORMATION		AGE	LITHOLOGY	LEGEND	
UNCONSOLIDATED		↑ QUATERNARY UPPER CAINOZOIC	ALLUVIUM CONSISTING OF AEOLIAN SAND, GRAVEL, SILT, CLAY, KANKAR		AQUIFER CHARACTERISTICS POROUS FORMATION FAIRLY THICK AND REGIONALLY EXTENSIVE, COVERING 78-70% OF AREA, THICKNESS OF SEDIMENTS VARIES WIDELY FROM 15 TO 140 m WHERE AS SATURATED THICKNESS FROM 30 TO 70 m IN GENERAL, GROUND WATER OCCURS MOSTLY UNDER UNCONFINED CONDITIONS AND SEMI-CONFINED OR CONFINED CONDITIONS LOCALLY DUE TO PRESENCE OF THICK CLAY FORMATION, DEPTH TO WATER LEVEL FROM 7.55 TO 75 m, DISCHARGE OF TUBEWELLS RANGES FROM 6 TO 50 m ³ /hr, SUITABLE FOR HIGH TO MEDIUM TUBEWELLS AND DUG CUM BOREWELLS, HAVE DISCHARGE FROM 5 TO 40 m ³ /hr, DUGWELL YIELD 150 TO 600 m ³ /day, QUALITY IS GOOD IN GENERAL EXCEPT IN ALSISAR BLOCK
			BOULDER FORMATION CONSISTING OF BOULDER, PEBBLES, SAND, CLAY		LIMITED THICKNESS. OCCUR LOCALLY IN FOOTHILL AREAS, GROUND WATER OCCURS UNDER PHREATIC CONDITION, DUG YIELD FROM 250 TO 600 m ³ /day, QUALITY IS GOOD WELL
CONSOLIDATED		↓ POST DELHI INTRUSIVES	GRANITE		FISSURED FORMATION LOCAL/DISCONTINUOUS UNCONFINED TO SEMI CONFINED AQUIFERS RESTRICTED TO WEATHERED MANTLE AND FRACTURE ZONES LIMITED POTENTIALITY, DUGWELL YIELD LESS THAN 250 m ³ /day AND BOREWELLS AT FEASIBLE LOCATIONS, DISCHARGE LESS THAN 5 TO 30 m ³ /hr, QUALITY IS GOOD
			LIMESTONE		LOCAL/DISCONTINUOUS UNCONFINED AQUIFER CAPERNOUS LIMESTONE YIELD 10 TO 40 m ³ /hr QUALITY IS POTABLE, EXISTING IN 11 Sq Km AREA
			QUARTZITE, SCHIST PHYLLITE,		LOCAL/DISCONTINUOUS UNCONFINED TO SEMI CONFINED AQUIFER RESTRICTED TO WEATHERED MANTLE AND FRACTURE ZONES, DEPTH TO WATER LEVEL 5 TO 55 m, LIMITED POTENTIALITY DUGWELL YIELD LESS THAN 250 m ³ /day AND BOREWELL AT FEASIBLE LOCATIONS DISCHARGE LESS THEN 5 TO 35 m ³ /hr, QUALITY IS GOOD

CGWB(WR) D. No 8293 / 02

Agriculture activity is spread over both kharif and rabi cultivation. Kharif cultivation is rainfed and rabi cultivation is mostly based on ground water. The main kharif crops grown in the area are Bajra, Guar, Cow Pea (Chola), Moong, Moth where as as principal rabi crops are Wheat, Gram, Mustard etc.

The total sown area is 6463.23 sq. km., out of which 2267.91 sq. km (forming 35.09%) is irrigated. Tehsil wise break up of area under various seasonal crops is given below.

Tehsil	Kharif		Rabi		Jayad Rabi	
	Area sown	Irrigated	Area sown	Irrigated	Area sown	Irrigated
Jhunjhunu	1239.48	5.55	304.58	303.41	11.57	11.57
Chirawa	1042.16	7.80	871.94	854.45	21.33	21.33
Khetri	346.85	6.53	220.19	192.09	5.04	5.04
Nawalgarh	517.75	18.11	208.30	207.36	15.10	15.10
Udaipurwati	488.22	11.61	279.97	275.56	11.31	11.31
Buhana	464.60	0.92	362.46	291.41	7.74	7.74
Total						

The area irrigated is mostly by ground water forming 98.98% of total area irrigated. Source wise irrigation detail is given below.

Tehsil	Wells/Tube wells		Ponds		Canals		Gross area irrigated	Net area irrigated
	No.	Area irrigated	No.	Area irrigated	No.	Area irrigated		
Jhunjhunu	4902	326.56	-	-	-	-	326.56	313.37
Chirawa	11653	898.64	-	-	-	-	898.64	876.57
Khetri	4146	182.55	2	0.36	-	0.17	183.08	164.45
Nawalgarh	6321	311.04	-	-	-	-	258.25	228.26
Udaipurwati	8117	258.25	-	-	-	-	311.04	293.48
Buhana	3495	290.34	-	-	-	-	290.34	282.98
Total			2	0.36	-	0.17	2267.91	2159.11

The district has been covered under systematic hydrogeological survey by 1979. Investigation, hydrogeological survey and ground water exploration for water supply to Khetri Copper Project were carried out during 1960-62. During 1971-74, Central Ground Water Board under UNDP project conducted ground water exploration and investigation to evaluate ground water potential in parts of Rajasthan including western part of Jhunjhunu district. Reappraisal hydrogeological survey was carried out in Jhunjhunu district in parts during 1980-81, 1987-88 and 1996-97. Ground water management studies for the entire Jhunjhunu district were carried out during 1999-2000. Ground water exploration is continued till date since 1960 including construction of piezometers. Monitoring of hydrograph stations four times a year is continued since 1978 including collection of ground water samples during pre-monsoon of respective year. District hydrogeological report of Jhunjhunu has been compiled and issued in the year 1989.

2.0 RAINFALL AND CLIMATE

The climate of the district can be classified as semi-arid. It is characterised by very hot summers and very cold winters with poor rainfall during south-west monsoon period. In May and June, the maximum temperature may sometimes go up to 48°C. The potential evapotranspiration rates are quite high, especially during May and June. The total annual potential evapotranspiration is 1502.6mm.

The mean annual rainfall of the district, based on 36 years data (1971-2006), works out to be 485.6mm. However normal annual rainfall (1901-71) of the district is 459.5mm. It can be inferred that the rainfall in the district has significantly increased in the recent years. The coefficient of variation is on higher side at 36.6% indicating that the rainfall is slightly unreliable. A perusal of the figure reveals that the district experienced very poor rainfall between the period 1979 to 1991 with the exception of few years in between. There after, the district was fortunate to have very good spell of rainfall continuously for a period of 7 years from 1992 to 1998. The year 1996 was the best with annual rainfall exceeding mean annual rainfall by 85.4%. The district again experienced drought conditions from 1999 to 2002. The year 2002 was the worst with rainfall being 62.3% less than mean annual rainfall.

3.0 GEOMORPHOLOGY AND SOIL TYPES

The district encompasses of three distinct geomorphic units.

- The hilly area in south eastern part of district is characterized by hills of Aravalli range, running in north easterly direction. The highest peak, 1051 m high is in the south of Lohagar village bordering Sikar district. Hills are almost barren of vegetation except a few bushes of acacia and cactus.
- The undulating area with small isolated hills having steep slope lies in the south western part of district. The major portion of hills is found in Khetri and Udaipurwati tehsils. The general elevation above mean sea level rests between 300 and 450m Quaternary level forms are represented by sand and colluvial deposits of talus and scree at piedment slopes.
- The desertic plain generally lying at an altitude of about 300m amsl occupies the northern part of the district and is covered with sand dunes. The general slope of the area is from south to north. Sand dunes are drifting in nature.

