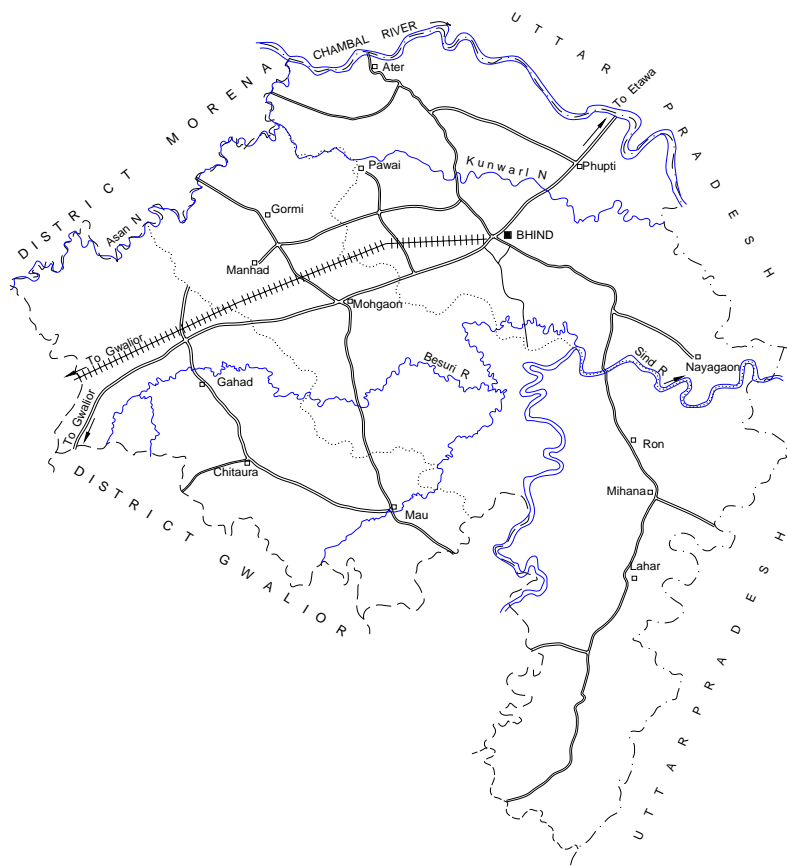


# DISTRICT GROUND WATER INFORMATION BOOKLET



## BHIND DISTRICT MADHYA PRADESH



**Ministry of Water Resources**  
**Central Ground Water Board**  
**North Central Region**  
**Government of India**

AUGUST, 2009

**BHIND DISTRICT AT A GLANCE**

S.No.	ITEMS	STATISTICS	
1.	<b>General Information</b>		
	i) Geographical area (In Sq. km)	4459	
	ii) Administrative Divisions (As on 2006 )		
	Number of Tehsil/Blocks	7/6	
	Number of Panchayats/Villages	447/889	
iii) Population (Census 2001)	1219000		
iv) Average Annual Rainfall (mm)	705.1		
2.	<b>Geomorphology</b>		
	i) Major Physiographic Units	1. Younger Alluvium plain 2. Older Alluvium plain 3. Ravines 4. Ridge Sedimentary	
	ii) Major Drainage	Lower Chambal Sub Basin of Yamuna Basin . Major Rivers Chambal, Kunwari, Vaisali, Sind & Pahuj	
3.	<b>Land Use (Sq.Km)</b>		
	i) Forest area	89.05	
	ii) Net area sown	3298.82	
	iii) Cultivable area	3406.25	
4.	<b>Major Soil Type</b>	: Deep Alluvial Soils	
5.	<b>Area Under Principal Crops ( June'2006)</b>	: 1467.00 Sq. Km.	
6.	<b>Irrigation by Different Sources</b>		
		<b>No. of Structures</b>	<b>Area (Sq.km)</b>
	Dugwells	10031	658.60
	Tube wells/Bore wells	708	184.69
	Tanks/Ponds	6	2.00
	Canals	3	331.33
	Other Sources	-	12.48
	Net Irrigated Area	-	1189.1
Gross Irrigated Area)	-	1191.25	
7.	<b>Number of Ground Water Monitoring Wells of CGWB(As on 31.3.2007)</b>		
	No. of Dug Wells	19	
	No. of Piezometers	Nil	
8.	<b>PREDOMINANT GEOLOGICAL FORMATIONS</b>	Alluvium followed by Vindhyan & Gwalior series.	
9.	<b>HYDROGEOLOGY</b> Major Water Bearing Formation	Alluvium, Weathered fractured & jointed Vindhyan sand stones &	

