

GROUND WATER INFORMATION BOOKLET



GUNA DISTRICT MADHYA PRADESH

Ministry Of Water Resources
Central Ground Water Board
North Central Region
BHOPAL
2008

GUNA DISTRICT AT A GLANCE

S.No.	ITEMS	STATISTICS	
1.	GENERAL INFORMATION		
	i) Geographical area (Sq. km)	6307.66	
	ii) Administrative Divisions (As on 2006) Number of Tehsil / Blocks Number of Panchayat / Villages	3/5 425/1260	
	iii) Population (Census 2001)	97,7827	
	iv) Average Annual Rainfall (mm)	1042.7	
2.	GEOMORPHOLOGY		
	i) Major Physiographic Units	1. Eastern and Western Vindhyan off shoot ranges 2. Sindh Valley and Malwa plateau 3. Parbati Valley 4. Binaganj and Chachoda hills	
	ii) Major Drainage	Innsh, Parbati & Kuno	
3.	LAND USE (Sq.Km)		
	i) Forest area	1009.28	
	ii) Net area sown	3285.89	
	iii) Cultivable area	4046.03	
4.	MAJOR SOIL TYPES	Clayey, Loamy and Fine soil	
5.	AREA UNDER PRINCIPAL CROPS (as on June'2006)	4279.06	
6.	IRRIGATION BY DIFFERENT SOURCES	No of Structures	Area irrigated (sq.km)
	Dugwells	24606	385.70
	Tube wells/Bore wells	8311	520.31
	Tanks/Ponds	32	38.68
	Canals	22	191.91
	Other Sources	-	258.45
	Net Irrigated Area	-	1395.05
	Gross Irrigated Area	-	1397.59
7.	NUMBER OF GROUND WATER MONITORING WELLS OF CGWB(As on 31.3.2007)		
	No. of Dug Wells	14	
	No. of Piezometers	07	
8	PREDOMINANT GEOLOGICAL FORMATIONS	Vindhyan sand stones, Shales and Lime stones; Deccan Trap	
9	HYDROGEOLOGY		
	Major Water Bearing Formation	Weathered fractured & jointed Deccan Trap & Vindhyan Sandstone & Shales	
	(Pre-monsoon depth to water level range during 2006)	2.92 to 17.4 m b.g.l.	
	(Post-monsoon depth to water level range during 2006)	0.35 to 14.00 m b.g.l.	
	Long Term water level trend in 10 years (1997-2006) in m/yr	(-) 0.04 – (-) 0.81 m/yr (Pre) (+) 0.053 – (+) 0.142m/yr (Pre) (-) 0.03 – (-) 0.93 m/yr (Post) (+) 0.07 – (+) - m/yr (Post)	

10.	GROUND WATER EXPLORATION BY CGWB (As on 31.3.2007)	
	No of wells drilled (EW,OW,PZ,SH = Total)	9, 8, Nil, Nil =17
	Depth Range (m)	61.00 to 193.00
	Discharge (liters per second)	2.5 to 8
	Storativity (S)	-
	Transmissivity (m ² /day)	-
11.	GROUND WATER QUALITY	
	Presence of Chemical constituents more than permissible limit (e.g. EC, F, As, Fe)	Electrical Conductivity ranges from 353 to 2443 μ -mhos/cm at 25 °c
	Type of Water	C ₂ S ₁ , C ₃ S ₁ & C ₄ S ₁
12	DYNAMIC GROUND WATER RESOURCES (year 2004) in MCM	
	Annual Replenishable Ground Water Resources	61163
	Net Annual Ground Water Draft	33266
	Projected Demand for Domestic and Industrial uses up-to 2025	2305
	Stage of Ground Water Development	54.39%
13	EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING	
	Projects completed by CGWB (No. & Amount Spent)	Nil
	Projects under technical guidance of CGWB (Numbers)	Nil
14	GROUND WATER CONTROL AND REGULATION	
	Number of OE Blocks	Nil
	Number of Critical Blocks	Nil
	Number of Notified Blocks	Nil