The distribution of soil is given below.

i	Desert soil (Covers 2666 sq.km.area forming 44.97% of district)	Occurs extensively in the central part of the area covering parts of all the blocks except Surajgarh block.These are yellowish brown, sandy to sandy loam, loose, structure less, well drained with high permeability. They are scanty of vegetation due to severe wind erosion and wind velocity high.
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ii	Sand dunes (Covers 2149 sq.km.area forming 36.25% of district)	Present mostly in northern part of the district covering parts of Alsisar, Buhana, and Chirawa blocks. These are non-calcareous soils, sandy to loamy sand, loose, structureless and well drained. In favourable localities they cultivated.
iii	Red desertic soil (Covers 468 sq.km.area forming 7.90% of district)	Rests in parts of Jhunjhunu and Nawalgarh blocks. These are pale brown to reddish brown colour, structureless, loose and well drained having texture from sandy loam to sandy clay loam. Suitable for agriculture but suffers from adverse climatic conditions.
iv	Lithosols and regisols of hills (Covers 329 sq.km.area forming 5.55% of district)	Found on Delhi hills and hill slopes between Khetri and Gudagaurji and south of Udaipurwati in parts of Khetri and Udaipurwati and Nawalgarh blocks. They are shallow with gravels very near the surface, light textured, fairly drained, reddish brown to grayish brown in colour. Cultivation is restricted because of limited root zone.
v	Older alluvium (Covers 316 sq.km.area forming 5.33% of district)	Found in southern most parts of the area in parts of Khetri, Udaipurwati and Nawalgarh blocks. They are derived from alluvium and are non-calcareous, semi-consolidated to unconsolidated brown soils, loamy sand to sandy loam in texture. Well drained and occupy gently sloping terrains.

Irrigation Projects

Only minor projects exist in the district. Basin wise/ Tehsil wise break up is furnished below.

SI No.	Name of tehsil	Name of Basin	Minor irrigation project
EXISTING			
1	Jhunjhunu	Shekhawati	1
2	Khetri	Shekhawati	8
3	Nawalgarh	Outside	1
4	Udaipurwati	Shekhawati	6
		Outside	1
TOTAL			17
ONGOING			
1	Udaipurwati	Shekhawati	4
TOTAL			4
PROPOSED			
1	Udaipurwati	Shekhawati	4
TOTAL			4

4.0 GROUND WATER SCENARIO

4.1 Hydrogeology

Quaternary alluvium is the principal water bearing formation (occupies 4663sq.km. forming 78.70 % of district) and hard rocks of Delhi Super Group

including post Delhi Intrusive (covers 1265 sq.km. forming 21.30% of district) form ancillary aquifers in the district (Figure 2).

Alluvium (composed of sand, silt, clay, kankar and gravel) forms the principal and potential aquifer in the area. Thickness of alluvial sediments (Figure 3) increases from south (having less than 60m) to north and north eastern parts of district (more than 100m). Ground water occurs under unconfined to semi-confined conditions in the primary porosity i.e. pore spaces. Exploratory bore hole data has revealed the presence of aquifer system down to the depth of 100 m in general and reaching maximum to 135 m in the Buhana block. a fence diagram showing saturated thickness of alluvial aquifer is given in Figure 4. Saturated thickness has been significantly reduced in parts of Jhunjhunu & Bhuana blocks and in areas around Singhana & Khetri, no more alluvial aquifer exists as water level declined and reached into hard rocks.

Quartzite, schist, phyllite, gneisses and limestone of Delhi Super Group including granites, amphibolites and pegmatites of post Delhi intrusives form the ancillary aquifer and occupy the south eastern area of the district covering parts of Khetri and Buhana blocks. Ground water occurs under unconfined condition in the weathered mantle (ranging in thickness from 10 to 15 m) and under unconfined to semi-confined conditions in deep seated secondary porosity i.e. fractures, joints, contacts etc. of hard formation.

The total number of hydrograph stations in the district is 24 including 5 dug wells and 19 piezometers. Depth to water level varies from 16.45 to 73.29m during pre-monsoon, 2007 (Figure 5) and 15.23m to 75.67m during post-monsoon, 2007. Deeper water level i.e. more than 40 m is constituted by 70.84% stations and rests in entire north eastern part of district covering entire Surajgarh, Buhana blocks, most part of Chirawa, Nawalgarh and Jhunjhunu blocks. Depth to water level between 20 to 40 m is constituted by 20.83% of stations covering most part of Alsisar, Udaipurwati and Khetri blocks. 8.33% of stations forms water level less than 20m which rests in isolated pockets falling in Khetri and Udaipurwati blocks. 85.70% of stations exhibit negative seasonal water level fluctuation (pre versus post-monsoon, 2006) has been noticed in major part of the district. Amplitude of negative fluctuation ranges from less than 0.08 m to 4m. Positive fluctuation (ranging from 0.57m to 1.53m) has been observed at local pockets falling in Khetri block.

The study of long term water level trend for the last ten years (pre-monsoon, 1998-2006) reveals that 89% of hydrograph stations exhibit declining trend ranging from 0.02 to 0.20 m/ year whereas only 11% of stations show marginal rising trend ranging from 0.008 m to 0.017m/ year indicated by only those stations falling in saline area having negligible ground water draft. Maximum declining trend has been noticed in eastern part of the district covering parts of Surajgarh, Bhuana and Khetri blocks (Figure 6). The representative hydrographs of select stations (Paporna, Mandasi Sandasi and Badgaon) have been depicted in Figure 7, which are showing falling trend.

The study of water table contour map reveals that general direction of ground water flow is from the hills areas in south and south eastern to northern side except

in the south eastern part (i.e. in the eastern part of Khetri) where it is from west to eastern side. In south eastern hilly areas of the district, movement of ground water is