	<p style="text-align: center;"><b>(Pre-monsoon)</b> Depth to water level during 2006</p> <p style="text-align: center;"><b>(Post-monsoon)</b> Depth to water level during 2006</p> <p style="text-align: center;">Long Term water level trend in 10 years (1997-2006) in m/yr</p>	<p>shale 9.5 to 35.5 m b.g.l.</p> <p>8.61 to 34.90 m b.g.l.</p> <p>(-) 0.12 – (-) 1.95 Pre (+) 0.05 – (+) 1.13 Pre (-) 0.11 – (-) 2.08 Post (+) 0.76 – (+) 1.13 Post</p>
<b>10.</b>	<b>Ground Water Exploration by CGWB (As on 31.3.2007)</b>	
	No of wells drilled (EW,OW,PZ,SH, Total)	28, 45, 6, Nil, 79
	Depth Range (m)	18.2 – 188.7
	Discharge (litres per second)	11.80 – 57.20
	Storativity (S)	0.21*10 <sup>-3</sup> to 4.80* 10 <sup>-3</sup>
	Transmissivity (m <sup>2</sup> /day)	161 to 5406
<b>11.</b>	<b>Ground Water Quality</b>	
	Presence of Chemical constituents more than permissible limit (eg EC, F, As,Fe) Type of Water	Electrical Conductivity ranges from 607 to 9740 micromhos/cm at 25 <sup>o</sup> c C3 – S1 Saline
<b>12</b>	<b>DYNAMIC GROUND WATER RESOURCES (2004) in MCM</b>	
	Annual Replenish able Ground Water Resources	74774
	Net Annual Ground Water Draft	18720
	Projected Demand for Domestic and Industrial Uses upto 2025	3974
	Stage of Ground Water Development	25.03%
<b>13</b>	<b>Efforts of Artificial Recharge &amp; Rainwater Harvesting</b>	
	Projects completed by CGWB (No. & Amount Spent)	Nil
	Projects under technical guidance of CGWB (Numbers)	Nil
<b>14</b>	<b>Ground Water Control And Regulation</b>	
	Number of OE Blocks	Nil
	Number of Critical Blocks	Nil
	Number of Notified Blocks	Nil

## 1.0 INTRODUCTION

### 1.1 Administrative Divisions

Bhind district is situated in the northern part of the Madhya Pradesh and covers an area of about 4459 sq. km. It lies between N Latitude 25° 55' and 26° 45' and E longitude 78° 12' and 79° 05' and falling in Survey of India toposheet nos 54 J & N. It is bounded in the North and east by Uttar Pradesh, in the south by the Gwalior & Datia districts in the west by the district Datia .

Bhind district is divided into 7 tehsils and 6 blocks. It has 889 villages. total population of the district is 12,19,000 ( As per census 2001) and density of the population is 273 persons in per sq. km. The block area and no of villages in each block are given in Table No. 1

**Table No. 1 Block area & Number of villages**

S. No	Block	Area in sq. km	No of villages
1.	Ater	447.37	190
2.	Bhind	687.43	778
3.	Mehgaon	968.16	145
4.	Gohad	1026.74	134
5.	Ron	425.34	147
6.	Lahar	656.48	125

### 1.2 Basin & Sub basins

Chambal, Asad, Kunawari, Besali, Sindh & Pahuj rivers drain the area. Ravines & Gullies have developed along the course of all rivers particularly along the flood plains. A very fine network of gullies and forming dendritic drainage network characterizes these. The depth of dissection by gullies is more intense along the river Chambal as compared to others.

