GROUNDWATER MANAGEMENT IN AN ARID STATE AND CLIMATE CHANGE: A CASE OF JHUNJHUNU DISTRICT IN RAJASTHAN

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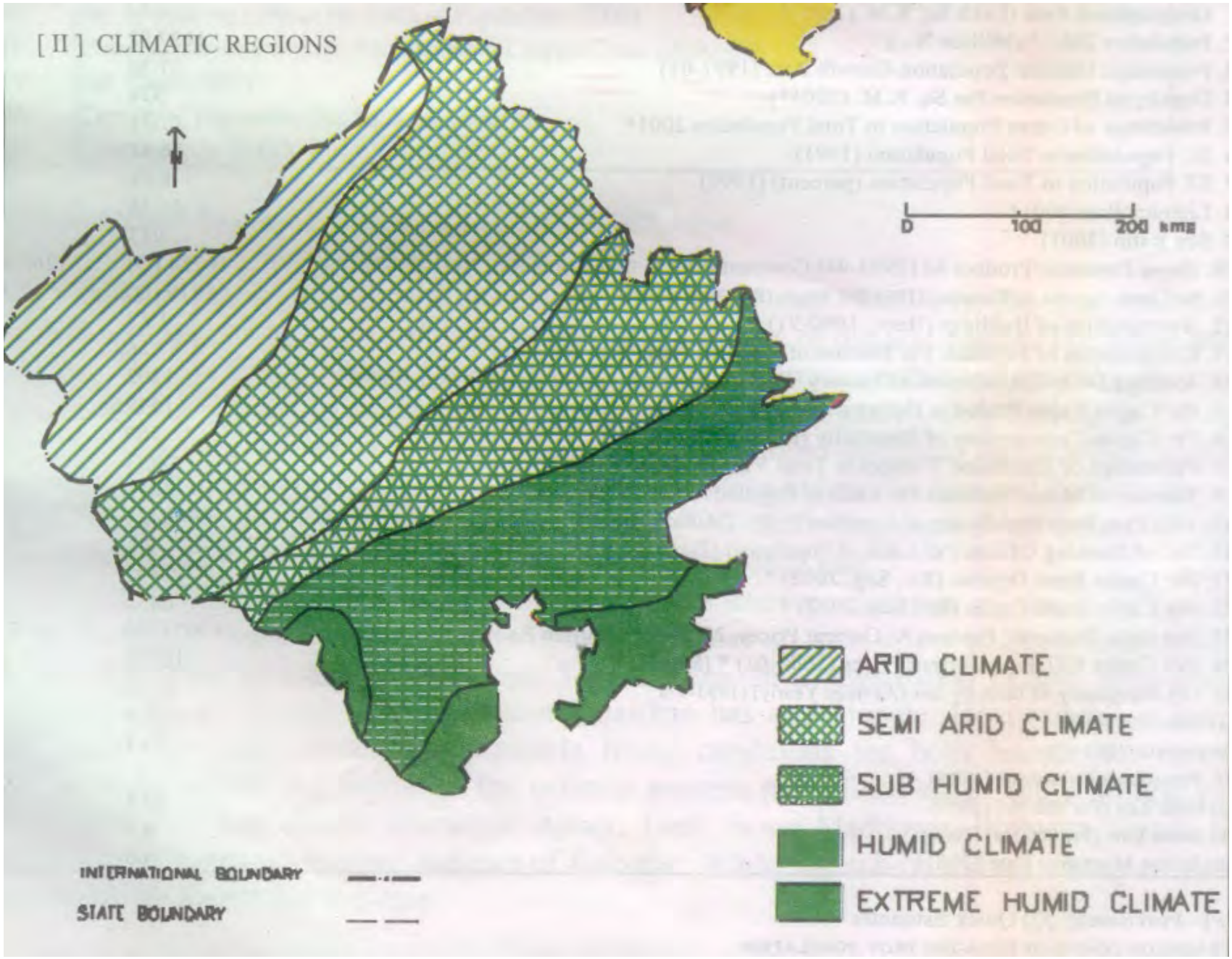
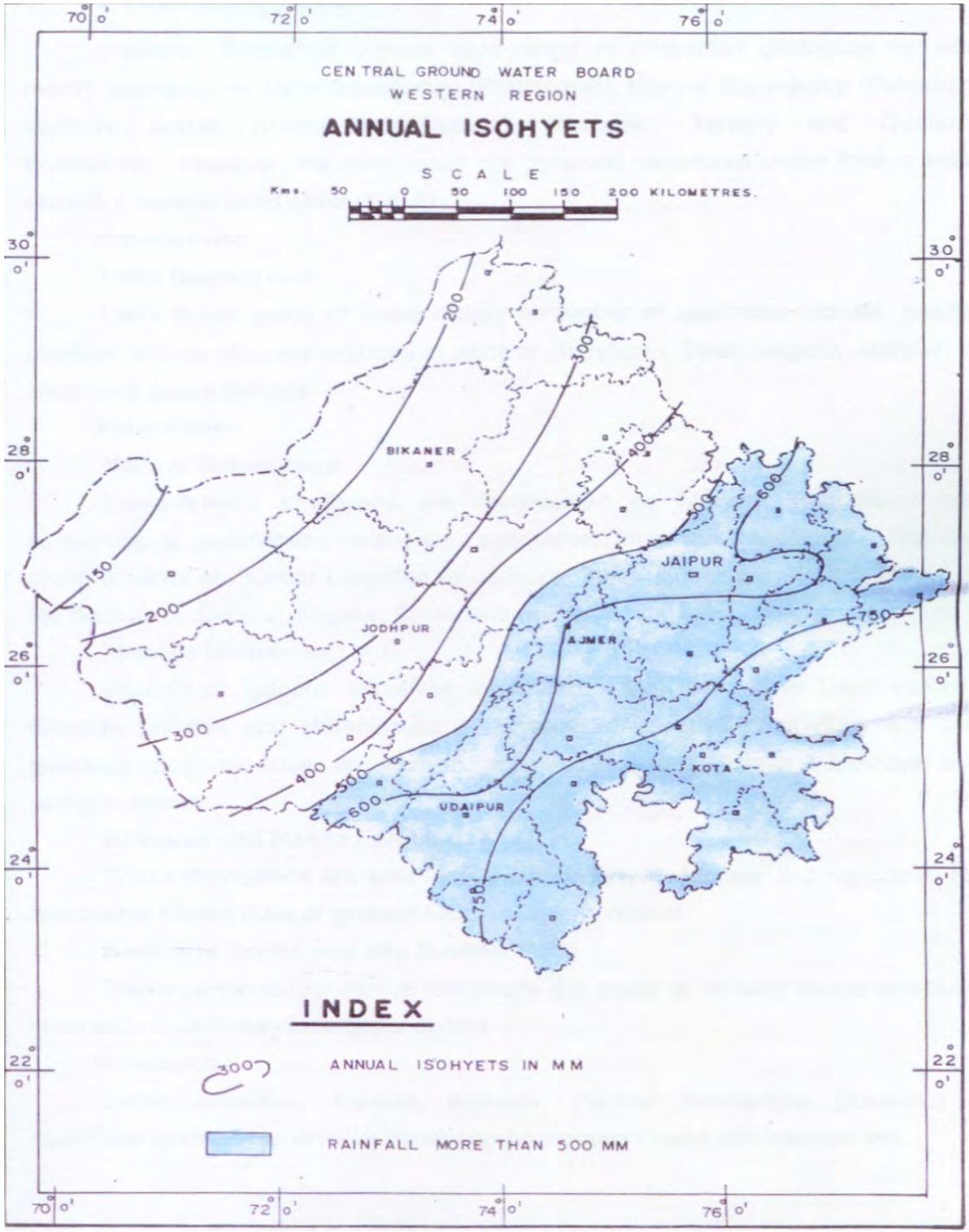
Rajasthan Key Parameters