FIG. - 3

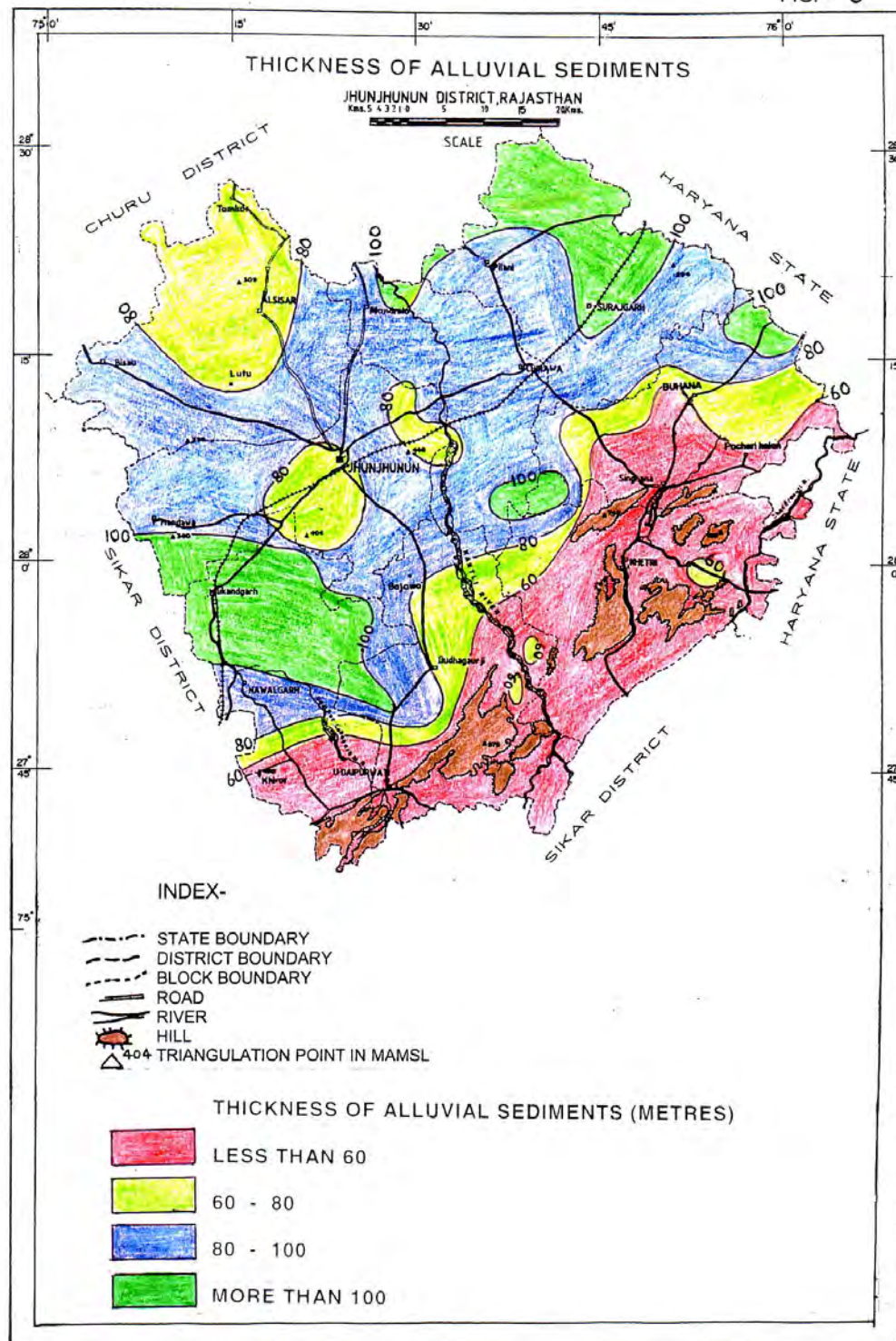


FIG. - 4

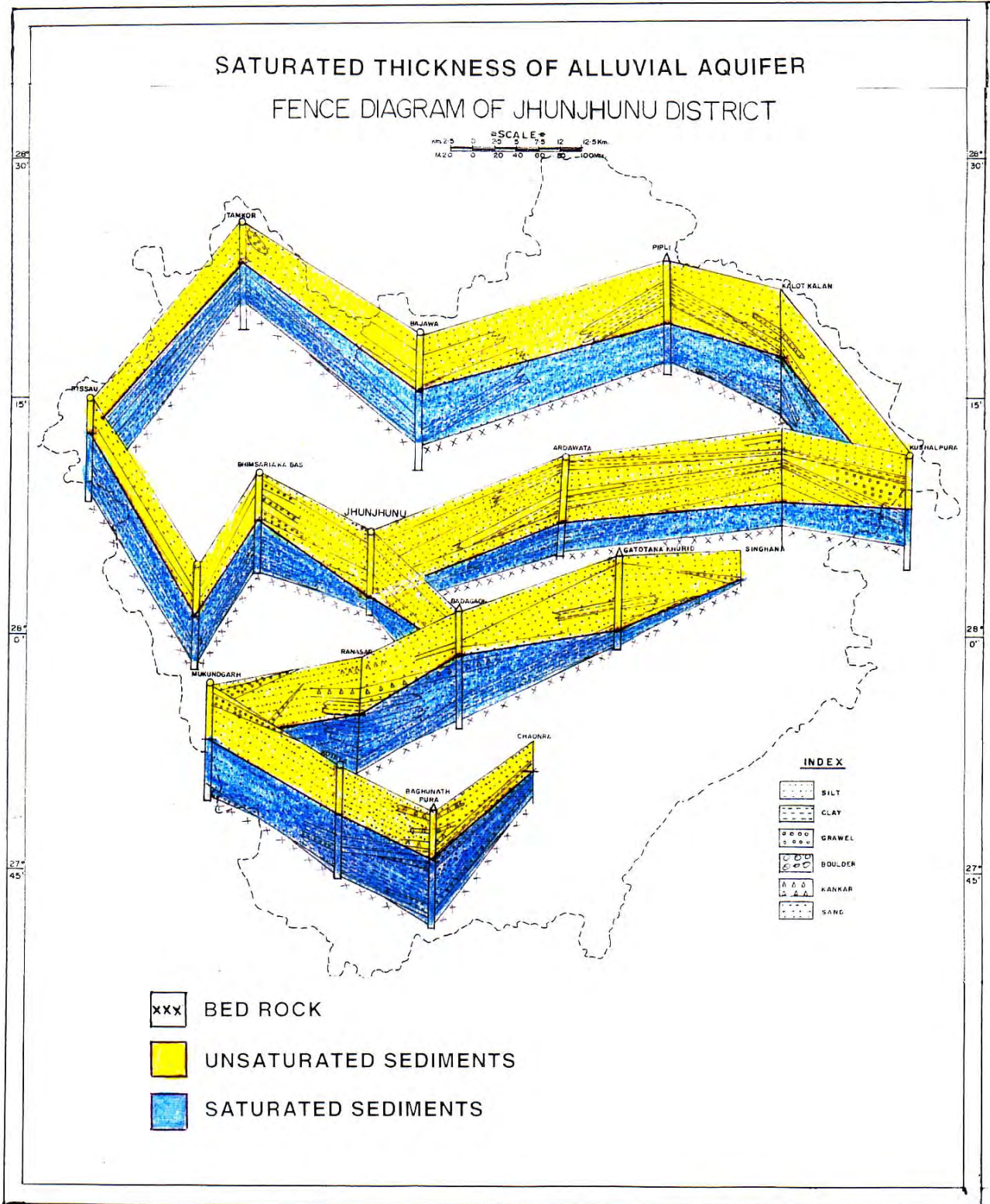


FIG. - 5

DEPTH TO WATER LEVEL MAP OF JHUNJHUNU, DISTRICT (MAY-2007)

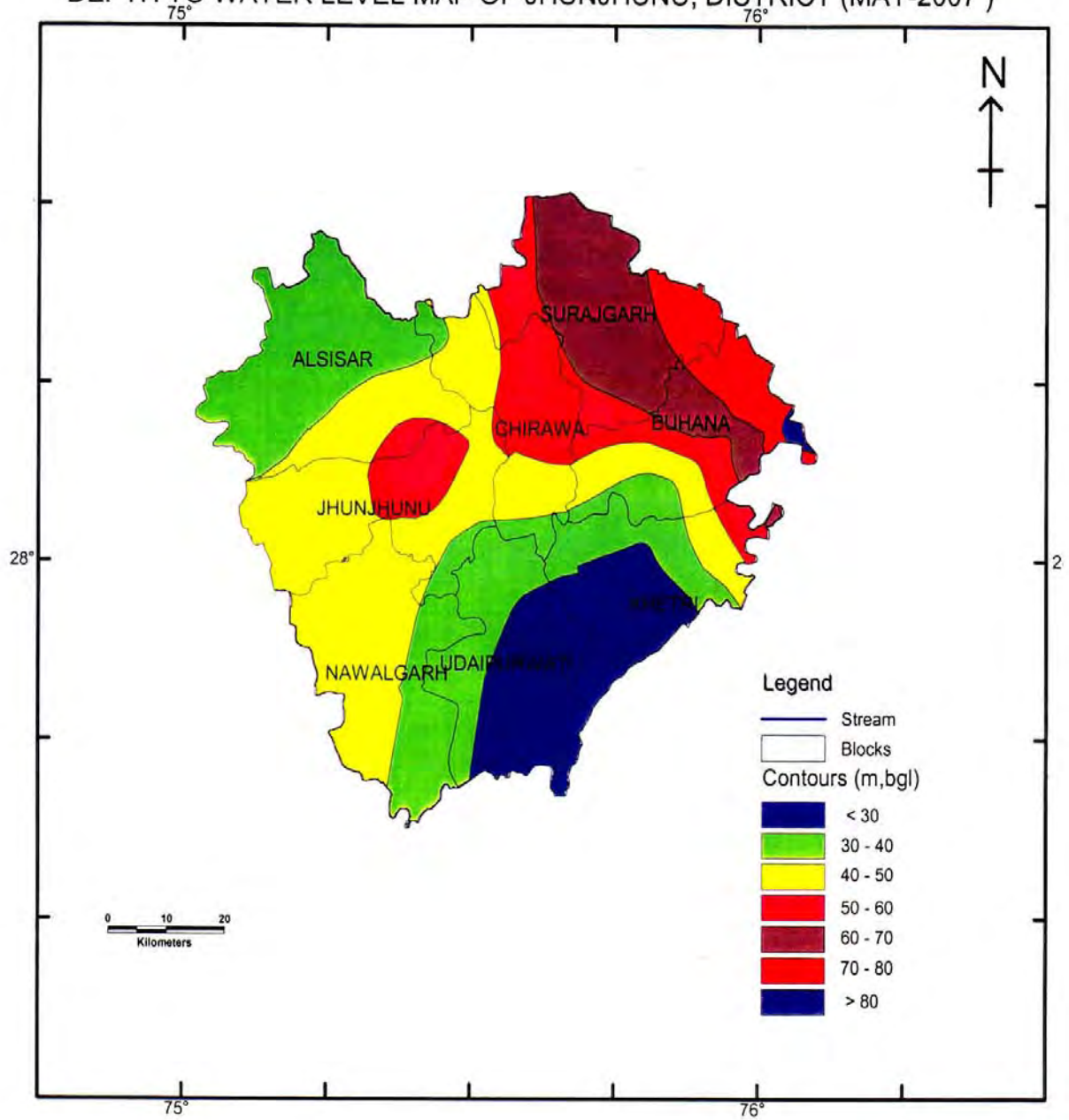


Fig 6

WATER LEVEL TREND MAP OF JHUNJHUNU DISTRICT (PRE-MONSOON)(1998 - 2007)