### 1.3 Hydrology & Irrigation

The entire Bhind district lies in lower Chambal basin. Major tributaries are Kunwari, Asad, Besali, Sindh & Pahuj rivers. The details of the catchment area of each rivers are given in table no. 2.

**Table No. 2 Catchment Area of the Major Rivers**

Sub Basin	Catchment area in the district (sq. Km.)	% of the Catchment area in the district	Length of river in the district (Km)
Direct Catchment of River Chambal	257.87	5.79	46.3
Asad & Kunwari	896.14	20.13	85.0
Besali	1729.28	38.84	57.0
Sindh	785.76	17.65	64.0
Pahuj	783.17	17.59	30.0
Total	4451.96	100.00	282.30

### Surface Water availability

The water availability at 75% dependability of major rivers is given in table no 3

**Table No. 3 Surface Water Availability of the major rivers**

Sub Basin	Yield in MCM/Sq. Km	Total yield in MCM
Direct Catchment of River Chambal	01406	36.22
Asad & Kunwari	0.1406	126.00
Besali	0.1176	203.35
Sindh	0.1288	101.21
Pahuj	0.1288	100.87
<b>Total</b>		<b>567.65</b>

The gross irrigated area by all sources is 1189.10 Sq. Kms. The Irrigation by different sources is given in Table No. 4

**Table No. 4 Irrigation by different sources**

Source	No of Structures	Irrigated Area (sq. km.)
Dugwells	10031	658.60
Tube wells/Bore wells	708	184.69
Tanks/Ponds	6	2.00
Canals	3	331.33
Other Sources	-	12.48

#### 1.4 Previous work

Systematic Hydrogeological studies was carried out by CGWB under Annual Action Plan of 1971 – 72, 1984 – 85, 1985 – 86 & 1993 –94 After the systematic Hydrogeological surveys the ground Water management studies was carried out in the entire district under AAP 1991 - 92. The ground water exploration in the district was carried out under Annual Action Plan from 1985 to 1993.

## 2.0 CLIMATE & RAINFALL

The climate of Bhind district, characterised by a hot summer and general dryness except during the southwestern monsoon. A year may be divided into four seasons. Cold season December to February followed by the hot season from March to about middle of June. The period from Middle of June to September is the southwestern monsoon season. October & November forms the post monsoon or transition period. The nearest observatory is at Gwalior and all meteorological parameters except rainfall of this station are used for analysis. The normal rainfall of the district is 705.1 mm. District receives maximum rainfall during south west monsoon period i.e. June to September. About 91.9% of the annual rain fall precipitates during the monsoon season. thus surplus water for ground water recharge is available

during the period from June to September. The maximum rainfall precipitated in Gohad is 820.7 mm and minimum 640.8 mm is at Mehgaon.

During the southwest monsoon season the relative humidity generally exceeds 83% (August month). In the rest of the period is dry. The driest period is summer season, when relative humidity is less than 26%. May is the driest month of the year.

Normal maximum temperature during the month of May is 42<sup>0</sup>C and minimum during January month is 7.1<sup>0</sup>C. Normal mean maximum & minimum temperature is 32.5<sup>0</sup>C & 21.8<sup>0</sup>C respectively.

Wind velocity is higher during the pre monsoon period as compared to the post monsoon period. The maximum wind velocity is 11.3 km/h during the month of June and minimum is 3.1 km/h during the month of November. Average normal annual wind velocity is 6.4 km/h. Normal climatologically parameters is given in Table No 5

**Table No. 5 : Normal Climatologically Parameter**

S. No.	Parameters	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
1.	Maximum Temp ( <sup>0</sup> C)	22.9	26.5	32.7	38.7	42.1	40.6	34.5	32.0	32.7	33.2	29.3	24.4	32.5
2.	Minimum Temp ( <sup>0</sup> C)	7.1	10.6	15.8	22.2	27.2	29.5	26.6	25.3	23.9	13.4	11.5	7.4	18.7
3.	Relative Humidity (%)	68	56	39	26	26	46	75	83	75	58	55	66	56
4.	Wind Velocity (km/h)	4.2	5.3	6.3	7.2	9.1	11.3	9.5	7.4	6.5	4.0	3.1	3.2	6.4
5.	Rain Fall (mm)	11.2	8.1	6.3	5.3	3.6	46.5	236.0	235.5	125.5	14.0	4.3	4.9	705.1