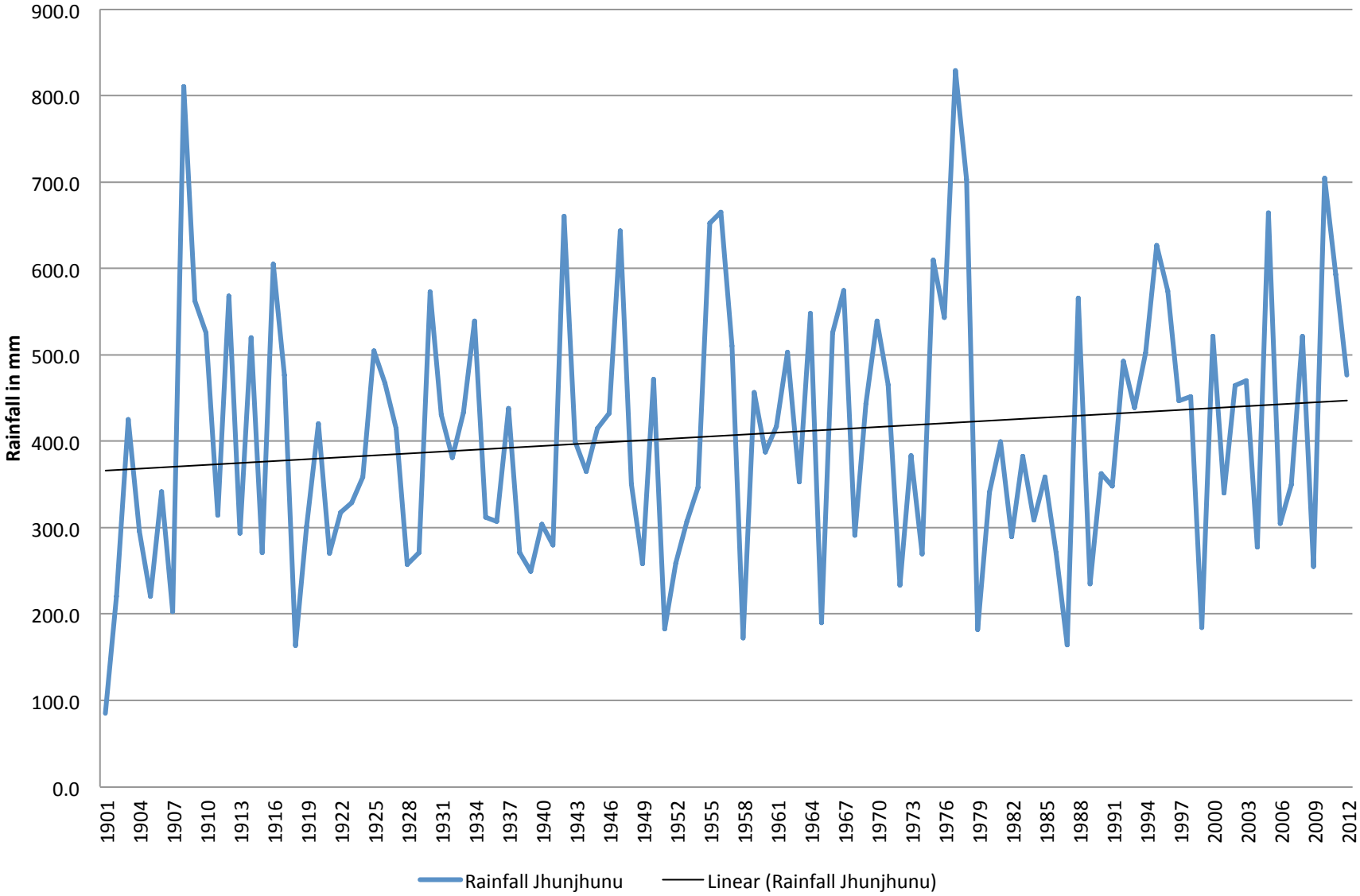
State Parameter	India	Rajasthan	As compared with India, in %
Area (Mha)	328.0	34.0	10.40
Population (2011 census)-million	1210.2	68.6	5.67
Cultivable area (Mha)	184.4	25.7	13.88
Rainfall (mm)	1125	531	47.2
Surface water (BCM)	1870.0	21.7	1.16
Ground water(BCM)	431.0	11.2	2.5
Irrigated area (Mha)	105.0	7.7	7.30


[II] CLIMATIC REGIONS
N
0
100
200 kms
ARID CLIMATE
SEMI ARID CLIMATE
SUB HUMID CLIMATE
HUMID CLIMATE
EXTREME HUMID CLIMATE
INTERNATIONAL BOUNDARY
STATE BOUNDARY