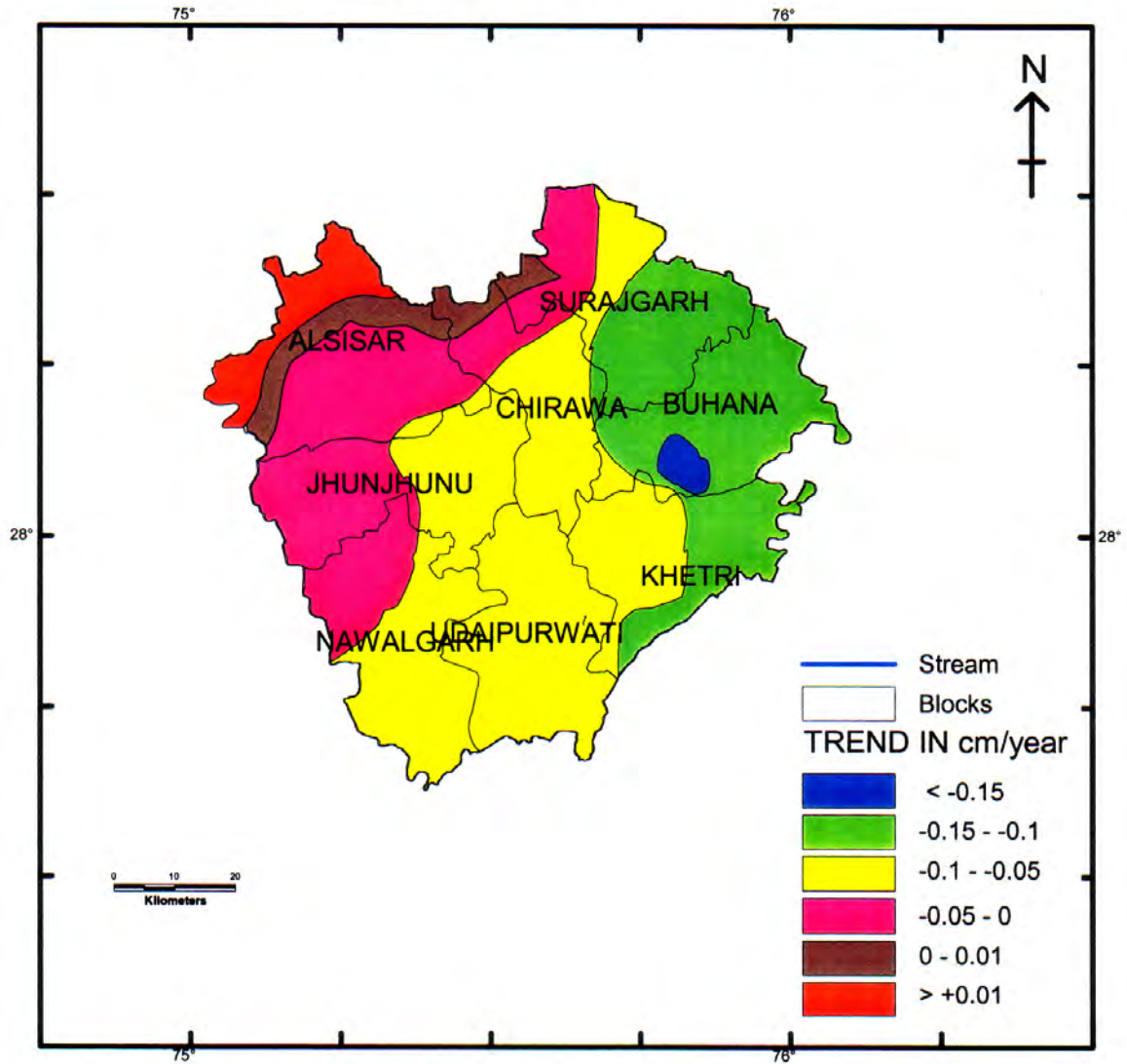
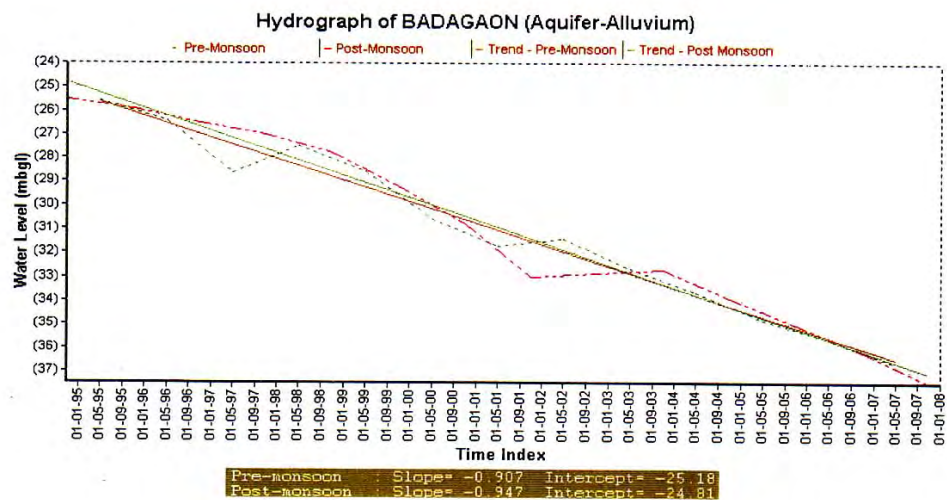
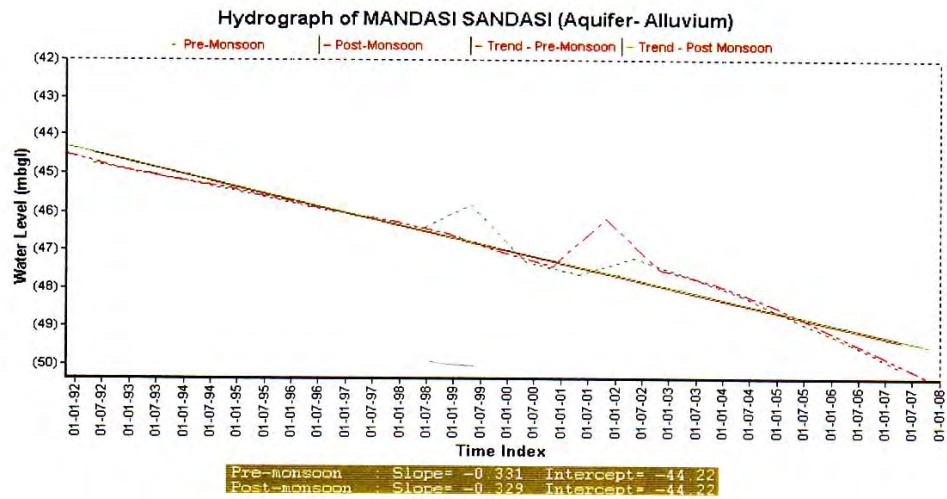
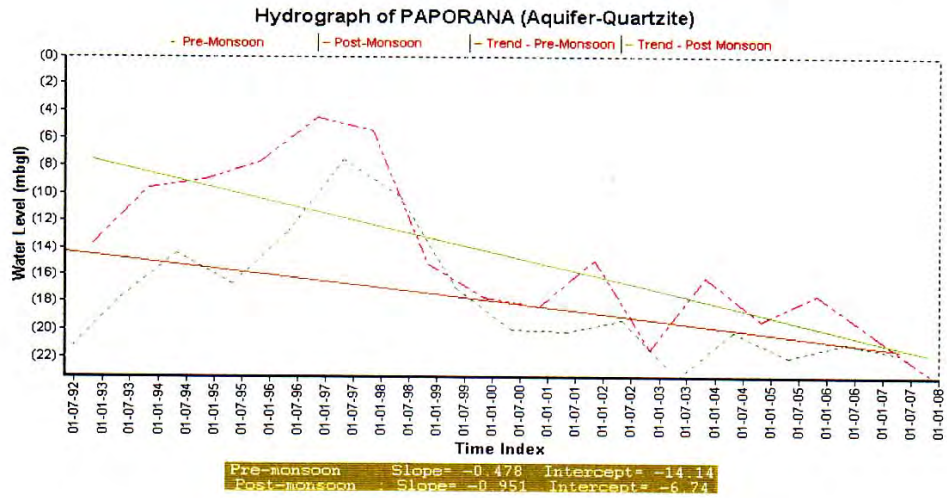


FIG. - 7



comparatively fast due to steep gradient while it is considerably slow in the remaining parts covered by alluvial formations having gentle gradient. The average hydraulic gradient of ground water table is southern part is 4m/km and is about 2 to 3 m/km in the northern part. The maximum elevation of water table has been observed in the south, south western part of area at willage Rampura .i.e 449.9 mamsl (Nawalgarh block) while minimum elevation in the north eastern part of area at village peepli .i.e.225.60 mamsl (Surajgarh block).

