GROUND WATER INFORMATION BOOKLET

BHIWANI DISTRICT HARYANA

CENTRAL GROUND WATER BOARD

Ministry of Water Resources

Government of India

North Western Region

CHANDIGARH

2012

CONTRIBUTORS

REENA BORANA

STA(HG)

PREPARED UNDER SUPERVISION OF

A. K. Bhatia

REGIONAL DIRECTOR

GROUND WATER INFORMATION BOOKLET
BHIWANI DISTRICT, HARYANA

CONTENTS

BHIWANI DISTRICT AT A GLANCE

Sr. No.	ITEMS	Statistics
1.	GENERAL INFORMATION	
	i. Geographical Area (sq. km.)	5140
	ii. Administrative Divisions Number of Blocks	 09 - Badhra,
		Bawani Khera Bhiwani, Dadri-I, Dadri-II, Loharu, Tosham, Kairu, Siwani,
	Number of Panchayats	-
	Number of Villages	444
	iii. Population (As per 2001 Census)	16,34,445
	iv. Average Annul Rainfall (mm)	420
2.	GEOMORPHOLOGY	
	Major Physiographic Units	Alluvium
	Major Drainage	Dohan river
3.	LAND USE (Sq. km.)	
	a. Forest Area :	
	b. Net area sown :	3940
	c. Cultivable area :	4180
4.	MAJOR SOIL TYPES	Arid brown soils
		and Tropical Arid brown soils
5.	AREA UNDER PRINCIPAL CROPS	165000 ha.
6.	IRRIGATION BY DIFFERENT	
	SOURCES (Areas and Number of Structures) Dugwells	 -
	Tubewells/Borewells	132000
		32,792 (tube wells)
	Tanks/ponds	-
	Canals	148000 ha
	Other sources	-
	Net Irrigated area	28000 ha
	Gross irrigated area	385000 ha

7.	NUMBERS OF GROUND WATER	
	MONITORING WELLS ON CGWB (As on	
	31-3-2012) No. of dug wells No. of Piezometers	 22 14
8.	PREDOMINANT GEOLOGICAL	Alluvium
	FORMATIONS	
9.	HYDROGEOLOGY *Major Water bearing formation	 Sand, Gravel
	* (Pre-monsoon depth to water level)	1.87-65.97 m bgl
	* (Post-monsoon depth to water level) *Long term water level trend in 10 yrs in m/yr	0.84- 64.19 m bgl 0.03m-1.38m/yr fall
10.	GROUND WATER EXPLORATION BY CGWB	
	No. of wells drilled EW	 21
	OW PZ SH Total Depth range (m)	- 14 35 111-226
	Discharge (liters per minutes)	632-946
	Storativity (S)	-
	Transmissivity (m^2/day)	1130
11.	GROUND WATER QUALITY	
	Presence of Chemical constituents more	
	than the permissible limit EC (micro mhos at 25^o C) As (mg/l) F (mg/l) Type of water	 8970µS/cm 0.02 10.83 Sodium mixed -
		anion type
12	DYNAMIC GROUND WATER	
	RESOURCES (2004) - inMCM Annual Replenishable Ground Water	 551.38
	Resources	
	Net Annual Ground Water Draft Projected Demand for Domestic and	438.24 111.45
	Industrial Uses upto 2025	

	Stage of Ground Water Development	79 %
13.	AWARENESS AND TRAINING ACTIVITY	
	Mass Awareness Programmes organized	
14.	EFFORTS OF ARTIFICIAL RECHARGE & RAIN WATER HARVESTING	
	Projects completed CGWB (No. & Amount spent)	
	Project under technical guidance of CGWB (Numbers)	
15.	GROUND WATER CONTROL AND REGULATION	
	Number of OE Blocks.	4– Bhadra, Dadri-I, Kairu, Loharu
	No. Critical Blocks	2- Dadri-II, Siwani
	No. of blocks notified	1- Bhadra
16.	MAJOR GROUND WATER PROBLEMS AND ISSUES.	Ground water decline, Rise in ground water level, Ground water quality.

GROUND WATER INFORMATION BOOKLET

BHIWANI DISTRICT, HARYANA

1.0 INTRODUCTION

Bhiwani District lies in South-Western part of Haryana state covering an area of 5140 sq.km. There is no perennial river passing through the district. Physiographic-ally the district consists of flat and level plain interrupted from place to place by clusters of sand dunes, isolated hillocks and rocky ridges. A few isolated rocky ridges elevated sharply from the plain occur in the south central portion or the district. Dohan river is the only ephemeral stream in the area and flows in direct response to precipitation.