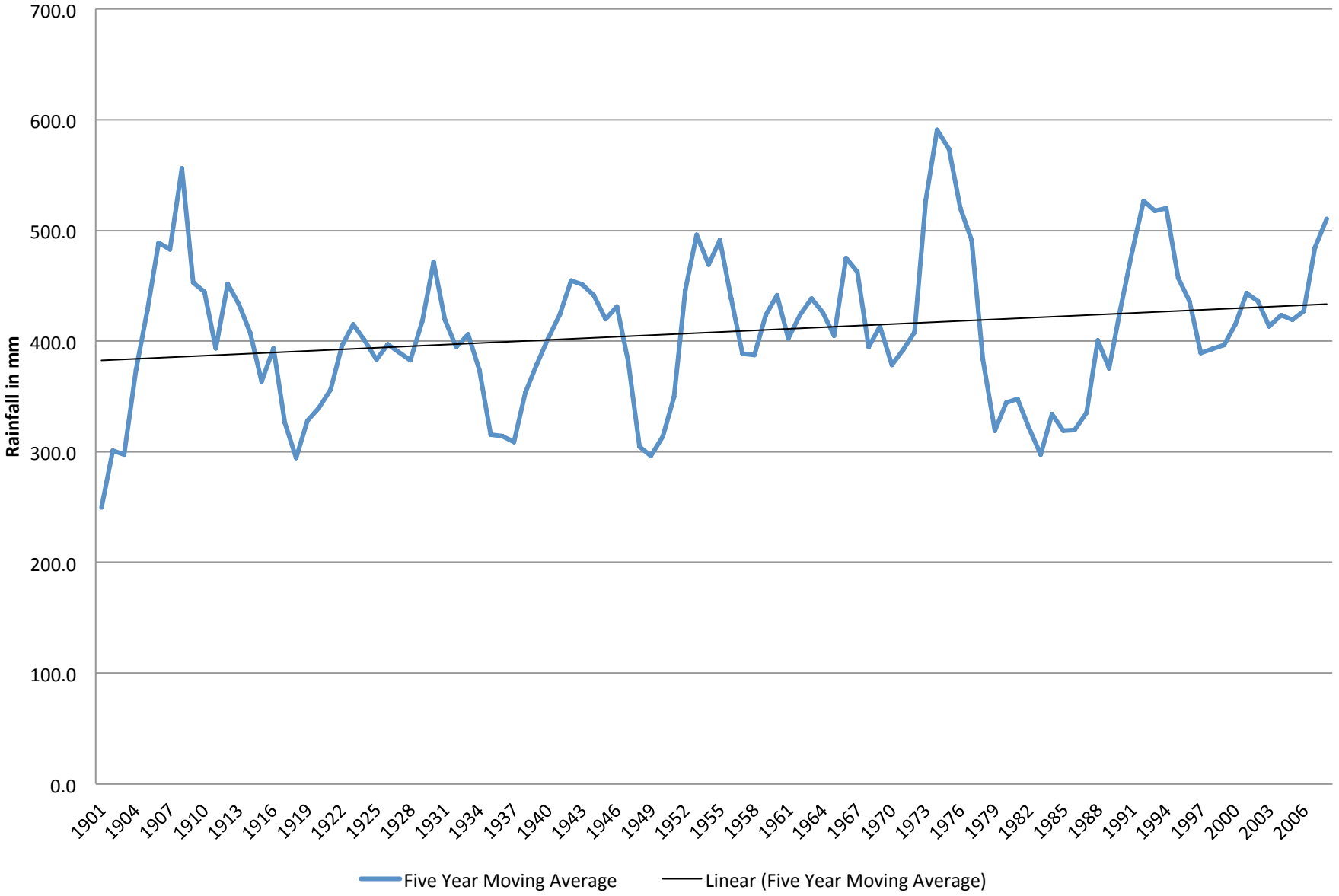
Agro Climatic Zones


CENTRAL GROUND WATER BOARD
WESTERN REGION
ANNUAL ISOHYETS
SCALE
Kms. 50 0 50 100 150 200 KILOMETRES.
70° 0'
72° 0'
74° 0'
76° 0'
30° 0'
28° 0'
26° 0'
24° 0'
22° 0'
BIKANER
JODHPUR
JAIPUR
AJMER
KOTA
UDAIPUR
150
200
300
400
500
600
750
INDEX
300
ANNUAL ISOHYETS IN MM
RAINFALL MORE THAN 500 MM

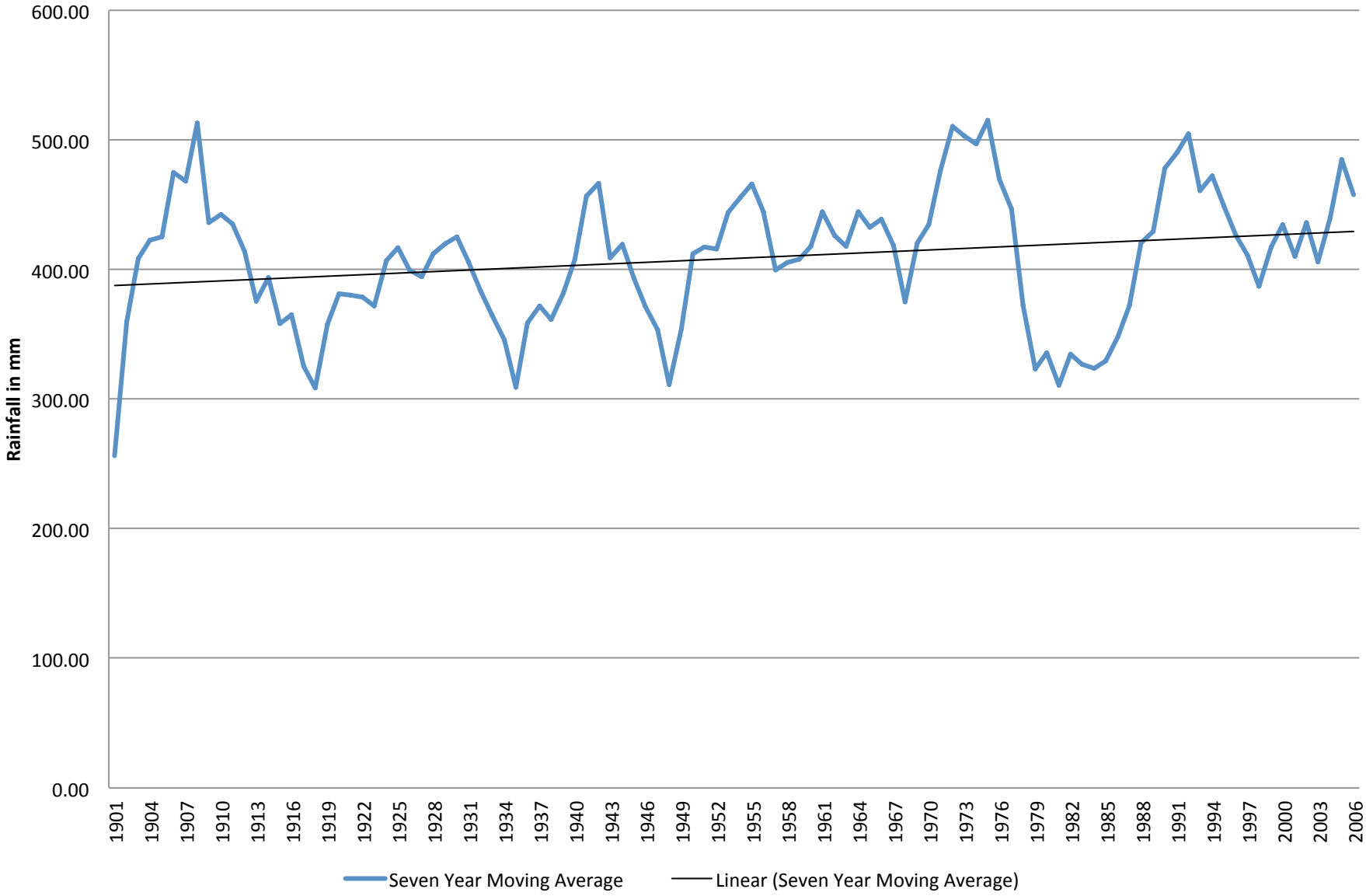
Yearly Rainfall Pattern, Jhunjhunu District