1.0 INTRODUCTION

1.1 Administrative Divisions

Guna district is situated in the northern part of the Madhya Pradesh and covers an area of about 6,393 Sq. km. It lies between N Latitude 23° 53' and 25° 06' and E longitude 76° 48' and 78° 16' and falling in Survey of India toposheet nos 54 G H & L. It is bounded in the North by Shivpuri district and east by Ashoknagar district, in the south by the Rajgarh district & in the west by the Rajasthan state.

Guna district is divided into 3 tehsils and 5 blocks (Fig-1) It has 1260 villages and the total population of the district is 97,7,827 (As per census 2001) and density of the population is 155 persons per sq. km. The block area and number of villages in each block are given in Table No. 1

Table-1 Block area & Number of villages

S. No	Block	Area in sq. km	No of villages
1.	Guna	1520.40	279
2.	Bamori	1787.00	228
3.	Raghogarh	1123.27	296
4.	Aron	812.75	164
5.	Chachoda	1149.94	293
Total		6393.36	1260

1.2 Basin & Sub basins

The district lies in the Yamuna drainage system. It drains by the Parbati & kuno rivers, which are the tributaries of River Chambal. The eastern part of the district is drain by the river Sindh. The general flow direction of all the rivers is towards north with low gradient

1.3 Hydrology & Irrigation

The gross irrigated area by all sources is 1397.59 Sq. Km. The Irrigation by different sources is given in Table No. 2

Table- 2 Irrigation by different sources

SOURCES	No of Structures	Area irrigated (sq.km)
Dugwells	24606	385.70
Tube wells/Bore wells	8311	520.31
Tanks/Ponds	32	38.68
Canals	22	191.91
Other Sources		258.45

1.4 Previous work

Systematic Hydrogeological studies was carried out by CGWB under Annual Action Plan of 1990 – 91 and the Ground Water management studies was carried out in the entire district under AAP 2000 - 2001. The ground water exploration in the district was carried out under Annual Action Plan; 2002-03, 2003-04, & 2004-2005.

2.0 CLIMATE & RAINFALL

The climate of Guna district is 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 normal rainfall of the district is 1042.5 mm. District receives maximum rainfall during southwest monsoon period i.e. June to September. About 92.2% of the annual rain fall predicates during the monsoon season. Only 7.8% of the annual rain fall takes place between October to May period. Thus surplus water for ground water recharge is available during the period from June to September. The maximum rainfall precipitated in Chachoda is 1140.20 mm and minimum 863.5 mm is at Ashoknagar.

During the southwest monsoon season the relative humidity generally exceeds 90% (August month) and the rest of the period is dry. The driest period is summer season, when relative humidity is less than 27%. May is the driest month of the year.

Normal maximum temperature during the month of May is 41.3⁰C and minimum during January month is 7.7⁰C. Normal annual mean maximum & minimum temperatures of Guna is 32.5⁰C & 21.8⁰C respectively.

Wind velocity is higher during the pre monsoon period as compared to the post monsoon period. The maximum wind velocity is 14.3 km/h during the month of June and minimum is 4.3 km/h during the month of November. Average normal annual wind velocity of Guna district is 8.1km/h. Normal climatologically parameters are given in Table No. 3

Table-3 Normal Climatologically Parameters

S. No.	Parameters	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
1.	Maximum Temp (⁰ C)	24.7	28.0	33.3	38.3	41.3	38.6	31.7	29.7	31.1	32.5	29.3	25.9	32.0
2.	Minimum Temp (⁰ C)	7.7	10.1	15.4	20.8	25.6	26.5	24.0	23.2	22.0	17.4	11.6	8.1	17.7
3.	Relative Humidity (%)	65	53	38	27	31	41	85	90	81	61	56	65	59
4.	Wind Velocity (km/h)	5.4	6.7	7.5	8.7	11.3	14.2	12.2	10.6	7.9	5.0	4.3	4.4	8.1
5.	Rain fall (mm)	14.3	7.1	5.8	3.4	10.1	97.0	348.7	345.0	170.2	22.3	12.1	6.5	1042.5