Bhiwani district ranks 3rd in Haryana with a population of 16,34,445 according to 2011 Census. The male population is 866,672 and female is 767,773. The density of population is 342 per sq.km. The literacy rate in the district is around 75.21%. 80% of the population lives in Rural area and the remaining 20% of the population lives in Urban area. Out of 444 villages 437 are inhabited and 7 are un inhabitated.

2.0 RAINFALL & CLIMATE

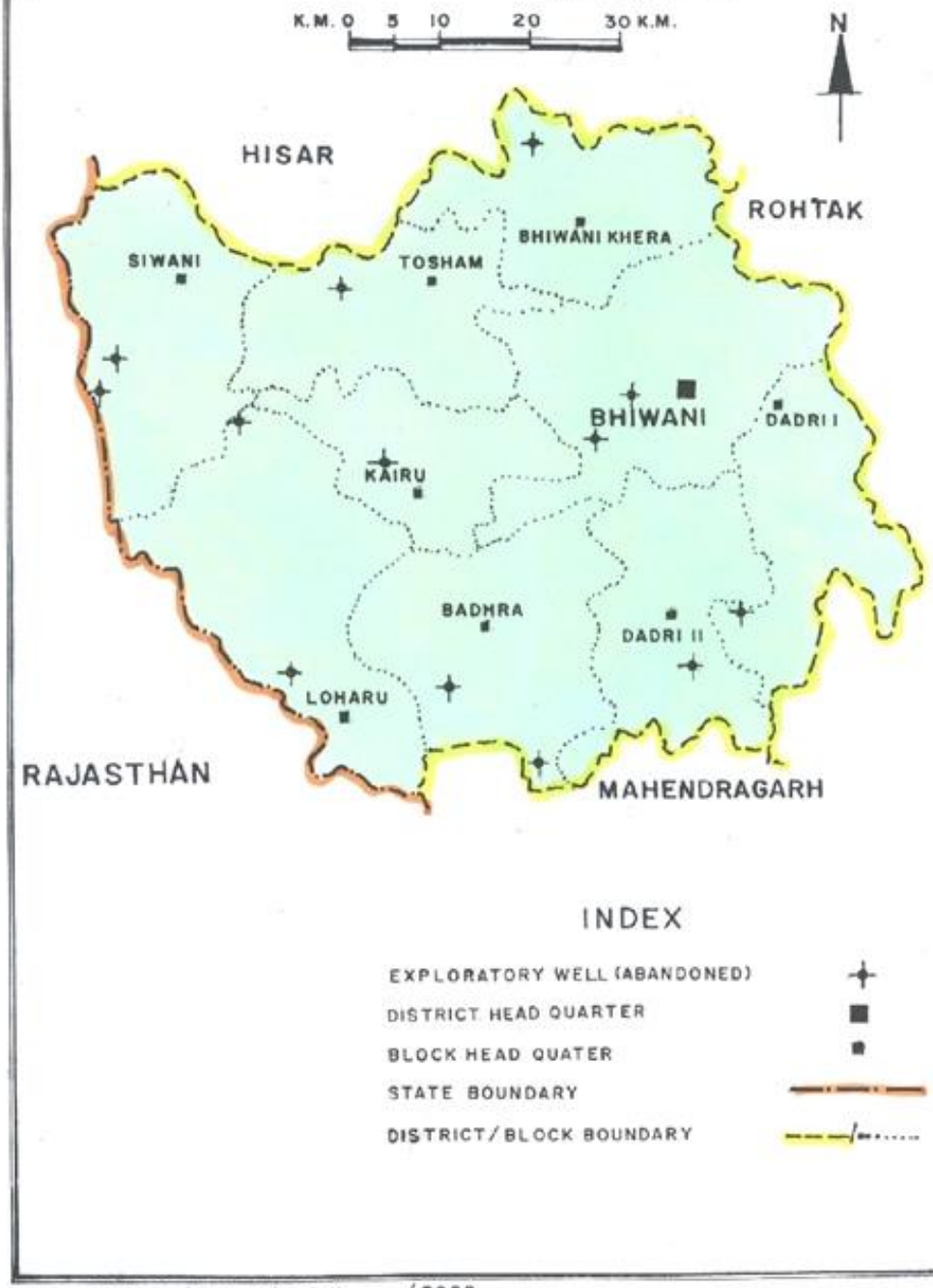
The climate of Bhiwani district can be classified as tropical steppe, semi-arid and hot which is mainly dry with very hot summer and cold winter except during monsoon season when moist air of oceanic origin penetrate into the district. There are four seasons in a year. The hot weather season starts from mid March to last week of the June followed by the south- west monsoon which lasts upto September. The transition period from September to October forms the post-monsoon season. The winter season starts late in November and remains upto first week of March.