The yield of open wells and dug cum bore wells tapping alluvial formation varies from 175 to 900 lpm having drawdown from 0.609 to 12.17 m depending upon the locations. The specific capacity of wells based on Slitcher's formula ranges from 0.0383 to 0.1131 m³/m/m. The optimum yield (Karanjack's method) of wells varies from 106 to 374 lpm. The permeability of wells tapping quartzite ranges from 0.016 to 0.045 m/hr and maximum water inflow capacity from 8.61 to 32.99 m³/ hr.

The status of bore holes (as on 31.03.2008) drilled by Board is presented below.

Type of wells	Formation		Total
	Alluvium	Hard rock	
Exploratory well (EW)	78	11	89
Observation well (OW)	10	Nil	10
Slim hole (SH)	Nil	Nil	Nil
Piezometer (PZ)	32	Nil	32

Exploratory bore hole data drilled in alluvial formation has indicated that depth of drilling ranges from 27.74 to 135.00 m having depth of wells from 30 to -115m. The discharge of wells varies from 160 to 2733 lpm having moderate drawdown. The transmissivity value of aquifer varies from 100 to 1915 m²/day and storativity from 5.48x10⁻⁵ to 1.05x10⁻².

In hard rock, the depth of bore wells lies between 106 and 172.50 m having discharge from less than 50 to 725 lpm with drawdown from 4.04 to 33.91m. The formations encountered are quartzite, shale, phyllite, schist, gneiss and limestone of Delhi Super Group. The transmissivity of aquifer varies from 26.35 to 465.35 m²/day

The discharge of exploratory wells statistically analysed is furnished below.

Discharge range(lpm)		Tubewell/Borewell	
From	To	Number	Percentage(%)
0	100	38	12.84
100	200	125	42.23
200	400	50	16.89
400	600	39	13.18
600	800	21	7.09
800	1000	8	2.70
1000	More	15	5.07

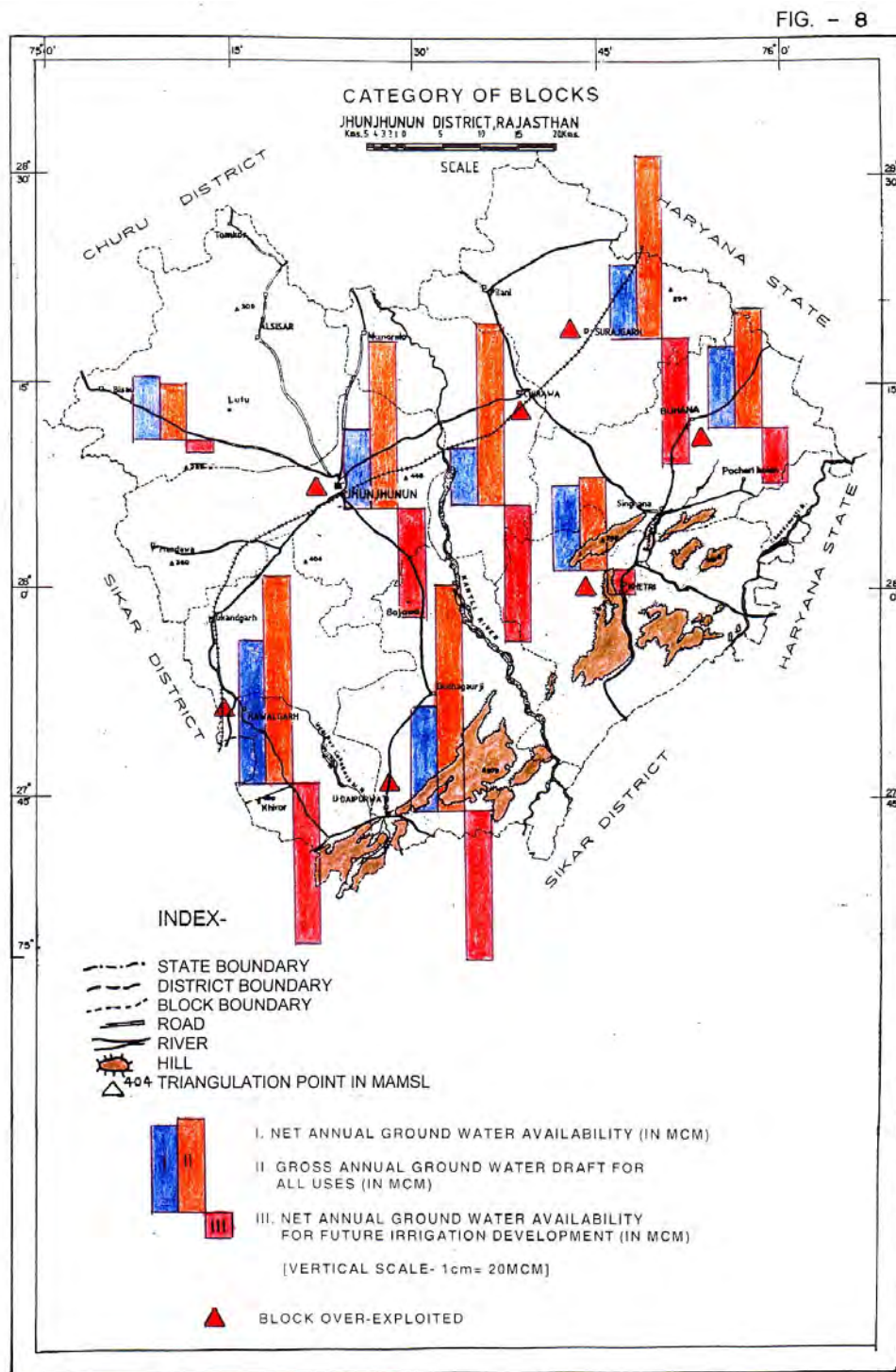
4.2 Ground Water Resources

The dynamic ground water resources as per ground water estimation as on 31.03.2004 is furnished below.

Block	Area of Block (Sq.K m.)	Type of area	Poten-tial Zone	Net Annual G W 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)	Net G.W. Availability for future Irrigation Development (mcm)	Stage of Ground Water Development (%)	Category
1	2	3	4	6	7	8	9	11	12	13
Alsisar	827.15	NC	Ao/1	10.2004	10.2855	3.6011	13.8866	-7.8651	136.14	
		NC	Ao/2	2.7521	1.6845	0.7001	2.3846	-0.8824	86.65	
		NC	Ao1	11.3777	3.4575	1.7637	5.2212	4.4502	45.89	
Block Total				24.3301	15.4275	6.0649	21.4924	-4.2974	88.34	SAFE
Buhana	651.14	NC	Ao	26.1770	32.5056	6.0889	38.5954	-16.6586	147.44	
		NC	Q	5.4642	5.0760	2.0008	7.0768	-3.6018	129.51	
Block Total				31.6412	37.5816	8.0897	45.6713	-20.2604	144.34	O.E.
Chirawa	493.04	NC	A	4.2657	10.6950	0.6892	11.3842	-7.9293	266.88	
		NC	Ao	17.8892	49.9200	8.4345	58.3545	-44.0308	326.20	
Block Total				22.1549	60.6150	9.1237	69.7387	-51.9601	314.78	O.E.
Jhunjhu nu	751.90	NC	Ao	29.2610	50.4030	12.7615	63.1645	-42.6420	215.87	
Block Total				29.2610	50.4030	12.7615	63.1645	-42.6420	215.87	O.E.
Khetri	819.44	NC	A	4.4183	3.0144	0.5227	3.5371	0.4839	80.06	
		NC	Ao	6.2667	6.6615	0.8468	7.5083	-3.1648	119.81	
		NC	Q	22.3438	20.8440	3.5865	24.4305	-6.2302	109.34	
Block Total				33.0289	30.5199	4.9560	35.4759	-8.9114	107.41	O.E.
Nawalgarh	696.80	NC	Ao	23.9934	62.9100	8.9849	71.8949	-57.2166	299.64	
		NC	Q	3.4068	6.5610	0.6388	7.1998	-4.4242	211.34	
Block Total				27.4002	69.4710	9.6237	79.0947	61.6408	288.66	O.E.
Surajgarh	779.09	NC	Ao	27.9985	61.5540	7.5022	69.0562	-48.0555	246.64	
Block Total				27.9985	61.5540	7.5022	69.0562	-48.0555	246.64	O.E.
Udaipurwati	867.28	NC	A	14.6425	21.7680	8.6848	30.4528	-22.1255	207.98	
		NC	Ao	17.7440	36.5796	2.5806	39.1602	-22.6556	220.70	
		NC	Q	6.9226	15.4080	1.6418	17.0498	-11.7954	246.29	
Block Total				39.3090	73.7556	12.9072	86.6628	-56.5766	220.47	O.E.
Alsisar		NC	Ao(S)	3.6635	1.3620	0.5767	1.9387	2.3015	52.92	
Block Total				3.6635	1.3620	0.5767	1.9387	2.3015	52.92	SAFE
Total of District	5885.84	NC		235.1238	399.3276	71.0289	470.3565	-294.3438	200.05	
		SAL		3.6635	1.3620	0.5767	1.9387	2.3015	52.92	