Five Year Moving Average Rainfall Pattern, Jhunjhunu District



Seven Year Moving Average Rainfall Pattern, Jhunjhunu District



WATER RESOURCES OF RAJASTHAN

	Availability (In BMC)	**Utilization (In BMC)**	**Percentage utilization**
Surface Water	27.71 (42.6)	11.29 (31.6)	52
Ground Water	11.362 (22.3)	11.771 (32.9)	104
External Water	17.88 (35.1)	12.66 (35.4)	78.81
Total	50.92 (100.0)	35.721 (100.0)	70.09

Groundwater Estimation in Rajasthan

(Figures in MCM)

Item	Year				
	1995	1998	2001	2004	2009
Gross/ Net groundwater recharge	13157	12602	11159	10382.58	11862.24
Groundwater Draft (1)Irrigation (2)Domestic & Industrial	 9085 696	 11036 983	 10454 1181	 11599.01 1392.19	 12864. 89 1654.35
Gross draft(1)+(2)	9781	12019	11635	12991.2	14519.24
Groundwater balance	3376	3894	(-)476	(-) 2608.62	(-)2657.0
Stage of groundwater Development in %	58.9	69.1	104.3	125.13	135

Status of Ground Water in Rajasthan

No of Blocks in Category	1984	2009
Over-Exploited (>100%)	12 (5%)	164 (69%)
Critical (90 to 100%)	11 (5%)	34 (15%)
Semi Critical (70 to 90%)	10 (4%)	8 (3%)
Safe (<70%)	203 (86%)	30 (13%)

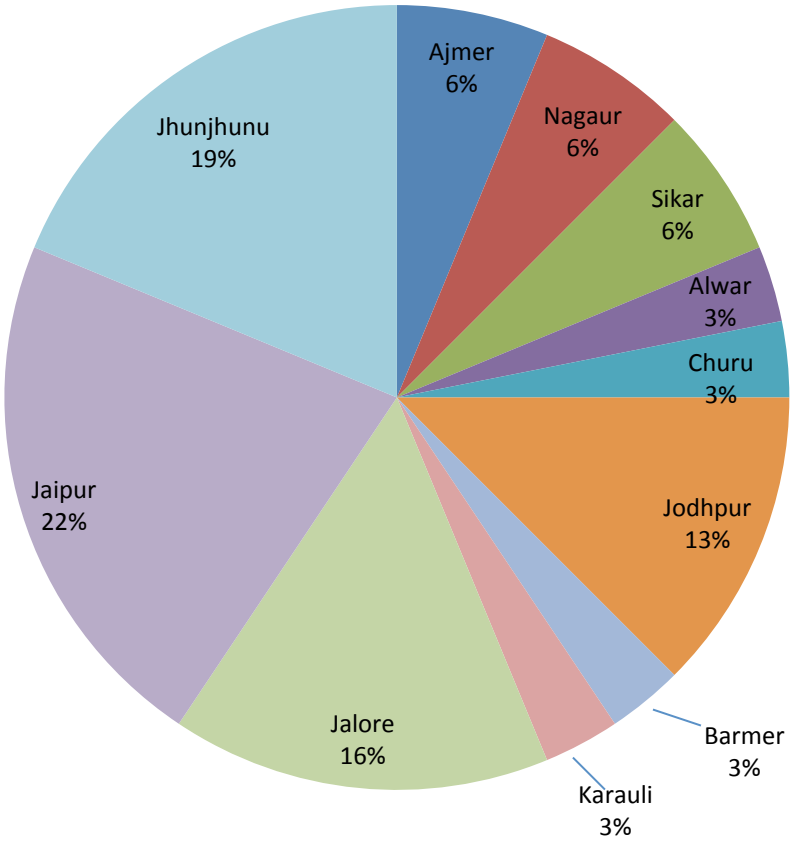
Rajasthan- Ground water availability vis-à-vis withdrawal

As per ground water resource assessment carried out jointly by CGWB and State GWD as on 2009

- Annually replenishable resource: 11.86 bcm
- Net annual availability : 10.79 bcm
- Annual ground water withdrawal: 14.52 bcm
- Stage of ground water withdrawal: 135%

NO OF BLOCKS NOTIFIED IN RAJASTHAN

Ajmer	2
Nagaur	2
Sikar	2
Alwar	1
Churu	1
Jodhpur	4
Barmer	1
Karauli	1
Jalore	5
Jaipur	7
Jhunjhunu	6
Total	32