The normal annual rainfall of the district is 420 mm which is unevenly distributed over the area 22 days. The south west monsoon, sets in from last week of June and withdraws in end of September, contributed about 85% of annual rainfall. July and August are the wettest months. Rest 15% rainfall is received during non-monsoon period in the wake of western disturbances and thunder storms. Generally rainfall in the district increases from southwest to northeast.

जल वर्ष 2007 Water Year 2007

INDEX MAP

BHIWANI DISTRICT, HARYANA



CGWB NWR CH. (N. Singh) D. O. No. /2009

Normal Annual Rainfall	: 420 mm
Normal monsoon Rainfall	: 355 mm
Temperature	
Mean Maximum	: 41oC (May & June0
Normal Raindays	: 22

3.0 GEOMORPHOLOGY AND SOILTYPES

The district consists of flat and level plain interrupted from place to place by clusters of sand dunes, isolated hillocks and rocky ridges. A few isolated rocky ridges elevated sharply from the plain occur in the south central portion or the district. Dohan river is the only ephemeral stream in the area and flows in direct response to precipitation. Only the tail of this ephemeral stream falls in the south-central corner of the district and ultimately dies out in sands around village

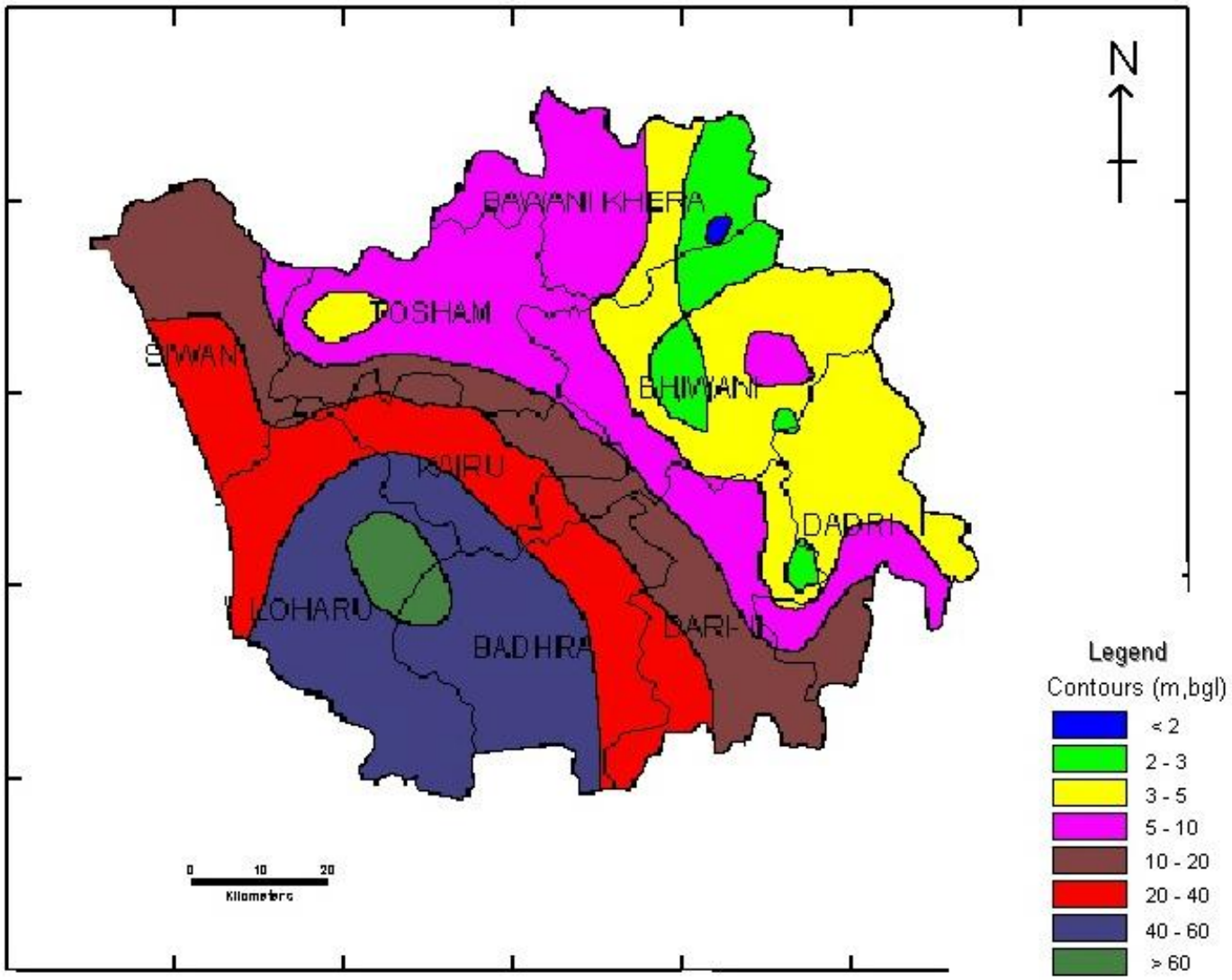
4.0 GROUND WATER SCENARIO

4.1 HYDROGEOLOGY

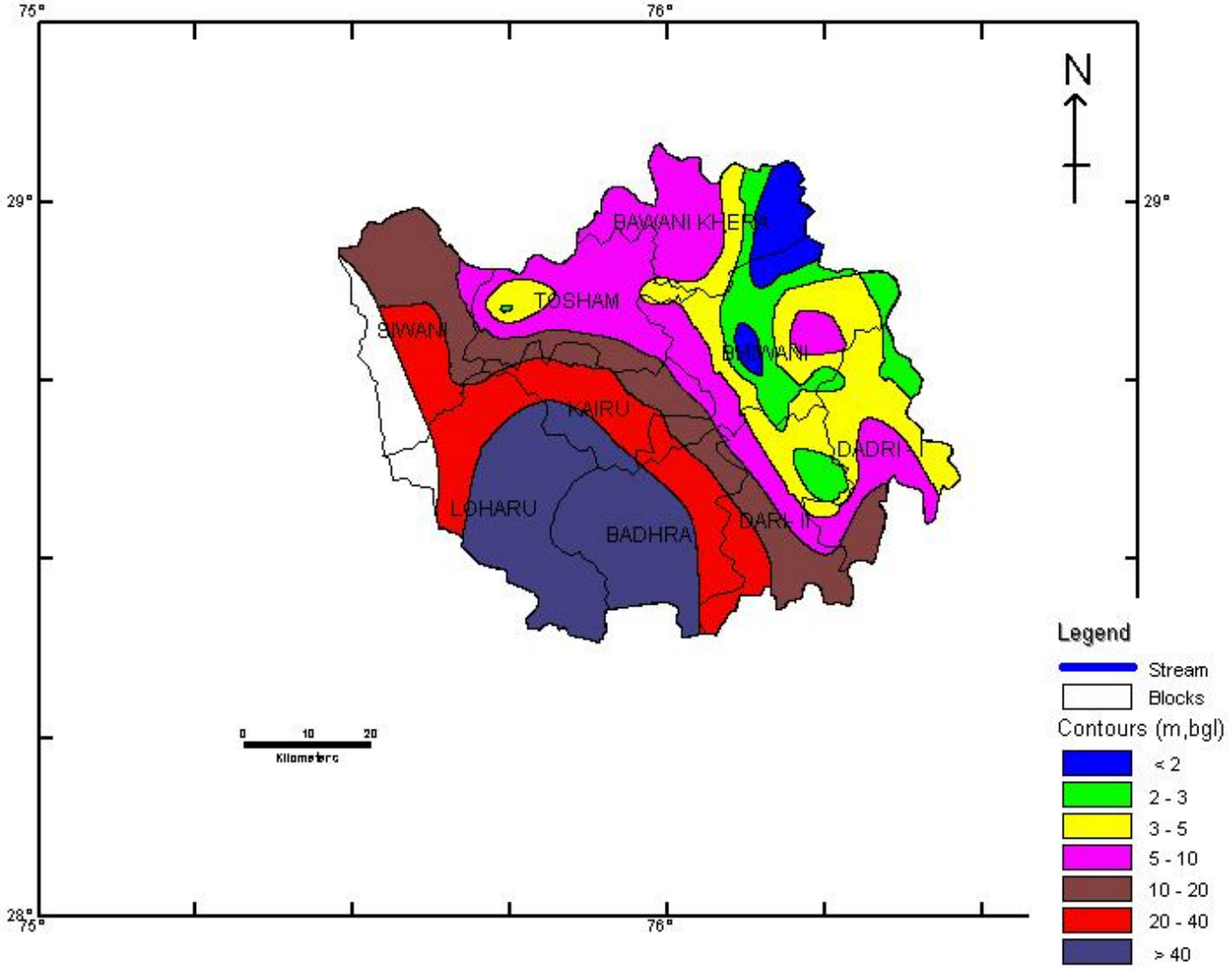
The geological formation met within the district are ferruginous chiastolite schist associated argillaceous rocks of Aravalli group, Alwar quartzite of Delhi system, Malani suite of volcanics of lower Vindhyan age, Older alluvial deposits of Quarternary age and Aeolian sands of recent age the out crops are, however, limited to small parts of the district, Older alluvium occurs extensively in the area consisting of inter bedded , lenticular, interfingering deposits of gravel sand ,silt, clay and Kanker mixed in various proportions. The youngest formations are aeolian deposits, which are unconsolidated surface sands covering large area in the western part of the district, these deposits occur as sand dunes at the surface and consist of sands.