### **3.0 GEOMORPHOLOGY & SOIL TYPES**

#### **3.1 Geomorphology**

Physiographically, a large area of the district forms part of the vast older plains including in filled riverbeds with structural plains, structural hills and valleys with denudation slope are restricted to southwestern part. The area has very gentle slope towards northeast with high elevation of 190 m above MSL in the southwestern part and the lowest elevation of 149 m above MSL in the northwestern part.

#### **3.2 Soil**

The soil in the district generally falls under the broad group of deep alluvial soils. Color of the soil varies from brown, yellowish brown to dark gray brown. Texture of soils varies from sandy loam (below 20% clay), loam (20 – 30% clay), clay loam (30 – 40% clay) & clay (more than 40% clay). Clay loam soil found in some parts of Gohad & Mehgaon blocks and sandy loam soil is usually found in other blocks.

## **4.0 GROUND WATER SCENARIO**

### **4.1 Hydrogeology**

District is characterised by variety of geological formations representing vast period of geological time.

#### **4.1.1 Alluvium**

The alluvial formation covers the major part of the district. Thickness varies from 70 to 250m and resting over the Vindhyan & Archaeans rocks. Alluvium consists of clay, sand & gravels. The thickness of the clay overburden generally decreases towards north and underlain by sand and gravel aquifers of the thickness vary from 3 to 17 m. The thickness of the overburden more than 60 m is occurring in south of Mehgaon.

Ground Water in this formation occurs under unconfined (up to a depth of 50 to 60 m.b.g.l.) and semi confined to confined conditions in the deeper aquifers i.e. below 60 m. The dug wells & shallow tube wells tap mainly kankary horizon. The deeper tube wells especially in the northern part tap sandy & gravelly aquifers underlying the clays. The grain size of the sand varies so the porosity & permeability of the sandy horizon also varies.

1. Fine Sand: - In this aquifer yield is not more and encounter mostly in dug wells & shallow tube wells. The thickness of this is about 5 m. and forms the upper most aquifer system in the district.
2. Medium Sand: - This aquifer system generally occurring under the thick clay beds therefore the ground water in this aquifer occurs under semi confined to confined conditions.
3. Coarse Sand: - This aquifer system is important as it has good porosity, permeability and yielding capacity. Ground water in this formation occurs under confined condition because it is generally occurs at the depth.

#### **4.1.2 Vindhyan Formation**

Some outcrops of this formation are exposed in the western parts of the district in Gohad tehsil. The sand stone & shales of the formation are encountered in the tube wells between 86 to 172 m b.g.l. (Source CGWB, Ground water Exploration). As these rocks are hard compact & devoid of weaker zones therefore the ground water occurrence is meager and ground water development in this formation is less. The depth to water level varies from 4.6 m, to 13.00 m b.g.l and seasonal fluctuation ranges from 2.5 to 5.00 m. (in normal monsoon years).

#### **4.1.3 Gwalior Series**

Gwalior series is exposed in southwestern part of the district and consists of Banded Hematite Quartzite. Ground water occurs under semi confined to confined conditions and yield potential is not too much.

## Depth to Water Level

To monitor the change in ground water levels in the district, Central ground Water board is Regularly monitoring 19 dug wells four time in a year.

## Pre Monsoon Depth to Water Levels

The depth to water levels during the pre monsoon period varies from 9.50 (Village Bhiekheri N lat.78<sup>0</sup> 28', E long 26<sup>0</sup> 28') to 35.50 (village Naharkapura E lat 78<sup>0</sup> 56', E long 26<sup>0</sup> 38')m.bgl. The depth to water level of about 15.78% of the wells is in the range of 9.50 to 10 m.bgl. 47.37% of the wells are falling in depth to water level range of 10 to 15 m.bgl and in the remaining wells depth to water is between 15 and 35.50 m.bgl.The pre monsoon depth to water level map is shown in Fig No. III

## Post Monsoon Water Levels

The depth to water levels during the post monsoon period varies from 8.61 (Village Mau N lat.78<sup>0</sup> 40', E long 26<sup>0</sup> 14') to 34.90 (village Naharkapura E lat 78<sup>0</sup> 56', E long 26<sup>0</sup> 38') m.bgl. The depth to water level of about 37.57% of the wells is between 8.61 and 10.00 m.bgl. 37.57% of the wells are falling in the depth to water level range of 10.00 to 15.00 m.bgl, and in the remaining wells depth to water falls between 24.75 and 34.90 m.bgl.