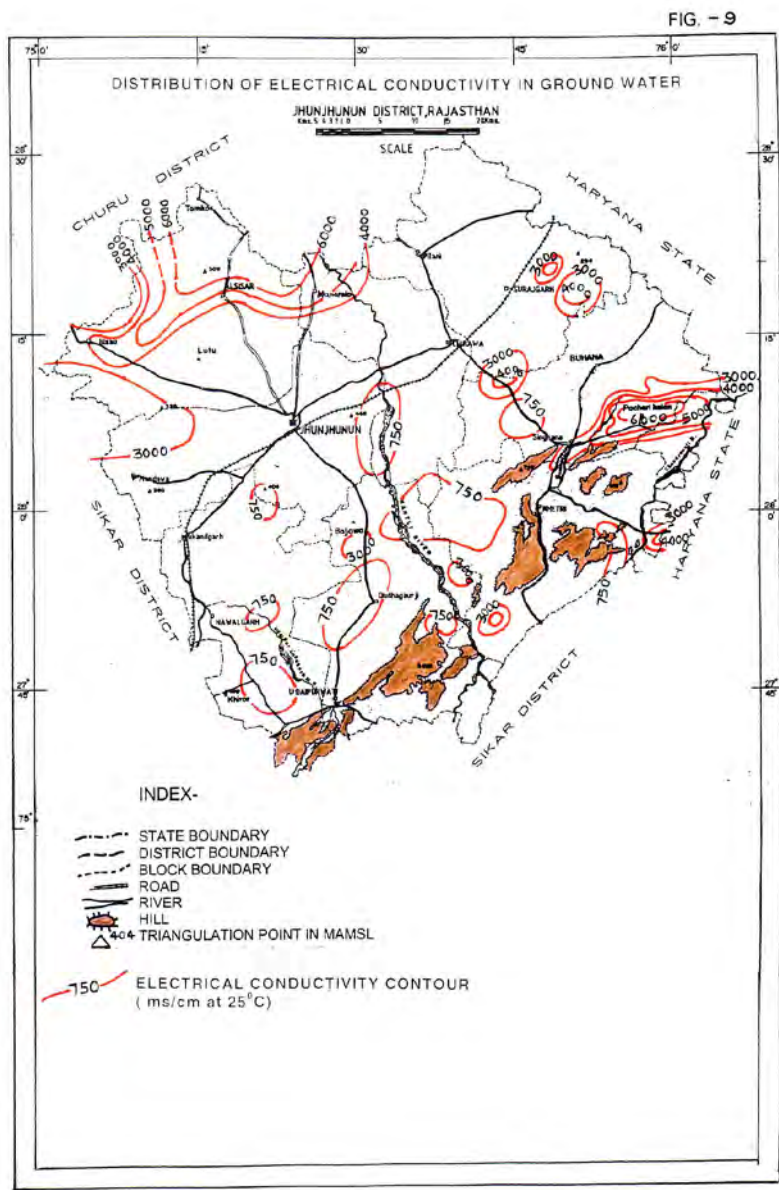
The net annual ground water availability, gross ground water draft and net ground water availability for future irrigation development is depicted with the help of Bar Diagram in Figure 8.

The entire area falls under non-command and all the blocks except Alsisar fall under over-exploited category due to excessive use of ground water being the only source of irrigation. Alsisar block rests in safe category which is attributed by negligible ground draft being area underlain by saline water.



4.3 Ground Water Quality

The ground water is alkaline type having pH value more than 7 and is potable in major part of the district except in northern part Alsisar block, northern most portion of Chirawa block, area lying south of Buhana and isolated pockets lying east of Surajgarh, south east of Chirawa and in south eastern border (located at midst) of Khetri block. The electrical conductivity ranges from 450 ms/cm at 25⁰ C (minimum at Parasrampura in Nawalgarh block) to 10600 ms/cm at 25⁰C (maximum at Jawaharpura in Alsisar block), however in general it rests between 450 and 3000 ms/cm at 25⁰ C which is constituted by 78 % of stations. The electrical conductivity between 3000 and 6000 ms/cm at 25⁰ C is represented by 17 % of stations while more than 6000 EC is by only 5% of stations (Figure 9).