Ground water occurs in alluvium and aeolian sands and underlying jointed and fractured hard rocks formations also form the aquifers, in alluvium, sands, silt, kankar and gravel form the water bearing zones. In-shallow aquifers zones, ground water occurs under water table conditions where as in the deeper zones, confined/semi-confined condition exist, hard rocks comprising of Aravalli group of rocks, Malani suite of volcanics and Alwar Quartzites of Delhi system are water bearing but have yet not been explored thoroughly. Drilling was conducted at 21 locations in the district, with the depth

DEPTH TO WATER LEVEL MAP OF HARYANA--BHIWANI, (PRE-MONSOON, 2012)



DEPTH TO WATER LEVEL MAP OF HARYANA--BHIWANI, (POST-MONSOON, 2012)



ranging from 111 to226m. Out of these 2 were constructed and remaining had to be abandoned due to poor quality of ground water or inadequate thickness of granular zones. In alluvium granular zones exist down to its entire thickness which is of negligible thickness near the out crops as revealed by the lithologs of boreholes. An exploratory tubewell at Budhera taps aquifer zones in the depth range of 52 to 100m and yields 946 LPM for 8.4 m. of drawdown with transmissivity of 1130 m^2/day. Another exploratory tubewell located at Jhojukalan taps aquifer zones in the depth range of 52 to 100m yields 632 LPM for 6.5 m. of drawdown with transmissivity of 265 m^2/day , 14 Piezometers also been constructed in the district by CGWB for water level monitoring.

During the post-monsoon period depth to water in the district varies from 0.84 m bgl at Dhanana, Bhawani khera block (Northern, Northeastern and Eastern part) to 64.19 m.bgl at Singhari, Loharu block (Western). In the pre-monsoon period depth to water table ranged between less than 1.87m.bgl at Dhanana, Bhawani khera block to 65.97 m bgl at Singhari, Loharu block

The depth to water level is shallow and range between 0.84 m to 10 m in the Northern, Northeastern and Eastern (Tosham Bhiwani khera Dadri-I and Bhiwani blocks) and 10 to 20 m.bgl in the Southern and Northwestern parts of the district (Badra, Dadri-II and Siwani). Ground water levels are deeper in the Western and some patches in the Central part ranging from 40 to more than 60 m(Loharu and Siwani blocks).

Water level fluctuation for 10 years shows rising water level trend in the Northern blocks and declining water level trend in southern blocks. During pre-monsoon water level rise fluctuates between 0.35 to 4.44 m, while in post monsoon it varies from 1.12 to 3.35 m. The decline varies from 0.71 m to 7.68 m.

4.2 GROUND WATER RESOURCES

The block wise ground water resource potential in the district has been assessed as per GEC-97. The stage of ground water development ranges between 17% (block-Bhawani Khera) to 206% (block- Bhadra). The total replenishable ground water resource in the district is 551.38 mcm.

The net ground water draft is 438.24 mcm. The stage of ground water development in the district is 79%.