## Decadal Depth to water Level Trend: -

Block wise decadal depth to water level trend is presented in table no 6

**Table No. 6 Block Wise Decadal Rise and Fall in DTW**

S. No.	Block	Pre monsoon		Post monsoon	
		Decadal Range of Rise in DTW (m) /No of wells	Decadal Range of Fall in DTW (m)/No of wells	Decadal Range of Rise in DTW (m) /No of wells	Decadal Range of Fall in DTW (m) /No of wells
1.	Ater	$\frac{0.06 - 1.13}{2}$	$\frac{0.12 - 1.95}{5}$	$\frac{1.13}{1}$	$\frac{0.2 - 2.08}{6}$
2.	Mehgaon	-	$\frac{0.61 - 0.99}{3}$	=	$\frac{0.78 - 1.16}{3}$
3.	Bhind	-	$\frac{0.12 - 0.37}{4}$	$\frac{0.76}{1}$	$\frac{0.12 - 0.47}{3}$
4	Gohad	-	$\frac{0.48 - 0.65}{4}$	-	$\frac{0.71 - 0.95}{4}$
5	Ron	-	$\frac{0.12 - 0.81}{2}$	-	$\frac{0.15 - 0.96}{2}$
6	Lahar	-	$\frac{0.12 - 0.61}{4}$	=	$\frac{0.11 - 0.75}{4}$

## 4.2 Ground Water Resources

Block wise Groundwater Resources has been calculated for the base year 2004 on the basis of GEC'97. Over all ground water development of the district is 25.03% and all the blocks of the district falls in safe category of ground water development. Net Ground water availability, existing ground water draft for all uses and allocation for the domestic and industrial use upto year '2029 are 747.74, 187.20 & 39.74 MCM respectively for the district.

**Table No. 7 Block wise Ground Water Resources**

Assessment Unit/ District	Command/ non- Command/ Total	Net Annual Ground water Availability (MCM)	Existing Gross Groundwater Draft for Irrigation	Existing Gross Groundwater Draft for Domestic & Industrial water Supply	Existing Gross Groundwater Draft for All uses (11+12)	Allocation for domestic & industrial requirement supply upto next 25 years	Net Groundwater Availability for future irrigation development	Stage of Groundwater Development {(13/10)*100} (%)
<b>In MCM</b>								
Ater	Command	28.73	2.27	0.89	3.16	1.41	25.05	11
	Non- Command	93.39	36.26	3.57	39.83	5.63	51.50	43
	<b>Block Total</b>	<b>122.12</b>	<b>38.53</b>	<b>4.46</b>	<b>42.99</b>	<b>7.04</b>	<b>76.55</b>	<b>35</b>
Bhind	Command	50.81	3.38	1.37	4.74	2.48	44.96	9
	Non- Command	87.11	25.00	2.54	27.54	4.60	57.51	32
	<b>Block Total</b>	<b>137.92</b>	<b>28.38</b>	<b>3.91</b>	<b>32.29</b>	<b>7.07</b>	<b>102.47</b>	<b>23</b>
Gohat	Command	66.96	2.73	1.71	4.44	2.57	61.66	7
	Non- Command	74.55	16.26	2.56	18.82	3.86	54.43	25
	<b>Block Total</b>	<b>141.51</b>	<b>18.99</b>	<b>4.27</b>	<b>23.26</b>	<b>6.43</b>	<b>116.09</b>	<b>16</b>
Lahar	Command	41.10	2.64	1.28	3.92	2.16	36.31	10
	Non- Command	86.15	19.62	2.38	22.00	4.00	62.53	26
	<b>Block Total</b>	<b>127.25</b>	<b>22.26</b>	<b>3.66</b>	<b>25.92</b>	<b>6.16</b>	<b>98.84</b>	<b>20</b>
Mehgaon	Command	57.12	4.14	1.29	5.42	2.16	50.83	9
	Non- Command	104.03	36.70	3.86	40.56	6.49	60.84	39
	<b>Block Total</b>	<b>161.15</b>	<b>40.84</b>	<b>5.15</b>	<b>45.98</b>	<b>8.65</b>	<b>111.66</b>	<b>29</b>
Ron	Command	32.58	7.23	1.77	9.00	3.50	21.85	28
	Non- Command	25.20	7.32	0.44	7.76	0.88	17.01	31
	<b>Block Total</b>	<b>57.79</b>	<b>14.55</b>	<b>2.22</b>	<b>16.76</b>	<b>4.38</b>	<b>38.86</b>	<b>29</b>
	<b>District Total</b>	<b>747.74</b>	<b>163.54</b>	<b>23.66</b>	<b>187.20</b>	<b>39.74</b>	<b>544.47</b>	<b>25</b>