3.0 GEOMORPHOLOGY & SOIL TYPES

3.1 Geomorphology

Physiographically, the major part exhibits a region of low level plateau plain of extrusive origin with terrace/rocky bench and flood plain (including in filled river bed) along the course of the rivers. The other landforms are low structural plateau & structural plains of Proterozoic rocks. The maximum & minimum elevations are 561 & 324 m above MSL at 9 km south of Aron in southern part and 31 km south south west of Paron in the north western part of the district respectively.

3.2 Soil

The soil of the district can broadly be divided into 3 major groups

- (A) Clayey soil associated with moderately stone of shallow depth occurring in well-drained moderately sloping plateau formed by severe erosion
- (B) Very shallow, well-drained loamy soils associated with stone on gently sloping plateau formed by severe erosion.
- (C) Moderately deep to deep fine soil developed in very gentle sloping and well drained areas

4.0 GROUND WATER SCENARIO

4.1 Hydrogeology

District is characterised by variety of geological formations representing vast period of geological time. The distribution of the geological formations is shown in Fig-2

4.1.1 Laterite & Alluvium

Laterite of Cainozoic age occurs as boulders capping the Vindhyan & Deccan Trap formations in the northern parts of the district. It varies in thickness from 1 to 5 m and ferruginous on nature.

Alluvium of Quaternary age occurs as a narrow belt along the major rivers like Kuno, Parvati and Sindh. It comprises pebble beds, gravel, silt and sand

In the area occupied by the laterite and alluvium the ground water occurs under water table condition. The granular portion of this formation such as sand & gravel forms good aquifers, but the thickness is shallow. The depth to water level in these formation ranges between 3.80 to 18.94 m.bgl. in pre monsoon period and water level fluctuation ranges from 1.54 to 6.50 m

4.1.2 Deccan Trap

Deccan trap basalts of Malwa Group of Cretaceous to Paleozoic age occupy major part of the district. Intertrappean of lacustrine or fluvial origin occur in the top part of the each lava flow. Deccan trap consist of number of basaltic lava flows.

Water bearing capacities in Deccan trap formation differ from flow to flow. Phreatic aquifer occurs in weathered, jointed and fractured basalts. In the areas where weathered basaltic layer is extensive, a continuous aquifer can be traced to some distance, however due to low permeability of the weathered basalt the aquifer sustain limited ground water withdrawal. The groundwater at deeper levels occurs under semi-confined to confined conditions in vesicular, jointed & fractured basalts. Yield of the wells in this formation varies from 3.5 to 8 lps. Unit draft of the wells varies from 0.001 to 0.008 mcm/year for dugwells & 0.005 to 0.017 mcm/yr for tube wells.

Under the Ground water Exploration Programme CGWB has constructed the exploratory wells and observation wells of 61.00 to 193.00m deep. The depth to water levels in these wells varies from 12.10 to 41.20m bgl and discharge of the wells ranges from negligible to 8 lps with a draw down of 28.00m.

4.1.3 Lameta Group

Lameta Group of Cretaceous age comprising siliceous limestone and highly fossiliferous sandstone is exposed at 8 to 25 km. southwest of Sirsi in the northern part of the district. It is horizontally disposed underneath the Deccan trap formation. The ground water in this group occurs under phreatic condition with good yield.