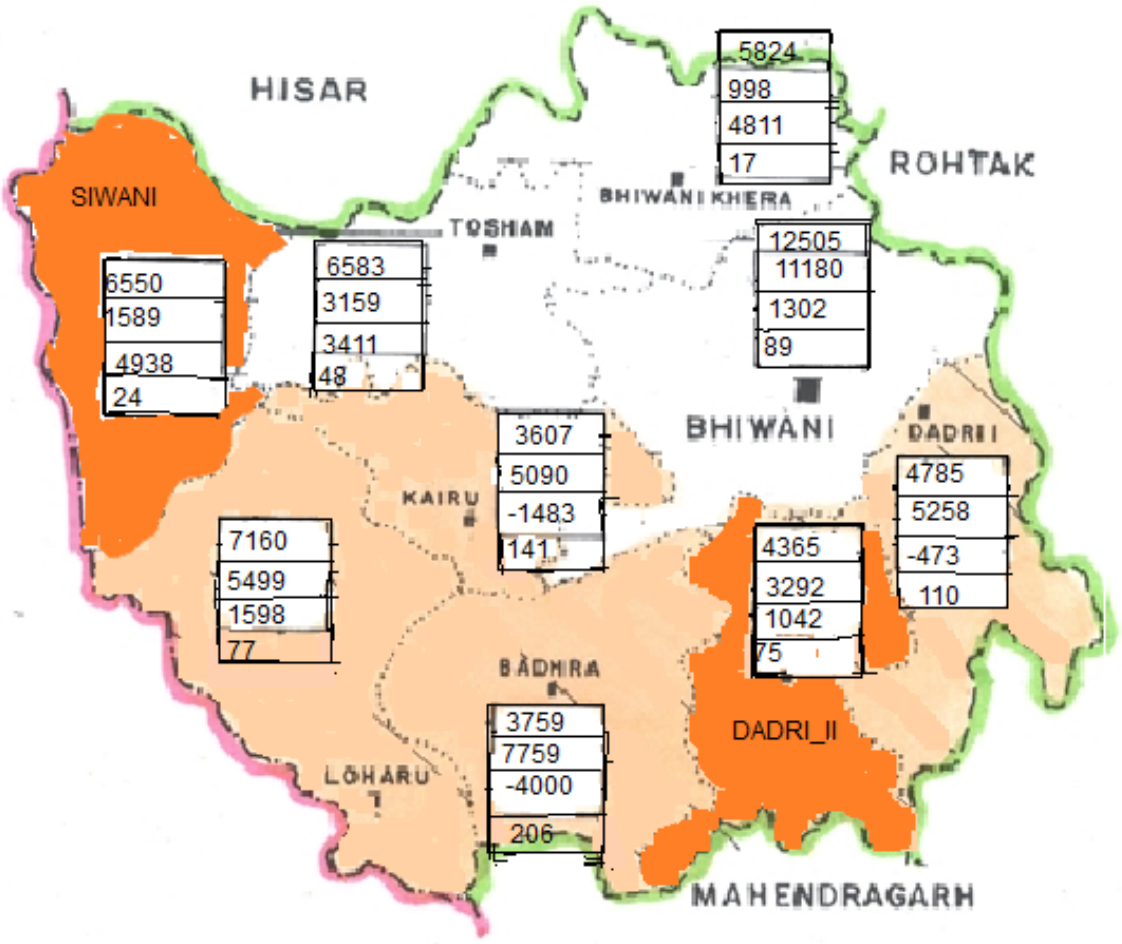
GROUND WATER RESOURCE AND DEVELOPMENT POTENTIAL (in ha m) OF BHIWANI DISTRICT .HARYANA AS ON 31ST MARCH. 2009

Sr. No.	Assessment Unit/District	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for Irrigation	Existing Gross Ground Water Draft for domestic and industrial water supply	Existing Gross Ground Water Draft for All uses	Allocation for domestic, and industrial requirement supply upto next 25 yrs	Net Ground Water Availaibility for future irrigation development	Stage of Ground Development
1	Badra	3759	7641	118	7759	118	-4000	206
2	Bhawani Khera	5824	953	45	998	60	4811	17
3	Bhiwani	12505	11111	69	11180	90	1302	89
4	Dadri-I	4785	5214	44	5258	44	-473	110
5	Dadri-II	4365	3200	92	3292	123	1042	75
6	Kairu	3607	5000	90	5090	90	-1483	141
7	Loharu	7160	5310	189	5499	252	1598	77
8	Siwani	6550	1520	69	1589	92	4938	24
9	Tosham	6583	3119	40	3159	53	3411	48
	TOTAL	55138	43068	756	43824	925	11145	79

The 4 blocks namely Badhra, Dadri-I, Kairu and Loharu falls under Over-Exploited blocks while Blocks Dadri-II and Siwani comes under Critical category. The Badhra Block has been notified for Ground water regulations.