### 4.3 Ground water quality

Ground Water quality in Bhind district is assessed by CGWB on the basis of water samples collected from nineteen numbers of hydrograph stations. Ground water is highly saline as electric conductivity values vary between 735 to 2965 micro mhos/cm. High EC of more than 1500 micro mhos/cm was found in dug well of Dewari (1520 micro mhos/cm), Lahar (1750 micro mhos/cm), Chirole (2640 micro mhos/cm) Mehenda (2760 micro mhos/cm) and Mau (2965 micro mhos/cm) villages. Constituents like Fluoride, Sulphate, calcium and Magnesium were within the safe limit for drinking water as per BIS standards. Nitrate in the ground water varies from 5 to 313 mg/l. Nitrate more than 100 mg/l was found in two villages namely Dewari (251 mg/l) and Mau (313 mg/l). High nitrate in ground water appears due to the use of fertilizers etc. The total hardness of ground water is under safe limit of BIS standards. High chloride of more than 250 mg/l was found in Chirole, Mehenda & Mau villages.

Quality of water for Irrigation:- Water samples fall in C<sub>3</sub>S<sub>1</sub> and C<sub>3</sub>S<sub>1</sub> classes of US salinity diagram.

**4.4 Status of ground water development;** -Block wise status of drinking water facilities available in villages, as on year 2006) is given in table no. 8

**Table No. 8: Status of drinking water supply**

S.No.	Block	Village having drinking water facility	Tap water supply villages
1.	Ater	178	24
2.	Bhind	96	32
3.	Mehgaon	195	14
4.	Gohad	191	15
5.	Ron	69	16
6.	Lahar	148	33
	<b>Total</b>	<b>8771</b>	<b>134</b>

Ground water is the main source of irrigation in the district and about 95% of the irrigation is from either through the dug well or tube wells. Till 1960 farmers were depend on mostly on monsoon rainfall and a few dug wells were existed. The deeper aquifers were totally unexploited in the year 1960 but after that ground water development in the district progressed and till 1994 the number of dug wells and tube wells constructed for irrigation purpose reached up to 8536 & 400 respectively. The total number of dug wells & tube wells in the year 2006 for irrigation purpose are 10031 & 708 respectively.

## 5.0 GROUND WATER MANAGEMENT STRATEGY

### 5.1 Ground Water Development

Ground water development of the Bhind district is 25.03% and all the blocks of the district falls under the safe category and block wise ground water development varies from 16 to 35%.

#### 5.2.1 Water Conservation & Artificial Recharge

So far CGWB has not constructed any ground water conservation and artificial recharge structure in the district.