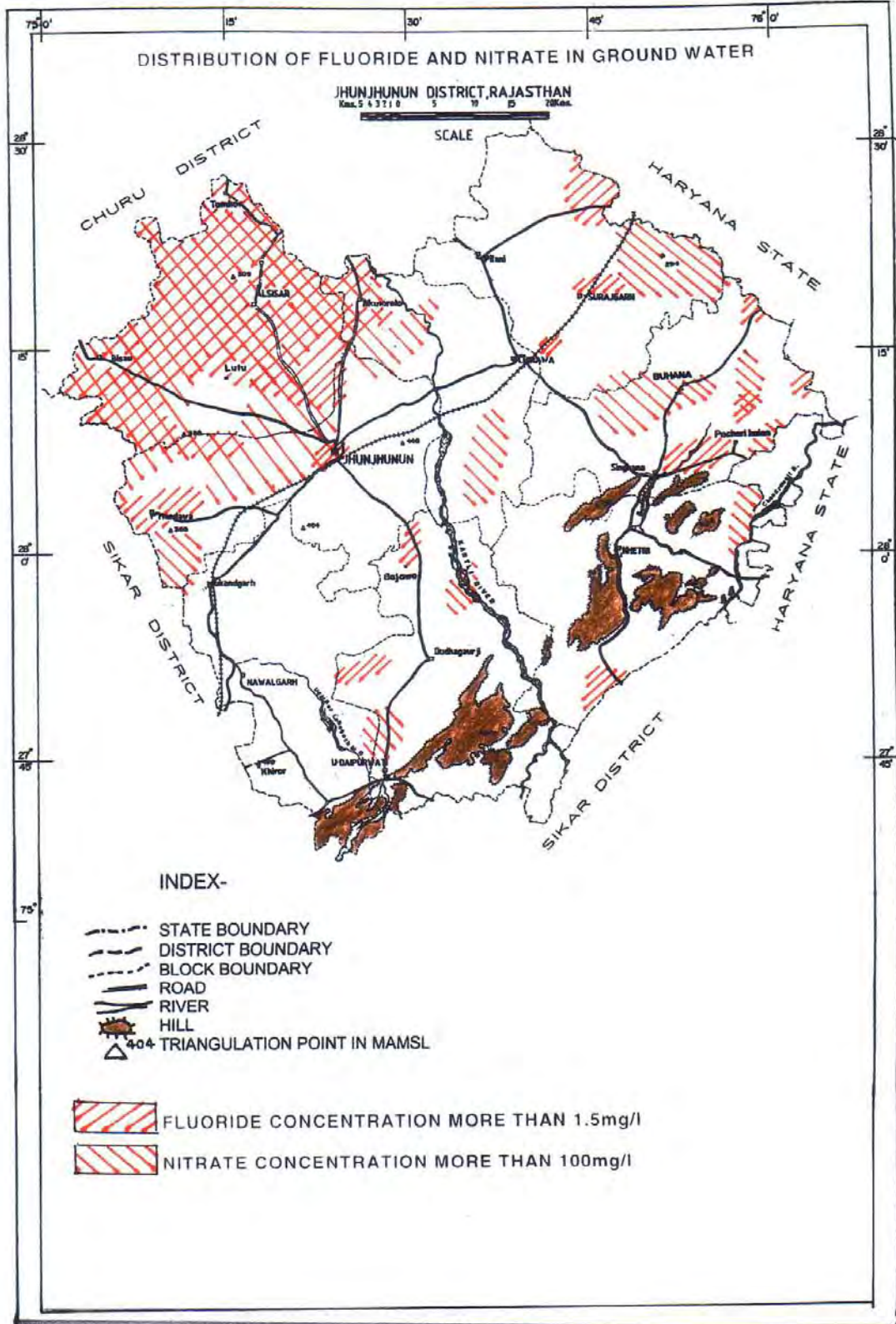


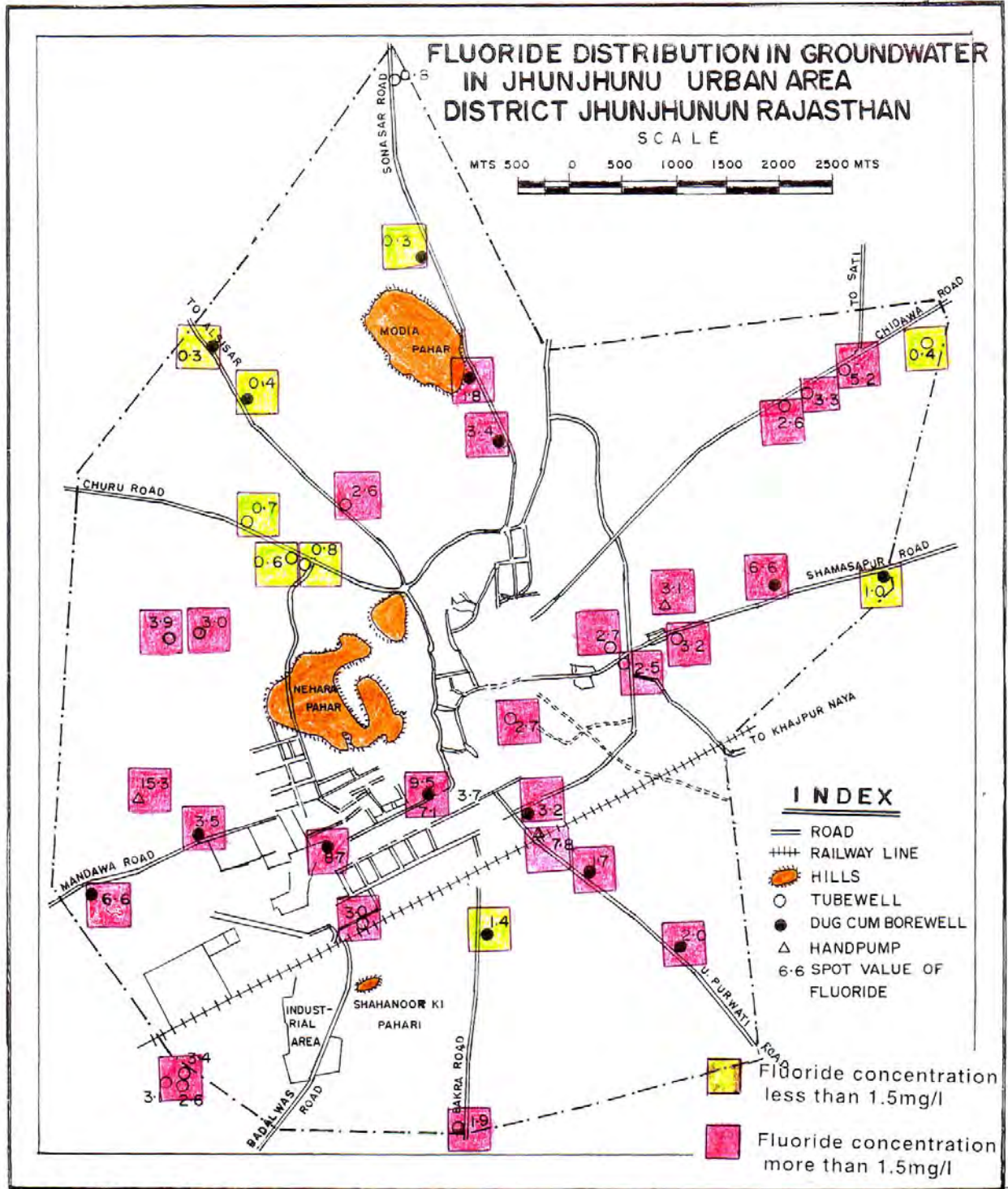
Nitrate concentration ranges from nil to a maximum value of 770 mg/l. Nitrate concentration within permissible limit i.e. 100mg/l is constituted by 69.14% of stations whereas 30.86% of stations represent more than 100 mg/l of nitrate concentration in the district. Nitrate concentration more than permissible limit has been found in the entire Alsisar block, Northern part of Jhunjhunu block, south of Mandawa, north east of Surajgarh, around Buhana, area lying south west of Buhana and isolated pockets falling in Buhana, Udaipurwati blocks (Figure 10).

Fluoride content ranges from 0.12 to a maximum of 15.3 mg/l (on Anasagar road, Jhunjhunu town) but in general lies between less than 0.5 and 3 mg/l. 57.87% of stations represent fluoride concentration within desirable limit of 1.0mg/l, 21% stations fall between 1.0 and 1.5mg/l, 11.23% stations between 1.5 and 3.00mg/l and 8.99% stations constitutes fluoride concentration beyond 3.00mg/l. The Jhunjhunu urban faces very high fluoride hazard having fluoride concentration reaching maximum to 15.3mg/l which is substantiated by the fact that 66.67% of stations constitute fluoride concentration above permissible limit of 1.5 mg/l (Figure 11). Apart from this, most part of the Alsisar block and north western corner of Chirawa block have fluoride content more than 1.5mg/l. Isolated pockets having fluoride content more than permissible limit have been noticed in Surajgarh, Buhana, Udaipurwati blocks. Most of the stations have iron concentration with permissible limit of 1.0mg/l.

The sodium absorption ratio ranges from 0.60 to 28.85. Irrigation suitability of ground water has been determined based on the USSL diagram which indicates that ground water belongs mostly to C3-S1, C3-S2, C3-S3 class connoting moderate suitability of ground water for irrigation. The high sodium absorption ratio (SAR) poses problem for irrigation water but sandy, highly porous and permeability nature of soil permit the use of ground water for irrigation. Ground water in Jhunjhunu urban area belongs to C3S3 and C3S4 class indicating the ground water's low suitability for irrigation purposes.

Fig. 10





C.G.W.B, W.R (KK) Drg. No 8378/2002

5.0 GROUND WATER RELATED ISSUES AND PROBLEMS

5.1 Declining water level

Long term water level data (pre-monsoon, 1997-2006) have indicated declining water level trend ranging from 0.0222 to 0.2010m/year. As a result of which all the blocks except Alsisar block have entered into the over-exploited category which is needed to be controlled through notifying the blocks and further imposing ban on construction of ground water abstraction structures except under indispensable cases. Three blocks i.e. Chirawa, Buhana, Surajgarh have been notified by Central Ground Water Authority, New Delhi.

5.2 Fluoride hazards

The Jhunjhunu urban faces very high fluoride hazards having fluoride concentration reaching maximum to 15.3 mg/l which is sustained by the fact that 66.67% of stations constitutes fluoride concentration above permissible limit of 1.5 mg/l. Apart from this, most part of the Alsisar block and western corner of Chirawa block have fluoride content more than 1.5 mg/l.

5.3 Nitrate hazards

Nitrate concentration more than permissible limit i.e. 100 ppm is constituted by 30.86% of stations in the district area. Nitrate concentration more than permissible limit has been found in the entire Alsisar block, Northern part of Jhunjhunu block, south of Mandawa, North east of Surajgarh, around Bhuana, area lying south west of Bhuana and isolated pockets falling in Bhuana. Udaipurwati blocks.

5.4 High sodium absorption ratio hazards

Irrigation suitability of ground water is moderate as it belongs to mostly to C3-S1, C3-S2, C3-S3 class. The high sodium absorption ratio (SAR) poses problem for irrigation water but sandy, highly porous, and permeability nature of soil permit the use of ground water for irrigation. Ground water in Jhunjhunu urban area belong to C3S3 and C3S4 class indicating the ground water's low suitability for irrigation purposes.