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Karauli	1
Jalore	5
Jaipur	7
Jhunjhunu	6
Total	32

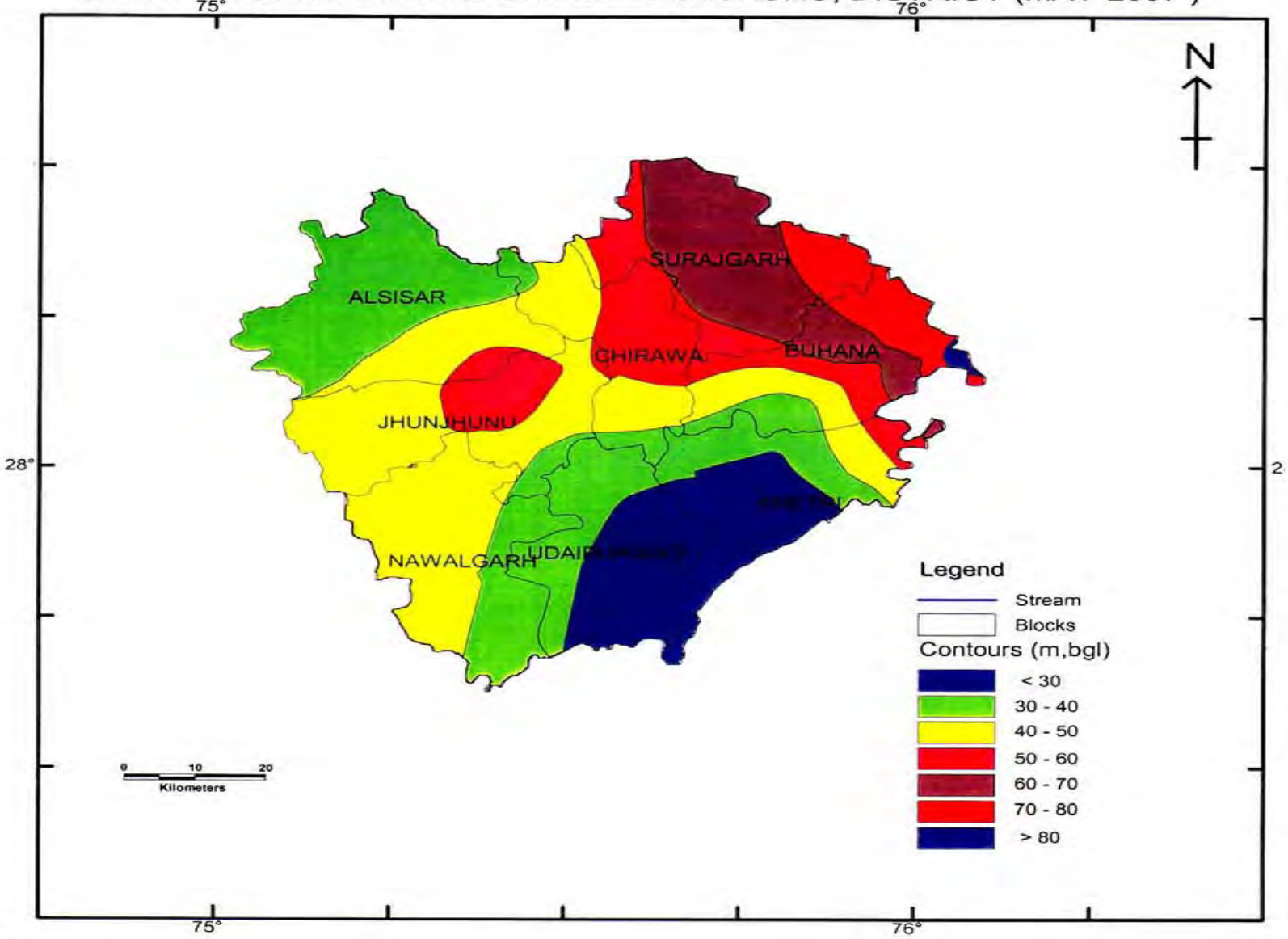
Groundwater Estimation in Jhunjhunu District

(Figures in MCM)

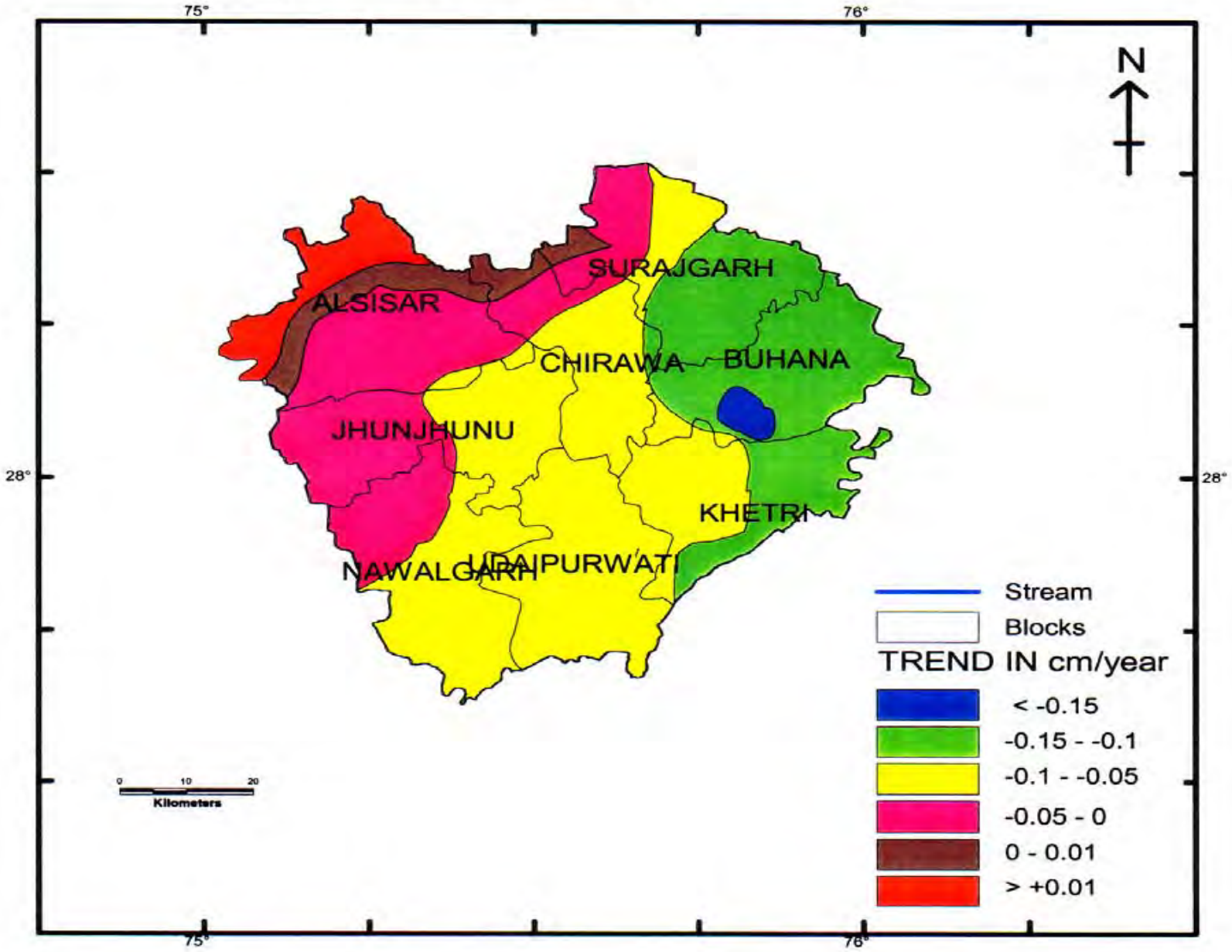
Item	Year			
	1998	**2001**	**2004**	**2009**
Gross/ Net groundwater recharge	220.27	243.04	235.12	269.53
Groundwater Draft (1)Irrigation (2)Domestic & Industrial	 335.22 56.39	 358.09 61.59	 399.33 71.03	 463.89 92.38
Gross draft(1)+(2)	391.61	419.68	470.36	556.27
Groundwater balance				
Stage of groundwater Development in %	177.79	172.68	200.05	228