GROUND WATER DEVELOPMENT POTENTIAL AND CATEGORISATION OF BLOCKS

BHIWANI DISTRICT, HARYANA



INDEX

55138	GROUND WATER RESOURCES (MCM)
43824	GROSS GROUND WATER DRAFT (MCM)
11145	FUTURE GROUND WATER AVAILABILITY (MCM)
79	STAGE OF GROUND WATER DEVELOPMENT %
	SAFE
	OVER EXPLOITED

K.M. 0 5 10 20 30 K.M.

4.3 GROUND WATER QUALITY

Chemical quality data of shallow aquifers reveals that ground water is alkaline in nature and significant number of samples have conductivity values more than 3000µS/cm. Concentration of vital chemical constituents such as fluoride and nitrate in about 50 % of the water samples is within permissible limit assigned by BIS 1991. Among trace metals, arsenic and iron are found in excess at Sui (0.02 mg/l) and tosham (10.83 mg/l) against the maximum permissible limit of 0.01 mg/l and 1.0 mg/l respectively.

Among anions, bicarbonates dominate in some wells having low to moderate salinity, chloride dominates in wells with high salinity and in remaining no single anion dominates. It means that the water is of mixed anion type. Among cations sodium dominates in more than 50% wells whereas no individual cation dominates in the remaining water samples.

Presence of chemical constituents more than permissible limits

Chemical Constituent	Total Wells	BIS Limit 1991	Above limits	Location with value
EC	38	3000µS/cm.	13	Max 8970µS/cm
F	38	1.5 mg/l	10	Max 8.39 mg/l
As	29	1.0 mg/l	2	Max 0.02 mg/l
Fe	29	0.01 mg/l	5	Max. 10.83 mg/l

The shallow ground water in the district is of Sodium-mixed anion type.

SUITABILTY OF WATER

Domestic

Based on the concentration of anions and cations in shallow ground water samples, it is found that in some parts of the district the quality of ground water is not suitable for drinking uses, whereas in others it is of permissible quality.

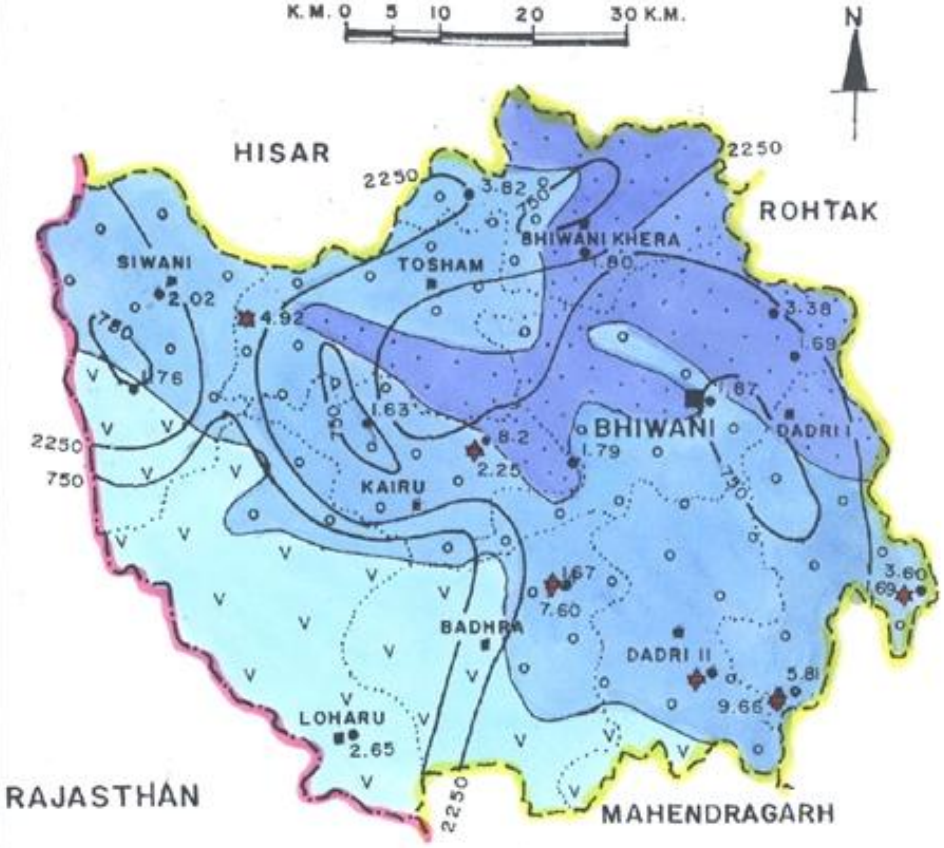
Irrigation

Plot of USSL diagram used for the classification of Irrigation waters indicates that Ground water fall under C2S,C3S1, C3S2, C3S3, C4S1, C4S2 and C4S4 classes. More than 50% ground water are likely to cause medium salinity hazards when used for customary irrigation and the remaining water falling under C3S4,