4.1.4 Vindhyan Formation

The Sandstone intercalated with Shale beds are exposed in the northern & northwestern parts of the district (Bamori & Guna blocks). The rocks are hard and compact, but at places and at different depth it is fractured and jointed and forming potential aquifer at deeper levels. The ground water occurs under semi confined to confined conditions and are being exploited through bore wells. The yield of these borewells is fairly good ranging between 2 to 10 lps. The depth to water level during pre monsoon period ranges from 3.70 to 22.10 m.bgl. with seasonal fluctuation of 0.07 to 9.98 m

4.2 Depth to Water Level

To monitor the change in ground water levels in the district, Central Ground Water Board is regularly monitoring 16 dug wells and 7 piezometers four times in a year.

4.2.1 Pre Monsoon Depth to Water Levels

The depth to water levels during the pre monsoon period varies from 2.92 (village Akoda N lat.77⁰ 11', E long 24⁰ 51') to 17.40 (village Myana E lat 77⁰ 27', E long 24⁰ 51') m.bgl. The depth to water level of about 56.25% of the wells is in the range of 9.50 to 10 m.bgl., 31.25% 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 17.40 m.bgl. The pre monsoon depth to water level map is shown in Fig No. 3

4.2.2 Post Monsoon Water Levels

The depth to water levels during the post monsoon period varies from 0.35 (Village Bamori N lat.77⁰ 21', E long 24⁰ 51') to 14.00 (village Jaitadongar E lat 77⁰ 20', E long 24⁰ 31') m.bgl. The depth to water level of about 56.25% of the wells is between 0.35 and 5.00 m.bgl. 31.25% of the wells are falling in the depth to water level range of 5.00 to 10.00 m.bgl, and in the remaining wells depth to water falls between 10.00 and 14.00 m.bgl.. The post monsoon depth to water level map is shown in Fig No. 4

4.2.3 Decadal Depth to water Level Trend

Block wise decadal depth to water level trend is presented in table no 4

Table-4 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.	Chachora	-	<u>0.51-0.47</u> 2	-	<u>0.04-0.42</u> 2
2.	Bamori	<u>0.41</u> 1	<u>0.11-0.61</u> 2	-	<u>0.18-0.79</u> 2
3.	Guna	<u>0.053</u> 1	<u>0.10-0.31</u> 6	-	<u>0.03-0.92</u> 7
4	Aron	-	<u>0.19-0.31</u> 2	-	<u>0.21-0.33</u> 2
5	Raghogarh	-	<u>0.18-0.42</u> 2	-	<u>0.12-0.42</u> 2

4.3 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 54.39% 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 611.63, 332.66 & 23.04 MCM respectively for the district and shown in table no.5. The Ground Water Resources is given in Fig- 5

Table No. 5 Block wise Ground Water Resources

Sl. No.	Assessment Unit/ District	Command/ non-Command/ Total	Net Annual Ground water Availability	Existing Gross Groundwater Draft for Irrigation	Existing Gross Groundwater Draft for Domestic & Industrial water Supply	Existing Gross Ground water Draft for All uses	Allocation for domestic & industrial requirement supply upto next 25 years	Net Ground water Availability for future irrigation development	Stage of Ground water Development (in %)
In MCM									
1	Aron	Command	1.10	0.18	0.09	0.27	0.10	0.82	24.25
		Non-Command	101.87	27.28	1.69	28.97	2.36	72.24	28.44
		Block Total	102.97	27.46	1.78	29.24	2.46	73.06	28.39
2	Bamori	Command	26.53	6.78	0.18	6.96	0.30	19.44	26.24
		Non-Command	101.13	66.78	2.51	69.28	4.18	30.18	68.51
		Block Total	127.66	73.56	2.69	76.25	4.48	49.62	59.73
3	Chachoda	Command	4.08	0.68	0.05	0.73	0.06	3.34	17.86
		Non-Command	114.24	77.64	4.31	81.95	4.83	31.77	71.73
		Block Total	118.32	78.32	4.36	82.68	4.89	35.12	69.88
4	Guna	Command	2.87	0.47	0.05	0.51	0.05	2.36	17.78
		Non-Command	113.33	71.17	4.53	75.71	5.08	37.08	66.8
		Block Total	116.20	71.64	4.58	76.22	5.13	39.43	65.59
5	Raghogarh	Command	31.05	1.45	0.47	1.91	0.53	29.07	6.17
		Non-Command	115.44	63.03	3.34	66.37	5.57	46.84	57.49
		Block Total	146.48	64.48	3.80	68.28	6.09	75.91	46.62
		District Total	611.63	315.45	17.21	332.66	23.05	273.14	54.39