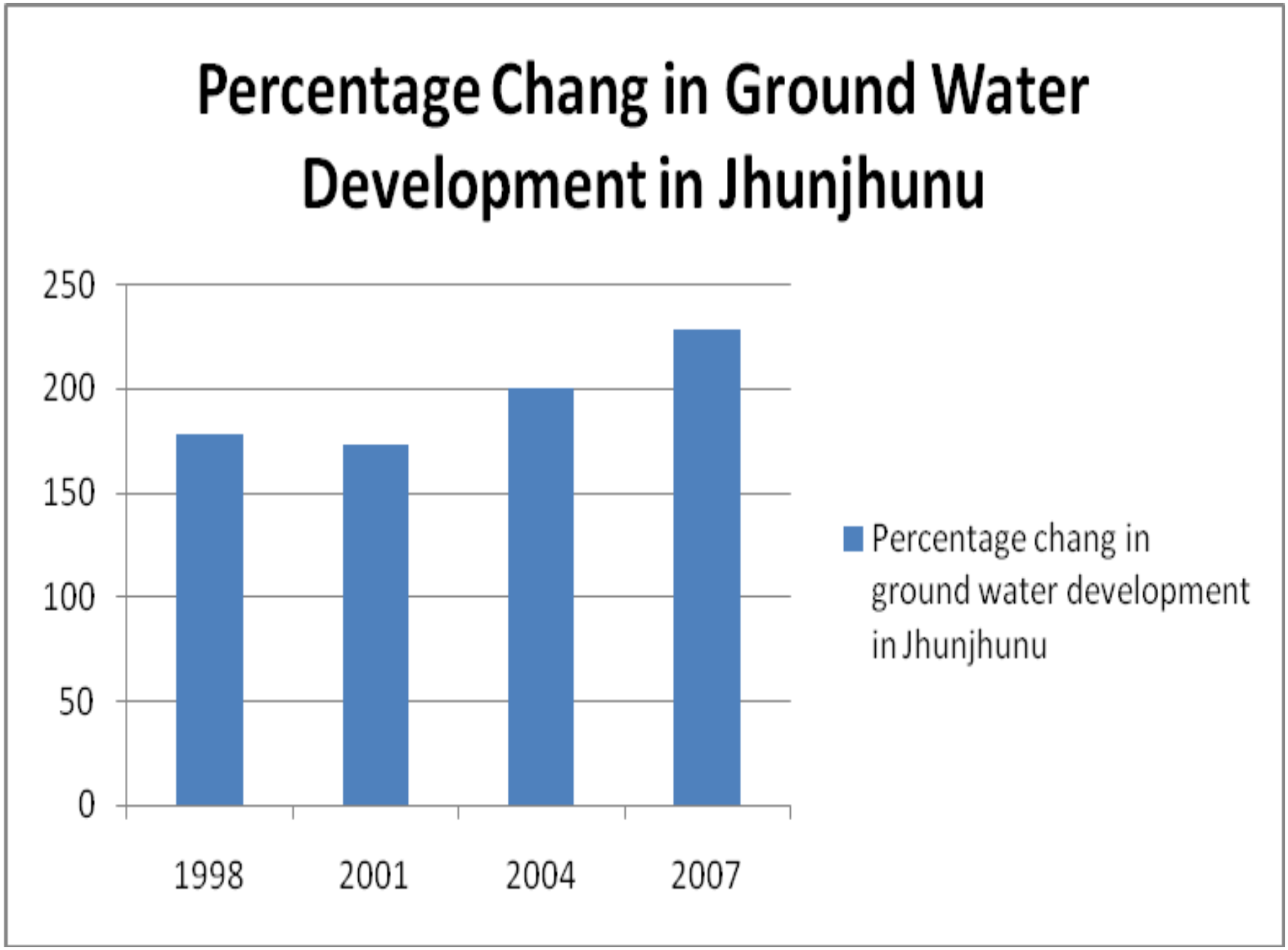
FIG. - 5

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



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




Percentage Chang in Ground Water Development in Jhunjhunu
250
200
150
100
50
0
1998
2001
2004
2007
Percentage chang in ground water development in Jhunjhunu

Well status in Jhunjhunu &Chirwa

(Numbers)

Jhunjhunu	**1981-82**	**1990-91**	**2001-2002**	**2007-2008**
Wells In use	15425	25010	40099	43245
Out of use		4294	3570	3987
Well total	15425	29304	43669	47232
Tube well diesel			14	122
Tube well electric			23	15865
Tube well total		19	37	15987
Pump set Diesel			3697	5219
Pump set electric			33138	270678
Pump set Total			36835	275897

Ground water Use Pattern in Jhunjhunu

(In MCM)

Year	Net ground water availability	Draft for all usage	Irrigation	Domestic & industrial
1998	220.27	391.61	335.22	56.39
2001	243.04	419.68	358.07	61.61
2004	235.12	470.35	399.33	71.02
2007	244.05	556.27	463.87	92.39

Net Area Irrigated by Source in Jhunjhunu District

(Area in ha.)