जल वर्ष 2007 Water Year 2007

HYDROGEOLOGY

BHIWANI DISTRICT, HARYANA



INDEX

	WELLS FEASIBLE	RIGS SUITABLE	DEPTH OF WELL (m)	DISCHARGE (lpm)	SUITABLE ARTIFICIAL RECHARGE STRUCTURES
SOFT ROCK AQUIFER	TUBE WELLS	REVERSE / DIRECT ROTARY	10 – 30	600 – 720	RECHARGE TRENCH WITH INJECTION WELL
SOFT ROCK AQUIFER	TUBE WELLS	REVERSE / DIRECT ROTARY	20 – 45	360 – 600	RECHARGE TRENCH WITH INJECTION WELL
SOFT ROCK AQUIFER	TUBE WELLS	REVERSE / DIRECT ROTARY	30 – 100	< 360	RECHARGE TRENCH AND RECHARGE SHAFT

ELECTRICAL CONDUCTIVITY (MICROMHOS/CM AT 25°C) — 750

2.65 ● FLUORIDE > PERMISSIBLE LIMIT (1.5ppm)

7.60 ✱ IRON > PERMISSIBLE LIMIT (1.0ppm)

CGWB NWR CH. (N. Singh) D.O. No. /2009

C4S3 and C4S4 classes are likely to cause high to very high salinity as well as sodium hazards when used for irrigation on normal soils. Such water can be used on highly permeable soils on which salt tolerant crops such as wheat, gram and rice are grown.

4.4 STATUS OF GROUND WATER DEVELOPMENT

The water supply to the district is mainly based on groundwater through tubewells. The urban population is covered under drinking water supply scheme. The water supply to the villages is met out with the installation of hand pumps by the villagers as spot and convenient source of water. The shallow tubewells in the district range from 20 to 90m. deep, tapping the aquifer from 15m to 90 m. with a discharge of 400 to 900 Ipm. Most of the shallow tube wells are either run by diesel engines or electric motors. There are 32790 motors working in the district. The major part of the district is being irrigated through ground water.

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 Ground Water Development

The hydrogeological data generated through exploratory test drilling has provided vital information regarding identification of aquifer systems, demarcation of their vertical and lateral extent, delineation of potential aquifer characteristics. These studies also provide information on well design and drilling techniques. A well assembly of 305/203mm dia. Combination, using about 40m to 50m housing length having slot size of 1.19mm would be ideal for the district area. The "V" wire galvanized Screen having 1.O mm slot width may also be used against granular zones, as it has more open area for the entrance of water. The shallow tube wells upto 40m depth should have 203mm single dia.pipe assembly with a suitable screen length. Direct Rotary rig can carry out the drilling in the district area .

5.2 WATER CONSERVATION AND ARTIFICIAL RECHARGE

In order to arrest the declining trend of water levels in the district, the rooftop rainwater harvesting technology should be adopted and recharge structures may also be constructed in depression areas where water gets accumulated during rainy season. This will help in enhancing the recharge to ground water reservoir. The crops consuming less quantity of water may be grown in place of crops requiring more water in the over exploited blocks

6.0 GROUND WATER RELATED ISSUES & PROBLEMS

Ground water decline and the ground water quality is the major problem in the district. As there is no Canal network in the district and complete dependence on groundwater it is making the problem worse. Ground water is declining at a rate of 1.38 m/yr. Out of Nine blocks five blocks in the district are Over exploited, the stage of ground water development is 104%.

7.0 RECOMMENDATIONS

1. In order to arrest the declining trend of water levels in the district, the rooftop rainwater harvesting technology should be adopted and recharge structures may also be constructed in depression areas where water gets accumulated during rainy season. This will help in enhancing the recharge to ground water reservoir.
2. The crops consuming less quantity of water may be grown in place of crops requiring more water in the over exploited blocks
3. The construction of roof top rainwater harvesting structures should be made mandatory in building bye-laws, which will help in checking the falling water level trend in the urban areas. 4. The abandoned dug wells may be cleaned and should be used for recharging the ground water by utilizing the surface monsoon runoff.
5. The Canal network in the block should be increased in order to decrease the over dependence on ground water.