4.4 Ground Water Quality

Ground Water quality in Guna district is assessed by CGWB on the basis of water samples collected from twenty-nine numbers of hydrograph stations. Ground water is generally medium to high saline as electric conductivity values vary between 353 to 2443 micro mhos/cm. High EC of more than 1500 micro mhos/cm was found in three dug well of Barod (1704 micro mhos/cm), Panchi (1709 micro mhos/cm) and Khakariya (2643 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 6.4 to 332mg/l. nitrate more than 100 mg/l was found at Husainpur (332 mg/l) and Mau (313 mg/l) villages. 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 at Barod, Panchi & Khakariya villages.

4.4.1 Quality of Ground water for Irrigation

High SAR is not good for irrigation as it lead to Sodium hazards. Water samples fall in C₂S₁, C₃S₁ & C₄S₁ classes of US salinity diagram. The ground water in the district is safe for irrigation purpose but proper drainage system is required where EC is high.

4.5 Status of Ground water Development

Block wise status of irrigation by Canals, Tube wells, Dug wells and Ponds as on year 2006) is given in table no. 6

Table- 6 Status of Irrigation

S.no.	Block	Number of Canal/ Irrigated Area in sq. km	Number of Tube wells/ Irrigated Area in sq. km	Number of Dug wells/ Irrigated Area in sq. km	Number of Ponds/ Irrigated Area in sq. km	Number of other sources/ Irrigated Area in sq. km
1.	Guna	<u>8.70</u> 4	<u>159.13</u> 2477	<u>43.28</u> 2882	<u>5.57</u> 5	43.78
2.	Bamori	<u>93.65</u> 6	<u>209.46</u> 3636	<u>10.65</u> 1449	<u>4.57</u> 11	38.74
3.	Aron	<u>0.5</u> 2	<u>71.27</u> 1012	<u>10.74</u> 1547	<u>1.08</u> 1	34.31
4.	Raghogarh	<u>78.14</u> 3	<u>45.53</u> 642	<u>150.64</u> 6517	<u>24.32</u> 8	108.07
5.	Chachora	<u>9</u> 5	<u>11.22</u> 278	<u>97.84</u> 5373	<u>3.14</u> 7	18.32
	Total	<u>191.91</u> 20	<u>520.31</u> 8045	<u>385.7</u> 17768	<u>38.68</u> 32	258.45
	Total % Irrigation	13.76	37.30	27.65	2.77	18.53

Ground water is the main source of irrigation in the district and about 64.94% of the irrigation is from either through the dug well or tube wells. Till 1960 farmers were depended 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. The total number of dug wells and tube wells in the year 2006 for irrigation purpose are 17768 and 8045 respectively.

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 Ground Water Development

Ground water development of the Guna district is 54.39% and all the blocks of the district falls under the safe category and block wise ground water development varies from 28.39 to 69.98%.

5.2 Water Conservation & Artificial Recharge

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

6.0 GROUND WATER RELATED ISSUES & PROBLEMS

In general quality of ground water in the district is suitable for domestic and irrigation purposes.

All the blocks of the district falls under the safe category and block wise ground water development varies from 28.39 to 69.98%.

7.0 RECOMMENDATIONS

The large area of the Guna District is suitable for bore wells and small patches in western part and central part is suitable for construction of dug wells (Fig- 6.)

Compiled by-

S. K. Verma

Scientist-“B”

Under the able guidance of-

Shri. R. N. Singh

Regional Director