Sources/ Jhunjhunu	**1981-1982**	**1990-1991**	**2001-2002**	**2006-07**	**2007-08**
Canals	0	17	24	0	0
Tank	52	0	0	0	0
Wells and Tube wells	56545	77914	206536	232411	203755
Others Sources	25	0	0	0	0
Net Area irrigated	56622	77931	206560	232411	203755 (260 %)

ISSUES IN WATER RESOURCE MANAGEMENT IN THE DISTRICT

- Rainfall Pattern is changing and the trend shows that annual rainfall is steadily increasing in the District.
- Surface water availability is limited and there is no proper estimation available. It is because part of the District is coved under Shekhawati River Basin and 60% area falls in outside Basin. The drainage systems are limited so surface water accounting has become difficult. However, there is ample scope for rainwater harnessing.

Issues Cont…

- The Groundwater scenario is frightening as the groundwater exploitation rate has jumped from 177% in 1998 to 228% in 2009. The stage is extremely critical and the trend needs to be arrested immediately.
- Groundwater quality is extremely affected by the overdraft. As it is the major source of drinking water in the district urgent intervention is required.
- Water use in agriculture is the major issue.
- Livelihood based on agriculture has limited scope for future of the people in the district. Livestock and nonfarm sector as an alternative livelihood option need greater attention.

AREAS OF INTERVENTION

- Proper mapping of water resources for the district is required, particularly of surface water.
- Serious regulatory and community interventions/ efforts are required to arrest the over exploitation trend of groundwater in the district.
- Groundwater related awareness and rainwater harnessing has to be taken up at large scale in the district involving all the stakeholders.
- The works undertaken by RJDSS on rainwater harnessing, recharge and conservation be documented and widely publicized for replication.

Areas of Intervention Cont…

- As groundwater quality is deteriorating and that being the major source of drinking water there is a need to shift the source to surface water and also build consumer awareness about the health impact of bad quality water. Roof top rainwater harvesting and surface water collection should be the priority areas of intervention.
- Agriculture Policy for the District be reviewed and discussed with the stakeholders and strong efforts be made for adoption of water saving technologies and change in cropping pattern.

ADAPTATION STRATEGIES BASED ON THE SITUATIONAL ANALYSIS

- **In view of this, six out of eight blocks viz. Buhana, Chirawa, Jhunjhunu, Udaipurwati, Surajgarh and Nawalgarh in Jhunjhunu district of Rajasthan** has already been notified by Central Ground Water Authority, New Delhi for regulation and control of ground water development, that means groundwater cannot be extracted from these areas and no new wells/tube wells can be commissioned.
- Thus there is need for harnessing, storing and conservation of rain water by designing household/community based rainwater harnessing/recharging systems and planning for optimal usage of Ground water in domestic and agriculture sector.
- Adoption of Managed Aquifer Recharge strategy as was recommended by Tushar Shah Committee for Gujarat.

CLIMATE CHANGE AND IMPACT ON GROUNDWATER

- Influence on GW recharge due to change in precipitation and evapotranspiration.
- Effect on groundwater availability in alluvial aquifers due to increase in flood events.
- Drought prone and flood prone areas will be most vulnerable areas.
- Areas with over-exploited, critical and semi-critical stage of groundwater development will be most vulnerable.