6.0 GROUND WATER DEVELOPMENT AND MANAGEMENT STRATEGY

6.1 Ground Water Development

The stage of ground water development for the district is 200.05%. Out of total 8 blocks, seven blocks viz. Chirawa, Buhana, Surajgarh, Udaipurwati, Nwalgarh, Jhunjhunu and Khetri have more than 100% stage of ground water development ranging from minimum 107.41% in Khetri block to a maximum of 314.78% in Chirawa block and have been categorized under over-exploited category. No recommendation is extended for additional ground water development. Alsisar block has 88.34% stage of ground water development and is categorized in safe category. Alsisar block has lesser ground water draft being area laden with saline ground water.

6.2 Ground Water Management

6.2.1 As the district has 200.05% stage of ground water development (all the blocks except Alsisar rest in over-exploited category having 107.41% to 314.78% stage of ground water development), thereby leaving little scope of further ground water development for irrigation except for drinking purpose which may be taken up only in very restricted and planned way to avoid becoming further over-exploited.

6.2.2 Ground water should be used judiciously taking in to account of modern agriculture water management techniques by cultivating crops requiring less watering and use of sprinkler system and drip irrigation should be encouraged.

6.2.3 A modern agriculture management has to be taken into account for effective water management techniques involving economic distribution of water maintaining minimum pumping hours and also be selecting most suitable cost effective crop pattern i.e. for getting maximum agriculture production through minimum withdrawal. Adopting proper soil and water management even the ground water with somewhat dissolved solids (TDS) may also be suitable for irrigation for salt tolerant crops in the area having high salinity.

6.2.4 Desalination and defluorosis plants may be installed in the areas /villages facing ground water salinity and fluoride hazards.

6.2.5 Area is underlain by unsaturated moderate thickness of alluvial which provides sufficient scope of artificially augmentation of the ground water body as alluvial formation has very good storage and transmission capacity in the district. In the district, there is rainfall of about 2878.64 mcm considering the area and average annual rainfall. Out of this, 235.1238 mcm is annual natural recharge as per the ground water estimation as on 31.03.2004. The above data indicate the availability of surplus water which can be used for artificial recharge through the various techniques feasible in alluvial and hard rock terrain.

In alluvial area, following ways of recharge techniques may be adopted.

- i) Roof top/paved area rain water harvesting for recharge to ground water in urban and industrial area.
- ii) Village water runoff/roof top water harvesting by dug wells/percolation tanks in rural area.
- iii) Construction of recharge shafts with gabion structures in nalas.
- iv) Recharge by dug well/percolation pit in agriculture farm.

In hard rock terrain nala bunding, anicuts, dug wells, percolation tanks etc. are feasible structures which may be used to recharge the ground water body. Technical guidance is provided to various organizations as and when approached.

6.2.6 Mass awareness programmes should be arranged at local level to make common mass aware of importance of ground water resources, its better practices of use in domestic, irrigation and industrial fronts, present status of ground water scenario, its conservation etc.

6.2.7 Training programmes should be arranged at local level to teach the common mass of various techniques of artificial augmentation to ground water resources.

6.2.8 The stage of ground water development of the district is 200.05% which reflects excessive withdrawal of ground water in comparison of recharge, resulting in depletion of ground water levels and reduction in yields of wells. In view of this, three blocks viz. Buhana, Chirawa and Surajgarh in Jhunjhunu district have already been notified by Central Ground Water Authority, New Delhi for regulation and control of ground water development. Now regulation on ground water use in the area should be implemented effectively.

7.0 AWARENESS AND TRAINING ACTIVITIES

7.1 Mass awareness programme (MAP) and Water Management Training Programme (WMTP) BY CGWB

Board has organized two mass awareness programme at Chirawa and Buhana block and one training programme on rain water harvesting at Jhunjhunu district head quarter. The brief note of the programmes is furnished below.

i) Mass awareness programme

a) At Buhana

Mass awareness programme on "*declining ground water trends-problems and remedial measures*" in Buhana block was organized at Buhana block head quarter on 10.03.2007. Shri Sunder Lal Shrama, MLA, Surajgarh was chief guest over the function and he emphasized over the conservation of water. More than 500 participants from various sectors including central and state Govt. official like Panchayat Samiti, Gram Panchayat, print & electronic media, women, children, students from town and colleges. A brochure on ground water scenario, problems and remedial measures (in Hindi) were distributed along with other related material among the participants. Scientists of Board explained about the importance of ground water, availability, ground water quality hazards, conservation techniques, augmentation through various techniques of artificial recharge to ground water etc. Exhibition organized exhibiting techniques of water saving, rain water harvesting for recharge to ground water, ground water situation and quality aspects in respect of Buhana block, Jhunjhunu district and Rajasthan state. About 70 school children participated in drawing competition and made drawing on "water conservation". Prizes were distributed to children who stood meritorious.

ii) At Chirawa

Mass awareness programme on "*declining ground water trends-problems and remedial measures*" in Chirawa block was organized at Chirawa block headquarter on 06.02.2003. Shri Sish Ram Ola, MP (Chirawa Constituency) and Ex. Minister, Ministry of Water Resources, Govt. of India was the chief guest on the occasion and he emphasized over the judicious use of ground water, use of modern irrigation practices and switching over to crops needing less watering. Scientists of Board explained about the importance of ground water, availability, ground water quality hazards, conservation techniques, augmentation through various techniques of artificial recharge to ground water etc.

iii) At Surajgarh

Mass awareness programme on “Declining ground water trends – Problems and Remedial measures” in Surajgarh block was organized at Surajgarh block head quarter on 06.02.2003. MAP was organized in Barasiya College Auditorium at Surajgarh. Shri Sunder Lal, MLA from Surajgarh, constituency, presently Chairman of Commission for SC/ST in Rajasthan was the chief guest on the occasion and he emphasized over the importance and judicious use of ground water. Scientists of Board explained about the present ground water scenario of Surajgarh block and importance of ground water, its availability, ground water quality hazards, conservation techniques, augmentation through various techniques of artificial recharge to ground water etc. Block Development Officer and Sarpanchs from all the Gram Panchayats and village agriculture workers/ farmers along with college’s faculty and students attended the function. College students presented several plays (Nukkad Sabha) on the theme to save water. Students from the Govt. Secondary School and private schools took part in drawing and painting competition on the theme of water conservation and techniques of artificial recharge in rural areas. Prizes were distributed to winners. A Kala Jatha programme was also organized by local cultural team who gave a thematic presentation on how to save water and about family planning. Shri Sunder Lal, MLA, also took part in the Kala Jatha programme and presented a thumri in local language. Folders containing the literature on techniques of artificial recharge to ground water and ground water brochure of Surajgarh block distributed to participants.

b) Training on rain water harvesting

i) At Jhunjhunu

A two days Training Programme on “Rainwater Harvesting for Artificial Recharge to Ground Water” was organized at Jhunjhunu on 27.09.2005 and 28.09.2005. Smt. Raj Bala Ola, Zila Pramukh, Jhunjhunu was the Chief Guest. She stressed over Principle of Demand and Supply of water resources and expressed concern over declining trend of rainfall and water resources availability. The function was presided over by Shri Bhawani Singh Detha, Collector, Jhunjhunu. Shri Detha explained about various aspects of water management. Professor G. D. Singh, Director, Agriculture Extension, Bikaner advised about utilization of water saving devices like sprinklers & drip irrigation and blending of fresh and saline water for drinking purposes. Scientists of the Board imparted the training. Dr. Hanuman Prasad, Krishi Vigyan Kendra, Jhunjhunu, Shri Hanuman Singh Choudhary, Executive Engineer, Irrigation Department, Sikar and Shri Niranjhan Singh, Shekhawati Jal Biradari also delivered lectures during the training programme. Officers of various state Govt. Department including Ground Water Department, Irrigation Department, Public Health Engineering Department, Agriculture Department, Gramin Vikas, other organizations like Birla Institute of Technology & Science. Pilani and representatives of Non Govt. Organizations participated in the training. An exhibition organized exhibiting techniques of water saving, rain water harvesting for recharge to ground water, ground water situation and quality aspects. Wide press coverage was also given during the training programme.

8.0 AREA NOTIFIED BY CGWA/SGWA

Three blocks viz. Surajgarh, Buhana and Chirawa of Jhunjhunu district have been notified by Central Ground Water Authority, New Delhi on 30.09.2003 for registration of existing ground water abstraction structures. Later Surajgarh block was notified on 02.12.2006 for regulation and control of ground water development.