### 5.1 Ground water Related Issues & Problems

**SALINITY PROBLEM** : - The salient features of the salinity affected villages are as follows in the table no. 9

**Table No. 9 : Salinity affected villages**

S.No.	District	Salinity Affected Villages	Salinity Affected Sources	Number of Non affected sources available in the villages
1	Bhind	120	388	118

Based on the ground water exploration data EC map has been prepared and presented in Fig No. V It has been observed that except four isolated patches entire Bhind district is yielding potable ground water. The salient features of the four saline zones are as follows: -

1. Kishupura – Surapura & Sakraya saline zone ; - This zone is located North of Bhind along the Chambal river. Saline zone occurs at the depth ranges from 84 to 140 mbgl with EC ranges from 2400 to 3430 m. mhos/cm at 25<sup>0</sup>c. The phreatic aquifer in this zone is non-saline and yields potable water.
2. Saraya – Kanchuri Saline zone : - Located NE of the Bhind town along the Chambal river. Saline zone occurs at a depth ranges from 30 to 184 m bgl with electrical conductivity ranges from 3550 to 3875 m. mhos/cm at 25<sup>0</sup>c.
3. Machand – Vijpura – Banpura Saline zone ; - located west and north of Sind river along the border of Madhya Pradesh & Utter Pradesh. Saline zone occurs at a depth ranges from 65 to 114 m bgl with electrical conductivity ranges from 3720 to 3954 m. mhos/cm at 25<sup>0</sup>c
4. Kemokheri – Chauraria – Bharoli – Amayan – Mau Saline zone : - Located west of the river Sind and along along the river. The electrical conductivity in this zone ranges from 2000 to 14000 m. mhos/cm at 25<sup>0</sup>c. and increase from phreatic aquifer to down below.

## **WATER LOGGING**

The waterlogging problem exist in the parts of the Chambal canal command areas of the district especially in Mohgaon & Gohad Tehsils. The proble is attributed to: -

1. Canal seepage
2. Presence of impermeable or poorly permeable sandy loam and clayey alluvium soils.
3. Occurrence of fresh soils with poor drainage capacity.
4. Lack of proper drainage or slope in the affected areas.
5. In sufficient ground water development causing gradual rise in water levels in phreatic aquifer.

The list of waterlogged villages in the year 1999 is given in table no. 10

**Table No. 10: Waterlogged villages**

<b>S.No.</b>	<b>Name of village</b>	<b>Effective area (Ha)</b>
1.	Katwa Gujar	50.94
2.	Taton	98.31
3.	Baron	25.23
4.	Bara	71.84
5.	Sarwa	98.89
6.	Tukeda	142.06
7.	Khaririya	67.00
8.	Chhinoka	144.98
9.	Sherpur	24.34
10.	Nohera	6.87
11	Chak Shankarpur	1.05
12.	Andori	14.13
13.	Rai Ki Pali	9.47
14	Phtehpur	15.47
15.	Amarpur	2.17
16	Lodhe Ki Pali	12.23
17.	Chak Tekheda	25.86
	<b>TOTAL</b>	<b>810.84</b>

## 6.0 RECOMMENDATIONS

For a fertile and prosperous district like Bhind, management of ground water is of utmost necessity. Though, all the blocks of the district are showing safe category of ground water development, but there is need for regulation of indiscriminate boring and withdrawal of ground water on scientific manner.

The waterlogged areas in small pockets of the Gohad & Mehgaon blocks should be paid more attention where canal irrigation facilities are available. The following measures are recommended in these areas: -

1. Lining of canals
2. Conjunctive use of surface & ground water.
3. Runoff of surface water through nadi & nalas should be made easy by cleaning & maintaining of slope of the stream channels.
4. Changing of cropping pattern by growing the high water requirement crops.

In the saline ground water areas the following measures are recommended: -

1. Depending on the agro climatic condition, rainfall pattern and quality of ground water in ground water salinity areas tolerant & semi tolerant crops are suggested.
  2. Drip and sprinkler irrigation, despite of limitation have better control over salinity
  3. Use of saline water should be avoided during the germination and flowering stages of plants as far as possible.
  4. In areas where canal irrigation is available the saline water can be blended for greater choice of crops i.e. conjunctive use of water should be in practice.
  5. Gypsum can be used to improve the sodic soil.
- The areas for ground water development by construction of dug wells & tube wells are shown in the Fig No. VI.