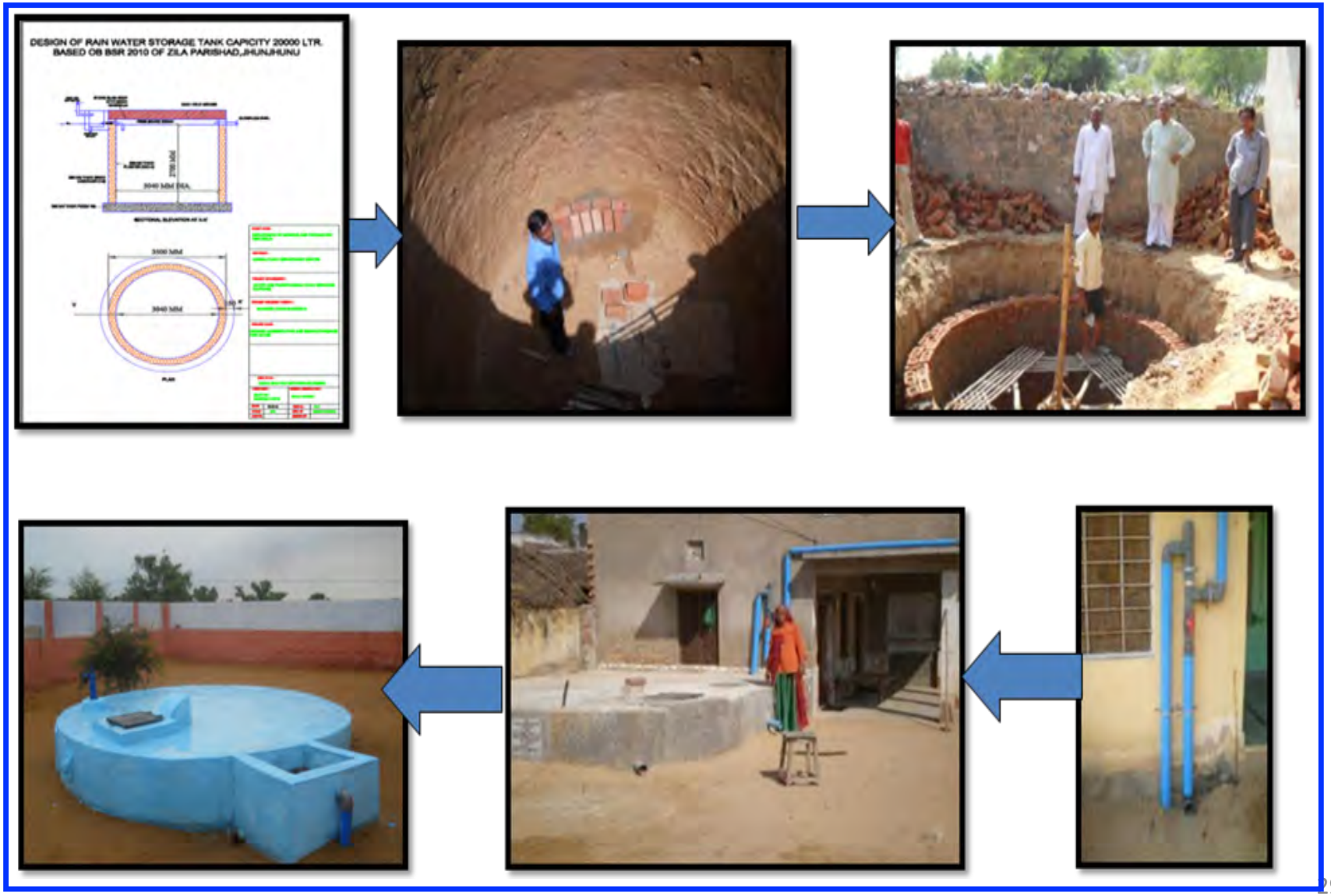
ACTION TO ADAPT OR MITIGATE THE IMPACT OF CC

- POLICY ACTION
  - Legislation to clarify ownership and regulatory responsibilities for groundwater management.
  - Regulation to check local groundwater markets.
  - Regulate subsidies on power tariffs for agriculture pumping of groundwater.
  - Review the policy of subsidy on micro irrigation.

LOCAL ACTION

-Individual and community participation in rainwater harnessing, conservation and recharging groundwater.

Conserve Rain Water Through Rain Water Harvesting Technique








TECHNOLOGIES TO BE ADOPTED IN CONSTRUCITNG RAIN WATER HARVSTING STRUCTURES

SOAK PIT

RECHARGE WELL

RECHARGE POND

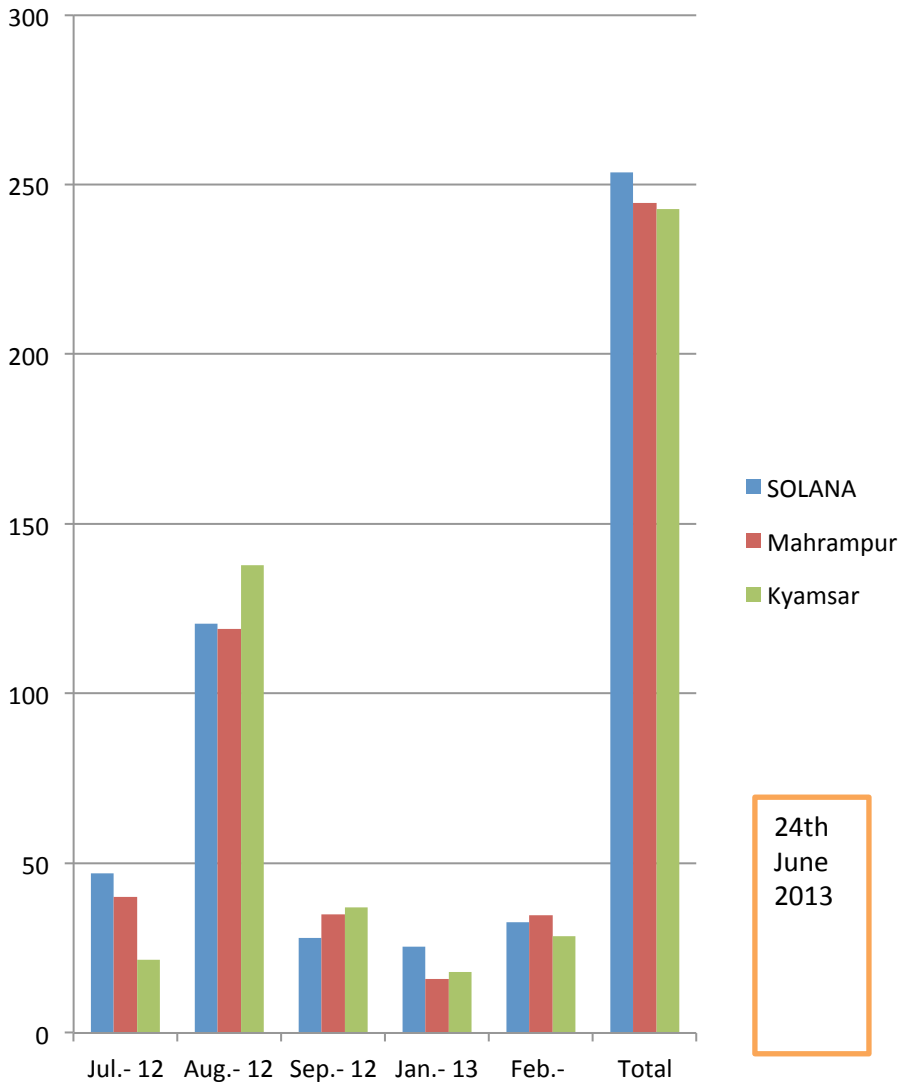
Before Implementation

Post Implementation

WATER LEVEL

Solana	8.9
Mahrampur	11.0
Kyamsar	8.8

RAINFALL DATA



24th June 2013

Month	Sola	Meh	Kya
Jul 12	47	40	21.5
Aug 12	120.6	119	137.8
Sep12	27.9	35	37
Jan 13	25.5	16	18
Feb 13	32.7	34.7	28.5
Total	253.7	244.7	242.8

TOTAL LAND & TOTAL WELL

Village	Total Land	Irrigated Land	Private Well
Marampur	551 Ha.	499 Ha.	171
Kayamsar	513 Ha.	416 Ha.	92
Solana	886 Ha.	594 Ha.	150
Total	1950 Ha.	1509 Ha.	413

One well- 6 hours usable/day with 15 HP Motors
Capacity of 15 Hp Motor is 500lit/ Min.
Per Hour- 30,000 lit.
Six Hour- 1,80,000 Lit./well/day
Total 413 Well= 7,43,40,0000 Lit/Day
Minimum Runs in At least Six months.

36


पुनर्भरण कूप . जखोदा
Thank You